PowerWater

Program Business Need Identification

Power and Water Corporation

CONTROLLED DOCUMENT

NMSC1

SCADA and Communications Obsolete Asset Replacement

Proposed:

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Asset Manager - SCADA
Power Networks
Date: 3/11/2017

Approved:

Michael Thomson
Chief Executive
Power and Water Corporation
Date: 6/12/2018

Djuna Pollard
Executive General Manager
Power Networks
Date: 3/11 /2017

D2017/490795
Finance Review
Date:03/11/2017

D2017/490737
PMO QA
Date:06/11/2017

1 Project Summary

Project Title:	SCADA and Communications Obsolete Asset Replacement		
Project No:		**SAP Ref:**	
Financial Year Commencement:	2019/2020		
Business Unit:	Power Networks		
Project Owner (GM):	Djuna Pollard	**Phone No:**	8985 8431
Contact Officer:	Cameron McKay	**Phone No:**	8985 7150
Date of Submission:		**File Ref No:**	
Submission Number:		**Priority Score:**	
Primary Driver:	Renewal / Replacement	**Secondary Driver:**	Service Improvement
Project Classification:	Capital Program of Works		

2 Recommendation

MAJOR PROJECT >$1M OR PROGRAM

It is recommended that Investment Review Committee (IRC) note the proposed five year SCADA and Communications obsolete asset replacement program for an estimated budget of $3.47M, and approve the inclusion of this program into the SCI for this amount.

The forecast for this program of work extends beyond the current SCI period. The first two years of this program aligns with the last two years of the 2017-18 SCI. This program will be included in the 2019-24 Regulatory Proposal to the Australian Energy Regulator (AER).

Note that individual projects within the program will be documented in Business Case Category Cs to be approved by the Executive General Manager Power Networks.

3 Description of Issues

This BNI describes the SCADA and Communications assets that have reached the end of their serviceable life and are now using obsolete technology and/or are no longer supported by the vendor.

The backbone communications network provides highly available and reliable communications services for:

- Line protection schemes
- SCADA
- Operational voice systems (UHF radio)

The Power Networks Technical Code and Planning Criteria require Power and Water Corporation to maintain a communications network for monitoring and control of the electricity network. PWC is also required by the Technical Code to provide a communications network between any Users connected to the network and System Control. To achieve this, PN must ensure the SCADA and Communications assets are fit for purpose and address any issues that could put the network at risk such as technological obsolescence, lack of vendor support or deteriorated condition.

Vendor support is critical to having equipment repaired, resolving software/firmware bugs, updating security patches to guard against cyber threats, and general overall support in programming and maintaining this equipment.

When equipment is at End of Support (EoS), the vendor support is no longer available and vendors do not sell spares or undertake repairs of faulty equipment. PN has limited capacity and capability to address difficult technical issues related to programming and maintaining complex telecommunications systems where the issues that need to be resolved are more complex than the normal day to day activities experienced with a telecommunications network.

The following two key issues have been identified for the SCADA and Communications Network:

- Assets have been identified as no longer supported by the vendor. The EoS notices are identified in the Asset Management Plans.
- Assets have been identified that will reach the end of their design life during the next regulatory period. These devices are electronic in nature and as yet PN does not have the historical data to be able to assess and monitor asset condition and the number of failures expected.

PN utilises the FMECA analysis as set out in the Asset Management Plan, to identify critical assets which pose a high risk to the network should they fail, and lower risk assets which will not have a major impact or have redundancy built into the network to mitigate their impact if they fail.

This BNI addresses the following assets which are reaching EoS or will reach the end of their expected life during the next regulatory period (FY20 to FY24):

3.1 Synchronous Digital Hierarchy (SDH) Multiplexors

SDH multiplexors are a common technology used in telecommunication networks. The SDH add/drop multiplexors used in the Power and Water operational telecommunications network are optimised for ring and terminal operations. The SDH Multiplexors provide a number of critical features which are advantageous for a utility operational telecommunications system, including:

- Provision of 2 mbit/s tributaries;
- Up to 4 fibre optic interfaces at capacities of STM1, STM4 and STM16; and
- Protected SDH ring and terminal options.

The SDH network is used for:

- Tele-protection;
- SCADA
- UHF private mobile radio site interconnections
- Communications Network Management System
- Corporate IT connections
- Substation LAN

The protection and SCADA services are critical services for the management and operation of the electrical network. The SDH network comprised of 62 units and wherever possible is built as a ring network to provide path redundancy and the equipment is duplicated so as to be compliant to the Power Networks Network Technical Code and Network Planning Criteria. This allows the equipment to be run to failure maximising its life. A life extension strategy has been developed and is detailed in the SCADA & Communications Asset Class Management Plan. This strategy considers spares management, failure response and maintenance.

The End of Support notice was issued to PWC on the12th November 2013 for the following equipment used in the PWC SDH network:

[redacted]

The SDH equipment is not yet fully recorded in PWC's Asset Management system and PN does not yet have sufficient historical data to determine the probability of failure of this asset type.

3.2 Microwave systems

Power and Water utilises both SDH and Plesiosychronous Digital Hierarchy (PDH) microwave radio terminals. SDH microwave is used as part of the SDH ring network in the greater Darwin area and PDH is used for the Lake Bennet to Katherine Microwave link. Forty (40) terminals are installed.

The microwave network is used for:

- Tele-protection;
- SCADA
- UHF private mobile radio site interconnections
- Communications Network Management System and
- Corporate IT connections

The protection and SCADA services are critical services for the management and operation of the electrical network. The microwave network assists in providing links within a ring network where fibre optic bearers do not exist or are uneconomical to build.

An End of Support notice was issued to PWC on the 2nd February 2017 for the following equipment used in the PWC microwave network:

These assets with EoS notices are now planned to be retired from service as they reach their end of life. Asset Management Plans have been developed to manage these assets until they are replaced.

The microwave equipment is not yet fully recorded in PWC's Asset Management system and PN does not yet have sufficient historical data to determine the probability of failure of this asset type.

3.3 Communications Network Management (CNMS)

Power and Water operates a number of equipment types within its telecommunications network. The large majority of the equipment can be monitored, managed, configured and operated remotely using vendor supplied software. The CNMS allows the aggregation and management of alarms from all of the various telecommunications equipment, eg a manager of managers. The CNMS is also a single point where the various vendor software is installed.

Cyber security of the CNMS infrastructure has been highlighted as a risk to the efficient and effective operations of the telecommunications network. Maintaining 'in support' hardware and operating systems (OS) is critical to ensure the risk of cyber security attacks are minimised.

3.4 Telemetry Systems

Radio based telemetry systems are utilised to provide remote control, and monitoring access to field devices such as Gas Break Switches (GBS) and Reclosers.

Power and Water currently has the following standalone telemetry systems

Area	Number of Repeaters	Number of Remotes
Darwin	10	37

Katherine	1	1
Tennant Creek	0	0
Alice Springs	3	12

The planned strategy for telemetry systems is to utilise the Digital Mobile Radio (DMR) system to provide improved coverage and simplification of management and support.

The End of Support notice for telemetry equipment was issued to PWC on the 12th August 2015. It is planned to run a pilot program in the Darwin area during the 2019-24 regulatory period and if successful, migrate the existing telemetry systems to the DMR as they fail or fall due for replacement in the 2025–29 regulatory period.

A number of spares will be retained to enable like for like replacement of any in service failures to ensure the SCADA and Communications network can be maintained.

3.5 Remote Terminal Unit (RTU)

RTUs are located in Substations and are the interface between the substation equipment and the SCADA system.

The End of Support notice was issued to PWC on 17th October 2016. A life extension strategy has been developed to ensure adequate sparing is available. The equipment will be run to failure. A number of spares will be retained to enable like for like replacement of any in service failures to ensure the SCADA and Communications network can be maintained.

The RTU equipment is not yet fully recorded in PWC's Asset Management system and PN does not yet have sufficient historical data to determine the probability of failure of this asset type.

3.6 Test Equipment

Test equipment is required to undertake the manufacturer's recommended maintenance and to affect repairs to the SCADA and Communications network equipment. For equipment which is no longer supported by the original equipment manufacturer and can no longer be repaired by other authorised repairers, replacement equipment will need to be purchased.

3.7 Server Room Equipment

Power and Water [redacted]

Uninterruptable Power Supplies (UPS) are critical to ensure the Energy Management System (SCADA Master Station) continues to operate unaffected during periods of AC power interruptions or fluctuations. Process Coolers are critical equipment required to maintain

the server room environmental conditions which ensures the correct operation of the servers and networking hardware equipment housed in the rooms.

Due to the critical nature and long lead time in replacement of these items, UPS's and Process Coolers are now planned to be retired from service as they reach their end of life.

3.8 Project Needs

a. Safety

The SCADA and Communications network is critical to ensure the safe operation of the electrical network. A functioning and reliable SCADA and Communications network is required for operators at System Control to:

- Monitor the state of the electrical network at all times;
- Operate the electrical network in a timely and efficient manner without the need to send a technician to site;
- React to electrical network events to ensure the network remains in a safe configuration; and
- Isolate the electrical network to allow maintenance

The SCADA and Communications networks also provide tele-protection to provide improved safety to the public and minimise potential damage to the electrical assets by clearing electrical faults as quickly as possible.

b. Compliance

The Power Networks Technical Code and Planning Criteria require Power Water Corporation to maintain a communications network for monitoring and control of the electricity network. PWC is also required by the Technical Code to provide a communications network between any Users connected to the network and System Control.

To meet these obligations, it is necessary for PWC to manage assets that are obsolete or no longer supported by the vendor, or at the end of their design life, through replacement or spares management as set out in the preferred option.

c. Reliability

The SCADA and Communications network is critical to ensure the reliable operation of the electrical network. It is required for operators at System Control to:

- Monitor the state of the electrical network at all times;
- Operate the electrical network in a timely and efficient manner without the need to send a technician to site;
- React to electrical network events to ensure the network remains in a safe configuration; and
- Switch the electrical network to restore supply.

4 Potential Solutions (Options Considered)

Due to the function of these assets, there are only a limited number of options that can be considered.

Options considered are:

Option 1 - Do nothing

Allow the assets to fail and do not replace. This does not comply with the requirements of the PN Technical Code with respect to the requirement for protection systems which maintain public and personnel safety and minimise damage of primary plant. This option is not recommended.

Option 2 - Replace at end of life (replace at failure)

Replace critical assets at the end of their design life and non-critical assets at failure with the same model (if spares available) or modern equivalent. At End of Support or end of life, manage the remaining fleet and spares to ensure failed assets can be replaced quickly. The number of spares of EoS assets will be managed by buying additional spares prior to EoS or replacing assets on the network with modern equivalents to generate spares of the existing assets. This option is recommended.

3. Proactive replacement (managed)

Replace the assets prior to end of life by assessing performance and asset condition. These devices are electronic in nature and as yet PN does not have the historical data to be able to assess and monitor asset condition and determine the probability of failure. This option is not feasible and therefore is not recommended.

4.1 Preferred Option

The safe and reliable operation of the network is dependent on the assets as described in Section 3. Those assets determined as critical by the FMECA analysis must be maintained, managed and replaced in an appropriate manner. Option 1 does not enable PWC to operate the network safely and reliably and is therefore not recommended. Option 3 is not feasible since PWC is not yet able to assess and monitor the condition of these assets.

The preferred option is option 2: replace at end of life.

This option ensures the maximum useful life of the asset is achieved and the N-1 design criteria of the network ensure that network security and reliability are maintained.

This option involves replacing the critical assets that are identified as no longer supported by the vendor and where the critical assets have reached the end of their design life:

- SHD Mux
- Microwave systems
- Network Communications Management
- Telemetry Migrations
- RTU
- Test equipment- UPS replacement / process coolers replacement

As part of this option, to ensure any in service failures of these assets can be quickly replaced to ensure continuity and security of the SCADA and Communications Network, an end of life management program will also be undertaken. This program will guard against random failures for assets that still have an expected design life remaining beyond EoS.

It will involve:

- Purchasing a number of spares of specific assets to ensure rapid restoration of the network following an in-service failure
- Where spares are not available, selected communications assets will be replaced with the modern equivalents and the existing assets will be recovered and retained as spares for the network.

4.2 Non-Network alternatives

Due to the type and function of the assets in the SCADA and Communications network, there are no non-network alternatives or solutions that can be implemented in place of direct asset replacement with like for like or modern equivalent assets.

4.3 Capex/Opex Substitution

PN communications network is primarily used for the provision of protection services. The protection services are critical to ensure safety of the public and personnel and to minimise damage to assets. Protection systems require high reliability and availability communications systems. Third party communications providers do not guarantee availability or reliability to the levels required for a protection system.

Due to the criticality of the protection service, opex substitution is not available, leaving the only option to replace the asset.

4.4 Contingent Project

This project does not qualify as a contingent project as defined by the NER Clause 6.6A.1. It is required for the continual safe and reliable operation of the network and is not contingent based on an external driver and does not exceed $30million or 5% of the forecast capital budget forecast.

5 Strategic Alignment

This program aligns with the Asset Objectives defined in the Strategic Asset Management Plan (SAMP) and Asset (Class) Management Plans (AMP). The capital investment into the SCADA and Communications infrastructure outlined in this program will contribute to the corporation achieving the goals defined in the boards Strategic Directions and SCI Key Result Areas of Health and Safety and Operational Performance.

6 Timing Constraints

This project is constrained by the design life of the assets being replaced. To maintain a reliable communications network and therefore electricity network, these items need to be replaced by the end of design life.

7 Expected Benefits

Driver	Benefit	Measure
Growth / Demand		
Renewal / Replacement	Network safety	Health and Safety Index
Compliance		
Service Improvement	Network reliability maintained	Performance against SAIDI and SAIFI targets
Commercial / Efficiency		
Social / Environmental		

8 Milestones (mm/yyyy)

1. Investment Planning	2. Project Development	3. Project Commitment	4. Project Delivery	5. Review
01/2018	NA	01/2019	06/2024	09/2024

The program delivery is scheduled to run over 5 years from July 2019 to June 2024. A program review will be held at the end of the 5 year program as well as interim reviews at the end of each Financial Year.

9 Key Stakeholders

Stakeholder	Responsibility
Internal governance stakeholders	Executive General Manager Power Networks
	Group Manager Service Delivery
	Chief Engineer
	Senior Manager Asset Management
Internal Design Stakeholders	Manager Protection

Stakeholder	Responsibility
	Manager Test & Protection Services
	General Manager System Control
	Manager SCADA and Communication Services
External – Unions and public	ETU
External regulators	Utilities Commission
	Australian Energy Regulator

10 Resourcing Requirements (to next gateway)

Not applicable. Resourcing requirements for this program are considered Business as Usual and will be incorporated into the development of Category C Business Case's for each individual replacement.

11 Delivery Risk

Between FY15 and FY17, Service Delivery was focused on major capital projects that were of high importance and criticality to the network. As a result, lower criticality projects were deferred. This has impacted the SCADA and Communications category, as shown in Figure 2.

To ensure the delivery of the proposed SCADA and Communications works, the forecast includes a higher reliance on external contractors to reduce the reliance on PWCs internal Service Delivery group.

12 Financial Impacts

12.1 Expenditure Forecasting Method

Scoped based on a bottom up build using historical project costs and quotes for assets, the labour rate for SCADA and Communications technicians and estimate of hours required.

12.2 Historical and Forecast Expenditure

Due to the asset database and systems configuration currently implemented by PWC, the historical expenditure per asset class within the SCADA and Communication category cannot be reported. However, the total expenditure under the SCADA and Communications category is shown below in Figure 1.

At a total category level, the forecast expenditure for the next regulatory period is shown to be approximately $400k higher than annual average for the past 3 years and budgeted two years remaining in this regulatory period.

The historical expenditure decreased during FY15 to FY17 as a result of delivery of multiple high criticality capital projects taking precedence over less critical repex. The forecast includes an uplift in replacement to address the backlog created by the deferral and a plan for higher reliance on external contractors to ensure capacity to deliver the required works.

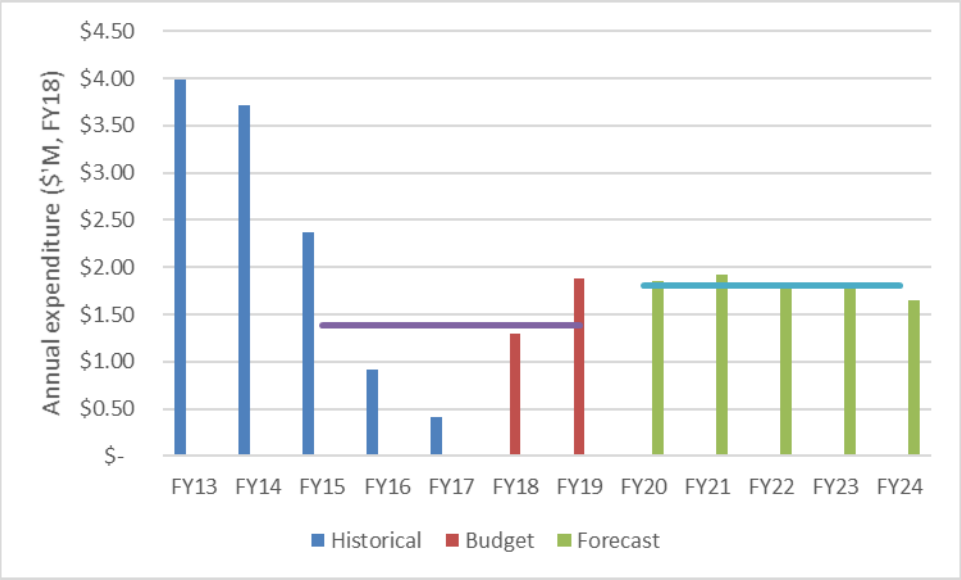

Figure 1: Historical, budget and forecast expenditure for the SCADA and Communications category

12.3 Validation

The forecast is shown to be aligned to historical expenditure at a SCADA and Communications category level with an average annual forecast increase of $400k compared to the actual and budgeted average for the current regulatory period.

12.4 Opex Implications

There are no opex step changes associated with this asset category or capex opex substitution opportunities.

12.5 Variance

The forecast for this program of work extends beyond the current SCI period. The first two years of this program aligns with the last two years of the 2017-18 SCI.

12.6Capex Profile

Year	2018-19 ($'000)	2019-20 ($'000)	2020-21 ($'000)	2021-22 ($'000)	2022-23 ($'000)	2023-24 ($'000)	Balance ($'000)	Total ($'000)
Investment Planning								
Project Development								
Project Commitment								
Project Delivery			960	540	780	750	440	**3,470**
Review								
Total			**960**	**540**	**780**	**750**	**440**	**3,470**

Appendix A

1. Forecast Expenditure by Expenditure Category

This information is to allow the forecast to be escalated.

The expenditure is to be in today's dollars.

RAB Category	Regulatory Year (A$M, $2017-18, Jul to Jun years)				
	2019-20	2020-21	2021-22	2022-23	2023-24
Total	$0.96	$0.54	$0.78	$0.75	$0.44
Labour	$0.19	$0.17	$0.19	$0.12	$0.09
Materials	$0.48	$0.25	$0.23	$0.46	$0.16
Contractors	$0.29	$0.12	$0.36	$0.17	$0.19
Other	$-	$-	$-	$-	$-

Definitions

Labour – The cost of direct internal Labour for the project. No overheads.

Materials – the cost of materials used in the project. No overheads.

Contractors – the cost of work performed by Contractors in the project, whether Labour or Materials. No overheads.

Other – expenditure that is not Labour, Materials or Contractors. No overheads.

2. Forecast Expenditure by RAB Category

Provide the forecast expenditure for this project / or program, in total and broken down by RAB category, by year for the regulatory control period.

This information is to enable regulatory modelling.

The forecast is to be in today's dollars ($2017-18).

RAB Category	Regulatory Year (A$M, $2017-18, Jul to Jun years)				
	2019-20	2020-21	2021-22	2022-23	2023-24

RAB Category	Regulatory Year (A$M, $2017-18, Jul to Jun years)				
	2019-20	2020-21	2021-22	2022-23	2023-24
Total	$0.96	$0.54	$0.78	$0.75	$0.44
System Capex					
Substations					
Distribution Lines					
Transmission Lines					
LV Services					
Distribution Substations					
Distribution Switchgear					
Protection					
SCADA	**$0.033**	**$0.130**	**$0.177**	**$0.116**	**$0.173**
Communications	**$0.925**	**$0.410**	**$0.598**	**$0.633**	**$0.267**
Non-system Capex					
Land and Easements					
Property					
IT and Communications					
Motor Vehicles					
Plant and Equipment					

3. Forecast Expenditure by CA RIN Category

This information is to allow the forecast to be escalated.

The expenditure is to be in today's dollars.

RAB Category	Regulatory Year (A$M, $2017-18, Jul to Jun years)				
	2019-20	2020-21	2021-22	2022-23	2023-24
Total	$0.96	$0.54	$0.78	$0.75	$0.44

RAB Category	Regulatory Year (A$M, $2017-18, Jul to Jun years)				
	2019-20	2020-21	2021-22	2022-23	2023-24
Repex	$0.96	$0.54	$0.78	$0.75	$0.44
Augex					
Connections					
Non-network: IT					
Non-network: Vehicles					
Non-network: Buildings and property					
Non-network SCADA & network control					
Non-network: Other					

4. Forecast Asset Disposals by RAB Category

Provide the forecast asset disposals for this project / or program, in total and broken down by RAB category, by year for the regulatory control period.

This information is to enable regulatory modelling.

The forecast is to be in today's dollars ($2017-18).

RAB Category	Regulatory Year (A$M, $2017-18, Jul to Jun years)				
	2019-20	2020-21	2021-22	2022-23	2023-24
Total					
System Capex					
Substations					
Distribution Lines					
Transmission Lines					
LV Services					
Distribution Substations					
Distribution Switchgear					

RAB Category	Regulatory Year (A$M, $2017-18, Jul to Jun years)				
	2019-20	2020-21	2021-22	2022-23	2023-24
Protection					
SCADA					
Communications					
Non-system Capex					
Land and Easements					
Property					
IT and Communications					
Motor Vehicles					
Plant and Equipment					

5. Forecast Capital Contributions by RAB Category (if required)

Provide the forecast capital contributions for this project / or program, in total and broken down by RAB category, by year for the regulatory control period.

This information is to enable regulatory modelling.

The forecast is to be in today's dollars ($2017-18).

RAB Category	Regulatory Year (A$M, $2017-18, Jul to Jun years)				
	2019-20	2020-21	2021-22	2022-23	2023-24
Total	**$0.96**	**$0.54**	**$0.78**	**$0.75**	**$0.44**
System Capex					
Substations					
Distribution Lines					
Transmission Lines					
LV Services					
Distribution Substations					

RAB Category	Regulatory Year (A$M, $2017-18, Jul to Jun years)				
	2019-20	2020-21	2021-22	2022-23	2023-24
Distribution Switchgear					
Protection					
SCADA	$0.033	$0.130	$0.177	$0.116	$0.173
Communications	$0.925	$0.410	$0.598	$0.633	$0.267
Non-system Capex					
Land and Easements					
Property					
IT and Communications					
Motor Vehicles					
Plant and Equipment					

Appendix B – Expected Asset Lives

Equipment Type	Asset Life (yrs)
Microwave Equipment	15
SDH equipment	15
DWDM terminals	15
PDH multiplexors	15
UHF radios (base stations and mobiles)	15
UHF radios (handhelds)	10
UHF core servers and networking equipment	7
Power Supplies	15
Solar Regulators	15
Shelters	40
Towers/Masts	50
Fibre Cable	40
Pilot (copper) Cable	50
Teleprotection	15
Network Management Hardware	8
Network Management Software	5
Telemetry Devices	15
RTU	15
Process Coolers/UPS	15

Appendix C – Number of Assets by Installed By Year