2016 IPLOCA EXCELLENCE IN PROJECT EXECUTION AWARD

Australia Pacific LNG Pipelines Project, Australia

MCJV – McConnell Dowell Constructors (Aust) Pty Ltd and Consolidated Contracting Company Australia Pty Ltd

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Executive summary

Effective collaboration has been the key to successful delivery of the Australia Pacific LNG Pipelines Project; one of the largest and most complex pipeline projects ever constructed in Australia. Management commitment along with the project contract model and cultural framework has provided a supportive environment for diverse stakeholders to come together and deliver excellence in project execution.

Australia Pacific LNG Pty Limited, an incorporated joint venture comprising Origin, ConocoPhillips and Sinopec, has delivered a world-scale coal seam gas (CSG) to liquefied natural gas (LNG) project in Queensland, Australia. A key project component has been the construction of approximately 720 km of high pressure gas transmission pipelines and associated facilities to transport CSG from the gas fields in the Surat and Bowen Basins to an LNG processing plant on Curtis Island, offshore from Gladstone.

In 2010 MCJV, a 50-50 joint venture comprising McConnell Dowell Constructors (Aust) Pty Ltd and Consolidated Contracting Company Australia Pty Ltd, was engaged by Origin as the Early Works Contractor to undertake the front end engineering design (FEED) stage and construction planning among other preliminary works for the project. MCJV worked as an integrated or single delivery team with Origin to deliver this Early Works phase. In 2011, MCJV was appointed the Engineer, Procure and Construct (EPC) Contractor, with engineering and procurement responsibility for the entire scope of works and construction responsibility for the main transmission pipeline and associated laterals for the project.

Early collaboration between MCJV and Origin enabled the client to leverage the contractor’s specialised construction expertise to inform the design and identify and solve potential construction challenges before construction commenced. It also enabled proactive consideration of the best cultural framework and management approach on which to base the project.

In June 2014, MCJV reached Ready for Commissioning Completion of the scope of works to achieve:

- **Outstanding outcomes that exceeded targets** – Industry-leading performance resulted in successful delivery in key result areas (KRAs) for safety, environment, quality and cultural heritage.

- **Optimised construction with a lasting legacy for the industry and community** – Early contractor involvement and collaborative project management strategies enabled the team to develop innovative construction solutions to successfully overcome logistical, stakeholder, environmental, terrain and resource constraints to the satisfaction of all stakeholders.

- **Exceptional leadership and best practice project management** – A collaborative cultural framework aligned with early contractor involvement raised the benchmark for best practice project management. Best-for-project decision making was institutionalised and a unified culture optimised management and workforce performance. This leadership and management approach provides a model for future projects seeking to emulate the success of this project.

“It amazes me how a group of ‘contractors’ from diverse backgrounds and generally no prior connection have developed such a great esprit de corps to focus on achieving success in such a complex project. The atmosphere of ‘best for project’ is real and is a real pleasure to be a part of”

– Australia Pacific LNG Pipelines Project staff member

Figure 1: Pipe stringing
MCJV profile

MCJV is a 50-50 joint venture comprising McConnell Dowell Constructors (Aust) Pty Ltd and Consolidated Contracting Company Australia Pty Ltd. This longstanding joint venture has successfully delivered projects around the world, drawing on combined expertise that includes construction of more than 40,000 km of pipelines over 50 years in the industry. Since 1999, MCJV has delivered a number of large scale pipeline projects in Africa, Azerbaijan, Papua New Guinea, Thailand and Australia.

McConnell Dowell

McConnell Dowell is the creative construction company that has built thousands of quality assets and facilities for clients and communities over more than 50 years. Our expertise spans civil, electrical, fabrication, marine, mechanical, pipelines, rail, tunnel and underground construction. Our clients benefit from our unique mix of local knowledge and international experience, with more than 7,500 employees and professional engineering and construction personnel operating in 23 locations in Australia, Asia, New Zealand, the Pacific Islands and the Middle East. The McConnell Dowell Group is wholly owned by Aveng Ltd, a South African infrastructure company listed on the Johannesburg Stock Exchange and employing more than 29,000 people.

McConnell Dowell provides a complete pipeline and facilities construction service in greenfields and brownfields environments, from engineering, procurement, fabrication, field erection, civil, mechanical, piping and electrical installation works, through to commissioning. We have specialist skills in industry sectors including oil and gas, chemical processing, petrochemical, mining and metals and water markets. Our ability to mobilise large project teams and specialist plant and equipment has been proven in successful delivery of large and complex projects in some of the world’s most remote and challenging environments.

Safety is our number one priority and we have an industry-leading safety record. Our integrated management system (MMS) provides a framework to manage timely and cost-efficient delivery of projects and drive excellence in safety, environment, time, cost and quality performance. The MMS is accredited to national and international HSE standards and certified by Lloyds Register Quality Assurance (LRQA).

CCC Australia

Consolidated Contractors Company (CCC) is a global engineering and construction company with operations in 50 countries across five continents. CCC’s diverse portfolio of experience includes building mega size LNG plants, refineries, petrochemical facilities, pipelines, power and desalination plants, water and sewage treatment plants, airports, heavy civil works, dams, road networks and high rise buildings. We excel in challenging projects, bringing an unmatched combination of knowledge, expertise and commitment to complete every project to the satisfaction of our clients.

Consolidated Contracting Company Australia (CCC Australia) is our established subsidiary company in Australia. CCC Australia has the group’s support in all forms, from financing, guarantees, plant and equipment and technical, to administrative and personnel matters. CCC’s international experience, technical expertise and extensive fleet of more than 16,000 pieces of plant and machinery is available to MCJV. Our business is based on mutual trust with clients and excellent communication. We are a privately owned family company and work to the highest commitment of HSE, quality and social responsibility.
Australia Pacific LNG Pipelines Project

Australia Pacific LNG has undertaken a significant project to deliver world-scale CSG to LNG operations in Queensland, Australia. As part of the unincorporated joint venture, upstream operator Origin has been responsible for the development and operation of the gas fields and the construction and operation of the gas gathering networks, gas processing facilities and high pressure gas transmission pipelines.

A key project component has been the construction of approximately 720 km of high pressure gas transmission pipelines and associated facilities to transport CSG from the gas fields in the Surat and Bowen Basins to an LNG processing plant on Curtis Island, offshore from Gladstone.

Origin engaged MCJV as Early Works Contractor during the FEED stage of this project component to undertake preliminary works. MCJV was then appointed EPC contractor, with engineering and procurement responsibility for the overall scope of works and construction responsibility for the main transmission pipeline and associated laterals. The construction scope is outlined in Table 1.

**Table 1** Scope of works for Australia Pacific LNG main transmission pipeline and associated laterals

<table>
<thead>
<tr>
<th>AUSTRALIA PACIFIC LNG MAIN TRANSMISSION PIPELINE</th>
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<tbody>
<tr>
<td><strong>Scope</strong></td>
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<tr>
<td><strong>Total length</strong></td>
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<tr>
<td><strong>Diameter</strong></td>
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<td><strong>Steel grade</strong></td>
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<td><strong>Major facilities</strong></td>
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<td><strong>Crossings</strong></td>
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<td><strong>Key dates</strong></td>
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<tr>
<td><strong>Value</strong></td>
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**Figure 2:** Project fast facts

- **270,000** tonnes of pipe
- **300** train loads of pipe
- **14,000** truck loads of pipe
- **OVER 6.5 MILLION** man hours worked
- **PEAK WORKFORCE OF 1,200 PEOPLE**
- **25,000** welds
- **3.8** TRIFR
- **48 MILLION** km travelled
- **6 CAMPS**
Findings

The Australia Pacific LNG EPC Pipeline is one of the largest, longest and most complex pipelines to have been constructed in Australia. Australian high pressure gas pipelines are traditionally of much smaller diameter with thinner wall thickness than encountered on this project.

Like many projects of this type and size, delivery was achieved through multiple companies having a multitude of roles. With much of the project extending through Australia’s remote regions and strong competition for resources, the project team was faced with significant terrain, environmental, weather, logistical, stakeholder and resourcing challenges.

A diversity of participating organisations, workforce members and many other stakeholders, including Queensland’s local communities and 200 landholders, needed to be managed by the project team. Australia Pacific LNG is made up of Australian-based Origin, USA-based ConocoPhillips and Chinese-based Sinopec. MCJV consists of Australian-based McConnell Dowell and Greek-based CCC, with KBR being the Engineering subcontractor for the project. The project workforce represented around 60 nationalities with a depth of experience gained in different environments and jurisdictions. Combined with a range of other stakeholders, a unified approach to project management was essential with many strategies based on building strong and productive relationships between all stakeholders from the outset.

Meeting terrain challenges and stringent environmental controls was a key to project success. The pipeline traversed hundreds of kilometres, crossing an escarpment and a range of sensitive environments, including farmland, numerous waterways, roads, rail lines and utilities. More than 2 km of the main pipeline was constructed on Curtis Island where the LNG plant was located. Over 800 watercourse, road, rail and utilities crossings were also completed on the project. Substantial permits and approvals were needed to meet environmental regulations and the requirements of local, state and federal governments.

Extreme weather conditions and tropical weather patterns traditionally experienced between November and March along the pipeline route impacted on construction planning. Temperatures were often in excess of 40°C with a mix of arid and humid conditions to manage, including the impact of two cyclones that affected the work site during the construction phase.

Tight construction schedules, vast distances and remote locations had a significant effect on procurement and transport of pipe, plant and equipment to numerous project construction sites along the right of way. These conditions stimulated adoption of best practice construction methodologies, particularly in relation to welding, pipeline anchoring and liquid management.

Distance and remote locations were also important factors in planning for safety, travel and accommodation for a workforce of up to 1,200 during the project.

Competition for human resources, plant and equipment was a significant issue for the project team that needed to compete successfully for resources against other major CSG projects in the Queensland construction market.
Solutions

Early Works and EPC contract model to build relationships and mitigate risk

A ‘one delivery team’ philosophy underpinned the success of the project. Key members of the client team made the decision early to invest in both the Contract Approach, with a focus on technical and commercial elements, and a Cultural Framework that concentrated on developing people and culture.

**MCJV as Early Works Contractor**

The engagement of MCJV as the Early Works Contractor during FEED ensured effective planning and early consideration of constructability issues. MCJV collaborated with Origin to assist in planning, approvals, procurement and preparing an open book estimate. This enabled the two entities to work together to ensure effective planning and early consideration of constructability issues. The strategy reduced a number of risks before construction started and improved overall efficiency of project delivery.

Open and honest communication between Origin and MCJV in developing the scope of works was encouraged. This required sharing of sensitive information to clearly explain factors and assumptions that could impact on project costs and delivery timeframes.

Contract responsibilities included:

- Working cooperatively with Origin and its team members in an integrated project team to develop an open book lump sum estimate or various iterations of estimates which would in turn lead to a fixed contract price.
- Providing Level 3 project time schedules and corresponding time-chainage charts. The parties developed the project schedule jointly, where a shared database was loaded with inputs so that everyone had an understanding of expected progress and drivers of potential delays. This enabled a collaborative response to any obstacles encountered throughout the course of the project.
- Working cooperatively with Origin to initiate and develop a project risk register. The contract structure also included provision of a risk pool fund to account for changes and cost impacts. The risk pool was created through identifying risks and evaluating contingencies in MCJV’s price and Origin’s risk register. This galvanised the integrated team approach where both parties were motivated to work out solutions jointly, regardless of which had ultimate responsibility. The strategy reduced a number of risks before construction started and improved overall efficiency of project delivery.

**MCJV as EPC contractor**

MCJV was appointed the EPC contractor with engineering and procurement responsibility for the whole scope of works and construction of the main transmission pipeline. This enabled Origin to leverage the contractor’s specialised construction expertise to help improve design and solve potential problems in the office, rather than in the field when construction was underway.

MCJV was able to work with Origin to undertake an extensive design review and further define and solve potential construction issues before construction began. The approach ensured constructor familiarity with the design and enabled further mitigation of unnecessary project delays.

Contract responsibilities included:

- Finalising and issuing management plans and procedures.
- Completing detailed engineering for the overall pipelines’ scope (720 km of predominantly large-bore pipeline).
- Early engagement with councils, shires and various stakeholders including landowners, local government and community groups.
- Procuring small diameter permanent material including valves, fittings and piping, fibre-optic cable, cathodic protection (CP) system and electrical and instrumentation material for the facilities.
• Obtaining access approvals and permits as per the MCJV scope.
• Managing logistics of pipe movement from port to laydowns and from laydowns to stringing locations.
• Constructing labour accommodation camps, material storage laydowns and infrastructure upgrades.
• Constructing the main pipeline system, including 366 km of 1,050 mm (42”), 56 km of 900 mm (36”) and 88 km of 750 mm (30”) high pressure pipe.
• Fabricating and constructing eight scraper stations, four block valve stations and two tie-in stations.
• Installing fibre-optic cable and a cathodic protection system along the pipelines route.
• Hydro testing of above-ground stations and MPS pipelines.
• Pre-commissioning of above-ground stations and MPS pipelines.

**Collaborative workplace culture to ensure a ‘one-project’ approach**

MCJV and Origin made a significant investment in and commitment to establishing and maintaining a collaborative workplace cultural framework – a focus that is unusual in the construction industry. Effective team interaction complemented the early contract involvement approach by supporting delivery of innovative and efficient solutions that were critical to the project’s success.

The project produced a joint Induction program that was mandatory for all newcomers to undertake. The induction covered key messages from both Australia Pacific LNG and MCJV, and included information around safety and environmental management, access codes, community engagement and cultural heritage.

Establishing an Integrated Leadership Team (ILT) and embedding a best-for-project ethos from the outset was crucial to creating a sense of cohesion and common purpose. The ILT valued safety-first decisions and timely issue resolution of issues at all levels. This team would make joint project-related decisions and guide project delivery so that there was no one agenda driving the project during its four-year duration. ILT members were positioned to remain objective during discussions with the embedded expectation to ‘play the ball, not the person’. Common project values, developed and endorsed by all, were fundamental to teamwork. Visible leadership was encouraged and leaders were required to be models for the project values, regardless of their background or parent company.

Leaders recognised that the project consisted of technically competent and experienced people who knew what they were doing. It was also recognised that to achieve optimal outcomes they needed to proactively manage relationships within the project team. Significant effort was therefore invested in encouraging a team culture at all levels of the organisation which focused on achieving optimal outcomes for the project. This included co-location and integration of offices and activities such as annual kick-off workshops, team development workshops and cultural integration workshops where staff were encouraged to identify themselves as project team members, rather than as belonging to their parent company. Team protocols and behaviours were also established to optimise the workplace environment. Collectively, these activities created a sense of lateral integration across teams, functions and entities, increasing trust and a willingness to share information, both positive and negative.

This collaborative cultural framework, in combination with early contractor involvement, resulted in positive project outcomes for all project participants and demonstrated a powerful model of approach for the construction industry in the future.

**’Game On’ to integrate the project team**

As the project progressed, the ILT developed a program to engage staff in project delivery and performance improvement. Called ‘Game On’, the program took a sport-based approach to encourage managers and supervisors to connect with their crews and teams, ensuring they spoke a common language and engaged in meaningful conversations around key performance indicators (KPIs) relating to the four key pillars of project delivery: safety, environment, quality and progress.
KPIs were set to be relevant to each work group, from field crews through to support teams and the ILT. They encouraged teams to take ownership and responsibility for their performance and project outcomes and were the basis for two-way meaningful discussions for all work groups. To be successful in the game, teams needed to work collaboratively, with scores and prizes awarded on a monthly basis to teams rather than individuals.

The project also engaged full time coaches to assist field supervisors and managers to develop engagement skills that would improve crew performance and achieve required behavioural change. The coaches provided quality one-on-one time with supervisors, assisting them to perform in their own environment.

The program encouraged crews and teams to assess priorities and align them with project delivery. It engaged them in conversations about performance and an open, honest and solutions-focused approach. It also ensured that positive work and appropriate action was recognised when challenges were encountered. An important element of Game On was management visibility, with senior managers visiting field crews on a regular basis to provide project updates and acknowledge the good work being completed by teams and individuals. This recognition proved to be a significant motivator for crews.

Safety initiatives

Safety remained a priority for each member of the project team during Early Works and throughout project execution. Key safety initiatives introduced into the project are summarised below:

- **Game On** – a whole-of-project program that maximised safety, quality, environmental and production performance. The integrated leadership team and all crews and support teams had specific KPIs for each area and scored themselves daily. Conversations were promoted to drive continual improvement.
- **Every Day is Game Day (EDIGD)** – a program that used the sporting analogy (and celebrity power of Australian rugby league legend, Darren Lockyer) to link good performance in sport with achievement in the workplace. It included interactive site visits by Darren Lockyer and focused on preparation, planning, training, following the ‘game plan’, teamwork and celebrating good performance.
- **Engagement of specialised performance coaches from RLG International to provide project managers, superintendents and supervisors with onsite coaching and development.**
- **New Employee Development Program (NEDP)** – new employees under 23 years old or with no pipeline experience were assigned an experienced mentor to work with them in the field. Mentors received training and conducted weekly performance reviews of new employees in key safety areas. New employees wore green hard hats to make them visible so everyone could look out for them.
- **OPER8** – eight simple steps to plant safety, including toolbox training, OPER8 posters and large banners, targeted safety conversations (documented) and OPER8 incentives. A significant decrease in plant damage incidents was noted after the program was introduced.
- **Call Point signage and In-Vehicle Monitoring System (IVMS).** Driving was assessed as a major safety risk, with over 48 million km travelled during the project. Speed Zone signage was installed along roads and the right of way (ROW) at blind spots. Driver safety, including speed, time and distance travelled, was diligently monitored through a state-of-the-art In-Vehicle Monitoring System (IVMS) with breaches of standards immediately followed up. Pipe transporters also used a system called OPT ALERT to monitor driver fatigue.
- **Other initiatives: Training Bus, Management/crew ‘Huddles’, Good to Great Training in safety leadership for managers, superintendents, supervisors and leading hands, a detailed Vacuum Lift Study, and the Safety Incentive Scheme – recognising and promoting good safety performance.**
Optimising construction through early involvement in design

MCJV was responsible for the project’s detailed design during the Early Works and EPC phases. A dedicated Engineering Manager managed an integrated team, including the engineering subcontractor KBR. This integration enabled optimisation of the design through exchange of ideas, innovation and reviews focused on project priorities and schedule milestones.

The design and construction teams combined to complete Route Alignment Walks (RAWs) to optimise the location of the pipeline. Landowner requirements, land accessibility, environmental approvals, cultural heritage approvals, location of end-of-line facilities and constructability of the pipeline were important considerations in this process. Initial refinements to the route alignment included squaring up approaches to watercourse crossings and gullies, minimising cross slopes and implementing accessibility options for operations and maintenance (O&M) post construction.

MCJV was also involved in reviewing vendor data during FEED. This was particularly beneficial to Origin in the procurement of its long lead items to meet the project schedule. The integration of all parties during Early Works allowed many best-for-project decisions to be made.

Managing procurement and transport of 270,000 tonnes of pipe

The project included procurement and delivery of 40,000 triple random length (18 m) pipes weighing 270,000 tonnes. The pipes were manufactured in Japan and coated in Malaysia, before being shipped to the Port of Gladstone. They were then transported by MCJV initially to a central laydown site by rail to minimise the impact on roads and the environment, and mitigate safety risks. Specially configured truck trailers were then used to transport 14,000 truckloads of the pipe lengths from this laydown to site.

Meeting tight construction schedules with 18 m pipe lengths

Triple random 18 m pipe lengths were introduced to the project rather than using traditional 12 m pipe lengths. Longer pipes enabled an increase in productivity with fewer onsite welds required. Light-weight extendable trailers with System 88 supports were also used to maximise metreage of pipe transported. This helped to meet the tight construction schedule planned around historic weather patterns and addressed safety issues associated with the number of trucks transporting pipes on local roads.

Introducing CRC automatic welding to increase productivity

The large pipe diameter and distance of the pipeline led to a CRC automatic welding system being used for the first time in Australia for an entire major pipeline. The technology represents international best practice and set new standards for the Australian market. The system enabled high productivity rates and quality standards.
A team of 80 welding crew members achieved an average of approximately 105 joints (1.9 km) of welding on the main line each day with a peak production of 155 joints per day and more than 25,000 welds overall (as part of MCJV’s scope) using:

- Internal welding of the root pass used an internal welding machine – a CRC self-propelled combined internal crawler, clamp and automatic bead welding unit to weld the root bead from inside the pipe.
- External welding of the hot pass, fill and cap used a CRC external welder system with either single torch or dual torch configurations, with one welding bug on each side of the pipe.

**Optimising pipeline facilities**

MCJV developed several innovative solutions for pipeline stress, anchoring and liquid management at the facilities. The team overcame historic issues around pipeline anchoring at the transitional zone between above-ground and below-ground piping by using the pipeline’s virtual anchor length to ensure adequate movement in the above-ground piping design. Early construction input optimised the design so that bends in the pipeline were used as a restraint mechanism instead of installing the anchor blocks. Potential liquid carry through the pipeline system also created challenges and the team designed a cyclone separator system to ensure its early detection and removal. This was installed at two locations. In addition, the construction team assisted to optimise site footprints, reducing pipeline platform step-overs to enhance accessibility for Operations and Maintenance personnel.

**Overcoming competition for resources**

Through early involvement and collaborative project management strategies, the team successfully competed for resources against other major CSG projects running concurrently in the heated Queensland construction market. Early involvement enabled the project team to assess and control resource risks, as well as secure the ‘A’ team and access specialised plant and subcontractors well in advance of construction. This helped to meet schedule constraints and achieve high quality outcomes.

Due to the unique project culture, MCJV managed to attract skilled and experienced resources in the market and minimised the rate of staff turnover in the highly competitive environment. At project peak there were 1,200 pieces of plant and equipment in use, including vehicles. MCJV had access to the international market and was able to secure the required plant and expertise that were short in Australia from its overseas suppliers and projects.

**Accommodating and transporting a large workforce over vast distances**

Accommodation and transport of up to 1,200 personnel across the alignment was one of the major project challenges. Camp locations were planned to minimise drive times to a maximum of one hour to and from the ROW. Four camps were constructed by MCJV and two commercial camps were used, with up to four camps running at any one time. Purpose-built, 18-seater 4WD buses transported crews to site each day. A combination of buses and commercial/charter aircrafts transported personnel to Brisbane and other destinations on cycle breaks which were based on 28 days continuous work and nine days off.

**Managing significant terrain challenges**

**Escarpment crossing**

The most significant terrain challenge of the mainline construction was the crossing of the Callide Range on approach to Gladstone, which stands 130 m tall from base to peak with a 34 degree slope.
Geotechnical engineering consultants, engineering design experts, construction managers and safety advisors assessed the design methodology and risk to determine the preferred installation method. Risks identified included equipment rollover on the steep slope, dealing with falling and loose debris, difficulty in moving plant and personnel and poor soil conditions.

The engineering solution involved a winch anchored at the peak of the escarpment to safely stabilise the 50T excavator working on the slope. An exclusion zone was set up in the work area to protect personnel from falling debris and a berm was constructed at the bottom of the escarpment to capture loose debris. The winch also pulled pre-welded strings of pipe up the slope on rollers to minimise construction activities undertaken on the slope. Trench breakers and specialised drainage were designed to stabilise the slope. A rocky channel and gully were constructed to direct water runoff and there was extensive use of hydro mulching and quick growing native seed to facilitate rehabilitation.

**Watercourse, road, rail and utility crossings**

Watercourse crossings were designed with lengths of concrete weight coated pipe to control pipe buoyancy and ensure depth of cover in the watercourse. Each crossing involved a separate design, construction and environmental management plan, and required more extensive preparatory earthworks, deeper trench excavation and heavier lifts of more complex pipe strings than for the general ROW.

Auger bore crossings under roads and railways also required steel or concrete casing pipe to be inserted. The project succeeded in providing sufficient design data to eliminate the need to install casing under such crossings. The removal of the steel casing pipe further enhanced the cathodic protection system design and construction efficiency.

**Engaging stakeholders to achieve positive outcomes**

*Establishing working relationships with local government*

An integrated approach was taken in working with local government across five areas. A regional consultative committee was established in each area to brief local communities, build relationships with key decision makers, negotiate and plan approvals, road use and placement of camps, and deal with issues as they arose. Local government representatives were comfortable with the approach used by MCJV and recognised many benefits for their communities, including hiring and sourcing of local resources, creating job opportunities and investing in local infrastructure.

*Landowner liaison program building strong relationships*

Although there were no compulsory land acquisitions, the project impacted on more than 200 properties. The Origin Landowner Liaison Program was put in place to build relationships between landowners and the project team from the outset. Landowners were assigned a dedicated Land Liaison Officer who built a personal rapport with them, explained the pipeline construction process and its effect on them on a daily basis. Landowners found their liaison representatives to be responsive and able to address issues quickly and to their satisfaction.

*Engaging with local communities*

The project was an important component of the broader CSG-LNG project that covers a significant area in Queensland and impacts on many communities. MCJV made a concerted effort to give back to the communities through which the project passed. Local services were procured and regional supply chains built wherever possible and with great success. MCJV also supported the competency development of local employees on the project through provision of Nationally Recognised Training.
MCJV sponsored and supported local community social activities including Rally Papers and community BBQs at each camp. It also supported the Royal Flying Doctor Service in 2010, Queensland Fire and Emergency Services in 2011, Meals on Wheels in 2012, Beyond Blue and the Wandoan car rally in 2013, and Anglicare Central Queensland in 2014. In addition, MCJV supported communities recovering from bushfires and floods.

**Supporting local indigenous communities**

Ninety local indigenous people were employed on the project, benefitting local Traditional Owner groups on the alignment economically and socially. Employees were skilled in various aspects of pipeline construction and now have further employment opportunities in the construction industry in Australia or overseas. MCJV took a proactive approach to meeting the ‘Closing the Gap’ strategies set by the Commonwealth Government.

**Cultural heritage**

Origin managed cultural heritage requirements, assisted onsite by MCJV. Cultural heritage specialists conducted early cultural heritage surveys and looked for Aboriginal artefacts and potential significant sites as the ROW was cleared. Employees and subcontractors were made aware of their cultural heritage obligations through the project induction material and ongoing training.

**Meeting environmental and sustainability challenges**

Stringent soil and erosion, flora and fauna and site rehabilitation management requirements covered a number of environmentally sensitive regions, including farmland and significant areas of flora and fauna habitat.

Project targets included:
- Successful rehabilitation and reinstatement of soils with no long-term disturbance to flora and fauna habitats.
- No significant long-term impact on good quality agricultural land.
- Compliance with specified regulatory requirements, applicable permits and approvals.

**Managing flora and fauna requirements**

The project team worked closely with relevant government agencies to agree cost-effective and efficient processes to meet environmental requirements and project objectives. Extensive flora, fauna and soil studies were undertaken and relevant approvals sought. Detailed erosion and sediment control plans were developed for all construction areas and MCJV worked with Origin to implement management plans addressing flora and fauna issues. The workforce induction program empowered the team to identify significant flora and fauna and implement techniques to minimise disturbance during construction.

**Restoring the ROW**

MCJV incorporated restoration of each section of the ROW to preconstruction conditions immediately on completion of construction works as a key part of its construction plan. This included preservation of topsoil and reinstatement of subsoil to the original topography and profiling watercourses to their original contours. It also involved vegetation rehabilitation based on existing local vegetation.

**Waste minimisation**

Waste minimisation was also a project priority where reuse of resources was promoted wherever possible. The project produced significant waste including contaminated soil, green waste, industrial waste, steel, oils and fuel, chemicals, glass, plastic, wastewater and batteries. All waste was transported and disposed of by licensed contractors with planning and approvals undertaken in conjunction with local governments. Training in waste management procedures was provided to all personnel.

**Meeting environmental requirements for plant and equipment**

Wash-down requirements for plant and equipment were stringent to meet landowner, local government and legislative requirements, particularly in relation to weed and seed infested areas. Wash-down stations were established on the ROW at property boundaries and weed/seed infested areas, with clear and grade
equipment undergoing an extensive wash-down before entering the next property. Wash-down stations were also established at each camp and laydown for light vehicles and trucks heading to the ROW.

A more stringent weed and seed management plan was implemented at the Common Infrastructure Corridor (CIC), Gladstone State Development Area (GSDA) and on Curtis island. Permanent wash down stations were constructed at designated access points to wash down all plant and equipment travelling along the ROW. Third party inspection sign off was a requirement for all plant at these points. MCJV operated these stations on a 24 hour basis to cope with the wash-down load and minimise the impact on construction schedule and crews.

**Technology and innovation contributing to project success**

Smart technologies were an important facet of the success of the project. Examples include:

- Hand-held PDAs to scan pipe tags during each construction stage to populate an up-to-date pipe movement and monitoring platform.
- A Game-On app, shown in Figure 9, for site supervisors to capture each day’s performance score on their smart phones and automatically update results on electronic leader boards for online viewing.
- State-of-the-art IVMS with real-time monitoring of vehicles and trucks.
- Supply of 18-metre pipes instead of conventional 12 metre pipes, based on a ‘best for project decision’ from a cost-benefit exercises undertaken during Early Works.
- Controlled blasting allowing trench blasting to commence with pipes strung on the ROW.
- Tree-felling and de-bushing using root racks.
- Use of patent vacuum lifting gear from PPH to minimise the size of excavators required for vacuum lifting and reduce the cost.
- CRC auto welding technology allowing welding progress to exceed planned figures through use of dual welding torch technology.
- FCAW method for filling and capping of joints during manual welding to speed up welding production.
- Remote-control (Kanga-loader) multi-task skid steer loader to mitigate risk in hazardous and high risk work environments. The loader provides an ergonomic, safe and efficient working alternative to conventional equipment with advanced safety features such as unique ID codes, redundancy control and automatic emergency stop.
- Mini Horizontal Directional Drilling (HDD) for FOC-casing at bored crossings.
- A Hydro Mulcher to ensure soils were bound together prior to rain events around watercourses and steep slopes or in areas of high erosion such as camps.
- System 88 (bolsters) to transport pipes of different diameters by train or truck with one adjustable and reliable system.

![Figure 9: Game On app](image-url)
Achievements

The Australia Pacific LNG EPC Pipeline project is a remarkable success among recent major onshore pipeline projects, particularly in relation to the project team’s industry-leading performance in meeting or exceeding all Key Result Area (KRA) targets for safety, environment and quality and successfully meeting timeframes that met Origin requirements.

Early collaboration between MCJV and Origin enabled the client to leverage the contractor’s specialised construction expertise to inform the design and identify and solve potential construction challenges before construction commenced. This approach enabled construction to be optimised with the project leaving an important legacy for the industry and community. It also enabled proactive consideration of the best cultural framework and management approach on which to base the project, resulting in exceptional leadership and best practice project management. The leadership and management approach set a new benchmark for the industry and provides a model for future projects seeking to emulate the success of this project.

Outcomes that met or exceeded targets

MCJV and Origin developed the KRAs and KPIs collaboratively during the Early Works Contract, based on the values of participant organisations and the project objectives. Targets were actively communicated, measured and discussed at all levels of the organisation to drive high standards of performance and ensure best-for-project outcomes. The success of this collaborative approach and early involvement provides a positive model for the construction industry in terms uniting a diverse project team to achieve exceptional outcomes.

The performance of the project team against specific safety, environment and sustainability, quality and progress KRAs is outlined below.

Safety

Safety was the most important consideration on the project. MCJV worked closely with Origin to ensure the safety of all personnel and achieve an outstanding safety result. ‘Game On’, which maximised safety performance, was judged runner up at the 2013 IPLOCA Safety Awards.

A target Total Recordable Incident Frequency Rate (TRIFR) was set at 4.0, which is equivalent to 0.8 under OSHA standards. A program of safety initiatives was implemented resulting in a final TRIFR of 3.80 for over 6.6 million man hours worked, with the completed project’s 12 month rolling average achieving 1.22. This represents approximately half of the industry average. The rolling average TRFIR from June 2012 to June 2014 is shown in Figure 10.

Figure 10: Rolling average TRFIR from June 2012 to June 2014
Environment and sustainability

The project team excelled in the effective planning and execution of works to ensure maximum productivity and positive environmental outcomes that minimised the footprint of the extensive pipeline. Environmental sustainability was an important element measured and managed through the ‘Game On’ program. There were minor environmental incidents recorded for the duration of the project.

The project was subject to numerous and regular audits by inspectors from the Queensland Department of Environment and Heritage Protection. There were no serious environmental incidents reported or regulator sanctions received during construction.

Rehabilitating the ROW

On completion of construction works, the ROW was immediately restored to preconstruction conditions to match the surrounding landscape. Major watercourses were profiled to their original contours and all watercourses and banks were cleaned out and restored according to pre-construction survey topography and photo monitoring. They were left in better condition than they had been found in a number of cases.

Vegetation rehabilitation was based on existing local vegetation and designed to promote plant growth, manage weeds and maintain ground cover. Permanent pipeline warning signs were erected along the construction corridor and the revegetation will be monitored for two years from project completion by the project team and into the future by the pipeline operator.

MCJV was recognised for its approach to environmental management with the erosion and sediment control program winning the inaugural Australian Pipeline Industry Association Environmental Award in 2012.

Relocating and restoring vegetation

The safe relocation of thousands of plants representing three protected species took priority during clearing and construction to comply with various approved clearing permits. Almost 2,500 threatened Eleocharis Blakeana plants were removed from around the Condabri lateral near Condamine and relocated. Hundreds of Cycas Megacarpa (Cycads) and Rutidosis Lanata were also removed, stored and replanted. Removal was generally completed by hand or with an excavator. Plants in inaccessible areas were transported out by helicopter. Environmental consultants and local experts were employed to assist with the relocation, which took over a year to complete.

Meeting environmental requirements for plant and equipment

The project received the 2013 Biosecurity Award from the Australian Government Department of Agriculture for its successful management of the exotic Siam Snail incursion via importation of plant and equipment from Thailand.

Addressing cultural heritage requirements

There were no significant cultural heritage finds identified before or during construction and all KPIs were met.

Quality

The MCJV Quality team carried out more than 60 quality audits with MCJV, the designers, subcontractors and Australia Pacific LNG in accordance with its integrated audit program. Non-conformance reports, corrective action requests and site and testing records were maintained in the Quality Management System to produce trend charts and item closeout schedules to fulfil project requirements.
An overall target of 4.50% was set for welding repairs. The final rate achieved was 2.59%, as shown in Figure 12. The welding average rate on the mainline pipeline (DN1050 dia) was 105 joints/day, with peak production at 155 joints/day. This production rate was critical to completing the project on time and within budget.

![Welding repair rate - target vs actual](image)

**Figure 12: Welding-repair rate – target vs actual**

Separate subcontract agreements were made between MCJV and its welding subcontractor Howell Davies and welding equipment supplier CRC-Evans. MCJV managed the subcontractors as a collaborative team, ensuring resources were integrated to maximise welding productivity and quality outcomes.

**Progress**

Progress was measured using an Earned Value Measurement System (EVMS). The work breakdown structure at Level 5 was further detailed to Levels 6 and 7, breaking the progress items into measurable and operational tasks. Physical progress was then used at Level 7 to calculate and roll up earned value to higher levels and ultimately overall project level. The as-built S-curve for the project is shown in Figure 13.

![Overall Project Plan Vs Earned Value (%)](image)

**Figure 13: Project as-built S-curve**
The planned completion date of 31 January 2014, shown in Figure 13, was amended by agreement with Origin due to scope changes and adverse weather events, including two flood events associated with cyclones. The project was successfully completed within the target timeframe that met the wider project requirements of Origin and Australia Pacific LNG.

**Exceptional leadership and best practice project management**

A collaborative cultural framework aligned with early contractor involvement raised the benchmark for best practice project management. Best-for-project decision making was institutionalised and a unified culture optimised management and workforce performance. This enabled site leaders to focus on delivery rather than contract issues and foster an environment of continuous improvement for the duration of the project. The single integrated delivery team approach led to agreed solutions and minimised delays.

**A focus on the challenge rather than the individual** enabled challenges to be resolved in an effective manner and encouraged sustainable relationships. This deliberate focus on people and relationships led to team alignment which drove behaviours and buy-in to the game plan. It set an environment for transparent discussions, both good and bad. The single delivery team approach resulted in agreed strategies and resolutions and a culture of continuous improvement.

**Visible leadership and consistency across the project** set the expectation for staff work practices and positive interaction among teams and organisations. Having strong relationships with colleagues and stakeholders positioned individuals and entities to respond effectively when challenges arose. The celebration of wins along the way helped to build motivation and cohesion, and keep staff focused on the end goal.

This had a **positive impact on staff engagement and satisfaction** and resulted in low staff turnover in a very competitive environment.

Results of the final climate survey included:

- 94% of respondents enjoyed working on this project.
- 92% of responses indicated a high level of job satisfaction.
- The clear majority of respondents (97%) indicated they were willing to go above what was required of them in their role.

A sample of comments provided by project team members demonstrates the impact of the approach.

“This is by far the best team atmosphere that I have come across and should be the benchmark for future projects.”

“It’s a shame the project is coming to an end. This is the best team I’ve worked in.”

“Outcomes are quite impressive for a project of its size and number of staff.”

**Optimised construction with a lasting legacy for the industry and community**

Early contractor involvement and collaborative project management strategies enabled the team to develop innovative construction solutions to successfully overcome logistical, stakeholder, environmental, terrain and resource constraints to deliver the project to the satisfaction of all stakeholders.

Local communities, including Indigenous communities, recognised many economic and social benefits as a result of the project. MCJV hired and sourced local resources, created job opportunities and invested in local infrastructure. Local services were procured and regional supply chains built wherever possible and with great success.

MCJV supported the competency development of local employees on the project through provision of Nationally Recognised Training and was nominated for a Queensland State Training Award in 2013. Employees skilled in pipeline construction now have further employment opportunities in the construction industry in Australia or overseas. MCJV also sponsored and supported local community social activities, leaving an important legacy for many communities.