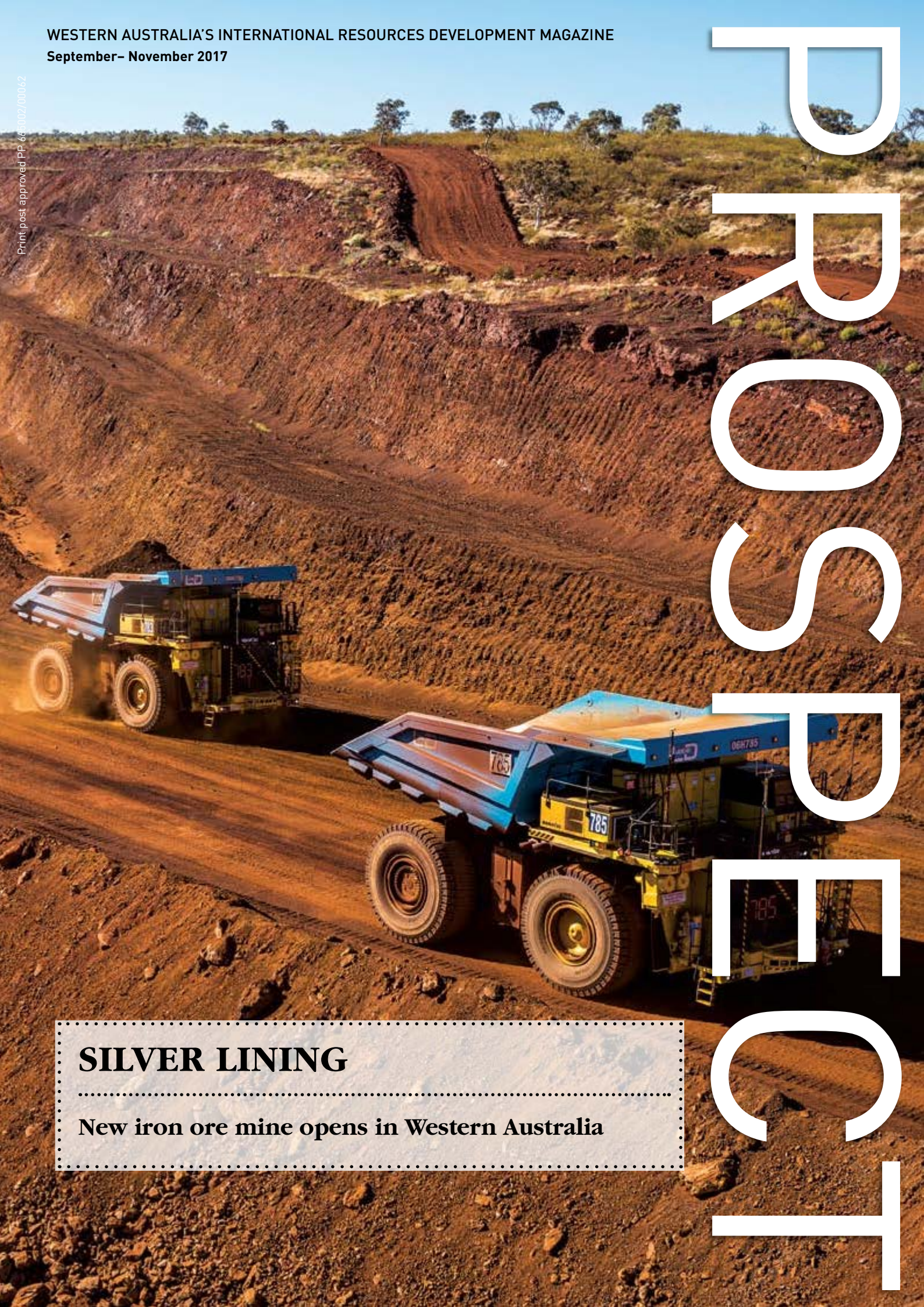


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PROSPECT



SILVER LINING

New iron ore mine opens in Western Australia



While Western Australia's strategic location in close proximity to growth economies in Asia has seen the State grow as a leading export economy, it's our strengths as an innovative, entrepreneurial State that are pushing us forward.

We have a long history as a reliable and exceptional exporter of goods and services, and, coupled with our talents and expertise in a diverse range of industries, Western Australia is continuing to lead.

The Western Australian Industry and Export Awards recognise the best and brightest of what Western Australia has to offer – not just to the rest of the nation, but to the world.

The finalists of this year's awards have been announced (story page 8) and represent the State's diverse industries, from agriculture, and manufacturing, to education, health and biotechnology, and defence.

Further recognition of our State's talent, is through the WA Innovator of the Year program (story page 12), recognising innovators behind new products, technologies, processes and services developed in Western Australia.

The very best of Western Australian aptitude and innovation has also been demonstrated by the State's top researchers and science communicators, recognised through this year's Premier's Science Awards (story page 18).

Further success stories of Western Australian innovation include the world's largest carbon capture and storage program on the verge of starting operations (page 11), and new technologies from earthquake monitoring (page 15) to the new Digital Core Atlas (page 20) developed by the State's Geological Survey.

With a wealth of talent and an innovative spirit, Western Australia is forging ahead, growing our economy, creating jobs and opportunities and leading into the future.

Mark McGowan
**PREMIER OF WESTERN AUSTRALIA & MINISTER FOR STATE DEVELOPMENT,
 JOBS AND TRADE**

Bill Johnston
MINISTER FOR MINES AND PETROLEUM

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All currency figures in Prospect are in Australian dollars unless otherwise specified.



Cover photo: Rio Tinto's Silvergrass iron ore mine officially opened in August (story page 3).
 Photo: Rio Tinto

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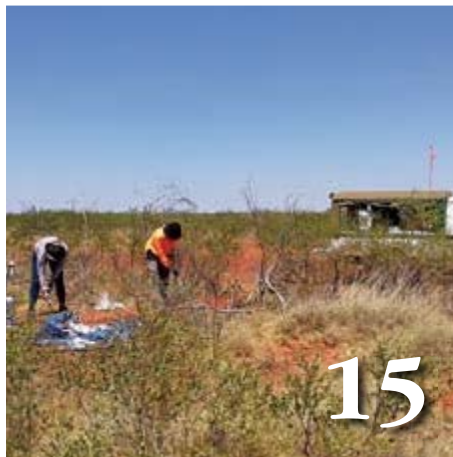
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STATE AGREEMENT SUPPORTS \$5.6 BILLION PILBARA PROJECT

The development of a new \$5.6 billion integrated iron ore project in Western Australia's Pilbara region moved a step closer in early September with a State Agreement introduced into Parliament.

Premier and Minister for State Development, Jobs and Trade, Mark McGowan introduced the Railway (BBI Rail Aus Pty Ltd) Agreement 2017 Bill into State Parliament, ratifying an agreement struck between the State and the project proponents earlier this year.

The Balla Balla Infrastructure Group (BBIG) plans to construct a new export facility on the Pilbara coast between Karratha and Port Hedland, with a 162-kilometre railway linking it to iron ore deposits in the central Pilbara.

The State Agreement provides tenure for the railway component of the project, and also sets out local industry participation, community development, and third-party access requirements.

A final investment decision for the project is expected next year. If approved, the project is expected to create 3300 construction jobs and 910 operational positions.

"I am pleased to introduce this State Agreement into State Parliament to facilitate this major project, which will generate jobs and economic activity for the central Pilbara," Mr McGowan said.

"Balla Balla Infrastructure Group has committed to maximising local employment opportunities within the Pilbara, with plans to bus workers in from Karratha and other towns.

"The project plans to use custom-built, innovative barges to transfer ore from the port onto ships, which both reduces costs and the need for dredging."

BBIG Chair Jon Young welcomed the support that the BBI Project and its State Agreement had received in Western Australia.

"The BBI Project will be a substantial job creator in both the construction and production phases," Mr Young said.

"The introduction of the State Agreement Bill into Parliament by Premier Mark McGowan is a key milestone for the BBI Project. It formalises BBIG's commitment to provide employment, economic and social opportunities for Pilbara residents, including skills development and training opportunities to promote work readiness and employment, as well as WA local industry participation."

The BBI project has full agreement and support from the traditional owners who hold Native Title over the BBI project land.

The historic Balla Balla port was originally established in 1898. When constructed, the new project will comprise an integrated port and rail infrastructure system that will provide a new gateway to the iron ore rich Pilbara region in Western Australia. ■

NEW LIFE FOR WOODIE WOODIE

Woodie Woodie manganese mine in the Pilbara will reopen less than two years after it was placed on care and maintenance due to historically low manganese prices.

The August announcement by Chinese company Ningxia Tianyuan Manganese Industry (TMI) comes only months after it purchased ConsMin, the mine's owners.

TMI will invest \$30 million to bring back to life the manganese mine, located 400 kilometres southeast of Port Hedland, and has a production target of 1.3 to 1.5 million tonnes of manganese per annum.

An initial 115 jobs have been secured to commence the restart and 300 people will be required at full-scale operation in October 2017.

Mines and Petroleum Minister Bill Johnston lauded the decision by TMI and the long-term economic benefits the company's investment would bring.

"The reopening of Woodie Woodie is fantastic news for the Western Australian economy and a positive sign for the future of the mining sector," Mr Johnston said.

"We are committed to supporting Western Australia's mining sector and creating jobs."

Founder and chairman of TMI Tianjiang Jia and ConsMin chief executive Oleg Sheyko met with Mr Johnston in Perth to announce the reopening.

They advised that ConsMin also plans to make significant investments in exploration to underpin a long-term future for Woodie Woodie.

"This is a very exciting time for TMI," Mr Jia said.

"We were attracted to ConsMin because of the quality of its assets and we were always confident that there would be future opportunities for Woodie Woodie at some stage.

"ConsMin is an important part of TMI's international strategy to integrate our mining and production operations to further enhance our position as the world's biggest electrolytic manganese metal producer."

Mr Sheyko said it was a tough decision to close Woodie Woodie, but at the time it was simply unviable.

"We are now confident in the manganese market outlook and with an exploration investment can see Woodie Woodie continuing into the future," Mr Sheyko said.

"This is a great outcome for ConsMin, the Pilbara region and Western Australia." ■

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SILVERGRASS: NEW WA IRON ORE MINE OPENS

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Premier Mark McGowan, Rio Tinto CEO Jean-Sebastien Jacques and Rio Tinto Iron Ore CEO Chris Salisbury at the opening. Photo: Rio Tinto

Rio Tinto's latest Western Australian iron ore mine was officially opened by Premier and Minister for State Development, Jobs and Trade, Mark McGowan, on 30 August.

The opening of the \$468 million Silvergrass project is a significant milestone in Rio Tinto's Western Australian operations, with more than 500 construction jobs created as a result of the new development.

The Silvergrass project is located within Rio Tinto's Greater Brockman mining operations about 70 kilometres northwest of Tom Price in Western Australia's Pilbara region.

Silvergrass is the 16th mine at Rio Tinto's Pilbara iron ore operations and will play a role in the company's plans to reach a production rate of 330 million tonnes this year, as well as helping to maintain the quality of its 'Pilbara blend' of ore.

First production from the Silvergrass mine is expected in the fourth quarter of 2017 and will add 10 million tonnes of annual production capacity.

Rio Tinto Iron Ore chief executive Chris Salisbury said Silvergrass was another Rio Tinto project delivering value for Western Australia with design, construction and commissioning all undertaken by Western Australian companies.

"Dozens of local businesses have benefitted from the purchase of major items including modular buildings, gantry cranes and a waste water treatment plant," Mr Salisbury said.

Production using the new primary crusher and conveyor at Silvergrass will begin later this year, with the project sustaining about 250 ongoing positions once construction is complete.

Rio Tinto recently announced its new procurement program to make it easier for local businesses to tender for work. The company also announced 200 graduate, apprenticeship, traineeship and vacation student places for 2018.

The Premier acknowledged the high percentage of local content for the Silvergrass project, with 75 per cent of steel for the project being fabricated and assembled in Bunbury, as well as a significant level of innovation at development, with all trucks to be driverless (controlled from Rio Tinto's Operations Centre in Perth).

"Western Australia's leading iron ore sector produced 38 per cent of the world's iron ore last year, and plays a vital role in the State's economy through jobs and royalties," Mr McGowan said.

"The Silvergrass mine is the latest in a series of new mine developments by a number of major companies, which show that confidence in the State's sector remains high.

"I congratulate Rio Tinto on the opening, and on its commitment to local jobs, through initiatives like its new procurement program which will make it easier for local businesses to tender for work.

"Rio has also committed to creating 200 apprenticeship, traineeship and vacation work positions next year, which is great news for Western Australians."

Rio Tinto's Pilbara iron ore operations include 16 mines, four shipping terminals located at Dampier and Cape Lambert, a railway spanning 1700 kilometres and a workforce of more than 11,000 employees.

The Silvergrass project was approved under the *Iron Ore (Hamersley Range) Agreement Act 1963*.

The Eastern Guruma people hold Native Title over the Silvergrass project area and an Indigenous Land Use Agreement between Rio Tinto and the Eastern Guruma native title group was registered as part of the project. ■



Rio Tinto's \$468 million Silvergrass iron ore mine in Western Australia's Pilbara region. Photo: Rio Tinto

MINISTER OFFICIALLY OPENS CAPE PRESTON AERODROME



Citic Pacific's new aerodrome will service the company's Sino Iron project in the Pilbara.

A purpose-built aerodrome to service CITIC Pacific Mining's Sino Iron mining operation is the latest addition for the Pilbara-based project.

The Cape Preston (Sino Iron) Aerodrome was officially opened by Mines and Petroleum Minister Bill Johnston and CITIC Pacific Mining Chairman Zhang Jijing at a special ceremony in July.

"Everything about Cape Preston is big, from its three-kilometre breakwater and 450-megawatt power station, to its 51-gigalitre desalination plant and 2000-room workers' village," Mr Johnston said.

"It seems only fitting that the project should have its own aerodrome."

The seven-month construction project was completed in May by two Western Australian-based contractors, Aerodrome Management Services and Decmil.

The project also employed a number of Karratha-based sub-contractors, including local indigenous firm, Baru Group.

Aviation company Alliance will provide aerodrome management services.

The official opening was held in July and was attended by community leaders, Traditional Owners, contractor partners and CITIC Pacific staff.



Citic Pacific Chairman Zhang Jijing, Mines and Petroleum Minister Bill Johnston, Member for the Pilbara Kevin Michel and Citic Pacific Chief Executive Chen Zeng.

Mr Zhang said the purpose-built facility was constructed on time and on budget.

"The reasons to proceed (with the aerodrome) were compelling. And they're all underpinned by the benefits that come with cutting travel time for our staff," Mr Zhang said.

From a safety point of view, the aerodrome means less fatigue and a quicker emergency response capability.

The direct flights also provide greater operating efficiencies.

CITIC Pacific Mining Chief Executive Officer Chen Zeng said the project was outside the company's usual scope of work and that good working partnerships underpinned its success.

"The key to construction success was a strong working relationship with WA contractors – headed by Decmil and supported by many Karratha-based subcontractors," Mr Chen said.

"We also worked closely with charter operator Alliance Airlines to ensure the facility would be ready to go from day one."

The aerodrome will handle about a dozen incoming flights each week and provide significant improvements in travel time for workers by approximately 30 per cent.

Prior to the development of the aerodrome, staff were required to fly from Perth to Karratha and then travel 100 kilometres by road to get to work. ■



Rare earth oxides.

NEW KIMBERLEY HEAVY RARE EARTHS PROJECT

Growing demand for technology that is faster, smaller and more energy efficient is driving Northern Minerals' new heavy rare earths project at Browns Range in the Kimberley.

The company plans to mine dysprosium (a heavy rare earth element) in what is planned to become the first rare earths project outside of China.

Dysprosium is a sought-after, strategic heavy rare earth element which is used in a variety of high-technology manufacturing processes, including in permanent magnetic motors for electric vehicles, industrial robots, air conditioning, and wind turbines.

It is also used in the defence and aviation industries where light-weight, high temperature resistant metals are required.

The company has planned a three-staged approach to develop its project, with Stage 1 including the establishment of a three-year test pilot plant to treat 60,000 tonnes of ore per annum (tpa) (based on being restricted to ten months of operation each year by wet season road flooding) to produce 49,000 kilograms of dysprosium.

Construction of the pilot plant commenced this year, with Premier and Minister for State Development, Jobs and Trade, Mark McGowan, officially turning the sod for the new project in late July.

Northern Minerals estimates the \$56 million pilot project will take about 11 months to build, with a construction workforce estimated at 50 personnel and 45 in operations.

If successful, the company plans to proceed with a full-scale plant with an expected capital expenditure of \$329 million and up to 680 new jobs across construction and operations.

The Browns Range project is located about 160 kilometres southeast of Halls Creek and 50 kilometres southeast of the Kundat Djaru community at Ringer Soak.

The project proponents have signed an agreement with the Djaru people, guaranteeing that at least 20 per cent of the workforce for the full-scale project will be from the local Aboriginal community.

The Premier welcomed the new pilot plant project and the boost to the local economy.

"This project provides vital economic development and employment opportunities to the Kimberley community," Mr McGowan said.

"The project proponents have also applied for Federal funding for a dedicated Aboriginal training centre at the mine site, to be run in partnership with Kununurra's Wunan Foundation.

"The State Government supports this application, and looks forward to the successful completion of the pilot plant project."

The company said that \$4.8 million in funding will enable the development of an \$8.1 million training-to-work program which will be run onsite.

Local people will be able to gain on-the-job experience in plant operator positions within the pilot plant, with the aim of being job ready as positions become available in the processing plant.

Construction of the training facilities will commence in the coming months. ■



Western Australia has a Memorandum of Understanding with the 19-nation Common Market for Eastern and Southern Africa bloc (COMESA), which includes Burundi, Comoros, Democratic Republic of the Congo, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia and Zimbabwe.

COMESA Secretary-General HE Sindiso Ngwenya was a guest at this year's Africa Down Under conference held in Perth and is pictured (above second left) with Western Australian Premier, Mark McGowan; Western Australian Government Commercial Manager – Africa, Filippo Raggi; and Department of Jobs, Tourism, Science and Innovation Country Manager (Europe, Middle East and Africa), John Shute, at the WA Government exhibition booth.

AFRICA DOWN UNDER IN WA

Western Australia hosted delegates from several African countries in early September as part of Australia Africa Week – a celebration of the economic and cultural ties between the two continents.

A highlight of the week was the annual Africa Down Under (Mining) Conference, which Perth has hosted for the past 15 years.

The event is the world's second largest African mining conference after Mining Indaba in South Africa, and works to raise awareness of Australia's interests in African mining and energy.

This year's conference, opened by Western Australian Premier and Minister for State Development, Jobs and Trade, Mark McGowan, saw close to 1000 participants attend, including 18 national delegations and nine African Ministers, and other dignitaries.

"Western Australia has a vested interest in Africa's economic and social development," Mr McGowan said.

"Africa maintained its position as the world's second-fastest growing region after South Asia in 2016, with an average 2.2 per cent Gross Domestic Product growth that is expected to reach 3.4 per cent in 2017 and 4.3 per cent in 2018, according to an African Development Bank report.

"Three of the 10 fastest-growing economies in the world are in Africa – Ethiopia (first), Tanzania (fifth), and Djibouti (sixth).

"August 2017 figures show that 115 Western Australian mining companies are operating 293 projects in 30 of the 54 African countries, accounting for approximately 70 per cent of Australian investment in the African mining industry."

Western Australia signed a Memorandum of Understanding with the 19-nation Common Market for Eastern and Southern Africa (COMESA) in January 2014, the key objectives of which include sharing knowledge and technology in the fields of mining, petroleum and agriculture.

Since the signing, a joint working group comprising the Departments of Jobs, Tourism, Science and Innovation; Mines, Industry Regulation and Safety; and COMESA, was established to implement key elements of the agreement.

Activities have included a series of policy and capacity-building workshops held in African nations by Western Australian delegates.

The workshops involved close collaboration between the Western Australian Government, as well as the Federal Government and non-government organisations and focussed on key areas, including land access, titles administration, environmental approvals and compliance, occupational health and safety, and royalties and taxation.

Based on the success of the workshops considerable interest for similar workshops and expanded forums has been expressed by African countries as well as overseas consulates and Australian embassies.

As part of the Africa Down Under (ADU) conference, Mines and Petroleum Minister Bill Johnston hosted the fourth ADU Ministerial breakfast event.

Guests included all eight Australian Heads of Mission, Secretary-General of COMESA HE Sindiso Ngwenya, African Mining Ministers, Heads of African Mining Ministries, the Head of The Kenya Vision 2030, and the Advisor to the President of the African Development Bank, as well as State and Federal Government representatives.

There was increased interest from African ministries in engaging with Western Australia in capacity building, including Nigeria, Sudan, Egypt, Madagascar and Zimbabwe.

The Government of Western Australia Mining Capacity workshops, presented by the Department of Mines, Industry Regulation and Safety, also took place during the conference for the third year in a row, and attracted more than 40 participants mainly from the African ministerial delegations visiting Perth.

The Western Australian Government, through the Department of Jobs, Tourism, Science and Innovation, operates a trade and investment office in Nairobi, Kenya, which looks after COMESA and other select African countries. For more information, visit www.jtsi.wa.gov.au ■



An Africa Down Under Ministerial Breakfast was hosted by Mines and Petroleum Minister Bill Johnston (fourth from left), pictured with guests, including COMESA Secretary General HE Sindiso Ngwenya (seated fifth from left).



Guests at the fourth Ministerial Breakfast event held in Perth as part of Africa Down Under.

WA INDUSTRY AND EXPORT AWARDS: OUTSTANDING LOCAL BUSINESSES

Endowed with vast natural resources and strategically located close to Asian growth economies, Western Australia has a proud history as a highly innovative export economy with a diverse range of industries.

Successful local companies have emerged and evolved with the growth of the State, in various fields from agriculture, and manufacturing, to education, health and biotechnology, and defence.

During the past three decades, the Western Australian Government has sought to recognise and award talented local companies through the prestigious Western Australian Industry and Export Awards.

The awards, which are currently in their 29th year, recognise and support the State's most innovative and forward-thinking companies.

Premier and Minister for State Development, Jobs and Trade, Mark McGowan recently announced the finalists for this year's awards, with 22 companies recognised.

"The WA Industry and Export Awards showcase the talent and entrepreneurial spirit of Western Australian business, from the top end of town to small, family run operations," Mr McGowan said.

"This year's finalists represent the best and brightest of what Western Australia has to offer - not just to the rest of the nation but to the world.

"We have a long history of being a reliable and exceptional exporter of goods and services, and the finalists recognised today are helping to continue that reputation into the future."

This year's winners will be announced at an awards ceremony on 26 October.

Award categories include the C.Y. O'Connor Award for Excellence in Engineering and Technology, WA Women in International Business, and Western Australia Exporter of the Year.

State winners of the 12 export award categories will automatically qualify for the 55th National Export Awards, to be announced at a ceremony in December.

For more information, visit:
www.jtsi.wa.gov.au/industryandexportawards ■

WA AND ZHEJIANG CELEBRATE 30 YEARS OF SISTERHOOD

A 22-member delegation from China's Zhejiang Province recently visited Perth to commemorate the 30th anniversary of Western Australia's sister state relationship with the province.

Madam Qiao Chuanxiu, Chairperson of the Chinese People's Political Consultative Conference (CPPCC), Zhejiang Province, and her official party arrived in Perth in early August for a two-day visit, along with 16 senior representatives from government, tourism, real estate, construction, manufacturing, logistics, publishing, arts and culture, and technology.

The Department of Jobs, Tourism, Science and Innovation worked with other agencies to host the Beautiful Zhejiang Photography Exhibition at

the State Library of Western Australia to mark the occasion, as well as a WA-Zhejiang Business Networking event at the Pan Pacific Perth, and a State Function at the State Reception Centre.

Four Memoranda of Understanding between Western Australian and Zhejiang businesses, ports, and business councils were signed at the State Function.

Zhejiang Province gifted 1300 bilingual books to the State Library of Western Australia for the people of Western Australia.

Western Australia has had a sister state relationship with Zhejiang since November 1987, with Zhejiang a major receival port for iron ore since the late 1980s.

Over the past 29 years, both Western Australia and Zhejiang have hosted, organised and initiated numerous projects, agreements and events to promote bilateral trade and investment, inter-government cooperation and exchanges, knowledge sharing and promotion of research including in medicine, agriculture, water resource management, ocean science, and education.

Premier and Minister for State Development, Jobs and Trade, Mark McGowan, and several other Western Australian Ministers will be visiting Zhejiang Province later this year to celebrate the anniversary in China, and to attend the 7th Biennial WA-Zhejiang Exchange Committee Meeting. ■



2016 WA Exporter of the Year

Perth-based medical technology company Proteomics International Laboratories Ltd (PILL) was the recipient of last year's WA Exporter of the Year Award, edging out shipbuilding giant Austal and Fortescue Metals Group to win the prestigious award. PILL also took out the Health & Biotechnology category for the second year in a row for outstanding international success.

PILL's Managing Director Dr Richard Lipscombe, accepted the awards on behalf of the company and spoke about how, "the awards highlight PILL's ever growing export achievements, being recognised for world-leading specialist analytical services and our new innovations in medical technology".

2017 WA Industry and Export Award finalists

- | | |
|--|--------------------------------|
| AGRIFresh | kwik-ZIP Spacers |
| Austal | Linear Clinical Research |
| Australian Mud Company (AMC) | Microcom |
| Blizzard Road Productions | Miles Morgan Australia Pty Ltd |
| Blue Ocean Monitoring | Proteomics International |
| Chaceon | Robertson Technology |
| Churchview Estate | Scitech |
| Epichem | Stanley International College |
| Gelflex | The Truffle and Wine Co |
| Health World Pharmaceuticals Australia | Vekta Automation |
| Imdex | Western Australian Honey |



Minister Paul Papalia, Madam Qiao Chuanxiu and Premier Mark McGowan.



Zhejiang Province delegates and Western Australian Government representatives celebrate the anniversary.



Madam Qiao Chuanxiu with delegates.



Delegates from Zhejiang Province visited Perth for the anniversary.

ENERGY SECURITY ON OPEN DAY AGENDA



The future of Western Australia's petroleum security was put under the spotlight at the recent annual Petroleum Open Day.

Hosted by the Department of Mines, Industry Regulation and Safety's Petroleum Division, the event provided insights to the department's vision for petroleum and legislative reform.

Executive Director Petroleum Jeff Haworth said energy security is at the top of the national agenda and Western Australia will likely take the lead on securing future supply.

"The department has been working on legislative reform that will streamline and modernise regulatory provisions to better reflect developments in the petroleum, CO₂ geosequestration and geothermal industries," Mr Haworth said.

"With the national focus on energy security we are investigating strategies that will secure gas

supply for our State by improving efficiencies and identifying opportunities.

"Western Australia has a stringent, multi-agency approvals process which ensures potential environmental impacts of mining and petroleum activities are carefully considered before activity can begin."

In addition to presentations from senior departmental staff, there was an extensive poster display and exhibits by the Pawsey Supercomputing Centre, Australian Marine Complex, Petroleum Exploration Society of Australia, National Energy Resources Australia, Western Australian Energy Research Alliance and Geoscience Australia.

The open day also included IT sessions for the Western Australian Petroleum and Geothermal Information Management System, or WAPIMS, and the Petroleum Gateway.

Some of the major presentations included:

- Vision for Petroleum 2020, Jeff Haworth, Executive Director Petroleum
- Towards 2020, Simon Ridge, Executive Director Resources Safety
- Waitsia/Senecio Project, Dr Suzanne Hunt, Manager Engineering and Development, AWE
- Tubridgi Gas Storage, Jon Cleary, General Manager Commercial, Dampier Bunbury Pipeline
- Panel discussion on Energy Security mediated by Tom Baddeley, Santos

Attracting more than 200 delegates, the Petroleum Open Day held at the Hyatt Regency Hotel in Perth on 15 September, was officially opened by Mines and Petroleum Minister Bill Johnston. ■

STATE GOVERNMENT HALTS ONSHORE GAS FRACKING IN WA

The Western Australian Government announced its decision in September to implement a ban on the use of hydraulic fracturing, or fracking, in existing and future petroleum titles in the South West, Peel and Perth metropolitan regions.

A moratorium was also placed on fracking throughout the rest of onshore (mainland) Western Australia until a scientific enquiry into the use of the process in WA is undertaken.

Department of Mines, Industry Regulation and Safety acting Executive Director Petroleum Denis Wills said the State Government's decision would prohibit companies from fracking during exploration or production of unconventional oil and gas.

He said the government was establishing a committee, to be chaired by Environmental Protection Authority chair Dr Tom Hatton, to conduct the independent scientific inquiry into fracking.

"The scientific inquiry will use credible scientific and historical evidence to assess each level of risk associated with fracking and outline regulatory mechanisms to identify and minimise potential risks to the environment, health, agriculture, heritage and the community," Mr Wills said.

"Western Australia has a comprehensive legislative framework that regulates oil and gas exploration and production in a manner that provides protection to the environment, community and workers.

"The department will continue to regulate the State's petroleum sector to ensure the highest

levels of safety, health and environmental standards are achieved in accordance with State legislation, regulations and policies."

Mines and Petroleum Minister Bill Johnston said the State Government was committed to a scientific inquiry into fracking.

"We are delivering our election commitment to conduct a public inquiry into the use of hydraulic fracturing and this will include holding community meetings in Perth, Geraldton and Broome," he said.

For more information go to:
www.frackinginquiry.wa.gov.au

The Hydraulic Fracturing Policy Statement is available on the department's website at
www.dmirns.wa.gov.au ■

GORGON'S GIANT CARBON STORAGE SOLUTION



Gorgon Project first shipment of LNG was exported from the Gorgon Project. Photo: Chevron

The world's largest carbon capture and storage (CCS) project is on the verge of starting operations with commissioning of the Gorgon Project's Carbon Dioxide Injection Project well underway.

The project will be more than three times bigger than the largest CCS project currently in operation – Shell's Quest Project in Canada. The Gorgon Project is already the world's largest natural gas project.

When fully operational, the Gorgon CO₂ Injection Project will inject between 100-120 million tonnes of carbon dioxide into a saline aquifer 2– 2.5 kilometres beneath Barrow Island. This will cut greenhouse gas emissions from the entire project by approximately 40 per cent.

The past 18 months has seen a number of project milestones reached, including the first Liquefied Natural Gas (LNG) cargo being exported in March 2016, domestic gas supply to the Western Australian market began in December 2016 and the third LNG train started in March 2017.

Department of Mines, Industry Regulation and Safety Executive Director Petroleum Jeff Haworth said the project includes a 15.6 million tonne-a-year LNG facility and a 50 trillion cubic feet gas resource covering the Greater Gorgon area.

"The Gorgon CO₂ Injection Project will see the injection of 3.3 to 4 million tonnes of carbon dioxide per year into a geological layer known as the Dupuy Formation, about 2.5 kilometres beneath Barrow Island in the State's North West," Mr Haworth said.

"The project also includes a commitment to supply 300 terajoules of domestic gas per day to Western Australia, an important part of our future energy security and part of the previous Labor Government's domestic gas policy initiative which is now paying dividends."

The project is of considerable international significance in establishing technical and regulatory benchmarks in greenhouse gas geosequestration.

"While standard industry practice is to vent separated carbon dioxide into the atmosphere so that the natural gas stream can be liquefied, the Gorgon Project will inject the carbon dioxide beneath Barrow Island where it will be trapped within the natural reservoir," Mr Haworth said.

"The department will ensure the venture has robust plans for managing any potential risks associated with the project."

Between 2003 and 2009 the department has conducted a total of five due diligence studies of the Gorgon CO₂ Injection Project.

An ongoing monitoring program to ensure that the State has a firm understanding of the storage site includes observation wells, seismic surveys and risk management strategies to assist in managing the performance of the storage formation.

In the decade since the release of the *Intergovernmental Panel on Climate Change Special Report on Carbon Dioxide Capture and Storage in 2005*, carbon capture and storage has been recognised as a major climate change mitigation option, and included in all major global greenhouse gas reduction scenarios.

In November 2006, the Commonwealth Government of Australia pledged \$60 million to the Gorgon CO₂ Injection Project as funding support for a commercial-scale project.

The injection and monitoring of CO₂ is approved and regulated under various State and Federal Acts. ■



Innovation and ICT Minister Dave Kelly (second left) with the 2017 WA Innovator of the Year Advisory Committee members.

INNOVATION CELEBRATION

Technologies to prevent mine truck accidents, manage mine site rehabilitation, and 3D mineral scanners, were among the innovations recently announced as finalists for this year’s WA Innovator of the Year program.

The annual awards, which have run since 2006, recognise exceptional local and regional innovators behind new products, technologies, processes and services developed in Western Australia.

Winners will be announced at an awards ceremony in November and will share in a prize pool of \$145,000 to help commercialise their innovations, with the program also linking industry and academia through research collaboration.

Innovations must be at the emerging or growth phase of development, and demonstrate an economic, social or environmental benefit for the State.

Former winners have gone on to extraordinary achievements, such as Professors Sue Fletcher and Steve Wilton who won the overall award in 2012 for their gene-patch drug treatment for Duchenne Muscular Dystrophy.

Last year, the ground breaking drug received approval from the US Food and Drug Administration, and now the two researchers are working on treatments for nearly 50 more rare diseases.

This year, there are five finalists in the Emerging Category, which is for innovations that are yet to generate revenue, and three companies have been shortlisted for the Growth Category, which recognises innovations already generating revenue.

There are also three finalists for the Young Innovator of the Year award, which is open to high school students taking part in the Just Start IT program.

Innovation and ICT Minister Dave Kelly said the Western Australian Government was committed to raising the profile of innovation in Western Australia and supporting the growth of the State’s innovation-based industries.

“In the lead-up to the awards ceremony in November, all our finalists and semi-finalists will take part in mentoring sessions and workshops on subjects like business management and pitching to investors,” Mr Kelly said.

“These sessions are designed to help start-ups and entrepreneurs as they seek to commercialise their ideas.”

The list of finalists and more information is available at www.jtsi.wa.gov.au/wa-ioty ■

TAKING DATA SNAPSHOTS TO IMPROVE SAFETY

By most measures, safety in Western Australia's mining industry has improved markedly – take for example gold mining. Back in 2000 the injury incidence rate for gold miners was 14, meaning for every 1000 employees, 14 suffered some kind of lost-time injury. Last year the rate was 3.8. Put simply, a gold miner working in 2015 was three-times less likely to suffer a lost-time injury than one working in 2005.

Similar trends are apparent across Western Australia's mining industry and, overall, the incidence rate for all commodities fell from 12 to 3.7. However, an analysis of the data across this period shows the rate of improvement slowing down, particularly over the past five years (see chart). Such slowdowns are inevitable the closer you get to zero.

In order to make further improvements, the Department of Mines, Industry Regulation and Safety (DMIRS) is looking at how it can better provide safety information to industry. In July, the department launched the first instalment of the Resources Safety Division's new monthly and quarterly safety snapshots on its website.

Presented as a series of infographics, the snapshots focus on injury and incident data provided by the mining sector, as well as safety topics identified by the department as potential areas of concern.

Mines Safety Director Andrew Chaplyn said the information can assist industry in making more data-driven decisions.

"Increasing the use of data to drive decision-making is an important focus for the department," Mr Chaplyn said.

"We collect so much information, it is important we use that data to improve our understanding and share that data with industry."

Mr Chaplyn said the better use of data also enabled the department to identify emerging safety trends and better direct regulatory effort.

"It is painting an even clearer picture of what we are seeing and the causes of these incidents," Mr Chaplyn said.

"Increasing our ability to use the data to inform industry and our direct regulatory efforts really is the backbone of what we are trying to achieve."

Resources Safety Executive Director Simon Ridge said the analysis and use of data was an important part of the department's Towards 2020 regulatory strategy for Resources Safety.

"Part of the Towards 2020 framework is about really analysing the data, finding what is hidden and using it to improve safety," Mr Ridge said.

Citing an example of a 2015 study of fatal incident data, Mr Ridge said such analysis can help find previously hidden gems of knowledge.

"It identified that a significant proportion of mining fatalities involved supervisors with less than 12 months' experience in the role. We hadn't anticipated that," Mr Ridge said.

"Data analysis can identify things which you hadn't necessarily thought of.

"It is only through this knowledge that we are able to make better decisions, as a regulator and within industry," he said.

It is this pursuit to provide timely information to industry that is behind the development of the safety snapshots and other knowledge-sharing initiatives that are a part of Towards 2020. While Mr Ridge acknowledges there is no single panacea to addressing worker safety and health, the role of data is an important one.

"Understanding the data can lead to better decisions and highlight solutions," Mr Ridge said.

The safety snapshots are one way the department is seeking to do just that. ■



Losing less time: The Lost Time Injury incidence rate has improved significantly since 2000.



In July DMIRS launched the first instalment of the Resources Safety Division's new monthly and quarterly safety snapshots on its website, www.dmirs.wa.gov.au.

INCENTIVE EXTENSION TO ENCOURAGE EXPLORATION



The Exploration Incentive Scheme will receive a further \$10 million in funding over the next two years to help encourage mineral and petroleum exploration in Western Australia.

In August, the Western Australian Government announced its continued support for the Exploration Incentive Scheme (EIS), providing \$10 million a year for the next two years through Royalties for Regions funding.

The announcement is the successful outcome of a review of the EIS along with all other Royalties for Regions funded programs.

Mines and Petroleum Minister Bill Johnston said he was thrilled to make the announcement.

“This is encouraging news for the Western Australian mining industry,” Mr Johnston said.

“The McGowan Government is delivering its election commitment to support and create jobs.

“Western Australia’s mineral industry is in its best shape since 2012, in the first half of 2017 there were 15 mineral initial public offerings on the ASX, four more than 2016.

“The surge of investor interest in gold and battery metals, lithium, graphite and cobalt, is helping Western Australia to emerge more rapidly from the equity funding doldrums.”

Department of Mines, Industry Regulation and Safety EIS Coordinator Charlotte Hall said the funding was good news for the WA resources sector.

“To date the EIS has funded projects which have significantly improved our understanding of Western Australian geology,” she said.

“The main aim of the EIS is to encourage exploration in underexplored greenfields areas by reducing risk to explorers by providing geological information.”

The EIS consists of several programs with about \$5 million a year spent on programs including precompetitive regional geophysics surveys, collaborative research projects, development of cutting edge database and systems, and Regional 3D modelling.

Ms Hall said one of the flagship programs of the EIS was the Co-funded Exploration Drilling program.

“Programs, such as precompetitive geoscience data generation and co-funded drilling, provides important geological knowledge which is key to the future development of the State’s resources sector,” she said.

“This highly competitive co-funded drilling program offers refunds for innovative exploration drilling projects.”

The co-funded drilling program offers a refund of up to 50 per cent of direct drilling costs through a competitive application process which is open for applications twice a year.

Co-funding offers, which are refunded after completion of the drilling project and supply of data by the successful applicant, are capped at \$200,000 for a single deep hole, \$150,000 for a multi-hole project and \$30,000 for applications in the prospectors category.

The reports submitted by the explorers are released via the department’s exploration databases, WAMEX or WAPIMS, after a short confidentiality period.

Any core which is submitted from cored drilling projects is then available in either the Perth or Kalgoorlie core libraries.

“These include increasing the coverage of WA by high quality medium spaced airborne geophysics to almost 100 per cent, increased gravity coverage of the State to about 50 per cent, as well as a number of regional deep crustal seismic surveys including across the Eucla into South Australia and a line of more than 700 kilometres in length along the coastal edge of the Canning Basin.”

The drilling program has provided co-funding for more than 370 projects, undertaking some 560,000 metres of drilling since 2009, which have contributed to more than 25 discoveries.

The modelling, in an independent economic impact review of the EIS released in 2015, found that for every \$1 million invested in the EIS the long run expected net benefit to the State, in terms of higher GSP, was \$23.7 million. ■

Round 15 co-funding announced

The Department of Mines, Industry Regulation and Safety has announced the successful applicants for Round 15 of the Co-funded Exploration Drilling program – part of the Exploration Incentive Scheme (EIS).

A total of \$5.26 million will be offered to 43 drilling projects to be drilled in the 2017–18 financial year and applies to successful projects drilled since the beginning of July 2017.

EIS success stories include the discovery of Camelwood nickel deposits, the Yeneena copper deposits, and Dusk Til Dawn gold discovery, as well as gold at Gruyere and the nickel discovery at Emily Ann deposit near Lake Johnston.

The Nova nickel mine was discovered using EIS geophysics data and co-funding in 2011–12; 360 people are now working onsite since production began in November 2016.

Another round of the co-funded drilling program opened in mid-September 2017 for projects to be drilled in 2018.

A list of successful Round 15 applicants and a map showing the distribution of projects is available at:
www.dmp.wa.gov.au/eisdrilling



Researchers installing vibration monitoring instruments as a part of the study.

RESEARCH TO PICK UP GOOD VIBRATIONS

A major international scientific collaboration has begun in Western Australia's north to monitor earthquake vibrations from around the globe that will yield valuable geological data about the deep structure of the region, including parts of the vast Canning Basin.

The first stage of the project began early in September with the installation of 20 vibration monitoring instruments between Port Hedland and the Kimberley plateau. A second stage is planned for 2018 to install an additional 40 seismometers to fill in gaps between the existing sensors to achieve higher data resolution.

The Department of Mines, Industry Regulation and Safety, the Institute of Geology and Geophysics of the Chinese Academy of Sciences, Macquarie University and The University of Western Australia are involved in the project through the Australian Research Council Centre of Excellence for Core to Crust Fluid Systems (CCFS).

The department's Manager 3D Geoscience Klaus Gessner said research funding for CCFS from the department's Exploration Incentive Scheme (EIS) meant the Geological Survey Division, or GSWA, was able to participate as a partner organisation.

He said Macquarie University in Sydney was the lead institution and its Research Associate Dr Huaiyu Yuan had been seconded to work with GSWA on the earthquake monitoring project.

Representatives from the Chinese Academy of Sciences, an International Partner in the CCFS, were responsible for setting up and monitoring the seismometers.

"The Chinese Academy of Science has provided all of the equipment for the monitoring project, while we have been able to provide the local expertise," Dr Gessner said.

"The department's Kimberley Liaison Officer Brian Lloyd has been invaluable in working with local stakeholders to assist us in installing the monitors on suitable sites throughout the region.

"The Academy is interested in the data as part of its geoscience research because no one has ever undertaken a passive seismic survey in northwest Australia, so the results will be a significant global addition to overall scientific knowledge.

"And for GSWA, the data will help to deduce the structure of the ground beneath us to depths of around 50km to 100km, and show how the different blocks of the Western Australian part of the continent fit together."

The selected sites were already in use, such as at roadhouses or at pastoral homesteads, and did not require any new disturbance of land. The sites will be visited every three to four months for data download and servicing.

Dr Yuan said the project was significant because it provided information about how and when the Canning Basin was formed.

He said further data would be gained from a separate related maritime project, currently underway, involving Macquarie University and the Academy.

This project involves the placement of 11 monitoring devices along a profile from shallow shelf waters off Port Smith on the Kimberley coast to depths of several thousand meters on the ocean bottom beyond the Rowley Shoals.

The ocean bottom seismometers will be provided by the Earth Imaging and Sounding program of AuScope, a Major National Research Facility that offers research infrastructure for Earth and geospatial science in Australia. ■



The Black Diamond Pit Lake in the State's South West

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WESTERN AUSTRALIA'S ABANDONED MINES PROGRAM BECOMES A REALITY

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The implementation of the Mining Rehabilitation Fund (MRF) in 2013 has enabled Western Australia's Abandoned Mines Program to become a reality.

The Department of Mines, Industry Regulation and Safety's program provides a whole-of-government framework for identifying and prioritising the management and rehabilitation of abandoned mines across Western Australia.

Four historical abandoned mine sites were selected as pilot projects for rehabilitation using interest generated by the MRF. The sites selected were the Black Diamond Pit Lake in the State's South West, the Pro-Force Plant Site in Coolgardie, the Bulong Nickel Tailings Storage Facility in the Goldfields and the Elverdton Dump near Ravensthorpe.

The department's Abandoned Mines Program Manager Sarah Bellamy said the Black Diamond and Pro-Force Projects were now completed, addressing safety and environmental issues.

"The completion of the works at Black Diamond and Pro-Force has provided the Abandoned Mines Program with numerous insights and learnings. In particular, it has underlined the importance of early and ongoing engagement with key stakeholders and the formation of partnerships," Ms Bellamy said.

Consistent with the Abandoned Mines Program's Partnerships Guideline, the Abandoned Mines Team established valuable partnerships and relationships to deliver the Black Diamond and Pro-Force projects, producing positive safety, environmental and community outcomes.

These partnerships involved community-based and commercial arrangements.

This included local coal miner Griffin Coal contributing native seed and expertise, while students and teachers from Allanson Primary School assisted with revegetation works at Black Diamond through a hands-on planting day.

Pivotal partnerships were also formed with the Shires of Coolgardie and Collie, as well as a range of technical experts who generously provided their time and expertise to the project and the community.

Ms Bellamy said the success of both projects would not have been possible without their involvement.

With the importance of stakeholder engagement in mind, the Abandoned Mines Team developed a stakeholder identification and rating tool to provide a transparent, consistent and repeatable methodology for determining how the team would engage with stakeholders for each project.

When the Abandoned Mines Team developed the tool, they recognised that the tool could be valuable to anyone undertaking mine planning or closure. The department recently launched the tool and supporting guidance on its website at: www.dmirns.wa.gov.au.



The Stakeholder Identification and Rating Tool will be used to guide the start of the next two pilot projects at Elverdton and Bulong.

“The tool supports the development of stakeholder communication and engagement strategies which, once finalised, guide how the Abandoned Mines Team will consult with its stakeholders.” Ms Bellamy said.

This consultation will aim to clearly define the scope of works required to achieve the department’s closure objectives, as well as deliver social and economic benefits.

With two of the four pilot projects finished and two just starting, Ms Bellamy said a key focus of the Abandoned Mines Program was planning for life after the completion of the pilot projects. To assist with this, the Abandoned Mines Team is busy developing tools to assess and prioritise abandoned mine features across Western Australia.

“The abandoned mines inventory, compiled by the Geological Survey of Western Australia between 1999 and 2011, contains more than 190,000 abandoned mine features, ranging from shallow workings and shafts to deep pits and large waste rock landforms,” Ms Bellamy said.

“To ensure we focus on the highest risk features first, effort is required to assess the inventory and identify those features that have significant environmental or safety concerns.”

There has also been a focus on building innovative partnerships that complement the program and maintain Western Australia’s status as a regulatory leader in mine site rehabilitation.

Such partnerships include working with the Western Australian Biodiversity Science Institute to investigate the biodiversity values of abandoned mine shafts.



Children from Allanson Primary School taking part in the seedling planting as part of the revegetation works.

This study will provide valuable information to help guide the process for rehabilitating abandoned mine shafts in a manner that takes into account its historical and environmental values.

The team is also planning to hold an Abandoned Mines Program Update and Black Diamond case study event later this year. The event will be an opportunity for the department to share lessons learned over the past two years, and discuss the next phase of the program.

It will also be an opportunity to hear directly from people who have been involved with the Black Diamond project, including members of the community of Allanson, businesses who contributed to the success of the project and the technical experts who advised and supervised the works to make the pit wall safe.

With two pilot sites complete and planning for the two remaining pilot sites underway the Abandoned Mines Program is continuing its journey to promote best practice methods to rehabilitate abandoned mine sites. ■



Western Australia's 2017 Premier's Science Awards recipients with Premier Mark McGowan.

PREMIER'S SCIENCE AWARDS RECOGNISE OUTSTANDING WA ACHIEVERS

Western Australia's top scientific researchers and outreach initiatives were recently recognised and rewarded for their achievements.

The Premier's Science Awards, now in their 16th year, celebrate the Western Australian science community's best and brightest.

This year's winners have contributed to improving the health of aboriginal children, particularly in the Kimberley region, improving treatments for breast cancer patients, increasing the resistance of wheat and barley crops to harsh environments, enhancing the performance of transmission systems and engaging young people with computer programming.

The 2017 Premier's Science Awards featured four categories:

- Scientist of the Year (\$50,000 prize) – a world-class scientist who, over the past 10 years, has demonstrated excellence in a field of science, scientific research or technological advancement.
- Woodside Early Career Scientist of the Year (\$10,000 prize) – an outstanding scientist who has completed their highest degree in the last five years and has demonstrated excellence in a field of science, scientific research or technological advancement.
- ExxonMobil Student Scientist of the Year (\$10,000 prize) – an outstanding postgraduate student who has demonstrated commitment to science at an early stage and shows great promise in reaching the highest levels of excellence.

- Chevron Science Engagement Initiative of the Year (\$10,000 prize) – an initiative that has made an outstanding contribution to community awareness, interest and/or participation in science in Western Australia.

In addition, Professor John Pate was inducted into the WA Science Hall of Fame in recognition of his decades-long career in plant ecology and physiology, which has greatly informed the knowledge of flora in Western Australia. The WA Science Hall of Fame was established in 2007 to recognise exceptional lifelong contributions from Western Australians to science, technology, engineering and mathematics or STEM.

Science Minister Dave Kelly said the 2017 winners were testament to Western Australia's world-class efforts in areas such as medicine, agriculture and biodiversity, and radio astronomy.

"These awards recognise outstanding work in scientific research and engaging the community with science," Mr Kelly said.

"Engaging young people in science is a key priority of the McGowan Labor Government as we look towards creating future employment opportunities and diversifying our economy through science.

"Advances in science are also important to improve the lives of Western Australians through improved health and wellbeing, enhanced infrastructure and more efficient industries."

The 2017 Premier's Science Awards Ceremony was held on 14 August at the State Reception Centre, Fraser's Kings Park. Chevron, ExxonMobil and Woodside have sponsored the awards since 2013. Western Australia's five universities supported the awards ceremony this year. ■



Professor Harvey Millar, Premier Mark McGowan and Rene Van Meeuwen (representing Christobel Saunders).

SCIENTIST OF THE YEAR

This year there were two joint-winners in the Scientist of the Year award category.



Professor Christobel Saunders

Professor of Surgical Oncology, Head, Division of Surgery, The University of Western Australia (UWA)

Professor Saunders is a Consultant Surgeon at Royal Perth, St John of God and Fiona Stanley Hospitals, and Professor of Surgical Oncology at UWA. She is a leader in surgical practice and cancer research in Australia and internationally. She has a particular research interest in breast cancer including clinical trials of new treatments, supportive care, and translational and health services research which have led to better treatments for people with cancer and improved survival. Professor Saunders is directly involved in strategic planning of Australian cancer services and research through her senior roles on numerous cancer boards, networks and taskforces.



Professor Harvey Millar

Centre Director, Australian Research Council (ARC) Centre of Excellence in Plant Energy Biology, The University of Western Australia (UWA)

Professor Millar is an award-winning leader in plant science research with a focus on the function of proteins that enhance the energy efficiency of plants in harsh environments. His novel research on wheat and barley is opening new opportunities in crop improvement directly relevant to Western Australian industries. Professor Millar is the National Director of the ARC Centre of Excellence in Plant Energy Biology (PEB) which is headquartered at UWA. Under his leadership, PEB now boasts the world's largest concentration of specialist researchers in the energy efficiency of plants and leads its Australian activities from Western Australia.

WOODSIDE EARLY CAREER SCIENTIST OF THE YEAR

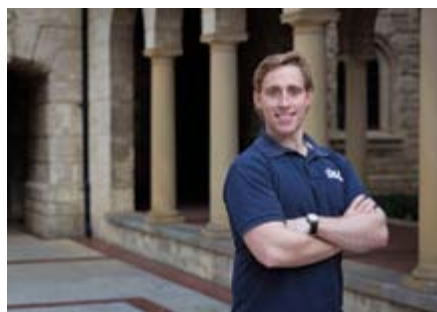


Dr Asha Bowen

National Health and Medical Research Council (NHMRC) Early Career Fellow, Telethon Kids Institute

Dr Bowen is a clinician-NHMRC early career researcher at Telethon Kids Institute and Paediatric Infectious Diseases specialist at Princess Margaret Hospital. As leader of the Telethon Kids Institute Skin Team, Dr Bowen uses an integrated approach to reduce the burden of skin infections in Aboriginal children. Dr Bowen's PhD was a world-first trial of the treatment of impetigo (a skin disease which can lead to life-threatening conditions) in remote Aboriginal children. The trial results have been translated into local, regional and national treatment guidelines. Dr Bowen is also leading the first comprehensive skin control program for Western Australia, which aims to halve the incidence of skin infections in Kimberley Aboriginal children.

EXXONMOBIL STUDENT SCIENTIST OF THE YEAR



David Gozzard

PhD candidate, The University of Western Australia

Mr Gozzard is completing a PhD in experimental physics, developing stabilised transmission systems to send atomic clock signals over long distances with improved precision. This research has direct application to the Square Kilometre Array (SKA) project and the Atomic Clock Ensemble in Space (ACES) mission. His research has required significant collaboration with major national and international research organisations. Mr Gozzard has had success at numerous national and international science competitions and devotes considerable efforts to science outreach. Mr Gozzard promotes science to school and university students through presentations, demonstrations and social media, as well as through direct involvement with Astrofest and the Gravity Discovery Centre.

CHEVRON SCIENCE ENGAGEMENT INITIATIVE OF THE YEAR



CoderDojo WA

Fogarty Foundation

CoderDojo WA is the Western Australian node of CoderDojo, an open source network of fun, free and social computer programming clubs, Dojos, for young people aged seven to 17. The international CoderDojo movement was founded to address the looming worldwide shortage of computer programmers and highly skilled ICT professionals. The Fogarty Foundation initiated the CoderDojo WA network by launching the State's first Dojo in 2013. Since then, the Western Australian network has expanded to more than 100 WA Dojos. As a result, more than 2000 young Western Australians have been able to access opportunities to learn computer programming and develop their digital skills.



David Gozzard and Premier McGowan.

“Professors Millar and Saunders both embody the very best of Western Australian aptitude and innovation, and have national leadership roles in their respective fields of plant science, and cancer research and treatment.

“They are also working actively to educate the next generation of Western Australian scientific researchers and practitioners.

“On behalf of the State Government, I'd like to congratulate all winners and finalists, and thank them for their contribution to the Western Australian community.”

– Premier Mark McGowan

DIGITAL INNOVATION INSPIRES CANNING BASIN EBOOK



The Olympic 1 petroleum well drilling project.

An innovative way to digitally present large volumes of geological data that will modernise how geologists and exploration companies review, use and store analytical datasets in the future has been designed by a team from the Department of Mines, Industry Regulation and Safety.

Developed in the past year by the department's Geological Survey Division, or GSWA, the *Digital Core Atlas* is an interactive electronic book containing large volumes of analytical data linked to detailed core photographs from Olympic 1, a petroleum well located in the north of Western Australia.

The atlas was designed during the Canning Basin Drilling Project, a collaboration between GSWA, Geoscience Australia and two exploration companies, Buru Energy and Finder Exploration.

The project began in 2015 when continuous sections of core totalling 1383.18 metres were recovered from three wells, Olympic 1, Theia 1 and Senagi 1. Thousands of samples were analysed for petroleum systems and CO₂ sequestration studies from the newly cored sections of the Canning Basin.

Olympic 1, drilled on the Broome Platform, was the first well in the program and cored a continuous section from the base of the Willara Formation, through nearly all of the Nambheet Formation. Before this, only a limited amount of core existed from this Lower to Middle Ordovician section of the stratigraphy.

GSWA Senior Geologist Leon Normore said the drilling project greatly increased the existing available core from the Nambheet Formation, making the data highly valuable for stratigraphic and petroleum systems analysis.

"The rocks in this region don't outcrop and therefore the core is extremely interesting, particularly with 320m of core of the Nambheet Formation from Olympic 1 available to analyse," Mr Normore said.

"We were able to do multiple-analysis on whole sections of rock and, with so many different datatypes, it was proving hard to keep up with where all the results came from within the core, hence the development of this product."

Originally based on a paper-based core atlas, developed by Finder Exploration for the Theia 1 petroleum well, the team worked on the digital book concept for almost a year.

"We wanted to create an interactive, user friendly tool to display every detailed photograph of the cored section and allow the user to click through to all the related data," Mr Normore said.

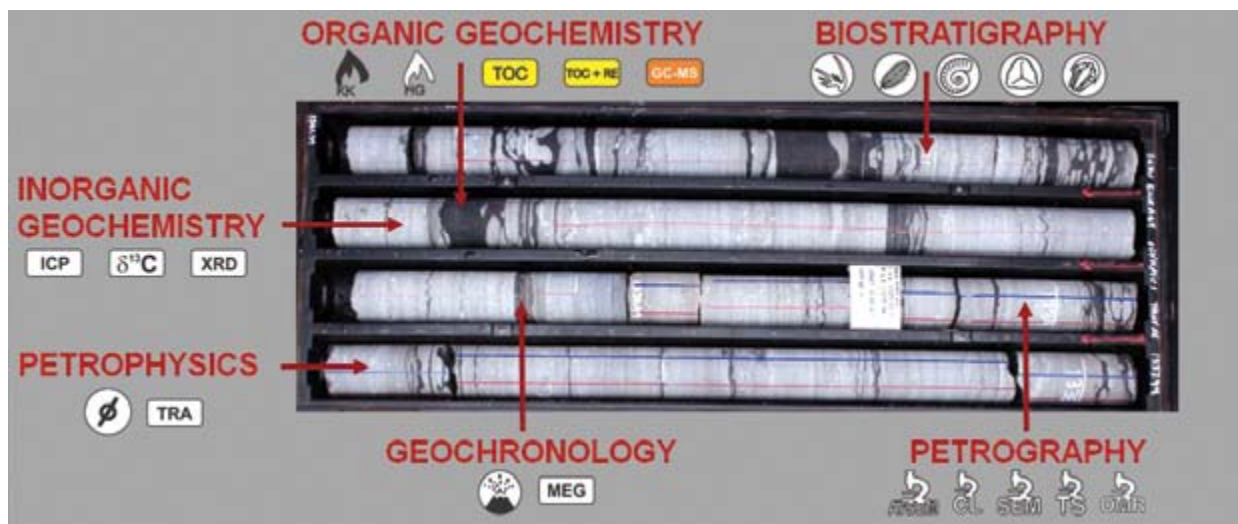
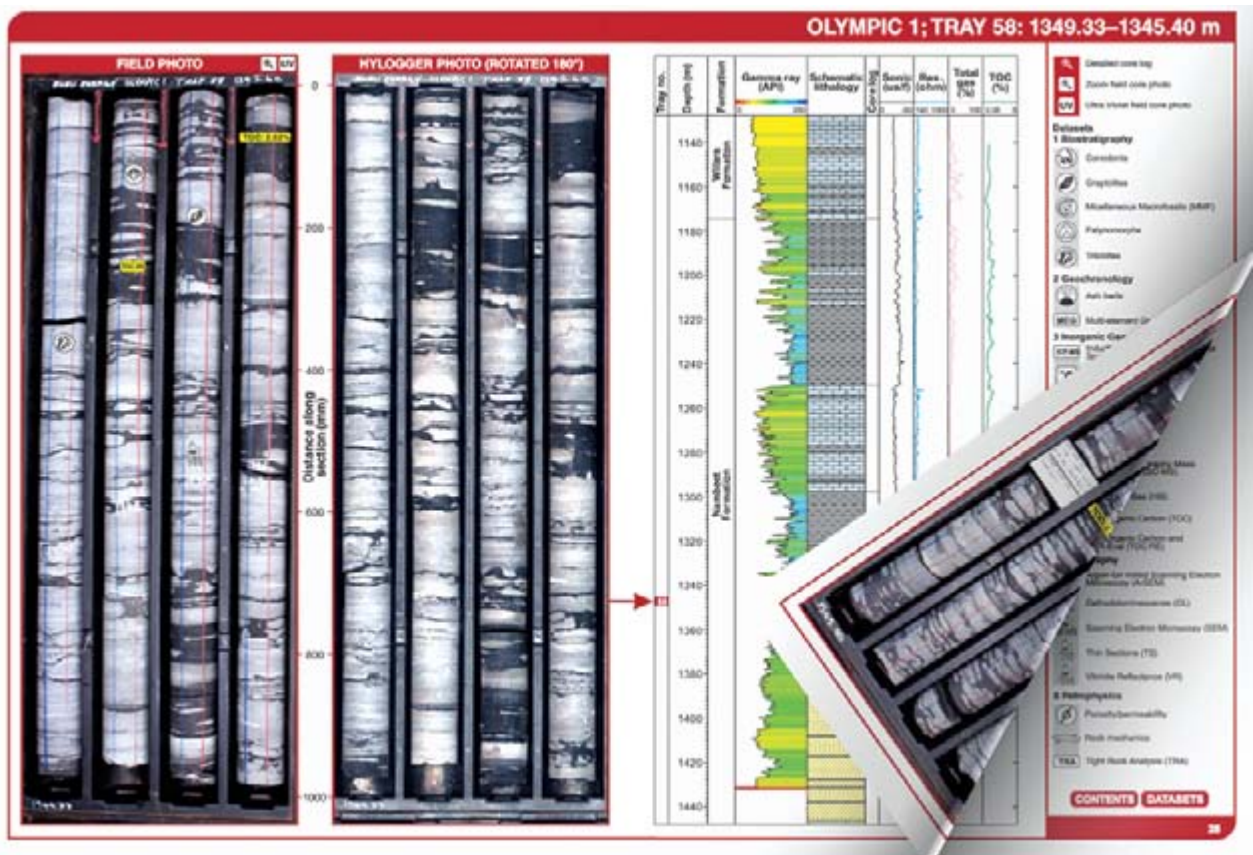


Figure 1. Examples of multiple dataset links in the Digital Core Atlas.



Each tray has a field, a HyLogger photo and symbols that link to all analyses available for a given depth interval.

“Using Flipbuilder software, the main pages of the atlas display core images on the left and a well log and legend for the dataset on the right. The photos include field photos of core taken immediately after retrieval from core barrels and a Hylogger photo taken at the department’s Core Library in Perth.

“Icons are placed on the field photos corresponding to the position of samples taken and analysis type (figure 1). Each icon is linked to the data recovered from that individual sample and the results are accessed with a simple mouse click.

“The location of the individual core tray is also marked on the adjacent well log to provide the user with a clear understanding of which part of the stratigraphy they are viewing.”

Mr Normore said GSWA would produce a similar digital core atlas for Finder Exploration’s well, Theia 1, which would contain analytical datasets for more than 700 metres of core, double the data for Olympic 1.

“It’s very labour intensive so we’re always looking at ways to make the process more efficient. It’s a worthwhile exercise though, as it’s so much easier to view all the core data, look at what analysis actually exists and on what lithology in the core,” he said.

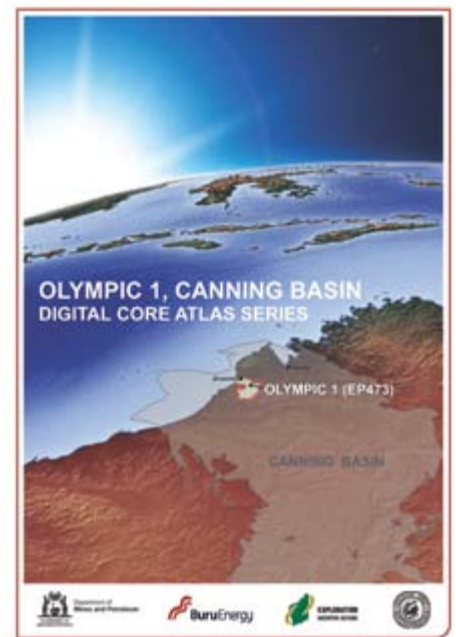
“Feedback from anyone who has seen the product has been extremely positive and industry is impressed by the possibilities.

“In 2016 we presented to the Geological Survey Liaison Committee, which includes representatives from the department, Geoscience Australia, the Commonwealth Scientific and Industrial Research Organisation and other industry and academic experts.

“When we showed them the *Digital Core Atlas* they were very enthusiastic and could see opportunities for their own data. Rather than just displaying core, it could host information about the whole well, cuttings analysis and sidewall core analysis.

“Similarly, when we presented in Norway in June this year to an international audience at the National Data Repository 2017 conference the reactions were the same. Everyone has been really thrilled by the product.”

The *Digital Core Atlas* for Olympic 1 is available on a USB, which can be ordered on the department’s website www.dmir.wa.gov.au for \$55 or can be downloaded free of charge from GSWA’s petroleum exploration database – the Western Australian Petroleum and Geothermal Information Management System. ■



Digital core atlas front cover for Olympic 1.



PORT HEDLAND DUST MANAGEMENT

Port Hedland. Photo: Department of Jobs, Tourism, Science and Innovation.

The Western Australian Government released in early August the latest report into managing dust issues in Port Hedland, with recommendations from the report process set to have a major impact on the future of the town.

Minister for Regional Development Alannah MacTiernan announced the release of the report, calling for public comment and submissions from Port Hedland residents, organisations, and other interested parties during a consultation period that ran until 6 October (see box right).

Port Hedland is the largest bulk handling port in the world, and makes a major contribution to the Western Australian and Australian economies.

In 2014–15, the value of exports through the port was almost \$30 billion, accounting for 27 per cent of Western Australia's merchandise exports and 12 per cent of Australia's. Its users generate about half of the Western Australian Government's royalty income – \$2.4 billion in 2014–15.

Export volumes through the port have risen rapidly in recent years, in response to strong demand in China for iron ore. Iron ore exports from the port rose from 167 million tonnes in 2010 to 424 million tonnes in 2015.

While rising exports have helped to support broader growth in Port Hedland, the town and port developed in an era before the adoption of modern planning principles on buffers and the separation of industrial, residential and commercial activity, and the health risks of exposure to dust were not well known.

In 2009, the Environmental Protection Authority raised concerns about the possible effects of dust on the health of Port Hedland residents.

The Premier established the Port Hedland Dust Management Taskforce in 2009 to co-ordinate and plan for dust management in Port Hedland.

The Taskforce produced the 2010 Port Hedland Air Quality and Noise Management Plan, which included interim measures to limit exposure to dust by groups considered most at risk of health effects.

The Taskforce concluded that it needed further information, including additional air quality data and

a detailed Health Risk Assessment, before it could make final recommendations on how to address dust issues.

Following the release of the Health Risk Assessment in 2016, which found sufficient evidence of health effects from dust to warrant dust management controls and land-use planning to reduce exposure, the Taskforce prepared a final report to Government with recommended strategies for managing dust in the town.

The Port Hedland Dust Management Taskforce report recommends establishing a Special Control Area over the West End of Port Hedland, with the aim of preventing further population growth west of Taplin Street, and limiting sensitive land uses between Taplin and McGregor streets.

Sensitive land uses may include facilities such as child care centres and retirement villages.

The report also recommends that exporters continue to reduce dust emissions at the port and be subject to more intense risk-based regulation, as well as the identification and mitigation of other dust sources in the town.

As well as the call for public submissions, Government agencies hosted an open day in Port Hedland on September 1, 2017, to provide further information to the local community.

The Taskforce report will also feed into a deliberative democracy forum on the future of the funding committed to the Port Hedland marina development, led by Ms MacTiernan in Port Hedland.

"The recommendations of this report will have a major impact on the future of Port Hedland and our Government will work with local residents and businesses to achieve the best possible outcome for the community, acknowledging that iron ore exports underpin the economic prosperity of the town," Ms MacTiernan said.

"The report also has a bearing on the future of the marina development. We have made clear that the \$112 million State Government commitment to the project will remain allocated to Hedland, however we are open to considering redirection to other projects.

"The State Government will provide a formal response to this report based on public submissions received and the outcomes of our deliberative democracy forum."

The report, fact sheets, and contact information for submissions are available at: www.jtsi.wa.gov.au/porthedlanddust ■

The Western Australian Government has released the Port Hedland Dust Management Taskforce's Report to Government for public comment. The consultation process seeks to obtain community, industry and other stakeholder inputs into the report.

The report, fact sheets, and contact information for submissions are available at: www.jtsi.wa.gov.au/porthedlanddust

About the Taskforce

The Port Hedland Dust Management Taskforce was formed in 2009. It comprises:

- Department of Jobs, Tourism, Science and Innovation (Chair) (previously the Department of State Development)
- Department of Health
- Department of Planning, Lands and Heritage (previously the Department of Planning)
- Department of Water and Environmental Regulation (previously the Department of Environment Regulation and the Office of the Environmental Protection Authority)
- Department of Transport
- Pilbara Development Commission
- LandCorp
- Town of Port Hedland
- Port Hedland Industries Council
- BHP
- Fortescue Metals Group
- Roy Hill Holdings
- Atlas Iron

NEW POLICY FOR URANIUM MINING

In June this year, the Western Australian Government enforced a ban on uranium mining on all future granted mining leases.

The announcement followed an election promise to block future applications to mine uranium in Western Australia.

In making the announcement, the Government said it would not prevent the progress of the four uranium projects that have previously received State Ministerial approvals.

This includes Toro Energy's Wiluna project, Cameco's Kintyre and Yeelirrie projects, and Vimy Resources' Mulga Rock project.

Mines and Petroleum Minister Bill Johnston said the decision supports the Labor Party's commitment to halt the expansion of uranium mining in Western Australia.

"In making this decision, the McGowan Government has carefully considered the potential liability risk for WA taxpayers," Mr Johnston said.

"We made a commitment that all uranium mining projects with State Ministerial approvals will be able to continue, providing they meet all planning approvals.

"The various Western Australian agencies will continue to stringently regulate the industry and ensure the four mines meet their regulatory and environmental responsibilities if they proceed."

Department of Mines, Industry Regulation and Safety Senior Advisor Graham Cobby said a range of secondary approvals were still required over the life of the four projects granted State Ministerial approvals.

"Each application will be considered on its merits as is standard procedure for all mining projects," Mr Cobby said.

"WA has a comprehensive legislative framework that regulates mining in a manner that provides protection for mining employees, the community and the environment." ■

Uranium projects in WA

Toro Energy – Wiluna Project

Four deposits within the Wiluna Project regional resource make up the current economic mine plan: Lake Way, Millipede, Centipede and Lake Maitland. The mine life is estimated to be approximately 16 years. Uranium oxide concentrate would be shipped through Port Adelaide. The Western Australian Minister for Environment provided environmental approval for the expanded Wiluna Uranium Project on 9 January 2017.

Cameco Australia Kintyre Uranium Project

Located in the East Pilbara, the Kintyre project has an estimated mine life of 12 years. Uranium oxide concentrate would be shipped through Port Adelaide. Cameco have since indicated that a development decision would be made when market conditions are more favourable. The Western Australian Minister for Environment provided environmental approval in March 2015.

Vimy Resources Mulga Rock Project

Located in the Shire of Menzies, 240km east-northeast of Kalgoorlie. Mining is proposed to take place through open pit methods in four separate deposits – Princess, Ambassador, Emperor and Shogun. The mine life is estimated to be approximately 16 years. Uranium oxide concentrate would be shipped through Port Adelaide. The Western Australian Minister for Environment provided environmental approval on 19 December 2016.

Cameco Australia Yeelirrie Uranium Project

Located 75km southwest of Wiluna, it is the largest known uranium deposit in Western Australia. The mine life is estimated to be approximately 22 years. Uranium oxide concentrate would be shipped through Port Adelaide. The Western Australian Minister for Environment granted environmental approval on 16 January 2017.



The Kintyre Project is in the East Pilbara. Photo: Cameco Australia.



Department of Mines, Industry Regulation and Safety

AWARDS FOR EXCELLENCE

Golden Gecko • Community Partnership • Safety & Health

AWARDS NIGHT TO CELEBRATE EXCELLENCE IN THE RESOURCES SECTOR

Western Australian resources sector operators who are going beyond their regulatory obligations to protect the environment, develop legacy community partnerships and find innovative safety solutions will be showcased through the prestigious 2017 Awards for Excellence.

The Department of Mines, Industry Resources and Safety annual awards acknowledge three areas, the Golden Gecko Awards for Environmental Excellence, Community Partnership Resources Sector Awards and, for the first time this year, the Safety and Health Resources Sector Awards.

The department's Director General, David Smith, said he has been impressed by the quality of the projects he has reviewed as a member of the assessment panels for two of the awards.

"The nominees have really demonstrated that our State's resources sector is pushing the envelope to be the best and advance standards across the industry," Mr Smith said.

"There is strong community expectation that the highest standards are adopted in WA's resources sector to ensure health, safety and the environment are not compromised and the sector is sustainable for the benefit of generations to come.

"These awards will showcase our nationally significant industry along with the innovative and significant work that resources companies are undertaking to protect the environment, lift the standards of safety and health, and build confidence to gain a social licence to operate."

Recently announced by Mines and Petroleum Minister Bill Johnston, the awards finalists have demonstrated that the resources sector is able to offer positive outcomes for employees, the community and the environment.

The 2017 Awards For Excellence Awards Ceremony will be held on Thursday 26 October at the Parmelia Hilton Hotel, Perth.

Before the ceremony, presentations will be given by selected nominees for the Golden Gecko, Community Partnership and Safety and Health awards, followed by the Awards ceremony.

Golden Gecko Environmental Excellence Award Finalists

Banksia Woodlands – A Restoration Guide for the Swan Coastal Plain

Hanson Construction Materials and Kings Park and Botanic Gardens

Provides the first comprehensive overview for practitioners, researchers and policy makers to assist Banksia woodland restoration activities and decisions, and a platform from which to build future strategies so these iconic systems remain an important part of the ecosystem.

Protecting our Northern Quolls from Introduced Predators

Rio Tinto Iron Ore

In collaboration with the Department of Biodiversity, Conservation and Attractions (Parks and Wildlife Service), Rio Tinto developed a threatened species plan to offset residual impacts to the Pilbara Olive Python and Northern Quoll for the Yandicoogina JSW and Oxbow Project in the Pilbara.

Venturi Reverse Circulation Drilling Waste Removal System

Rio Tinto Iron Ore

Rio Tinto Iron Ore's Venturi Reverse Circulation Drilling Waste Removal System has achieved several environmental benefits including reducing required ground disturbance, reducing hydrocarbon use and better managing drilling waste.



A joint project between Rio Tinto Iron Ore and Parks and Wildlife Service has been developed to protect Northern Quolls from introduced predators. Photo: Hannah Anderson.

Utilising Mining Technology for the Tracking and Management of Rehabilitation Materials

Roy Hill Holdings

Roy Hill Holdings is utilising technology to track rehabilitation materials, including automated storage of data, effective tracking and management of materials, management of weed infested topsoil, use as an auditing system and the potential to manage hostile wastes.

Leading Practice in Banded Iron Formation Restoration

Sinosteel Midwest Corporation and the Botanic Garden and Parks Authority

Sinosteel Midwest Corporation formed a seven-year research partnership with Kings Park Science (Botanic Gardens and Parks Authority) to tackle the complex environmental and biodiversity issues associated with post mining restoration of a threatened ecological community in a banded iron formation landform.

Safety and Health Resources Sector Award Finalists

Engineering

Enhancing Electrical Safety Through DrawingBox

Aurecon

DrawingBox is a low cost digital drawing and documentation access system for electrical assets. Works with a client's existing information management system and provides them the information security they require.

Drill of the Future

FORACO

The Drill of the Future (DOTF) is the most advanced reverse circulation drill on the global exploration market. The system allows the driller to operate the rig from more than an eight metre distance, providing a much safer and comfortable work environment.

Elimination of excess temperature and high-risk levels of Legionella bacteria in eyewash safety showers

Heat Trap Solar Pty Ltd

The Heat Trap chillers provide simple and cost effective management of excess temperature and high-risk levels of Legionella bacteria in eyewash safety showers for both retrofit and new applications.



A steer named Winston is part of a partnership between Illuka and Dardanup farmers Peter and Judy Milton to highlight mental health issues.

Improving the Safety and Reliability of Distribution Power Lines

Rio Tinto

The acoustic inspection technology has delivered significant safety improvements through a reduction in working at heights and heat distress exposure while also demonstrating a dramatic improvement in distribution power line reliability.

Rail Mounted Working at Heights Platforms

Rio Tinto

A rail-mounted work platform that eliminates the Working at Heights risk associated with performing belt maintenance on yard conveyors.

Safescape Edge Protector

Safescape

The Safescape Edge Protector is a system for improved edge protection in open pit mines. The structure is designed to allow pit haul roads to be narrower while retaining the same or better safety characteristics.

Continued next page...

Safety Representatives

The Safety Barometer

Fortescue Metals Group

The Safety Barometer is about understanding the impact attitude and distraction can have on safety and provides a tool to target the way people are feeling in the workplace.

Scenario based learning

Fortescue Metals Group

Scenario-based learning is a way of leading crews, over time, to become more and more adept at recognising changes that increase exposure to harm.

Systems and People

Innovative technology to manage onsite inductions

Aglime of Australia

Aglime, designed, configured, developed and installed an induction app that is transferable across industry regardless of the scale of mining operations.

Onsite – Suicide Ideation Management

Fortescue Metals Group

Fortescue, with the assistance of CentreCare Corporate, has formulated an approach to ensure the safety and wellbeing of an employee or contractor who has reported suicidal thoughts whilst on a Fortescue site.

Iluka Resources Winston Partnership

Iluka Resources (South West Operations)

The partnership between Iluka, Dardanup farmers Peter and Judy Milton, and a steer named Winston has delivered an innovative and unique approach to raising awareness of mental health issues within the workforce, the resources industry and the wider community.

Unmanned Aerial System for Abandoned Pit Lake Sampling at Talling Peak

Mount Gibson Mining

Using a water sample container mounted beneath the helicopter drone to collect pit lake surface water samples from an abandoned pit, this innovative sampling technique has removed field technicians from the high risks posed by unstable geological units.

Critical Risk Management – Fatality Elimination Program

Rio Tinto

A verification system that provides real-time knowledge of critical control effectiveness and is the centre piece of a broader cultural change program designed to create a change in safety performance and make zero fatalities a reality.

Community Partnership Resources Sector Award Finalists

TLG-IGO Rural Tutoring Program

Teach Learn Grow (TLG) and Independence Group NL (IGO)

The program provides ongoing tailored and one-on-one tutoring to primary school students in the Goldfields-Esperance region to improve the educational opportunities and outcomes for socio-disadvantaged students by delivering low-cost tutoring from volunteer university students.

Industry Road Safety Alliance South West

Shires of Boddington, Collie and Harvey, RoadWise, Main Roads WA, Road Safety Commission, WA Police, Department of Transport, South32 Worsley Alumina, Newmont Boddington Gold, Premier Coal and Synergy

Incorporates industry, community and government working together to improve road safety. The Alliance makes a positive difference to road safety, locally and statewide, with the partnership model now adopted across Western Australia.

Swan Alcoa Landcare Program (SALP)

Department of Biodiversity, Conservation and Attractions and Perth NRM (On behalf of multiple community-based landcare groups) and Alcoa of Australia

A community Landcare grants program funded by Alcoa of Australia and the Department of Biodiversity, Conservation and Attractions. The partnership provides funding for community-based Landcare projects in the Swan region of WA, with more than 1200 projects completed to date.

The Budadee Foundation

Budadee Foundation and Atlas Iron Limited

Fosters the preservation of endangered sacred traditional knowledge of communities living in the Woodstock-Abydos Protected Reserve.

KCGM & KBULG Environmental and Sustainability Partnership

Kalgoorlie-Boulder Urban Landcare Group and Kalgoorlie Consolidated Gold Mines (KCGM)



The Rural Tutoring program supported by Independence Group and developed by Teach Learn Grow offers tailored and one-on-one tutoring, to primary school students in the Goldfields-Esperance region.

KCGM and KBULG have worked in unison in a number of cultural and environmental awareness events locally, including the, Karlkurla Dreaming Culture Trail, the Annual Community Tree Planting Day, The Sustainable Garden Competition, Kalgoorlie-Boulder Clean-Up Day and the Reconstructed Art Competition.

BHP Billiton Strategic Environmental Assessment Traditional Owner Stakeholder Engagement Program

Yamatji Marpa Aboriginal Corporation and BHP Billiton Iron Ore

The extensive and independently delivered program focuses on long-term environmental stewardship and improving environmental outcomes for Traditional Owners.

The Graham (Polly) Farmer Foundation – Rio Tinto Partnership

The Graham (Polly) Farmer Foundation and Rio Tinto

A 20-year partnership committed to working together to support Indigenous students to

graduate from school, enter university, technical education or gain an apprenticeship, traineeship or employment.

BHP Billiton and Aspire UWA: forging educational pathways

BHP Billiton and Aspire UWA

Enhancing the educational journeys of disadvantaged students and schools across Western Australia. The project has supported 2000 students to access higher education.

The Wiluna Martu Ranger Program

Tarlka Matuwa Piarku Aboriginal Corporation and Central Desert Native Title Services, Land and Community

The partners have jointly and consistently realised and supported a vision for the development of work opportunities for young, working age Martu men and women via the commercialisation of land management services.



Kidman General Manager Chris Williams, SQM Vice President Development & Planning Pablo Altimiras, SQM Chairman Luis Eugenio Ponce Lerou, SQM CEO Patricio de Solminihac Tampier and Kidman Managing Director Martin Donohue in Perth.

CHILEAN INVESTMENT HELPS POWER LITHIUM PROJECT

Already recognised by the US Geological Survey as the world's largest producer of lithium, Western Australia has experienced rapid expansion in the sector.

Lithium production has more than doubled during the past 10 years on the back of increased global demand for the metal. Its use in batteries, particularly electric cars and solar energy storage, has driven a modern-day rush and Western Australia is ideally placed to reap the benefits of its considerable lithium resources.

In addition to the three mines already operating in Western Australia, a suite of new lithium projects are on the horizon. Among them is the Mt Holland project near Southern Cross in the State's Goldfields region.

In July, a joint venture partnership was announced between Australian mining company Kidman Resources and the Chile-based Sociedad Química Minera de Chile, or (SQM) to develop the project.

This is the first time a Chilean company has invested in Western Australia's mining industry. Mines and Petroleum Minister Bill Johnston welcomed the joint venture and the confidence it showed in the State's mining sector.

"SQM is a world leader in lithium and chemical production, and we look forward to the expertise and skills they will bring to our State," Mr Johnston said.

The joint venture partners plan to build a downstream lithium refinery in Western Australia. About 200 jobs will be created during the mine site's construction and approximately 200 full-time jobs once operations start. At the refinery, up to 200 jobs are expected to be created during construction and 180 full-time processing operational jobs.

Kidman Managing Director Martin Donohue said the Earl Grey deposit, around which the Mt Holland project is built, has attracted significant global interest.

"Their proposal to build an integrated lithium business here in Western Australia with a refinery plant drawing on SQM's technical capabilities has a lot of merit, for our shareholders and for the economic development of WA," Mr Donohue said.

According to Mr Donohue, support from the Western Australian Government was recognition of the potential skills injection from having SQM build and operate a large-scale industrial plant in the State.

SQM Chief Executive Patricio de Solminihac said it had become clear that combining Kidman's project and hard-rock mining experience in Australia with SQM's technical capabilities and vast expertise in the lithium business would form the foundation of a new long-term, world-class lithium operation.

"We are very enthusiastic about the project and investing in Western Australia," Mr de Solminihac said.

"There are plenty of examples of Australian mining companies investing in Chile. Now a Chilean company is making a significant investment in the Australian industry."

Current modelling puts the Earl Grey mine life at more than 50 years, which will underpin a long-life lithium refinery. The refinery is expected to produce in the order of 40,000 to 50,000 tonnes-per-year of lithium carbonate/hydroxide. ■

Lithium projects in Western Australia

According to data from the Department of Mines, Industry Regulation and Safety, lithium concentrate production in WA has more than doubled during the past 10 years and reached a record 520,000 tonnes in 2016.

By 2020, WA's lithium concentrate production could increase to 2.9 million tonnes.

By 2020–21 lithium royalties could increase \$14.7 million to \$34.5 million.

If all lithium projects currently under development in Western Australia were to reach full capacity, the industry could potentially generate more than \$100 million in annual royalties.

The total construction cost of lithium mines currently in development is estimated at \$865.7 million.

Potential employment is estimated at around 1150 jobs during construction and more than 660 jobs once these projects are operational.

Company	Project	Status
Galaxy Resources	Mt Cattlin	Operating
Reed Industrial Minerals	Mt Marion	Operating
Mineral Resources	Wodgina	Operating
Talison Lithium	Greenbushes expansion	Under construction
Pilbara Minerals	Pilgangoora	Under construction
Altura Mining	Pilgangoora	Final Investment Decision
Tawana Resources (50%)	Bald Hill	Final Investment Decision
Alliance Mineral Assets (50%)		



Phillip Playford at the 'balancing rock' in the Napier Range, Canning Basin.

A LIFE OF GEOLOGY, EXPLORATION AND HISTORY

Renowned Western Australian geologist Dr Phillip Elliot Playford died on 12 July aged 85.

In the 1930s there was a small, boutique museum in Guildford, one of Western Australia's oldest towns. Doubling as a suburban home, the museum's exhibitions predominantly consisted of different rocks, curated by an inquisitive and adventurous boy named Phillip Playford. He would invite people to his home/museum to view his collection, encouraging them to contribute any rocks they might have.

Given this early interest, a career in geology might have seemed a natural progression. But it was surveying that initially appealed to Phillip. Growing up on tales of Sir John Forrest's state-defining expeditions as a government surveyor, Phillip wanted to become a professional adventurer. However, the job description of a modern-day surveyor bore little resemblance to Forrest's experiences more than half-a-century earlier. For the kind of adventure Phillip was after, he would have to return to rocks.

He got a taste of this adventure as part of an honours project mapping the Jurassic geology around Geraldton in the State's Mid West. Travelling to and from the field area on a Triumph 3T motorbike, he collected a large number of ammonites, an extinct group of sea molluscs. He sent them to British geologist W.J. Arkell at Oxford University, regarded as a leading authority on the Jurassic era. The work resulted in Phillip's first major publication – the first of many.

In 1953, oil was discovered at Rough Range near Exmouth in the State's Gascoyne region by West Australian Petroleum, or WAPET. It was the first significant oil find in Australia and captured the nation's imagination. The discovery sparked an exploration rush not seen since the gold rush of the 1890s.

The early days of oil exploration in Western Australia involved a lot of detailed geological mapping. As a geologist in search of adventure and discovery, working for WAPET provided the perfect opportunity. For Phillip the discoveries he made during July 1954 while working in Shark Bay would define his career.

In the hypersaline waters of Hamlin Pool lives a modern-day incarnation of prehistoric organisms. Stromatolites first appeared on earth about 3.5 billion years ago when there was little or no oxygen in the atmosphere. It was through the oxygen-generating activity of stromatolites that other animal life on earth was able to develop. Usually found as fossilised remains, the stromatolites of Hamlin Pool were living, and they were discovered by Phillip and his colleague Daryl Johnstone. The discovery led to a lifelong interest in stromatolites and the geology of the Shark Bay area and played a significant part in it being recognised as a World Heritage Area.

Later that same month, he met 54-year-old stockman Tom Pepper at Tamala station. Similar to stumbling across stromatolites, the unplanned encounter was one which would leave an indelible mark on Phillip's life. The Tamala station stockman showed Phillip the contents of 'a grubby flour bag' which contained silver coins, belt buckles and "other battered bits and pieces". Originally found in April 1927, they were relics from a shipwreck the stockman had found at the foot of some coastal cliffs 65km south of Tamala.

Equipped with a Land Rover four-wheel drive and a rough idea about its location, 22-year-old Phillip set out on his own to find the wreckage. He drove along an old stock route and then into some dense scrub until he could drive no more. The scrub was so thick Phillip had to tie a sample bag to the telescopic aerial from his Flying Doctor radio transmitter so he would be able to locate his car again. With his makeshift vehicle locator installed, he set of on foot to the coastline to search for the wreck.

History would see Phillip, along with the stockman Tom Pepper, named as co-discoverers of what would later be confirmed as the wreckage of the Dutch trading ship, the *Zuytdorp*. However, its rediscovery was just the start of the adventure, which Phillip retold with aplomb in his award-winning book "Carpet of Silver".

In 1956, Phillip was introduced to the Devonian reef complexes, which started a lifelong love affair with these superbly exposed rocks in the Canning Basin. The Aboriginal cave paintings in these Devonian limestones also fascinated him, resulting in research into the mythological significance of the paintings and the mapping of tribal boundaries.

Three years later, Phillip travelled to the United States to start a new adventure as the recipient of a Fulbright Scholarship to complete a PhD at Stanford University. His research took him to a small Mormon community in eastern Nevada and resulted in his thesis on the geology of Egan Range, near the small town of Lund in White Pine County.

In the 1960s Phillip began working for the Geological Survey of Western Australia. One of his first recommendations was to encourage the then Minister for Mines to encourage WAPET to drill the anticline below Barrow Island in the Carnarvon Basin. The subsequent discovery of oil in commercial quantities in 1964 marked the dawn of petroleum production in Western Australia. Phillip's association with the Geological Survey would last for more than half a century and well beyond his official retirement in 1992.

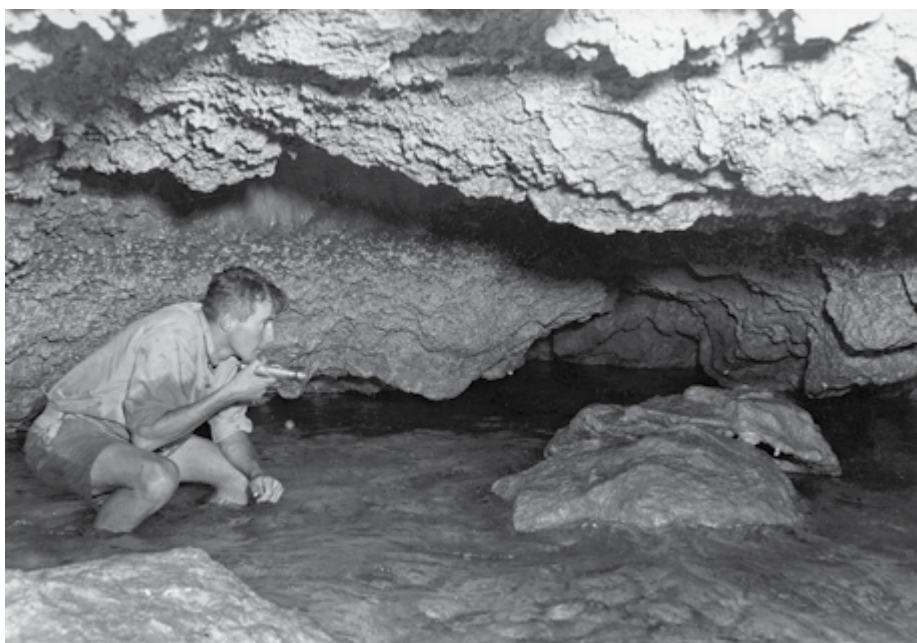
The intersection between culture, history and geology was something Phillip encountered throughout his career. Parts of his research and subsequent publications on the Devonian reef complexes and on Shark Bay were devoted to the history and Aboriginal heritage of the West Kimberley and the Shark Bay areas.

While his contribution to Western Australian geology was immense, his legacy extends beyond the scientific field. Phillip was instrumental in uncovering the State's history of early Dutch explorers and aspects of Aboriginal art and heritage. Work that captured the public's imagination and increased our understanding of Western Australian history beyond British settlement.

From an early age Phillip knew he wanted to live an adventurous life of discovery. In that he succeeded. While his earthly adventure has ended, his discoveries live on. ■



Phillip Playford with Dutch coins from the wreck of the Zuytdorp in 1954.



Investigating the wreck of the Dutch ship, the Zuytdorp in 1954.



Jim Parry, Tony Cockbain, Murray Johnstone, Rex Prider, Phillip Playford and Ian Blayden at Windjana Gorge in the Kimberley in 1975.

OIL & GAS DEVELOPMENTS**Carnarvon Basin - Greater Western Flank Phase 1****WOODSIDE ENERGY**

The Greater Western Flank Phase 1 Project to develop the Goodwyn GH and Tidepole fields, via a subsea tie-back to the existing Goodwyn A Platform has been successfully completed by Woodside Energy. First gas was produced from the Goodwyn GH field in late 2015 and production from the Tidepole field commenced in Q4 2016.

Expenditure: \$2.5b.

LITHIUM**Kwinana – Tianqi Lithium Processing Project
TIANQI LITHIUM AUSTRALIA PTY LTD**

Tianqi Lithium Australia Pty Ltd holds a 51% interest in Talison Lithium, the operator of the Greenbushes mine in the South West of WA. The company has committed to a major expansion of the mine and the construction of a lithium hydroxide processing plant at the Kwinana Strategic Industrial Area, south of Perth. The processing plant will be constructed in two stages. The first stage will accommodate the production of 23,900tpa of lithium hydroxide and will occur between 2016-2018. The second stage will expand the plant to produce up to 47,800tpa of lithium hydroxide and will occur between 2018-2020. The final product will be shipped to customers in China. Lithium hydroxide is a highly-valued resource for industries involved in energy storage, hybrid vehicles, aviation and other technological industries

Expenditure: \$608m.

Employment: Construction: 500; Operation: 115

OIL & GAS DEVELOPMENTS**Carnarvon Basin – Greater Western Flank Phase 2****WOODSIDE ENERGY**

The Greater Western Flank 2 Project was approved in December 2015 and will develop gas and condensate from the Keast, Dockrell, Sculptor, Rankin, Lady Nora and Pemberton fields via a subsea tieback to the existing Goodwyn platform. The project has awarded most major contracts and commenced manufacturing and fabricating key project infrastructure. The project is expecting start-up from the initial tranche of five wells in 2H 2019, with the remaining three wells expected in 1H 2020.

Expenditure: \$2.8b.

Carnarvon Basin – Persephone Project**WOODSIDE ENERGY**

Woodside Energy Ltd, as operator of the North West Shelf Joint Venture is developing the A\$1.2b Persephone gas field. The development involves two subsea wells and an 8km subsea tieback to the existing North Rankin Complex. Fabrication activities and offshore brownfield work has commenced, with start-up expected in Q3 2017.

Expenditure: \$1.2b.

Carnarvon Offshore Basin – Barrow Island – Gorgon Project**GORGON JOINT VENTURE**

The Gorgon Foundation Project on Barrow Island, now in its eighth year of construction, is a three train LNG development with a nameplate capacity of 15.6Mtpa and includes a domestic gas plant capable of delivering at least 300TJ/d of gas to the mainland. Cost estimates for the project construction are expected to total more than A\$55b. The project involves the processing of gas from both the Gorgon and Jansz/lo gas fields and includes potentially the largest commercial CO₂ geosequestration project in the world. Train one start up and first shipment of LNG commenced in March 2016. Train 2 produced first LNG in October 2016 and train three was commissioned in March 2017.

Expenditure: \$55b.

Employment: Construction: 8000;
Operation: 300

Pilbara – Wheatstone LNG Development**CHEVRON AUSTRALIA PTY LTD**

Chevron Australia Pty Ltd as Operator of the Wheatstone Project is currently working towards the construction of two LNG trains, a domestic gas plant and port facilities at the Ashburton North Strategic Industrial Area near Onslow. The Project will initially produce 8.9Mtpa of LNG and have a 200TJ per day domestic gas plant connected to the Dampier-to-Bunbury Natural Gas Pipeline. The Project is targeting first LNG by mid-year 2017.

Expenditure: \$40b.

Employment: Construction: 7200;
Operation: 400

POWER STATIONS**Boodarie Industrial Estate – South Hedland Power Station****TRANSALTA**

In July 2014, TransAlta Energy (Australia) Pty Ltd announced it will build, own and operate a 150MW power station in South Hedland's Boodarie Industrial Estate. The plant will consist of a combined cycle gas plant, featuring both natural gas and steam turbines. The A\$570m investment will help meet the future energy needs of the region through a 25-year agreement with both Horizon Power and Fortescue Metals Group. The plant is being designed to allow for expansion and there is a possibility that other customers may be added in the future. The project is in final stages of commissioning with an expected completion of mid-2017.

Expenditure: \$570m.

Employment: Construction: 250; Operation: 20

AGRICULTURE**East Kimberley – Project Sea Dragon****SEAFARMS GROUP LIMITED**

Seafarms Group is a Queensland based producer of farmed prawns. Seafarms proposes to invest up to US\$1.45b over the next eight years in Project Sea Dragon, a large scale, integrated, land based aquaculture project to produce black tiger prawns for export markets in Asia. The aquaculture component of the project will be located in the Northern Territory and is planned as a staged development commencing with Stage 1, 1,000ha of ponds and supporting infrastructure. In Western Australia a founder stock and quarantine centre is operational in Exmouth, a processing plant is proposed for Kununurra, and subject to competitive tender Wyndham port will be utilised for export and import. The project will create approximately 300 jobs in the Kimberley during construction, 150 direct jobs in the region at Stage 1 building to 700 direct jobs when fully operational.

Seafarms Group expect to commence development during 2018.

HEAVY MINERAL SANDS**Shark Bay – Coburn Zircon Project****STRANDLINE RESOURCES LIMITED**

Strandline proposes to develop the Coburn zircon project, located south of Shark Bay and approximately 250km north of Geraldton. It contains total ore reserves of 308Mt at an average grade of 1.2 per cent heavy minerals, all of which lie within the portion of the project area that has received government environmental approvals for mining. At a mining rate of 23.4Mtpa, the project is expected to produce 49,500tpa of zircon, 109,000tpa of chloride ilmenite and 23,500tpa of a mixed rutile-leucocoxene over its 19 year mine life. The company has secured all of the approvals required to commence mining and processing operations at Coburn, and is continuing to pursue discussions with parties interested in becoming a strategic partner in the project.

Expenditure: \$173m.

Employment: Construction: 170; Operation: 110

INFRASTRUCTURE**West Kimberley – Browse LNG Precinct****WA STATE GOVERNMENT**

The State Government is developing the Browse Liquefied Natural Gas (LNG) Precinct approximately 60km north of Broome. By focussing development at a suitable location, the Precinct will minimise the environmental footprint of gas processing and any social impacts in the region while maximising opportunities for the local community to benefit from development of the Browse Basin gas fields. The Precinct will have the capacity to accommodate at least two LNG processing operations, with a combined capacity of up to 50Mtpa. The State Government has acquired the land for the Precinct and will secure all relevant approvals to ensure the Precinct is 'project ready'.

IRON ORE

Pilbara – Balla Balla Infrastructure Project BALLA BALLA JOINT VENTURE

The Balla Balla Infrastructure project proposes to construct and operate a 165km railway connecting the Flinders Mines Ltd's Pilbara Iron Ore Project, located in the central Pilbara as its foundation customer, to a proposed transshipment and stockyard facility at Balla Balla, situated midway between Karratha and Port Hedland. The Railway (BBI Rail Aus Pty Ltd) Agreement 2017 was executed between the State, the Company and the Guarantors on 23 January 2017.

The State Agreement will now form part of a Bill to be introduced into Parliament before September 2017.

Expenditure: \$5.6b.

Employment: Construction: 3300; Operation: 900

Pilbara – South Flank Project BHP BILLITON IRON ORE PTY LTD

BHP Billiton Western Australian Iron Ore will require the development of an additional ore deposit to sustain production as the Yandi mine is exhausted over the next five to ten years. Development of the South Flank satellite high-grade ore body is currently the preferred long-term solution for replacement volumes of up to 80Mtpa. South Flank is located approximately 130km by road north-west of the town of Newman, and adjacent to the Company's existing Mining Area C operation. The proposed project would establish mining operations at South Flank and transport ore to an expanded Mining Area C hub for processing and onward logistics. The proposed project is currently in study phase and is subject to a number of internal and external approvals.

Pilbara – West Pilbara Iron Ore Project API MANAGEMENT PTY LTD

The Australian Premium Iron Joint Venture is proposing to develop the West Pilbara Iron Ore Project. Stage 1 of the project is based on the production of 40Mtpa of direct shipping iron ore from deposits, including Red Hill and Mt Stuart deposits, located 35-80km south west of Pannawonica. The ore is proposed to be transported by a 282km heavy haul railway for export via the proposed multi-user port at Anketell. State and Federal environmental approvals for the mine, rail and port elements of the project are in place. Subject to the successful completion of feasibility studies, and receipt of final regulatory approvals, the company anticipates construction to commence following a decision to proceed by the joint venturers and completion of funding arrangements.

Expenditure: \$6.8b.

Employment: Construction: 1500;
Operational: 900

OIL & GAS DEVELOPMENTS

Canning Basin – Buru Canning Basin Tight Gas

BURU ENERGY

The Buru Energy/Mitsubishi joint venture (JV) is appraising the commercial potential of the Laurel Formation, a large onshore natural gas resource located in the Canning Basin. Following the successful completion of the 2015 tight gas stimulation program on and near Noonkanbah Station, Buru commissioned DeGolyer and MacNaughton, a specialist tight gas and unconventional resource assessment consulting group to undertake an independent assessment of the gas and liquids potential of the Laurel Formation in the Valhalla area. This independent assessment has confirmed that the region contains a significant wet gas accumulation. The JV recently executed native title Agreements with the Yungngora and Warlanguru people covering the recently tested Asgard and Valhalla wells. The agreements provide for, amongst other matters, the support of the Yungngora and Warlanguru people for the future grant of the tenure required for the further development of the gas resources in the area. The Yungngora agreement has now been registered with the National Native Title Tribunal.

Expenditure: \$40m.

Employment: Construction: 100; Operation: 30

URANIUM

Northern Goldfields – Yeelirrie – Yeelirrie Uranium

CAMECO AUSTRALIA PTY LTD

Cameco Australia proposes to develop the Yeelirrie project in the North-eastern Goldfields, near Wiluna. The project entails open cut mining of shallow deposits of uranium ore, treatment in a plant to be established at the site, and development of associated infrastructure. The project will process up to 2.4Mtpa of uranium ore over about 17 years. The resultant uranium oxide is to be transported to South Australia by road for export to overseas markets. The project received environmental approval on 16 January 2017. Cameco will advance the project at a pace aligned with market conditions.

Employment: Construction: 500; Operation: 225



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Significant resource projects in Western Australia

Western Australia continues to lead the way as Australia's premier resources investment destination. There are more than A\$120 billion worth of projects either committed or under consideration for the State during the next few years. These would create more than 21000 construction jobs and almost 3000 permanent jobs.

This section is intended as an overview and does not constitute an exhaustive list of projects within the Western Australia resources industry. Based on company announcements.

Significant Projects as at April 2017

	Project Value (estimated A\$m)	Employment	
		Construction	Permanent
Iron and Steel			
API Management Pty Ltd – West Pilbara Iron Ore Project	6800	1500	900
CITIC Pacific – Cape Preston Mine & Processing Projects	12000	4000	1000
South Flank	n/a	n/a	n/a
Sub Total	18800	5500	1900
Oil, Gas and Condensate			
Browse LNG Precinct	n/a	n/a	n/a
Buru Energy – Buru Canning Basin Tight Gas	40	100	30
Chevron – Wheatstone LNG	40000	7200	400
Gorgon Joint Venture Gas Processing Project	55000	8000	300
Woodside Energy – Greater Western Flank Phase 1	2500	n/a	n/a
Woodside Energy – Greater Western Flank Phase 2	2800	n/a	n/a
Woodside Energy – Persephone	1200	n/a	n/a
Sub Total	101540	15300	730
Other			
Cameco Australia – Yeelirrie Uranium	n/a	500	225
TransAlta – South Hedland Power Station	570	250	20
Sub Total	570	750	245
TOTAL	120910	21550	2875

All currency figures are in Australian dollars unless otherwise specified.

Abbreviations Key

b	billion	m	million
EPC	Engineering, Procurement and Construction	Mt	million tonnes
GL	gigalitres	Mtpa	million tonnes per annum
ha	hectares	MW	megawatts
JV	joint venture	t	tonnes
km	kilometres	THM	total heavy mineral
LNG	liquefied natural gas	TJ	terajoules
LOA	length overall	tpa	tonnes per annum



Mineral symbols		Commodities	
◆ Precious metal	Au (or as shown)	Ag..... Silver	
◆ Steel alloy metal	Ni (or as shown)	Au..... Gold	
◆ Speciality metal	Ti-Zr (or as shown)	Chert..... Chert	
■ Base metal		Cu..... Copper	
■ Iron		Fe..... Iron	
■ Alumina	All sites are bauxite	K..... Potassium	
● Coal and lignite		Kln..... Kaolin	
▽ Industrial mineral		Li..... Lithium	
⊠ Processing plant		LNG..... Liquefied natural gas	
● Petroleum symbols		LPG..... Liquefied petroleum gas	
● Gas field		Mag..... Magnetite	
● Oil field		Mn..... Manganese	
● Oil and gas field		Mo..... Molybdenum	
▲ Processing plant		Ni..... Nickel	
— Oil / gas pipeline, operating		Pb..... Lead	
- - - Oil / gas pipeline, proposed		Phos..... Phosphate	
■ Power plant		REE..... Rare earth elements	
■ Irrigation / water / desalination		Sid..... Silica sand	
■ Port		Ta..... Tantalum	
		Tlc..... Talc	
		Ti..... Titanium	
		V..... Vanadium	
		W..... Tungsten	
		Zn..... Zinc	
		Zr..... Zirconium	

Enquiries for latest information for Commonwealth controlled waters is available from the National Offshore Petroleum Titles Administrator (NOPTA) at <info@nopta.gov.au>

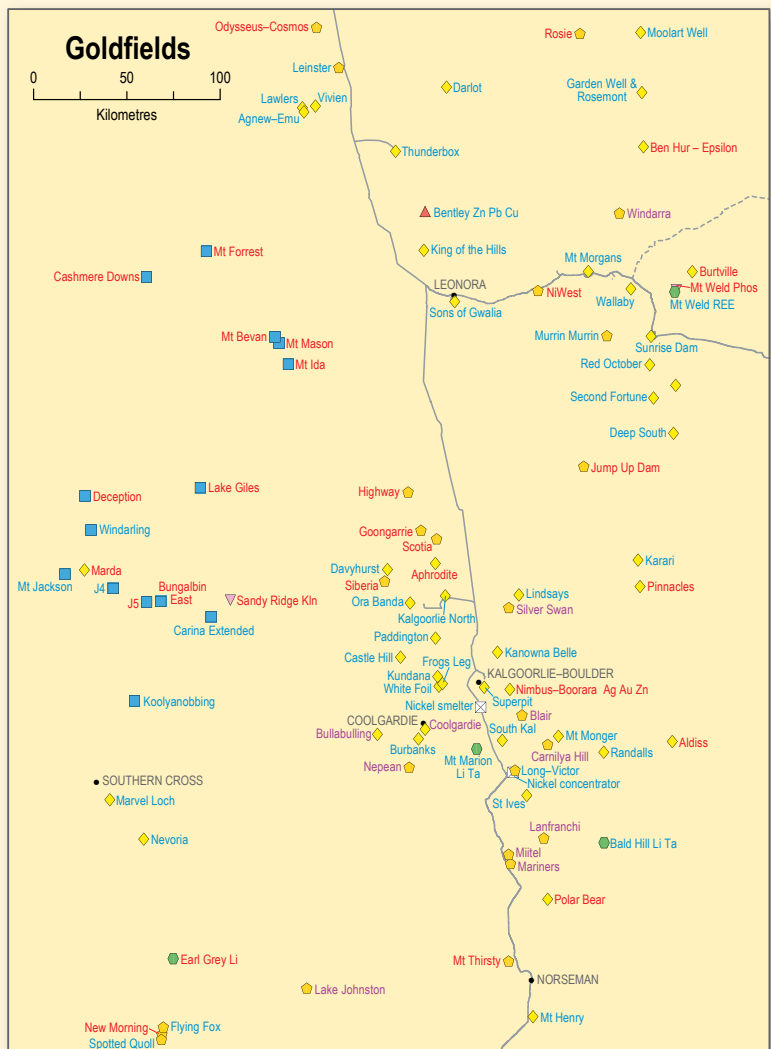


Project labels:

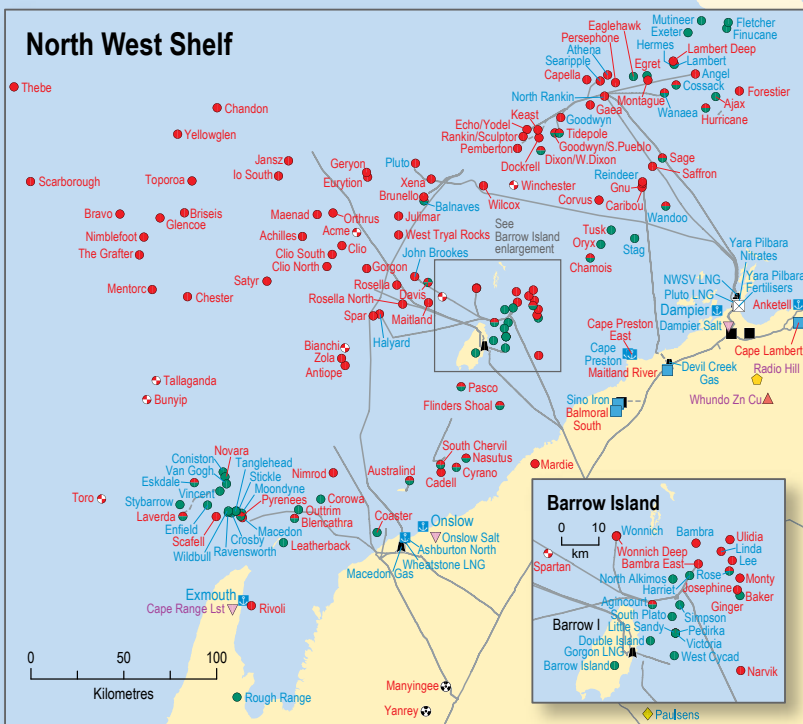
Projects operating or currently under development with an actual or anticipated value of production greater than A\$10 Million are shown in blue

Proposed or potential projects with a capital expenditure greater than A\$20 Million are shown in red

Projects under care and maintenance are shown in purple



North West Shelf



Major Resource Projects September 2017

Project labels:

Projects operating or currently under development with an actual or anticipated value of production greater than A\$10 Million are shown in blue

Proposed or potential projects with a capital expenditure greater than A\$20 Million are shown in red

Projects under care and maintenance are shown in purple



Commodities

- Ag..... Silver
- Au..... Gold
- Co..... Cobalt
- Cu..... Copper
- Dmd..... Diamond
- Fe..... Iron
- Fl..... Fluorite
- Gp..... Gypsum
- Gr..... Graphite
- Grt..... Garnet
- K..... Potassium
- Kin..... Kaolin
- Li..... Lithium
- Lst..... Limestone
- LNG..... Liquefied natural gas
- Mn..... Manganese
- Nb..... Niobium
- Ni..... Nickel
- Pb..... Lead
- Pd..... Palladium
- PGE..... Platinum group elements
- Pt..... Platinum
- REE..... Rare earth elements
- Ta..... Tantalum
- Ti..... Titanium
- V..... Vanadium
- W..... Tungsten
- Zn..... Zinc
- Zr..... Zirconium

Mineral symbols

- ☆ Precious mineral
- Dmd Diamond
- ◆ Precious metal
- Au (or as shown)
- ◆ Steel alloy metal
- Ni (or as shown)
- Speciality metal
- Ti-Zr (or as shown)
- ▲ Base metal
- Iron
- Alumina
- All sites are bauxite
- Coal and lignite
- Uranium
- ▽ Industrial mineral
- ⊠ Processing plant

Petroleum symbols

- Gas field
- Oil field
- Oil and gas field
- ◇ Significant gas discovery
- ◇ Significant oil discovery
- ◇ Significant oil and gas discovery
- ▲ Processing plant
- Oil / gas pipeline, operating
- - - Oil / gas pipeline, proposed

Infrastructure

- Power plant
- Irrigation / water / desalination
- Port

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Government of Western Australia
Department of Mines, Industry Regulation and Safety