September 2016

roma to brisbane pipeline

access arrangement submission.

attachment 5-1 – historic capital expenditure project documents

business case
emergency works

Project Review– Capital Expenditure

RBP Emergency Works – Flood Recovery

Business Case Number AA-01 – REVISION 1

1 Project Approvals

TABLE 1: PROJECT REVIEW– PROJECT APPROVALS

Prepared By	Francis Carroll, *Engineering Services Manager Queensland, APA Group*
Reviewed By	Craig Bonar, *Manager East Coast Grid Engineering, APA Group*
Approved By	Paul Thorley, Manager Field Services North East, Transmission, *APA Group*

2 Project Overview

TABLE 2: PROJECT REVIEW – PROJECT OVERVIEW

Description of Issue/Project	This project review addresses APA's emergency response and repair work on the Roma Brisbane Pipeline associated with severe weather events in the period from 2010-11 through to May 2016, including flooding and landslips. The pipeline assets suffered damage from a number of extreme weather events which impacted shippers due to capacity reductions. The impact of the damage was immediate pressure (and hence capacity) reductions were required to safely assess damage, then various outages of pipeline segments to undertake repairs. Work was carried out to restore the pipeline in the areas of Toowoomba, Withcott, Grantham and Marburg.
Options Considered	The following options were considered: 1. Option 1: Do Nothing Option – not undertaking works to restore the pipeline; 2. Option 2: Replace pipeline section in all emergency impacted locations – including two creek crossings, Toowoomba escarpment and Marburg range; 3. Option 3: The selected option was to restore the pipeline by undertaking localized pipe cutout in two locations, temporary reduced diameter insert at rail crossing, pipe lowering at two creek washout locations and HDD replacement at Marburg Range.
Estimated Cost	$16.57 m
Consistency with the National Gas Rules (NGR)	The reinstatement of these assets complies with the new capital expenditure criteria in Rule 79 of the NGR because: • it is necessary to maintain and improve the safety of services and maintain the integrity of services (Rules 79(2)(c)(i) and (ii)); and • it is such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services (Rule 79(1)(a)).
Stakeholder Engagement	Landholders were engaged as part of getting access to the locations where the work was necessary.

3 Background

The Roma Brisbane Pipeline (RBP) traverses a right-of-way approximately 440 km in length between Wallumbilla and Brisbane. This region of Queensland has suffered from a number of severe weather events since the major floods of 2010/11. These weather events led to significant damage to the RBP assets. A range of emergency response and repair activities were undertaken by APA.

Maintaining the integrity and safety of the high pressure gas transmission pipeline system is a mandatory requirement of the Queensland Petroleum and Gas (Production and Safety) Act and Australian Standard AS 2885. APA therefore acted in accordance with the regulations and standards to enact emergency response procedures and to make appropriate repairs to the pipelines.

3.1 Emergency and Repair Works in 2012 Submission

The previous works completed and costs incurred prior to 2012 are detailed in the previous submission Attachment 8.1 “Queensland Floods”, which incorporate the following:

- Toowoomba escarpment – washout of DN400 pipeline, requiring remediation and reinstatement, and loss of containment failure of DN250 pipeline in January 2011 requiring a cut out and replacement pipe construction.
- Rocky Creek crossing, Withcott – major washout of both DN250 and DN400 pipelines, requiring stabilization and in-service lowering of both pipelines
- Arubial meter station – submerged by Condamine River flooding, requiring replacement of electrical and control systems, repairs and modificatons to the site control hut and facilities
- Redbank meter station – submerged by floodwaters, requiring replacement of electrical and control systems, repairs to site hut
- Other watercourse crossings – six sites were affected by bank erosion and basic civil works such as gabion baskets were completed to stabilize the ground around the pipelines. This included Sandy Creek.
- Marburg (Minden) Range – side slope landslip discovered in September 2011. Details of required works were unclear at the AA submission time.

Note that a separate Business Case applies to APA’s proposed future works at the Toowoomba Range.

3.2 Emergency and Repair Works – Current Submission

This project justification details emergency response and repair works that continued in the 2012 to 2017 period. This included some ongoing works related to the 2010-11 flooding and works related to new emergency situations.

The significant emergency and repair works in this period included:

- Toowoomba escarpment – work following a DN250 loss of containment failure in June 2014 including a 70 m pipe cutout and replacement, plus an insertion repair beneath the railway as a result of further damage identified in that area.
- Sandy Creek, Grantham – major flooding of the creek in 2013 caused pipelines to be exposed on the banks and within the creek bed. Initial assessment and bank restoration was done, but further flooding destroyed these works and led to in-service lowering of both pipelines in 2013-2014.
- Marburg Range – A temporary bypass was constructed above ground through the slip area while investigations were carried out. The most appropriate solution to the identified land slip was to relocate both the DN250 and DN400 pipelines out of the unstable material via HDD beneath the slip area.

3.2.1 Toowoomba Escarpment

A loss-of-containment pipeline failure occurred on the Toowoomba Range escarpment in June 2014. Deleted - confidential

The current document reviews the emergency works carried out in response to the 2014 failure, including:

- Pipeline emergency response, shutdown, and failure investigation
- Construction of 70 metre replacement pipeline section in failure zone
- Assessment of other pipeline strain events in the vicinity resulting in a pipeline cutout and insertion repair beneath the railway crossing

3.2.2 Sandy Creek, Grantham

Heavy rain in the area led to creek flooding in early 2013 which caused erosion of the creek banks, fully exposed the DN250 pipeline on both banks and partially exposed the DN400 pipeline. While the pipelines suffered damage there was no loss of containment. This was at the same location where rock gabion baskets were previously installed to protect the pipelines in the creek bed, however the damage this time was at the banks of the creek both east and west of the gabion protection. The creek had significantly widened as a result of the flooding.

As a result of the exposure of the pipeline the MOP was immediately reduced for safety reasons until the damage could be assessed. Then APA undertook an assessment of the pipeline. This involved excavation of the partially exposed sections of pipeline that had been re-buried by action of the flood debris, and diversion of the flowing watercourse to allow access to the pipelines. The assessment identified damage to the pipeline, mainly dents on the side of the pipeline from rocks and other flood debris, and significant damage to the coating. The damage was assessed and repaired by fibre composite strengthening wrap repairs, and coating was reapplied to replace the damaged coating section.

After completion of repairs, the pipeline was returned to service and re-buried. The MOP restriction was removed. Earth works were undertaken to reinstate the creek banks to pre-flood status to return the watercourse to its natural route and effectively cover the pipeline.

Unfortunately, further flooding at the same location only a few months later washed away the newly repaired creek banks and re-exposed the pipelines. Further studies confirmed that the natural creek bed level had been lowered by the floodwater action and the pipelines no longer had sufficient depth of cover. Target depth was identified as 2 metres below the lowest surveyed point of the creek bed and in-service lowering was selected as the most cost-effective option.

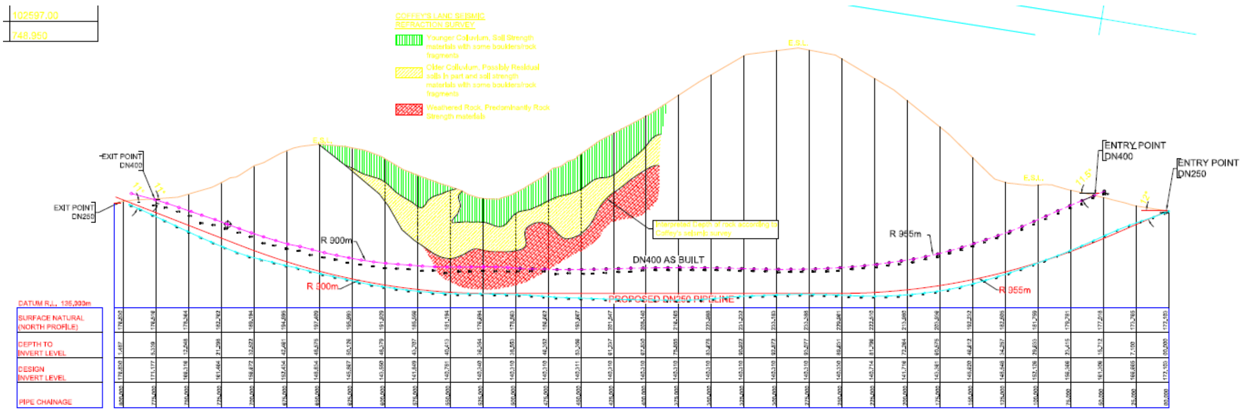
Long and deep trenches were required to implement the lowering, to expose enough pipe to safely lower the creek section without over-stressing the pipe. Significant civil works were therefore carried out through 2013-14 as a major construction project. Each pipeline was separately lowered in a trench using bridging I-beams with chain and winch mechanisms. The photograph below shows the scale of construction required – this was the DN250 pipeline near completion of the lowering process.

Temporary MOP restrictions were enforced on both pipelines while they were exposed during the project. The DN400 was lowered in service, with gas flowing in the pipeline. The DN250 pipeline required blow down, purging and cutting at both ends of the lowering section, due to pipe stress concerns in relation to the vintage girth welds, before lowering and tying-in the lowered pipe section to the existing pipe at either end with new tie-in spools.

3.2.3 Marburg Range

APA discovered a localised landslip in September 2011 in the Marburg Range area at Mile Post 225-226 that had laterally pushed the DN250 pipeline by 1-2 metres. The pipelines are located on a side slope in this area. Emergency works were done to depressurise the damaged section of pipeline and a temporary DN250 above-ground bypass pipeline was constructed through the slip area, using existing DN250 line pipe from APA's spare pipe stocks, and commissioned. Geotechnical and survey monitoring of the slope and of the temporary pipeline was implemented whilst APA developed options for a permanent repair.

Engineering and geotechnical studies determined that in-trench replacement of the pipe was not feasible due to slope instability risks, and that HDD was the preferred option. Due to the high-consequence risk associated with the DN400 pipeline which was located in the same side slope, APA relocated both the DN250 and DN400 pipelines by HDD, beneath the slip area. The total HDD length was approximately 800 metres due to the topography of the area. The image below illustrates the as-constructed pipeline profiles which were selected to avoid the unstable colluvium material in the valley.



LONGITUDINAL SECTION - DN250 & DN400 AS-BUILT

The construction project was challenging due to the steep terrain and ground conditions which made HDD difficult. After the replacement sections were installed in the HDD bore holes, they were tied-in to the existing pipelines. Efficiency was gained by using the new DN250 HDD section as a bypass for the DN400 pipeline, by ensuring that it was hydrostatically tested to a pressure suitable for the DN400 operation. Hot tap and stopple operations were used to divert flow into the bypass and then tie-in the permanent DN400 section. Following DN400 commissioning, the DN250 pipeline was blown down, cut and welded in to the new section. The temporary above-ground bypass pipeline was decommissioned and removed from site and the right-of-way was reinstated.

3.3 Summary of Costs Incurred

The table below summarises the costs incurred by APA in completing these emergency works.

YEAR	FY2012	FY2013	FY2014	FY2015	FY2016	TOTAL
Toowoomba Escarpment			30,578	2,803,439		2,834,017
Sandy Creek, Grantham	135,074	267,564	4,420,467	18,682		4,841,787
Marburg Range				8,787,584		8,787,584
Other		98,027		14,028		112,055
Total	135,074	365,591	4,451,045	11,623,733		16,575,443

Insurance proceeds received by APA in relation to the emergency are summarised below.

YEAR	FY2012	FY2013	FY2014	FY2015	FY2016	TOTAL
Insurance Proceeds	135,074	267,564	2,656,503	6,039,298		9,098,439

4 Risk Assessment

A risk assessment was carried out using APA's corporate risk policy and associated risk evaluation matrix. The below table summarises the risk assessment associated with the unrepaired flood damage.

Note that the risk assessment summary below does not include the leak failures at Toowoomba Range due to the impracticalities and non-legal operation associated with leaving the leak in place.

TABLE 3: RISK RATING (UNTREATED RISK)

Risk Area	Risk Level
Health and Safety	High
Environment	High
Operational	High
Reputation	Moderate
Compliance	Moderate
Financial	Low
Final Untreated Risk Rating	High

5 Options Considered

The options are assessed in accordance with rule 79 of the National Gas Rules and relevant legislative requirements.

5.1 Option 1 – Do Nothing

This would involve not undertaking any work in order to restore the pipelines.

5.1.1 Cost/Benefit Analysis

Do nothing was not a valid option. At the Toowoomba escarpment the pipe had failed and had resulted in a loss of containment. In the case of Rocky Creek and Sandy Creek the exposure of the pipe was resulting in ongoing stress to the pipeline and damage from objects contacting the pipeline. This significantly increased the risk of a failure of containment in addition to posing a public risk from exposure of the pipeline at the eroded creek crossing.

The land movement around Marburg range was placing significant stress on the pipeline and again significantly increased the risk of pipeline failure. As a result of the effects of the weather events, none of these pipelines were at an acceptable level of safety to APTPPL, compliant with APTPPL's obligations under AS2885 or the Petroleum & Gas (Production & Safety) Act.

5.2 Option 2 – Replace section of pipeline

A second option on response to each emergency event was to replace the pipeline at each of the emergency event locations. This would incorporate all of the below works:

- Replacement HDD at both Sandy Creek and Rocky Creek washout – this includes purchase of additional easement to extend out beside the original line. Creek refurbishment would still be required, as would tie-in of new sections to the existing pipelines including hot tap and stopple operations on the DN400 pipeline.
- Replacement HDD at Marburg Range (as was completed);

- Replacement HDD at Toowoomba Escarpment – this was not feasible within the emergency repair timeframe, as a significant quantity of pipe would have been required.

5.2.1 Cost/Benefit Analysis

HDD costs at Marburg range are as per the selected solution - $8.9 million.

Costs of HDD replacements at both the creek washout locations were not investigated - due to the emergency nature of the works, a permanent crossing beside the existing line was not possible, due to the narrow pipeline easement at these crossings and the emergency timeframe of the works. A budget indication of $6.0 million has been adopted considering the scope and scale of a dual HDD replacement, similar to Marburg or Toowoomba but a shorter length and simpler terrain.

Similarly, the failures at Toowoomba escarpment resulted in a gas leak and required immediate response. Due to customer supply impacts, it was not feasible to conduct the required analysis and planning for a replacement HDD at this location, including associated additional easement purchase, within the timeframe required for emergency repair. Deleted - confidential

5.3 Summary of Cost/Benefit Analysis

TABLE 4: SUMMARY OF COST/BENEFIT ANALYSIS

Option	Benefits (Risk Reduction)	Costs
Option 1 – Do Nothing	The pipeline would have remained outside the parameters of safe continued operation	Not compliant with safety obligations – not assessed
Option 2 – Replace Pipelines	Would have resulted in greater expenditure than necessary to alleviate the problem for limited additional benefits.	Approx. $29.4 million
Option 3 – Emergency Repairs	Preferred solution. Minimizes costs whilst rectifying the problem in a reasonable timeline to avoid customer supply impacts.	$16.57m (less insurance proceeds)

5.4 Proposed Solution

5.4.1 What was the solution adopted?

The preferred solution was the repair works undertaken at each of the sites – Option 3.

5.4.2 Why was this solution pursued?

This was the most cost effective and timely means of addressing the damage and risks that occurred to the RBP as a result of flooding. As outlined above doing nothing was not consistent with community expectations and APTPPL's legal obligations.

Replacing larger sections of the pipeline would have been considerably more expensive in some cases, than the emergency repairs actually performed. Further, these replacements were not feasible due to the emergency nature of the works in order to return the pipeline to full capacity within a small timeframe. As outlined above, replacement of larger sections of the pipeline would have involved significant planning, analysis and easement purchase in order to achieve.

5.4.3 Consistency with the National Gas Rules

The capex is consistent with rule 79 of the National Gas Rules.

Rule 79(2)

The capex is consistent with rule 79(2) of the National Gas Rules as it is necessary in order to maintain and improve the safety of services (r79(2)(c)(i)) and it is necessary in order to maintain the integrity of services (r79(2)(c)(ii)).

This expenditure rectified the immediate containment failure in the Toowoomba ranges. This addressed both safety and integrity failures on the pipeline as a result of the slippage. This is consistent with rules 79(2)(c)(i) and (ii). Deleted - confidential

As a result of the pipelines being exposed as a result of localized flooding washing away the earth cover there was a significant risk of pipeline failure at both Rocky Creek and Sandy Creek. Pipeline failure would have obvious repercussions for the safety and integrity of the pipeline. The work undertaken at this site reduced the risk of pipeline failure both in the short term and the longer term consistent with rules 79(2)(c)(i) and (ii).

Failure to undertake the expenditure rectifying Marburg range meant that it would have remained inconsistent with the requirements of good industry practice and APTPPL's legal obligations. There was an increased and significant risk of pipeline failure as has occurred in other geohazard locations on the RBP. This means the expenditure is consistent with 79(2)(c)(i) and (ii).

Rule 79(1)

Rule 79(1)(a) states:

> *the capital expenditure must be such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services*

This capital expenditure is consistent with rule 79 as it is:

Prudent – In the absence of this expenditure the pipeline through the Toowoomba Range would no longer be able to operate due to the loss of containment and the risks posed by the state of the pipeline at Rocky Creek, Sandy Creek and the Marburg range are inconsistent with good pipeline management and AS2885.

Efficient – The option selected is the most cost effective long term option that meets the necessary operational requirements in order to remain compliant with legislative and regulatory obligations and Australian standards. The work was identified and considered under APA's expenditure framework and was undertaken in accordance with APA's procurement policies.

Consistent with accepted and good industry practice – Addressing the risks associated with the damaged pipelines is accepted as good industry practice. In addition, the reduction of risk to as low as reasonably practicable in a manner that balances cost and risk is consistent with Australian Standard AS2885.

To achieve the lowest sustainable cost of delivering pipeline services – The sustainable delivery of services includes reducing risks to as low as reasonably practicable and maintaining reliability of supply.

APT Petroleum Pipelines Limited

Queensland Floods

Attachment 8.1

Contents

1 Flood Impact 2010 - 2011

The period from July to December 2010 was the wettest on record for Australia, while December 2010 was the wettest on record for Queensland [1].

1.1 December 2010 Floods

By mid-December 2010, many rivers were already at or near flood level as a result of the rains in the preceding weeks. Heavy rain from 23 to 28 December, on top of the pre-existing wet conditions, resulted in exceptional flooding in many parts of central and southern Queensland.

Some of the most extreme flooding in late December occurred in the Condamine-Balonne catchment with record flood levels at a number of locations, including the township of Condamine.

The Arubial inlet station connects the Peat Lateral to the RBP DN250 mainline and is located on the outskirts of Condamine, in close vicinity to the Condamine River. It was submerged when the Condamine River flooded but continued to operate on pneumatic run at 70% capacity. However, all electrical equipment had to be replaced, including flow computers, RTUs, communications equipment and air conditioners.

1.2 January 2011 Floods

The most destructive floods during the period occurred during the second week of January in the southeast corner of Queensland. There was major flooding through most of the Brisbane River catchment, most severely in the Lockyer and Bremer catchments where numerous flood height records were set along with the Toowoomba area just outside the Brisbane catchment. In Brisbane it was the second-highest flood of the last 100 years, after January 1974. The flooding caused substantial loss of life, and thousands of properties were inundated in metropolitan Brisbane and elsewhere. Major flooding with inundation of properties also extended inland to the upper Condamine-Balonne catchment, with Chinchilla and Dalby being severely affected for the second time in less than a month[2].

On 10 January, two severe thunderstorms combined into one concentrated storm, delivering intense rainfall across the Great Dividing Range.

[1] Australian Bureau of Meteorology, *Special Climate Statement 24: Frequent heavy rain events in late 2010/early 2011 lead to widespread flooding across eastern Australia,* 2011.

[2] Australian Bureau of Meteorology, *Special Climate Statement 24: Frequent heavy rain events in late 2010/early 2011 lead to widespread flooding across eastern Australia,* 2011.

1.3 Impact on system

Four sites suffered major damage, requiring an immediate response, due to submersion or washout by floodwaters. This included two stations, Arubial and Redbank, that were submerged and two large areas of exposure of the pipeline. At one of these sites, on the Toowoomba escarpment, a landslip required a section of the pipeline to be taken out of service due to a loss of containment.

A further six sites experienced significant washouts, exposing the pipeline and there was substantial erosion across multiple smaller sites along the pipeline.

Operating pressures in both the DN400 and DN250 pipelines were reduced while damage was being assessed however sufficient supply to meet customer demand was maintained during this time.

1.4 APTPPL response

In accordance with AS2885.3, APTPPL deployed resources as required in response to the floods, including;

- An initial, immediate response to ensure safety and security of supply;
- Temporary compressor modifications to provide continuity of supply to meet contracted customer demand;
- Performed engineering assessments in accordance with AS2885.3 to ensure integrity of the pipeline;
- Safety management study conducted to systematically assess and address the risks associated with the flood damage; and
- Substantial remedial works were required at several sites during January to June 2011. Further remedial works continued through to September 2011 to address erosion issues along the pipeline.

1.4.1 Toowoomba escarpment

The RBP runs down the Toowoomba escarpment at an acute angle. There was a significant washout of the DN400 pipeline approximately 200m from the top of the Toowoomba range where the pipeline crosses under a dual railway line. There was also a loss of containment on the DN250, 20m further down the slope, due to land slippage.

A brief summary of key actions follows:

- Stabilisation of the pipelines;

- DN250 pipeline was shut-in between Oakey and Withcott;
- DN400 pipeline supported and stabilised;
- Unstable land mass removed; and
- Exposed DN250pipeline to locate leak site.

Repair to DN250 pipeline

- Blowdown pipeline;
- Performed cold cut to remove defect including upstream and downstream of defect;
- Surveyed and constructed field bend for new pipeline section;
- New pipeline section tie-in – aligned and weld certified;
- Pipeline purged and re-pressurised to 150kpa, then increased by 2,000kpa increments and with foot leak survey conducted down escarpment at each increment;
- Coating repair and site re-instated;
- Intelligent pigging to confirm integrity of pipelines; and
- Repair completed and restricted gas flow to 6000kpa until pipeline integrity confirmed.

Return to normal operations

- Intelligent pigging to confirm integrity of pipelines;
- Coating repair and trench remediation for DN400 pipeline, completed;
- Analysis of pigging data; and
- Pressure restriction lifted.

1.4.2 Rocky Creek washout repair

The RBP runs under Rocky Creek, approximately 5km east of Toowoomba. Prior to the January flood event the pipeline was approximately 1.2m below the surface. There was a major washout of both DN400 and DN250 pipelines resulting in exposure of approximately 80m of DN400 and 10m of the DN250. Repairs to both the pipelines were completed during April 2011.

A summary of key actions follows:

- Initial stabilisation in January 2011, including pipe supports and re-diversion of creek bed;
- For exposed pipeline sections of both DN250 and DN400 pipelines, in accordance with Appendix U3 of AS2885.1 “stresses in unrestrained pipelines” confirmed stress limits were acceptable;
- Commenced preparations including collecting data, surveying pipe levels, assessing repair options, engineering design – stress analysis and pipe lowering profile, prepare execution plan, work method development, construction safety management plan and logistics;
- Expose pipeline and install skids every 15m to hold weight of pipeline; 400m of the DN400 pipeline needed to be exposed;
- Prepare pipeline; defect assessment and coating repair;
- Prepare trench for lowering;
- Support pipeline for lowering;
- Lower pipeline in service; and
- Backfill and remediate site.

1.4.3 Arubial and Redbank stations

Arubial Station is located near Condamine on the Condamine River. It was partially submerged in December 2010; at the peak of the floods the water level was about 2m above ground level. Arubial Station was again partially submerged two weeks later.

A summary of key actions follows:

- Once water receded enough, clean up commenced in compound;
- Following second flooding, local technician sent to site via helicopter to assess damage;
- Once water receded enough again, clean up compound;
- Access track was re-built;
- Control hut opened and all equipment removed to enable clean up;

- Control equipment checked to ensure flow through station was suitable and that control equipment was functional;
- Pneumatic controller installed on the DN400 run to control pressure;
- Over-pressure trip units tested by technicians to ensure operation;
- Compound fence removed and erosion repairs carried out around station;
- Control room and panel cleaned to remove silt/mud and water;
- Design new RTU system;
- Commenced stripping of cables/field devices/control panel;
- Power supply to site moved into new switchboard;
- Field equipment replaced, wired up and tested;
- Engage contractor to raise & relocate Control Room;
- Install re-built control panel and terminate field cables;
- Re-instated power and new air-conditioner; and
- Site communications, phone lines and communications lines to SCADA re-instated.

The Redbank Meter Station is located in Redbank, Ipswich, and was completely submerged at the flooding peak in January 2011.

A summary of key actions follows:

- Once water receded enough, clean up commenced in compound;
- Control hut opened and all equipment removed to enable clean up;
- Control equipment checked to ensure flow through station was suitable and that control equipment was functional;
- Control Panel rebuilt on site with new parts;
- Power supply installed;
- Site communications, phone lines and communications lines to SCADA re-instated; and
- Builders completely stripped out control room and re-lined.

1.4.4 Other washout repairs

- Aerial pipeline patrols conducted to identify locations with potential damage and visual inspection performed;
- Detailed foot patrols performed from Oakey compressor station to Ellengrove gate station;
- Significant washouts requiring repair located at MP's 12, 155.5, 179.2, 185 & 188.8 and 189.5 and photographed for later repair;
- Visual examination and depthing to determine remaining cover over pipeline;
- Re-instatement of appropriate depth of cover over erosion sites; and
- Pipeline history and characteristics.

1.5 *Costs associated with the damage*

It is anticipated that the majority of costs incurred as a result of flooding damage will be recovered through insurance except for those of related ordinary time labour costs. The following table summarises the cost impact of the flood damage in 2010/11.

Table 1.1: Summary of Flood Repair Costs

Repair Sites	Total Cost ($'000)
Toowoomba Escarpment	1,736
Rocky Creek	968
Redbank and Arubial Station	786
Other washouts repairs	837
Total	4,327

Adjustments to base year costs

Taking out:

- Emergency flood response costs.
  - Actual costs - $3.487M including labour ($1.12M), contractors ($1.449M), P&E ($454k), materials ($282k) and other costs ($182k).

- Provision of $840k including contractors ($736k) and materials ($104k).
- Increase in contractor costs ($56k) relating to backfilling of operation staff during flood response and repairs. This estimate was based on a listing of preventative maintenance activities (extracted from the asset maintenance system), using current rates charged by associated contractors.

Adding in:

- Normal operational costs not incurred due to flood response.
  - Labour – actual ordinary time costs that would have been incurred in normal operations ($701k), including cap overtime which is paid as ordinary. The figure is reduced by $125k to reflect ordinary time costs of staff involved in the flood response that are from other areas of the APA Group. These works undertaken by APTPPL on flood damage repairs meant that the proportion of fixed labour resources allocated to the operation and maintenance of the RBP was below normal levels. The high level of labour allocation to flood repair work is not expected to continue in the access arrangement period, due to the exceptional nature of the event.

1.6 *Minden Range 2011/12*

In late September 2011, during flood easement rectification works, it was identified that a land slip on the Minden Range, approximately 25km west of Ipswich had impacted on the DN250 pipeline. It is thought that this slippage may be related to the January 2011 flooding event. At the time of submitting this Access Arrangement proposal, there is limited information available to know definitively the nature and extent of any repair works required. In order to provide an accurate forecast of 2011/12 operating expenditure, a provisional amount of $750k, based on the recent flood repair experience detailed above, has been included in 2011/12 forecast costs. It must be stressed that this is only a best estimate, based on professional judgement and interpretation of the limited information to hand at this time.

Risk Management Policy

Owner	Head of Risk & Insurance		
Policy (including changes) approved by	Audit & Risk Management Committee		24th November 2015
Direct questions on Policy to	Head of Risk & Insurance		
Policy to be reviewed no later than	August 2016		
Version control	Date	Version	Nature of Change
	21 June 2008 17 August 2012 15 October 2013 19 February 2015 24 November 2015	1 2 3 4 5	Rewrite Annual Review Annual Review Impact (Consequence) Update Enterprise Risk metrics

Contents

1 Purpose

Risk is inherent in all aspects of APA Group's (APA) business. The APA Risk Management Policy is designed to apply a consistent approach to the management of risks associated with all activities undertaken by APA.

Our goal is to cost effectively manage risk through identification, assessment and active management and mitigation of potential outcomes. APA will maintain a system of risk management appropriate to the level of risk considered acceptable by the APA Board (Board), which will be based on the international risk standard AS/NZS ISO 31000:2009 (Risk Management – Principles and Guidelines).

2 Values & Commitments

"Risk" is defined as the "effect of uncertainty on objectives". We seek to ensure we understand and manage the risks that could prevent the achievement of APA's core objectives.

Our challenge is to consistently apply robust risk management principles to all parts of APA in an effective and consistent manner. By adopting the principles of risk management we will ensure that the impacts of undesired outcomes are minimised and opportunities are enhanced. We will embrace risk where we understand it and where we believe our controls are appropriate to manage the risk and achieve our overall objectives. We will ensure that the risk management process adds value at all levels of the business.

3 Coverage / Scope

This policy applies to all risks and risk management activities of APA, all subsidiaries and controlled entities. These policy requirements are mandatory unless the Audit & Risk Management Committee (ARMC) or Board approves a specific written exemption.

4 Policy

APA is committed to a culture where risks that could affect our shareholder value, employees, stakeholders, the community, the environment, our reputation, our operating assets, our financial and legal status, or prevent the achievement of our objectives are well managed. APA will manage such risks by:

- Complying with all applicable regulatory and legislative requirements;
- Educating and involving our employees and stakeholders in the process of risk management;
- Articulating the roles and responsibilities of the different controls and individuals within the risk management process;
- Prioritising risk management according to likelihood (probability) and the consequence (impact) of risks, with appropriate consideration of controls and their effectiveness;

- Developing action plans which assign responsibilities and accountabilities to minimise high level risks;
- Incorporating risk management into our strategic plans, project plans, budgets, overall decision making and operating philosophy;
- Undertaking regular reviews of the risk management processes to ensure continuous improvement; and
- Regularly considering and updating the Company's risk registers and risk profile, including the identification of new business activities and unusual circumstances which may present new risks.

4.1 Approval and annual review

This policy is approved by the ARMC and is in force until rescinded or altered by that Committee.

The Head of Risk & Insurance is responsible for ensuring that this Policy is reviewed annually. Amendments to this policy must be approved by the Audit & Risk Management Committee.

4.2 Risk identification and analysis

APA adopts a Top-Down and Bottom-Up approach to the identification, assessment and management of risks:

- **Top Down** – the Managing Director, with support from the executive team, is responsible for developing and maintaining a register of the key risks facing the business. The process will be facilitated by the Head of Risk & Insurance. It is anticipated that this should focus predominantly on strategy / planning risks; and

- **Bottom Up** – Consolidated Risk Owners will develop and maintain a risk register for activities of the business for which they are accountable. It is anticipated that this should largely focus on operational / infrastructure, governance / compliance, reporting, and project risks.

Both approaches will identify / review and analyse risks, and establish mitigation strategies to ensure appropriate management. Risks from individual business units will be consolidated into an APA register of risk. The Managing Director may elect to separate top-down risks into a separate risk register should it be deemed necessary, given the commercial sensitivity of the strategy and planning risks identified.

Analysis of risks must be undertaken in accordance with the rating factors shown as Attachments 1 - 3, which corresponds to the agreed appetite for retention of risk.

It is the responsibility of all Managers to ensure the risk register/s accurately reflect the risks faced by APA at all times. A key component of the risk mitigation strategy must be a process undertaken by management to validate the effectiveness of controls.

4.3 Risk reporting

The Managing Director and the Head of Risk & Insurance must be notified of material risks that have arisen, as they become known. The Managing Director will apply the appropriate discretion in the reporting of those events to the Board and/or the ARMC.

On a half yearly basis, Consolidated Risk Owners (defined in Section 5) and Risk Owners (defined in Section 5) will provide a Risk & Control Declaration to the ARMC confirming:

- The adequacy of the control environment for areas of the business for which the Risk owner is responsible;
- Risk Registers are accurate, and up to date, including actions identified to improve controls and control effectiveness; and
- Details of risks that have occurred, including details of actions taken to respond to the risk at the time it occurred and to minimise probability and impact of recurrence.

The above reports will be requested by, and must be returned to the Head of Risk & Insurance on a half-yearly basis. Upon receipt of the reports, findings will be collated by the Head of Risk & Insurance for reporting to the ARMC.

4.4 Risk Appetite and Metrics

Effective risk management is an integral part of good management practice. It is an iterative process consisting of steps which, when undertaken in sequence, enable continual improvement in decision-making and the treatment of risk. Risk management will not work effectively if it is undertaken as a stand-alone task at a set point in time. It must become embedded into the daily activities of the business.

Where possible, the use of quantitative data and risk expressions to measure likelihood and consequence of any identified risks can be applied. In some circumstances this may not be possible nor efficient or effective, therefore a qualitative approach may be adopted.

The Board have established the appetite for retention of risk. These details are shown in Attachment 3 (Risk Measurement Matrix) which reflects risk ratings based upon consideration of likelihood (Attachment 1 – Likelihood Measures) and Consequence, (Attachments 2(i) Enterprise Consequence Ratings – Enterprise, and 2(ii) Consequence Ratings - Project).

Risk ratings determine the requirement for risk treatment, which may be in one or more of the following forms:

- Avoiding the risk by deciding not to continue with the activity that gives rise to the risk;
- Accepting / taking the risk by informed decision in order to pursue an opportunity;
- Removing the source of the risk;
- Changing the probability (likelihood);

- Changing the impact (consequence); and
- Transferring / sharing the risk with another party or parties (such as insurers).

Appetite for retention for risk must be reviewed on an annual basis and approved by the ARMC.

5 Roles & Responsibilities

All APA staff are responsible for the management of risk. Specific responsibilities are allocated to the APA Executive Committee to ensure that risk management is effectively implemented, maintained and monitored at all levels of the organisation.

It is the responsibility of the person who detects any risk to satisfy himself or herself that the risk has been reported to an appropriate person, and that reasonable steps will be taken to report, rectify and/or manage the risk.

For the purposes of monitoring and managing risk across APA, the following specific responsibilities apply:

The Board

The Board has ultimate responsibility for the oversight of risk management across the APA Group.

The Board is responsible for adopting and reviewing APA's risk-based approach to the identification, evaluation and management of risks that are significant to the fulfilment of APA's business objectives, and for the determination of appetite for retention of risks across the Group.

Audit & Risk Management Committee

The primary risk management function of the ARMC is to maintain and oversee a sound system of internal risk management controls based on the Board's adopted risk management approach. Specific risk management responsibilities include:

- Reviewing and approving APA's risk appetite, the APA Risk Management Policy, and the APA Risk Management Statement;
- Reviewing at least annually APA's implementation of the Risk Management Policy;
- Receiving and reviewing management's report on the effectiveness of risk management and internal systems and otherwise monitoring the effectiveness of risk management and the system of internal control, and progress against agreed risk management plans; and
- Delegation to the Managing Director of approval of individual elements of the Risk Management Framework, (as defined in Section 3).

The Audit & Risk Management Committee will review with APA management the process supporting APA's risk management and internal compliance functions to confirm that they are operating efficiently and effectively in all material aspects, in accordance with the Best Practice Recommendations of the ASX Corporate Governance Council.

Executive Risk Management Committee

The Executive Risk Management Committee ensures that an appropriate level of risk analysis is applied to critical decisions and provides assurance to the Board that risk processes at all levels are effective and compliant with risk management policy and objectives. The Committee is comprised of the members of the Executive Committee and the Head of Risk & Insurance (ex-officio).

The Committee's scope includes:

- Review & Approval of the APA Risk Management Report to Audit & Risk Management Committee;
- Review of half yearly Risk & Control Declarations;
- Compliance with the requirements of the APA Risk Management Policy;
- Review of risk profiles across the business;
- Review of risk profiles across all major projects;
- Ensure an appropriate level of analysis of risks inherent in critical decisions;
- Review of material findings from risk workshops / assessments performed;
- Review effectiveness of the risk management framework;
- Insurance program renewal;
- Insurance claims;
- Issues management; and
- Other matters relating to effective management of risk across APA.

Managing Director

Reporting to the Board, the Managing Director is accountable for ensuring that a risk management system is established, implemented and maintained in accordance with the Risk Management Policy.

Executive Managers ("Consolidated Risk Owners")

Consolidated Risk Owners are the direct reports to the Managing Director and are accountable for risk management within the areas under their control, including devolution of the risk management process to operational managers (Risk Owners), and are responsible for:

- Reviewing risk impact measures to APA to ensure they remain current to APA's context;
- Identifying material business risks that may impact on APA's business plans and objectives and the development, implementation, performance and review of risk management plans. In doing so, management considers all forms of risk across APA;

- Aggregating operational risk data across APA, and monitoring external factors, to facilitate monitoring of APA's risk profile;
- Contributing advice, leadership and facilitation in the development of Group-wide risk control solutions; and

In addition, the Chief Financial Officer has day-to-day leadership responsibility for the activities of the Head of Risk & Insurance.

Head of Risk & Insurance

The Head of Risk & Insurance is responsible for ensuring that a risk management plan is completed for each division of APA. The Head of Risk & Insurance is also responsible for:

- Overseeing and facilitating the co-ordination of the risk management activities of APA;
- Reporting regularly to the ARMC on APA's risk profile and the effective implementation of the APA risk management framework;
- Contributing to leadership of risk management across APA through mentoring, education, and facilitation as a subject matter expert on risk management; and
- Identifying, recommending and implementing mechanisms to elevate the maturity of risk management across APA.

Operational Managers ("Risk Owners")

All risks must be allocated to a Risk Owner, who has responsibility for the accuracy of analysis of the risk, its controls and control effectiveness. Risk Owners have management responsibility for the area to which the risk relates.

Risk Owners are responsible for the development of action plans to improve controls and control effectiveness on risks where deemed appropriate, and within the usual commercial parameters (cost v benefit).

Risk Management Champions

Each business unit across APA has a dedicated Risk Management Champion who has the responsibility to ensure Consolidated Risk Owners meet their obligations in respect to Risk Management.

All APA Staff

Effective risk management is the responsibility of all APA staff.

Internal Audit

Internal Audit provides assurance to the ARMC and the Board of the effectiveness of controls to mitigate identified risks. Whilst it is the responsibility of risk owners to confirm control effectiveness, Internal Audit "checks the checker" to confirm that the validation process is working and effective, in addition to carrying out independent checks.

The internal audit function will be independent of the external audit function. It will have the necessary access to management and the right to seek information and explanation on issues to enable it to fulfill its role.

The Internal Audit function will be accountable through the ARMC to review various functions across APA and provide assurance of effective implementation of APA risk policy, including validation of controls for management of identified risks.

6 Risk Management Framework

Together with this Risk Management Policy, the following documents shall collectively be known as the "APA Risk Management Framework":

- Risk Management Statement,
- Risk Management Handbook,
- Risk Register/s; and
- Business Continuity Policy and Plans.

Other documents may be included in the Risk Management Framework as required.

7 Acceptance / Approval of Risks

Acceptance of risks must be in accordance with the requirements of the APA Delegation of Authority Policy. Individual authorities for the acceptance / approval of risks are based upon risk ratings and are detailed in the Table of Authorities.

8 Issues Register

An Issue is a potential risk that has materialised. It may or may not have been foreseen. When a risk becomes an issue it must be reported within the times specified according to the risk as follows:

- Extreme Risk - Immediate notification to the Managing Director, Consolidated Risk Owner and Head of Risk & Insurance;
- High Risk - Immediate notification to the Managing Director, Consolidated Risk Owner and Head of Risk & Insurance;
- Medium Risk – Immediate notification to the Consolidated Risk Owner / Head of Risk & Insurance;
- Low Risk – Notification to the Consolidated Risk Owner within 10 business days; or
- Negligible Risk - Notification to the Consolidated Risk Owner within 10 business days.

Details of all Issues must be included in an Issues Register, which will be retained by the Business Unit / Project against which the Issue has arisen.

When an Issue arises, the following action must be taken:

- Ensure appropriate steps are taken to respond to the Issue, and to minimise the impact. In the case of a physical risk, this must include any steps needed to minimise the ongoing exposure. Ensure appropriate third parties have been informed (such as insurers, regulators, etc.);
- Review the risk register to validate the assumptions made in analysis of the risk that has arisen, based upon the updated circumstances of the risk; and
- Ensure steps are taken to implement increased controls and / or control effectiveness, as appropriate (on cost v benefit basis).

Issues reporting should not be confused with APA's requirements to report and manage incidents, which will generally be more specific to site risks measured against the metrics required under operational standards (e.g. AS 2885, AS 4645) or local licensing requirements, and more specifically in accordance with the requirements of APA's Health Safety and Environmental Management System, Safeguard.

Where actions are required to improve controls, specific dates for completion of any actions must be determined. The ARMC will undertake a regular review of Issues / Incidents reported and progress in the completion of agreed control improvements, including overdue target dates.

9 Links / interaction with other policies

This policy is the corporate master Risk Management Policy under which all other risk management policies are developed and approved. The policy is not intended to duplicate or override existing operational or regulated risk management processes but rather to ensure a uniform approach to management of risk across APA.

The application of this policy does not diminish APA's responsibility to comply with various other standards (e.g. AS 2885, AS 3806, and AS 4645).

This Risk Management Policy does not diminish APA's responsibility to comply with relevant regulatory and legislative requirements.

In the event of a conflict between the requirements of this policy and the requirements of another corporate policy, this policy will be taken to apply, except where a specific ARMC or Board exemption has been granted.

10 Attachments

10.1 Attachment 1: Likelihood Measures

Enterprise Risks

Level	Descriptor	Description	Frequency
6	Frequent	Is currently occurring, and can be expected to occur on a regular and repeating basis	More than once in any 1 year (1:1)
5	Likely	Can be expected to occur in many circumstances	No more than once in 2 years (1:2)
4	Occasional	Has been known to occur when certain circumstances prevail	No more than once in 5 years (1:5)
3	Possible	May occur when certain circumstances prevail	No more than once in 25 years (1:25)
2	Unlikely	Unlikely to occur unless arising from abnormal circumstances	No more than once in 100 years (1:100)
1	Rare	Conceivable, but has not been known to arise previously	Less than once in 100 years (<1:100)

Probability of future events is driven by the past experience of events arising.

Project Risks

Level	Descriptor	Project Risks	Frequency
6	Frequent	Is certain to occur within the project, given occurrence in other similar projects.	Has arisen in every project (1:1)
5	Likely	Is likely to occur within the project given occurrence in other similar projects.	Arises in 1 in 2 projects (1:2)
4	Occasional	Has been known to occur under certain circumstances in other similar projects.	Arises in 1 in 5 projects (1:5)
3	Possible	May occur during the course of the Project	Arises in 1 in 25 projects (1:25)
2	Unlikely	Has potential to arise during the life of the project, but is not expected.	Arises in 1 in 100 projects (1:100)
1	Rare	Conceivable, but has not been known to occur in any project	Arises in less than 1 in 100 projects (<1:100)

Probability of events is based upon experience within and external to APA projects.

10.2 Attachment 2 (i) – Impact (Consequence) Ratings – Enterprise Risks (excl. Project Risks)

Consequence Category	Definition	Impact (Consequence) Ratings					
		Insignificant	Minor	Medium	Significant	Major	Catastrophic
		1	2	3	4	5	6
Health & Safety	Injuries or illness of a temporary or permanent nature, or death, to employees and contractors or members of the public.	Injury or illness requiring first aid treatment - able to return to work immediately.	Injury or illness requiring external medical treatment - able to return to work the next day / shift.	Injury or illness resulting in time lost from work of one day / shift or more.	Injury or illness resulting in permanent or partial disability.	Fatality or life threatening injuries or illness or permanent total disability	Fatality arising from systematic failure of APA safety systems or Multiple fatalities
Environment	The surroundings in which APA operates, including air, water, land, natural resources, flora, fauna, humans and their interrelationships.	Minor spill of contaminated materials, contained at a localised level.	Loss of containment of contaminant materials extending beyond localised site, but contained without impact to ecosystem and / or habitat.	Loss of containment of contaminant materials extending beyond localised site, with reversible resulting damage to ecosystem and / or habitat.	Localised, reversible, environmental damage (i.e.; not at an ecosystem, habitat level).	Rectifiable damage to an ecosystem, habitat, or site of cultural significance.	Irreversible damage to an ecosystem, habitat, or site of cultural significance.
Operational Capability	Disruption in the daily operations and / or the provision of services or commercial opportunity.	**Transmission:** No interruption to delivery of services or material effect to operations **Networks:** Loss of Service to a domestic customer. **Power Generation**: Complete loss of supply to customers soley relying upon APA related generation for 1 hour.	**Transmission:** An interruption of less than 7 days to the delivery of non-firm services or any interruption to firm services and/or reversible loss of operational efficiencies for less than 12 months **Networks:** Loss of Service to multiple domestic/I&C customers less than 100 **Power Generation**: Complete loss of supply to customers soley relying upon APA related generation for 2 hours.	**Transmission**: An interruption of more than 7 days but less than 1 month to the delivery of non-firm services and/or reversible loss of operational efficiencies **Networks:** Loss of Service to between 100 and 1,000 customers - Loss of service to a Demand customer **Power Generation**: Complete loss of supply to customers soley relying upon APA related generation for 1 day.	**Transmission:** An interruption of more than 7 days but less than 1 month to the delivery of firm services and reversible loss of operational efficiencies **Networks:** - Loss of Service to greater than 1,000 customers - Loss of service to multiple Demand customers - Loss of service, without alternate supply options, to a high risk site with individual consumer impacts (e.g. single dialysis patient) **Power Generation**: Complete loss of supply to customers soley relying upon APA related generation for 1 week.	**Transmission:** An interruption of more than 1 month but less than 1 year to the delivery of firm services and/or material loss of operational efficiencies **Networks:** - Loss of Service to a regional area or greater than 10,000 customers - Loss of service to a Demand customer resulting in material loss - Loss of service, without alternate supply options, to a high risk site with multiple consumer impacts (e.g. hospital, school) **Power Generation**: Complete loss of supply to customers soley relying upon APA related generation for 2 weeks.	**Transmission:** An interruption of more than 1 year to the delivery of firm services and permanent material loss of operational efficiencies. **Networks:** - Loss of Service to a metropolitan area - Loss of service to a Material Demand customer resulting in material loss (e.g. OneSteel) **Power Generation**: Complete loss of supply to customers soley relying upon APA related generation for 1 month.

10.2 Attachment 2 (i) – Impact (Consequence) Ratings – Enterprise Risks (excl. Project Risks)

Consequence Category	Definition	Impact (Consequence) Ratings					
		Insignificant	Minor	Medium	Significant	Major	Catastrophic
		1	2	3	4	5	6
Reputation	The view of APA from stakeholders, including customers, counterparties, security holders, and regulators. (Measured against - knowledge and skills, leadership, vision, quality, financial credibility, and environmental credibility)	Isolated adverse comments from stakeholders	Isolated adverse media coverage	One off negative report by financial analysts Sustained adverse media coverage	Repeated / multiple negative reports by financial analysts Prolonged adverse media coverage	Loss of support from stakeholders, including investors, security holders, financiers resulting in loss of future opportunities Repeated / multiple negative reports by financial analysts	Loss of support and withdrawal from existing investment arrangements with stakeholders, including investors, security holders, financiers. Loss of investment opportunities.
Compliance	The impact from a breach of operational license, legal, regulatory, contractual obligations, debt financing covenant, or reporting / disclosure requirement.	Immaterial non-compliance with an: - operational license - legal/regulatory obligation - contractual obligation which can be resolved internally without the involvement of an external party or negotiation between the counterparties	Immaterial non-compliance with an operational license Legal/regulatory/funding breach which which must be reported to a regulatory authority or lender Immaterial non-compliance with a contractual obligation which can only be by negotiation between the counterparties	Non-compliance with an operational license with scope for loss of license Legal/regulatory/funding breach which requires formal explanation and corrective action plan Material non-compliance with a contractual obligation which can be resolved through arbitration between the counterparties Review Event under debt financing obligation - addressed through consultation	Non-compliance with an operational license without scope for loss of license Legal/regulatory breach which results in an independent investigation by a regulatory authority Material non-compliance with a contractual obligation which results in litigation between the counterparties Breach of covenant under debt financing obligation - not material	Material non-compliance breach of operating license (potential for loss of license) Breach of law resulting in fines and / or imposition of restrictions on the operation of the business Temporary cessation of a contract Breach of covenant under debt financing obligation - material.	Loss of Operational License Breach of law resulting in prosecution and / or incarceration of directors / officers of the company Permanent loss of major / material contract. Event of Default under debt financing obligation - leading to acceleration of drawn debt facilities
Financial	Balance sheet and / or profitability, measured on a cumulative basis.	A negative impact (cumulative) of up to A$2.5M	A negative impact (cumulative) of more than $2.5M but less than $12.5M	A negative impact (cumulative) of more than $12.5M but less than $25M	A negative impact (cumulative) of more than $25M but less than $50M	A negative impact (cumulative) of more than $50M but less than $200M and / or Permanent downgrade of either credit rating by a <u>single</u> notch.	A negative impact (cumulative) of more than $200M and / or Permanent downgrade of either credit rating by <u>two</u> notches or more (i.e. downgrade to sub-investment grade).

10.3 Attachment 2 (ii) – Impact (Consequence) Ratings – Project Risks

Consequence Categories	Impact (Consequence) Ratings					
	Insignificant	Minor	Medium	Significant	Major	Catastrophic
	1	2	3	4	5	6
Health & Safety	First aid treatment only with the ability to return to work immediately	External medical treatment but excluding hospitalisation with the ability to return to work the next day	Injury or illness requiring hospitalisation and resulting in the inability to return to work the next day (LTI)	Permanent partial disability	Fatality OR life threatening injuries OR permanent total disability	Fatality arising from systematic failure of APA safety systems Or Multiple fatalities
Environmental	Limited impairment to minimal area of low significance	Short-term (less than 12 months) temporary impairment to the biological or physical environment of a very localised area (,0.1ha)	Prolonged (more than 12 months but less than 2 years) reversible impairment to the biological or physical environment of a localised area (<1ha) which is easily rectified and which does not affect ecosystem function	An uncontrolled off-site release of event resulting in reversible prolonged (more than 2 years but less than 5 years) impairment to the environment but which does not affect ecosystem function	An uncontrolled off-site release or event in wide area resulting in reversible long-term, environmental impairment of ecosystem function	Uncontained, long-term serious environmental degradation OR permanent impairment to ecosystem function or habitat
Schedule	The higher of: - less than 1 week; or - Less than 5% of the approved schedule	The higher of: - 1 week - 1 month; or - 5% - 10% of the approved schedule	The higher of: - 1 - 3 months; or - 10% - 25% of the approved schedule	The higher of: - 3 - 6 months; or - 25% - 40% of the approved schedule	The higher of: - 6 - 12 months; or - 40% - 50% of the approved schedule	The higher of: - more than 12 months; or - More than 50% of the approved schedule
Reputational	Isolated adverse comments from stakeholders	Isolated adverse local media coverage	Short-term impairment to reputation as perceived by stakeholders (as defined) OR prolonged adverse local media coverage	One-off negative report by financial analysts/s OR isolated adverse national media coverage	Long-term impairment to reputation as perceived by stakeholders (as defined) OR repeated negative reports by financial analyst/s OR extended adverse coverage in national media	Prolonged condemnation by stakeholders (as defined) and / or in the national or international media

10.3 Attachment 2 (ii) – Impact (Consequence) Ratings – Project Risks

Consequence Categories	Impact (Consequence) Ratings					
	Insignificant	Minor	Medium	Significant	Major	Catastrophic
	1	2	3	4	5	6
	Insignificant	**Minor**	**Medium**	**Significant**	**Major**	**Catastrophic**
Financial	The higher of: - variance to budget of <$1m; OR - variance to budget of <5% measured against project Capex	The higher of: - variance to budget of >$1m - $5m; OR - variance to budget of >5% - 10% measured against project Capex	The higher of: - variance to budget of >$5m - $10m; OR - variance to budget of >10% - 15% measured against project Capex	The higher of: - variance to budget of >$10m - $20m; OR - variance to budget of >15 - 20% measured against project Capex	The higher of: - variance to budget of >$20m - $75m; OR - variance to budget of >20% - 25% measured against project Capex	The higher of: - variance to budget of >$75m; OR - variance to budget of >25% measured against project Capex

10.4 Attachment 3 – Risk Measurement Matrix (Likelihood & Consequence)

Likelihood	Consequences					
	Insignificant 1	Minor 2	Medium 3	Significant 4	Major 5	Catastrophic 6
6. Frequent	Low	Moderate	High	Extreme	Extreme	Extreme
5 Likely	Low	Moderate	High	High	Extreme	Extreme
4 Occasional	Low	Low	Moderate	High	High	Extreme
3 Possible	Negligible	Low	Moderate	High	High	High
2 Unlikely	Negligible	Low	Moderate	Moderate	High	High
1 Rare	Negligible	Negligible	Low	Moderate	Moderate	High

Legend:
Extreme risk – Immediate action required and risk monitored at Board level
High risk – Executive Management attention needed and risk monitored
Moderate risk – Management responsibility must be specified
Low risk – Manage by routine procedures
Negligible risk – Review periodically to ensure risk has not increased

business case

aquarium passage

Project Review – Capital Expenditure

RBP Aquarium Passage Crossing

Business Case Number AA-04 – REVISION 1

1 Project Approvals

TABLE 1: PROJECT REVIEW – PROJECT APPROVALS

Prepared By	Francis Carroll, *Engineering Services Manager Queensland, APA Group*
Reviewed By	Jennifer Ward, *Pipeline & Asset Management Engineer, APA Group*
Approved By	Craig Bonar, *Manager East Coast Grid Engineering, APA Group*

2 Project Overview

TABLE 2: PROJECT REVIEW – PROJECT OVERVIEW

Description of Issue/Project	The Lytton Lateral is a DN200 pipeline and part of the Roma Brisbane Pipeline system, which was constructed and commissioned in 2010. Due to issues encountered during the project, the planned crossing of the Aquarium Passage watercourse could not be completed as designed. In order to meet customer schedule requirements, a temporary crossing was installed using a reduced diameter (DN100) pipe installed in the Doboy Bridge. This crossing had a short design life and prevented inline inspection of the entire Lytton Lateral. The Aquarium Passage project replaced the temporary crossing with a permanent DN200 crossing by constructing a horizontal directionally drilled crossing beneath the watercourse, a thrust bore crossing beneath Lytton Road, and tie-ins to the existing DN200 pipework. This was completed in FY15 and was required in order to make the Lytton Lateral piggable and ensure its integrity for the design lifetime.
Options Considered	The following options were considered: 1. Option 1: Do nothing option 2. Option 2: Complete crossing construction (preferred solution)
Estimated Cost	$1.92 million
Consistency with the National Gas Rules (NGR)	The construction of the Aquarium Passage crossing complies with the new capital expenditure criteria in Rule 79 of the NGR because: • it is necessary to maintain and improve the safety of services and maintain the integrity of services (Rules 79(2)(c)(i), (ii) and (iii)); and • it is such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services (Rule 79(1)(a)).
Stakeholder Engagement	The project was developed and executed with careful liaison with the major customer on the pipeline in terms of shutdown and tie-in strategies. The project also involved significant stakeholder engagement with the local council, road authorities, environmental authorities, neighbors and other infrastructure owners in the area.

3 Background

3.1 Lytton Lateral

The Lytton Lateral is a 5 km DN200 lateral on the RBP system that supplies natural gas to the Lytton meter station. It was constructed in 2010.

Works Permit and Environmental Authority variation lead times as determined through project design meant the Aquarium Passage crossing could not be completed within the project schedule for 2010 completion. The following explains the background and what was identified at the design stage for this crossing.

The Access and Approvals Team working on the project identified all the approvals required for Lytton Lateral including the crossing of Aquarium Passage. Project Environmental consultants were engaged to prepare and lodge the relevant documentation to amend the existing Environmental Authority (EA). Three options were explored for the crossing of Aquarium Passage:

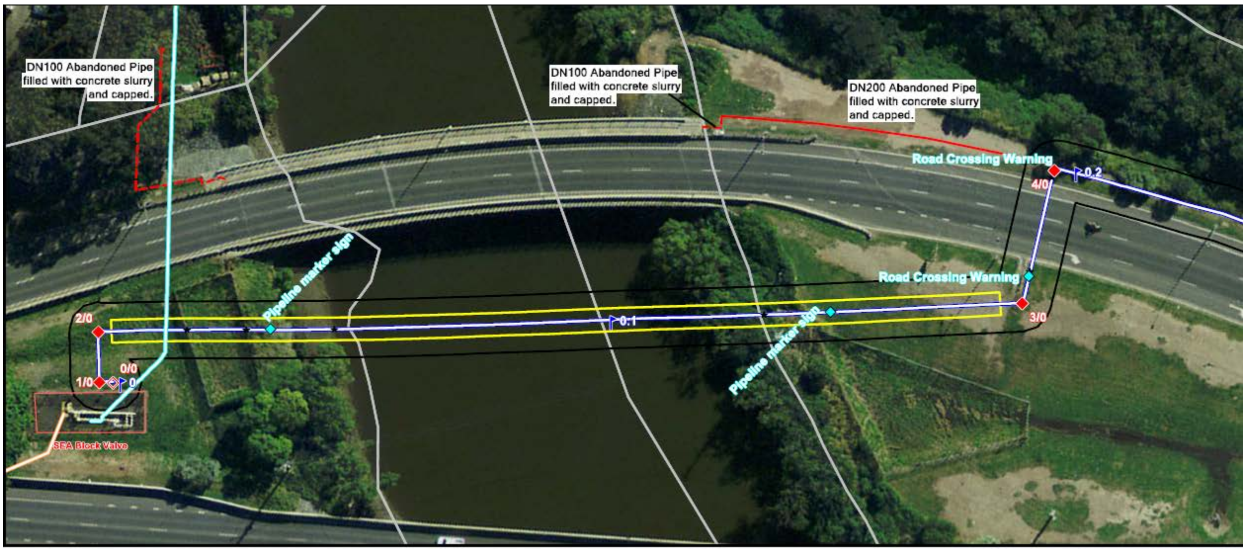
1. Attach the pipe to the external bridge superstructure.
2. Locate the pipe in existing ducting within the bridge's footpath
3. Drill under Aquarium Passage.

Option 3 was determined as the best option to meet long term delivery requirements and satisfy integrity design and management requirements. The environment application process to obtain Department Environment Heritage Protection (DEHP) EA variation and Brisbane City Council's Tidal Works Permit was extensive and waiting for completion would result in significant delays in which gas would not be supplied to the user. (*Note - the BCC Tidal Works Permit has similar mandatory times frames to the development approval process that demands Referral Agency status*)

As the Tidal Works Permit was progressed to approval, a temporary solution using option 2 above was approved by Main Roads and subsequently used to allow commissioning and meet initial supply contract agreement on schedule. The temporary crossing used a reduced diameter pipe and was supplied via a tee off the existing Gibson Island lateral, which meant that the lateral was not piggable. The crossing also only had a reduced design life to reflect the temporary nature of the installation, as it was not inspectable, and the bridge section, installed in a plastic conduit, would not be fully protected against corrosion by the CP system.

3.2 Aquarium Passage Project

The scope of the Aquarium Passage project was therefore to construct a permanent crossing of the Aquarium Passage watercourse and Lytton Road, in DN200 pipe, and to connect the SEA pig launcher to the remainder of the lateral. The image below shows the route of the DN200 pipeline from SEA station on the left, tying into the existing Lytton Lateral on the right. The red lines indicate the position of the temporary pipeline that has now been abandoned.



The reason for its construction was to meet customer timeframes for gas supply in the absence of approvals and permits for the drilled crossing.

3.3 Technical Requirements

AS 2885 requires APA Group as the Licencee to operate the pipeline safely and to manage its integrity. The temporary bridge crossing section had a limited design life of only three years, based on the likely ineffectiveness of cathodic protection inside the bridge conduit and the inability to inspect its condition. It would not have been possible to continue operating the pipeline beyond its design life without a detailed assessment of its condition (this was not feasible given its location inside the bridge structure).

To enable the entire Lytton Lateral pipeline to be pigged and inspected by ILI, it was required to contain only one pipe diameter from launcher to receiver. As it was a smaller diameter in order to fit within the available service conduit on the bridge, the temporary section was not piggable and therefore the entire lateral would not have been able to be inspected or to have an appropriate integrity management regime for a transmission pipeline. Further, the Queensland Petroleum and Gas (Production and Safety) Act and Regulations designate the RBP, inclusive of laterals such as the Lytton Lateral, as a Strategic Pipeline. Strategic pipelines are specifically required by the legislation to be inspected by ILI within seven years of commissioning.

4 Risk Assessment

Overall the main risk associated with the temporary crossing of the watercourse is associated with operation of the pipeline and compliance with licence requirements and regulations. The net effect if the Aquarium Passage project was not completed would be a regulatory directive to shut down the pipeline and cease operations, until a permanent solution was implemented (i.e. the HDD crossing). This presents a material risk to APA in terms of restriction of operation of the business, and cessation of contracted revenue, in the event that APA failed to meet its regulatory obligations for safe operation of the pipeline. In the worst case a potential pipeline failure leading to a high pressure gas leak on the bridge would be a potential outcome.

Refer to the risk assessment result included as Appendix A to the Business Case. Risk was assessed using APA's corporate risk matrix as per the Risk Management Policy.

TABLE 3: RISK RATING

Risk Area	Risk Level
Health and Safety	Moderate
Environment	Low
Operational	High
Reputation	Low
Compliance	High
Financial	Low
Final Untreated Risk Rating	High

5 Options Considered

5.1 Option 1 – Do Nothing

Under this option the temporary crossing would remain in place. APA would be unable to carry out pigging and integrity management activities on the Lytton Lateral. The likely outcome would be a regulatory directive to cease operation of the pipeline and this would be an unsatisfactory outcome.

5.1.1 Cost/Benefit Analysis

This option would have avoided the cost associated with the construction of the Aquarium Passage crossing, however it was not a feasible option for ongoing safe and compliant operation of the pipeline.

5.2 Option 2 – Complete Aquarium Passage Project.

This option entailed completion of the Aquarium Passage project using a HDD crossing of the watercourse, a bored crossing of the Lytton Road eastbound carriageway, and tie-in pipework at SEA and into the existing pipeline. In total approximately 220 metres of DN200 pipeline was constructed, including a HDD of approximately 140 metres.

The scope of the project was as described in section 3.2 above.

5.2.1 Cost/Benefit Analysis

This option provides a compliant and permanent solution to the Aquarium Passage crossing, providing a design lifetime that is matched to the remainder of the Lytton Lateral. It essentially completes the Lytton Lateral project in accordance with the original design intention.

Completion of the project also enables pigging and therefore compliant integrity management of the overall Lytton Lateral.

The actual cost of the Aquarium Passage project was $1.920 million. The project was commissioned in FY15 (January 2015).

5.3 Summary of Cost/Benefit Analysis

Overall,

TABLE 4: SUMMARY OF COST/BENEFIT ANALYSIS

Option	Benefits (Risk Reduction)	Costs
Option 1 – Do Nothing	Unacceptable risk – non compliant with AS 2885 and QLD Legislation	$0
Option 2 – Construct Aquarium Passage Crossing	Risk reduced to LOW – compliant solution enabling business as usual integrity management	$ 1.920 million

5.4 Proposed Solution

The selected solution was to construct the permanent crossing, for the reasons described in the options analysis section.

5.4.1 Consistency with the National Gas Rules

5.4.1.1 Rule 79(1)

Rule 79(1)(a) states:

> *the capital expenditure must be such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services*

This capital expenditure is consistent with rule 79 as it is:

- Prudent – The expenditure is necessary in order to address the significant risks to safety and integrity and to comply with the Queensland Petroleum and Gas (Production and Safety) Act and Regulations requirement that as part of the RBP, Licence #2, the Lytton Lateral as a strategic pipeline must be piggable and must be inspected within 7 years.

- Efficient – The expenditure was undertaken in accordance with APA's planning and procurement policies. These planning and procurement policies are designed to produce effective and efficient procurement practices that are essential to facilitate optimal sustainable outcomes for APA

- Consistent with accepted and good industry practice – Addressing the risks to the pipelines in the manner proposed is consistent with accepted and good industry practice. It made the pipeline compliant with AS2885 and with the Queensland Petroleum and Gas (Production and Safety) Act and Regulations.

- To achieve the lowest sustainable cost of delivering pipeline services – The long term solution implemented is the approach that in the long term delivers the requisite safety, integrity and legal outcomes at the lowest possible cost.

5.4.1.2 Rule 79(2)

The expenditure is justified under rule 79(2)(c)(i), 79(2)(c)(ii) and 79(2)(c)(iii).

As noted above the temporary work that had been undertaken on the Aquarium Passage prohibited pigging the pipeline. Under the Queensland Petroleum and Gas (Production and Safety) Act and Regulations pigging was required within 7 years of construction. In the absence of pipeline upgrade pigging could not be done. The pipeline is now capable of pigging and will be brought into compliance with the law. This makes it justified under r79(2)(c)(iii).

Prior to the construction of the current pipeline the entire Lytton Lateral could not be pigged. This made the long term integrity of the pipe more difficult to determine. Further, the temporary bridge crossing section had a limited design life and it would not have been possible to continue operating the pipeline beyond its design life without a detailed assessment of its condition (this was not feasible given its location inside the bridge structure). This meant risk associated with a failure of the pipeline was higher and there was limited lifespan for the ongoing safe provision of services on the pipeline thus satisfying r79(2)(c)(i) and (ii).

5.4.2 Project Cost Breakdown

TABLE 5: PROJECT COST SUMMARY,

	Total
Labour	853,295
Contractors	871,524
Materials	180,470
Other	15,222
Total	1,920,511

Appendix A – Risk Assessment

		Section Description (as applicable):	Aquarium Passage				
	Risk Description			RISK - Before Treatment			
Item	Category	Possible Consequence Description	Existing Control Measures	Frequency	Consequence	Risk	Comment/Basis
1.0	Health and Safety	Pinhole leak due to undetected corrosion	Pipe wall and coating (CP not effective)	Occasional	Medium	Moderate	
2.0	Environment	Possible loss of contianmnet, without impact to ecosystem		Occasional	Minor	Low	
3.0	Operational	Shutdown of pipeline due to non compliance - outage of up to 1 year		Occasional	Major	High	
4.0	Reputation	Isolated adverse media coverage		Occasional	Minor	Low	
5.0	Compliance	Breach of operating licence or temporary cessation of a contract		Occasional	Major	High	
6.0	Financial	Likely impact of < $2.5M but < $12.5M in terms of revenue or construction repair costs		Occasional	Minor	Low	
7.0	Total Risk			Occasional	Major	High	
8.0							
9.0	With Aquarium Crossing Constructed						
10.0	Health and Safety	Pinhole leak due to undetected corrosion	Pipe wall and coating (CP not effective)	Rare	Medium	Low	
11.0	Environment	Possible loss of contianmnet, without impact to ecosystem		Occasional	Minor	Low	
12.0	Operational	Shutdown of pipeline due to non compliance - no material effect anticipated		Rare	Insignificant	Negligible	
13.0	Reputation	Isolated adverse media coverage		Occasional	Minor	Low	
14.0	Compliance	Breach of operating licence or temporary cessation of a contract		Possible	Insignificant	Negligible	
15.0	Financial	Likely impact of < $2.5M but < $12.5M in terms of revenue or construction repair costs		Occasional	Minor	Low	
16.0	Total Risk			Occasional	Minor	Low	

business case

bi-directional flow

Project Review – Capital Expenditure

RBP Bi-Directional Flow Upgrade

Business Case Number AA-07 – REVISION 1

1 Project Approvals

TABLE 1: PROJECT REVIEW – PROJECT APPROVALS

Prepared By	Francis Carroll, *Engineering Services Manager Queensland, APA Group*
Reviewed By	Paul Thorley, *Manager Field Services North East, APA Group*
Approved By	Craig Bonar, *Manager East Coast Grid Engineering, APA Group*

2 Project Overview

TABLE 2: PROJECT REVIEW – PROJECT OVERVIEW

Description of Issue/Project	To create flexibility and further enhance the options available to customers using the RBP, APA elected in 2014 to investigate the best method for facilitating westbound flows from the RBP into other pipelines for customers wishing to transport gas from the receipt points along the RBP back to the Wallumbilla Hub. It was resolved to amend the licence and construct piping and metering facilities at Wallumbilla to facilitate westbound flows.
Options Considered	The following options were considered: 1. Option 1: Do Nothing Option 2. Option 2: install bi directional functionality
Estimated Cost	$8.159m
Consistency with the National Gas Rules (NGR)	The replacement of these assets complies with the new capital expenditure criteria in Rule 79 of the NGR because: • the overall economic value of the expenditure is positive r79(2)(a). • the present value of the expected incremental revenue to be generated as a result of the expenditure exceeds the present value of the capital expenditure r79(2)(b) • it is such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services (Rule 79(1)(a)).
Stakeholder Engagement	• Discussions were held with shippers about their appetite for a westbound service on RBP. Support for the change existed although there were was no willingness to contract firm capacity for a RBP westbound service.

3 Background

APA Group's Roma to Brisbane Pipeline (RBP) was constructed in 1969 and is the connecting link between Wallumbilla gas hub and Brisbane in the South East. The RBP is currently configured to supply gas from the Wallumbilla Hub, and other producers with inlet facilities along the route, to consumers in Brisbane and environs.

The pipeline is approximately 440 km long and has been expanded since original construction to now consist of fully looped sections of 250mm and 400mm pipelines.

In additional to Wallumbilla there are now receipt facilities into the RBP at Peat and Scotia (via the Peat Lateral pipeline), Windibri, Argyle, Kogan North and Braemar connections

The SWQP originally had a unidirectional connection to the RBP at Wallumbilla, which enabled gas from the SWQP to flow into the RBP. RBP operates at up to 9.3 MPa at Wallumbilla, compared to SWQP which operates at up to 14.92 MPa.

Wallumbilla SWQP facility has three compressor stations. They are:

- WCS1 which includes 3 off Waukesha engine driven Ariel JGD/4 reciprocating compressors and unitized suction scrubbers, aftercoolers and coalescing filters and station fuel gas system, control building, waste oil collection and oily water collection;
- WCS2 which includes 3 off Caterpillar engine driven Ariel JGK/4 reciprocating compressors and unitized suction scrubbers, aftercoolers and coalescing filters, and station fuel gas system, control building, waste oil collection and oily water collection;
- WCS3 which includes 3 off Solar Turbines Mars 90 Gas Turbine units with unitized aftercoolers, standalone station power supply and external Ergon Energy supplied 3-phase power supply, instrument air system, station scrubber, and station fuel gas system, control building, waste oil collection and oily water collection;

This compression capacity is currently fully contracted but under the contracts this compression is available to other users on a non firm basis when not being used by the contracting party. This is clearly a more attractive option than constructing new compression capacity on the RBP.

To create flexibility and further enhance the options available to customers using the RBP APA elected in 2014 to investigate the best method for facilitating westbound flows from the RBP into other pipelines for customers wishing to transport gas from the coal seam gas projects along the RBP into the greater East Coast grid.

4 Options Considered

1.1 Option 1 – Do Nothing

As noted in the background section, prior to the completion of this project there was only unidirectional capability to flow gas from the SWQP eastbound into the RBP. This is despite 41 PJ per annum of gas entering the RBP east of Wallumbilla through inlets including Peat and Scotia, Windibri, Argyle, Kogan North and Braemar connections.

1.1.1 Cost/Benefit Analysis

If the project had not proceeded then the capability would have only remained to have eastbound gas flows from the SWQP to the RBP or flows within the RBP. This would have limited the options available to the users of the pipeline and producers of gas from the CSG areas.

This option would have avoided the capital cost associated with the project of $8.159 million.

1.2 Summary of Cost/Benefit Analysis

The section should include a general overview of how the options compare and identify any options are not technically feasible.

TABLE 4: SUMMARY OF COST/BENEFIT ANALYSIS

Option	Benefits (Risk Reduction)	Costs
Option 1	No additional benefit	$0
Option 2	Install bi-directional capability	$8.159 million

1.3 Solution

1.3.1 The Solution

APA decided to modify the valving and metering equipment in the RBP Wallumbilla facility and constructed a new filtering, metering and flow control skid within the SWQP Wallumbilla facility. This upgrade was commissioned in FY15 with final tie-ins completed in June 2015. The scope included:

- Removal of a check valve and metering orifice plate on Wallumbilla RBP Meter Run 3;
- Demolition of existing Kincora Run 5 skid and pipeline within SWQP Wallumbilla site boundaries;
- Installation of new offtake valve connection;
- Installation of new redundant basket strainers with isolation valves to allow on line cleaning of each;
- Installation of new multipath ultrasonic meter and associated pressure and temperature instrumentation and mechanical isolation and flow conditioning with future ability to upgrade for installation of a series proving run;
- Installation of a new flow control valve with back pressure and flow control capability;
- Installation of new buried connections from new facilities to tie-ins on WC1 suction header adjacent to existing BWP Flow Reversal Skid and on lean gas redirection header for WCS3 suction connection;
- Installation of new actuated valves for run selection for either WCS1/2 or WCS3 flows (not both concurrently);
- Allowance for future pressure control valve installation on both runs to allow future concurrent flows;
- Installation of new control panel, instrumentation and cabling;
- Earthworks and fencing for new facilities;

This project utilizes the existing 300mm. interconnect pipe that runs between the SWQP and the RBP in such a way as to enable the compression on the SWQP to be utilized to take gas out of the RBP.

1.3.2 Why are we proposing this solution?

The selected approach is the most cost effective manner of providing westbound gas flow of 120 TJ/d. Option 1 doesn't provide any ability to flow gas westbound. The preferred option uses the compressors already at Wallumbilla on the SWQP.

Therefore, the preferred option provides the capacity to flow gas westbound at lowest cost. The capacity provided by a relatively small capital expenditure it is extremely likely that this project will provide economic benefits greater than costs.

1.3.3 Consistency with the National Gas Rules

Rule 79(2)

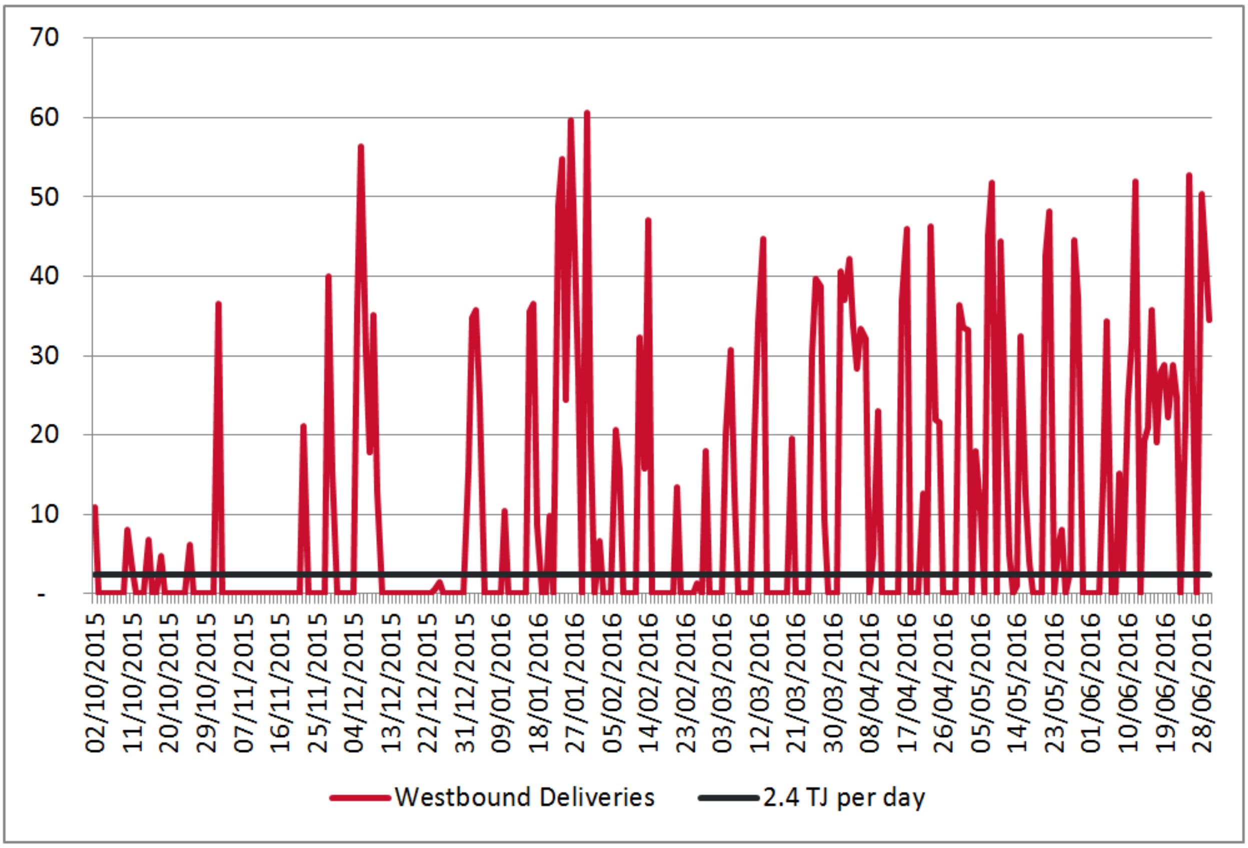
This project was undertaken through the APA planning and procurement framework and therefore is such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services.

The supply and construction work was tendered out in accordance with APA procurement policies. The construction work was awarded to EnergyWorks, wo were selected on the basis they were the most cost efficient respondent that was able to demonstrate specific expertise in completing the installation of the facilities in a safe and cost effective manner. The expenditure can therefore be considered consistent with the expenditure that a prudent service provider acting efficiently would incur. Engineering design was managed by APA's in house engineering team with support from Clough Amec for detailed engineering.

The work on all aspects of this project has been undertaken in accordance with the relevant Australian standards which is consistent with accepted good industry practice

This project is consistent with both Rule 79(2)(a) and Rule 79(2)(b): The expenditure is a very small amount considering it provides 120 TJ capacity. This means it is prudent expenditure to undertake and that it is highly likely to satisfy both of these rules. At an estimated tariff of $0.71 per GJMDQ it requires only 2.4 TJ per day to breakeven. Capex that satisfies 79(2)(b) by definition satisfies 79(2)(a) although it would be expected that volumes at a lower level would still satisfy rule 79(2)(a) even if they should be insufficient for 79(2)(b).

Early experience has been that on average this threshold is satisfied, although the volumes have been highly variable.



The expenditure is directly linked to the ability to provide a westbound gas service. By definition if the service is required then the expenditure is justified. It is also correct that as the capex was efficiently incurred that if the capex is not justified then neither is the service.

1.3.4 Cost Breakdown

The table below sets out the costs for the capital expenditure incurred.

TABLE 5: PROJECT COST SUMMARY

	Total
Labour	735,936
Contractors	5,221,551
Materials	2,038,421

Other	163,207
Total	8,159,115

business case

SCADA upgrade

Project Review– Capital Expenditure

SCADA Upgrade

Business Case Number AA-10 – REVISION 1

1 Project Approvals

TABLE 1: PROJECT REVIEW– PROJECT APPROVALS

Prepared By	Andrew Reghenzani, *Metering and Industrial Systems Engineer, APA Group*
Reviewed By	Richard Kong, *SCADA Project Manager, APA Group*
Approved By	Andries Buys, *Manager Engineering Systems Development, APA Group*

2 Project Overview

TABLE 2: PROJECT REVIEW – PROJECT OVERVIEW

Description of Issue/Project	This project upgraded the SCADA system for the RBP as well as other Queensland APA pipelines. The previous SCADA system was obsolete in terms of IT hardware and software and communications protocols with site devices and was incompatible with APA's move to a national integrated operations centre and common SCADA platform. APA upgraded from the existing Honeywell Experion system (version R301.3) to the ClearSCADA platform provided by Schneider Electric.
Options Considered	The following options have been considered: 1. Option 1: Do Nothing Option 2. Option 2: Change to alternate stand alone system 3. Option 3: Move to National ClearSCADA system
Cost (as incurred)	$1.9m (RBP $0.97m)
Consistency with the National Gas Rules (NGR)	The replacement of these assets complies with the new capital expenditure criteria in Rule 79 of the NGR because: • it is necessary to maintain and improve the safety of services and maintain the integrity of services (Rules 79(2)(c)(i) and (ii)); and • it is such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services (Rule 79(1)(a)).
Stakeholder Engagement	This project was carried out in close consultation with APA's control room, SCADA engineers, local operations and engineering teams and commercial and operational technology groups within APA.

3 Background

APA SCADA System

APA uses supervisory control and data acquisition (SCADA) systems for 24x7 monitoring and control for gas transmission operations. The SCADA system receives and displays operational data from remote sites such as metering, compression and pressure regulating stations. The SCADA system is also used to perform data acquisition for measurement and billing systems.

Prior to this project, APA's SCADA system for Queensland assets including the RBP was the Honeywell Experion version 301.3, built by Honeywell in 2006. No separate Historian was used, rather Experion's built in historical data archiving system was used. A minimum of two years data was available online and older data was archived to storage media which could be restored if requested.

The Honeywell SCADA system eventually monitored approx. 54 remote sites with 6 remote stand alone SCADA nodes (5 Honeywell Experion, 1 GE iFix). The System included approx. 14,186 points.

SCADA development and maintenance were performed internally by APA staff, with ongoing support from Honeywell.

At this time APA was also moving towards a national integrated operations centre with a consolidated SCADA platform across all APA pipelines and assets. The Experion system was not consistent with the national SCADA standardisation initiative or the IOC requirements.

Honeywell Experion System Issues

The Queensland Honeywell Experion system that was in use (version R301.3) was only supported on Windows XP/Windows Server 2003. It was discovered the trend object was not displaying correctly by running Experion clients on Windows 7 and from the Citrix environment. Trends are an essential tool for graphically viewing history and troubleshooting. This issue was investigated but never resolved and was potentially an issue with the version of Internet Explorer and its security settings as the trend object was an ActiveX control.

In order to stay with R301.3 APA would have either had to maintain Windows Server 2003 terminal servers or run Windows XP virtual machines on any Windows 7 PC's, both options are undesirable from an IT security and maintenance point of view.

Upgrading to Experion R400 may have resolved the Windows operating system issue as it is fully compatible with Windows 7/Windows Server 2008, however upgrading Experion also required updating the communications layer software (Bristol Babcock Netview). Considerable risk and incompatibility issues were anticipated as the new Netview software no longer ran as a "service" which is a requirement for Experion.

Server and Communications Infrastructure

The Honeywell Experion system was built on a redundant pair of Dell PowerEdge 2950 servers with Windows 2003 SP2 Server operating system. The SCADA servers were connected to a SCADA local area network which was not fire walled from the corporate network.

The SCADA System communicated with remote telemetry units mainly over satellite / DDS links (provided by Ursys / Telstra) using Modbus and Bristol Babcock protocols (OpenBSI OPC and BSAP serial). The DDS links were replaced by Satellite or NextG links as Telstra discontinued this service provision. Based on the following identified weaknesses identified by Ericsson in a consultant's report written for APA:

- High cost of license and support from Honeywell
- Low level of business integration with Networks SCADA Control Centre in terms of data sharing between common telemetry sites
- Use of proprietary (Bristol Babcock) SCADA/Telemetry protocol

Ericsson recommended that the Mt. Gravatt control centre "Develop a detailed plan for migration to the unified APA Group SCADA platform".

4 Options Considered

1.1 Option 1 – Do Nothing

Under this option the RBP (and other Queensland assets) would have remained on the Honeywell Experion 301.3 SCADA system.

1.1.1 Cost/Benefit Analysis

The consequences of not doing the SCADA upgrade were:

- Support for software and hardware of existing systems was not available.
- The system was becoming less reliable
- Separate processing was required for functionality relating to billing.
- The growth in Input and Outputs created issues for the existing system

No additional capital costs would be incurred to upgrade the system. Increasing additional expenditure would have been incurred to work around the limitations of the unsupported Honeywell system. Due to the risks outlined above being so significant to warrant replacement no attempt was made to quantify these costs.

1.2 Option 2 – Stand-alone SCADA system

Option two is a separate SCADA system for the APA Queensland assets. This system could have been a more modern version of the Honeywell system, or moved to alternate systems separate from the ClearSCADA system used by APA nationally.

This would have involved the entire cost of the SCADA system being allocated between the RBP, CGP and BWP. This would have been an inefficient solution as an entire new system includes computer servers and software which need to be purchased and engineered, and these costs would have been applied only to these three assets.

1.2.1 Cost/Benefit Analysis

This would be an expensive option that would not have provided the additional benefits of the ClearSCADA system as set out in option 3.

High level cost estimates were in the order of $1.5 million to undertake a stand-alone SCADA upgrade for the RBP alone.

1.3 Option 3 – Upgrade to ClearSCADA Platform

This option involved transition of all RBP assets from the obsolete Honeywell Experion system to the new ClearSCADA platform.

1.3.1 Cost/Benefit Analysis

The cost of the project including RBP, CGP and BWP assets was $1.87 million. The estimated cost of the RBP assets alone was $0.97 million.

Benefits of adopting the ClearSCADA platform included:

- Shared hardware e.g. servers and workstations with other APA assets instead of a whole set of hardware for RBP, CGP and BWP alone
- Shared software licenses instead of additional expensive non- ClearSCADA licenses
- Shared internal support instead of additional support by external contractors
- Multiple application users (removal of key personnel risk)
- Consistency with other applications used for the RBP such as Historian.
- Reduced operational risk associated with the different platforms and conventions across APA
- Reduced security and maintenance risk by using standard hardware, software and network architecture.

1.4 Summary of Cost/Benefit Analysis

TABLE 4: SUMMARY OF COST/BENEFIT ANALYSIS

Option	Benefits (Risk Reduction)	Costs
Option 1	No additional benefit	$0
Option 2	Stand alone SCADA	RBP $1.5m (Est)
Option 3	ClearSCADA	$1.87m (RBP $0.97m)

1.5 Implemented solution

1.5.1 What is the Solution?

Option 3 - Move Queensland assets including the RBP across to the ClearSCADA platform with OSI Soft PI Historian package.

The contract for the SCADA upgrade in Queensland was offered and conducted by Schneider Electric after a comprehensive FEED study process. This project was completed in FY16 (final commissioning August 2015). The scope of work involved upgrading the SCADA for the following assets:

- Roma to Brisbane Pipeline
- Berwyndale to Wallumbilla Pipeline
- Carpentaria Gas Pipeline

1.5.2 Why we pursued this solution?

This represented the cheapest long term solution which addressed the risk of the obsolete Honeywell Experion SCADA system that had previously been used for the RBP, CGP and BWP. It also was compatible with the Historian data program which was utilised for data storage and access.

1.5.3 Consistency with the National Gas Rules

Rule 79(2)

This project was undertaken through the APA planning and procurement framework and therefore is such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services.

This project is consistent with both Rule 79(2)(a) and Rule 79(2)(b): A failure of the SCADA system could result in the following negative consequences:

- Loss of remote control (open/close valves, start/stop compressors, change of operating setpoints)

It would also mean that there would be longer term consequences as:

- Loss of pipeline data if the failure was for an extended period (metering, pressure, temperature)
- Critical sites would potentially need to be manned 24hrs per day for any manual controls
- Metering data would either need to be collected manually once per day or estimated

The above 2 points would not be sustainable for any length of time

Therefore the expenditure to manage the risk to safety for APA employees and the general public means that this capital expenditure meets the requirements to maintain and improve the safety of services (r79(2)(c)(i)). The expenditure also manages the risk of interruptions to gas flows and therefore addresses the integrity of the services (r79(2)(c)(ii))

1.5.4 Cost Breakdown

The table below sets out the costs for the capital expenditure incurred.

TABLE 5: TOTAL QUEENSLAND PROJECT COST

	Total
Labour	819,471
Contractors	971,437
Materials	21,619
Other	62,029
Total	1,874,556

10 Appendix B – APA National SCADA Policy Rev A

APA Group

National SCADA Policy

Owner	Asset Management & Engineering			
Changes to be approved by	General Manager Asset Management and Engineering			
Direct questions on Policy to	Engineering Manager			
Policy to be reviewed no later than	July 2014			
Version control	Date	Version	Nature of Change	Approved by Mark Fothergill
	July 2009	A	Initial Issue	

APA Group National SCADA Policy Page 1 of 5

1 Purpose

The APA Group utilises Supervisory Control and Data Acquisition (SCADA) System technology to monitor and control all of its major assets. This must be achieved efficiently and reliably to protect the workforce, the environment, the public and customers and to preserve the Company's assets and reputation.

This policy is to provide standard criteria for SCADA systems for both new assets and for the replacement of current SCADA systems as they reach obsolescence.

2 Coverage / Scope

This policy applies to all APA operated SCADA systems, except for those in power stations and similarly packaged assets, where the SCADA system is an integral part of the vendor's package.

Only SCADA systems are covered. Other information technology systems are outside of the scope.

3 Values & Commitments

This policy provides a basis for efficient and reliable monitoring and control of APA assets. It promotes the following values:

- Maintenance of a safe environment and a professional workplace
- Delivery of business outcomes
- Consistently meeting commitments and delivering excellent results to the benefit of our employees, customers, investors and the community
- Continually improving our processes and systems
- High quality service delivery

and the following commitments:

- Providing customers with safe and reliable delivery
- Providing a safe working environment
- Development and implementation of effective and optimal structures, internal systems and processes to enable the delivery of APA's objectives.

4 Policy

This policy provides standard criteria for new SCADA systems and for the replacement of current SCADA systems as they reach obsolescence.

SCADA systems that are covered by this policy are to be in accordance with the APA National SCADA Blueprint. The Blueprint is a live SCADA system specification developed by defining APA's SCADA needs in all operating areas with an understanding of current SCADA system technology. Its implementation provides APA with optimal SCADA efficiency and reliability and control over its SCADA intellectual property.

The Blueprint's scope includes; the supervisory computer system, communication infrastructure, interfaces and protocols connecting the supervisory system to the RTUs, PLCs and flow computers and to interdepartmental and third party systems that are reliant on SCADA for their data. The scope of the Blueprint does not extend to the specification of RTU, PLC and flow computer SCADA components nor does it extend to interdepartmental and third party systems

When an individual SCADA component requires replacement outside of a major SCADA replacement, the new component must obviously be compatible with the existing SCADA system but must also be capable of operating to National SCADA Blueprint standards.

5 Goals

The Blueprint addresses national SCADA goals:

1. A single SCADA system with a common platform covering all Australian operated assets;
2. Minimal SCADA computer hardware providing a fully backed up platform;
3. Maximum utilisation of common SCADA hardware, including spare parts;
4. Disaster recovery and business continuity capability;
5. Common communications systems and protocols that support the ease of future expansion and mobility;
6. Common security, polling, displays, processes and reporting formats;
7. The flexibility to switch control between control rooms operating continuously and others operating during business hours only;
8. The flexibility and capacity to accommodate new assets;
9. Data processing carried out at field locations;
10. Common utilisation of applications and business systems that are reliant on SCADA data;
11. Transportable master station software;
12. Implementation consistent with APA's IT SCADA security protocols;

13. Capability for log-in via the intranet;

14. On line upgrade capability;

15. Capability of exporting live data: and

16. A common change control process.

6 Links / interaction with other policies

Related APA policies include:

- Crisis and Emergency Management
- Asset Management
- Risk Management
- Work Safety and Hazard Management
- Environmental Management Plan
- IT SCADA security Policies (under development)

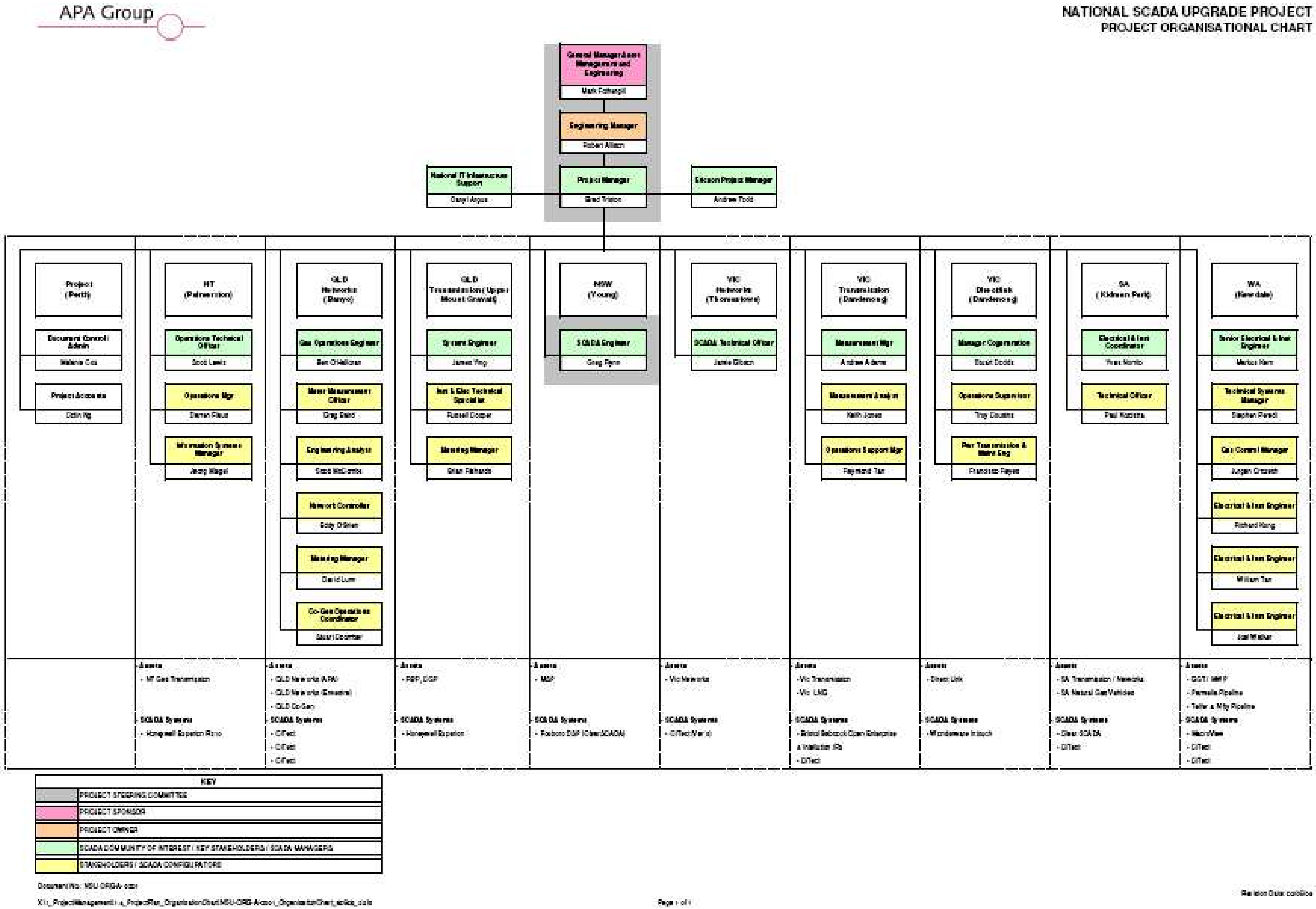
7 Attachments

- National SCADA Blueprint (under development)
- National SCADA Roadmap (under development)
- The list of SCADA systems covered by this policy.

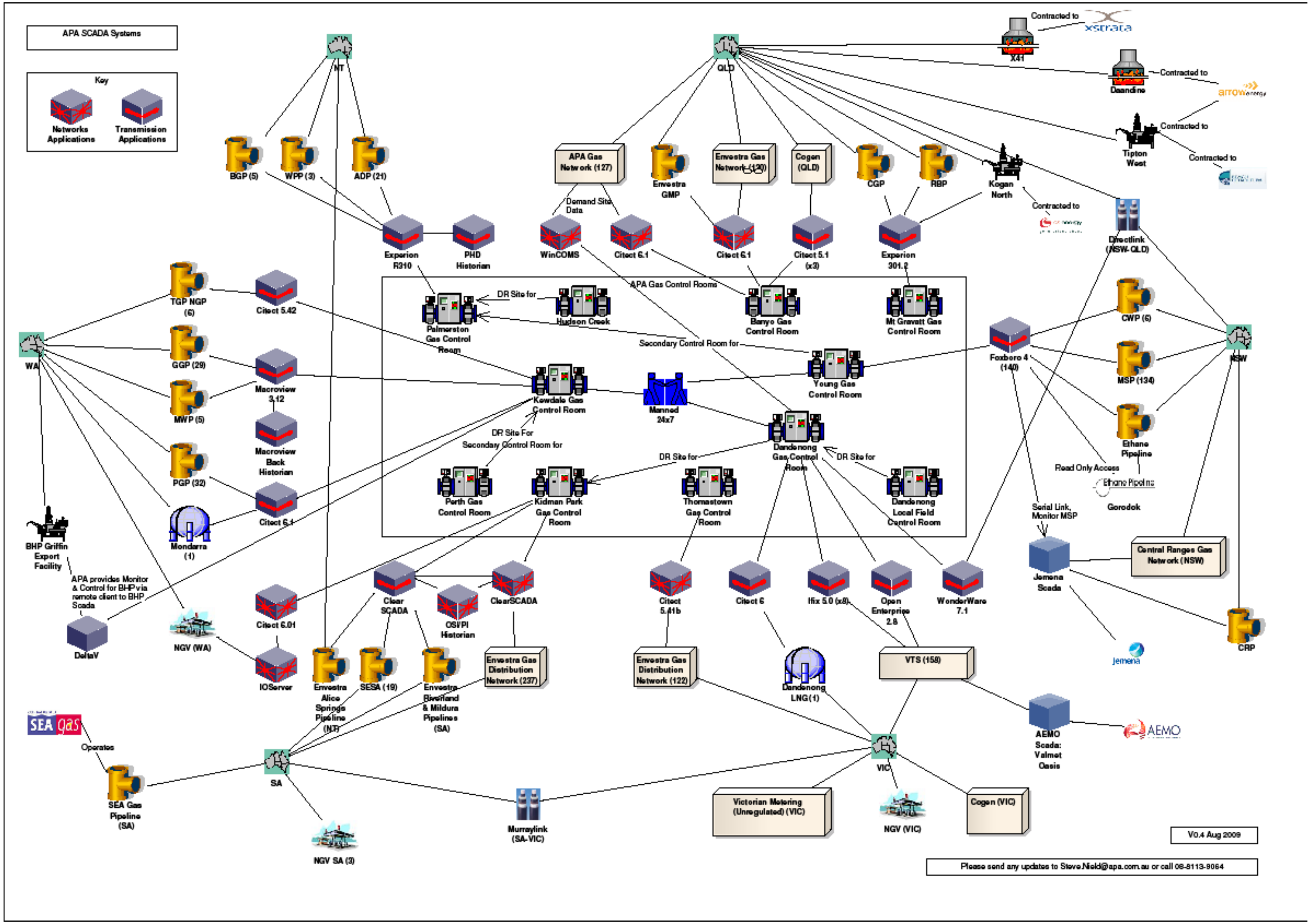
8 Procedures

Procedures for SCADA system replacement and expansion are specified in the National SCADA Roadmap. The Roadmap is a plan (to be developed) for the implementation of the Blueprint.

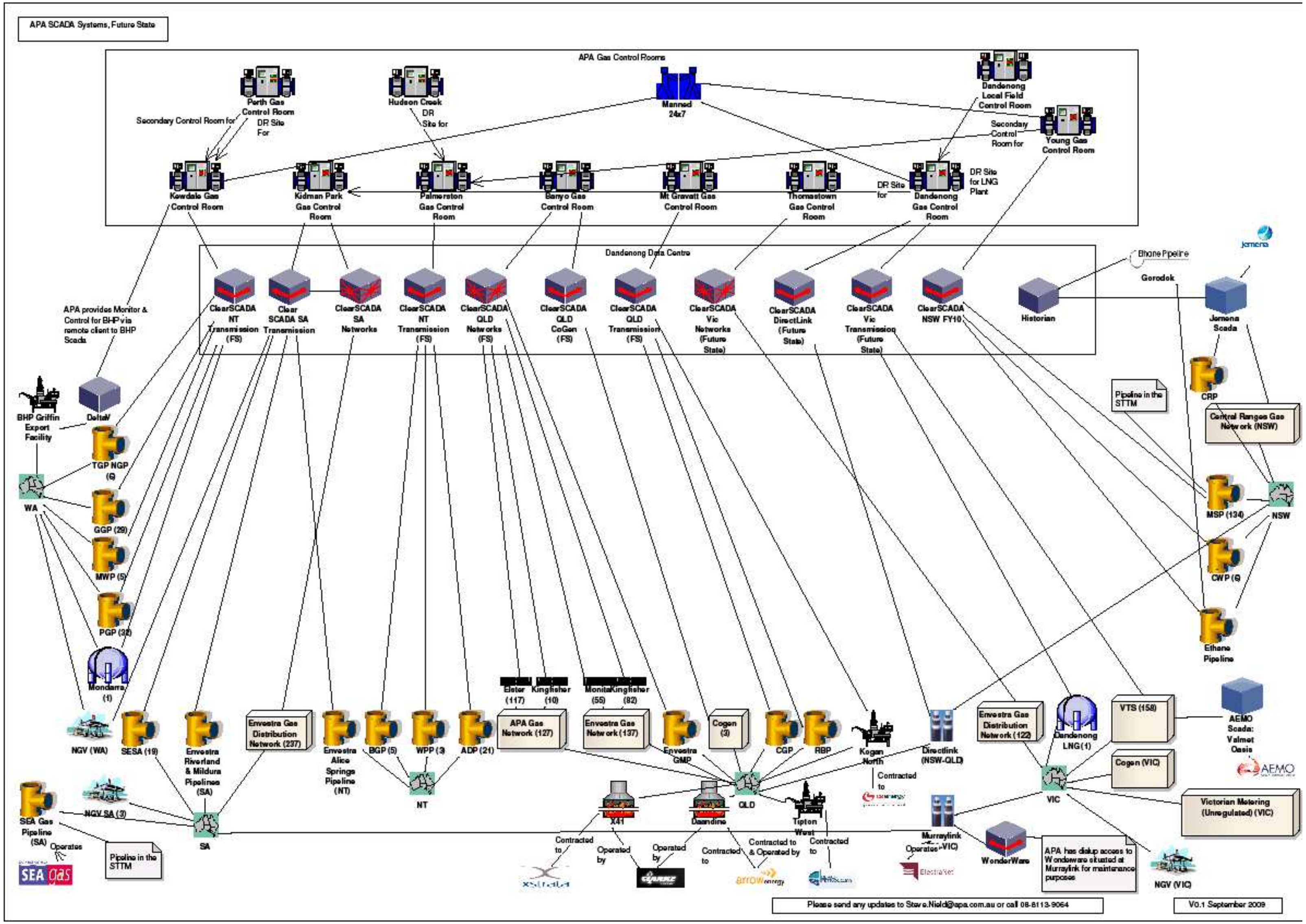
11 Appendix C - Organisation Chart Showing SCADA Systems Involved in the Roadmap



12 Appendix D – Overview of Current APA SCADA Systems



13 Appendix E – Overview of APA SCADA Systems Future State



business case

RTU and Flow Computer Upgrade

APA Group

Project Review– Capital Expenditure

RTU and Flow Computer Upgrade

Business Case Number AA-11 – REVISION 1

1 Project Approvals

TABLE 1: PROJECT REVIEW– PROJECT APPROVALS

Prepared By	Ryan Brown, *Senior Electrical and Instrumentation Engineer, APA Group*
Reviewed By	Francis Carroll, *Engineering Services Manager Queensland, APA Group*
Approved By	Craig Bonar, *Manager East Coast Grid Engineering, APA Group*

2 Project Overview

TABLE 2: PROJECT REVIEW – PROJECT OVERVIEW

Description of Issue/Project	There has been an ongoing RTU (Remote Telemetry Unit) and Flow Computer upgrade program on the RBP assets to replace obsolete station controllers (RTUs) and flow computers. These were identified as a critical risk to pipeline control, as their reliability had been established to be low and numerous failures have occurred in the past. This program was started initially in FY13, however the majority of works were completed on the RBP through FY14 and FY15, with some carryover to finish works in FY16. The original hardware involved consisted of Bristol 3300 series station controllers (circa 1980-1990) and ROC407 flow computers (circa 1985 – 1995). Spare parts for this equipment are not able to be ordered from the vendors and the critical spares storage for these devices was limited to only a few parts, other than those released into service by performing an RTU upgrade. Under this project, the obsolete hardware was replaced with standard functionality and hardware in the form of a Bristol ControlWave Micro PLC, with a flow computer and station controller version of this hardware rolled out respectively.
Options Considered	The following options have been considered: 1. Option 1: Do Nothing Option 2. Option 2: Perform long term, staged replacement 3. Option 3: Perform short, rapid replacement
Cost (as incurred)	$1.10 million
Consistency with the National Gas Rules (NGR)	The replacement of these assets complies with the new capital expenditure criteria in Rule 79 of the NGR because: • it is necessary to maintain and improve the safety of services and maintain the integrity of services (Rules 79(2)(c)(i) and (ii)); and • it is such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services (Rule 79(1)(a)).
Stakeholder Engagement	

3 Background

The RBP system is operated, monitored and controlled by a remote control room, which communicates via a SCADA system to the individual site control systems at the various receipt, metering, compression and delivery stations along the pipeline.

The original control system hardware at the stations prior to this project consisted of Bristol 3300 series station controllers (circa 1980-1990) and ROC407 flow computers (circa 1985 – 1995). Spare parts for this equipment were not able to be ordered from the vendors and the critical spares storage for these devices was limited to only a few parts, other than those reclaimed and reused into service by performing an RTU upgrade.

This control system hardware had reached the end of its service lifetime and required upgrade to current model hardware, with standardised software programming to suit the new hardware.

4 Risk Assessment

Risk assessment was carried out in accordance with APA's corporate risk policy and accompanying risk matrix. These risks were assessed with the legacy equipment in place without any upgrade works.

TABLE 3: RISK RATING (UNTREATED – IF NOT DONE)

Risk Area	Risk Level
Health and Safety	Low
Environment	Low
Operational	High (Loss of supply)
Reputation	Low
Compliance	Moderate
Financial	Low
Final Untreated Risk Rating	High

5 Options Considered

1.1 Option 1 – Do Nothing

Under this option the RBP hardware would not be replaced and equipment replaced only as failure occurs and no spare replacement parts are available.

1.1.1 Cost/Benefit Analysis

The consequences of not doing the RTU upgrades would have been:

- Support for hardware was not available.
- The replacement timeframe is significant (re-engineering and design, as well as comprehensive testing is required)
- Station controllers not operating would mean the lack of remote visibility and control of the pipeline.
- Flow computers not operating would mean metering is not being reported accurately.

No additional capital costs would be incurred to upgrade the system. Though increasingly additional expenditure would have been incurred to work around the limitations of the failed hardware, as well as the possible loss of supply to the customer. Due to the risks outlined above being so significant to warrant replacement no attempt was made to quantify these costs.

1.2 Option 2 –Replacement over 5-10 year Period

Under this option, the RBP RTU hardware would be replaced over a period of 5 to 10 years, with approximately 1 to 3 sites replaced per year.

1.2.1 Cost/Benefit Analysis

The consequences of performing a slower, staged RTU upgrade was:

- No guarantee that a station controller or flow computer planned for upgrade will be the one that fails (refer consequences of option 1)
- No optimisation of hardware roll-out available (shared travel costs, duplicated code, etc)
- Advantages in spreading costs over multiple financial years.

This option was the original option chosen for this project, in FY13 (where only a small number of RTUs were replaced). However, option 3 was switched once a number of system failures caused capacity impacts. The overall direct costs of doing a longer roll-out would be similar, however these costs have been spread over a larger number of years. Accordingly, increased project management and labour costs would be incurred due to the prolongation of the project.

1.3 Option 3 – Replacement over 2-3 Year Period

Under this option, the RBP RTU hardware would be replaced in a 2-3 year period.

1.3.1 Cost/Benefit Analysis

The consequences of performing this faster paced RTU upgrade was:

- Station controllers and flow computers are upgraded as quickly as possible, producing spares faster than failures;
- Optimisation of hardware roll-out available (shared travel costs, duplicated code, etc)
- Disadvantage in compressing costs into a small number of financial years.

This was the option chosen in FY14, after a number of station controller failures caused loss of supply issues.

1.4 Summary of Cost/Benefit Analysis

TABLE 4: SUMMARY OF COST/BENEFIT ANALYSIS

Option	Benefits (Risk Reduction)	Costs
Option 1	No additional benefit. Increased risk of failure and loss of supply.	$0
Option 2	Perform staged replacement over a 5-10 year period	$1.30 million (estimated)
Option 3	Perform full replacement over a 2-3 year period	$1.10 million (actual)

1.5 Implemented solution

1.5.1 What is the Solution?

Option 3 - Perform a roll-out of RTU replacements over 2-3 financial years.

1.5.2 Why we pursued this solution?

This represented the cheapest and lowest risk solution which addressed the issues of the failure of obsolete control systems equipment for the RBP.

1.5.3 Consistency with the National Gas Rules

Rule 79(2)

This project was undertaken through the APA planning and procurement framework and therefore is such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services.

This project is consistent with both Rule 79(2)(a) and Rule 79(2)(b): A failure of the SCADA system could result in the following negative consequences:

- Loss of remote control (open/close valves, start/stop compressors, change of operating setpoints)

It would also mean that there would be longer term consequences as:

- Loss of pipeline data if the failure was for an extended period (metering, pressure, temperature)
- Critical sites would potentially need to be manned 24hrs per day for any manual controls
- Metering data would either need to be collected manually once per day or estimated

The above 2 points would not be sustainable for any length of time

Therefore the expenditure to manage the risk to safety for APA employees and the general public means that this capital expenditure meets the requirements to maintain and improve the safety of services (r79(2)(c)(i)). The expenditure also manages the risk of interruptions to gas flows and therefore addresses the integrity of the services (r79(2)(c)(ii))

1.5.4 Cost Breakdown

The table below sets out the costs for the capital expenditure incurred.

TABLE 5: PROJECT COST

	Total
Labour	499,287
Contractors	351,748
Materials	245,985
Other	5,893
Total	1,102,914

business case

toowoomba station upgrade

Project Review – Capital Expenditure

Toowoomba Station Upgrade

Business Case Number AA-12

1 Project Approvals

TABLE 1: PROJECT REVIEW – PROJECT APPROVALS

Prepared By	Jen Ward, *Pipeline and Asset Management Engineer, APA Group*
Reviewed By	Francis Carroll, *Engineering Services Manager Queensland, APA Group*
Approved By	Craig Bonar, *Manager East Coast Grid Engineering, APA Group*

2 Project Overview

TABLE 2: BUSINESS CASE – PROJECT OVERVIEW

Description of Issue/Project	The RBP Toowoomba meter and regulator station supplies gas from the RBP to the distribution network in the city of Toowoomba. It is one of the original offtake stations on the RBP and its original construction is a similar age to the DN250 RBP, i.e. constructed around 1970. The Toowoomba network supplies around 20,000 customers including hospitals. Equipment in the station had deteriorated and required replacement. Some parts of the station had insufficient capacity for peak demand in the network, and others were not compliant with current design philosophy. A station upgrade was required to ensure reliable and safe operation. This was completed in late 2014.
Options Considered	The following options were considered: 1. Option 1: Do Nothing Option 2. Option 2: Partial upgrade 3. Option 3: Compliant upgrade 4. Option 4: Total station replacement
Estimated Cost	$1.301 million
Consistency with the National Gas Rules (NGR)	The replacement of these assets complies with the new capital expenditure criteria in Rule 79 of the NGR because: • it is necessary to maintain and improve the safety of services and maintain the integrity of services (Rules 79(2)(c)(i) and (ii)); and • it is such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services (Rule 79(1)(a)).
Stakeholder Engagement	Stakeholders consulted for this project included APA Field Services, Commercial, and Control Room departments. APA distribution network engineering and operations staff were also consulted and engaged during the design and construction of the upgrade.

3 Background

The Toowoomba Meter and Regulator Station receives gas from the RBP at mile post 185.3. The station process includes filtration, pressure reduction and regulation, and flow metering out to the Toowoomba city distribution network.

The original station was constructed along with the RBP in the late 1960s/early 1970s. APA had reviewed the design in 2011 and recommended an upgrade. APTPPL included the upgrade as a business case at the time of the 2011 access arrangement submission (Ref APPL12-AA-06-F).

The regulator, filter and metering pipework had design aspects that no longer met current industry standards and practices, such as a single regulator bypass and a filter vessel not rated to the full inlet pressure. The design deficiencies also included isolation valves that under certain circumstances could be exposed to pressures in excess of their safe design, redundant equipment and a dual-cut pressure cut situation without full redundancy. The control valves also had insufficient capacity for the current and anticipated peak demand flows. Toowoomba's climate is such that significant winter morning and evening peaks are experienced due to gas heating appliances in the network. As part of the upgrade project, significant issues were also found with the existing cut and fill ground conditions and the pipe supports which had allowed areas of the station piping to deform out of shape and impose unquantified stresses on the piping.

The station equipment was old and in relatively poor condition with corrosion evident in many places, including the existing filter vessel, pressure control valves, threaded fittings, pipe supports, and similar. To ensure a safe and reliable supply it was necessary to upgrade the facility to modern Standards. Obsolete equipment was removed and the regulators upgraded to provide standard active-monitor dual run configuration and AS 2885-compliant overpressure protection for the downstream network.

Shutdown of the station was not possible due to the criticality of supply to the downstream network. Line pack of the downstream network was assessed as insufficient to provide any survival time in the event of a station shutdown.

4 Options Considered

1.1 Option 1 – Do Nothing

Under this option no capital expenditure would have been undertaken to modernise and make the site compliant with APTPPL's legal obligations. Basic maintenance such as painting of pipework and overhaul of valves would have been continued.

1.1.1 Cost/Benefit Analysis

The 'Do Nothing' option was not considered a viable alternative as the equipment was in poor condition, the design did not provide compliant overpressure protection for the filter vessel or the downstream network, and operational safety was dependent upon warning tags which were subject to environmental degradation.

1.2 Option 2 – Partial upgrade to maintain code compliance

A partial upgrade was possible which would have involved replacement of deteriorated components such as pressure control valves and the gas filter in a simple like-for-like swap. Additional pipework modifications would have been required to provide basic maintainability of the duty equipment. This process would have enabled the current system to be compliant and a second 'first cut' regulator could have been installed to provide a redundant second stream providing for a system failure backup. The bypass piping would have been removed.

This option would not have allowed for reconfiguration of the pressure control skid to active/monitor configuration, rectification of the ground movement and pipe support issues, or removal of all deteriorated and corroded items.

1.2.1 Cost/Benefit Analysis

The station would still have contained redundant equipment and corroded areas of the pipe work that would have needed to be cut out and replaced.

Due to the inability to shut down the station, additional piping and temporary valves would have been required to maintain supply during the upgrade works.

Based on a similar project at the Redbank meter station in previous years, and considering the extra complexity of Toowoomba station in comparison, a budget estimate for this partial upgrade would be in the order of $600,000.

1.3 Option 3 – Compliant station upgrade

This option was the result of a risk assessment on the existing design, which identified one High risk (the non-compliant bypass regulator) and six Intermediate risks associated with the liquid knockout vessel, control valves, isolation valves, lack of peak capacity/redundancy, and pipe support / ground movement issues.

This was the option that was selected and involved:

- New dry gas filter vessel and skid including access platform
- Inlet piping rated to full Class 600 pressures to allow supply from DN400 pipeline in the event of a DN250 pipeline outage (this was needed immediately after the project was commissioned due to issues on the Toowoomba Range nearby)
- Replacement pressure control skid with duty and standby runs, each with active and monitor regulators
- Check valves to prevent reverse flow
- Replacement of piping and equipment under-rated for pressure rating to Class 600 and Class 150
- Provision of future offtakes for meter runs and heater skid
- Updating of station instrumentation to include intermediate pressure monitoring between regulator stages for increased reliability
- Removal of non-code compliant station bypass piping
- Replacement of inadequate and badly corroded pipe supports
- Earthing grid study, new grid design and construction
- Soil survey analysis and new skid footings to suit soil type for filter and pressure regulation skids and pipe supports

The existing turbine meter runs and associated instrumentation were retained and the outlet connections to the distribution network facilities were retained.

A summary of the risk assessment on the design is appended to this Business Case.

1.3.1 Cost/Benefit Analysis

The cost of this option was $1.3 million.

It was considered to be the minimum scope of work to adequately address the identified issues with the end-of-life existing station and to provide a safe and reliable facility to supply the Toowoomba network.

1.4 Option 4 – Complete station replacement

Under this option, the entire station would have been replaced with new. This would have involved all of the Option 3 scope, plus a new hot tap and offtake from the RBP, new Coriolis meter runs with series prove configuration, and instrumentation. The scope of the civil works and electrical earthing would have also been expanded accordingly.

1.4.1 Cost/Benefit Analysis

This option would have addressed all of the risk items associated with the existing Toowoomba station and would have provided a complete new facility.

A budget cost of $2.0 to 2.5 million would have applied to this option.

Due to the higher costs of this option, a complete station replacement incorporating replacement meter runs was deemed not necessary, as the risk associated with the meter run component of the station was low. The project did provide valving to allow a future metering upgrade when necessary. The new offtake from RBP was also not required, as this was addressed by a separate project which installed a new MLV in the DN250 pipeline at the same location.

1.5 Summary of Cost/Benefit Analysis

TABLE 4: SUMMARY OF COST/BENEFIT ANALYSIS

Option	Benefits (Risk Reduction)	Costs
Option 1	Do nothing	$0
Option 2	Partial upgrade	$0.6m
Option 3	Compliant station upgrade	$1.3m
Option 4	Full station replacement	$2.5m

1.6 Proposed Solution

1.6.1 What was the adopted Solution?

The adopted solution was Option 3 – upgrade of all parts of the station with identified significant risks with new code compliant equipment.

1.6.2 Why did we undertake this solution?

This solution was implemented as it was identified as the lowest cost long term option that enabled APTPPL to fully comply with its safety obligations.

The scoping and design process identified a number of issues requiring rectification, particularly valving and piping, but also the filter vessel and the ground conditions and pipe supports. The partial upgrade option, while cheaper initially, would not have rectified all of these issues and would have resulted in further substantial station upgrades required in future years. Option 4, the full station replacement, was assessed as not required since the existing metering was still fit for purpose.

The selected option was a higher cost than initially envisaged when the project was first proposed, which was a result of the risk assessment and identification of additional issues when compared with previous similar projects. The additional scope items were the replacement pressure vessel, and regulator skid (not just individual valves), and the civil works and pipe supports.

1.6.3 Efficient Execution

Procurement packages for the project were competitively sourced from APA's supplier panels, or tendered, for valves, piping and skid fabrication, site construction, electrical works, and engineering support where required.

APA investigated the potential utilization of APA networks fabrication facilities but sufficient resources were unavailable in the timeframes required. A local fabrication and construction contractor in Brisbane, Quality Process Services, was the successful bidder for the skid fabrication and site installation works.

Equipment was constructed, assembled and tested off-site in skid packages in the fabricator's workshop to maximize efficiency and minimize site construction duration and cost.

1.6.4 Consistency with the National Gas Rules

Rule 79(1)

Rule 79(1)(a) states:

the capital expenditure must be such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services

This capital expenditure is consistent with rule 79 as it is:

Prudent – In the absence of this expenditure there was a high risk to the safe and ongoing delivery of gas to Toowoomba.

Efficient – The option selected is the most cost effective long term option that meets the necessary operational requirements in order to remain compliant with AS 2885 and to provide a safe and reliable supply to the Toowoomba distribution network. The work was identified and considered under APA's expenditure framework and was undertaken in accordance with APA's procurement policies.

Consistent with accepted and good industry practice – Addressing the risks is consistent with Australian Standard AS2885. The existing station had exceeded the normal design life for above-ground facilities of 25 years and its condition had degraded to the point where replacement of station components was the appropriate action.

To achieve the lowest sustainable cost of delivering pipeline services – The identified solution delivers the lowest long term cost for rectifying the problems identified at the Toowoomba Metering and Regulator Station. It provides for future metering upgrades at minimal cost and has addressed all of the significant compliance and safety issues in a sustainable manner, avoiding the need for ongoing upgrades if issues were not addressed.

Rule 79(2)

The Toowoomba meter and regulator station was not consistent with appropriate standards. It had a high risk of failure in light of issues with isolation valves that posed a direct to the safety of the station and the supply of gas to Toowoomba users. Therefore, the work was necessary to maintain the safety and integrity of the pipeline services (rule 79(2)(c)(i) and (ii)).

1.6.5 Forecast Cost Breakdown

The table below sets out the costs for the capital expenditure incurred.

TABLE 5: PROJECT COST ESTIMATE,

	Total
Internal Labour	$409,513
Materials	$300,962
Contractors	$588,062
Other Costs	$3,082
Total	$1,301,619

No.	Hazard	Possible Outcome	Likelihood Rating	Consequence Rating	Risk Level (Before Treatment)	Comments / Notes
1	Offtake from DN250 RBP and valve. Condition of pipe offtake is unknown. Single layer PE tape wrap. Unpiggable. Probably original T in RBP construction, not hot tap. Valve is in good condition and seals well.	Corrosion failure could occur on the T or brach offtake underground, considering age and coating type.	Remote	Severe	Low	Only short section (~1 metre?). Suggest dig up and inspect as part of works, if 10" connection will still be used.
2	First cut control valve condition is poor. Corrosion on shaft threads, body etc.	Control valve fails open; second cut takes full line pressure. Regulator out of service. Could lead to worse low temperature issues if prolonged.	Unlikely	Minor	Low	Valve is old. Actuator could be refurbished. Body unknown by vendor - could be replaced. Refurb most likely option. Routine maintenance could be increased.
3	First cut control valve has no backup. If bypassed for maintenance, second cut sees mainline pressure.	No issue in the short term (2nd cut is suitably rated). Increased noise / low temperatures from 2nd cut for extended outage.	Unlikely	Trivial	Negligible	
4	Second cut control valve condition is poor. Corrosion on shaft and body due to wet environment from condensation.	If control valve fails open; liquid knockout would be exposed to 4800 kPa and vent through thermal relief (set @ 4000 kPa). This would be undetected until the site was next attended.	Unlikely	Minor	Low	Preferably address by removing or upgrading vessel. Overhal control valve.
5	Second cut control valve has no backup. If bypassed for maintenance, 1st cut has to be adjusted to a lower pressure beforehand.	As for item 3 - not considered a major problem.	Unlikely	Trivial	Negligible	
6	Both control valves or multiple components fail, due to liquid slug or similar	Vessel sees full line pressure. Probable 3rd cut failure too.	Hypothetical	Severe	Negligible	This type of scenario would cause similar problems even in a new station.
7	Liquid knockout vessel is aged and corroded, rating plate illegible, may only be rated to 4228 kPa. Severe corrosion around sight glass.	Unwanted gas venting or possible failure of vessel, loss of containment. No pressure transmitter, would not discover until operator attended site.	Remote	Severe	Low	Vessel can be isolated and bypassed in the short term. Review process need, consider removing vessel. Possible future changes in gas supply points. Consider extra pressure transmitters. Better inspection and/or larger relief valve??
8	Ball valves DN 100 x3 around liquid knockout vessel. Valves are aged, condition uncertain.	Not frequently used. Could be readily tested for sealing ability. Possible gas passing during maintenance / upgrade work if there is a problem.	Unlikely	Trivial	Negligible	
9	Thermal relief (DN 20) on liquid knockout vessel is set to 4000 kPa, will vent if 2nd cut control valve fails but is not full flow relief.	Pressure vessel may be overpressured as relief is too small for full flow, may not be compliant with AS 1210.	Unlikely	Severe	Intermediate	A process review should investigate the need for this vessel. Consider removing vessel entirely if not needed, otherwise replace/upgrade including overpressure protection.
10	Third cut control valves condition is very poor. Still functional but very wet and corroded. The capacity is insufficient for station flows - both runs are needed for daily peaks and there is no duty/standby arrangement.	If one valve fails or has to be isolated, supply to the network would be restricted.	Occasional	Severe	Intermediate	Consider replacement with new higher capacity regulators if retaining this part of the station. Otherwise consider new regulator runs in the upgrade design.
11	The two isolation valves (V14 and V15) downstream of 3rd cut are under-rated. They are Class 150 but should be Class 600. Design is not code compliant.	Either valve could be exposed to 2400 kPa (2nd cut pressure) if closed and the 3rd cut regulator failed to lock up.	Unlikely	Severe	Intermediate	Replace with Class 600 if upgrading existing regulator runs. Otherwise modify station to eliminate this hazard.
12	Station relief valve and vent. The relief is (or will be soon) a new unit and in good working order.	If the PSV opens, there would be noise and environmental issues from this large valve. However there are no close residential neighbours.	Unlikely	Trivial	Negligible	Option to replace with slam-shuts in new design, however this is not preferred for a distribution network station. Suggest leaving as PSV
13	Secondary liquids removal system includes 3 "vessels" and automatic dump valves which drain to the elevated condensate tank. Condition is poor particularly around the sight glasses in each vessel.	Corrosion due to wet environment and poor condition (e.g. around sight glass) could lead to a leak or failure of the vessel.	Unlikely	Minor	Low	Review need for these vessels. Consider removing entirely if not needed, otherwise replace/upgrade including overpressure protection.
14	Metering runs (turbine meters). Meters are old and according to GTA should be recertified every 3 years. This requires overseas shipment. No capability to run meters in series.	A meter failure could occur; the second meter would then be used.	Unlikely	Trivial	Negligible	Consider including series prove ability in any pipework mods in the area, or new metering skid.
15	Station bypass is not code compliant and has insufficient capacity. 1" regulator is old and there is no secondary overpressure protection or relief. The condition of the underground bypass pipe is unknown.	If the bypass had to be used in its current state, the most likely scenario is a supply restriction when bypass used.	Occasional	Severe	Intermediate	Bypass would require upgrade with over pressure protection and sufficient size regulator to be safely useable. Consider removal of bypass and station upgrade to dual runs.
16	Bypass regulator could fail if used, and overpressure downstream network. There is no secondary overpressure protection or relief and no means of isolating the bypass from the distribution network without shutting supply.	Overpressure of distribution network.	Unlikely	Major	High	Bypass would require upgrade with over pressure protection and sufficient size regulator to be safely useable. Consider removal of bypass and station upgrade to dual runs.
17	Station bypass has a Class 300 valve immediately downstream of bypass regulator. Cannot isolate to remove without shutting in station.	Valve could be overpressured if closed (same issue as valves downstream of 3rd cut regulators). Should be Class 600.	Unlikely	Severe	Intermediate	Bypass would require upgrade with over pressure protection and sufficient size regulator to be safely useable. Consider removal of bypass and station upgrade to dual runs.
18	Pipework and fittings condition generally is poor. Bolts, grease nipples, small-bore pipework / fittings, instrument valves, etc. are corroded and in poor condition due to the condensation and continually wet surrounds.	Continued deterioration may lead to a failure on small-bore item and a gas release.	Unlikely	Minor	Low	Consider replacement of all deteriorated fittings / tubing during upgrade project.
19	Coatings on above ground pipework -condition is poor. Cannot be painted while station is operational due to condensation and low temperatures.	Could lead to (e.g.) a flange leak or bolt failure; in the longer term pipework could be at risk from ongoing corrosion of the pipe wall.	Unlikely	Minor	Low	During station upgrade, use bypass or temporary piping to allow blasting and painting of all main pipework that will remain in place.
20	Condensate drainage and elevated tank are no longer used and may be redundant.	No immediate hazard. Consider removal in future. Could fail and leak condensate / oil if not maintained.	Unlikely	Trivial	Negligible	
21	Instrumentation is lacking (esp. intermediate pressure monitoring)	Risk covered above. Control room would not detect a regulator failure and gas may vent until the operator attends.	Unlikely	Minor	Low	Suggest adding pressure transmitters between all pressure reduction stages and on station outlet (3 additional PITs required)

No.	Hazard	Possible Outcome	Likelihood Rating	Consequence Rating	Risk Level (Before Treatment)	Comments / Notes
22	Low temperatures, condensation, ice. Substantial pressure drop through station leads to temperatures around -10 degrees C. Problem will worsen as loads increase in future.	Continual condensation causes problems in repainting. Damage to concrete slab from water. Need to check pipework minimum temps. Need to avoid frost heave on the ground. If not addressed the risk is same as item 19 above.	Unlikely	Minor	**Low**	Best solution would be a water bath heater, unlikely to be available within existing budget. Leave facility for future water bath heater. Consider trace heating on pipework?
23	No filtration at the station, either on the inlet or any instrument gas lines.	Lack of filtration could affect operation of instruments, meters, regulators, controllers. Current design practices would include filtration.	Occasional	Minor	**Low**	Include filter (or make provision for future filter) in upgrade design. Single filter probably sufficient, with bypass.
24	Pipe supports condition (screw jack type) is poor. Heavy corrosion on screw threads. Some are loose, others propped on timber. There has been substantial ground settlement and movement of pipe and supports.	Stress on pipework and joints could lead to a flange leaking or bolt failure. Could cause problems in fitting new spools. Worst on the upstream end of the station.	Occasional	Severe	**Intermediate**	Replace supports in station upgrade, particularly upstream side of station. Consider any geotechnical requirements to address movement of pipelines.