

CASE STUDY

Clough – Post Moresby Power Station

Introduction

Clough is a leading EPC Contractor with a successful track record of delivering complex multi-discipline projects around the globe. Clough (in Joint Venture with [Wartsila](#)) was awarded the EPC contract by NiuPower to deliver the [Port Moresby Power Station Project](#).



Figure 1 Onsite construction

The project was managed through the Clough Brisbane office in collaboration with engineering partner [Wartsila](#) in Helsinki. Onsite work was delivered by Clough using expatriate staff, local staff and a local work force including local subcontractors.

Clough have a mature project controls capability built around traditional systems like PRISM, Oracle Primavera P6 and Oracle E-Business. These systems require site data relating to cost, progress etc. to enable accurate monthly reporting. As is the case with most EPC and construction contractors, Clough traditionally relied on ad hoc and labour-intensive manual processes to collect, format and upload the data required for end-of-month reporting.

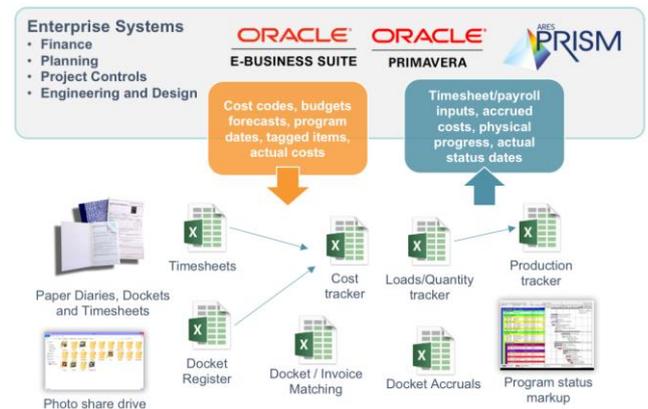


Figure 2 BEFORE - inefficient and ad hoc data silos

Given the remote location and the cost of onsite teams, Clough challenged their normal way of working and applied Lean principles to the collection and processing of site data to support faster decision making, monthly project controls and reporting. Clough selected Envision to help streamline the collection of project data using mobile and web technology. This provided **daily** insight and simplified the end-of-month reporting from their enterprise systems.

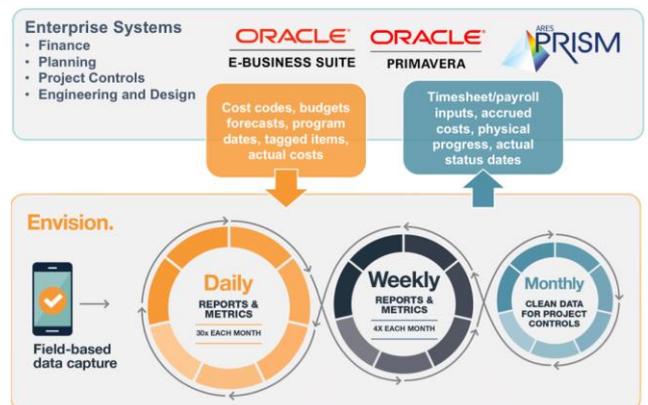


Figure 3 AFTER - streamlined, controlled and transparent daily feedback

Lean Principles

Within construction, Lean principles are typically only applied to field work and not normally, applied to the back office needs of project planning, administration or reporting etc. This is because Lean practices are generally adapted from the manufacturing industry which benefits from having a stable and controlled work environment. These conditions are quite different in construction. However, the key principles of Lean can still be applied across both field and office work practices.

Lean thinking changes the focus of management from optimising separate technologies, assets, and vertical departments to optimising the flow of products and services through entire value streams that flow horizontally across technologies, assets, and departments to customers.

This thinking can be distilled into some key principles:

- Optimise the whole
- Eliminate waste
- Process and flow
- Value generation
- Continuous improvement

From an implementation perspective, these Lean principles can be deployed using the following simple 4 steps.

1. Design and operate work to reveal problems in process
2. Solve problems close in person, place and time
3. Accumulate and share knowledge
4. Develop capabilities in team

In setting up and operating the project Clough and the Envision team utilised the above steps across a range of planning, data capture and reporting activities. A couple of key examples are demonstrated.

“The technology allows us to run with leaner project teams”. “We now have improved quality and frequency of communications”

Geoff Scott, Operations Manager, Clough

Daily Site Records and Reporting

For Clough to deliver the project using a largely offsite (Brisbane based) management team, daily site records and reports were essential.

These records and reports contain information that includes:

- Site conditions (weather)
- Health and safety compliance
- Supervisor diaries
- Workforce attendance
- Delays
- Site photos
- Workforce timesheets
- Plant/Equipment usage

Envision was used by the onsite supervisors and engineers to capture the above data using web and mobile devices. The availability of this real-time data enabled the offsite management team to monitor progress, costs and issues as they occurred. This work flow was critical to keeping the project on track and formed the basis of regular management interventions that, if left until the end-of-month, could have resulted in costly rework and/or program slippage.

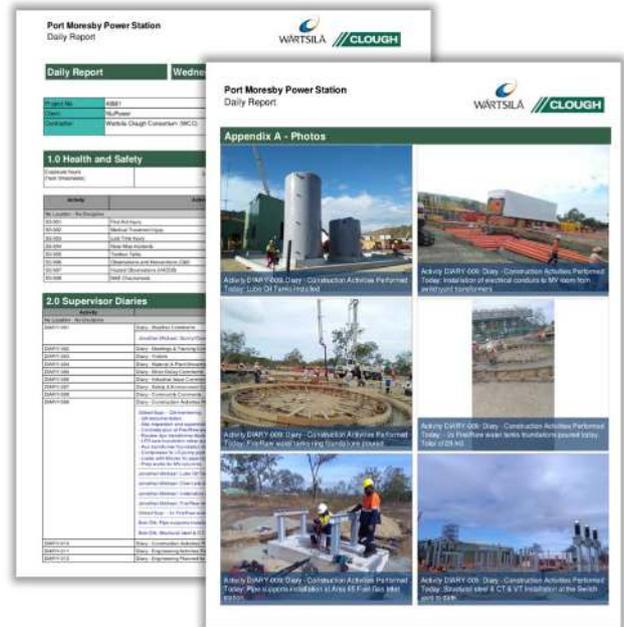


Figure 4 Example of automatically generated report

These work practices have the effect of revealing and highlighting problems, thereby allowing Lean practice of solving problems close in person, place and time.

Change (Event) Management

As is case with all projects, unplanned circumstances arise during the normal course of delivery. To ensure these issues did not snowball or block/impact other activities, the project team tracked and managed events as they occurred.

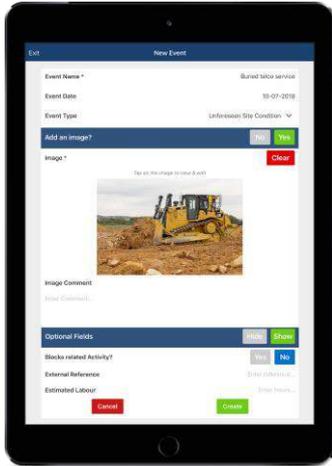


Figure 5 Mobile site Event capture

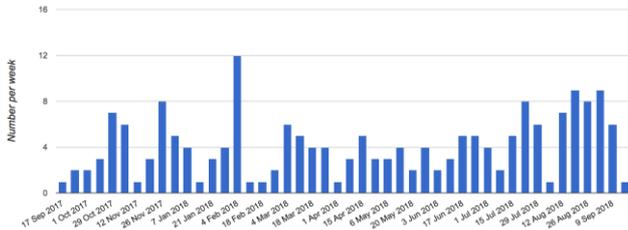


Figure 6 Event creation per week

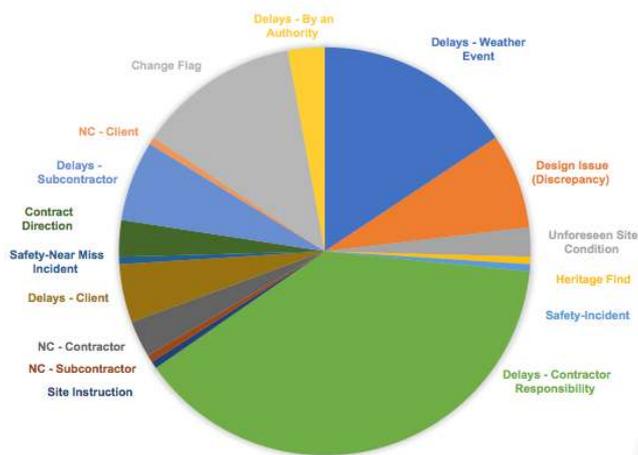


Figure 7 Distribution of Event Types

At the time of writing the project had raised more than 200 events and these were typically

"With Envision we now have less admin time and duplication errors and more time for the analytics."

Paula Gaudiello, Cost Controller, Clough

handled the same day, with the mean time to close being 8 days and the longest being 30 days. These metrics demonstrate the discipline of the project team to manage unplanned site events.

Program Acceleration

A challenge that emerged during delivery of the project was the requirement to accelerate the program. Program acceleration normal creates resource as there are constraints that include availability of labour and the disruption caused

"Clough's innate discipline around process and technology made the implementation easier."

Hugh Hofmeister, CEO, Envision

by more teams working in close proximity to one another.

The project team tracked progress against engineering and construction activities on a weekly basis and generated detailed reports (both client facing and internal). These reports were automatically generated by Envision and included s-curves, cost-code breakdowns, performance metrics including SPI and CPI and percentage completes.

Port Moresby Power Station
Weekly Progress Report

CLOUGH
pursuit of excellence

Overall Control Accounts by Area

Location	Cost Type	Unit	Period	Approved Budget	SAC Amount	Actual Value	SP	Percent Complete		
10000	Progress - Commissioning	\$	To Date	208,200.00	208,200.00	208,200.00	100.0%	100.0%		
		AUD	Report Period							
	Progress - Construction	\$	To Date	3,761,741.79	3,761,741.79	3,433,543.94	91.3%	84.3%		
		AUD	Report Period			1,633,611.14				
	Progress - Engineering	\$	To Date	2,038,748.01	2,038,748.01	2,038,748.01	100.0%	100.0%		
		AUD	Report Period							
	Progress - Fabrication	\$	To Date	1,076,481.19	1,076,481.19	528,739.93	49.1%	49.1%		
		AUD	Report Period							
	Progress - General Ground Improvement Outside Balance	\$	To Date	828,010.00	828,010.00	399,910.99	48.3%	50.0%		
		AUD	Report Period							
	Progress - Head Office Profile	\$	To Date	14,886,000.00	14,886,000.00	10,088,178.41	67.8%	67.8%		
		AUD	Report Period							
Progress - Procurement	\$	To Date	16,477,053.17	16,477,053.17	3,213,814.78	19.5%	19.5%			
	AUD	Report Period			3,073.30					
Progress - Site Facilities - Utilities - Establish (inc. Mobilisation)	\$	To Date	607,200.00	607,200.00	457,240.00	75.3%	75.3%			
	AUD	Report Period								
Progress - Underground services including conduit	\$	To Date	1,390,000.00	1,390,000.00	1,187,888.83	85.4%	87.3%			
	AUD	Report Period								
20000	Progress - Construction	\$	To Date	400,488.64	400,488.64	371,437.03	92.7%	92.7%		
		AUD	Report Period			3,768.91				
	Progress - Engine Hall Concrete	\$	To Date	600,000.00	600,000.00	588,888.89	98.1%	98.1%		
		AUD	Report Period							
	Progress - Procurement	\$	To Date	11,888,788.64	11,888,788.64	1,187,199.88	10.0%	10.0%		
		AUD	Report Period			638,888.78				
	30000	Progress - Construction	\$	To Date	108,547.12	108,547.12	108,547.12	100.0%	100.0%	
			AUD	Report Period						
		Progress - Procurement	\$	To Date	400,000.00	400,000.00	388,888.89	97.2%	97.2%	
			AUD	Report Period						
		Progress - Rebar/iron Concrete Cyls	\$	To Date	100,000.00	100,000.00	100,000.00	100.0%	100.0%	
			AUD	Report Period						
40000		Progress - Construction	\$	To Date	316,410.27	316,410.27	306,641.18	96.6%	97.0%	
			AUD	Report Period						
		Progress - Exhaust stack/Concrete	\$	To Date	300,000.00	300,000.00	288,888.89	96.3%	96.3%	
			AUD	Report Period						
		Progress - Procurement	\$	To Date	77,744.84	77,744.84	6,000.00	7.7%	7.7%	
			AUD	Report Period						
	50000	Progress - Construction	\$	To Date	3,000,370.48	3,000,370.48	1,334,000.11	44.5%	44.5%	
			AUD	Report Period			99,666.67			
		Progress - Procurement	\$	To Date	1,480,070.40	1,480,070.40	1,480,070.40	100.0%	100.0%	
			AUD	Report Period						
		60000	Progress - Construction	\$	To Date	100,000.00	100,000.00	100,000.00	100.0%	100.0%
				AUD	Report Period					
Progress - SPMS Concrete			\$	To Date	100,000.00	100,000.00	100,000.00	100.0%	100.0%	
			AUD	Report Period						
Progress - Procurement			\$	To Date	40,000.00	40,000.00	40,000.00	100.0%	100.0%	
			AUD	Report Period						
70000			Progress - Construction	\$	To Date	100,000.00	100,000.00	100,000.00	100.0%	100.0%
				AUD	Report Period					
	Progress - Procurement		\$	To Date	100,000.00	100,000.00	100,000.00	100.0%	100.0%	
			AUD	Report Period						
	80000		Progress - Construction	\$	To Date	400,000.00	400,000.00	388,888.89	97.2%	97.2%
				AUD	Report Period					
		Progress - Procurement	\$	To Date	10,000,000.00	10,000,000.00	1,000,000.00	10.0%	10.0%	
			AUD	Report Period						
		Progress - Switchyard / Transformers Concrete	\$	To Date	200,000.00	200,000.00	199,999.99	99.9%	99.9%	
			AUD	Report Period						
		90000	Progress - Construction	\$	To Date	100,000.00	100,000.00	100,000.00	100.0%	100.0%
				AUD	Report Period					
Progress - Procurement			\$	To Date	700,000.00	700,000.00	700,000.00	100.0%	100.0%	
			AUD	Report Period						
Progress - Switchrooms / Control room Concrete			\$	To Date	400,000.00	400,000.00	399,999.99	99.9%	99.9%	
			AUD	Report Period						
Total	\$		To Date	34,410,000.00	34,410,000.00	26,007,100.00	75.6%	75.6%		
	AUD		Report Period			3,000,000.00				

Figure 8 Cost account summary report

These reports relied on data collected within both engineering (offsite) and construction (onsite) teams and provided verification that efforts to accelerate the program where being effective. Without these weekly reports, the project team would have otherwise relied on end-of-month reporting to confirm that efforts to accelerate were being effective.

"I know where my project is daily, so I can understand the issues and be prepared, and if required, act in time."

Giuseppe Gaudiello, Project Manager, Clough

Summary

Clough applied Lean thinking to the project control systems and data collection for a remote construction project. This approach enabled them to reduce onsite costs by utilizing the onsite supervision and engineering staff to help gather site data and enable daily reporting.

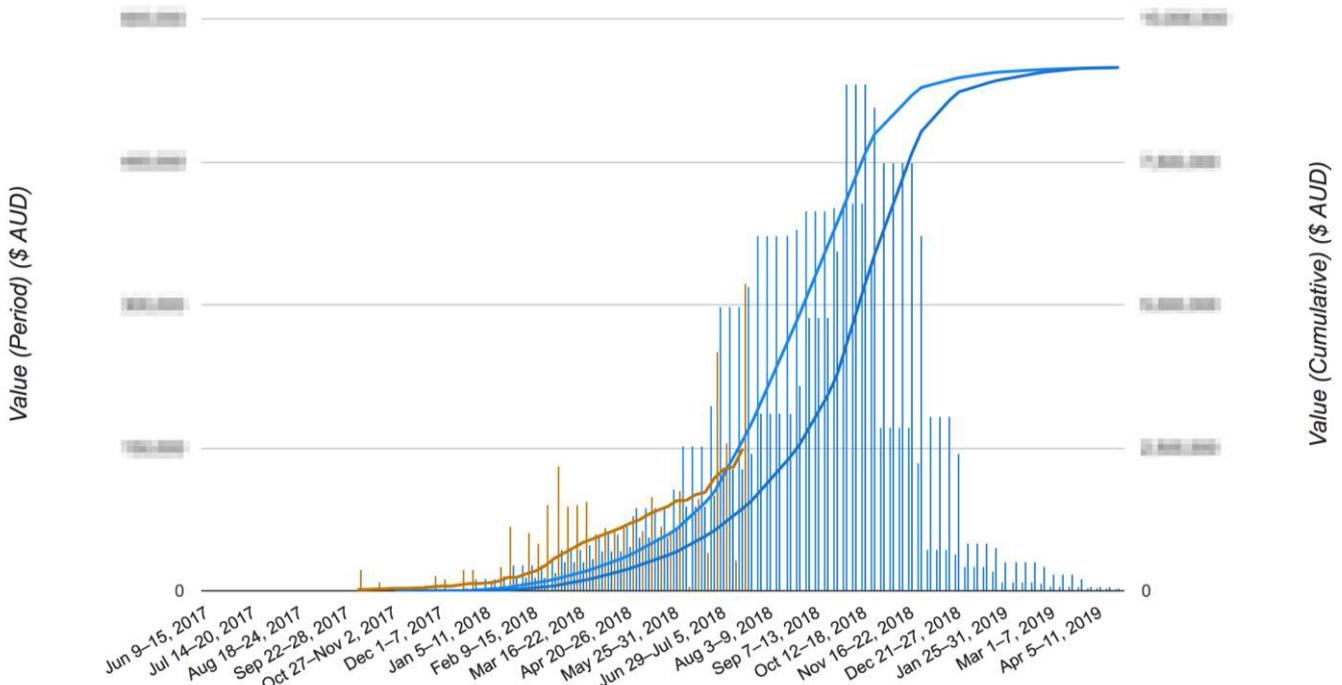


Figure 9 Earned Value s-curve