LIFECYCLE MANAGEMENT PLAN

Roma to Brisbane System FY23 – FY27

Rev	Date	Status	Author	Custodian	Checked	Approved
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1. Introduction

1.1 Purpose

This Lifecycle Management Plan (LCMP) presents a summary of the key technical aspects of the management activities with respect to the Roma to Brisbane System; comprising the Roma to Brisbane Pipeline (RBP) and its associated looping lines and laterals.

The intent is to present the 'deliverable' requirements of lifecycle management for the RBP that are outside of routine maintenance requirements. The plan details tangible outcomes that are necessary to achieve ongoing safety and reliability.

1.2 Scope

This document is specific to the group of APA assets that collectively form the Roma to Brisbane Pipeline System.

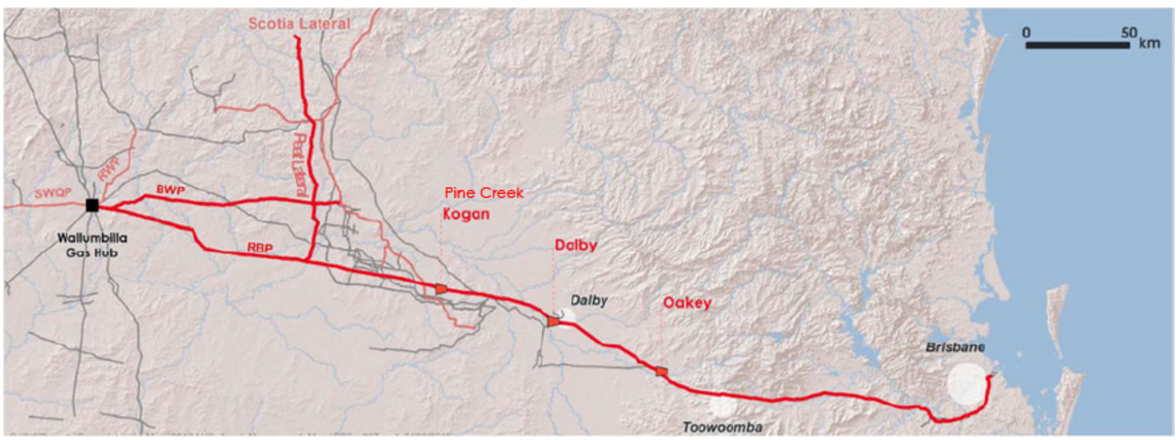


Figure 1 - Roma to Brisbane Pipeline System Geographical Position

Table 1 - Roma to Brisbane Pipeline System Sections
*MOP subject to ongoing management

Roma to Brisbane System Sections	Pipeline Licences	MOP (kPa)	MAOP (kPa)
DN250	PPL2	3000 - 4250*	7136
DN400	PPL2	6355 - 9600	9300 & 9600
DN400 Metro Looping	PPL2	9600	9600
DN400 Swanbank Lateral	PPL2	6355	9600
DN300 Metro	PPL2	3050 – 4200	3050 – 4200
DN200 Gibson Island Lateral	PPL2	4200	4200
DN200 Lytton Lateral	PPL2	9600	9600
Peat Lateral	PPL74	10200	10200

The LCMP includes the capital programs necessary to maintain the reliability, safety and integrity of the RBP system to ensure the capability to meet customer requirements.

Growth projects and routine operations (operating expenditure) are not reported in this plan.

2. APA Asset Management

In 2018, APA introduced its current Asset Management Policy and associated Framework guides effective asset management across APA supporting the efficient and effective management of assets.

The Asset Management Policy is critical to ensuring APA balances risk, cost and performance of its assets to meet the services required by our customers. This Policy applies to all assets that are under direct APA asset management control.

APA's Asset Management (AM) Department is the custodian for all of APA's owned assets nationally, including the RBP. The Department works in close association with the leadership of the Queensland state operational staff.

2.1 Asset Management Responsibilities

The Department is responsible for the following:

Accountable to design, govern and maintain:

- Framework to deliver a consistent and integrated approach to asset management;
- Operational excellence framework for all asset operations; Financial Accountability for P&L.

Accountable to execute:

- Asset Business planning and budgeting (including integration with Finance APA Business planning process);
- Asset lifecycle planning;
- Budget management for Stay-In-Business (SIB) Projects, Major Cyclical Maintenance (MCM) and major shutdowns;
- Individual and integrated Asset Management planning and performance reporting;
- Review and improvement processes for Asset Management performance - improvement opportunity identification and delivery.

This particular LCMP is written specifically for the RBP Access Arrangement but reflects the outcomes from the ongoing management of the assets under the normal lifecycle planning processes carried out across APA.

2.2 Lifecycle Management

The role of the Lifecycle Management staff involves the management of the Stay in Business (SIB) cycle across the whole of the asset base nationally. The department manages short and long term SIB with a short and long term focus to provide a broad 20 year view of the anticipated expenditure and more detailed 5, 2 and 1 year views.

2.2.1 Process Map

The following process map shows the high level approach that is applied to new proposed projects. A comprehensive 20 year plan is captured in an online database and was used to generate the budgetary work for the assets which is reflected in this Plan.

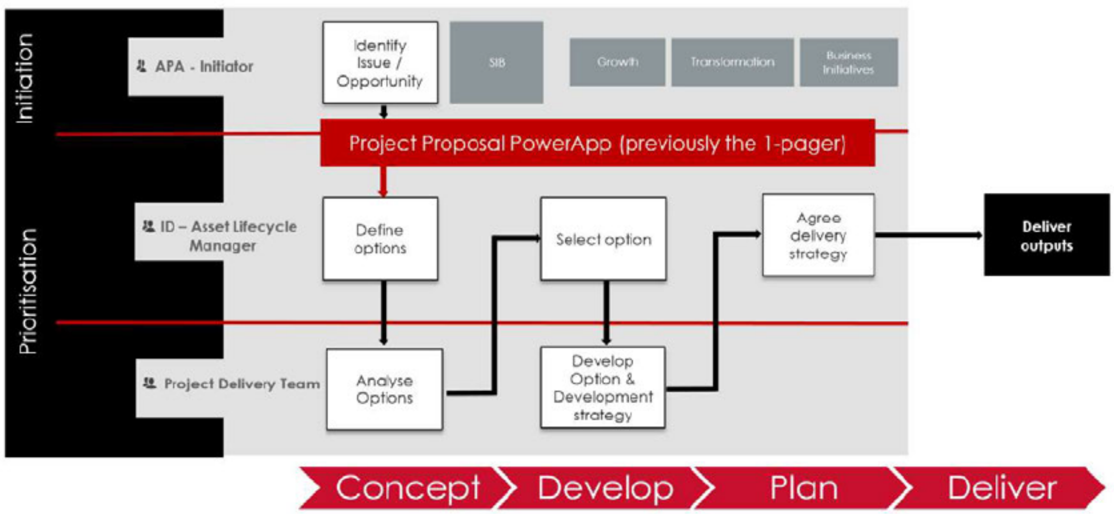


Figure 2 - Project Proposal Lifecycle Map

2.2.2 Project Identification and Selection

Project initiatives typically originate from the following sources:

- Pipeline integrity driven work
- Major equipment cyclical maintenance e.g. compressor overhauls
- Field inspection driven replacement/upgrades
- Facility reliability improvement and upgrades

Project requests are costed to ~+/-30% and if logical are added to the Lifecycle Management Plan as a new line item. The initiator provides as much information as possible to enable the projects to be understood and generally all proposals are expected to be acceptable. Where a project has insufficient detail or there is concern that the budget proposed is inappropriate further investigation in a pre-FEED style process may be carried out, which might also include more detailed costing.

Most projects in the SIB category have an obvious solution as they typically relate to strategic projects or direct replacement. Where there are multiple solutions possible all will be considered and the preferred selected.

2.2.3 Project ranking and budget development

All proposed projects undergo risk assessment during the identification stage 1.0, however this is validated and adjusted if necessary, during the concept stage 2.0. The risk assessment is carried out against APA's corporate matrix (see Appendix B) which is aligned to AS2885.6 but incorporates additional criteria.

As an additional assessment criterion, each project is rated for its alignment to Asset Management Planning objectives, (see Appendix C) to ensure that APA's strategic objectives are brought into consideration during the prioritisation. This is a critical step to ensure that items such as obsolescence that are likely to have a relatively low risk have some strategic priority applied. This balances the risk approach with sound logic enabling a more comprehensive review of priority.

The results are shown also plotted in the following bubble chart, where APA's prioritisation for expenditure can be seen by plotting the risk against the AM alignment. The diagram indicates and the boundary for routine approval. The bubbles sized by their value indicate the big picture priority groupings.

There is no fixed pass or fail line but an initial approval line is normally added during the process to enable automatically successful projects to progress without further consideration against a known budget. Projects that fall below the line are subject to further consideration. In this way project proposals with low risk and a low level of strategic importance can be readily identified.

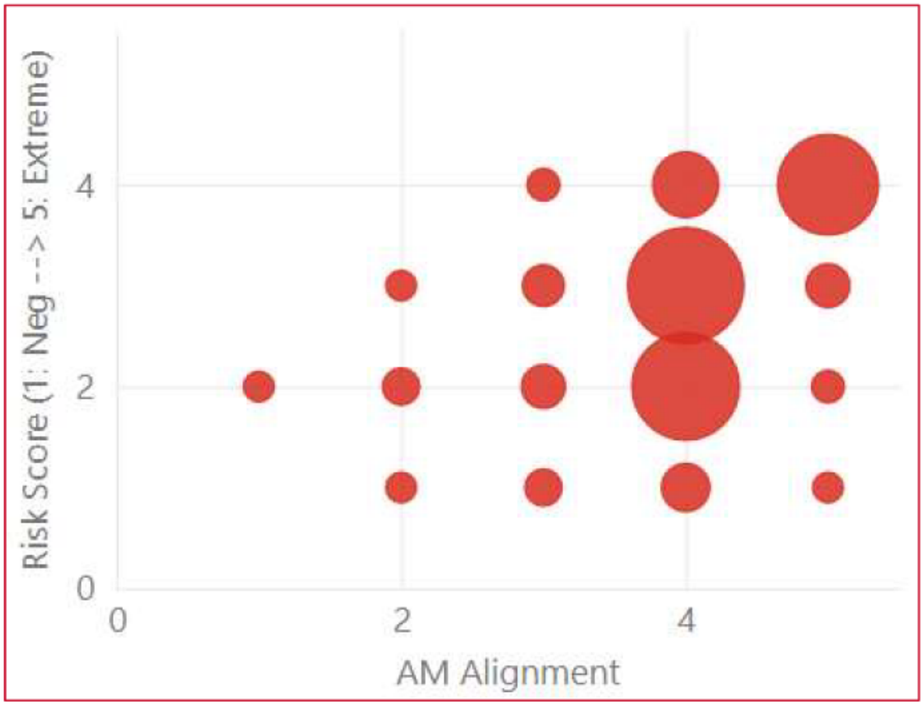


Figure 3 - Roma to Brisbane Pipeline System Project Prioritisation Matrix

This methodical approach applies a level of due diligence to the development of the necessary financial requirements for budget cycles. Project ranking and prioritisation is reviewed on an ongoing basis with the Asset Manager and may be adjusted accordingly.

2.2.4 Project and budget optimisation

The Lifecycle Team has flexibility during the budget development period and throughout the delivery periods to manually adjust the delivery scope where necessary. In addition, the lifecycle planning process provides the opportunity to group works on a site basis or on a delivery scope basis. In this way the delivery can be optimised and the project delivery schedules adjusted to cater for any identified efficiency opportunities. It is also necessary throughout the year to manage any unforeseen changes in priority and adjustment for any necessary scope changes.

2.2.5 Delivery management

Capital projects are typically delivered by APA's Infrastructure Projects team, within the Engineering and Planning business unit. Some projects may also be delivered by the Infrastructure Development construction group or by Operations & Maintenance depending on the nature of the project. Throughout the year the delivery of projects is reviewed and the expenditure re-forecast monthly. The delivery teams operate independently, and separate governance meetings are held monthly to ensure scope, schedule and budget milestones are being met.

The Lifecycle team take any variations taken into consideration and may add projects to or defer projects from the annual scope as necessary.

3. Asset Condition Summary

The Roma to Brisbane Pipeline (PL 2) consists of:

- DN250 RBP - Wallumbilla to Bellbird Park approximately 396.8 km in length which was commissioned in 1969;
- DN300 RBP Metro – Bellbird Park to Gibson Island. This section is approximately 40.2 km in length and consists of 37.6 km of DN300 and 2.6 km of DN200 which was commissioned in 1969;
- DN400 RBP - Wallumbilla to Swanbank Power Station approximately 405.55 km in length which was constructed and commissioned in stages between 1988 and 2002.
- DN400 Collingwood-Ellengrove Pipeline – a lateral running from Collingwood Drive Inlet Station on the DN400 pipeline to Ellengrove Gate Station which is approximately 9.5 km in length, commissioned in 2002.
- DN200 Lytton Lateral, a 5.4 km extension from the end of the DN300 at the SEA Block Valve to the Lytton Meter Station, which was commissioned in 2010;
- DN400 Metro Looping 1 - a section of 5.815 km of Brisbane metro looping pipeline from Carina to Paringa Road Scraper Station which was commissioned in 2012.

This Roma to Brisbane Pipeline System also includes the Peat Lateral Pipeline (PL 74), which consists of:

- The Woodroyd to RBP DN250 pipeline 110.7 km long (commissioned 2001); and
- The Scotia Extension DN250 pipeline 10.7 km long (commissioned in 2002).

The Peat Lateral connects the Scotia and Peat (Woodroyd) coal seam gas production facilities into the RBP at Arubial inlet station, near Condamine.

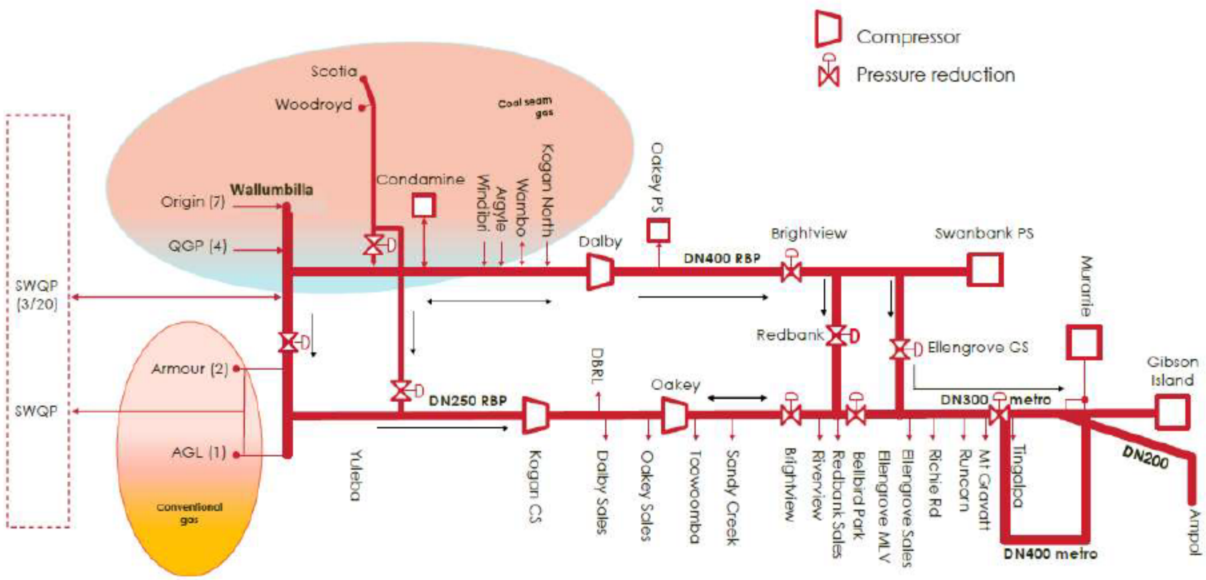


Figure 4 - Roma to Brisbane Pipeline System Schematic Diagram

The original RBP DN250, DN300 and DN200 lines which were commissioned in 1969 are considered to be ageing pipelines with specific integrity issues requiring ongoing management.

Key processes involved with monitoring the pipeline integrity involve In-line inspection (ILI) surveys to ensure that the development of any corrosion threat can be assessed, monitored and can be repaired where necessary in a timely manner. For facilities the key processes involve direct inspection, operational performance and vendor support of the equipment.

There are a several significant items on the RBP system which the LCMP has considered:

- Pipe wall corrosion and Stress Corrosion Cracking
- Cathodic Protection levels
- Obsolescence of electrical equipment
- Management of liquids resultant of coal seam gas processing.

The management of these items is currently undertaken by routine inspection and refurbishment programs. These programs will be required for the remaining life of the pipeline, and program costs can be expected to escalate as the pipeline continues to age and additional degradation becomes apparent. High-level funding requirements to manage these items are detailed in Tables 2 and 3 herein.

Electrical systems at many of the older stations have been identified as an issue that will need management and funding throughout this planning period.

3.1 DN250 Pipeline

The DN250 RBP - Wallumbilla to Bellbird Park section condition is of particular note. APA is currently undertaking analysis of the future needs of the 250mm pipeline and the lowest cost solution. This analysis is in progress, for the purposes of the plan the current forecast is that this section will reach the end of economic life in Financial Year 2024. This issue is discussed further in the DN250 - Supply Security Project, refer Section 6.2.3.1

3.2 Brisbane Metro Pipeline

The DN300 Metro pipeline and DN200 Gibson Island pipelines, downstream of Ellengrove, is critical to supply to distribution networks and customers, and is also an ageing asset being part of the 1969 original RBP construction. Its integrity is currently managed closely with frequent inline inspection, digups and repairs as required, and cathodic protection. As of 2021 this remains manageable and risks are acceptable. However, given its age the risk to the community, and the costs of managing the asset integrity, will continue to increase in future. The history of the DN250 pipeline gives an indication of the expected future of the Metro pipelines; while they are slightly better protected by coatings than the DN250 pipeline, in time they are expected to follow a similar trajectory.

Security of supply becomes a significant risk on the Metro pipeline; on the DN250 APA has been able to shut down sections for repair as required. This is not an option for the Metro pipeline and any major repairs would need hot taps, stopple and bypass at significant cost and risk to the community. The Metro pipeline passes through many suburban residential properties, in some cases in the back yards of houses between the dwelling and the shed or swimming pool.

In 2012 APA constructed Stage 1 of the Metro Looping project between Carina and Murarrie, aimed at increasing capacity and supply security at the downstream end of the Metro. Stages 2 and 3 of Metro Looping in future will construct a DN400 pipeline connection from Ellengrove through to Carina. These stages have not been developed to date as there has not been a customer demand for increased capacity, however supply security and reliability will likely drive a requirement for this looping pipeline. APA intends to commence studies into the Brisbane supply security requirements during the next access arrangement period and subsequently progress land tenure to preserve a corridor for the future looping pipeline or other solutions as appropriate.

4. RBP Risk

APA complies with AS2885.3-2012 Pipelines - Gas and liquid petroleum Part 3 Operation and maintenance for the operation of the assets and utilises a standard risk assessment matrix which is consistent with AS2885.6 for the management of risk, but which has been extended to also satisfy APA's corporate requirements.

The RBP is the only supply of natural gas to south-east Queensland distribution networks, including the Brisbane metropolitan area, Gold Coast and northern New South Wales. Given the age of the original RBP sections, the periodic augmentation of the RBP system and the environment it operates within, the RBP system faces a number of risks. Those relevant to and being treated through the application of SIB capital in the relevant period are:

- Pipeline integrity risk
- DN250 Structural Integrity and security of supply risk
- Equipment obsolescence risk
- Liquids in pipelines risk.

The pipeline risk assessments utilised for the business cases confirm that the necessary work over future years will largely be driven by good business practice, dealing with identified threats prior to them materialising. Whilst proactivity comes at a cost, it is being managed in a responsible manner with medium term programs being applied to avoid sudden financial shocks and reliability issues.

5. RBP Financial Summary

The following table breaks down the expenditure into the five financial years of the Access Arrangement. The expenditure has been developed with the input of Assessment Management and Engineering staff and is thought to be a reliable indication of the necessary expenditure.

Table 2 - Five Year SIB Capital Summary

	FY23	FY24	FY25	FY26	FY27	Total
SIB Capital	$14,342,232	$2,211,514	$1,526,427	$1,422,546	$3,054,793	$22,557,513

6. RBP SIB Programs of work

6.1 Expenditure by functional groups

The following table sets out the SIB capital expenditure high level breakdown for the RBP system.

The costs have been allocated across financial years to reflect the proposed capital expenditure budget.

Table 3 - Five Year SIB Capital summary by functional group

Item	FY23	FY24	FY25	FY26	FY27
E&I	$1,059,708				
Integrity	$6,973,751	$1,674,590	$1,123,069	$1,016,685	$2,647,415
Mechanical	$5,908,378	$135,418			
Minor Projects	$400,395	$401,506	$403,358	$405,861	$407,378
Grand Total	**$14,342,232**	**$2,211,514**	**$1,526,427**	**$1,422,546**	**$3,054,793**

Commentary

1. The RBP SIB Capital budget is dominated by projects directly related to the ongoing integrity management requirements to ensure that it remain fit-for-purpose throughout its intended operational lifecycle.
2. Growth projects and major expense OPEX projects are not reported in this plan.

6.2 Expenditure by Business Case Grouping

Table 4 - Five Year SIB Capital summary by business case grouping

Function – Business Case	Business Case No.	FY23	FY24	FY25	FY26	FY27
E&I						
Battery charger upgrade Program	A-2	$249,467				
Dalby Compressor Station communications relocation	A-3	$55,685				

SCADA hardware lifecycle management	A-4	$754,556				
Integrity						
In-Line Inspection program	A-1					$1,400,411
Validation and repair excavation program	A-1	$2,958,755				
Cathodic protection augmentation	A-1	$ 4,014,996	$ 1,341,838	$ 1,123,069	$ 1,016,685	$ 1,247,004
Warrego Highway upgrade pipeline protection	A-5		$ 332,752			
Mechanical						
DN250 - Supply security project	A-6	$ 4,749,535				
Underground valves upgrade	A-7	$ 112,273	$ 135,418			
Peat Lateral liquid removal upgrades	A-8	$ 1,046,570				
General						
Minor Projects	N/A	$400,395	$401,506	$403,358	$405,861	$407,378
Grand Total		$14,342,232	$2,211,514	$1,526,427	$1,422,546	$3,054,793

6.2.1 Electrical & Instrumentation Summary

6.2.1.1 *Battery charger upgrade*

Electrical power is critical to ensure the control and monitoring of the stations can be performed and to apply the power for the cathodic protection to the pipeline. Power is supplied from 240 volt sources to an uninterruptible power supply (UPS) battery charger system, which ensures that the back-up batteries are correctly charged and available.

The battery chargers typically have a useful life of 15 years in the field application and it is important that the UPS systems work reliably, particularly for meter stations. The chargers on the RBP have been assessed and a number are scheduled to be replaced during the FY23 period based upon their age and the level of their ongoing support.

6.2.1.2 *Dalby Compressor Station communications relocation*

The Dalby town council customer communication & Dalby site corporate communications link equipment are currently located in the decommissioned compressor unit 1 control room. This work will consolidate all communication equipment into a single location and eliminate the need for a second battery charger and battery bank at Dalby Compressor Station, which would be required to maintain the two communications links for metering data.

The corporate router power is not maintained by the unit 1 back up batteries and there has been a loss of data during power outages. Relocation is warranted to eliminate the need for the second charger and batteries.

6.2.1.3 *SCADA hardware lifecycle management*

Safe and efficient operation of the RBP system relies on APA's Integrated Operations Centre having visibility and control of the pipeline process conditions and equipment status. This function and facilitated by a Supervisor Control and Data Acquisition (SCADA) system.

A typical design life for a SCADA equipment is approximately 10 to 15 years under field conditions and as with many electronic items they may become unsupported during their lifecycle. A number of sites have been identified as requiring replacement due to obsolescence of various elements of the system including hardware supportability, technologies i.e. 3G & NBN and satellite lifecycle.

6.2.2 Integrity summary

6.2.2.1 *In-Line Inspection program*

With the FY23 to FY27 period, APA will continue RBP system integrity management programme as documented in the Roma to Brisbane Pipeline Asset-Specific Pipeline Integrity Management Plan. The sections to be inspected are:

- DN300 Metro – Magnetic Flux Leakage (MFL) and Electro-Magnetic Acoustic Transducer (EMAT)
- DN400 Metro Looping – Magnetic Flux Leakage.

The Magnetic Flux Leakage inspection is used to identify pipe wall corrosion and the Electro-Magnetic Acoustic Transducer is used to detect Stress Corrosion Cracking. The DN300 being assessed as susceptible to SCC is hence inspected using EMAT in addition to MFL. The features identified by these tools are then subject to the Validation and Repair Excavation Program described below.

6.2.2.2 *Validation and repair excavation program*

Further to the In-Line Inspection activities the following routine validation excavations will be undertaken in order to complete the inspection processes undertaken within the current Access Arrangement period in 2021-22:

- DN300 Metro

These inspections are necessary to validate the data received form the In-Line Inspection process to assure the effectiveness of the integrity management programme.

In addition to the routine validation excavations, APA will continue the repair excavation program for the DN250 until this section of the pipeline has be made safe within the DN250 - Supply Security Project, refer Section 6.2.3.1. These excavations are required to excavate, inspect and repair defects that through previous In-Line Inspections and use of growth rate models have a credible risk of failure if not repaired.

Furthermore, there is also work underway to develop a plan to assess and manage the integrity of our underground pipework within our compressor, metering and regulation facilities. Typically this pipework is outside of the pipeline which can be inspected using the ILI methodology outlined above. Whilst this plan is still to be firmed up, it is anticipated that $300-$500k per year will be required to manage this risk.

6.2.2.3 *Cathodic protection augmentation*

6.2.2.3.1 Cathodic Protection Unit replacement

Cathodic protection remains a significant focus of the RBP integrity management program. The cathodic protection units (CPUs) are effectively smart transformers that responds to the protection level on the pipeline and supply DC electricity to protect the pipeline against corrosion. These units work 24/7 with a finite life and a number of them are obsolete, with spare parts difficult or impossible to obtain. Increased current demand on the pipelines has also required that the units being replaced are upgraded to higher current capacity systems. The intention is to proactively replace obsolete CPUs prior to them failing, based either upon condition assessment or opportunistically when carrying other electrical upgrades at a site.

6.2.2.3.2 *New cathodic protection sites*

A buried steel pipeline is protected against corrosion by a coating. Over time the coating system degrades, this could lead to corrosion (rust) and ultimately failure of the pipe. A protective cathodic current is therefore applied to the pipeline, from the time of construction, to maintain the pipeline at the desired electrical potential whereby corrosion can't occur.

As the pipeline coating slowly deteriorates with time the protective cathodic protection current necessary increases to the point where the CPUs have insufficient capacity to supply the full requirement. Cathodic protection surveys are carried out along the pipeline to identify locations of poor protection and additional CPUs are specified to provide the necessary current to restore full protection at those points.

The Cathodic Protection Upgrade Programme will focus on the integrity of DN400, DN300 and DN200 CP systems whilst maintaining the DN250 to an alternate compliance criteria to prudently manage expenditure. For the DN250 it is anticipated the alternate criteria can be achieved with no new sites. For the DN400, DN300 and DN200 sections of the RBP system, it has been found that 1 to 2 additional cathodic protection sites per year is a reasonable anticipation of the increased power requirement necessary to maintain the protective current.

Additional sites require the negotiation of additional easements for the installation of anode beds, which can require extensive landholder negotiation. Securing easements is a key part of the cathodic protection project program.

6.2.2.3.3 *Replace cathodic protection ground beds*

A cathodic protection ground bed provides an electrical link between the anodes and the pipeline, but are gradually consumed and require replacement. This is monitored throughout their life as the degradation is usage based not time enabling regeneration of the site in a timely manner.

With the number of sites on the RBP it is anticipated that 4 sites per year would be adequate to maintain a satisfactory system. This has been budgeted for the FY23 to FY27 period. However ongoing monitoring may identify an increased requirement as the number of units in service increases.

6.2.2.4 *Warrego Highway upgrade - pipeline protection*

Queensland Department of Transport and Main Roads plan to upgrade sections of the Warrego Highway. During Stage 3A of their plan, the RBP, near Oakey would be affected.

The effected section of the pipeline will need to be addressed to ensure the pipeline remains safe to operate and access to the pipeline is maintained for any future works that may be required during the life of the pipeline, such as validation or repair excavations.

APA have assessed the cost of the activities for which APA will be responsible for and as such have been included in the SIB plan. This assessment has been conducted based on the Queensland Petroleum and Gas (Production and Safety) Act.

6.2.3 Mechanical summary

6.2.3.1 *DN250 - Supply security project*

The condition of the DN250 is such that a full analysis of the options required to assure the supply security of the customers currently supplied via the DN250 is required. APA is currently undertaking analysis of the future needs of the 250mm pipeline and the lowest cost solution. This analysis is in progress, for the purposes of the plan it is assumed that the current forecast is that this section will reach the end of economic life in Financial Year 2024.

The activities that are assumed to be required are:

- Re-connection of existing DN250 offtakes to the DN400
- Installation of underground protective barriers on the DN400 to support a Maximum Operating Pressure increase to 8MPa which is required to assure the metropolitan section capacity
- Equipment modifications at Bellbird Park and Ellengrove to support the sustainable operation of the pipeline system
- Permanent Suspension of RBP 250 Sections.

6.2.3.2 *Underground valves upgrade*

The RBP system encompasses isolation valves that are used to isolate section of the pipeline in the event of an emergency. Currently there are a number of valve sites where the valve is located within an underground pit. Access to these valves requires confined space access protocols to be implemented prior to entry to assure the safety of those persons entering the pits, this delays any emergency response to operate these valves.

This project will install valve extensions to remove requirement for confined space access, thus reducing risk to personnel and improving response time in the event of an emergency requiring the use of these isolation valves.

6.2.3.3 *Peat Lateral liquid removal upgrades*

A number of QLD assets have had periodic issues with liquids. While some of these issues have most likely been in place for a number of years, more recently these have been causing specific problems at a number of locations. These are generally associated with coal seam gas inlets (glycol from dehydration processes, containing conductive solids).

The Peat Lateral has suffered from cathodic protection issues from insulating joints being electrically bridged as a result. This problem has occurred periodically over the past years and current practice is to undertake cleaning pigging as required in order to maintain cathodic protection. When the bridging occurs, the cathodic protection levels are significantly lower than required to provide protection.

APA has investigated the options for cost effective management if liquids on the Peat Lateral. This analysis found that the installation of permanent liquid drop out vessels at Scotia and Woodroyd Meter Stations as the most effective means to manage the liquids.

APPENDIX A: BUSINESS CASES

The following table sets out the SIB Capital work program developed by individual business cases.

Table 5 - Five year SIB Capital Work Program by Business Case

No.	Item	Budget
A-1	Pipeline Integrity Management	$13,102,759
A-2	Battery Charger Upgrade Program	$249,467
A-3	Dalby Compressor Station Communications Relocation	$55,685
A-4	SCADA Hardware Lifecycle Management	$754,556
A-5	Warrego Highway Upgrade Pipeline Protection	$332,752
A-6	DN250 - Supply Security Project	$4,749,535
A-7	Underground Valves Upgrade	$247,691
A-8	Peat Lateral Liquid Removal Upgrades	$1,046,570
TOTAL		**$20,539,015**

Risk Analysis

APA utilises the AS2885 risk methodology for the risks associated with integrity challenges, but for general purposes APA has a specifically extended corporate version that includes additional risk categories.

A copy of the Risk Matrix is included as Appendix B.

Appendix B: APA CORPORATE RISK MATRIX

APA Enterprise Risk Matrix - May 18 v3 - Ex projects

Likelihood*	5	frequent [many times in 1yr]	Low	Moderate	High	Extreme	Extreme
	4	Occasional [every 2yrs]	Low	Low	Moderate	High	Extreme
	3	Unlikely [every 5yrs]	Negligible	Low	Moderate	High	High
	2	Remote [every 20yrs]	Negligible	Negligible	Low	Moderate	High
	1	Rare [every 50yrs]	Negligible	Negligible	Negligible	Low	Moderate
			1. Minimal	2. Minor	3. Significant	4. Major	5. Catastrophic
					Impact (consequences)		

Appendix C: AMP ALIGNMENT RATING

Alignment to Asset Objectives

AMPAlignment	Description	Examples
5	Board level endorsed, APA strategy/strategic imperative	Unpiggables, MSP SCC, MWP CP Augmentation
4	High priority initiatives linked to an endorsed improvement program or key strategic issue in an AMP or required for compliance (APA Policy, customer contract, legislation)	GGP reliability improvements, Regulatory Compliance, 10 year Integrity plan, Hours based Overhauls, HA Rectification, EC functional improvements
3	Immediate business benefit and alignment with accepted division wide initiatives to address known / systematic issues, improve operability/efficiency, safety	Aggregated equipment obsolescence programs, Vic Battery Chargers, control system upgrades, Maximo upgrades, Online Sim
2	Provides medium term benefits to the business that are logical to progress	Enterprise Analytics. Power BI dashboards, O&M Tools & equipment
1	Low urgency but provides longer term benefits to the business	Tools to trend long term equipment performance, Team one-off initiatives

Note: rating order is 1 – Lowest; 5 - Highest

Business Case – Capital Expenditure

RBP Pipeline Integrity Management

Business Case Number A-1 – REVISION 0

1 Project Approvals

TABLE 1: BUSINESS CASE – PROJECT APPROVALS

Prepared By	Chris Meades, *Asset Lifecycle Specialist, APA Group*
Reviewed By	Robert Hall, *Manager Asset Lifecycle, APA Group*
Approved By	Francis Carroll, *Asset Manager, APA Group*

2 Project Overview

TABLE 2: BUSINESS CASE – PROJECT OVERVIEW

Description of Issue/Project	The RBP includes over 800 km of buried pipelines, in sizes between DN200 and DN400, the oldest of which was constructed in 1968-69 and has been in service ever since. All buried pipelines are subject to coating deterioration and corrosion from the soil environment and require integrity management to comply with standards and legislation. The RBP has particular characteristics such as its over-the-ditch tape coating system and its age that mean it requires significantly greater effort and expense in corrosion and integrity management that most other pipelines in Australia. If insufficiently managed the corrosion and integrity issues could lead to pipeline failures affecting both public safety, given the pipeline traverses many populated areas, and security of supply to customers. The successful solution will ensure an effective pipeline integrity management system is continued and that the risk of pipeline failure is managed to an acceptable level considering health and safety and security of supply.
Options Considered	The following options have been considered: 1. Option 1: Do Nothing (Carry out only basic pipeline integrity activity; allow pipelines to deteriorate) **2. Option 2: Carry out pipeline integrity management activities** 3. Option 3: Replace pipelines
Estimated Cost	**$13.1 million** over the AA period
Consistency with the National Gas Rules (NGR)	The pipeline integrity management work 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	Pipeline integrity management activities are an essential part of operating the RBP. Resources Safety & Health (RSHQ), the Queensland technical regulator is a key stakeholder and their compliance programme includes assurance of RBP safety and integrity. Members of the public, APA staff and contractors working around the pipelines also expect APA to prudently manage the pipeline assets to minimize risks of failure and loss of containment. Shippers on the pipeline also expect APA to safely manage pipeline integrity.

3 Background

3.1 General

The RBP system includes over 800 km of buried pipelines, in sizes between DN200 and DN400, the oldest of which was constructed in 1968-69 and has been in service ever since. The pipelines transport natural gas between Wallumbilla, near Roma, and the Brisbane metropolitan region in south-east Queensland. The RBP is the sole supply route for natural gas to homes and businesses in south-east Queensland, including Dalby, Oakey, Toowoomba, Ipswich, greater Brisbane, the Gold Coast and far northern New South Wales.

All buried pipelines constructed of steel pipe are subject to coating deterioration and corrosion from the soil environment and require integrity management to comply with standards and legislation. Part of this integrity management is protection from corrosion that is applied to the pipeline. Primarily this protection comes in two ways. The first is a coating protection that is applied to the pipeline at the time of construction. The second is cathodic protection (CP) which uses current and an anode to protect the pipeline. As pipelines age the level of effort required to maintain their integrity increases.

The RBP has particular characteristics, such as its over-the-ditch-applied polyethylene tape coating system (on the original DN250, DN300 and DN200 pipelines) and its age, that mean it requires significantly greater effort and expense in corrosion and integrity management than most other pipelines in Australia. This includes risks associated with deterioration of the tape coating, corrosion of the pipe wall and other mechanisms such as stress corrosion cracking.

3.1.1 DN250 and DN300 and DN200 Pipelines (1969 Vintage)

Globally in the pipeline industry there is an accepted differentiation between ‘modern’ and ‘vintage’ pipelines. The ‘vintage’ category generally includes pipelines constructed prior to the mid-1970s, which have relatively low toughness steel, over-the-ditch-applied coatings and a lower level of inspection and quality assurance compared to modern pipelines. The original 1960s RBP segments are clearly considered ‘vintage’ pipelines.

If insufficiently managed the corrosion and integrity issues could lead to pipeline failures affecting both public safety, given the pipeline traverses many populated areas, and security of supply to customers. Significant portions of the RBP are located within residential areas in Brisbane and surrounding areas.

There have been significant improvements in pipeline coating technology such that modern pipe coatings such as fusion-bonded epoxy can be expected to last 50-60 years or longer, compared to less than 30-40 years seen on some sections of the RBP with the original over-the-ditch polyethylene tape coating system. One aspect of this is the thorough abrasive blast cleaning of the steel surface prior to coating, which was not done in the 1960s construction.

No design life for the pipeline was specified at original construction in 1968-69. In 2008-2009 a design life review was conducted (at 40 years age) which concluded that the pipeline could continue to operate subject to appropriate integrity management. A number of specific actions were recommended in the design life review including an increased focus on coating refurbishment. In 2015 a Remaining Life Review (as per AS 2885.3-2012) was conducted for the Metro section and in 2016 for the DN250 section. Since this time a major repair and CP program has been undertaken where it has been evident that pipeline integrity continues to decline and the expenditure required continues to increase. This has necessitated APA to undertake analysis of the future needs of the DN250 and the lowest cost solution. This analysis is in progress, for the purposes of the plan it is assumed that the current forecast is that the lowest whole-of-life cost will be achieved by physically transferring the DN250 customer connections over to the DN400 pipeline, allowing the deferral of significant pipeline integrity works on the DN250

DN400 Pipeline System

The RBP DN400 first looping stages were constructed in 1988 and are approaching 30 years in service. This pipeline has a different risk profile from the DN250 and its factory extruded HDPE coating (“yellowjacket”) has generally performed well. However, it has tape coating and/or heat shrink sleeves on its field joints which means it is exposed to similar risks as the DN250 pipeline in the field joints. In APA’s experience, pipelines from the 1980s such as the RBP DN400 also have some of the characteristics of 'vintage' pipelines. In recent years evidence of longitudinal splitting of heat shrink sleeves has been observed which have led to corrosion of the pipeline.

Design lives for the DN400 looping stages are likely to have been nominated as between 40 and 60 years in accordance with normal industry practice, at the time of design and construction of each looping stage. The next Remaining Life Review on the DN400 system will be completed in 2022 (10 years from its MOP Upgrade) in accordance with AS 2885.3-2012, or earlier if required based on ILI and engineering assessment.

3.1.2 Main Integrity Issues

The main integrity issues faced by the RBP include the following:

- Deterioration and disbondment of the external coatings leading to high load on CP system and external corrosion where the CP system cannot sustain complete protection of the pipe wall
- Shielding of CP by disbonded coating leading to inadequate protection of pipe wall in shielded areas, including the entire DN250 pipeline and field joints with heat shrink sleeves and tape wrap coating on the DN400
- Deterioration of dents and gouges by a combination of the above factors with increased risk of fatigue cracking or stress corrosion cracking (SCC)
- 1960s Electric Resistance Welded seam pipes with occasional lack of fusion or other defects in the seam welds, which although passed a hydrotest at commissioning, are at risk of growth through SCC or fatigue
- Bending strain on pipeline caused by ground movement or external loads leading to excessive longitudinal stresses, coating degradation and potential circumferential SCC

Further background information is available in the referenced documents listed in the Appendix.

3.1.3 Scope of Project

The integrity upgrade project comprises a number of different aspects:

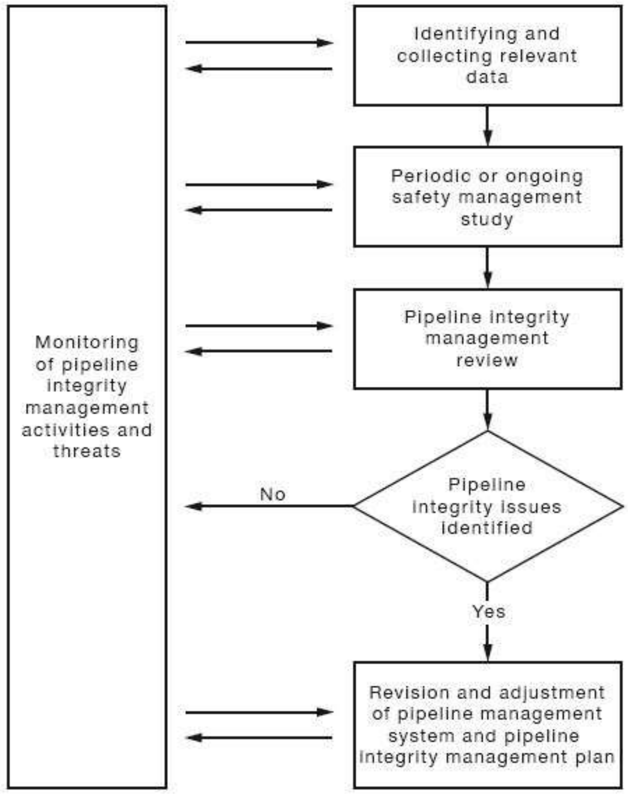
- Inline Inspection (ILI)
- Excavation, integrity works and new coating upgrades
- Cathodic Protection Replacement and Upgrades

3.2 Code and Regulatory Requirements

Integrity management of pipelines is a core requirement of AS 2885.3-2012 and of the Queensland Petroleum and Gas (Production and Safety) Act and Regulation. APA as the pipeline licensee has an obligation to carry out integrity management activities under the requirements of the Pipeline Management System and the Pipeline Integrity Management Plan. Sections 5, 6 and 9 of AS 2885.3-2012 set out the specific requirements.

The key objectives of the legislation and the Australian Standard is to ensure that pipelines are safely constructed, operated and maintained, and that risks of harm to people and to the environment and security of supply are managed to an acceptable level. Pipeline integrity management is critical to achieving these objectives by reducing the risk of pipeline failure and loss of containment.

The diagram below illustrates the iterative and ongoing process of pipeline integrity management.



3.3 Inline Inspection

As with all significant hydrocarbon transmission pipelines, the RBP requires regular inspections. In-line inspection (ILI) using intelligent pigs is one of the most important and conclusive activities in the spectrum of pipeline integrity management processes, as it allows pipeline deterioration and damage to be identified and rectified prior to failure.

APA has a national policy and schedule for ILI. The policy sets out the frequency and schedule for ILI across the company's pipelines. This policy sets the standard duration between ILI at 10 Years, unless an engineering assessment determines otherwise. Further, the RBP is designated in the Queensland Petroleum and Gas (Production and Safety) Act 2004 as a 'Strategic Pipeline'. Under this legislation, all sections of pipeline under the RBP licence (#2) are required to be inspected by ILI within the first 7 years of operation, and at least once within every 10-year period after that. However, for the RBP, due to its age and complexity of integrity threats, many sections require more frequent inspections.

ILI results are used to reassess dig numbers taking corrosion growth rates and adverse tool tolerance into account, as required by Australian Standard AS 2885.3-2012. Corrosion growth modelling based on data from previous ILI and validation excavations has indicated the appropriate re-inspection interval for metal loss as per the table below. APA's experience is that reinspection generally results in a decrease in the number of features requiring repair, as actual corrosion growth rates can be established for features rather than assuming a uniform and conservative growth rate.

The required ILI technologies are as follows:

- High-resolution magnetic flux leakage (MFL) inspection – detects corrosion, gouges, grooves, mill defects, girth weld anomalies and other metal loss features. This is the standard ILI for which the corrosion growth modelling determines reinspection intervals.

- Geometry or caliper inspection – detects dents, ovality (out of roundness) and similar – can indicate 3rd party mechanical damage, rock dents from flooding or landslides, or dents remaining in the pipeline since construction. This is generally done in conjunction with the MFL inspection. It is noted by APA that dents are high risk of cracking or gouging and are the most likely defects to lead to pipeline failure. The ILI detection of dents has been a key part of the RBP integrity program and has enabled APA to find and repair dents with gouges, corrosion and cracking that would have had significant consequences if left to fail.

- Inertial Mapping (IMU) – Maps the geographical position of the pipeline centreline and records any movement or change in shape since previous inspection. IMU pigging enables curvature and strain analysis which is a key factor in mitigation of circumferential stress corrosion cracking. This is also done in conjunction with the MFL inspection as required.

- Electro-Magnetic Acoustic Transducer (EMAT) inspection –detects cracking and crack-like features. EMAT is used in the RBP to detect and manage stress corrosion cracking and longitudinal weld anomalies. This is a more specialised inspection technique with tighter operational requirements on pipeline velocity and may be scheduled separately or together with standard MFL ILI. EMAT is of particular importance to vintage pipeline segments and is only available down to a minimum diameter of DN250 at present.

In 2018-19 APA undertook MFL and EMAT ILI of the DN250. Analysis of this combined with the results of the 2016 ILI of Metro DN300 supported previous ILI inspections. However, the data obtained from 2018-19 inpsection enabled a recalibration of the growth rate modeling described above to support a revised excavation and integrity upgrade programme.

The table below illustrates the ILIs completed in the current access arrangement period and planned for the remaining years of the current period and next access arrangement period.

RBP System Sections	ILI Frequency	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27
DN250	3 years			MFL & EMAT			[1]			[1]		
DN400	10 years				MFL							
DN400 Metro Looping	10 years				MFL							
DN400 Ellengrove Lateral	10 years				MFL							
DN300 Metro	5 years	MFL & EMAT					MFL & EMAT					MFL & EMAT
DN200 Gibson Island Lateral	10 years						MFL					
DN200 Lytton Lateral	10 years	MFL										MFL
Peat Lateral	10 years			MFL								

1. DN250 ILI not anticipated to be conducted prior to FY24 – refer section 3.4.2

3.4 Excavation and integrity upgrade programme

3.4.1 Anomaly Assessment and Defect Repair Process

Anomaly assessment and defect repair is a mandatory requirement of AS 2885.3. This requires APA to maintain the RBP's safety and integrity and ability to withstand the internal pressure and other loads.

Following the completion of an InLine Inspection, excavations are routinely undertaken to validate the data obtained from the ILI. These excavations verify the anomaly sizing accuracy and probability of the detection/identification if anomalies are within the statistical specifications of the ILI tool used. For older pipelines, it is common that the number of validation excavations required is less than the total number of anomalies identified by the ILI that require further investigation. These additional excavations are referred to as repair excavations and form the integrity upgrade programme.

For corrosion features, repair requirements have been developed and prioritized based on anomaly assessment of the ILI data using ASME B31G, Modified B31G, and Effective Area calculation methodologies.

A typical integrity upgrade excavation includes:

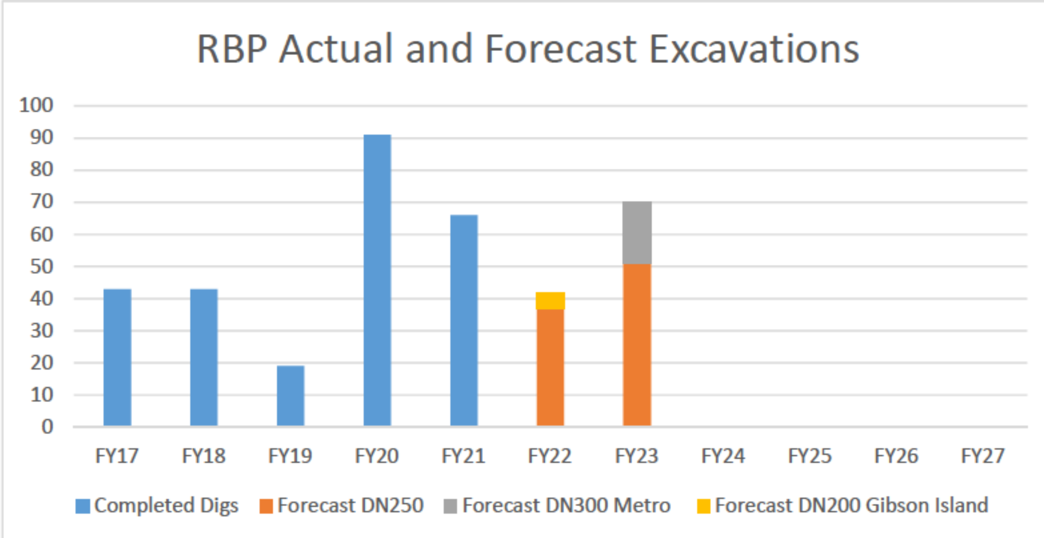
- Excavating and exposing the pipeline at the location of the anomaly
- Removing the pipeline coating from the pipeline exterior surface
- Inspection and assessment of the anomaly and determination of a repair process
- Repair of the anomaly and refurbishment of the pipeline coating
- Reinstatement of the earth fill around the pipeline and soil surface

3.4.2 Forecast Look-Ahead

Future digup and repair requirements for pipelines are planned based on corrosion and crack growth analysis, which uses previous inspection data to determine growth rates and model the timeframe when each feature will require repair. For the RBP, the age and condition of the DN250, DN300, DN200 & DN400 is such that those pipelines all require excavation and repair of anomalies as they grow and reach the limits of safe pressure containment. The digup and repair requirements are more substantial than just the ILI validation excavations normally undertaken after ILI when there are fewer anomalies.

APA is currently undertaking analysis of the future needs of the DN250 to achieve the lowest cost solution. This analysis is in progress, for the purposes of the plan it is assumed that the current forecast is that this section will reach the end of economic life in Financial Year 2024. Based on the past ILI results, APA will be required to continue the excavation of ILI anomalies on the RBP DN250 until Financial Year 2024.

The following chart shows the outcomes of the pipeline integrity modelling showing the number of excavations and repairs that have been completed and forecast to be required in each financial year, based on corrosion growth modelling in accordance with AS 2885.3-2012 and the relevant referenced standards.



Actual digs have been prioritized and scheduled according to risk levels and sorted into financial-year dig campaigns. Features have been grouped into single digs where they are close together. One excavation and repair in the above graph may incorporate many features if they are within the same pipe spool. As a result of the large number of previously unreported features being discovered in the 2019 ILI, the number of excavations increased significantly in FY20 & FY21.

It should be noted that the above graph is based on no further ILI reinspection of the DN250 pipeline past 2021 due to the its anticipated end of financial life in FY24. This will increase the excavation requirements in FY22 & FY23 due to the modelled corrosion growth rate, but the costs of these excavations have been estimated to be less than the cost to undertake the ILI inspection.

The integrity upgrade programme also includes SCC direct assessment as per section **Error! Reference source not found.** and selected coating upgrade areas for CP interference / mitigation as required.

3.4.3 Delivery of Integrity Upgrade Programme

APA has the experience and capability to deliver the necessary integrity upgrade program of works. Over the past years the work has transitioned from ad hoc excavations and repairs by operations personnel, to a major project 'campaign' approach using APA's in-house construction and project management team.

APA has continued to optimize the efficiency and costs of the programme by:

- Competitive tendering of scopes of work to take advantage of a competitive market process
- Benchmarking and knowledge sharing with the Moomba-Wilton gas pipeline repair programme, which typically undertakes several hundred excavations and repairs per year
- Optimisation of the number of excavations undertaken to repair co-located features both that require to be immediately treated and prospective future defects to negate future excavation requirements.

3.5 Stress Corrosion Cracking

The older pipelines of the RBP System; DN250, DN300 & DN200, meet the criteria for susceptibility to near-neutral pH stress corrosion cracking (SCC). These criteria include the age of the pipeline, steel metallurgy of the time, lack of abrasive blasting of the pipe surface before coating, use of the PE tape coating system, and potential shielding of CP by disbonded tape coating. Environmental factors for near-neutral pH SCC include soil type, pH and moisture level as well as ground movement or steep slopes. More detail on the SCC mechanisms is set out in the SCC Management Plan.

AS 2885.3 requires APA to manage threats to the pipeline's integrity, including SCC. APA has developed a Stress Corrosion Cracking Expert Guide which informs the management of SCC throughout any susceptible pipelines. To meet the requirements of the standard and the Expert Guide, APA has developed a SCC management plan specific for the RBP, with reference to international standards including the CEPA guideline Stress Corrosion Cracking – Recommended Practices and the NACE International SCC Direct Assessment standard.

Near-neutral pH SCC can include both axial and circumferential cracking. Both types of cracks, to differing severities, have been found in RBP.

As the name suggests a circumferential crack is one travelling around the pipe. The RBP has an actual history of leaks resulting from circumferential cracks in the pipe body – 1983, 2011, 2014. Whilst no leaks since 2014, APA identified (through our ILI and digup program) and fixed similar circumferential cracks as late as 2020. The exact nature of this failure was not fully understood until 2014 as it is an unusual failure mechanism, related to areas of high curvature and bending strain over a period of time which can now be detected by inertial mapping ILI. Strain features were subsequently included in the RBP excavation and life extension programme.

An axial crack travels along and depth-wise through the pipe. Axial cracks provide the highest risk of rupture particularly if their length exceeds the critical defect length for the pipeline. Both leaks and ruptures could occur anywhere in the pipeline as internal pressure provides the tensile force. CEPA guidelines apply and this threat is considered in the SCC expert guide.

In order to check for the axial cracking failure mechanism, crack detection ILI is now undertaken for all of RBP DN250 and DN300 sections in the SCC Management Plan. The DN300 Metro line was inspected with an EMAT tool in 2016 and is planned for a further EMAT in 2021. The DN250 was EMAT inspected through 2018 & 2019. The alternative ILI method is ultrasonic testing - while this is a proven technology for crack detection, is not feasible for gas pipelines without inserting a large liquid slug which is not practical in the RBP without major impacts to distribution network customers. The EMAT ILI also has the capability to detect longitudinal seam weld anomalies, which are not uncommon in vintage Electric Resistance Welded line pipe.

APA is undertaking SCC direct assessment at all digs on the susceptible RBP sections; this involves 100% coating removal and crack detection by magnetic particle inspection or eddy current array, which increases dig cost and duration compared to standard ILI verification digs. The coating upgrade at digs include abrasive blasting of surface and liquid applied epoxy or tape wrap coating in accordance with APA's current engineering standards.

Where SCC is identified, ultrasonic inspection is carried out to estimate the crack depth and length and any sub-surface continuation of cracking. Fine and shallow cracking (typically less than 10% of wall thickness in depth) may be removed by buffing or grinding. Fitness for service assessment is conducted on any remaining cracking. Loss of containment cracks such as the three historic leaks, or severe cracking failing FFS assessment, is generally removed from the pipeline either by depressurisation, purging, cutout and pipe replacement, or by in-service hot tapping to remove the defect area, as determined by engineering assessment.

3.6 Cathodic Protection Upgrade Programme

An aging pipeline and ongoing coating deterioration requires significant investment in CP upgrades to continue to meet the requirements of AS 2832.1. All CP systems on RBP are under heavy load due to the high current demand, particularly on the DN250 pipeline. During the current Access Arrangement period the DN250 and DN400 RBP lines were electrically separated from each other with cross-bonds removed. This has successfully improved the CP performance on the DN400 pipeline, which was previously impacted by the high current demand on the DN250 pipeline.

Since 2021, the DN250 pipeline CP assessment criterion has been changed to the 100 mV depolarisation criterion of AS 2832.1 instead of the usual instant-off potential criterion. This remains compliant with AS 2832.1 but has reduced the future CP current demand and upgrade requirements compared to previous projections.

Continual upgrade of the remaining CP systems is required including an increase in current output capacity of systems (new CP units and anode beds, new land easements to locate anodes further from pipeline), and the installation of new CP systems to infill low protection areas between existing systems. This is because the increased exposed steel surface area requires additional CP current. Further, the increased current demand causes more rapid attenuation of protection potentials along the pipeline away from CP units. CP upgrade requirements are set out in a RBP CP upgrade 5-year plan.

Due to increasing requirements and technology changes, the anode beds when upgraded often need to be physically larger and also need to be located further away from the pipeline to improve CP current distribution, meaning that additional land is required. Land requirements include easements and new or improved landholder agreements.

4 Historical Capital Expenditure

The table below provides actual capex over the current AA period for projects related to pipeline integrity management.

Project / Programme	FY17	FY18	FY19	FY20	FY21 (Full Year Forecast)	FY22 (Plan)
Inline Inspection of Pipelines	$368,608	$965,589	$4,472,338	$3,110,107	$418,544	$1,000,000
Coating Upgrade and Life Extension	$4,048,964	$1,900,246	$1,571,309	$6,173,375	$3,156,215	$1,477,200
Laser Scanner for Feature Assessment	$ -	$ -	$ -	$ -	$ -	$150,000
CP Upgrade Programme	$538,348	$2,250,347	$2,385,906	$4,402,787	$3,099,315	$3,600,000
Total Capex - Integrity Management	$5,178,644	$5,116,182	$7,886,110	$13,686,269	$6,674,074	$6,227,200

4.1 Comments on Historical Capex

Comments are provided on the historical expenditure as follows.

4.1.1 Inline Inspection

ILI is traditionally a 'lumpy' spend with substantial costs at long intervals. Across there RBP there have been a number of ILI campaigns in the period:

- FY17 – Lytton Lateral MFL and DN300 Metro MFL
- FY19 – DN250 MFL & EMAT and Peat Lateral MFL
- FY20 – DN400 MFL, DN400 Metro Loop MFL and Ellengrove Lateral MFL
- The DN200 Gibson Island Lateral MFL and DN300 Metro MFL & EMAT are both planned for FY22
- Overall, the ILI costs have been near estimates with movements for timing, with the exception of the DN250 EMAT. This was the first time APA had completed an EMAT ILI on the DN250, with the DN250 EMAT tool newly developed by the vendor. The pipeline required extensive cleaning, exceeding the number of cleaning runs budgeted. Additionally, modifications to the scrapper stations were required to load the tool into the pipeline due to the physical length required to accommodate the EMAT technology.

4.1.2 Coating Refurbishment / Excavation and Integrity Upgrade

- FY17-FY19 continued the program that had been established and informed by the previous ILI. The number of digs were generally less than what was forecast in the Previous Access Arrangement Reset and costs were generally lower than anticipated with economies of scale exercised and collocated features being completed by one excavation.
- As a result of the large number of previously unreported features being reported in the ILI completed in FY19, the number of excavations increased significantly in FY20 & FY21 to address these features.

4.1.3 CP Upgrades

- There has been an ongoing upward trend in costs due to increasing CP current demand (new systems, replacement anode beds, larger TR units) as discussed elsewhere in the business case
- The CP Upgrade Programme has greatly exceeded previous forecasts with regard to the number of upgrade sites required to achieve compliance, the impact of the DN250 condition on the combined DN400 & DN250 CP systems and the difficulty in obtaining easements for anode beds. The adoption of the alternative CP criterion will help to mitigate these challenges and reduce future costs.

4.2 Problem/Opportunity Statement

This project is a proposed continuation of works to manage and improve the safety and integrity of the RBP buried pipelines. The works address ongoing corrosion and deterioration of the buried pipelines associated with their age, construction methods, coating degradation and other time-dependent threats to the pipelines.

If not addressed, this problem would affect all users of the pipeline as the outcomes would be pressure restrictions, loss of supply, shutdown of critical pipeline sections and eventual pipeline failure by leak or rupture, potentially with significant safety consequences. The upgrades will also slow the rate of growth in pipeline deterioration. This will be expected to reduce the number of urgent repairs required on the pipeline compared to what otherwise would have been the case.

A successful solution will result in pipelines that are safe and fit for purpose and able to be operated in accordance with the relevant legislation and standards without endangering the public or APA employees.

4.3 Timing of the Issue

With any buried pipeline, the issues of pipeline integrity management commence as soon as the pipe is laid. The proposed work is a continuation of the ongoing integrity management activities that have been in progress for decades.

As described in the historical capex review above, work has been ongoing on this issue for some time. It will continue for the life of the assets, or until the pipelines are decommissioned.

Due to the age of the asset and more sophisticated assessment, the expenditure on integrity improvements has been increasing in recent years and are expected to continue at this new level for the duration of the access arrangement. This is expected to reduce the need for significantly more expensive interventions in emergency situations in the future.

4.4 Standards and Legislation

The following standards and legislation apply to the integrity management of the RBP:

- Queensland Petroleum & Gas (Production and Safety) Act 2004 and Regulation 2018
- Australian Standard AS 2885.3
- RBP Pipeline Licence #2

The legislation and code requirements are for APA as the Licensee to maintain and operate the pipeline in accordance with AS 2885.3, which includes pipeline structural integrity management, corrosion protection and monitoring, and pipe wall integrity requirements in Section 6.

Further to the AS 2885.3 requirements, the Queensland legislation designates the RBP as a ‘strategic pipeline’ and specifies mandatory ILI maximum intervals.

5 Risk Assessment and Alignment to Asset Management Plan

Risks associated with natural gas transmission pipeline integrity include significant safety hazards. Potential outcomes if integrity management works are not carried out include leak (e.g. from corrosion) or rupture (e.g. from

SCC or large corrosion defect) releasing a large inventory of flammable gas, with possible ignition and catastrophic consequences up to and including fatalities to workers and members of the public within the measurement length.

Depending on the location of any such failure, a leak or rupture of the RBP could also have serious operational, customer reputation and financial impacts to APA. Since the pipeline is the sole source of natural gas to south-east Queensland, loss of containment in certain locations could lead to curtailment or failure of gas supply to significant distribution networks to homes and businesses, as well as large industrial users and power stations.

Pipeline integrity risks are managed in APA through the AS 2885 Safety Management Study process. The SMS assesses risk levels with existing controls and the relevant SMS records to pipeline integrity management are summarized in Table 3. Details from the SMS database for these relevant existing threats are available in the attachments.

The existing risk rankings in the RBP SMS are listed along with the theoretical risk levels that would apply if the integrity management programme was discontinued. The worst-case risk rankings are generally associated with risk to personnel and public, i.e. injuries and fatalities resulting from a leak or rupture with ignition. Loss of supply risks are also significant in some cases.

TABLE 3: RISK RATING (AS 2885 SMS EXTRACT)

Threat	Risk Level (Existing APA AS 2885 SMS)	Assessed Risk Without Integrity Management (AS 2885)
External corrosion	Low (Remote/Severe)	**Intermediate (Unlikely/Severe)**
Internal corrosion	Failure not credible	**Failure not credible**
Stray current corrosion (railway etc)	Failure not credible	**Low (Remote/Severe)**
Stress corrosion cracking - Axial	Intermediate and ALARP (Catastrophic/Hypothetical)	**High (Catastrophic/Unlikely)**
Circumferential cracking in DN250 and DN300 pipelines (1969) due to strain on pipe	Low (Remote/Severe)	High (Catastrophic/Remote)
Dents combined with metal loss or located on welds	Low (Hypothetical/Major)	**High (Unlikely/Major)**

Pipeline Integrity is inherently aligned to the Asset Management Plan as it is required for compliance to the ILI Policy, as such it rated 4 for Asset Management Plan Alignment as referenced in Appendix C of the Roma to Brisbane System Lifecycle Management Plan FY23 – FY27.

6 Options Considered

6.1 Option 1 – Do Nothing

Under this option APA would cease to undertake the suite of integrity management on the pipeline and would drop back to a minor level of integrity activities. This would not meet the safety and integrity requirements of the RBP. It would entail reduced ILI frequencies; greatly reduced excavation, coating upgrade and life extension works, and reduced CP upgrades.

6.1.1 Cost/Benefit Analysis

This option would result in a deterioration of the pipeline, increases in the future cost of CP and costs and risks associated with pipeline failure. It would fail to provide the basic integrity requirements of the RBP and would reflect a failure of APA's systems. The safety management study would identify a significantly increase risk level which would include risks ranked as High and therefore unacceptable under the AS 2885 framework.

This would result in APA breaching its obligations under AS 2885 and the P&G Act. Pipeline CP would rapidly deteriorate and the likely outcome would be pipeline failure/s, potentially with catastrophic consequences. At the more extreme level even in the absence of a demonstrated pipeline failure APA may still be directed to cease operation of the pipeline due to the unacceptable risk posed to the public.

The reduction in pipeline integrity would lead to an increase in the indirect costs and risks of responding to failures, including:

- More expensive and intrusive repairs e.g. cut out of failed pipeline section rather than recoating or strengthening in situ; and
- Likely regulatory penalties, civil damages, reputational and customer losses, gas losses and risk of injury and death for the public and employees.

6.2 Option 2 – Continue Integrity Management and Upgrade Program

This option involves the continuation of the Integrity Management (IM) programme on the existing RBP assets as per the proposed actions set out in the Business Case sections above. Details of the proposed integrity management and upgrade program are set out below.

6.2.1 Inline Inspection

APA would propose to continue the ILI program at intervals as required by the PIMP and set out in the ILI master schedule.

Upcoming ILI within the AA period includes:

- DN300 Metro MFL and EMAT FY27 (last done 2017 and planned for FY22 – 5 yr interval)
- DN200 Lytton Lateral MFL – FY27 (last done 2017 - 10 year interval)

The ILI inspection intervals are set by the PIMP and are in line with APA's corporate ILI policies and Queensland legislation.

Note that no further ILI is proposed on the DN250 pipeline due to its assumed suspension from FY24, as part of the value optimization the ILI and excavation requirements will be deferred.

6.2.2 Excavation and Integrity Upgrades

APA would continue the prioritised excavation, repair and recoating works as set out in the forecast in section 3.4.2. The dig program would continue to address dents (prioritised where dents are associated with metal loss, seam weld or girth weld), pipeline strain events, and metal loss indications.

It is anticipated that by FY23, on the basis that the DN250 Supply Security project results in the make safe of the DN250, the Excavation and Integrity Upgrades will repair all currently known features and those features likely to be identified by Inline Inspections in FY22. From that time the program is expected to be able to complete both validation and repair excavations in the Financial Year following the ILI. Hence the next period of excavations will be in FY28.

Furthermore, there is also work underway to develop a plan to assess and manage the integrity of our underground pipework within our compressor, metering and regulation facilities. Typically this pipework is outside of the pipeline which can be inspected using the ILI methodology outlined above. Whilst this plan is still to be firmed up, it is anticipated that between $300-$500k per year will be required to manage this risk.

6.2.3 Cathodic Protection Upgrades

This option includes continuation of the CP upgrade program, including CP systems, anode beds, TR units, as well as telemetry units to provide SCADA monitoring and land tenure works to obtain easements for new and existing anode beds where required.

The CP Upgrade Programme will focus on the integrity of DN400, DN300 and DN200 CP systems whilst maintaining the DN250 to an alternate compliance criteria to minimise expenditure of that section until such time as the DN250 Supply Security project has determined the future life of the DN250.

6.2.4 Cost/Benefit Analysis

Benefits of this option are:

- Compliance with statutory obligations and AS 2885
- Mitigation of risk of pipeline failure to acceptable levels
- Extension of asset lifetimes and deferral of eventual replacement costs
- Avoid regulatory fines, civil damages, reputational and customer losses

Costs for the proposed programme are detailed in the cost breakdown in section 6.5.4.

6.3 Option 3 – Replace Pipelines

Another option is to replace sections of the pipeline at the point that its integrity begins to deteriorate through dents or metal loss.

The highest priority for pipe replacement would be DN300 Metro and DN250 pipeline due to age (52 years) and condition (these are where the majority of CP, ILI and upgrade costs are going). DN400 Wallumbilla to Moggill would also need to be replaced within AA period as sections are approaching 30 years old.

6.3.1 This option was considered in the SMS for the Intermediate threat of axial stress corrosion cracking as part of the ALARP analysis, but was not selected in comparison to the integrity management due to the very high costs. The DN250 Supply Security project will also consider this option; however, it is anticipated to be prohibitively expensive.Cost/Benefit Analysis

This option is not a realistic alternative to the preferred option at this time due to the high capital cost of pipeline replacement. A high level estimate, based on the actual cost of metro looping and recent APA experience on other pipelines, would cost the replacement of the DN250 and DN300 pipelines at approximately $920m. While there would be some minor opex savings resulting from the newer pipeline and some capex work would be delayed they would be insufficient to offset the significant upfront cost.

6.4 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)	Direct Costs	Commentary
Option 1	Do nothing - Minimal integrity management SMS risk = High	**0** (additional to normal O&M costs)	Significant risk of early pipeline failure
Option 2	Integrity management and upgrade programme SMS risk = Low to Intermediate / ALARP	**$13.1M**	This option is the minimum required works to maintain safety and integrity of existing assets
Option 3	Replace Pipelines SMS risk = Low	$900M+	Replace DN250 and DN300 immediately; Others likely during the AA period as well

6.5 Proposed Solution

6.5.1 What is the Proposed Solution?

Option 2 – Continue integrity upgrade programme to manage the safety and integrity of the existing assets, with further consideration of the DN250 requirement.

6.5.2 Why are we proposing this solution?

IM activities are a mandatory requirement of AS 2885 and QLD P&G Act so doing nothing in relation to integrity management would breach our legal obligations and appropriate standards.

Option 2 is also the most efficient means of ensuring the ongoing safety and integrity of the pipeline. Continuing to undertake this in a manner adopted prior to this program would result in higher long term costs as a result of inefficiently targeting the areas of need and not undertaking a sufficient rollout of new coating and upgraded CP resulting in a deterioration in the long term integrity of the RBP.

The option of replacing the pipeline while also effective at achieving an outcome consistent with AS2885 it would cost more than 90 times the cost of the preferred option.

Future pipeline replacement requirements will be assessed as part of ongoing integrity and risk management on the RBP.

6.5.3 Consistency with the National Gas Rules

6.5.3.1 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)). The RBP is aging and is being affected by corrosion and dents. As these corrosion and dents are precursors for pipeline failure it is necessary that they be identified and resolved. Pipeline failure would result in sudden loss of pressure and an inability to continue to provide pipeline services until the issue has been resolved. Further, a sudden pipeline failure is potentially fatal to anyone in the area of impact in addition to the health risks associated with a loss of containment of the natural gas. Therefore, the expenditure is necessary to maintain the safety and integrity of pipeline services.

6.5.3.2 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 RBP would reach a point where it could no longer continue to operate. As APA would be directed for safety reasons to cease to operate the pipeline.
- **Efficient** – The option selected is the most cost effective long term option that meets the necessary operational requirements in order remain compliant with legal obligations and Australian standards. The work was identified and considered under APA's expenditure framework and was and will continue to be undertaken in accordance with APA's procurement policies.
- **Consistent with accepted and good industry practice** – Addressing the risks associated with the corrosion and metal loss 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.

6.5.4 Forecast Cost Breakdown

The below table provides a summary of the integrity management capex project cost forecasts as set out in the asset management plan.

Project / Programme	FY23	FY24	FY25	FY26	FY27
Inline Inspection of Pipelines	$ -	$ -	$ -	$ -	$1,400,4118
Coating Refurbishment and Life Extension	$2,958,755	$ -	$ -	$ -	$ -
CP Upgrade Programme	$ 4,014,996	$ 1,341,838	$ 1,123,069	$ 1,016,685	$ 1,247,004
Total Forecast Capex	**$6,973,751**	**$1,341,838**	**$1,123,069**	**$1,016,685**	**$2,647,415**

Proposed costs (rates and volumes) are based on the following.

ILI – amounts are based on vendor quoted costs, typically standard rates for inspection type x length of pipeline / no. of sections). These are competitively tendered, and currently APA has a preferred ILI vendor selected by a competitive tender process. APA utilize panel tender for ILI services panel and as such cost rates are likely to be similar for the next period. Some services such as EMAT pigging are not available from all vendors, in which case the pricing is negotiated and agreed with the available vendor/s.

A breakdown of the forecast ILI costs is provided below.

Project / Programme	FY23	FY24	FY25	FY26	FY27
DN300 Metro MFL and EMAT					$ 1,157,365
DN200 Lytton Lateral MFL					$243,047
ILI Total					$1,400,4118

Coating refurbishment and life extension – Number of excavations required each year has been developed from APA's integrity modelling based on ILI data, considering site verification of ILI results, tool tolerance, and corrosion growth rates. The cost per excavation has been calculated from the work programme actual costs, taking into account the variation in complexity and cost between metropolitan and rural work sites. The programme is managed prudently in accordance with APA's Infrastructure Development major project framework. Contractors and materials are sourced by competitive processes in accordance with APA procurement policy including a formal tender process for the pipeline excavation and coating upgrade works.

CP Upgrades and Easements – The forecast expenditure over the years until FY23 is anticipated to remain significant, until such time as the DN250 is stabilized to the alternate compliance criteria. From this time, system installation will be reduced to the DN400, DN300 and DN200 CP systems, the rate of which will be reduced from previous years on the DN250

All cost estimates are based on recent or current similar programme costs.

7 Glossary

Cathodic Protection	A technique used to control the corrosion of a metal surface. In its application in a pipeline system, an electrical current is applied to the pipeline to maintain the pipeline at an electrical potential that minimises the rate of corrosion.
Dig	A common term used in reference to the excavation, inspection and if necessary, repair of an anomaly identified with the pipe wall and or pipeline coating.
InLine Inspection (ILI)	A method of inspection whereby a device is inserted into the pipeline and is propelled along the pipeline by the flow of gas within the pipeline. As the device travels through the pipeline it gathers information as to the condition of the pipe wall and geometric detail.
Pig	A common term used to collectively for the different type of devices inserted into a pipeline during an InLine Inspection process. Devices can be non-intelligent, such a cleaning device, or intelligent which are used to gather information as to the condition of the pipe wall and geometric detail.
Pigging	A common term used in reference to InLine Inspection

Appendix A – Source documents

320-PL-AM-0183 APA Queensland Pipeline Integrity Management Plan

DRAFT - Roma to Brisbane Pipeline Asset-Specific PIMP Addendum

360-POL-L-0005 Technical Policy – In-Line Inspection – Transmission Pressure Pipelines

320-PL-AM-0031 Roma Brisbane Pipeline - Stress Corrosion Cracking Management Plan

320-GD-AM-0003 Expert Guide - Stress Corrosion Cracking Management

RBP.2373-PL-CP-0002– Plan to 2030 - Cathodic Protection - Roma Brisbane Pipeline

A-2 – Electrical & Instrumentation – Battery Charger Upgrade

Background

Electrical power is critical to ensure the control and monitoring of the stations can be performed and to apply the power for the cathodic protection to the pipeline. Power is supplied from 240 volt sources to an uninterruptible power supply (UPS) battery charger system ensures that the back-up batteries are correctly charged and available.

The UPS provides power to maintain station control and monitoring in the event that the site power fails. If the UPS system cannot supply the required power for long enough periods prior to the situation being resolved, the site will automatically shut in as a safety precaution.

The battery chargers typically have a useful life of 15 years in the field application and it is important that the UPS system works reliably particularly for meter stations.

Objectives / Outcomes

This business case is to provide the funding for the replacement of 240V powered battery chargers on site.

Risk Analysis and Alignment to Asset Management Plan

APA utilises the AS2885.3-2012 Pipelines – Gas and liquid petroleum Part 3: Operation and Maintenance risk methodology for the risks associated with integrity challenges, but for general purposes APA has a specifically extended corporate version that includes additional risk categories.

Failure of a battery charger is not acceptable for more critical sites, especially the meter stations. Without backup power these sites cannot be monitored or controlled remotely via SCADA. The ability to perform remote monitoring is a requirement of the pipeline licence and AS 2885.

For a worst case scenario the loss of a meter station failing closed after a power disruption and a failure of the UPS has been assessed.

Such a failure though is feasible and has been rated as UNLIKELY– unlikely to occur, but possible when certain circumstance prevail.

RISK AREA	RISK LEVEL	RISK
HEALTH AND SAFETY	NEG	
ENVIRONMENT	NEG	
OPERATIONAL CAPABILITY	LOW	Disruption <1 week
PEOPLE	NEG	
COMPLIANCE	NEG	
REPUTATION AND CUSTOMER	LOW	Adverse media coverage
FINANCIAL	NEG	

The risk assessment indicates that there is a low risk. It is though an unacceptable situation the risk of which that can be proactively managed out.

The RBP is a major national pipeline and good practice requires site power to be appropriately maintained to enable the pipeline equipment to operate in accordance with its design basis and AS2885.

The replacement of the battery chargers has a moderate alignment to the Asset Management Plan as it is an aggregated equipment obsolesce program, as such it rated 3 for Asset Management Plan Alignment as referenced in Appendix C of the Roma to Brisbane System Lifecycle Management Plan FY23 – FY27.

Evaluation of alternatives

Replacement equipment is the only logical option where the units are obsolete and in poor condition, or fail. This is increase important with the criticality of the stations.

Delivery Concept

The battery chargers would be purchases against standard APA specification and installed by APA resources.

Estimate and Timeframe

For the purpose of this AA submission it is anticipated 3 sites, detailed below, would be required to support the battery charger replacements.

Recommendation

The recommendation is to provide funding for the upgrade of battery charger at 3 locations.

Budget

	FY23	FY24	FY25	FY26	FY27
Gatton	$83,156				
Oakey	$83,156				
Kogan	$83,156				

Justification

This capital expenditure is justified under Rule 79(2)(c)(ii) as the work is necessary to maintain the integrity of service.

A-3 – Electrical & Instrumentation – Dalby Compressor Station Communications Relocation

Background

Pipeline stations require communications connectivity to support the safe and effective operation of the pipeline. This includes the collection and assimilation of accurate metering data to ensure customers are provisioned with accurate representation of the gas they have received.

Currently at the Dalby Compressor Station, Dalby town council & Dalby site corporate communications link equipment are still located in the decommissioned unit 1 control room.

Objectives / Outcomes

Relocation of the communications equipment will eliminate the need for a second battery charger and battery bank at Dalby Compressor Station, which would be required to maintain the two communications links for metering data.

All communications equipment would be rationalised to one area with the power supply provisioned with appropriate integrity.

Risk Analysis and Alignment to Asset Management Plan

APA utilises the AS2885 risk methodology for the risks associated with integrity challenges, but for general purposes APA has a specifically extended corporate version that includes additional risk categories.

Loss of communications can result in loss of accurate billing data and SCADA communications to the site. The corporate router power is not maintained by the unit 1 back up batteries and there has been a loss of data during power outages.

RISK AREA	RISK LEVEL	RISK
HEALTH AND SAFETY	NEG	
ENVIRONMENT	NEG	
OPERATIONAL CAPABILITY	LOW	Loss of accurate metering data and SCADA
PEOPLE	NEG	
COMPLIANCE	NEG	
REPUTATION AND CUSTOMER	NEG	
FINANCIAL	NEG	

The relocation of the communications equipment rated 2 for Asset Management Plan Alignment as referenced in Appendix C of the Roma to Brisbane System Lifecycle Management Plan FY23 – FY27.

Evaluation of alternatives

Installation of a second battery charger and UPS to support the existing location of communications equipment would incur additional capital expenditure and increase maintenance costs to assure the integrity of the equipment.

Relocation is warranted to eliminate the need for the second charger and batteries as above.

Delivery Concept

Relocation of the communications equipment is not a complex process and will be carried out as part of the annual SIB programs. It is likely that APA staff will complete the work.

Estimate and Timeframe

The cost is detailed below and are anticipated to be completed in FY23.

Recommendation

The recommendation is to relocate the current communications equipment to one area with the power supply provisioned with appropriate integrity.

Budget

	FY23	FY4	FY25	FY26	FY7
Communications Relocation	**$55,685**				

Justification

This capital expenditure is justified under Rule 79(2)(c)(ii) as the work is necessary to maintain the integrity of service.

A-4 – Electrical & Instrumentation – SCADA Hardware Lifecycle Management

Background

Safe and efficient operation of the RBP system relies on APA's Integrated Operations Centre having visibility and control of the pipeline process conditions and equipment status. This function is facilitated by a Supervisory Control And Data Acquisition (SCADA) system.

A typical design life for SCADA equipment is approximately 10 to 15 years under field conditions and as with many electronic items they may become unsupported during their lifecycle. A number of sites have been identified as requiring replacement due to obsolescence of various elements of the system including hardware supportability, technologies i.e. 3G & NBN and satellite lifecycle.

This will require deployment of a standardised approach to site management where some sites will require upgrade of various elements where other site may only require connection to a new satellite service.

Objectives / Outcomes

This business case is to provide the funding for the replacement of SCADA hardware across the RBP system to ensure ongoing reliability.

Risk Analysis and Alignment to Asset Management Plan

APA utilises the AS2885 risk methodology for the risks associated with integrity challenges, but for general purposes APA has a specifically extended corporate version that includes additional risk categories.

Failure of the SCADA system is not acceptable for more critical sites, especially the meter stations and compressor stations. Without SCADA these sites cannot be monitored or controlled remotely. The ability to perform remote monitoring is a requirement of the pipeline licence and AS 2885.

For a worst-case scenario, the loss of a meter station failing closed after a power disruption has been assessed. Such a failure is feasible and has been rated as occuring occasionally or in many circumstances.

RISK AREA	RISK LEVEL	RISK
HEALTH AND SAFETY	NEG	
ENVIRONMENT	NEG	
OPERATIONAL CAPABILITY	MOD	Disruption <1 week
PEOPLE	NEG	
COMPLIANCE	NEG	
REPUTATION AND CUSTOMER	LOW	Adverse media coverage
FINANCIAL	NEG	

The risk assessment indicates that there is a moderate risk. It is an unacceptable situation, the risk of which that can be proactively managed out. The cost of waiting until failure or obsolescence, then reactively upgrading the sites under emergency conditions, would be higher than the cost of poractively conducting the works in a planned manner.

The RBP is a major national pipeline and good practice requires the SCADA system to be appropriately maintained to enable the pipeline equipment to operate in accordance with its design basis and AS2885.

The lifecycle management of SCADA hardware is inherently aligned to the Asset Management Plan as it is part of an endorsed improvement program, as such it rated 4 for Asset Management Plan Alignment as referenced in Appendix C of the Roma to Brisbane System Lifecycle Management Plan FY23 – FY27.

Evaluation of alternatives

Replacement equipment is the only logical option where the system elements are obsolete. This is of increased important with the criticality of the stations.

Delivery Concept

The site upgrade plan has been developed across all APA assets. Design and procurement of various elements will be against standard APA specification and installed by APA resources using specialist contractors as required.

Estimate and Timeframe

APA has developed a multi-year plan that has commenced in the current Access Arrangement period and will conclude in the next period as detailed below. The multi-year plan supports prioritisation of elements that have imminent obsolescence and considers the criticality of sites.

Recommendation

The recommendation is to proactively replace equipment prior to becoming obsolete or failing.

Budget

Site Types	**FY23**	**FY24**	**FY25**	**FY26**	**FY27**
Cathodic Protection Sites	$132,499				
Meter Stations	$409,484				
Compressor, Main Line Valve and Scrapper Sites	$212,573				
Total	**$754,556**				

Justification

This capital expenditure is justified under Rule 79(2)(c)(ii) as the work is necessary to maintain the integrity of service.

A-5 – Integrity – Warrego Highway Upgrade Pipeline Protection

Background

Queensland Department of Transport and Main Roads plan to upgrade sections of the Warrego Highway. During Stage 3A of their plan, the RBP, near Oakey would be affected. The affected section of the pipeline will need to be addressed to ensure the pipeline remains safe to operate and access to the pipeline is maintained for any future works that may be required during the life of the pipeline, such as validation or repair excavations.

APA has assessed the cost of the activities for which APA will be responsible for and as such have been included in the SIB plan. This assessment has been conducted based on the Queensland Petroleum and Gas (Production and Safety) Act.

Objectives / Outcomes

This business case is to provide the funding to enable the work required to mitigate the risk to pipeline integrity from the upgrade of the Warrego Highway to ensure ongoing integrity and reliability of the RBP system.

Risk Analysis and Alignment to Asset Management Plan

APA utilises the AS2885 risk methodology for the risks associated with integrity challenges, but for general purposes APA has a specifically extended corporate version that includes additional risk categories.

The unmitigated impact of the highway upgrade works on the operating pipeline are considerable. Without mitigation the pipeline may be physically damaged during the works or by effects such as coating damage and loading mat result in long-term failures.

For a worst-case scenario, the potential to an interruption of supply via a pipeline strike has been assessed. Such a failure is feasible and has been rated as not anticipated but may occur if certain abnormal circumstances prevail.

RISK AREA	RISK LEVEL	RISK
HEALTH AND SAFETY	NEG	
ENVIRONMENT	NEG	
OPERATIONAL CAPABILITY	LOW	Disruption <1 week
PEOPLE	NEG	
COMPLIANCE	NEG	
REPUTATION AND CUSTOMER	LOW	Adverse media coverage
FINANCIAL	NEG	

The risk assessment indicates that there is a low risk. However, it is an unacceptable situation, the risk of which that can be proactively mitigated.

AS2885 requires APA to manage external interference and control activities near the pipeline.

The management of risk to the pipeline associated with the Warrego the highway upgrade works is inherently aligned to the Asset Management Plan in order to maintain the safe and secure supply to customers, as such it rated 4 for Asset Management Plan Alignment as referenced in Appendix C of the Roma to Brisbane System Lifecycle Management Plan FY23 – FY27.

Evaluation of alternatives

APA is currently working with DTMR to understand the design of the highway upgrade and its impacts on the pipeline. This is a collaborative process whereby the design of the road upgrade and pipeline protection cannot be conducted in isolation. From the preliminary designs shared with APA, it is apparent only the DN250 will be impacted. There are several alternatives that may be feasible to mitigate the threat to the DN250 pipeline integrity. One of the factors that influence the selection of a preferred option is the future use of the DN250 combined with the timing of the highway upgrade. The following options are considered:

1. Do nothing; In this option APA would accept the and take the risk of impact such as ovality and coating damage resultant from loading or worst case a pipe strike. This option is not considered acceptable to APA.
2. Increased protection for the pipeline in the existing alignment, such as load bearing slabbing, additional depth of cover and coating renewal. This option will impact the design and works plan for DTMR. Based on APA's interpretation of the Queensland Petroleum and Gas (Production and Safety) Act with respect to the determination of how asset owner costs are borne, this is likely less expensive to APA than option 3.
3. Relocation of the pipeline to a revised alignment; this works would probably be done prior to the DTMR works and would reduce the interaction and impact on the DTMR design and works plan; but at an increased cost APA.
4. Abandonment / removal of the pipeline in the road alignment; this option would become feasible of the pipeline is suspended prior to the DTMR works. Depending on DTMR design APA could either cut and cap each side of the road and slurry fill the under-road section. Alternately if the DTMR design clashes levels with the abandoned pipeline, it would be cut and capped each side of the road and leave the abandoned section to be removed as part of the DTMR works.

For the purposes of this business case it is assumed that the DN250 will reach the end of economic life in Financial Year 2024. Based on information available to APA at the time of writing this business case, it appears unlikely that the highway upgrade works will commence before this time.

Delivery Concept

The works required to mitigate the threat to the pipeline can be completed by APA resources using specialist contractors as required.

Estimate and Timeframe

As discussed above, it is anticipated that there works may be undertaken in FY23 with costs to as descried below.

Recommendation

The recommendation is to select option 4 as the most cost-effective option to be pursued based on the information known at this time.

Budget

Site Types	FY23	FY24	FY25	FY26	FY27
Pipeline Protection		$332,752			

Justification

This capital expenditure is justified under Rule 79(2)(c)(i) as it is required to maintain and improve the safety of services and also Rule 79(2)(c)(ii) as the work is necessary to maintain the integrity of service.

Project Review– Capital Expenditure

DN250 - Supply Security Project

Business Case Number A-6

1 Project Approvals

TABLE 1: PROJECT REVIEW– PROJECT APPROVALS

Prepared By	Chris Meades, *Asset Lifecycle Specialist, APA Group*
Reviewed By	Robert Hall, *Manager Asset Lifecycle, APA Group*
Approved By	Francis Carroll, *Asset Manager, APA Group*

2 Project Overview

TABLE 2: PROJECT REVIEW – PROJECT OVERVIEW

Description of Issue/Project	**Gas consumers** on the RBP outside of metropolitan Brisbane are currently supplied from connections on either or both of the DN250 and DN400 pipelines. A number of consumer connections, typically for distribution networks, are supplied solely from the DN250 pipeline. The RBP DN250 pipeline integrity continues to decline notwithstanding considerable investment via the pipeline integrity management and upgrade program. Some sections of the DN250 pipeline not directly supplying customer connections have been temporarily suspended from operation in order to defer large replacement or repair costs, while supply to customers has been maintained by modifying the operational configuration to reverse flow the DN250 pipeline. . These circumstances have necessitated APA to undertake analysis of the future needs of the DN250 and determine the most prudent and efficient (lowest long-term cost) solution. This project ensures that all current and prospective customers of the RBP system are adequately provisioned via cost effective sustainable solution.
Options Considered	The following options have been considered: 1. Option 1: Do Nothing 2. Option 2: Permanent Bellbird Park Back Feed 3. Option 3: Cross Connect the DN400 to the DN250 at Kogan **4. Option 4: Permanent Suspension of the DN250 from Wallumbilla to Bellbird Park** 5. Option 5: Reinstatement of the DN250 from Wallumbilla to Bellbird Park
Cost (as incurred)	$4.75m
Consistency with the National Gas Rules (NGR)	The replacement of these assets complies with the capital expenditure criteria in Rule 79 of the NGR because: • it is necessary to maintain and improve the safety of services, maintain the integrity of services and comply with a regulatory obligation or requirement. (Rules 79(2)(c)(i),(ii) & (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	This project was communicated and discussed at the customer and stakeholder engagement group forum in April 2021.

3 Background

The RBP system includes over 800 km of buried pipelines, in sizes between DN200 and DN400, the oldest of which was constructed in 1968-69 and has been in service ever since. The pipelines transport natural gas between Wallumbilla, near Roma, and the Brisbane metropolitan region in south-east Queensland. The RBP is the sole supply route for natural gas to homes and businesses in south-east Queensland, including Dalby, Oakey, Toowoomba, Ipswich, greater Brisbane, the Gold Coast and far northern New South Wales.
Since 2014 APA has been undertaking a pipeline integrity upgrade program across the RBP system; through the excavation and repair of defects identified through Inline Inspection activities and prioritised upgrade of the Cathodic Protection system. This program has proved successful for the majority of the pipelines which make up the RBP system. However, the condition of the DN250, which is the original pipeline, along with the DN300 and DN200 metro sections, has continued to decline.

In 2020 APA took the decision to temporarily suspend the operation of the DN250 from Wallumbilla to Kogan due to the extent of the pipeline integrity degradation. This enabled the deferral of significant pipeline replacement and repair expenditure, as a prudent and efficient option, as no direct customer offtakes were affected in this section. APA was able to continue to supply its customers currently served by the DN250 with the section from Kogan to Bellbird Park remaining operational in a modified operational configuration.

These circumstances have necessitated APA to undertake analysis of the future needs of the DN250 and the lowest cost solution to meet the long-term requirements of the asset.

4 Risk Assessment and Alignment to Asset Management Plan

Overall the main risk associated with the current condition of the DN250 is rapid deterioration of the pipeline integrity, increases in the cost of CP and costs and risks associated with pipeline failure. 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.

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	**High**
Environment	**Low**
Operational	**Moderate**
Reputation	**High**
Compliance	**High**
Financial	**Moderate**
Final Untreated Risk Rating	**High**

The DN250 supply security project is inherently aligned to the Asset Management Plan in order to maintain the safe and secure supply to customers, as such it rated 4 for Asset Management Plan Alignment as referenced in Appendix C of the Roma to Brisbane System Lifecycle Management Plan FY23 – FY27.

5 Options Considered

5.1 Option 1 – Do Nothing

Under this option APA would continue the temporary arrangements to supply DN250 customers with no further modifications, keeping the DN250 pipeline operational but without the ability to run ILI tools. This would not meet the safety and integrity requirements of the RBP and is not considered a feasible option. Hence therefore APA took the decision in 2020 to temporarily suspend the operation of the DN250 from Wallumbilla to Kogan and modified the operational configuration to supply its customers currently served by the DN250.

5.1.1 Cost/Benefit Analysis

This option would result in an accelerated deterioration of the DN250 pipeline. It would fail to provide the basic integrity requirements of the RBP and would reflect a failure of APA's systems. The safety management study would identify a significantly increased risk level which would include risks ranked as High under the AS 2885 framework.

This would result in APA breaching its obligations under AS 2885 and the P&G Act. Pipeline CP would rapidly deteriorate, and the likely outcome would be pipeline failure/s, potentially with catastrophic consequences. At the more extreme level even in the absence of a demonstrated pipeline failure APA may still be directed to cease operation of the pipeline due to the unacceptable risk posed to the public.

APA would be exposed to likely regulatory penalties, civil damages, reputational and customer losses, gas losses and risk of injury and death for the public and employees.

5.2 Option 2 – Bellbird Park Back Feed

Option two is the retention of the current operational configuration that APA implemented on the suspension of the Wallumbilla to Kogan section to continue to supply its customers currently served by the DN250. This configuration incurs additional risk reduction requirements including modifications to enable inline inspection, pipeline slabbing and relocation of pressure control equipment to enable APA to meet its obligations under AS 2885.

This option would also require the pipeline to be inspected by ILI in the "reverse" direction from the conventional gas flow from the pipelines original design, this would result in approximately 4.5TJ per section per ILI run of natural gas having to be vented to atmosphere at Dalby to achieve suitable flowrates, an adverse impact on the environment via greenhouse gas emissions and an additional cost.

Furthermore, the RBP system pressures would not be adequate to support EMAT ILI which is used to detect Stress Corrosion Cracking. This defect has been found to occur on the DN250 and failure to inspect for it would lead to an increased potential for pipeline failure. It should also be noted that this pipe has never been inspected by ILI in the reverse direction, and as such there would be a level of risk that is difficult to quantify in doing this for the first time.

APA would continue its integrity management activities on the DN250 pipeline in the Kogan to Bellbird Park section. The section from Wallumbilla to Kogan would remain temporarily suspended for the next submission period.

5.2.1 Cost/Benefit Analysis

This option has comparatively low upfront and full lifecycle costs. However, the integrity issues of the remaining operational section between Kogan and Bellbird Park remain a significant lifecycle cost and this is a source of potential increased spend exceeding the plan, which may result in overspend beyond what has been costed based on current condition.

The environmental impact of venting of large volumes of natural gas to atmosphere as required for ILI is also not consistent with APA approach to delivery of responsible energy.

Given the known potential for SCC being present of the DN250, the inability to inspect for SCC is a major deficiency of this option.

5.3 Option 3 – Cross Connect the DN400 to the DN250 at Kogan

This option involved the design and installation of a cross connection between the DN400 and DN250 at Kogan Compressor Station to flow gas and regulate the pressure into the DN250. The DN250 customers would continue to be suppled via the existing connections downstream of Kogan.

ILI activities would be able to be resumed in the conventional “forward” direction mitigating the need to vent natural gas. However, further risk reduction requirements including increased direct assessment of the pipeline and increased patrols would be required to increase the operating pressure required at times of ILI to support EMAT ILI for SCC detection.

APA would continue its integrity management activities on the DN250 pipeline in the Kogan to Bellbird Park section. The section from Wallumbilla to Kogan would remain temporarily suspended for the next submission period.

5.3.1 Cost/Benefit Analysis

This option has comparatively moderate upfront and high full lifecycle costs required to achieve the pressures required for EMAT ILI. The integrity issues of the remaining operational section between Kogan and Bellbird Park remain a source of potential increased spend exceeding the plan, which may result in overspend beyond what has been costed based on current condition.

The environmental impact of venting of large volumes of natural gas to atmosphere as required for ILI in the reverse direction is mitigated. However, the ongoing costs are increased to support higher operating pressures during EMAT ILI.

5.4 Option 4 – Permanent Suspension of the DN250 from Wallumbilla to Bellbird Park

This option would see all customers currently supplied by the DN250 relocated to the DN400.

The purpose of this option is to avoid major pipeline integrity costs on the DN250, while still meeting customer and contractual supply requirements.

Under this option, additional risk reduction requirements of pipeline slabbing are required to be undertaken to ensure the RBP system has sufficient capacity to meet forecast contractual requirements. The DN300 Pig launcher is required to be moved to Ellengrove to allow ILI of DN300 Metro section.

The integrity management program for the RBP system is revised such that the excavation and repair of currently known defects on the DN250 is required to be continued until such time as the DN250 is made safe, currently assumed to be by the end of FY24 based on current forecasts. From this time, it is expected that the excavation program on the still in service RBP system section will consist of validation and some repair excavations, all of which would be able to be completed within the year following the completion of an ILI. An alternate CP compliance criterion is adopted to ensure efficient expenditure on the CP system resulting in the CP upgrade program being significantly reduced.

5.4.1 Cost/Benefit Analysis

The primary benefit of this option is that the escalating costs required to address the ongoing degradation of the DN250 pipeline integrity are removed. This is primarily driven by the reduced ILI, digup and CP system upgrade costs. The risk of further costs exceeding the plan, which may result in overspend beyond what has been costed based on current condition is also eliminated.

This option has comparatively high upfront costs. However, the full lifecycle costs are much lower due to the significant reduction of the integrity management program, refer Business Case A-1 for further details.

The risk for this option is that should the DN250 be required to be reinstated in future; significant costs well above those otherwise incurred in keeping the DN250 in ongoing service may be required and may be prohibitive to this remaining a credible future option. However, APA have no forecast that indicates the requirement for the additional capacity of the DN250 beyond the system capacity available by selecting this option.

5.5 Option 5 – Reinstatement of the DN250 from Wallumbilla to Bellbird Park

This option involves a reinstatement and recommissioning of the entire DN250 pipeline between Wallumbilla and Bellbird, up to a pressure sufficient to flow into the Metro pipeline for pigging purposes, including the compressor stations as required, and the currently temporarily suspended sections of pipeline.

This would require both the excavation and repair of significant volumes of defects, replacement of lengths of pipeline, and further upgrade of the CP system. Furthermore, the ongoing integrity management program would need to be expanded to maintain the pipeline in a fit for purpose state.

5.5.1 Cost/Benefit Analysis

The cost of this option, both upfront and full lifecycle would be significant. The benefit of this option would be the preservation of the DN250 to serve a future demand. However, APA have no forecast that indicates the requirement for the DN250.

5.6 Summary of Cost/Benefit Analysis

TABLE 4: SUMMARY OF COST/BENEFIT ANALYSIS

Option	Benefits (Risk Reduction)	Costs	Commentary
Option 1: Do Nothing	Minimal integrity management SMS risk = High	**0** (additional to normal O&M costs)	Significant risk of early pipeline failure
Option 2: Bellbird Park Back Feed	Integrity management and upgrade program ongoing SMS risk = Low to Intermediate / ALARP	$1.4m Upfront; $92.4m NPV @ 25 Years	Risk of pipeline failure managed (SCC risk present) with comparatively low upfront and full lifecycle costs.
Option 3: Cross Connect the DN400 to the DN250 at Kogan	Integrity management and upgrade program ongoing SMS risk = Low to Intermediate / ALARP	$3.4m Upfront; $111.9m NPV @ 25 Years	Risk of pipeline failure comprehensively managed (SCC risk present) with comparatively low upfront and full lifecycle costs.
Option 4: Suspension of the DN250 from Wallumbilla to Bellbird Park	Integrity management and upgrade program significantly reduced. Risk of pipeline failure eliminated.	$4.75m Upfront; $25.5m NPV @ 25 Years	Significant costs required to return pipeline to service if required in future. No forecast requirement for this part of the RBP pipeline system.
Option 5: Reinstatement of the DN250 from Wallumbilla to Bellbird Park	Integrity management and upgrade program increased ongoing SMS risk = Low to Intermediate / ALARP	~$40m Upfront; ~$264m NPV @ 25 Years	Significant expenditure required to return pipeline to service at this time. No forecast requirement for this pipeline.

5.7 Implemented solution

5.7.1 What is the Solution?

The prudent solution over the lifecycle of the asset is the suspension of the DN250 from Wallumbilla to Bellbird Park.

5.7.2 Why we pursued this solution?

This option represents the most prudent and efficient (cheapest long term cost) solution which addresses the risk of ongoing and increased pipeline integrity degradation through impaired CP system performance and mitigates the ongoing expenditure otherwise required to manage this risk.

Whilst the costs that would be required to reinstate the DN250 should it be required in the future be significant, APA have no forecast that indicates the requirement for the DN250.

5.7.3 Consistency with the National Gas Rules

Rule 79(1)

This project will be undertaken through the APA planning and procurement framework. Lifecycle analysis also shows the selected option to be the lowest costs over the lifecycle of the pipeline 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.

Rule 79 (2)

The project 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)), it is necessary in order to maintain the integrity of services (r79(2)(c)(ii)) and it is necessary to comply with a regulatory obligation or requirement (r79(2)(c)(iii)). A failure of the pipeline integrity system including the Cathodic Protection system could result in the following negative consequences:

- Ongoing degradation of the pipeline integrity
- This would result in APA breaching its obligations under AS 2885 and the P&G Act. Pipeline Integrity and CP would continue to deteriorate, and the eventual outcome would be pipeline failure/s, potentially with catastrophic consequences.

5.7.4 Cost Breakdown

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

TABLE 5: PROJECT COST

	Total
Labour	$902,411
Contractors	$1,614,842
Materials	$2,137,291
Other	$47,495
Total	$4,749,535

A-7 – Mechanical – Underground Valves Upgrade

Background

Mainline valves are installed on all pipelines to provide pipeline isolation for maintenance or during times of emergency as required. The valves are either operated by actuators or manual operation.

The valves are required by AS2885.1 Section 4.8.1 and are a standard item for pipeline safety. "Equipment shall be provided for the isolation of the pipeline system for maintenance purposes or in the vent of a loss of containment within the segment".

Currently there are a number of valve sites where the valve is located within an underground pit. Access to these valves requires confined space access protocols to be implemented prior to entry to assure the safety of those persons entering the pits, this delays any emergency response to operate these valves.

Objectives / Outcomes

Installation of valve extensions to remove requirement for confined space access, will eliminate the risk to personnel and improve response time in the event of an emergency requiring the use of these isolation valves.

Delays in isolating a pipeline segment are unacceptable, particularly in populated areas such as along the RBP, with any increased loss of linepack having potential safety, environmental and financial consequences.

Risk Analysis and Alignment to Asset Management Plan

APA utilises the AS2885 risk methodology for the risks associated with integrity challenges, but for general purposes APA has a specifically extended corporate version that includes additional risk categories.

For a worst case scenario it could be assumed that a pipeline is punctured and the time to close a valve is delayed. The impact is for additional volumes of gas being released over a longer period of time to account for the additional time required to enter a confined space. This limits the response to the incident site and provides some minor incremental environmental and commercial impact.

For the purpose of the assessment it is anticipated that an actuator failure coinciding with pipeline damage is Remote and the impact is only the increase in impact caused by the delay.

RISK AREA	RISK LEVEL	RISK
HEALTH AND SAFETY	NEG	
ENVIRONMENT	NEG	
OPERATIONAL CAPABILITY	LOW	Minor extension of delays
PEOPLE	NEG	
COMPLIANCE	LOW	Possibility of regulatory action including fines
REPUTATION AND CUSTOMER	LOW	Adverse media coverage against APA

FINANCIAL	NEG	Potential for increased damage at incident site

The risk assessment confirms that the risk is focussed upon the reaction of other parties. Shippers might have concerns and demand payment for needing to source urgent gas and for the additional lost gas, the regulator could implement aggressive control measures and APA might incur additional costs and fines.

The upgrade of underground valves to mitigate the requirement for confined space access has a lower alignment to the Asset Management Plan. However, it provides medium term benefits to the business and is logical to progress, as such it rated 2 for Asset Management Plan Alignment as referenced in Appendix C of the Roma to Brisbane System Lifecycle Management Plan FY23 – FY27.

Evaluation of alternatives

The installation of new wholly above ground valves is a technically feasible alternative. However, this would incur significant costs and risks in modifying pipework, establishing land tenure for above ground facilities or expanded access pits, and likely live pipeline hot tap and stopple work.

Deferring or cancelling the program would leave APA exposed to the worst case scenario foreshadowed above with no real ability to mitigate the risk.

Delivery Concept

Installation of valve extensions is not a complex process and will be carried out as part of the annual SIB programs. It is likely that APA staff will complete the work.

Estimate and Timeframe

The sites to be upgraded are detailed below and are anticipated to be completed across FY23 & FY24.

Recommendation

The recommendation is to upgrade the underground valves to enable operation from above ground via valve extensions.

Budget

	FY23	FY24	FY25	FY26	FY7
Preston Road – 4 valves	**$89,818**				
Riverview – 1 valve	**$22,454**				
Collingwood – 5 valves		**$112,848**			
Ellengrove – 1 valve		**$22,570**			

Justification

This capital expenditure is justified under Rule 79(2)(c)(i) & (ii) as the work is both necessary to improve the safety of services and maintain the integrity of service.

Project Review– Capital Expenditure

Peat Lateral Liquid Removal Upgrades

Business Case Number A-8

1 Project Approvals

TABLE 1: PROJECT REVIEW– PROJECT APPROVALS

Prepared By	Chris Meades, *Asset Lifecycle Specialist, APA Group*
Reviewed By	Robert Hall, *Manager Asset Lifecycle, APA Group*
Approved By	Francis Carroll, *Asset Manager, APA Group*

2 Project Overview

TABLE 2: PROJECT REVIEW – PROJECT OVERVIEW

Description of Issue/Project	In recent years, Cathodic Protection levels on the Peat Lateral Pipeline have been dropping below the requirements of AS 2832 and AS 2885. The cause of these reduced levels is significant amounts of liquids entering the pipeline from upstream production facilities, resulting in electrically bridged Insulation Joints and ineffective cathodic protection. The excessive liquids also increase costs and operational impacts associated with pigging and downstream filtration and processing. This project will install suitable inlet filtration at the Scotia Metering Station and Woodroyd Metering Station to prevent liquids entering the pipeline.
Options Considered	The following options have been considered: 1. Option 1: Do Nothing Option 2. Option 2: Periodic Cleaning Pigging **3. Option 3: Install Suitable Inlet Filtration**
Cost (as incurred)	$1.05m
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, maintain the integrity of services and comply with a regulatory obligation or requirement. (Rules 79(2)(c)(i),(ii) & (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	APA participates and contributes to the Future Fuels Collaborative Research Council who continue to research this issue across industry. The options considered are consistent with what the FFCRC reports on this topic.

3 Background

The Peat Lateral Pipeline (PLP) (Petroleum Pipeline Licence No. 75 – PPL74) is a DN250 natural gas pipeline from the Woodroyd (Peat) Coal Seam Methane Field (east of Wandoan) to the existing Roma to Brisbane natural gas pipeline (RBP) in the Arubial Parish near Condamine. The Scotia Extension section is also DN250 and extends the pipeline north from Woodroyd to the Scotia gas processing plat, a further 10 km. The approximate length of the

pipeline is 121 km and for the purposes of this report the PLP is considered to include the Scotia Extension section. APA's connection points to the PLP are facilitated through the Scotia Metering Station and Woodroyd Metering Station.
In recent years, Cathodic Protection levels on the PLP have been dropping below the requirements of AS2885. The cause of these reduced levels is significant amounts of electrically conductive liquids entering the pipeline, resulting in bridged Insulation Joints thereby being a leak point for CP currents into the above ground station piping. This leaking current raises concerns that any pipeline coating defects are not being suitably protected by the CP system.

Recent pigging activities have removed a heavy black sludge from the PLP, indicating the gas supply from Scotia and Woodroyd to the RBP contain a significant amount of liquid. Laboratory testing of samples has identified the liquid as mostly glycol (tri-ethylene glycol, TEG), with small amounts of liquid hydrocarbon condensate. The TEG is used in upstream gas processing facilities to dehydrate the gas (i.e. remove the water) before the gas enters the transmission system. For a variety of reasons, not all TEG is recovered and is 'carried-over' with the gas into the downstream system. APA has raised the issue with the upstream gas producers but there is little that can be done as often it's hard, or impossible, to prove that the gas being supplied is outside any gas specification standards.

Both the Scotia and Woodroyd Metering Stations are only equipped with dry gas filters to capture contaminants before they are introduced to the PLP. These filters are not designed, nor are they effective, at removing the liquid that is being carried over from upstream gas compressors and facilities.

Analysis of the problem indicates the rate of liquid accumulation is not yet fully understood. However, it appears to be correlated with Coal Seam Gas production rates and hence flows into the pipeline. Increased liquid accumulation may also be attributed to process upsets within the upstream gas processing facilities. APA participates and contributes to the Future Fuels Collaborative Research Council who continues to research this issue across industry.

4 Risk Assessment and Alignment to Asset Management Plan

Overall the main risk associated with the liquids accumulation is deterioration of the pipeline integrity, increases in the cost of CP and costs and risks associated with pipeline failure. 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.

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	**Low**
Environment	**Low**
Operational	**Low**
Reputation	**Low**
Compliance	**Moderate**
Financial	**Low**
Final Untreated Risk Rating	**Moderate**

The Peat Lateral liquids removal upgrade has a moderate alignment to the Asset Management Plan as it is part of an accepted division wide initiative to address the systematic issues of liquids in pipelines, as such it rated 3 for Asset Management Plan Alignment as referenced in Appendix C of the Roma to Brisbane System Lifecycle Management Plan FY23 – FY27.

5 Options Considered

5.1 Option 1 – Do Nothing

Under this option the PLP would continue to accumulate liquids and Isolation Joints would remain compromised resulting in ineffective Cathodic Protection and deterioration of pipeline integrity. Liquid removal would only occur as cleaning activities prior to InLine Inspection and would rapidly reaccumulate post ILI.

5.1.1 Cost/Benefit Analysis

This option would result in a deterioration of the pipeline integrity, increases in the cost of CP and costs and risks associated with pipeline failure. It would fail to provide the basic integrity requirements of the PLP and would reflect a failure of APA's systems.

This would result in APA breaching its obligations under AS 2885 and the P&G Act. Pipeline CP would continue to deteriorate, and the eventual outcome would be pipeline failure/s, potentially with catastrophic consequences.

Increased cost for cleaning activities prior to InLine Inspection would also be incurred.

5.2 Option 2 – Periodic Cleaning Pigging

Option two would utilise frequent cleaning pigging to physically remove the liquids that have entered and built up in the pipeline. Experience with the rate of liquids accumulation has indicated the cleaning activities would need to be conducted at least monthly to manage the liquids build up such that the impact to the Insulation Joints remain effective. The period between cleaning activities is likely to remain dynamic as investigation and analysis has demonstrated the rate of liquid accumulation is not linear nor fully understood.

5.2.1 Cost/Benefit Analysis

This option whilst minimising upfront expenditure has increased costs over the life of the asset.

5.3 Option 3 – Install Suitable Inlet Filtration

This option involved the design, selection and installation of inlet filtration at Scotia Metering Station and Woodroyd Metering Station capable of removing the liquids prior to entering the pipeline. The design would utilise findings of the Future Fuels Collaborative Research Council combined with analysis of the liquids material that APA has sampled from the PLP.

5.3.1 Cost/Benefit Analysis

Whilst this option has higher upfront costs, it has the benefit of potential removal of the root cause. There is still potential unknown effectiveness of the coalescing filter design, with entrained TEG carry over as risk to the success of the solution.

This option utilises recommendations from the Future Fuels Collaborative Research Council on the management of liquids in pipelines. If effective; this option has the lowest cost over the Lifecycle of the PLP.

5.4 Summary of Cost/Benefit Analysis

TABLE 4: SUMMARY OF COST/BENEFIT ANALYSIS

Option	Benefits (Risk Reduction)	Costs
Option 1: Do Nothing	No additional benefit	$0 Upfront; $2.4m NPV @ 25 Years
Option 2: Periodic Cleaning	If effective; removes liquids built up over time	$0 Upfront; $1.5m NPV @ 25 Years
Option 3: Install Suitable Inlet Filtration	Prevents liquids entering the pipeline system	$1.05m Upfront; $1.2m NPV @ 25 Years

5.5 Implemented solution

5.5.1 What is the Solution?

The prudent solution over the lifecycle of the asset has been to selected the Install Suitable Inlet Filtration at Scotia Metering Station and Woodroyd Metering Station.

5.5.2 Why we pursued this solution?

Whilst the upfront costs is significant, this options represents the cheapest long term solution which addresses the risk of pipeline integrity degradation through impaired CP system performance and addresses the root cause.

Whilst there exists a risk as to the effectiveness of the design, the option is also supported by recommendations of the Future Fuels Collaborative Research Council.

5.5.3 Consistency with the National Gas Rules

Rule 79(1)

This project will be undertaken through the APA planning and procurement framework. Lifecycle analysis also shows the selected option to be the lowest costs over the lifecycle of the pipeline 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.

Rule 79 (2)

The project 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)), it is necessary in order to maintain the integrity of services (r79(2)(c)(ii)) and it is necessary to comply with a regulatory obligation or requirement (r79(2)(c)(iii)). A failure of the pipeline integrity system of which the Cathodic Protection system forms part of could result in the following negative consequences:

- Initial degradation of the pipeline integrity
- This would result in APA breaching its obligations under AS 2885 and the P&G Act. Pipeline CP would continue to deteriorate, and the eventual outcome would be pipeline failure/s, potentially with catastrophic consequences.

5.5.4 Cost Breakdown

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

TABLE 5: PROJECT COST

	Total
Labour	$240,711
Contractors	$293,040
Materials	$502,354
Other	$10,466
Total	**$1,046,570**