January 2026

# Powerlink 2027-32 Revenue Proposal

## Project Pack

## CP.02829 Strathmore SVC Secondary Systems

*Project Status: Unapproved*

## Network Requirement

H035 Strathmore Substation is a major 275 and 132kV substation located approximately 5km from the Collinsville Township. The substation was established in 2001 and consists of both 275kV and 132kV switching bays.

The 275kV SVC -80/+260 MVAr was installed in 2007 on a separate platform, approximately 300m from the 275kV switchyard. The SVC provides reactive power control to manage power system voltages across a wide range of operating conditions. It is a significant source of dynamic reactive power to maintain the power system in a satisfactory operating state during and immediately following major power system disturbances. It also assists to return the power system to a secure operating state in the period following an unplanned outage event.

The SVC secondary systems include not only the normal protection and control functions found in a typical substation implementation but also the thyristor firing controls. As the firing controls are specific to the model of thyristor they need to be replaced as a package, including the thyristor cooling system.

A condition assessment of Strathmore SVC has recommended the SVC secondary systems, thyristor valve control systems and cooling control systems equipment to be replaced. This is required to maintain network reliability and availability within Powerlink's current standards, and to minimise operational and compliance risks associated with aging and obsolete secondary systems assets. It will also enable spare parts to be recovered to support Powerlink's remaining fleet of SVCs from the same manufacturer. [1]

The Strathmore SVC performs the following critical functions:

- Manage steady state power system voltages in North Queensland across a range of power system conditions;
- Manage over voltage limitations in North Queensland during periods of low demand and/or low power transfer conditions;
- Extend the voltage stability limit for power flow from Central to North Queensland; and
- Extend the power transfer capability for power flow from North to Central Queensland.

During 2024 the SVC operated inductive for over 80% of the time. Analysis confirms that voltage levels in North Queensland would violate the obligations in the National Electricity Rules (NER) in the event of outages of other reactive plant in north Queensland if the SVC was decommissioned [2].

## Recommended Option

As this project is currently 'Unapproved', project need and options will be subjected to the public RIT-T consultation process to identify the preferred option closer to the time of investment. The objective is to undertake the minimum works to affect a 20-year life extension for the Strathmore SVC.

The current recommended option involves full replacement of SVC secondary systems by December 2028 [3].

Options considered but not proposed include:

- Do Nothing – rejected due to non-compliance with NER System Standards and Powerlink's Transmission Authority;
- Replacement of the SVC with a new STATCOM – expected to be greater overall cost;
- Replacement of the SVC with a shunt reactor – this will result in reduced power transfer capability into and out of North Queensland due to the lack of dynamic reactive power range; and
- Non-network option – no viable non-network options have been identified at this time.

## Cost and Timing

The estimated cost to replace Strathmore SVC secondary systems is $23.5m ($2025/26) [4].

Target Commissioning Date: December 2028.

## Documents in CP.02829 Project Pack

### Public Documents

1. H035 Strathmore Secondary Systems Condition Assessment Report
2. CP.02829 Strathmore SVC Secondary Systems Replacement – Planning Statement
3. CP.02829 Strathmore SVC Secondary Systems Replacement – Project Scope Report
4. CP.02829 Strathmore SVC Secondary Systems Replacement – Concept Estimate

# H035 STRATHMORE 275kV, 132kV Substation and 275kV SVC

# Secondary Systems Condition Assessment Report

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# Table of *Contents*

# 1. Introduction

H035 Strathmore substation is a major 275 and 132kV substation located on Strathmore Road, Strathmore, approximately 5km from the Collinsville Township. The substation consists of both 275kV and 132kV switching bays sharing a common platform and a perimeter fence. The substation was established in 2001 and later extended to accommodate the Network Development in North Queensland Area. A 275kV SVC -80/+260 MVAr was installed in 2007 on a separate platform and perimeter fence, approximately 300m from the 275kV switchyard. SVC and substation's earth-grids are joined together by a number of earth-grid conductors. A short transmission line is linked between the SVC's coupling transformer and the substation 275kV switching bays.

This report is pertinent to H035 Strathmore 275kV / 132kV substation secondary systems and SVC secondary systems. Recommendations in this report have been based on the secondary system asset conditions only. Network reconfigurations, refurbishment solutions and implementation methodologies have not been considered in this report. These important factors should be covered by the relevant stakeholders.

H035 Strathmore 275 / 132kV substation currently consists of:

- A 275kV substation
- 2 of 275kV Buses – 1 and 2 busbars;
- 16 switching bays:
    - 2 x 275kV Transformer Switching Bays – (T1 HV):
        - = C03-A10 (iPASS), T1 TFMR HV (1 Bus Side - CB 5412)
        - = C03-A30 (iPASS), Diameter 3 Coupler (2 Bus Side - CB 5032)
    - 4 x 275kV Diameter Coupler Switching Bays:
        - = C01-Q30, Diameter 1 Coupler (CB 5012)
        - = C02-Q30, Diameter 2 Coupler (CB 5022)
        - = C04-A40 (iPASS), Diameter 4 Coupler (CB 5042)
        - = C06-Q30, Diameter 6 Coupler (CB 5062)
    - 2 x 275kV SVC Switching Bays (1 SVC):
        - = C07-Q20, 1 SVC (2 Bus Side - CB 5812)
        - = C07-Q30, Diameter 7 Coupler (1 Bus Side - CB 5072)
    - 7 x 275kV Feeder Switching Bays:
        - =C01-Q10, Feeder 8858 (Ross)
        - =C02-Q10, Feeder 8857 (Ross)
        - =C02-Q20, Feeder 878 (Nebo)
        - =C04-A10 (iPASS), Feeder 879 (Haughton River)
        - =C04-A20 (iPASS), Feeder 8845 (Nebo)
        - =C05-Q10, Feeder 8906 (Crush Creek)
        - =C06-Q20, Feeder 822 (Nebo)
    - 1 x 275kV Reactor Switching Bays:
        - =C6-Q10, 1 Line Reactor (CB 5712)

- A 132kV switchyard (same platform and perimeter fence with the 275kV yard)
- 2 of 132kV Buses – 1 and 2 busbars;
- 5 switching bays:
    - 5 x 132kV Feeder Bays:
        - =D06-A10, Feeder 7360 (Bowen North)
        - =D02-A10, Feeder 7264 (1 Transformer 132kV)
        - =D03-Q10, Feeder 7457 (Hamilton Solar Farm)
        - =D07-A10, Feeder 7208 (Clare South)
        - =D09-A10, Feeder 7127 (Nebo)

Figure 1 - H035 Strathmore 275/132kV Substation and 275kV SVC Aerial View

# 2. Site infrastructure

## 2.1 Substation Buildings

There are six (6) buildings at H035 Strathmore substation:

- Building “+T” (Brick): Telecommunications, site OpsWAN server, AC and DC systems, workshop and amenities.
- Brick Building “+4”: SVC building, control and protection, thyristor valves and cooling system, SVC OpsWAN server, AC and DC systems, workshop and amenities.
- Demountable Building “+E”: 132kV secondary systems, AC and DC systems.
- Demountable Building “+5”: 275kV secondary systems, AC and DC systems.
- Demountable Building “+6”: 275kV secondary systems, AC and DC systems.

- Demountable Building “+9”:  275kV iPASS secondary systems, AC and DC systems.

Building +E has space to accommodate another five (5) standard secondary system panels, refer to drawing series A1-H-120447.

Building +5 has space to accommodate approximately another seventeen (17) standard secondary system panels, refer to drawing series A1-H-131919.

Building +6 has space to accommodate another eleven (11) standard secondary system panels, refer to drawing series A1-H-131920.

Building +9 (iPASS) was customised for the iPASS secondary systems panels, refer to drawing series A1-H-130701.  It is unlikely that this building has the appropriate capacity to accommodate new secondary systems panels.

All control buildings and communications rooms are air-conditioned, except the workshop, lunch room and amenity room of the building “+T”.

Figure 2 - H035 Strathmore Brick Building “+T”

Figure 3 - H035 Strathmore 275kV Demountable Building “+5”

Figure 4 - H035 Strathmore 275kV Demountable Building “+6”

Figure 5 - H035 Strathmore 275kV iPASS Demountable Building “+9”

Figure 6 - H035 Strathmore 132kV Demountable Building “+E”

The condition assessment of the buildings is not in scope of this report; please refer to the relevant substation condition assessment report. Based on visual inspection, the existing control buildings appear to be in serviceable condition. Depending on the secondary systems implementation methodology and the availability of spare panel spaces, existing control buildings can be utilised to accommodate new secondary systems.

## 2.2 SVC Building

The condition assessment of SVC control building is not in scope of this report; please refer to the relevant substation condition assessment report. Based on visual inspection, the SVC control building was built in October 2007, seems to be in good condition and it has sufficient space to accommodate new SVC control and protection panels if required.

Figure 7 - H035 275kV Strathmore SVC Control Building “+4”

# 3. Condition Assessment

## 3.1 Cable Trenches, HV Yard Control Cables and Marshalling Cubicles

The 132kV secondary systems consists of five (5) switching bays, four (4) of which have control and protection cables terminated directly between secondary systems panels and PASS-M0 switchgear control cubicles – no building termination racks, no bay marshalling kiosks. The PASS-M0 switchgear control cubicles are integral parts of the primary plant hence their conditions are not covered in this report. A new bay (=D03-Q10 – T242 Spinglands) has recently been installed for the Whitsunday solar farm. This bay uses a three poles dead tank breaker and a marshalling kiosk. The control and protection cables between the SDM8 secondary systems panel and bay =D03-Q10 – T242 Spinglands bay marshalling kiosk are still new (2018).

Conditions of the 275kV bay marshalling kiosks, AC, DC, bus zone CTs and VT kiosks, including internal links, terminals, wirings, MCBs / fuses and cables to primary plant were visually inspected and assessed. Equipment Health Indices and recommended replacement timeframe have been detailed in the **Appendix A (Substation)** and **Appendix B (SVC)**.

### 3.1.1 Cable Trenches

Cable trenches and substation structures are classed as HV systems assets. Condition assessments of these assets have been excluded from this report. The following photos were taken during the site inspection in August 2018 are for information purposes only.

Figure 8 - Strathmore 132kV Cable Trenches

Figure 9 - Strathmore 275 kV Cable Trenches

### 3.1.2 HV Yard Cables

Visual inspections of cables between control buildings and yard marshalling kiosks / PASS-M0 control cubicles showed that most cables appear to be in good condition. They are considered to be suitable for another 20-25 years of service. Cables between yard marshalling kiosks and primary plant, including cables between PASS-M0 modules and associated control cubicles, should be replaced at the same time with the primary plant replacement.

### 3.1.3 Marshalling Cubicles

The chassis of bay marshalling cubicles, VT, AC and DC kiosks, are in good condition and deemed to be suitable for another 20-25 years of service. However, door seals and air filters of some kiosks have been degraded due to poor quality materials that have been damaged to UV light, heat and air pollution. All yard cables are still in good condition and not required to be replaced therefore marshalling cubicles can also be retained as is and only some degraded door seals, air filters, which are recommended to be replaced every five / six years as part of routine maintenance.

The bay marshalling kiosks' terminals and links are considered to be in good conditions – condition wise, they are not required to be replaced. However, Powerlink's workplace health and safety team should be consulted to ensure that they still meet Powerlink's safety requirements.


Figure 10 – Visual illustrations of a sample 132kV PASS-M0 Control Cubicle


Figure 11 – Visual illustrations of a sample 275kV PASS-M0 Local Control Cubicle

Marshalling Kiosk AC Kiosk DC kiosk

Figure 12 – Visual illustrations of sample 275kV conventional switchgears (AIS) yard marshalling kiosks

## 3.2 Termination Racks, Bay and Non-Bay Control and Protection Equipment

Condition assessments of H035 Strathmore substation 132, 275kV and SVC control and protection systems, including cubicles, equipment, internal components such as links, terminals, wirings, MCBs, fuses, cables are summarised in the **Appendix A (Substation)** and **Appendix B (SVC)**.

### 3.2.1 Building Termination Racks

Building +5, +6, +4 (SVC), +9 (iPASS) have termination racks. Building +E (132kV) does not have termination racks.

### 3.2.2 Secondary Systems Panels

All secondary systems panels, including auxiliary parts e.g. links, terminals and internal wirings are still in good condition and don't need to be replaced unless Powerlink's standard secondary systems solutions dictate their replacement.

Visual illustrations of the existing secondary systems panels are shown in below.

+5A6 - 275kV Bay =C02 Fdr2 (Nebo - 878)
2007

+6A6 - 275kV Bay =06 Fdr2 (Nebo 822)
2007

Strathmore 275kV Secondary Systems


Strathmore 275kV iPASS Secondary Systems - 2016

+E7 - Bay =D7 Fdr 7208-Clare
2002

+E5 =D03 Fdr 7457 - Springlands
2018

Strathmore 132kV

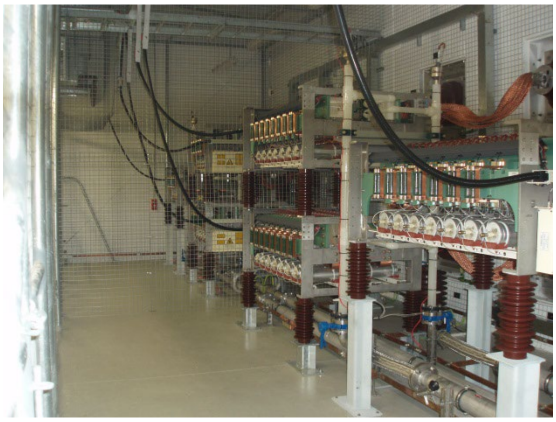

Control Panels


Protection Panels


iPCOMM SCADA


Protection Relays


Electronic DC CTs


Thyristor Valves


Cooling System

Strathmore 275kV SVC - 2007

### 3.2.3 Control, Protection, Auxiliary, Ancillary, Metering and OpsWAN Equipment

#### 3.2.3.1. Assessment Methodologies based on Risk, Cost and Performance

Health indices of secondary systems equipment have been assessed in accordance with Powerlink Quantitative Risk Assessment Frameworks and the Secondary Systems Asset Risk Model developed in [1] based on the following parameters:

- Equipment functional failure rates,
- Environmental conditions where equipment are installed,
- Equipment ages,

Equipment health indices are fundamental inputs of the secondary systems **reliability**. Fundamental inputs of the secondary systems **availability** are derived from the availability of suitable spare parts, equipment obsolesce and technical support (hardware, software and firmware). The **capability** (i.e. **performance**) of the secondary systems depends on both the systems reliability and availability.

Health indices are modelled in the range from zero (0) to ten (10), where zero represents newly installed assets and ten indicates assets that have reached the optimum replacement ages. According to [1], the optimum replacement ages for Powerlink's secondary systems assets signify an optimal replacement time period just before the secondary systems availability and reliability start to transition to a rapidly declined trajectory. Assets with condition scores close to ten represent moderate increase of functional failures, but longer outage duration and significantly higher risk of impacting systems availability and reliability due to equipment obsolescence.

Delaying replacement of secondary systems assets beyond the optimal replacement timeframe does not always necessarily result in higher mal-tripping of network elements, but lower secondary systems availability and reliability. It is important to note that not every functional failure will necessarily result in an outage to a network element, but it does represent the loss of some of the normal functions of the protection and control system[1] and can contribute to forced outage events of network elements. This model in [1] projects that the effect of extending the mean replacement age of Powerlink's secondary system assets from 20 years to 25 years is a near doubling of the annual duration of secondary systems functional outages due to functional failures. In addition, delaying the mean replacement ages of secondary system assets beyond the optimal replacement time would increase the yearly operation and maintenance cost for secondary system assets and additional demands on field staff resources. This conclusion is based on Powerlink data and is a direct reflection of Powerlink's environment, including the types of relays purchased, the conditions in which they are installed, the maintenance regime used, and the quantity of spares held.

The recommended replacement timing for secondary systems assets has been optimised based on the secondary systems capability, associated network risks and cost. This report recommends the optimal replacement timing for secondary systems assets and equipment based on the above principles and condition assessment data. It does not specify any specific requirements for replacement methodologies or solutions. A cost effective solution that satisfies Powerlink's requirements will be required to address the conditions of assets listed in the Appendix A and B.

Depending on fundamental inputs and systems performance, the optimal replacement timing is also recommended for groups of secondary systems assets with lower health indices (e.g. acceptable reliability) but lack of spares and technical support (e.g. low availability). These assets can often be grouped together based on their reliability and availability for strategic and opportunistic replacement in order to maximise cost benefits and asset lifecycle management benefits.

#### 3.2.3.2. 275kV and 132kV Substation Secondary Systems Assets Conditions

Strathmore 275 and 132kV secondary systems comprise mostly digital (microprocessor type) protection and control equipment manufactured approximately between 2001 and 2018. There is a small number of modern electro-mechanical relays still being used for high impedance protection e.g. bus zone and reactor MFAC protection relays. It's important to note that there are some relatively new relays that were replaced as part of remote end protection upgrade and faulty relay replacement during operation.

A number of equipment models have been phased out or superseded by the newer models. It means that like-for-like equipment replacement may not be practically possible for some models. Upgrade to newer models is always possible as long as it is carried out under appropriately planned secondary systems outages e.g. planned secondary systems refurbishment projects.

[1] *The functions that could be unavailable include auto-reclose, automatic voltage control, emergency voltage control, protection signalling, SCADA, remote control or others.*

Strathmore 275kV and 132kV – Typical Substation Secondary Systems Equipment

Refer to the Appendix A and B for detailed equipment Health Conditions and refurbishment recommendations.

### 3.2.3.3. 275kV SVC Secondary Systems Assets Conditions

Some SVC's control systems equipment was not recorded in SAP. Strathmore SVC HMI PC and Engineering PC have have been virtualised and run on Powerlink's standard PCs in 2017. This has removed the urgent need to replace the orignial HMI and Engineering PCs, which were subjected to obsolescence risks. The HMI PC risks are now dependent on the supportability of the virtualised software environment. SVC's AC protection systems e.g. transformer, reactor, capbank protection relays are of the same types as those used in conventional substations. They typically would last around 20 to 25 years in airconditioned operting environment.

The key asset risks for Strathmore SVC over the next ten (10) years are SVC (TDC) control systems, thyristor valve control systems (VBE), Cooling Control Systems, SU200 I/O units, iPCOM SCADA gateways and Digital Fault Recorder PC. The optimal replacement time for Strathmore SVC secondary systems, including thyristor valves and cooling control sytems is 2025 / 2026 as shown in the appendix B. SVC secondary systems replacement should be aligned with the the 275kV secondary systems replacement project to maximise the time and cost savings for both projects.

OpsWAN systems and equipment at this site were installed at various stages since 2001. OpsWAN systems are still functioning and have an important role in operation and maintenance efficiencies. They are considered as auxiliary sub-systems of the power systems. Generally, their condition and performance generally cannot be used to trigger secondary systems refurbishment projects. Therefore, OpsWAN systems and equipment should be opportunistically refurbished as part of the secondary systems replacement projects.


275kV Building +5


275kV Building +6


132kV Building +E


Building +T


SVC OpsWAN System and Equipment

Strathmore 275kV & 132kV Substation OpsWAN Systems and Equipment

### 3.2.4 Auxiliary Supply

#### 3.2.4.1. AC Auxiliary Supply

AC auxiliary supplies, including station transformers and backup diesel generator/s are classed as HV primary systems assets. Condition assessments of HV primary systems assets have been excluded from this report. The following notes were recorded and visually illustrated for information purposes only.

The 400/230 VAC changeover cubicle outside building +T (brick building) was installed in July 2006. Each control building has a dedicated building AC distribution board.

### 3.2.4.2. DC Batteries and Chargers

The building +T (telecoms and OpsWAN building) has duplicated A & B 50V DC batteries and chargers only - no 125V DC batteries and chargers.

All demountable buildings, e.g. +5, +6, +E, +9 and SVC, all have duplicated X & Y 125VDC secondary systems batteries and chargers, but no 48V DC batteries and chargers.

Telecommunications equipment e.g. Muxes in these buildings are supplied from 125 / 48V DC/DC converters. In general, DC systems in the demountable buildings +5, +6, +E, +9 and SVC control building were installed at the time when these buildings were first installed.

- 132kV demountable building +E - X and Y 125V DC batteries and chargers installed in 2002.
- Telecoms building (brick) +T – A & B 50V DC batteries and chargers installed in 2001.
- 275kV demountable buildings +5 - X and Y 125V DC batteries and chargers installed in 2007.
- 275kV SVC building +4 (brick) - - X and Y 125V DC batteries and chargers installed in 2007.
- 275kV demountable building +6 - X and Y 125V DC batteries and chargers installed in 2002.
- 275kV demountable iPASS building +9 - X and Y 125V DC batteries and chargers installed in 2016.

The replacement of 125VDC batteries and chargers in buildings +4 (SVC) +5, +6 has been included in an OR project, which has recently been initiated in C55 (C55 Project number 1297 - "DC Battery Replacement 2019-2021 – Northern").

The replacement of batteries and chargers in building +E (132kV) and +T (telecoms and OpsWAN) has already been included in "OR 2029 - COM10 DC System Upgrade – North" project.

All equipment in building +9 (iPASS building) were recently installed in 2016. There is no work required for assets in this building.


19.1kV/400V AC

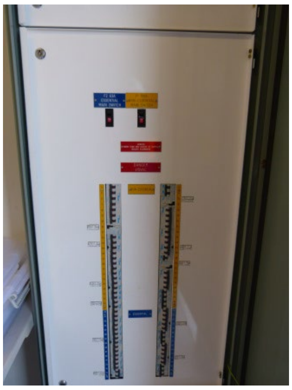

Diesel Generators


SVC Station Transformer


275kV & 132 kV AC Changeover

SVC 400V AC Changeover


275kV building +5


275kV building +6


132kV building +E


Telecoms and OpsWAN +T


275kV iPASS building +9

Strathmore 275kV, 132kV and SVC AC Supply, Changeover and AC Distribution

Building +5 – 125VDC Batteries and Chargers

Building +6 – 125VDC Batteries and Chargers

Building +E - 125VDC Batteries and Chargers

Building +9 - 125VDC Batteries and Chargers

Building +T - 50VDC
Batteries and Chargers

Building +4 (SVC) - 125VDC Batteries and Chargers
Batteries and Chargers

Strathmore 275kV, 132kV and SVC DC Supply and Chargers

# 4. Conclusion

This report comprehensively details the conditions of secondary systems assets at Strathmore 275kV, 132kV Substation and 275kV SVC. Equipment health indices and optimal replacement timeframe have been recommended in the Appendix A (Substation) and Appendix B (SVC). The primary objective of the recommended secondary systems refurbishment project is to maintain the current network reliability and availability and to minimise operation and compliance risks associated with secondary systems assets at Strathmore substation and SVC.

# 5. Attachments

- **Appendix A** – H035 STRATHMORE 275KV & 132KV Substation Secondary Systems Equipment Health Indices and Recommended Replacement Timeframe.

  H035 Data -     H035 Data -

- **Appendix B** – H035 STRATHMORE 275KV SVC Secondary Systems Equipment Health Indices and Recommended Replacement Timeframe.

  H035 Data -     H035 Data -

- CIGRE 2018 - B3 - 205 - Modelling Substation control and Protection Asset Condition for Optimal reinvestment Decision Based on Risk, Cost and Performance.

  B3 - 205 - Modelling Substation control an     B3 - 205 - Modelling Substation control an

# 6. References

[1] "Modelling Substation control and Protection Asset Condition for Optimal reinvestment Decision Based on Risk, Cost and Performance", CIGRE PARIS 26-31 August 2018, T Vu, M. Pelevin, D. Gibbs, J.Horan, C. Zhang.

# 7. Appendix A

**APPENDIX A - H035 STRATHMORE 275KV & 132KV SUBSTATION SECONDARY SYSTEMS - EQUIPMENT HEALTH INDICES AND RECOMMENDED REPLACEMENT TIMEFRAME**

Notes:
(a): Subject to Powerlink's O&M Safety Requirements, Current Standard Solutions and Implementation Methodologies, it may be more beneficial to align with the recommended replacement timeframe of sedondary systems equipment
(b): Recommended Timeframe is based on majority of Equipment Health Indices
(c): Based on Visual Inspection and Subject to the decision of the Control Building and Secondary Systems Panels. A number of New Cables may be requried if location of control building or secondary systems panels is changed.
(d): As a minimum requirement, Rubber Seals, Air filter and Terminals and Links are required to be repalced by the recommended timeframe. New Marshalling Kiosks should be considered if Exsiting Cables are to be replaced.

| BAY | C&P PANEL | | | | SECONDARY SYSTEMS EQUIPMENT | | | | | X-PROT | | Y-PROT | | AUX & CTRL | | OPSWAN | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Function | Panel Descripion | Panel No. | Year | HI | Functional Loc. | Description | Manufacturer | Model number | Obsolete (Yes or No) | Eff. Age | HI | Eff. Age | HI | Eff. Age | HI | Eff. Age | HI |
| 132kV BUS 1 | 132kV 1 Buszone CBF Bus Trip Common RTU 1 | +E1 | 2002 | 4.86 | H035-SSS-1BU4-BAYCONT | 1 BUS ZONE BAY CONTROL UNIT | FOXBORO | [redacted] | Y | | | | | 14.87 | 7.44 | | |
| | | | | | H035-SSS-1BU4-XPROT | 1 BUS ZONE X PROTECTION | GE | [redacted] | N | 14.94 | 7.47 | | | | | | |
| | | | | | H035-SSS-NBAY-XPROT132 | 132kV NON BAY X PROTECTION | RMS | [redacted] | N | 14.94 | 7.47 | | | | | | |
| | | | | | H035-SSS-1BU4-YPROT | 1 BUS ZONE Y PROTECTION | GE | [redacted] | Y | | | 14.94 | 7.47 | | | | |
| | | | | | H035-SSS-NBAY-YPROT132 | 132kV NON BAY Y PROTECTION | RMS | [redacted] | N | | | 14.94 | 7.47 | | | | |
| 275kV Bus 1 | 275 kV 1 Buszone CBF Bus Trip Buszone RTU 1 | +6B4 | 2007 | 3.43 | H035-SSS-1BU5-BAYCONT | 1 BUS ZONE BAY CONTROL UNIT | FOXBORO | [redacted] | Y | | | | | 10.50 | 5.25 | | |
| | | | | | H035-SSS-1BU5-XPROT | 1 BUS ZONE X PROTECTION | RMS | [redacted] | N | 10.05 | 5.02 | | | | | | |
| | | | | | H035-SSS-1BU5-XPROT | 1 BUS ZONE X PROTECTION | RMS | [redacted] | N | 10.05 | 5.02 | | | | | | |
| | | | | | H035-SSS-1BU5-YPROT | 1 BUS ZONE Y PROTECTION | RMS | [redacted] | N | | | 10.05 | 5.02 | | | | |
| | | | | | H035-SSS-1BU5-YPROT | 1 BUS ZONE Y PROTECTION | RMS | [redacted] | N | | | 10.05 | 5.02 | | | | |
| 1 TFMR PLC | 275kV 1 TFMR PLC | | 2002 | 4.86 | H035-SSS-1TRF-CONTSYS | 1 TRANSFORMER CONTROL SYSTEMS | ALLEN BRADLEY | [redacted] | Y | | | | | 19.55 | 9.78 | | |
| 275kV Bus 2 | 275 kV 2 Buszone CBF Bus Trip Buszone RTU 1 | +6B6 | 2007 | 3.43 | H035-SSS-2BU5-BAYCONT | 2 BUS ZONE BAY CONTROL UNIT | FOXBORO | [redacted] | Y | | | | | 10.50 | 5.25 | | |
| | | | | | H035-SSS-2BU5-XPROT | 2 BUS ZONE X PROTECTION | RMS | [redacted] | N | 10.05 | 5.02 | | | | | | |
| | | | | | H035-SSS-2BU5-XPROT | 2 BUS ZONE X PROTECTION | RMS | [redacted] | N | 10.05 | 5.02 | | | | | | |
| | | | | | H035-SSS-2BU5-YPROT | 2 BUS ZONE Y PROTECTION | RMS | [redacted] | N | | | 10.05 | 5.02 | | | | |
| | | | | | H035-SSS-2BU5-YPROT | 2 BUS ZONE Y PROTECTION | RMS | [redacted] | N | | | 10.05 | 5.02 | | | | |
| +6B3 - 275kV - 1 Buszone (REB 500) | +6B3 - 275kV - 1 Buszone (REB 500) | +6B3 | 2016 | 0.86 | H035-SSS-507--XPROTBZ | 5072 X BUS ZONE + CB FAIL | ABB | [redacted] | N | 1.15 | 0.57 | | | | | | |
| | | | | | H035-SSS-571--XPROTBZ | 5712 X BUS ZONE + CB FAIL | ABB | [redacted] | N | 1.15 | 0.57 | | | | | | |
| | | | | | H035-SSS-8857-XPROTBZ | 88572 X BUS ZONE + CB FAIL | ABB | [redacted] | N | 1.15 | 0.57 | | | | | | |
| | | | | | H035-SSS-8858-XPROTBZ | 88582 X BUS ZONE + CB FAIL | ABB | [redacted] | N | 1.15 | 0.57 | | | | | | |
| | | | | | H035-SSS-507--YPROTBZ | 5072 Y BUS ZONE + CB FAIL | ABB | [redacted] | N | | | 1.15 | 0.57 | | | | |
| | | | | | H035-SSS-571--YPROTBZ | 5712 X BUS ZONE + CB FAIL | ABB | [redacted] | N | | | 1.15 | 0.57 | | | | |
| | | | | | H035-SSS-8857-YPROTBZ | 88572 Y BUS ZONE + CB FAIL | ABB | [redacted] | N | | | 1.15 | 0.57 | | | | |
| | | | | | H035-SSS-8858-YPROTBZ | 88582 Y BUS ZONE + CB FAIL | ABB | [redacted] | N | | | 1.15 | 0.57 | | | | |
| +6B5 - 275kV - 2 Buszone (REB 500) | +6B5 - 275kV - 2 Buszone (REB 500) | +6B5 | 2016 | 0.86 | H035-SSS-501--XPROTBZ | 5012 X BUS ZONE + CB FAIL | ABB | [redacted] | N | 0.99 | 0.50 | | | | | | |
| | | | | | H035-SSS-822--XPROTBZ | 8222 X BUS ZONE + CB FAIL | ABB | [redacted] | N | 2.00 | 1.00 | | | | | | |
| | | | | | H035-SSS-581--XPROTBZ | 5812 X BUS ZONE + CB FAIL | ABB | [redacted] | N | 0.99 | 0.50 | | | | | | |
| | | | | | H035-SSS-878--XPROTBZ | 8782 X BUS ZONE + CB FAIL | ABB | [redacted] | N | 2.00 | 1.00 | | | | | | |
| | | | | | H035-SSS-501--YPROTBZ | 5012 Y BUS ZONE + CB FAIL | ABB | [redacted] | N | | | 0.99 | 0.50 | | | | |
| | | | | | H035-SSS-822--YPROTBZ | 8222 Y BUS ZONE + CB FAIL | ABB | [redacted] | N | | | 2.00 | 1.00 | | | | |
| | | | | | H035-SSS-581--YPROTBZ | 5812 Y BUS ZONE + CB FAIL | ABB | [redacted] | N | | | 0.99 | 0.50 | | | | |
| | | | | | H035-SSS-878--YPROTBZ | 8782 Y BUS ZONE + CB FAIL | ABB | [redacted] | N | | | 0.99 | 0.50 | | | | |
| Bay 1 CPLR (=C01) | 275kV Bay (=C01-Q30) COUPLER - CB 5012 | +5A2 | 2010 | 2.57 | H035-SSS-501--BAYCONT | 1 BUS COUPLER BAY CONTROL UNIT | FOXBORO | [redacted] | Y | | | | | 10.50 | 5.25 | | |
| | | | | | H035-SSS-501--XPROT | 1 BUS COUPLER X PROTECTION | GE | [redacted] | Y | 9.98 | 4.99 | | | | | | |
| | | | | | H035-SSS-501--YPROT | 1 BUS COUPLER Y PROTECTION | SCHWEITZER | [redacted] | N | | | 7.07 | 3.54 | | | | |
| Bay 2 CPLR (=C02) | 275kV Bay (=C02-Q30) COUPLER - CB 5022 - CB MGNT | +5A5 | 2007 | 3.43 | H035-SSS-502--BAYCONT | 2 BUS COUPLER BAY CONTROL UNIT | FOXBORO | [redacted] | Y | | | | | 10.50 | 5.25 | | |
| | | | | | H035-SSS-502--XPROT | 2 BUS COUPLER X PROTECTION | GE | [redacted] | Y | 10.05 | 5.02 | | | | | | |
| | | | | | H035-SSS-502--YPROT | 2 BUS COUPLER Y PROTECTION | SCHWEITZER | [redacted] | N | | | 10.05 | 5.02 | | | | |
| | | | | | H035-SSS-878--PSSITA | F878 SITA H035 TO H011 DIGITAL PROT SIG | DEWAR | [redacted] | N | | | 10.05 | 5.02 | | | | |
| | | | | | H035-SSS-878--PSSITB | F878 SITB H035 TO H011 DIGITAL PROT SIG | RFL ELECTRONICS | [redacted] | N | | | 10.05 | 5.02 | | | | |
| FDR 878 (=C02-Q20) | 275kV FDR 878 (=C02-Q20 - H011 NEBO) - CB 8782 | +5A6 | 2007 | 3.43 | H035-SSS-878--BAYCONT | FEEDER 878 BAY CONTROL UNIT | FOXBORO | [redacted] | Y | | | | | 10.50 | 5.25 | | |
| | | | | | H035-SSS-878--PSBLKA | F878 PIT H035 TO H011 DIGITAL PROT SIG | DEWAR | [redacted] | N | 10.05 | 5.02 | | | | | | |
| | | | | | H035-SSS-878--XPROT | FEEDER 878 X PROTECTION | AREVA | [redacted] | Y | 10.05 | 5.02 | | | | | | |
| | | | | | H035-SSS-NBAY-TWFL | TRAVELLING WAVE FAULT LOCATOR | HATHAWAY | [redacted] | Y | | | | | 6.85 | 3.42 | | |
| | | | | | H035-SSS-878--YPROT | FEEDER 878 Y PROTECTION | SCHWEITZER | [redacted] | Y | | | 13.80 | 6.90 | | | | |
| Bay 3 CPLR (=C03-A30) | 275kV Bay (=C03-A30 iPASS) COUPLER - CB 5032 - CTRL & AUX | +9B5 | 2016 | 0.86 | H035-SSS-503--BAYCONT | 1 TRANSFORMER BAY CONTROL UNIT | ABB | [redacted] | N | | | | | 9.30 | 4.65 | | |
| | | | | | H035-SSS-503--CPSCXT1A | 5032 CP-SC, Secondary Converter X T1 A | ABB | [redacted] | N | 2.00 | 1.00 | | | | | | |
| | | | | | H035-SSS-503--CPSCXT1B | 5032 CP-SC, Secondary Converter X T1 B | ABB | [redacted] | N | 2.00 | 1.00 | | | | | | |
| | | | | | H035-SSS-503--CPSCXT1C | 5032 CP-SC, Secondary Converter X T1 C | ABB | [redacted] | N | 2.00 | 1.00 | | | | | | |
| | | | | | H035-SSS-503--CPSCXT2A | 5032 CP-SC, Secondary Converter X T2 A | ABB | [redacted] | N | 2.00 | 1.00 | | | | | | |
| | | | | | H035-SSS-503--CPSCXT2B | 5032 CP-SC, Secondary Converter X T2 B | ABB | [redacted] | N | 2.00 | 1.00 | | | | | | |
| | | | | | H035-SSS-503--CPSCXT2C | 5032 CP-SC, Secondary Converter X T2 C | ABB | [redacted] | N | 2.00 | 1.00 | | | | | | |
| | | | | | H035-SSS-503--CPSCYT1A | 5032 CP-SC, Secondary Converter Y T1 A | ABB | [redacted] | N | | | 2.00 | 1.00 | | | | |
| | | | | | H035-SSS-503--CPSCYT1B | 5032 CP-SC, Secondary Converter Y T1 B | ABB | [redacted] | N | | | 2.00 | 1.00 | | | | |
| | | | | | H035-SSS-503--CPSCYT1C | 5032 CP-SC, Secondary Converter Y T1 C | ABB | [redacted] | N | | | 2.00 | 1.00 | | | | |
| | | | | | H035-SSS-503--CPSCYT2A | 5032 CP-SC, Secondary Converter Y T2 A | ABB | [redacted] | N | | | 2.00 | 1.00 | | | | |
| | | | | | H035-SSS-503--CPSCYT2B | 5032 CP-SC, Secondary Converter Y T2 B | ABB | [redacted] | N | | | 2.00 | 1.00 | | | | |
| | | | | | H035-SSS-503--CPSCYT2C | 5032 CP-SC, Secondary Converter Y T2 C | ABB | [redacted] | N | | | 2.00 | 1.00 | | | | |
| | | | | | H035-SSS-503--GDENMONA | 5032 Gas Density Monitor A | ABB | [redacted] | N | | | | | 2.00 | 1.00 | | |
| | | | | | H035-SSS-503--GDENMONB | 5032 Gas Density Monitor B | ABB | [redacted] | N | | | | | 2.00 | 1.00 | | |
| | | | | | H035-SSS-503--GDENMONC | 5032 Gas Density Monitor C | ABB | [redacted] | N | | | | | 2.00 | 1.00 | | |
| | | | | | H035-SSS-503--SASNTWK | 5032 SAS NETWORK SWITCH | RUGGEDCOM | [redacted] | N | | | 1.10 | 1.10 | | | | |
| | | | | | H035-SSS-503--XMU1 | 5032 X MERGING UNIT | ABB | [redacted] | N | 2.00 | 1.00 | | | | | | |
| | | | | | H035-SSS-503--XPROTBZ | 5032 X BUS ZONE + CB FAIL | ABB | [redacted] | N | 1.10 | 0.55 | | | | | | |
| | | | | | H035-SSS-503--YMU1 | 5032 Y MERGING UNIT | ABB | [redacted] | N | | | 2.00 | 1.00 | | | | |
| | | | | | H035-SSS-503--YPROTBZ | 5032 Y BUS ZONE + CB FAIL | ABB | [redacted] | N | | | 1.10 | 0.55 | | | | |

| BAY | CABLES (HI) | CABLES (HI) | CABLES (HI) | YARD MARSHALLING KIOSKS (HI) | RECOMMENDED REPLACEMENT TIMMING (Based on Trigger Conditions only, Exclude considerations for Solutions, implementation methodologies): C&P PANELS (Chassis) | Sec Sys Eqiupment | CABLES | | | YARD MARSHALLING KIOSKS |
|---|---|---|---|---|---|---|---|---|---|---|
| Function | C&P Panels To Termination Racks | Termination Racks to HV Yard Marshalling Panels (MK, CT, VT, AC, DC) | C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) | Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) | C&P Panels | Sec Sys Equipment & Auxiliary Components | C&P Panels To Termination Racks | Termination Racks to HV Yard Marshalling Panels (CB, MK, CT, VT, AC, DC, COOLING) | C&P Panels Directly to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) *New Termination Racks May be Required* | Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) |
| 132kV BUS 1 | NA | NA | 4.86 | 4.86 | > 2037 | 2022/23 (b) | NA | NA | > 2037 (c) | > 2037 (d) |
| 275kV Bus 1 | 3.43 | 3.43 | NA | 3.43 | > 2042 | 2027/28 (b) | 2027/28 (b) | > 2042 (c) | NA | > 2042 (d) |
| 1 TFMR PLC | NA | NA | 4.86 | 4.86 | > 2037 | 2022/23 (b) | NA | NA | > 2037 (c) | > 2037 (d) |
| 275kV Bus 2 | 3.43 | 3.43 | NA | 3.43 | > 2042 | 2027/28 (b) | 2027/28 (b) | > 2042 (c) | NA | > 2042 (d) |
| +6B3 - 275kV - 1 Buszone (REB 500) | 0.86 | 0.86 | NA | 0.86 | > 2051 | 2036/37 (b) | 2036/37 (b) | > 2051 (c) | NA | > 2051 (d) |
| +6B5 - 275kV - 2 Buszone (REB 500) | 0.86 | 0.86 | NA | 0.86 | > 2051 | 2036/37 (b) | 2036/37 (b) | > 2051 (c) | NA | > 2051 (d) |
| Bay 1 CPLR (=C01) | 2.57 | 2.57 | NA | 2.57 | > 2045 | 2030/31 (b) | 2030/31 (b) | > 2045 (c) | NA | > 2045 (d) |
| Bay 2 CPLR (=C02) | 3.43 | 3.43 | NA | 3.43 | > 2042 | 2027/28 (b) | 2027/28 (b) | > 2042 (c) | NA | > 2042 (d) |
| FDR 878 (=C02-Q20) | 3.43 | 3.43 | NA | 3.43 | > 2042 | 2027/28 (b) | 2027/28 (b) | > 2042 (c) | NA | > 2042 (d) |
| Bay 3 CPLR (=C03-A30) | 0.86 | 0.86 | NA | 0.86 | > 2051 | 2036/37 (b) | 2036/37 (b) | > 2051 (c) | NA | > 2051 (d) |

## APPENDIX A - H035 STRATHMORE 275KV & 132KV SUBSTATION SECONDARY SYSTEMS - EQUIPMENT HEALTH INDICES AND RECOMMENDED REPLACEMENT TIMEFRAME

Notes:
(a): Subject to Powerlink's O&M Safety Requirements, Current Standard Solutions and Implementation Methodologies, it may be more beneficial to align with the recommended replacement timeframe of sedondary systems equipment
(b): Recommended Timeframe is based on majority of Equipment Health Indices
(c): Based on Visual Inspection and Subject to the decision of the Control Building and Secondary Systems Panels. A number of New Cables may be requried if location of control building or secondary systems panels is changed.
(d): As a minimum requirement, Rubber Seals, Air filter and Terminals and Links are required to be repalced by the recommended timeframe. New Marshalling Kiosks should be considered if Exiting Cables are to be replaced.

RECOMMENDED REPLACEMENT TIMMING (Based on Trigger Conditions only, Exclude considerations for Solutions, implementation methodologies)

| BAY | C&P PANEL | | | | SECONDARY SYSTEMS EQUIPMENT | | | | | X-PROT | | Y-PROT | | AUX & CTRL | | OPSWAN | | CABLES (HI) | CABLES (HI) | CABLES (HI) | YARD MARSHALLING KIOSKS (HI) | C&P PANELS (Chassis) | Sec Sys Eqipment | CABLES | | | YARD MARSHALLING KIOSKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Function | Panel Descripion | Panel No. | Year | HI | Functional Loc. | Description | Manufacturer | Model number | Obsolete (Yes or No) | Eff. Age | HI | Eff. Age | HI | Eff. Age | HI | Eff. Age | HI | C&P Panels To Termination Racks | Termination Racks to HV Yard Marshalling Panels (MK, CT, VT, AC, DC) | C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) | Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) | C&P Panels | Sec Sys Equipment & Auxiliary Components | C&P Panels To Termination Racks | Termination Racks to HV Yard Marshalling Panels (CB, MK, CT, VT, AC, DC, COOLING) | C&P Panels Directly to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) - *New Termination Racks May be Required* | Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) |
| Bay 4 CPLR (=C04-A30) | 275kV Bay (=C04-A30 iPASS) COUPLER - CB 5042 - CTRL & AUX | +9A3 | 2016 | 0.86 | H035-SSS-504--BAYCONT | CB 5042 BAY CONTROL UNIT | ABB | [redacted] | N | | | | | 9.30 | 4.65 | | | 0.86 | 0.86 | NA | 0.86 | > 2051 | 2036/37 (b) | 2036/37 (b) | > 2051 (c) | NA | > 2051 (d) |
| | | | | | H035-SSS-504--CPSCXT1A | 5042 CP-SC, Secondary Converter X T1 A | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-504--CPSCXT1B | 5042 CP-SC, Secondary Converter X T1 B | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-504--CPSCXT1C | 5042 CP-SC, Secondary Converter X T1 C | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-504--CPSCXT2A | 5042 CP-SC, Secondary Converter X T2 A | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-504--CPSCXT2B | 5042 CP-SC, Secondary Converter X T2 B | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-504--CPSCXT2C | 5042 CP-SC, Secondary Converter X T2 C | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-504--CPSCYT1A | 5042 CP-SC, Secondary Converter Y T1 A | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-504--CPSCYT1B | 5042 CP-SC, Secondary Converter Y T1 B | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-504--CPSCYT1C | 5042 CP-SC, Secondary Converter Y T1 C | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-504--CPSCYT2A | 5042 CP-SC, Secondary Converter Y T2 A | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-504--CPSCYT2B | 5042 CP-SC, Secondary Converter Y T2 B | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-504--CPSCYT2C | 5042 CP-SC, Secondary Converter Y T2 C | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-504--GDENMONA | 5042 Gas Density Monitor A | ABB | | N | | | | | 2.00 | 1.00 | | | | | | | | | | | | |
| | | | | | H035-SSS-504--GDENMONB | 5042 Gas Density Monitor B | ABB | | N | | | | | 2.00 | 1.00 | | | | | | | | | | | | |
| | | | | | H035-SSS-504--GDENMONC | 5042 Gas Density Monitor C | ABB | | N | | | | | 2.00 | 1.00 | | | | | | | | | | | | |
| | | | | | H035-SSS-504--SASNTWK | 5042 SAS NETWORK SWITCH | RUGGEDCOM | | N | | | 0.97 | 0.97 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-504--XMU1 | 5042 X MERGING UNIT | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-504--XPROTBZ | 5042 X BUS ZONE + CB FAIL | ABB | | N | 0.97 | 0.49 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-504--YMU1 | 5042 Y MERGING UNIT | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-504--YPROTBZ | 5042 Y BUS ZONE + CB FAIL | ABB | | N | | | 0.97 | 0.49 | | | | | | | | | | | | | | |
| Bay 6 CPLR (=C06-Q30) | 275kV Bay (=C06-Q30) COUPLER - CB 5062 - CB MGNT | +6A5 | 2007 | 3.43 | H035-SSS-506--BAYCONT | 6 BUS COUPLER BAY CONTROL UNIT | FOXBORO | | Y | | | | | 10.50 | 5.25 | | | 3.43 | 3.43 | NA | 3.43 | > 2042 | 2027/28 (b) | 2027/28 (b) | > 2042 (c) | NA | > 2042 (d) |
| | | | | | H035-SSS-506--XPROT | 6 BUS COUPLER X PROTECTION | GE | | Y | 10.05 | 5.02 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-506--YPROT | 6 BUS COUPLER Y PROTECTION | SCHWEITZER | | N | | | 10.05 | 5.02 | | | | | | | | | | | | | | |
| Bay 7 CPLR (=C07-Q30) | 275kV Bay (=C07-Q30) COUPLER - CB 5072 - CB MGNT | +6A8 | 2007 | 3.43 | H035-SSS-507--BAYCONT | 7 BUS COUPLER BAY CONTROL UNIT | FOXBORO | | Y | | | | | 10.00 | 5.00 | | | 3.43 | 3.43 | NA | 3.43 | > 2042 | 2027/28 (b) | 2027/28 (b) | > 2042 (c) | NA | > 2042 (d) |
| | | | | | H035-SSS-507--XPROT | 7 BUS COUPLER X PROTECTION | GE | | Y | 10.05 | 5.02 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-507--YPROT | 7 BUS COUPLER Y PROTECTION | SCHWEITZER | | N | | | 10.05 | 5.02 | | | | | | | | | | | | | | |
| 1TFMR 275kV (=C03-A10) | 1TFMR 275kV (=C03-A10 - iPASS) - CB 5412 - CTRL & AUX | +9B6, +9B7 | 2016 | 0.86 | H035-SSS-541--BAYCONT | 1 TRANSFORMER BAY CONTROL UNIT | ABB | | N | | | | | 9.30 | 4.65 | | | 0.86 | 0.86 | NA | 0.86 | > 2051 | 2036/37 (b) | 2036/37 (b) | > 2051 (c) | NA | > 2051 (d) |
| | | | | | H035-SSS-541--CPSCXT1A | 5412 CP-SC, Secondary Converter X T1 A | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--CPSCXT1B | 5412 CP-SC, Secondary Converter X T1 B | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--CPSCXT1C | 5412 CP-SC, Secondary Converter X T1 C | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--CPSCXT2A | 5412 CP-SC, Secondary Converter X T2 A | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--CPSCXT2B | 5412 CP-SC, Secondary Converter X T2 B | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--CPSCXT2C | 5412 CP-SC, Secondary Converter X T2 C | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--CPSCYT1A | 5412 CP-SC, Secondary Converter Y T1 A | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--CPSCYT1B | 5412 CP-SC, Secondary Converter Y T1 B | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--CPSCYT1C | 5412 CP-SC, Secondary Converter Y T1 C | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--CPSCYT2A | 5412 CP-SC, Secondary Converter Y T2 A | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--CPSCYT2B | 5412 CP-SC, Secondary Converter Y T2 B | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--CPSCYT2C | 5412 CP-SC, Secondary Converter Y T2 C | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--GDENMONA | 5412 Gas Density Monitor A | ABB | | N | | | | | 2.00 | 1.00 | | | | | | | | | | | | |
| | | | | | H035-SSS-541--GDENMONB | 5412 Gas Density Monitor B | ABB | | N | | | | | 2.00 | 1.00 | | | | | | | | | | | | |
| | | | | | H035-SSS-541--GDENMONC | 5412 Gas Density Monitor C | ABB | | N | | | | | 2.00 | 1.00 | | | | | | | | | | | | |
| | | | | | H035-SSS-541--SASNTWK | 5412 SAS NETWORK SWITCH | RUGGEDCOM | | N | | | 1.10 | 1.10 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--XMU1 | 5412 X MERGING UNIT | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--XPROT | 1 TRANSFORMER CB FAIL X PROTECTION | ABB | | N | 1.10 | 0.55 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--XPROTBZ | 5412 X BUS ZONE + CB FAIL | ABB | | N | 1.10 | 0.55 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--YMU1 | 5412 Y MERGING UNIT | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--YPROT | 1 TRANSFORMER CB FAIL Y PROTECTION | ABB | | N | | | 1.10 | 0.55 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-541--YPROTBZ | 5412 Y BUS ZONE + CB FAIL | ABB | | N | | | 1.10 | 0.55 | | | | | | | | | | | | | | |
| REACT 1 (=C06-Q10) | 275kV REACT 1 (=C06-Q10) - CB 5712 | +6A4 | 2009 | 2.86 | H035-SSS-571--BAYCONT | 1 BUS REACTOR BAY CONTROL UNIT | FOXBORO | | Y | | | | | 10.50 | 5.25 | | | 2.86 | 2.86 | NA | 2.86 | > 2044 | 2029/30 (b) | 2029/30 (b) | > 2044 (c) | NA | > 2044 (d) |
| | | | | | H035-SSS-571--POWAVE | 1 BUS REACTOR POINT ON WAVE | ABB | | Y | | | | | 6.54 | 13.08 | | | | | | | | | | | | |
| | | | | | H035-SSS-571--XPROT | 1 BUS REACTOR X PROTECTION | GE | | Y | 9.98 | 4.99 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-571--XPROT | 1 BUS REACTOR X PROTECTION | ALSTOM | | N | 8.52 | 4.26 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-571--YPROT | 1 BUS REACTOR Y PROTECTION | SCHWEITZER | | N | | | 8.52 | 4.26 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-571--YPROT | 1 BUS REACTOR Y PROTECTION | ALSTOM | | N | | | 8.52 | 4.26 | | | | | | | | | | | | | | |
| SVC 2-BUS SIDE (=C07-Q20) | 275kV SVC 2-BUS SIDE (=C07-Q20) - CB 5812 | +6A9 | 2007 | 3.43 | H035-SSS-581--BAYCONT | 1 SVC BAY CONTROL UNIT | FOXBORO | | Y | | | | | 10.50 | 5.25 | | | 3.43 | 3.43 | NA | 3.43 | > 2042 | 2027/28 (b) | 2027/28 (b) | > 2042 (c) | NA | > 2042 (d) |
| | | | | | H035-SSS-581--XPROT | 1 SVC X PROTECTION | GE | | Y | 10.05 | 5.02 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-581--YPROT | 1 SVC Y PROTECTION | SCHWEITZER | | N | | | 10.05 | 5.02 | | | | | | | | | | | | | | |
| FDR 7127 (=D09-A10) | 132kV FDR 7127 (=D09-A10 - T220 COLLINSVILLE NORTH) - CB 71272 | +E6 | 2002 | 4.86 | H035-SSS-7127-BAYCONT | FEEDER 7127 BAY CONTROL UNIT | FOXBORO | | Y | | | | | 14.87 | 7.44 | | | NA | NA | 4.86 | 4.86 | > 2037 | 2022/23 (b) | NA | NA | > 2037 (c) | > 2037 (d) |
| | | | | | H035-SSS-7127-XPROT | FEEDER 7127 X PROTECTION | SCHNEIDER | | Y | 9.55 | 4.77 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-7127-YPROT | FEEDER 7127 Y PROTECTION | SCHWEITZER | | Y | | | 14.87 | 7.44 | | | | | | | | | | | | | | |
| FDR 7208 (=D07-A10) | 132kV FDR 7208 (=D07-A10 - T193 CLARE SOUTH) - CB 72082 | +E7 | 2002 | 4.86 | H035-SSS-7208-BAYCONT | FEEDER 7208 BAY CONTROL UNIT | FOXBORO | | Y | | | | | 14.87 | 7.44 | | | NA | NA | 4.86 | 4.86 | > 2037 | 2022/23 (b) | NA | NA | > 2037 (c) | > 2037 (d) |
| | | | | | H035-SSS-7208-XPROT | FEEDER 7208 X PROTECTION | AREVA | | Y | 10.78 | 5.39 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-7208-YPROT | FEEDER 7208 Y PROTECTION | SCHWEITZER | | Y | | | 14.87 | 7.44 | | | | | | | | | | | | | | |
| FDR 7264 (=D02-A10) | 132kV FDR 7264 (=D02-A10 - TFMR) - CB 72642 | +E4 | 2002 | 4.86 | H035-SSS-7264-BAYCONT | FEEDER 7264 BAY CONTROL UNIT 1 TRANSF | FOXBORO | | Y | | | | | 14.87 | 7.44 | | | NA | NA | 4.86 | 4.86 | > 2037 | 2022/23 (b) | NA | NA | > 2037 (c) | > 2037 (d) |
| | | | | | H035-SSS-7264-XPROT | FEEDER 7264 X PROTECTION (1 TRANSF) | GE | | Y | 14.94 | 7.47 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-7264-XPROT | FEEDER 7264 X PROTECTION (1 TRANSF) | GE | | Y | 7.82 | 3.91 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-7264-YPROT | FEEDER 7264 Y PROTECTION (1 TRANSF) | SCHWEITZER | | Y | | | 14.94 | 7.47 | | | | | | | | | | | | | | |
| FDR 7360 (=D06-A10) | 132kV FDR 7360 (=D06-A10 - T181 BOWEN NORTH) - CB 73602 | +E12 | 2010 | 2.57 | T181-SSS-7360-BAYCONT | REMOTE TERMINAL UNIT FOXBORO C50 | FOXBORO | | Y | | | | | 10.50 | 5.25 | | | NA | NA | 2.57 | 2.57 | > 2045 | 2030/31 (b) | NA | NA | > 2045 (c) | > 2045 (d) |
| | | | | | H035-SSS-7360-XPROT | FEEDER 7360 X PROTECTION | AREVA | | Y | 10.78 | 5.39 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-7360-YPROT | FEEDER 7360 Y PROTECTION | SCHWEITZER | | Y | | | 8.84 | 4.42 | | | | | | | | | | | | | | |
| FDR 7457 (=D03-Q10) | 132kV FDR 7457 (=D03-Q10 - T242 SPRINGLANDS) - CB 74572 | +E5 | 2018 | 0.29 | H035-SSS-7457-BAYCONT | FEEDER 7457 BAY CONTROL UNIT | FOXBORO | | Y | | | | | 1.00 | 0.50 | | | NA | NA | 0.29 | 0.29 | > 2053 | 2038/39 (b) | NA | NA | > 2053 (c) | > 2053 (d) |
| | | | | | H035-SSS-7457-XPROT | FEEDER 7457 X PROTECTION | SCHNEIDER | | Y | 1.00 | 0.50 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-7457-YPROT | FEEDER 7457 Y PROTECTION | DEWAR | | N | | | 1.00 | 0.50 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-7457-YPROT | FEEDER 7457 Y PROTECTION | DEWAR | | N | | | 1.00 | 0.50 | | | | | | | | | | | | | | |

## APPENDIX A - H035 STRATHMORE 275KV & 132KV SUBSTATION SECONDARY SYSTEMS - EQUIPMENT HEALTH INDICES AND RECOMMENDED REPLACEMENT TIMEFRAME

Notes:
(a): Subject to Powerlink's O&M Safety Requirements, Current Standard Solutions and Implementation Methodologies, it may be more beneficial to align with the recommended replacement timeframe of sedondary systems equipment
(b): Recommended Timeframe is based on majority of Equipment Health Indices
(c): Based on Visual Inspection and Subject to the decision of the Control Building and Secondary Systems Panels. A number of New Cables may be requried if location of control building or secondary systems panels is changed.
(d): As a minimum requirement, Rubber Seals, Air filter and Terminals and Links are required to be repalced by the recommended timeframe. New Marshalling Kiosks should be considered if Exiting Cables are to be replaced.

RECOMMENDED REPLACEMENT TIMMING (Based on Trigger Conditions only, Exclude considerations for Solutions, implementation methodologies)

| BAY | C&P PANEL | | | | SECONDARY SYSTEMS EQUIPMENT | | | | | X-PROT | | Y-PROT | | AUX & CTRL | | OPSWAN | | CABLES (HI) | CABLES (HI) | CABLES (HI) | YARD MARSHALLING KIOSKS (HI) | C&P PANELS (Chassis) | Sec Sys Eqiupment | CABLES | | | YARD MARSHALLING KIOSKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Function | Panel Descripion | Panel No. | Year | HI | Functional Loc. | Description | Manufacturer | Model number | Obsolete (Yes or No) | Eff. Age | HI | Eff. Age | HI | Eff. Age | HI | Eff. Age | HI | C&P Panels To Termination Racks | Termination Racks to HV Yard Marshalling Panels (MK, CT, VT, AC, DC) | C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) | Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) | C&P Panels | Sec Sys Equipment & Auxiliary Components | C&P Panels To Termination Racks | Termination Racks to HV Yard Marshalling Panels (CB, MK, CT, VT, AC, DC, COOLING) | C&P Panels Directly to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) *New Termination Racks May be Required* | Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) |
| FDR 822 (=C06-Q20) | 275kV FDR 822 (=C06-Q20 - H011 NEBO) - CB 8222 | +6A6 | 2007 | 3.43 | H035-SSS-822--BAYCONT | FEEDER 822 BAY CONTROL UNIT | FOXBORO | [redacted] | Y | | | | | 10.50 | 5.25 | | | 3.43 | 3.43 | NA | 3.43 | > 2042 | 2027/28 (b) | 2027/28 (b) | > 2042 (c) | NA | > 2042 (d) |
| | | | | | H035-SSS-822--PSPITX | F822 PITX+IAR H035 TO H011 DIG PROT SIG | DEWAR | | N | 11.65 | 5.82 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-822--PSPITY | F822 PITY+IAR H035 TO H011 DIG PROT SIG | DEWAR | | N | | | 16.35 | 8.18 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-822--XPROT | FEEDER 822 X PROTECTION | AREVA | | Y | 10.05 | 5.02 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-822--XPROT | FEEDER 822 X PROTECTION | GE | | Y | 11.29 | 5.64 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-822--YPROT | FEEDER 822 Y PROTECTION | SCHWEITZER | | Y | | | 9.47 | 4.74 | | | | | | | | | | | | | | |
| FDR 878 (=C04-A10) | 275kV FDR 878 (=C04-A10 - H091 HAUGHTON RIVER) - CB 8782 | +9A4 & +9A5 | 2016 | 0.86 | H035-SSS-879--BAYCONT | CB 8792 BAY CONTROL UNIT | ABB | | N | | | | | 9.30 | 4.65 | | | 0.86 | 0.86 | NA | 0.86 | > 2051 | 2036/37 (b) | 2036/37 (b) | > 2051 (c) | NA | > 2051 (d) |
| | | | | | H035-SSS-879--CPSCXT1A | 8792 CP-SC, Secondary Converter X T1 A | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--CPSCXT1B | 8792 CP-SC, Secondary Converter X T1 B | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--CPSCXT1C | 8792 CP-SC, Secondary Converter X T1 C | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--CPSCXT2A | 8792 CP-SC, Secondary Converter X T2 A | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--CPSCXT2B | 8792 CP-SC, Secondary Converter X T2 B | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--CPSCXT2C | 8792 CP-SC, Secondary Converter X T2 C | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--CPSCYT1A | 8792 CP-SC, Secondary Converter Y T1 A | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--CPSCYT1B | 8792 CP-SC, Secondary Converter Y T1 B | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--CPSCYT1C | 8792 CP-SC, Secondary Converter Y T1 C | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--CPSCYT2A | 8792 CP-SC, Secondary Converter Y T2 A | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--CPSCYT2B | 8792 CP-SC, Secondary Converter Y T2 B | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--CPSCYT2C | 8792 CP-SC, Secondary Converter Y T2 C | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--GDENMONA | 8792 Gas Density Monitor A | ABB | | N | | | | | 2.00 | 1.00 | | | | | | | | | | | | |
| | | | | | H035-SSS-879--GDENMONB | 8792 Gas Density Monitor B | ABB | | N | | | | | 2.00 | 1.00 | | | | | | | | | | | | |
| | | | | | H035-SSS-879--GDENMONC | 8792 Gas Density Monitor C | ABB | | N | | | | | 2.00 | 1.00 | | | | | | | | | | | | |
| | | | | | H035-SSS-879--SASNTWK | 8792 SAS NETWORK SWITCH | RUGGEDCOM | | N | | | 0.95 | 0.95 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--XMU1 | 8792 X MERGING UNIT | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--XPROT | FEEDER 879 X PROTECTION | ABB | | N | 11.28 | 5.64 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--XPROTBZ | 8792 X BUS ZONE + CB FAIL | ABB | | N | 0.95 | 0.48 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--YMU1 | 8792 Y MERGING UNIT | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--YPROT | FEEDER 879 Y PROTECTION | SCHWEITZER | | N | | | 0.95 | 0.48 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--YPROT | FEEDER 879 Y PROTECTION | ABB | | N | | | 8.37 | 4.19 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-879--YPROTBZ | 8792 Y BUS ZONE + CB FAIL | ABB | | N | | | 0.95 | 0.48 | | | | | | | | | | | | | | |
| FDR 8845 (=C04-A20) | 275kV FDR 8845 (=C04-A20 - H011 NEBO) - CB 88452 | +9A1 & +9A2 | 2016 | 0.86 | H035-SSS-8845-BAYCONT | F8845 BAY CONTROL UNIT | ABB | | N | | | | | 9.30 | 4.65 | | | 0.86 | 0.86 | NA | 0.86 | > 2051 | 2036/37 (b) | 2036/37 (b) | > 2051 (c) | NA | > 2051 (d) |
| | | | | | H035-SSS-8845-CPSCXT1A | 88452 CP-SC, Secondary Converter X T1 A | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-CPSCXT1B | 88452 CP-SC, Secondary Converter X T1 B | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-CPSCXT1C | 88452 CP-SC, Secondary Converter X T1 C | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-CPSCXT2A | 88452 CP-SC, Secondary Converter X T2 A | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-CPSCXT2B | 88452 CP-SC, Secondary Converter X T2 B | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-CPSCXT2C | 88452 CP-SC, Secondary Converter X T2 C | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-CPSCYT1A | 88452 CP-SC, Secondary Converter Y T1 A | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-CPSCYT1B | 88452 CP-SC, Secondary Converter Y T1 B | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-CPSCYT1C | 88452 CP-SC, Secondary Converter Y T1 C | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-CPSCYT2A | 88452 CP-SC, Secondary Converter Y T2 A | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-CPSCYT2B | 88452 CP-SC, Secondary Converter Y T2 B | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-CPSCYT2C | 88452 CP-SC, Secondary Converter Y T2 C | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-GDENMONA | 88452 Gas Density Monitor A | ABB | | N | | | | | 2.00 | 1.00 | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-GDENMONB | 88452 Gas Density Monitor B | ABB | | N | | | | | 2.00 | 1.00 | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-GDENMONC | 88452 Gas Density Monitor C | ABB | | N | | | | | 2.00 | 1.00 | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-SASNTWK | 88452 SAS NETWORK SWITCH | RUGGEDCOM | | N | | | 0.97 | 0.97 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-XMU1 | 88452 X MERGING UNIT | ABB | | N | 2.00 | 1.00 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-XPROT | F8845 X PROTECTION | ABB | | N | 11.28 | 5.64 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-XPROTBZ | 88452 X BUS ZONE + CB FAIL | ABB | | N | 0.97 | 0.49 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-YMU1 | 88452 Y MERGING UNIT | ABB | | N | | | 2.00 | 1.00 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-YPROT | F8845 Y PROTECTION | ABB | | N | | | 8.37 | 4.19 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-YPROT | F8845 Y PROTECTION | SCHWEITZER | | N | | | 0.97 | 0.49 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8845-YPROTBZ | 88452 Y BUS ZONE + CB FAIL | ABB | | N | | | 0.97 | 0.49 | | | | | | | | | | | | | | |
| FDR 8857 (=C02-Q10) | 275kV FDR 8857 (=C02-Q10 - H013 ROSS) - CB 88572 | +5A4 | 2007 | 3.43 | H035-SSS-8857-BAYCONT | FEEDER 8857 BAY CONTROL UNIT | FOXBORO | | Y | | | | | 10.50 | 5.25 | | | 3.43 | 3.43 | NA | 3.43 | > 2042 | 2027/28 (b) | 2027/28 (b) | > 2042 (c) | NA | > 2042 (d) |
| | | | | | H035-SSS-8857-XPROT | FEEDER 8857 X PROTECTION | AREVA | | Y | 10.05 | 5.02 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8857-XPROT | FEEDER 8857 X PROTECTION | AREVA | | Y | 10.05 | 5.02 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8857-YPROT | FEEDER 8857 Y PROTECTION | SCHWEITZER | | Y | | | 10.05 | 5.02 | | | | | | | | | | | | | | |
| FDR 8858 (=C01-Q10) | 275kV FDR 8857 (=C01-Q10 - H013 ROSS) - CB 88582 | +5A1 | 2010 | 2.57 | H035-SSS-8858-BAYCONT | FEEDER 8858 BAY CONTROL UNIT | FOXBORO | | Y | | | | | 10.50 | 5.25 | | | 2.57 | 2.57 | NA | 2.57 | > 2045 | 2030/31 (b) | 2030/31 (b) | > 2045 (c) | NA | > 2045 (d) |
| | | | | | H035-SSS-8858-XPROT | FEEDER 8858 X PROTECTION | AREVA | | Y | 7.07 | 3.54 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-8858-YPROT | FEEDER 8858 Y PROTECTION | SCHWEITZER | | Y | | | 9.47 | 4.74 | | | | | | | | | | | | | | |
| "+5" COMMON & OPSWAN | 275kV BUILDING +5 COMMON RTU & OPSWAN CUBIBLE | +5B1 | 2007 | 3.43 | H035-SSS-NBAY-LCF5 | LOCAL CONTROL FACILITY BUILDING +5 | SUN | | Y | | | | | 12.00 | 10.00 | | | 3.43 | 3.43 | NA | 3.43 | > 2042 | 2027/28 (b) | 2027/28 (b) | > 2042 (c) | NA | > 2042 (d) |
| | | | | | H035-SSS-NBAY-LCF5 | LOCAL CONTROL FACILITY BUILDING +5 | SUN | | Y | | | | | 8.35 | 8.35 | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-LCFINT5 | LOCAL CONTROL FACILITY INTERFACE BLD +5 | FOXBORO | | Y | | | | | 12.06 | 6.03 | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-NSCLNK15 | NSC LINK 1 BUILDING +5 | FOXBORO | | Y | | | | | 10.50 | 5.25 | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-NSCLNK25 | NSC LINK 2 BUILDING +5 | FOXBORO | | Y | | | | | 12.06 | 6.03 | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWINVRT5 | OPSWAN INVERTER BUILDING +5 | LATRONICS | | N | | | | | | | 12.00 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWNTWK5 | OPSWAN NETWORK BUILDING +5 | RUGGEDCOM | | N | | | | | | | 10.05 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWNTWK5 | OPSWAN NETWORK BUILDING +5 | PERLE | | N | | | | | | | 10.05 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWNTWK5 | OPSWAN NETWORK BUILDING +5 | PERLE | | N | | | | | | | 10.05 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWNTWK5 | OPSWAN NETWORK BUILDING +5 | WYSE | | Y | | | | | | | 5.78 | 5.78 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWCAM2 | OPSWAN CAMERA ASSEMBLY WEST =C02 | CANON | | Y | | | | | | | 9.75 | 9.75 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-RTUCOM5 | COMMON RTU BUILDING +5 | FOXBORO | | Y | | | | | 10.50 | 5.25 | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-TIMING5 | TIMING SYSTEM BUILDING +5 | TEKRON | | Y | | | | | 11.28 | 5.64 | | | | | | | | | | | | |

## APPENDIX A - H035 STRATHMORE 275KV & 132KV SUBSTATION SECONDARY SYSTEMS - EQUIPMENT HEALTH INDICES AND RECOMMENDED REPLACEMENT TIMEFRAME

Notes:
(a): Subject to Powerlink's O&M Safety Requirements, Current Standard Solutions and Implementation Methodologies, it may be more beneficial to align with the recommended replacement timeframe of sedondary systems equipment
(b): Recommended Timeframe is based on majority of Equipment Health Indices
(c): Based on Visual Inspection and Subject to the decision of the Control Building and Secondary Systems Panels. A number of New Cables may be requried if location of control building or secondary systems panels is changed.
(d): As a minimum requirement, Rubber Seals, Air filter and Terminals and Links are required to be repalced by the recommended timeframe. New Marshalling Kiosks should be considered if Exsiting Cables are to be replaced.

RECOMMENDED REPLACEMENT TIMMING (Based on Trigger Conditions only, Exclude considerations for Solutions, implementation methodologies)

| BAY | C&P PANEL | | | | SECONDARY SYSTEMS EQUIPMENT | | | | | X-PROT | | Y-PROT | | AUX & CTRL | | OPSWAN | | CABLES (HI) | CABLES (HI) | CABLES (HI) | YARD MARSHALLING KIOSKS (HI) | C&P PANELS (Chassis) | Sec Sys Eqiupment | CABLES | | | YARD MARSHALLING KIOSKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Function | Panel Descripion | Panel No. | Year | HI | Functional Loc. | Description | Manufacturer | Model number | Obsolete (Yes or No) | Eff. Age | HI | Eff. Age | HI | Eff. Age | HI | Eff. Age | HI | C&P Panels To Termination Racks | Termination Racks to HV Yard Marshalling Panels (MK, CT, VT, AC, DC) | C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) | Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) | C&P Panels | Sec Sys Equipment & Auxiliary Components | C&P Panels To Termination Racks | Termination Racks to HV Yard Marshalling Panels (CB, MK, CT, VT, AC, DC, COOLING) | C&P Panels Directly to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) *New Termination Racks May be Required* | Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) |
| "+6" MASTER LCF NSC COMMON & OPSWAN | 275kV BUILDING +6 MASTER LCF NSCs COMMON RTU & OPSWAN CUBIBLE | +6B1 | 2007 | 3.43 | H035-SSS-NBAY-OWINVRT6 | OPSWAN INVERTER BUILDING +6 | LATRONICS | [redacted] | N | | | | | | | 12.00 | 10.00 | 3.43 | 3.43 | NA | 3.43 | > 2042 | 2027/28 (b) | 2027/28 (b) | > 2042 (c) | NA | > 2042 (d) |
| | | | | | H035-SSS-NBAY-OWNTWK6 | OPSWAN NETWORK BUILDING +6 | RUGGEDCOM | [redacted] | N | | | | | | | 10.05 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWNTWK6 | OPSWAN NETWORK BUILDING +6 | PERLE | [redacted] | N | | | | | | | 10.05 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWNTWK6 | OPSWAN NETWORK BUILDING +6 | PERLE | [redacted] | N | | | | | | | 10.05 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWNTWK6 | OPSWAN NETWORK BUILDING +6 | WYSE | [redacted] | Y | | | | | | | 5.78 | 5.78 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWCAM1 | OPSWAN CAMERA ASSEMBLY NORTH =C07 | CANON | [redacted] | Y | | | | | | | 9.75 | 9.75 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-TIMING6 | TIMING SYSTEM BUILDING +6 | TEKRON | [redacted] | Y | | | | | 11.28 | 5.64 | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-RTUCOM6 | COMMON RTU BUILDING +6 | FOXBORO | [redacted] | Y | | | | | 10.50 | 5.25 | | | | | | | | | | | | |
| "+E" MASTER LCF NSC COMMON & OPSWAN | 132kV BUILDING +E14 MASTER LCF NSCs & OPSWAN CUBIBLE | +E14 | 2002 | 4.86 | H035-SSS-NBAY-LCFE | LOCAL CONTROL FACILITY BUILDING +E | SUN | [redacted] | Y | | | | | 17.00 | 10.00 | | | NA | NA | 4.86 | 4.86 | > 2037 | 2022/23 (b) | NA | NA | > 2037 (c) | > 2037 (d) |
| | | | | | H035-SSS-NBAY-LCFE | LOCAL CONTROL FACILITY BUILDING +E | SUN | [redacted] | Y | | | | | 5.51 | 5.51 | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-LCFINTE | LOCAL CONTROL FACILITY INTERFACE BLD +E | FOXBORO | [redacted] | Y | | | | | 14.87 | 7.44 | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-NSCLNK2E | NSC LINK 2 BUILDING +E | FOXBORO | [redacted] | Y | | | | | 14.87 | 7.44 | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWINVRTE | OPSWAN INVERTER BUILDING +E | LATRONICS | [redacted] | N | | | | | | | 17.00 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWCAM3 | OPSWAN CAMERA ASSEMBLY 132kV YARD | CANON | [redacted] | Y | | | | | | | 13.66 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-NSCLNK1E | NSC LINK 1 BUILDING +E | FOXBORO | [redacted] | Y | | | | | 14.87 | 7.44 | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWNTWKE | OPSWAN NETWORK BUILDING +E | STALLION | [redacted] | Y | | | | | | | 13.66 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWNTWKE | OPSWAN NETWORK BUILDING +E | 3 COM | [redacted] | Y | | | | | | | 13.66 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWNTWKE | OPSWAN NETWORK BUILDING +E | WYSE | [redacted] | Y | | | | | | | 5.78 | 5.78 | | | | | | | | | | |
| "+9" MASTER LCF NSC COMMON & OPSWAN | 275kV iPASS BUILDING +9B1 & 9B2 MASTER LCF NSCs & OPSWAN CUBIBLE | +9B1 & 9B2 | 2016 | 0.86 | H035-SSS-NBAY-NSCLNK19 | NSC LINK 1 BUILDING +9 | ABB | [redacted] | N | | | | | 1.15 | 0.57 | | | 0.86 | 0.86 | NA | 0.86 | > 2051 | 2036/37 (b) | 2036/37 (b) | > 2051 (c) | NA | > 2051 (d) |
| | | | | | H035-SSS-NBAY-NSCLNK29 | NSC LINK 2 BUILDING +9 | ABB | [redacted] | N | | | | | 1.15 | 0.57 | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWNTWK9 | OPSWAN NETWORK BUILDING +9 | RUGGEDCOM | [redacted] | N | | | | | | | 4.09 | 4.09 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-RTUCOM29 | COMMON RTU 2 / SPARE POLE BUILDING +9 | ABB | [redacted] | N | | | | | 9.30 | 4.65 | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-SASSERV9 | SUB AUTOMATION SYSTEM SERVER (LCF) +9 | ADVANTECH | [redacted] | N | | | | | 1.15 | 1.15 | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-RTUCOM19 | COMMON RTU 1 BUILDING +9 | ABB | [redacted] | N | | | | | 9.30 | 4.65 | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-TIMING19 | TIMING SYSTEM BUILDING +9 | MEINBERG | [redacted] | N | | | | | 3.00 | 1.50 | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-TIMING29 | TIMING SYSTEM BUILDING +9 | MEINBERG | [redacted] | N | | | | | 3.00 | 1.50 | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-XPROT275 | 275kV NON BAY X PROTECTION | ABB | [redacted] | N | 1.15 | 0.57 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-YPROT275 | 275kV NON BAY Y PROTECTION | ABB | [redacted] | N | | | 1.15 | 0.57 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-YMU1 | 330kV SPARE POLE MERGING UNIT | ABB | [redacted] | N | | | 3.00 | 1.50 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-SASNTWK1 | ROOT SAS NETWORK SWITCH | RUGGEDCOM | [redacted] | N | 1.15 | 1.15 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-SASNTWK2 | B/UP ROOT SAS NETWORK SWITCH | RUGGEDCOM | [redacted] | N | | | 0.15 | 0.15 | | | | | | | | | | | | | | |
| "+T" OPSWAN & COMMS RTU | BUILDING +T OPSWAN, CAMERA, AND COMMS RTU | | 2001 | 5.14 | H035-SSS-NBAY-OWNTWKT | OPSWAN NETWORK BUILDING +T | STALLION | [redacted] | Y | | | | | | | 13.66 | 10.00 | NA | NA | 5.14 | 5.14 | > 2036 | 2021/22 (b) | NA | NA | > 2036 (c) | > 2036 (d) |
| | | | | | H035-SSS-NBAY-OWNTWKT | OPSWAN NETWORK BUILDING +T | STALLION | [redacted] | Y | | | | | | | 13.66 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWNTWKT | OPSWAN NETWORK BUILDING +T | 3 COM | [redacted] | Y | | | | | | | 18.00 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWNTWKT | OPSWAN NETWORK BUILDING +T | 3 COM | [redacted] | Y | | | | | | | 18.00 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWNTWKT | OPSWAN NETWORK BUILDING +T | CISCO | [redacted] | Y | | | | | | | 9.37 | 9.37 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWNTWKT | OPSWAN NETWORK BUILDING +T | PERLE | [redacted] | N | | | | | | | 4.31 | 4.31 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWPRINTT | OPSWAN PRINTER BUILDING +T | HEWLETT PACKARD | [redacted] | Y | | | | | | | 18.00 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWSERVT | OPSWAN SERVER BUILDING +T | COMPAQ | [redacted] | N | | | | | | | 18.00 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWSERVT | OPSWAN SERVER BUILDING +T | COMPAQ | [redacted] | N | | | | | | | 18.00 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWSERVT | OPSWAN SERVER BUILDING +T | LATRONICS | [redacted] | N | | | | | | | 11.00 | 10.00 | | | | | | | | | | |
| 132kV PQM | 132kV PQM PANEL | +E11 | 2013 | 1.71 | H035-SSS-NBAY-PWRQUAL1 | POWER QUALITY MONITOR 1 | UNIPOWER | [redacted] | Y | | | | | | | 4.33 | 2.17 | NA | NA | 1.71 | 1.71 | > 2048 | 2033/34 (b) | NA | NA | > 2048 (c) | > 2048 (d) |
| | | | | | H035-SSS-NBAY-PWRQUAL2 | POWER QUALITY MONITOR 2 | UNIPOWER | [redacted] | Y | | | | | | | 4.33 | 2.17 | | | | | | | | | | |
| 275kV PQM | 275kV PQM PANEL | +6B7 | 2013 | 1.71 | | POWER QUALITY MONITOR 1 | UNIPOWER | [redacted] | Y | | | | | | | 4.33 | 2.17 | 1.71 | 1.71 | NA | 1.71 | > 2048 | 2033/34 (b) | 2033/34 (b) | > 2048 (c) | NA | > 2048 (d) |
| | | | | | | HIGH SPEED RECORDER | QUALITROL | [redacted] | Y | | | | | | | 4.33 | 2.17 | | | | | | | | | | |

# 8. Appendix B

**APPENDIX B - H035 STRATHMORE 275KV SVC SECONDARY SYSTEMS - EQUIPMENT HEALTH INDICES AND RECOMMENDED REPLACEMENT TIMEFRAME**

Notes:
(a): Subject to Powerlink's O&M Safety Requirements, Current Standard Solutions and Implementation Methodologies, it may be more beneficial to align with the recommended replacement timeframe of sedondary systems equipment
(b): Recommended Timeframe is based on majority of Equipment Health Indices
(c): Based on Visual Inspection and Subject to the decision of the Control Building and Secondary Systems Panels. A number of New Cables may be requried if location of control building or secondary systems panels is changed.
(d): As a minimum requirement, Rubber Seals, Air filter and Terminals and Links are required to be repalced by the recommended timeframe. New Marshalling Kiosks should be considered if Exsiting Cables are to be replaced.

RECOMMENDED REPLACEMENT TIMMING (Based on Trigger Conditions only, Exclude considerations for Solutions, implementation methodologies)

| BAY | C&P PANEL | | | | SECONDARY SYSTEMS EQUIPMENT | | | | | X-PROT | | Y-PROT | | AUX & CTRL | | OPSWAN | | CABLES (HI) | CABLES (HI) | CABLES (HI) | YARD MARSHALLING KIOSKS (HI) | C&P PANELS (Chassis) | Sec Sys Eqiupment | CABLES | | | YARD MARSHALLING KIOSKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Function | Panel Descripion | Panel No. | Year | HI | Functional Loc. | Description | Manufacturer | Model number | Obsolete (Yes or No) | Eff. Age | HI | Eff. Age | HI | Eff. Age | HI | Eff. Age | HI | C&P Panels To Termination Racks | Termination Racks to HV Yard Marshalling Panels (MK, CT, VT, AC, DC) | C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) | Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) | C&P Panels | Sec Sys Equipment & Auxiliary Components | C&P Panels To Termination Racks | Termination Racks to HV Yard Marshalling Panels (CB, MK, CT, VT, AC, DC, COOLING) | C&P Panels Directly to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) - *New Termination Racks May be Required* | Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) |
| | | | | | H035-SSS-1SVC-3HFXPROT | 3RD HARMONIC FILTER X PROTECTION | TRENCH | [redacted] | N | 9.96 | 4.98 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-3HFXPROT | 3RD HARMONIC FILTER X PROTECTION | TRENCH | [redacted] | N | 9.96 | 4.98 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-3HFYPROT | 3RD HARMONIC FILTER Y PROTECTION | SIEMENS | [redacted] | N | | | 9.96 | 4.98 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-5HFXPROT | 5RD HARMONIC FILTER X PROTECTION | TRENCH | [redacted] | N | 9.96 | 4.98 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-5HFYPROT | 5RD HARMONIC FILTER Y PROTECTION | SIEMENS | [redacted] | N | | | 9.96 | 4.98 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-8HFXPROT | 8TH HARMONIC FILTER X PROTECTION | TRENCH | [redacted] | N | 9.96 | 4.98 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-8HFYPROT | 8TH HARMONIC FILTER Y PROTECTION | SIEMENS | [redacted] | N | | | 9.96 | 4.98 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-BICOOL | BINARY INTERFACE COOLING SYSTEM | SIEMENS | [redacted] | Y | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-BICTRLAN | BINARY INTERFACE CONTROL / LAN | SIEMENS | [redacted] | Y | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-BICTRLAN | BINARY INTERFACE CONTROL / LAN | SIEMENS | [redacted] | Y | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-BIPROT | BINARY INTERFACE PROTECTION / TRANSF | SIEMENS | [redacted] | Y | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-BIPROT | BINARY INTERFACE PROTECTION / TRANSF | SIEMENS | [redacted] | Y | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-BISTN | BINARY INTERFACE STATION SERVICE | SIEMENS | [redacted] | Y | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-BIYACDC | BINARY INTERFACE S/YARD, AC/DC SUPPLIES | SIEMENS | [redacted] | Y | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-BIYACDC | BINARY INTERFACE S/YARD, AC/DC SUPPLIES | SIEMENS | [redacted] | Y | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-BIYACDC | BINARY INTERFACE S/YARD, AC/DC SUPPLIES | SIEMENS | [redacted] | Y | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-CONTSYS | SVC CONTROL SYSTEM | SIEMENS | [redacted] | N | | | | | 17.38 | 8.69 | | | | | | | | | | | | |
| 1 SVC (275kV) | 1 SVC (275kV) | Multi Panels | 2007 | 3.43 | H035-SSS-1SVC-DATCONV | SVC DATA CONVERTER COMPUTER | IPCOMM | [redacted] | Y | | | | | 9.96 | 9.96 | | | 3.43 | 3.43 | NA | 3.43 | > 2042 | 2025/26 (b) | 2025/26 (b) | > 2042 (c) | NA | > 2042 (d) |
| | | | | | H035-SSS-1SVC-DISTREC | SVC DISTURBANCE RECORDERS | IBA | [redacted] | N | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-DISTREC | SVC DISTURBANCE RECORDERS | IBA | [redacted] | N | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-DISTREC | SVC DISTURBANCE RECORDERS | IBA | [redacted] | N | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-DISTREC | SVC DISTURBANCE RECORDERS | IBA | [redacted] | N | | | | | 9.96 | 9.96 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-HMI | HUMAN MACHINE INTERFACE - Monitor | FUJITSU SIEMENS | [redacted] | N | | | | | 12.00 | 10.00 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-HMI | HUMAN MACHINE INTERFACE | SIEMENS | [redacted] | N | | | | | 9.96 | 9.96 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-INDMET | SVC INDICATION METERING | ALSTOM | [redacted] | Y | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-INDMET | SVC INDICATION METERING | ALSTOM | [redacted] | Y | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-INDMET | SVC INDICATION METERING | | [redacted] | N | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-INDMET | SVC INDICATION METERING | | [redacted] | N | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-INDMET | SVC INDICATION METERING | | [redacted] | N | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-INDMET | SVC INDICATION METERING | | [redacted] | N | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-INDMET | SVC INDICATION METERING | | [redacted] | N | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-OWCOVERT | OPSWAN CONVERTER | PHOENIX | [redacted] | N | | | | | | | 12.00 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-OWINVERT | OPSWAN INVERTER | LATRONICS | [redacted] | N | | | | | | | 12.00 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-OWNTWK | OPSWAN NETWORK | RUGGEDCOM | [redacted] | N | | | | | | | 9.96 | 9.96 | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-OWNTWK | OPSWAN NETWORK | ALLOY | [redacted] | N | | | | | | | 9.96 | 9.96 | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-OWPRINT | OPSWAN PRINTER | HEWLETT PACKARD | [redacted] | Y | | | | | | | 12.00 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-NBAY-OWCAM4 | OPSWAN CAMERA ASSEMBLY SVC YARD | CANON | [redacted] | Y | | | | | | | 10.05 | 10.00 | | | | | | | | | | |

## APPENDIX B - H035 STRATHMORE 275KV SVC SECONDARY SYSTEMS - EQUIPMENT HEALTH INDICES AND RECOMMENDED REPLACEMENT TIMEFRAME

Notes:
(a): Subject to Powerlink's O&M Safety Requirements, Current Standard Solutions and Implementation Methodologies, it may be more beneficial to align with the recommended replacement timeframe of sedondary systems equipment
(b): Recommended Timeframe is based on majority of Equipment Health Indices
(c): Based on Visual Inspection and Subject to the decision of the Control Building and Secondary Systems Panels. A number of New Cables may be requried if location of control building or secondary systems panels is changed.
(d): As a minimum requirement, Rubber Seals, Air filter and Terminals and Links are required to be repalced by the recommended timeframe. New Marshalling Kiosks should be considered if Exsiting Cables are to be replaced.

| BAY | C&P PANEL | | | | SECONDARY SYSTEMS EQUIPMENT | | | | | X-PROT | | Y-PROT | | AUX & CTRL | | OPSWAN | | CABLES (HI) | CABLES (HI) | CABLES (HI) | YARD MARSHALLING KIOSKS (HI) | RECOMMENDED REPLACEMENT TIMMING (Based on Trigger Conditions only, Exclude considerations for Solutions, implementation methodologies): C&P PANELS (Chassis) | Sec Sys Eqiupment | CABLES | | | YARD MARSHALLING KIOSKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Function | Panel Descripion | Panel No. | Year | HI | Functional Loc. | Description | Manufacturer | Model number | Obsolete (Yes or No) | Eff. Age | HI | Eff. Age | HI | Eff. Age | HI | Eff. Age | HI | C&P Panels To Termination Racks | Termination Racks to HV Yard Marshalling Panels (MK, CT, VT, AC, DC) | C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) | Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) | C&P Panels | Sec Sys Equipment & Auxiliary Components | C&P Panels To Termination Racks | Termination Racks to HV Yard Marshalling Panels (CB, MK, CT, VT, AC, DC, COOLING) | C&P Panels Directly to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) - *New Termination Racks May be Required* | Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING) |
| 1 SVC (275kV) | 1 SVC (275kV) | Multi Panels | 2007 | 3.14 | H035-SSS-NBAY-OWNTWKS | OPSWAN NETWORK BUILDING +SVC | WYSE | [redacted] | Y | | | | | | | 5.78 | 5.78 | 3.43 | 3.43 | NA | 3.43 | > 2042 | 2025/26 (b) | 2025/26 (b) | > 2042 (c) | NA | |
| | | | | | H035-SSS-NBAY-OWNTWKS | OPSWAN NETWORK BUILDING +SVC | WYSE | | Y | | | | | | | 5.78 | 5.78 | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-OWPSA | OPSWAN PERIMETER SECURITY APPLIANCE | FORTINET | | Y | | | | | | | 11.00 | 10.00 | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-OWSTNTWK | SVC TO OPSWAN ST CONECTOR | RUGGEDCOM | | N | | | | | | | 9.96 | 9.96 | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-RTU | SVC REMOTE TERMINAL UNIT | FOXBORO | | Y | | | | | 10.50 | 5.25 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-SERVPC | SVC SERVICE COMPUTER | SIEMENS | | N | | | | | 9.96 | 9.96 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-SVCNTWK | SVC CONTROL SYSTEM NETWORK | RUGGEDCOM | | N | | | | | 9.96 | 9.96 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-SVCXPROT | SVC X PROTECTION TRF,BUS,TCR,TSC,FILTER | SIEMENS | | N | 9.96 | 4.98 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-SVCYPROT | SVC Y PROTECTION TRF,BUS,TCR,TSC,FILTER | SIEMENS | | N | | | 9.96 | 4.98 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-TCRVBE | TCR VALVE BASE ELECRTONIC | SIEMENS | | N | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-TCRXPROT | TCR X PROTECTION | SIEMENS | | N | 9.96 | 4.98 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-TCRYPROT | TCR Y PROTECTION | SIEMENS | | N | | | 9.96 | 4.98 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-TIMING | SVC TIMING SYSTEM | SIEMENS | | N | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-TRFXPROT | SVC 3 TRANSFORMER X PROTECTION | SIEMENS | | N | 9.96 | 4.98 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-TRFXPROT | SVC 3 TRANSFORMER X PROTECTION | SIEMENS | | N | 9.96 | 4.98 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-TSCVBE | TSC VALVE BASE ELECRTONIC | SIEMENS | | N | | | | | 9.96 | 4.98 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-TSCXPROT | TSC X PROTECTION | SIEMENS | | N | 9.96 | 4.98 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-TSCXPROT | TSC X PROTECTION | TRENCH | | N | 7.15 | 3.58 | | | | | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-TSCYPROT | TSC Y PROTECTION | SIEMENS | | N | | | 9.96 | 4.98 | | | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-VCOOLCON | VALVE COOLER CONTROL SYSTEM | SIEMENS | | N | | | | | 17.38 | 8.69 | | | | | | | | | | | | |
| | | | | | H035-SSS-1SVC-VCOOLCON | VALVE COOLER CONTROL SYSTEM | SIEMENS | | N | | | | | 9.96 | 4.98 | | | | | | | | | | | | |

| **Planning Report** | **27/10/2020** |
|---|---|
| Title | CP.02829 H035 Strathmore SVC Secondary Systems Replacement |
| Zone | North Queensland |
| Need Driver | Emerging compliance risks arising from condition and obsolescence of Strathmore SVC's ageing secondary systems. |
| Network Limitation | The Strathmore SVC is required to maintain the CQNQ power transfer capability to the North Queensland load centres and manage voltage levels within the NER system standards. |
| Pre-requisites | None |

## Executive Summary

The Strathmore 275kV SVC -80/+260 MVAr, manufactured by Siemens, was installed in 2007.

Condition assessment shows operational and compliance risks associated with aging and obsolete secondary systems, thyristor valve control systems and cooling control systems equipment associated with the Strathmore SVC.

The Central scenario load forecasts confirm an enduring need for an ongoing voltage support to manage high voltages and maintain exist power transfer capability into North Queensland.

The removal of the Strathmore SVC would violate voltage system standards following outages of other reactive devices in North Queensland and significantly impact the power transfer capability between central and north Queensland.

The preferred network solution for Powerlink to continue to meet its statutory obligations is the replacement of the at-risk secondary systems, thyristor valve control systems and cooling control systems equipment associated with the Strathmore SVC.

This will ensure ongoing compliance with Powerlink's Electricity Act, Electrical Safety Act and Electricity Safety Regulation obligations.

## Table of Contents

## 1. Introduction

H035 Strathmore Substation is a major 275 and 132kV substation located approximately 5km from the Collinsville Township. The substation, established, in 2001 consists of both 275kV and 132kV switching bays.

The 275kV SVC -80/+260 MVAr, manufactured by Siemens, was installed in 2007 on a separate platform, approximately 300m from the 275kV switchyard. The SVC and substation's earth-grids are joined together by earth-grid conductors. A short transmission line links the SVC transformer and the substation 275kV switching bays.

Figure 1 shows the geographic location in the vicinity of the Strathmore Substation and Figure 2 shows the location of the SVC relative to the 275kV switchyard.

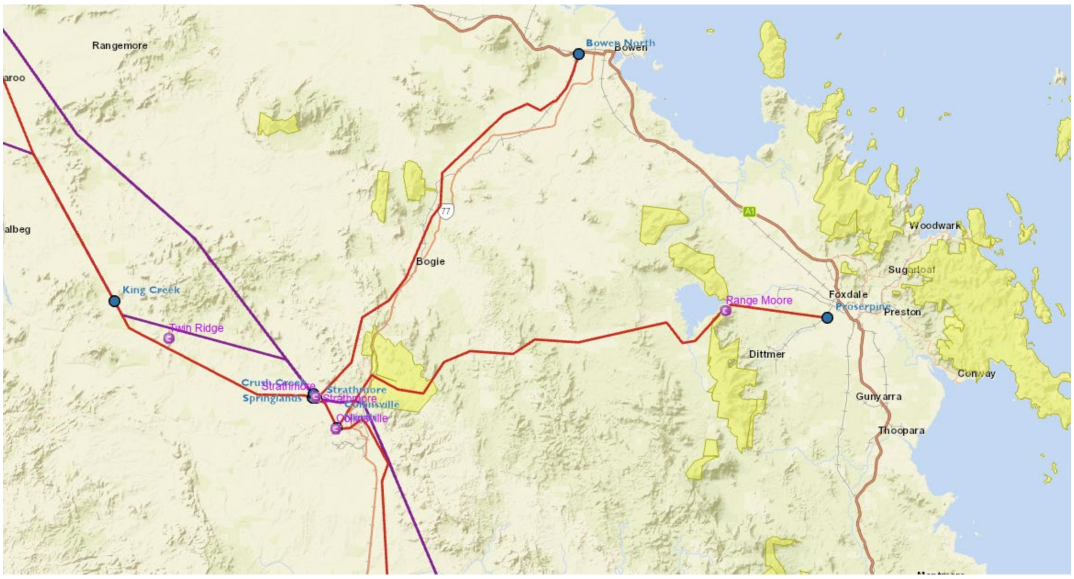



Figure 1. Geographic location of the Broadsound Substation

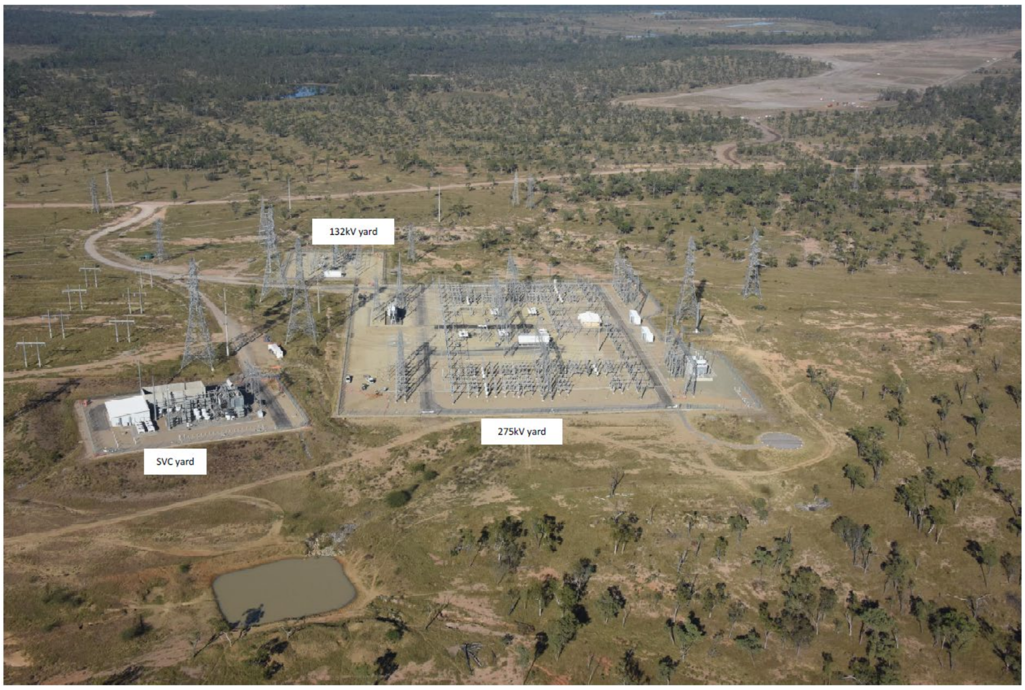



Figure 2. Strathmore Substation Aerial View

A condition assessment recommends the SVC secondary systems, thyristor valve control systems and cooling control systems equipment to be replaced to maintain network reliability and availability within Powerlink's current standards, and to minimise operational and compliance risks associated with aging and obsolete secondary systems assets. Furthermore, replacement of the SVC secondary systems will enable the control system to be modified to provide additional support for low fault level operation.

This report assesses the impact that removal of the at-risk plant would have on the performance of the network and Powerlink's statutory obligations. It also establishes the indicative requirements of any potential alternative solutions to the current services provided by Broadsound Substation.

## 2. H035 Strathmore Substation configuration

Figure 3 shows the existing connection configuration of the Strathmore Substation, highlighting the connection of the Strathmore SVC.

[redacted]

Secondary Systems scope under CP.02829

Figure 3. Strathmore Substation operating diagram

## 3. North Queensland Demand Forecast

The Northern region includes substations between the Central and Far North Queensland (excluding the Central West and Gladstone zones). The combined load must be met by the North Queensland generation and the power transfer capacity of the CQNQ 275kV grid section.

Figure 4 shows that the maximum demand for these loads is expected to gradually increase over the forecast period.

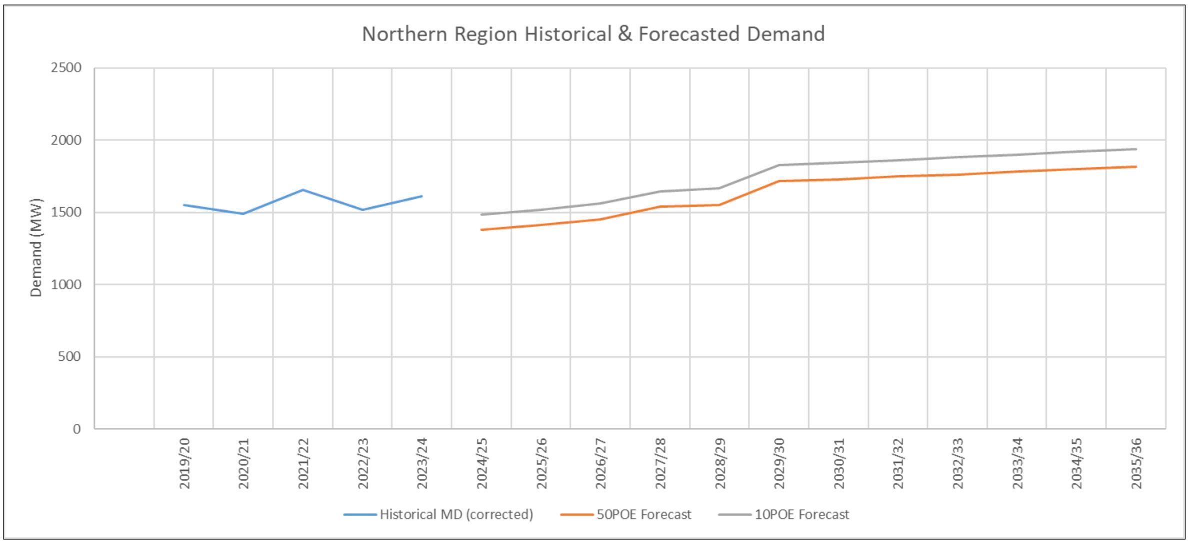



Figure 4. Northern Queensland demand forecast

The historical load duration curves for the combined Far North Queensland, Ross and North Queensland zones are shown in Figure 5.

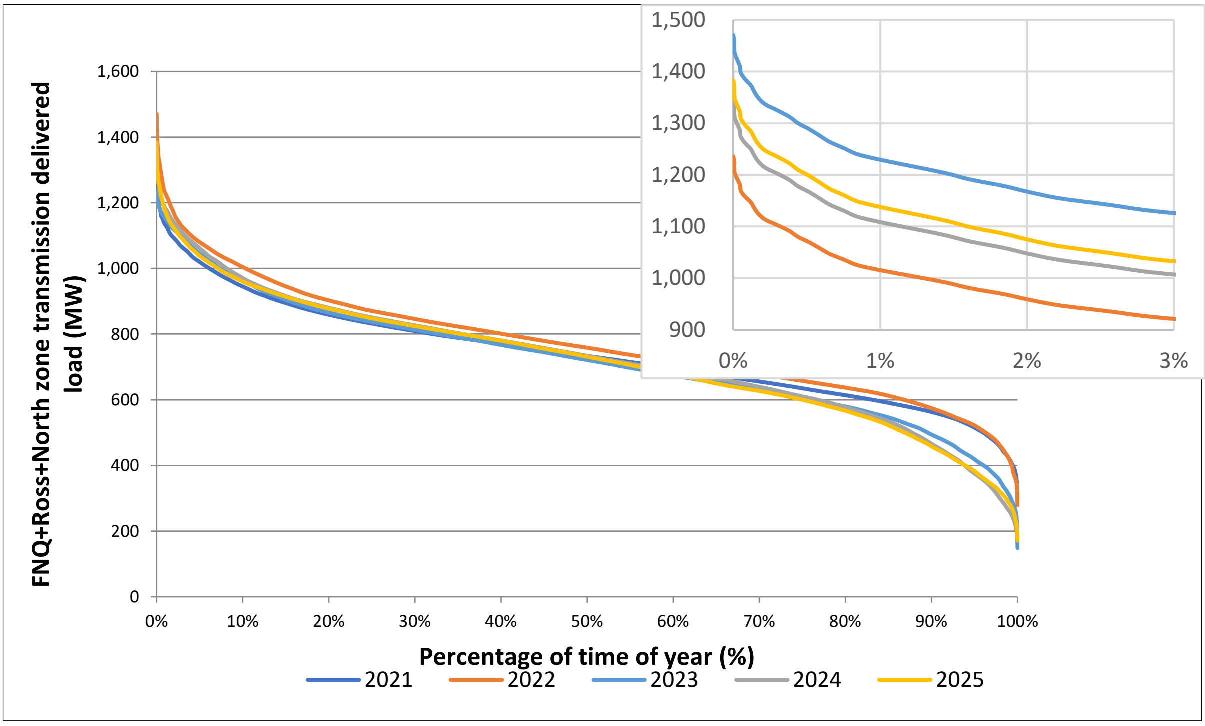



Figure 5. Historical Load Duration Curves for the aggregate of FNQ, Ross and North Queensland zones.

In addition to the Central scenario load forecast the 2025 Transmission Annual Planning Report (Table 2.1) describes several proposals for large mining, metal processing, other industrial loads, including the electrification of existing operations. While these developments have not progressed sufficiently to be included (either wholly or in part) in Powerlink's Central scenario forecast of future load, they collectively represent approximately 1500MW across Northern Queensland.

Such load would have a significant impact on transmission system performance and adequacy between central and Northern Queensland.

# 4. Statement of Investment Need

The Strathmore SVC was commissioned in 2007. Its primary role is to control voltage levels and increase voltage and transient stability enabling higher power transfers on the 275kV network. The reactive range of the SVC is:

- Strathmore SVC -80 MVAr to +260MVAr.

## 4.1 The Strathmore meets the technical requirements in North Queensland

The Strathmore SVC provides the following functions:

- valued operational tool for voltage management in north Queensland
- contributes to the management of over voltage limitations in North Queensland during periods of low load and/or low power transfer conditions
- increases the central to north Queensland voltage stability limit by 100MW to 120MW
- increases the power transfer capability between north and central Queensland.

## 4.2 Managing high voltages in North Queensland

The SVC plays a critical role in mitigating high voltages in north Queensland.

The historical operating point of the Strathmore SVC for the calendar year 2024 is shown in Figure 6.

During 2024 the SVC operated inductive for 80% of the time and at more than 50MVAr inductive for approximately 10% of the time. This is an indication of the current role it is required to play in the management of high voltages in north Queensland.

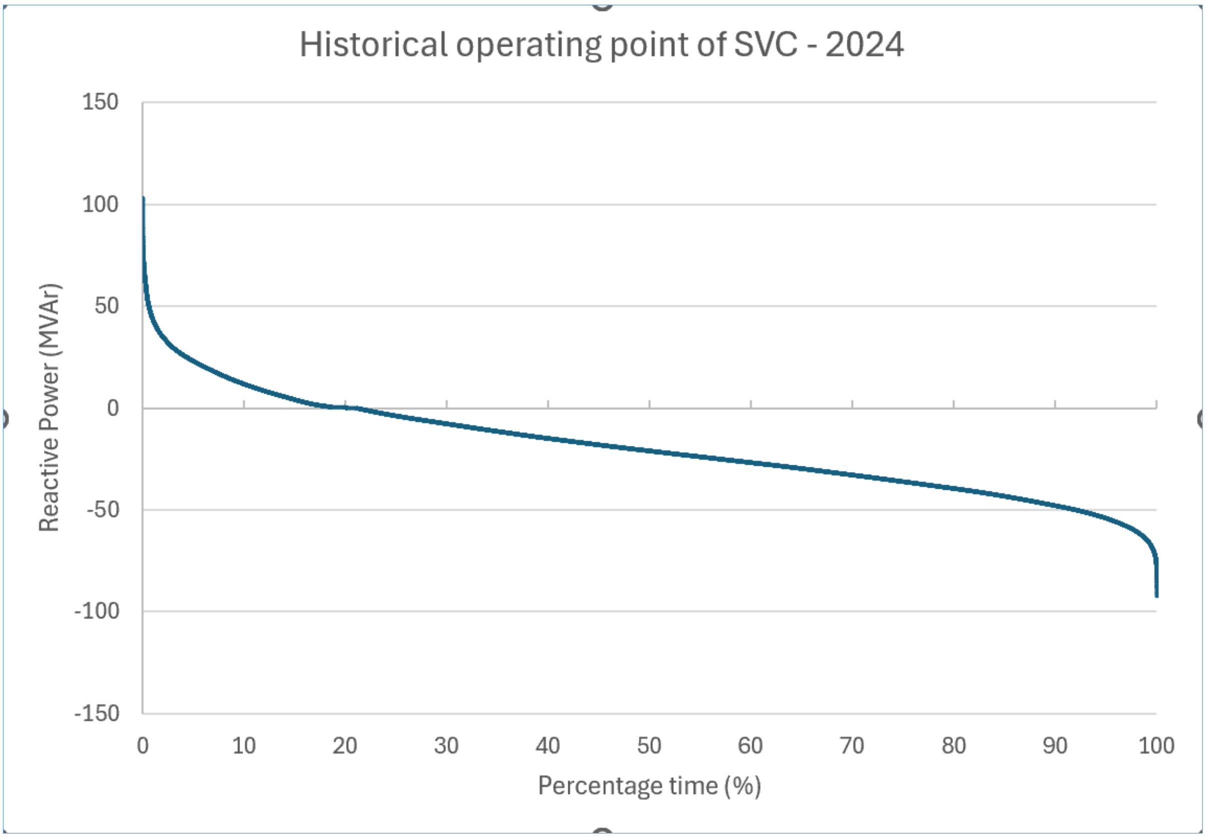



Figure 6. Historical operation of the Strathmore SVC - 2024

### 4.2.1 Analysis methodology

The amount of reactive power absorption capacity required to manage voltages in North Queensland was further assessed by analysing time sequential (system intact) snapshots from FY 2025.

These snapshots were modified to take account of increasing reactive requirements in North Queensland (refer to Section 4.2.1) but balanced by the addition of committed generation (refer to Section 4.2.2) not modelled in the original historical snapshots. The analysis also retuned the voltage control setpoints in North Queensland to lower the system intact voltage profile.

The resulting half-hour snapshots were then reanalysed with:

- the Strathmore SVC removed from service (new system normal)
- trip one 84MVAr shunt reactor at Strathmore or Ross substations (N-1)

- Following the N-1, assess the ability to resecure the network (N-1-secure) by tripping a 84MVAr shunt reactor at Ross
- Switch two 275kV circuits out-of-service (Nebo to Strathmore and Strathmore to Ross) if the N-1-secure voltage profile is too high.

The playback of this analysis is summarised in Section 4.2.3.

### 4.2.2 Increasing reactive requirements in North Queensland

The load in North Queensland (Far North, Ross and North zones) is becoming increasingly capacitive. This trend has been analysed over the past 5-years from operational load SCADA data.

Figure 7 shows the average change in the total reactive component of the load in North Queensland, between 2020 and 2025. This shows a plot of the average yearly increase in MVAr load for each 48-half hour periods for each day that corresponds within a given season. The graph also shows the average yearly increase in MVAr load, averaged across all seasons.

The analysis shows that depending on the time of day the increase in capacitive current that must be absorbed by the network is between 10 MVA to 15MVAr per annum.

This increasing need for reactive power absorption in North Queensland must be taken into account when assessing the need reactive power absorption capability from network or non-network sources.

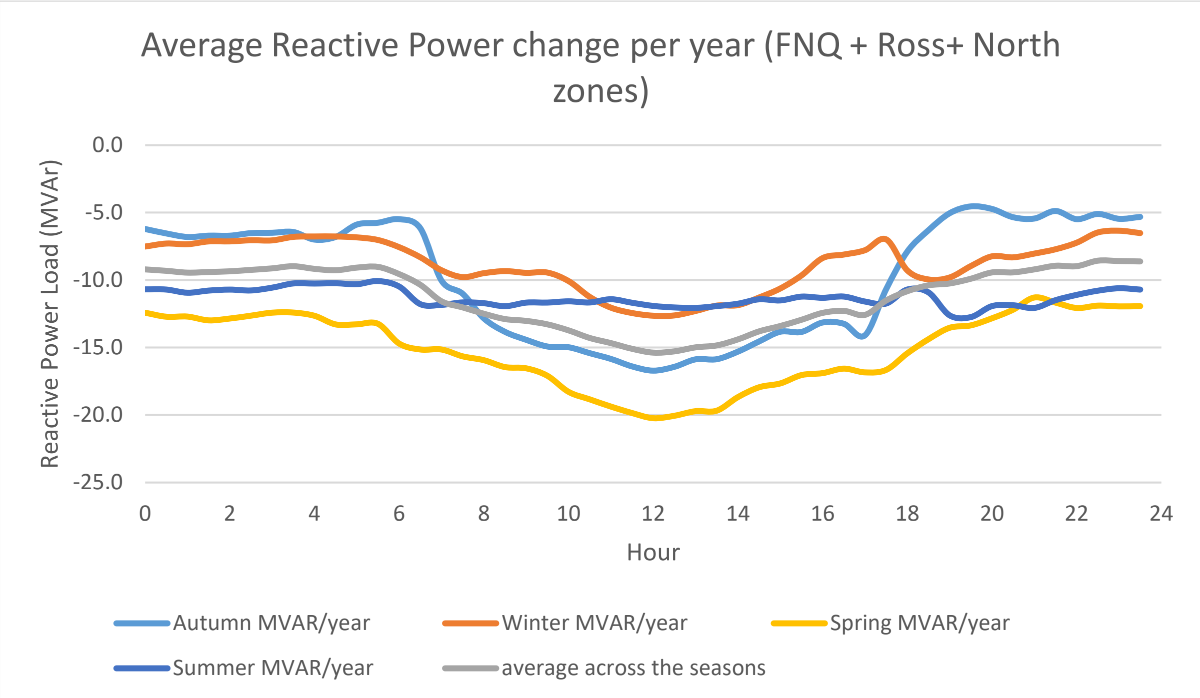



Figure 7. Historical operation of the Strathmore SVC - 2024

### 4.2.3 Pipeline of additional voltage control plant in north Queensland

Assessing the need for reactive power absorption in North Queensland must also take into account the operation of existing and committed generation (synchronous and inverter-based) in north Queensland.

Committed generation not included in this analysis includes:

- Kidston PHES – this is in Far North Queensland and remote from grid. The PHES connects via a 190km single circuit 275kV line to the Guybal Munja Substation (mid-way between Ross and Chalumbin. The ability of this plant to impact voltages on the interconnected network is limited. However, to make some allowance the Chalumbin 275kV voltage has been excluded from the analysis in Tables 1 and 2.
- Broadsound Solar Farm – this is approximately 320km from Strathmore
- Lotus Creek Wind Farm – this s approximately 270km from Strathmore
- Yabulu BESS – Yabulu South Substation near Townsville.

### 4.2.4 Results of snapshot playback analysis

Power flow analysis confirms that voltage level in north Queensland would violate the obligations in the National Electricity Rules (NER) in the event of outages of other reactive plant in north Queensland if the SVC was out-of-service.

As a planning standard a threshold of 1.09pu has been used to capture the occurrences of non-compliance against the NER System Standard (NER S5.1a.4). Applying this margin (0.01pu) to the NER System Standard is considered prudent and takes account of modelling errors, metering and other levels of uncertainty (including system tuning).

The result of this analysis is summarised in Table 1. This analysis, and that of Table 2, observes the 275kV voltages from Broadsound to Ross (inclusive).

Table 1. Playback of voltage profile in North Queensland with the Strathmore SVC out-of-service

| | **N-1** | | **N-1-secure** | | **N-1-secure (plus 2 circuits out-of-service)** |
|---|---|---|---|---|---|
| | Max Vpu | % time > 1.09pu | Max Vpu | % time > 1.09pu | % time > 1.09pu |
| Voltages in North Queensland | 1.13 | 1.6% | 1.136 | 9.3% | 0.9% |

Depending on system conditions, the critical contingency can either be an outage of an 84MVAr shut reactor at Strathmore or Ross substations. These results are denoted in the "N-1" column of Table 1.

Following an outage of one of these reactors, AEMO has 30-minutes to resecure the network. This must take into account the possibility of losing another shunt reactor or voltage control device. The consequence of which is shown in the "N-1-secure" columns of Table 1. The furthest most right column shows the results with two 275kV circuits (refer to Section 4.2.1) switched out of service to help manage over voltages when resecuring the network. Even with this operational strategy violation of the voltage criterion still occurs 0.9% of the time.

The playback of the system snapshots was further investigated to determine the breakdown (time-of-day and season) of the occurrence of high voltages in north Queensland. These insights are summarised in Table 2.

The potential over voltage limitation occurs day and night and across all seasons. As shown in the subsequent analysis this is forecast to be a growing problem unless additional reactive power absorption capability emerges or is installed in north Queensland.

Table 2. Distribution of the forecast voltage violations

| | | Time of day | | Season | | | |
|---|---|---|---|---|---|---|---|
| | | Day | Evening | Autumn | Winter | Spring | Summer |
| Distribution of forecast voltages violations in North Queensland | N-1-1 | 40% | 60% | 2% | 36% | 22% | 41% |
| | N-1 | 43% | 57% | 0% | 23% | 43% | 33% |

A significant observation from Table 2 is the high percentage of potential voltage violations that occur during the day.

Notwithstanding that contracts for reactive power support (Q at night) may be able to address the evening violations (the hypothesis of which has not been tested), the day-time violations point to the need for additional reactive power absorption capability to be augmented into the Norh Queensland system if the Strathmore SVC is removed from service.

Therefore, not reinvesting in the Strathmore SVC would result in a reduction of 80 MVAr of reactive power absorption capability. As demonstrated, this has an adverse impact on the ability to manage high voltages in north Queensland within the required system standards.

### 4.3 Dynamic reactive power increases power transfer capability

The Strathmore SVC also provides 260MVAr of dynamic capacitive reactive power. This increases the voltage and transient stability limits into North Queensland. For example, the Strathmore SVC adds approximately 100MW to 120MW to the voltage stability limit into North Queensland. This has the potential to defer more expensive network augmentation between central and north Queensland under load growth scenarios described in Section 3.

The Strathmore SVC also increases the power transfer between northern and central Queensland. This is the subject of joint planning with Queensland Investment Corporation (QIC) to understand the hosting capacity of the eastern section of the CopperString Project between the Flinders Regional Energy Hub (REH) and the connecting substation (Reid River) south of Townsville.

Initial studies by Powerlink have shown that the export capacity of the Flinders REH depends on the strength of the North Queensland network. The Strathmore SVC increases this network strength in North Queensland.

## 5. Non-Network Options

Non-network solutions would need to replicate the support that the Strathmore SVC gives to the operation and capability of the North Queensland power system.

At minimum the potential non-network solutions would need to be capable of delivering up to 260MVAr of dynamic capacitive support and 80MVAr of inductive voltage support. This reactive power capacity is in addition to the already existing and committed dynamic plant (inverter-based and/or synchronous) in North Queensland.

Powerlink is not presently aware of any Demand Side Solutions (DSM) in Northern Queensland capable of meeting this requirement. However, Powerlink welcomes submissions from proponents and will investigate the feasibility of potential non-network options as part of the formal RIT-T consultation process.

# 6. Network Options

This section discusses the options which were considered to address the above identified condition based secondary systems issues.

## 6.1 Proposed Option to address the identified need

To address the emerging condition issues it is recommended that the SVC secondary systems, thyristor valve control systems and cooling control systems equipment to be replaced.

This will allow Powerlink to meet its reliability of supply and safety obligations under its Transmission Authority, the Electricity Act 1994 and Section 5.1 of the Rules.

The proposed network solution will not have any material inter-network impact, and as such does not need to formally consult with other Market Participants.

## 6.2 Option Considered but Not Proposed

This section discusses alternative options that Powerlink has investigated but does not consider technically and/or economically feasible to address the above identified issues and thus are not considered credible options.

### 6.2.1 Do Nothing

“Do Nothing” would not be an acceptable option as the primary drivers (secondary systems) and associated operational and compliance risks would not be resolved. Furthermore, the “Do Nothing” option would not be consistent with good industry practice and would result in Powerlink breaching their obligations with the requirements of the System Standards of the National Electricity Rules and its Transmission Authority.

### 6.2.2 Installation of an 84MVAr shunt reactor

Section 4.2 demonstrates that without the Strathmore SVC in service, voltage levels in North Queensland may not be able to be managed within compliant levels following the outage of other inductive plant in North Queensland. This limitation could be managed by installing an additional 84MVAr shunt reactor at Strathmore Substation.

Whilst addressing the over voltage limitation this option does not maintain the existing voltage and/or transient stability limits into and out of North Queensland.

To address both needs a 84MVAr reactor and up to three 85MVAr switched capacitor banks would need to be installed. These devices would deliver equivalent static reactive capability to the Strathmore SVC, but not provide the equivalent dynamic performance. This would result in inferior transient performance and given the cost of the reactive devices and associated 275kV bays at a higher cost compared to reinvesting in the SVC.

# 7. Recommendations

Condition assessment shows operational and compliance risks associated with aging and obsolete secondary systems, thyristor valve control systems and cooling control systems equipment associated with the Strathmore SVC.

The Central scenario load forecasts confirm an enduring need for an ongoing voltage support to manage high voltages and maintain exist power transfer capability into North Queensland.

The removal of the Strathmore SVC would violate voltage system standards following outages of other reactive devices in North Queensland and significantly impact the power transfer capability between central and north Queensland.

The preferred network solution for Powerlink to continue to meet its statutory obligations is the replacement of the at-risk secondary systems, thyristor valve control systems and cooling control systems equipment associated with the Strathmore SVC.

This will ensure ongoing compliance with Powerlink's Electricity Act, Electrical Safety Act and Electricity Safety Regulation obligations.

## 8. References

1. H035 Strathmore Secondary Systems Condition Assessment Report – 20190715 (A3416566)
2. CP.02829 H035 Strathmore SVC Sec Sys Replacement – Project Scope Report (A4491578)
3. 2025 Transmission Annual Planning Report (A6049612)
4. Asset Planning Criteria - Framework (ASM-FRA-A2352970)
5. Powerlink Queensland's Transmission Authority T01/98

# CP.02829 H035 Strathmore SVC Secondary System Replacement

# Concept Estimate

## Table of Contents

## 1. Executive Summary

The purpose of this project is to replace the Strathmore SVC secondary systems, thyristor valves and cooling system to extend the service life by 20 years.

The concept report considers two options.

**Option 1:** The full secondary system replacement including the removal and replacement of failed capacitor bank associated with Thyristor Switched Capacitor (TSC). The proposed commissioning date is December 2028, as stated in the project scope report.

**Option 2:** The full secondary system replacement including the removal the of failed capacitor banks associated with TSC. The proposed commissioning date is December 2028, as stated in the project scope report.

This project will follow the two (2) stage approval process and be subject to a RIT-T consultation process.

[redacted]

*Figure 1 H035 Strathmore Substation Line Diagram*

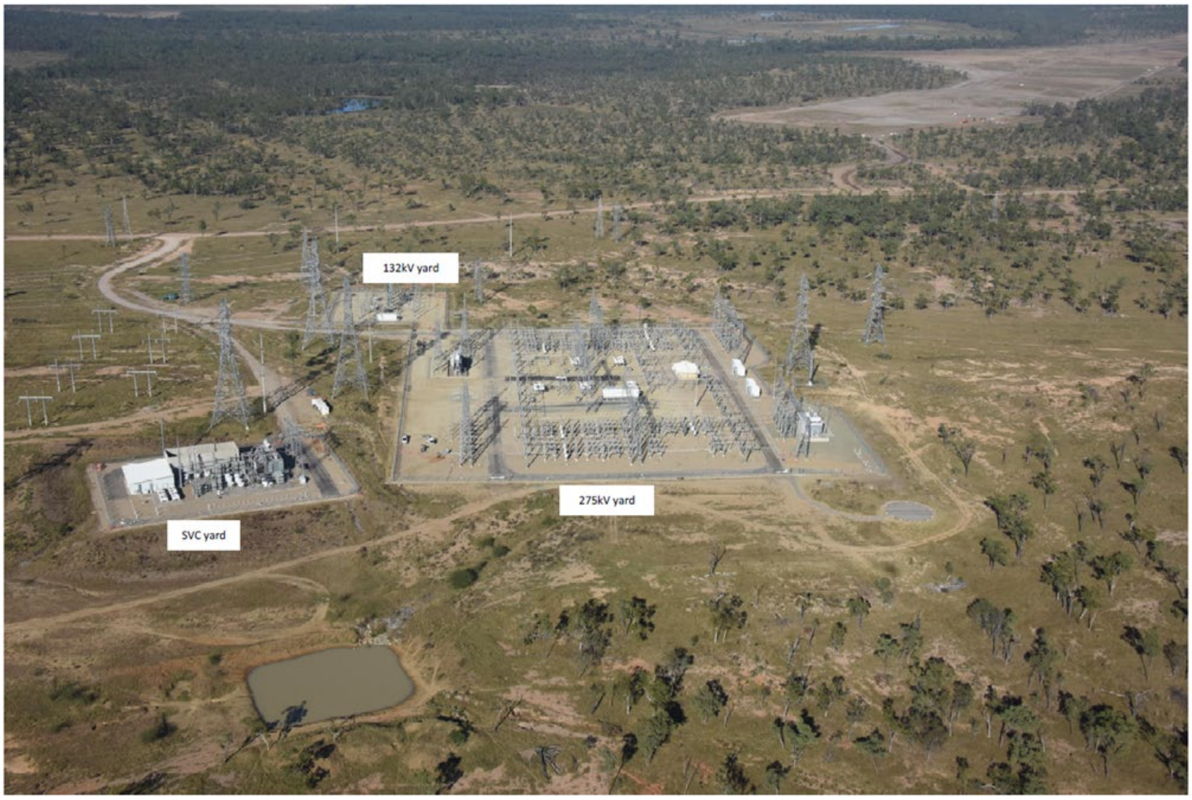



*Figure 2 H035 Strathmore Substation*

# 2. Project Information

## 2.1 Option Comparison Table

| | Option 1 | Option 2 |
|---|---|---|
| **Scope** | Design, Supply, install and commission a new secondary system, valves, and cooling system for TCR 1 and TCS 1 + new TSC 1 Capacitor Banks. | Design, Supply, install and commission a new secondary system, valves, and cooling system for TCR 1 (TSC de-commissioned) |
| **Identified Released Budget** | [redacted] | [redacted] |
| **Identified Approved Budget** | [redacted] | [redacted] |
| **Timing** | The current Project Scope Report requests a commissioning date of December 2028. The proposed project staging aligns with the requested commissioning date. | The current Project Scope Report requests a commissioning date of December 2028. The proposed project staging aligns with the requested commissioning date. |
| **Outage Requirements** | 8-week outage. | 8-week outage |

| | | |
|---|---|---|
| **Delivery Strategy** | **Design:** PQ in conjunction with specialist vendor.<br>**Construction**: Specialist vendor under NEC.<br>**SAT and Commissioning**: MSP with PQ Secondary Systems Support. | **Design:** PQ in conjunction with specialist vendor.<br>**Construction:** Specialist vendor under NEC.<br>**SAT and Commissioning:** MSP with PQ Secondary Systems Support. |
| **Opportunities** | Development of a standard specification to suit interacting projects. | Development of a standard specification to suit interacting projects. |
| **Environmental and CH issues** | Existing substation site. Minimal risk. | Existing substation site. Minimal risk. |
| **Standards Compliance / Functionality** | Specification to be developed by PQ SME's for tender and execution. | Specification to be developed by PQ SME's for tender and execution. |

## 2.2 Dependencies & Interactions

This project is dependent on the completion delivery of the following projects:

| Project No. | Project Description | Planned Commissioning Date | Comment |
|---|---|---|---|
| Interactions | | | |
| CP.03104 | Replace 275kV ABB IMB CTs - Northern | Dec 2029 | This project requires multiple bay outages. Opportunity to co-ordinate outages for the two projects. |
| CP.02985 | Trench CVT Replacement - Central North Phase 2 | Dec 2026 | If this project is delayed, it may be an opportunity to co-ordinate outages for the two projects. |
| CP.02807 | Greenbank 275kV SVC Secondary System Replacement | Dec. 2029 | This project will be delivered in conjunction with this project utilising the same specialist contractor. |
| Other Related Projects | | | |
| CP.02399 | H035 Strathmore 275kV and 132 Secondary Systems Replacement Stage 2 | TBA | SVC interface cubicle is to be designed to ensure upgrade will be compatible. |
| CP.02321 | Woree SVC Secondary Systems Replacement | Apr 2025 | This project was used as basis of this estimate. Labour hours and escalation. |

## 2.3 Site Specific Issues

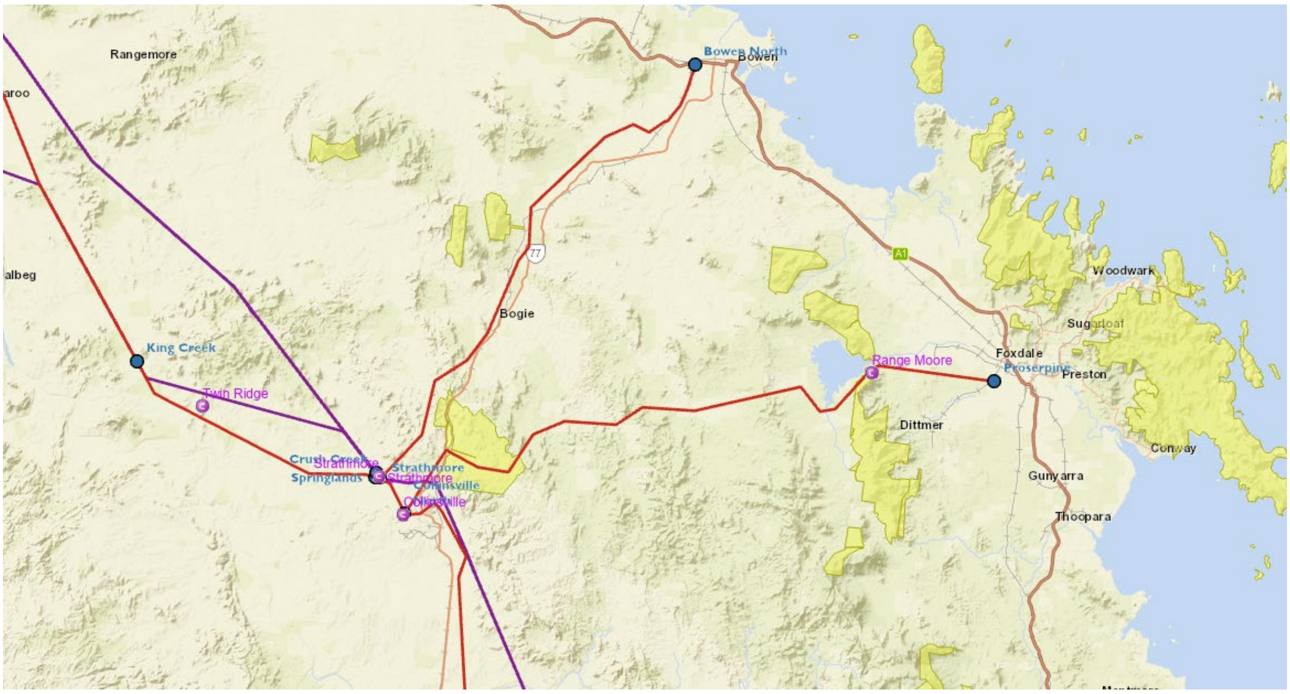



*Figure 3: Site Location:*

- Site Location:
  - 3 Hour 280km drive from Mackay Airport. Road is sealed except for the last 5 km to the Substation. The unsealed road has two causeways and may be subject to flooding.
  - Ample and suitable accommodation is available in either Collinsville or Bowen.
- Climate considerations:
  - Months of extreme heat can be experienced January to March.
- Site Access:
  - No issues identified for delivery or transport of equipment.
- Geotechnical parameters:
  - Existing foundations will be utilised.
- Noise restrictions, Construction working times:
  - No identified noise receptors.
  - 7 day a week access will not be restricted
- Environmental and Cultural Heritage issues:
  - Any works will be undertaken within the existing substation.
  - No ground disturbance will take place.
  - Cultural Heritage to be notified during the next stage of approvals.
- Services:
  - Electrical supply – Contractor will be required to supply a generator.
  - Water – No potable water on site. To be allowed for by Contractor / MSP.
  - Toilets – Due to the increase of personnel on site additional facilities will be required.
- Rosters:
  - Will be to the requirements of the contractor and MSP.
- Weather and Climate:
  - The Springlands area is subject to following average number of days of rain. Consideration was given to this while developing the project schedule.

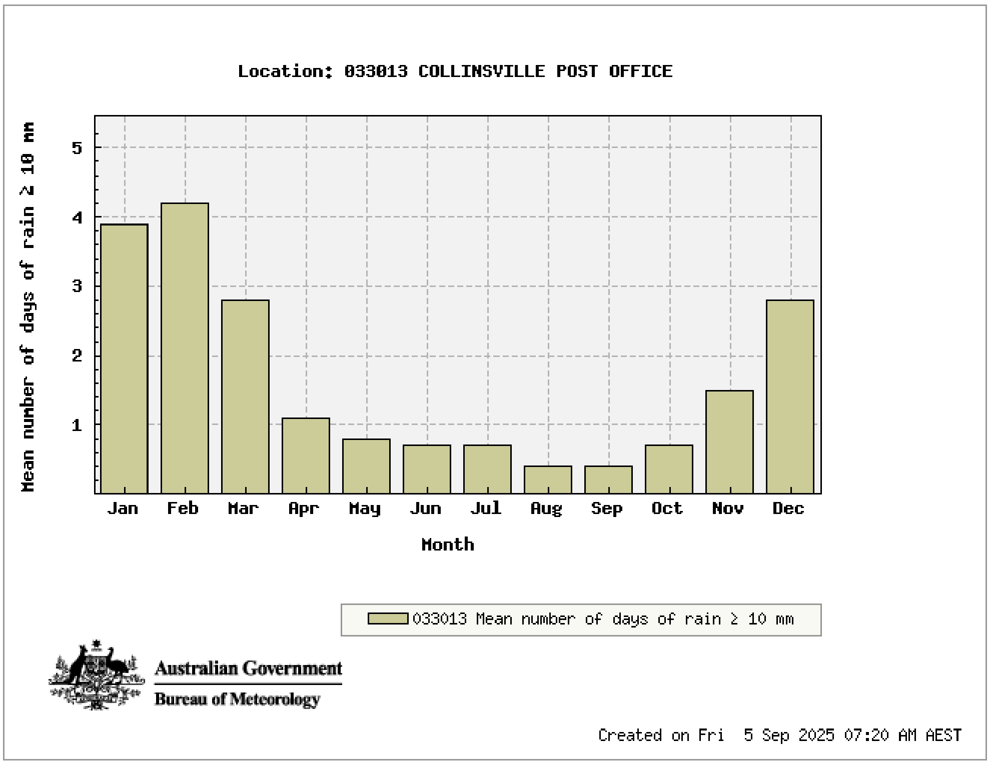



*Figure 4:Number of Days of Rain >=10mm (Source: Bureau of Meteorology 5th of September 2025)*

# 3. Option 1

## 3.1 Option Definition

### 3.1.1 Option Scope

- Design, Supply, install and commission a new secondary system, valves, and cooling system for TCR 1 and TCS 1 + new TSC1 Capacitor Banks.

[redacted]

- Design, procure, construct and commission the full replacement of all SVC secondary systems in the existing SVC control building (+4) SVC protection devices
  - SVC control system (TDC) with additional support for low fault level operation.
  - Valve control units including VBE.
  - Cooling Control systems including associated transducers.
  - All SVC automation/control equipment including GPS clock, SU200 I/O units, iPCOM SCADA gateways and Digital Fault Recorder PC.
  - All links/terminals and other miscellaneous relays, fibre isolation devices, power supplies etc.
- Replacement of thyristor valves and associated cooling system for the Thyristor Switched Capacitor (TSC) and the Thyristor Controlled Reactor (TCR) (H035-M01-VLV) if required to be compatible with the new secondary systems.
- Install an Uninterruptible Power Supply (UPS) for the cooling water system pumps.
- Review and modify interface between the SVC secondary system and the substation secondary system to accommodate new SVC protection (Strathmore C07 diameter secondary systems will be upgraded at a later stage under CP.02399 Strathmore 132kV and 275kV secondary systems replacement Stage 2).
- Replace/install cabling to accommodate the new secondary systems (condition of the existing cables and marshalling kiosks has been assessed to be in good condition and suitable for another 20 years of service).
- Review of the OpsWAN and remote monitoring facilities and upgrade as necessary to support replacement secondary systems.
- Install a new AC changeover board with DC supply for the control circuitry with AC supplies as follows:
  - Main Supply – SVC Auxiliary Transformer.
  - Back up Supply – Transformer 2 auxiliary transformer.

  - Emergency Supply – facility to plug in diesel generator.
- Replace 125V DC systems (note 125V battery banks were replaced in 2022 under OR.02350).
- New system must have appropriate Cyber security and patching for any computers, Network equipment and other related equipment to maintain a resilient system. Patches and updates are to be provided by the vendor and must come with confirmation that they have been checked and tested and that no adverse behaviour will result.
- Provision of spare parts for the new secondary systems, test equipment and training.
- Provision of long-term manufacturer support agreement for the remaining life of the SVC.
- Decommission and recover all redundant equipment, and update drawing records, SAP records, config files, etc.; accordingly.
- Review, update and catalogue spare parts, minimum stock holding and store inventories associated with Strathmore SVC systems and equipment.

#### 3.1.2 Scope Assumptions

- Project scope is based on a Secondary Systems Condition assessment published November 2018.
- For a GE or Hitachi solution to be compatible with the existing SVC primary plant, the thyristor valves and cooling system will require replacement.
- Siemens do not currently offer a secondary systems replacement solution that meets Powerlink's Asset Management requirements. Further investigation will be required upon submission of tender.
- Estimate has been compiled using preliminary pricing supplied from GE as this has been identified as the most likely delivery strategy.

#### 3.1.3 Scope Exclusions

- Replacement of any primary plant other than the failed capacitor bank.
- Telecoms upgrade.
- Any building extension or civil construction.
- Upgrade to access tracks, internal roadways.
- Extensive replacement of multi-core cables within the SVC yard.

## 3.2 Project Execution

### 3.2.1 Project Schedule

| Milestones | High-Level Timings |
|---|---|
| Class 5 Project Proposal Submission | August 2025 |
| Request for Class 3 Estimate | October 2025 |
| Class 3 Project Proposal Submission | March 2026 |
| RIT-T (assumed 26 weeks) | April 2026 – September 2026 |
| *Stage 1 Approval (PAN1)* includes funds for design & procurement | Jan 2027 |
| Project Development Phase 1 & Phase 2 | May 2027 |
| Reconcile Estimate and Submit PMP for Stage 2 Approval | July 2027– December 2027 |
| *Stage 2 Approval (PAN2)* | April 2028 |
| Site Mobilisation | August 2028 – October 2028 |
| Project Commissioning | October 2028 |

### 3.2.2 Network Impacts

- The construction and commissioning of the project will require an eight-week outage to the SVC.
- Concurrent outages with Bus 1 reactor at Strathmore and any other north Queensland SVCs including Nebo, Ross and Woree are to be avoided.
- Outages during the winter period (June, July and August) should be avoided due to low system loads in north Queensland and subsequent high system voltages overnight.
- AEMO summer outage guidelines also suggest avoiding reactive plant outages for the 4 weeks from mid-Dec to mid-Jan for high voltage management.
- Outages during the summer period (January, February) should also be avoided as high system loads require SVCs to be in-service to assist with maintaining system voltages pre/post contingency.
- Outages on Strathmore SVC will affect the Central Queensland to Northern Queensland voltage stability limits.

### 3.2.3 Resourcing

Design:

- Internal design in conjunction with Specialist Contractor.

Construction:

- Specialist Contractor.

Commissioning:

- FAT, Specialist Contractor witnessed by Powerlink Representatives. Overseas location to be determined.
- Switching requirements SAT and final testing – MSP. RFQ to be submitted as part of the class 3 proposal.
- Secondary system support – PQ.
- Network Operations – PQ.

### 3.3 Project Estimate

| | | Total $ |
|---|---|---|
| **Estimate Class** | 5 | |
| **Estimate accuracy (+% / -%)** | -50% / 100 % | |
| Base Estimate | | $23,496,741 |
| [redacted] | | [redacted] |
| [redacted] | | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | | [redacted] |
| [redacted] | | [redacted] |

# 4. Option 2

## 4.1 Option Definition

### 4.1.1 Option Scope

- Design, Supply, install and commission a new secondary system, valves, and cooling system for Thyristor Control Reactor 1 and Thyristor Controlled Series Capacitor 1 +. Decommission and remove Thyristor Switched Capacitor 1.

[redacted]

- Design, procure, construct and commission the full replacement of all SVC secondary systems in the existing SVC control building (+4) SVC protection devices.
    - SVC control system (TDC) with additional support for low fault level operation.
    - Valve control units including VBE.
    - Cooling Control systems including associated transducers.
    - All SVC automation/control equipment including GPS clock, SU200 I/O units, iPCOM SCADA gateways and Digital Fault Recorder PC.
    - All links/terminals and other miscellaneous relays, fibre isolation devices, power supplies etc.
- Replacement of thyristor valves and associated cooling system for the Thyristor Switched Capacitor (TSC) and the Thyristor Controlled Reactor (TCR) (H035-M01-VLV) if required to be compatible with the new secondary systems.
- Install an Uninterruptible Power Supply (UPS) for the cooling water system pumps.
- Review and modify interface between the SVC secondary system and the substation secondary system to accommodate new SVC protection (Strathmore C07 diameter secondary systems will be upgraded at a later stage under CP.02399 Strathmore 132kV and 275kV secondary systems replacement Stage 2).
- Replace/install cabling to accommodate the new secondary systems (condition of the existing cables and marshalling kiosks has been assessed to be in good condition and suitable for another 20 years of service).

- Review of the OpsWAN and remote monitoring facilities and upgrade as necessary to support replacement secondary systems.
- Install a new AC changeover board with DC supply for the control circuitry with AC supplies as follows:
  - Main Supply – SVC Auxiliary Transformer.
  - Back up Supply – Transformer 2 auxiliary transformer.
  - Emergency Supply – facility to plug in diesel generator.
- Replace 125V DC systems (note 125V battery banks were replaced in 2022 under OR.02350).
- New system must have appropriate Cyber security and patching for any computers, Network equipment and other related equipment to maintain a resilient system. Patches and updates are to be provided by the vendor and must come with confirmation that they have been checked and tested and that no adverse behaviour will result.
- Provision of spare parts for the new secondary systems, test equipment and training.
- Provision of long-term manufacturer support agreement for the remaining life of the SVC.
- Decommission and recover all redundant equipment, and update drawing records, SAP records, config files, etc.; accordingly.
- Review, update and catalogue spare parts, minimum stock holding and store inventories associated with Strathmore SVC systems and equipment.

#### 4.1.2 Major Scope Assumptions

- Project scope is based on a Secondary Systems Condition assessment published November 2018.
- For a GE or Hitachi solution to be compatible with the existing SVC primary plant, the thyristor valves and cooling system will require replacement.
- Siemens do not currently offer a secondary systems replacement solution that meets Powerlink's Asset Management requirements. Further investigation will be required upon submission of tender.
- Estimate has been compiled using preliminary pricing supplied from GE as this has been identified as the most likely delivery strategy.

#### 4.1.3 Scope Exclusions

- Replacement of any primary plant other than the failed capacitor bank.
- Telecoms upgrade.
- Any building extension or civil construction.
- Upgrade to access tracks, internal roadways.
- Extensive replacement of multi-core cables within the SVC yard.

## 4.2 Project Execution

### 4.2.1 Project Schedule

| Milestones | High-Level Timings |
| --- | --- |
| Class 5 Project Proposal Submission | August 2025 |
| Request for Class 3 Estimate | October 2025 |
| Class 3 Project Proposal Submission | March 2026 |
| RIT-T (assumed 26 weeks) | April 2026 – September 2026 |
| *Stage 1 Approval (PAN1)* includes funds for design & procurement | Jan 2027 |
| Project Development Phase 1 & Phase 2 | May 2027 |
| Reconcile Estimate and Submit PMP for Stage 2 Approval | July 2027– December 2027 |
| *Stage 2 Approval (PAN2)* | April 2028 |
| Site Mobilisation | August 2028 – October 2028 |
| Project Commissioning | October 2028 |

### 4.2.2 Network Impacts

- The construction and commissioning of the project will require an eight-week outage to the SVC.
- Concurrent outages with Bus 1 reactor at Strathmore and any other north Queensland SVCs including Nebo, Ross and Woree are to be avoided.
- Outages during the winter period (June, July and August) should be avoided due to low system loads in north Queensland and subsequent high system voltages overnight.
- AEMO summer outage guidelines also suggest avoiding reactive plant outages for the 4 weeks from mid-Dec to mid-Jan for high voltage management.
- Outages during the summer period (January, February) should also be avoided as high system loads require SVCs to be in-service to assist with maintaining system voltages pre/post contingency.
- Outages on Strathmore SVC will affect the Central Queensland to Northern Queensland voltage stability limits.

#### 4.2.3 Resourcing

Design:

- Internal design in conjunction with Specialist Contractor

Construction:

- Specialist Contractor.

Commissioning:

- FAT, Specialist Contractor witnessed by Powerlink Representatives. Overseas location to be determined.
- Switching requirements SAT and final testing – MSP. RFQ to be submitted as part of the class 3 proposal.
- Secondary system support – PQ.
- Network Operations – PQ.

### 4.3 Project Estimate

| | | Total $ |
|---|---|---|
| **Estimate Class** | 5 | |
| **Estimate accuracy (+% / -%)** | -50% / 100 % | |
| Base Estimate | | $17,218,438 |
| [redacted] | | [redacted] |
| [redacted] | | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | | [redacted] |
| [redacted] | | [redacted] |

The estimate strategy has been based on the actual hours extracted from project CP.02321 Woree SVC Secondary Systems Replacement. This in conjunction with SME verification and preliminary quotation received from GE Hitachi.

## 5. Project Risks:

| Description | Impact | Likelihood | Mitigation Strategy |
| --- | --- | --- | --- |
| Availability of Resources:<br>• Contractor<br>• MSP (OSD) | Major | Moderate | ITT for contract issued in early works stage.<br>RFQ will be issued as part of the Project Proposal. |
| Change in project delivery strategy due to:<br>• Network Outage Change<br>• Staging Change | Medium | Possible | Review Strategy, staging, outage and design on an ongoing basis. |
| Wet weather impacts during construction. | Minor | Possible | Project timing is to be planned prior to the wet season. |
| RIT-T process (assumed duration 26 weeks): Any delays to this process will directly impact the commissioning date. | Minor | Possible | Maintain communication with the Sponsor during RIT-T so that any foreseeable delay can be managed appropriately. |

# 6. References

| Document | Version | Date |
|---|---|---|
| Project Scope Report | 3 | 1/05/2025 |

# Project Scope Report

# CP.02829

# H035 Strathmore SVC Sec Sys Replacement

## Concept – Version 3

### Document Control

Change Record

| Issue Date | Revision | Prepared by | Reviewed by | Approved by | Background |
|---|---|---|---|---|---|
| 24/11/2020 | 1 | [redacted] | [redacted] | [redacted] | Initial Draft |
| 19/3/2025 | 2 | [redacted] | [redacted] | [redacted] | |
| 1/5/2025 | 3 | [redacted] | | [redacted] | Added requirement to provide additional support for low fault level operation<br>Added outage considerations under Section 10 |

Related Documents

| Issue Date | Responsible Person | Objective Document Name |
|---|---|---|
| 30/11/2018 | [redacted] | H035 Strathmore Secondary Systems Condition Assessment Report (A3416566) |
| 03/07/2023 | [redacted] | PIF - CP 02829 H035 Strathmore SVC Sec Sys Replacement (A3416565) |
| | | |

## Document Purpose

The purpose of this Project Scope Report is to define the business (functional) requirements that the project is intended to deliver. These functional requirements are subject to Powerlink's design and construction standards and prevailing asset strategies, which will be detailed in documentation produced during the detailed scoping and estimating undertaken by DTS (or OSD), i.e. it is not intended for this document to provide a detailed scope of works that is directly suitable for estimating.

## Project Contacts

| | |
|---|---|
| Project Sponsor | [redacted] |
| Strategist – HV Asset Strategies | [redacted] |
| Planner - Main/Regional Grid | [redacted] |
| Manager Projects | [redacted] |
| Project Manager | [redacted] |
| [redacted] | [redacted] |

## Project Details

### 1. Project Need & Objective

H035 Strathmore substation is a major 275 and 132kV substation located on Strathmore Road, Strathmore, approximately 5km from the Collinsville Township. The substation, established, in 2001 consists of both 275kV and 132kV switching bays.

A 275kV SVC -80/+260 MVAr, manufactured by Siemens, was installed in 2007 on a separate platform, approximately 300m from the 275kV switchyard. The SVC and substation's earth-grids are joined together by earth-grid conductors. A short transmission line links the SVC's coupling transformer and the substation 275kV switching bays.

A condition assessment of Strathmore SVC has recommended the SVC secondary systems, thyristor valve control systems and cooling control systems equipment to be replaced. This is required to maintain network reliability and availability within Powerlink's current standards, and to minimise operational and compliance risks associated with aging and obsolete secondary systems assets. It will also enable spare parts to be recovered to support Powerlink's remaining fleet of Siemens SVCs.

Furthermore, replacement of the SVC secondary systems will enable the control system to be modified to provide additional support for low fault level operation.

The objective of this project is to replace the Strathmore SVC secondary systems, thyristor valves and cooling system by December 2028 to extend the service life by 20 years.

This project will follow the two (2) stage approval process and will require RIT-T consultation.

## 2. Project Drawing

[redacted]

Secondary Systems scope under CP.02829

*Figure 1: Strathmore Operational Diagram*

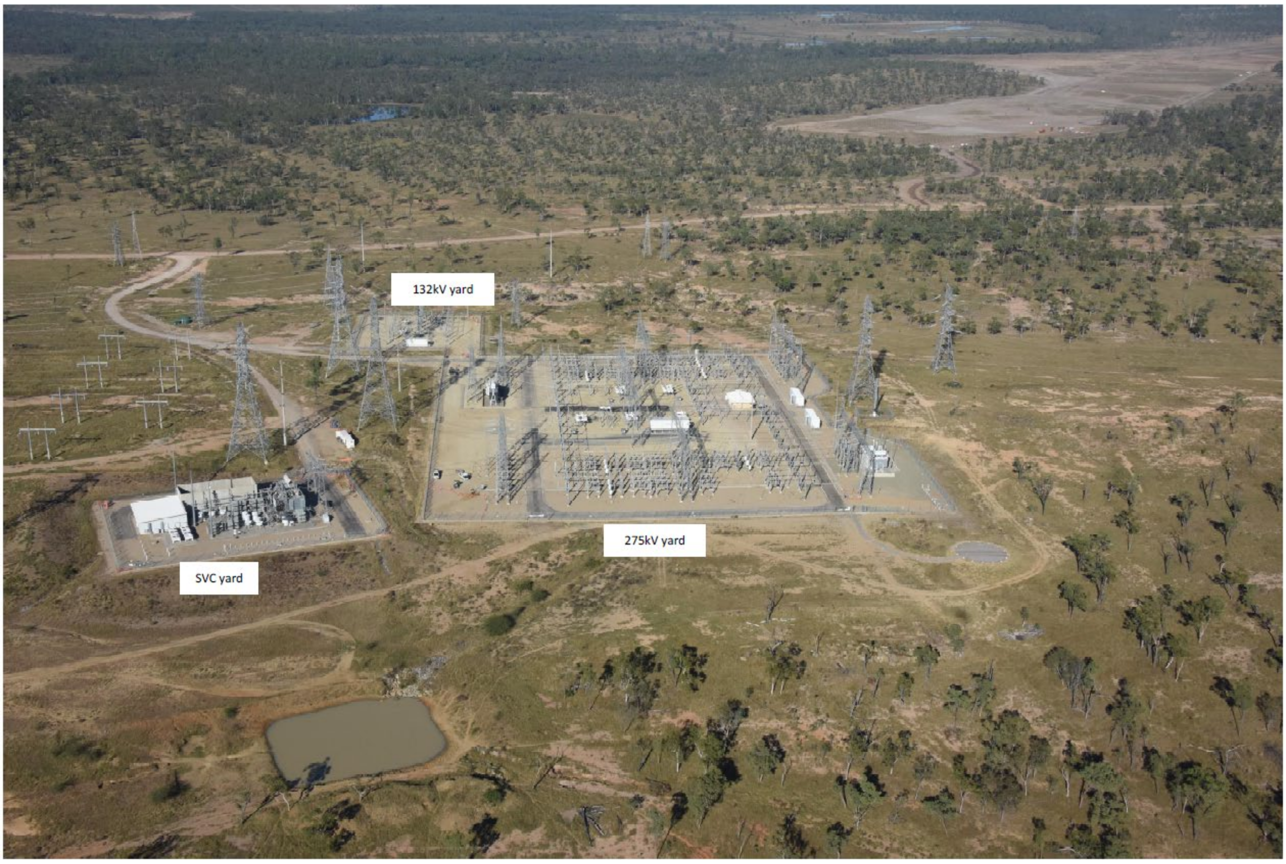



*Figure 2: Strathmore Aerial View*

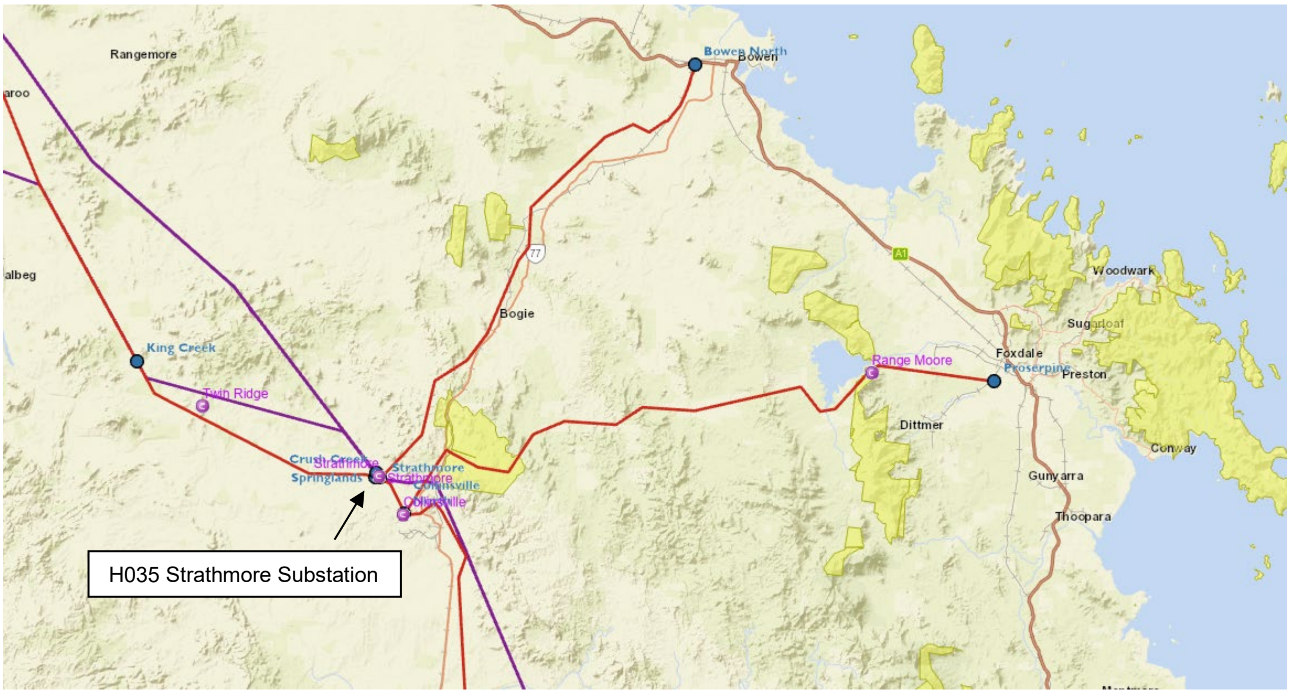



*Figure 3: Location of H035 Strathmore Substation*

# 3. Deliverables

The following deliverables are to be provided in response to this Project Scope Report. The requirement dates for these deliverables will be communicated separately.

This project will follow the two stage approval process. The following deliverables are to be provided for the purposes of Stage 1 Approval and RIT-T consultation:

1. A report (e.g. Concept Estimate Report) detailing the works to be delivered, high level staging, resource requirements and availability, and outage requirements and constraints for each option
2. A class 5 estimate (minimum) for each option
3. A basis of estimate document and risk table, detailing the key estimating assumptions and delivery risks for each option
4. Outline staging and outage plans for each option
5. As this project will follow the two (2) stage approval process, provide a separate estimate for stage 2 development phase costs which includes project planning, design and preliminary works, including supplier tender. Also provide the schedule and time information to align with 2-stage approval.

# 4. Project Scope

## 4.1. Original Scope

The following scope presents a functional overview of the desired outcomes of the project. The proposed solution presented in the estimate must be developed with reference to the remaining sections of this Project Scope Report, in particular *Section 7 Special Considerations*.

Briefly, the project consists of the replacement of the H035 Strathmore SVC secondary systems, thyristor valves and cooling system, to extend the SVC service life by 20 years, by 31st December 2028.

### 4.1.1. Transmission Line Works

Not Applicable

### 4.1.2. H035 Strathmore Substation Works

Undertake a detailed inspection of SVC primary and secondary systems to confirm the scope of refurbishment work that will extend the SVC service life by 20 years, nominally including;

- Design, procure, construct and commission the full replacement of all SVC secondary systems in the existing SVC control building (+4) including (full list of SVC components to be replaced is provided in Attachment 1):
    - SVC protection devices
    - SVC control system (TDC) with additional support for low fault level operation

  - Valve control units including VBE
  - Cooling Control systems including associated transducers
  - All SVC automation/control equipment including GPS clock, SU200 I/O units, iPCOM SCADA gateways and Digital Fault Recorder PC
  - All links/terminals and other miscellaneous relays, fibre isolation devices, power supplies etc.

- Replacement of thyristor valves and associated cooling system for the Thyristor Switched Capacitor (TSC) and the Thyristor Controlled Reactor (TCR) (H035-M01-VLV) if required to be compatible with the new secondary systems;

- Install an Uninterruptible Power Supply (UPS) for the cooling water system pumps;

- Review and modify interface between the SVC secondary system and the substation secondary system as required to accommodate new SVC protection (Strathmore C07 diameter secondary systems will be upgraded at a later stage under CP.02399 Strathmore 132kV and 275kV secondary systems replacement Stage 2);

- Replace/install cabling as required to accommodate the new secondary systems (condition of the existing cables and marshalling kiosks has been assessed to be in good condition and suitable for another 20 years of service);

- Review of the OpsWAN and remote monitoring facilities and upgrade as necessary to support replacement secondary systems;

- Install a new AC changeover board with DC supply for the control circuitry with AC supplies as follows:

  - Main Supply – SVC Auxiliary Transformer;

  - Back up Supply – Transformer 2 auxiliary transformer; and

  - Emergency Supply – facility to plug in diesel generator.

    (Note if alternate arrangements are preferred from a delivery perspective, these can be considered in consultation with Asset Strategies)

- Replace 125V DC systems as required (note 125V battery banks were replaced in 2022 under OR.02350);

- New system must have appropriate Cyber security and patching for any computers, Network equipment and other related equipment to maintain a resilient system. Patches and updates are to be provided by the vendor and must come with confirmation that they have been checked and tested and that no adverse behaviour will result;

- Provision of spare parts for the new secondary systems, test equipment and training as required;

- Provision of long term manufacturer support agreement for the remaining life of the SVC;

- Decommission and recover all redundant equipment, and update drawing records, SAP records, config files, etc. accordingly; and

- Review, update and catalogue spare parts, minimum stock holding and store inventories associated with Strathmore SVC systems and equipment.

#### 4.1.3. Telecoms Works

Not applicable

#### 4.1.4. Easement/Land Acquisition & Permits Works

Not applicable

### 4.2. Key Scope Assumptions

The following assumptions should be included in the estimating of this scope:

- For a GE or Hitachi solution to be compatible with the existing SVC primary plant, the thyristor valves and cooling system will require replacement; and
- Siemens do not currently offer a secondary systems replacement solution that meets Powerlink's Asset Management requirements.

### 4.3. Variations to Scope (post project approval)

Not applicable

## 5. Key Asset Risks

The key asset risks for Strathmore SVC are SVC (TDC) control systems, thyristor valve control systems (VBE), Cooling Control Systems, SU200 I/O units, iPCOM SCADA gateways and Digital Fault Recorder PC.

The SVC is a complex integrated plant that heavily relies on the reliability and availability of its major components e.g. TDC and VBE Control Systems, Cooling Control Systems and associated control cards. Therefore, delaying replacement of SVC secondary systems beyond the recommended replacement timeframe represents significant risks to the reliability, availability and capability of the SVC. The ability to control network voltages and provide network support (e.g. stability) during and post contingency events in North Queensland area can be significantly compromised if Strathmore SVC is out of service due to failure of obsolete components.

Asset risk management shall be in accordance with the Asset Risk Management Process Guideline (A4870713).

## 6. Project Timing

### 6.1. Stage 1 Approval Date

The anticipated date for Stage 1 approval is September 2025.

### 6.2. Site Access Date

Site access is immediately available for Powerlink construction works to commence as H035 is an existing Powerlink site.

### 6.3. Commissioning Date

The latest date for the commissioning of the new assets included in this scope and the decommissioning and removal of redundant assets, where applicable, is 31st December 2028.

The commissioning date is to be confirmed as part of the Concept Estimate submission.

## 7. Special Considerations

- The Power System Performance team is to be engaged to provide requirements for the additional functionality required to support low fault level operation, including during system restart.
- Hitachi and GE are to be engaged to undertake the replacement works.
- Siemens is discontinuing the TDC control system and moving to the new Beckhoff system which has not yet been trialled. The proposed Beckhoff system is not yet comercially available. This solution is not preferred from an asset management perspective due to the risks of being an early adopter of new technology.
- If the replacment is done using the Siemens TDC control system (only Siemens option available at this time) there is a risk of not being able to maintain ongoing support from Siemens as this product will become obsolete. The proposed solution for the secondary systems replacement must include an arrangement to guarantee long term manufacturer support for the remaining life of the SVC.

## 8. Asset Management Requirements

Equipment shall be in accordance with Powerlink equipment strategies.

Unless otherwise advised Sarah Gilmour will be the Project Sponsor for this project. The Project Sponsor must be included in any discussions with any other areas of NBD including Asset Strategies & Planning.

## 9. Asset Ownership

The works detailed in this project will be Powerlink Queensland assets.

## 10. System Operation Issues

Operational issues that should be considered as part of the scope and estimate include:

- interaction of project outage plan with other outage requirements;
- likely impact of project outages upon grid support arrangements; and
- likely impact of project outages upon the optical fibre network.

Outage considerations specific to Strathmore SVC are as follows:

- Concurrent outages with Bus 1 reactor at Strathmore and any other north Queensland SVCs including Nebo, Ross and Woree are to be avoided;

- Outages during the winter period (June, July and August) should be avoided due to low system loads in north Queensland and subsequent high system voltages overnight;
- AEMO summer outage guidelines also suggest avoiding reactive plant outages for the 4 weeks from mid-Dec to mid-Jan for high voltage management;
- Outages during the summer period (January, February) should also be avoided as high system loads require SVCs to be in-service to assist with maintaining system voltages pre/post contingency; and
- Outages on Strathmore SVC will affect the Central Queensland to Northern Queensland voltage stability limits.

## 11. Options

Not applicable

## 12. Division of Responsibilities

Not Applicable.

## 13. Related Projects

| Project No. | Project Description | Planned Comm Date | Comment |
|---|---|---|---|
| Pre-requisite Projects | | | |
| | | | |
| Co-requisite Projects | | | |
| | | | |
| Other Related Projects | | | |
| CP.02807 | Greenbank 275kV SVC Secondary System Replacement | 2029 | |
| C55.1240 | South Pine SVC full secondary system replacement | 2029 | |

## Attachment 1: Functional Locations to be replaced

| Functional Loc. | Description | Model number | Start-up date |
|---|---|---|---|
| H035-SSS-1SVC-3HFXPROT | RELAY CAPACITOR/FILTER TRENCH CPR04 -F31 | CPR04 | 20/10/2007 |
| H035-SSS-1SVC-3HFXPROT | RELAY CAPACITOR/FILTER TRENCH CPR04 -F33 | CPR04 | 20/10/2007 |
| H035-SSS-1SVC-3HFYPROT | RELAY OVERCURR & OVERLOAD SIEMENS 7SJ602 | 7SJ602 | 20/10/2007 |
| H035-SSS-1SVC-5HFXPROT | RELAY CAPACITOR/FILTER TRENCH CPR04 | CPR04 | 20/10/2007 |
| H035-SSS-1SVC-5HFYPROT | RELAY OVERCURR & OVERLOAD SIEMENS 7SJ602 | 7SJ602 | 20/10/2007 |
| H035-SSS-1SVC-8HFXPROT | RELAY CAPACITOR/FILTER TRENCH CPR04 | CPR04 | 20/10/2007 |
| H035-SSS-1SVC-8HFYPROT | RELAY OVERCURR & OVERLOAD SIEMENS 7SJ602 | 7SJ602 | 20/10/2007 |
| H035-SSS-1SVC-BICOOL | BINARY INTERFACE MODULE (SU200:1) | SU200 | 20/10/2007 |
| H035-SSS-1SVC-BICTRLAN | BINARY INTERFACE MODULE (SU200:12) | SU200 | 20/10/2007 |
| H035-SSS-1SVC-BICTRLAN | BINARY INTERFACE MODULE (SU200:13) | SU200 | 20/10/2007 |
| H035-SSS-1SVC-BIPROT | BINARY INTERFACE MODULE (SU200:3) | SU200 | 20/10/2007 |
| H035-SSS-1SVC-BIPROT | BINARY INTERFACE MODULE (SU200:4) | SU200 | 20/10/2007 |
| H035-SSS-1SVC-BISTN | BINARY INTERFACE MODULE (SU200:14) | SU200 | 20/10/2007 |
| H035-SSS-1SVC-BIYACDC | BINARY INTERFACE MODULE (SU200:16) | SU200 | 20/10/2007 |
| H035-SSS-1SVC-BIYACDC | BINARY INTERFACE MODULE (SU200:17) | SU200 | 20/10/2007 |
| H035-SSS-1SVC-BIYACDC | BINARY INTERFACE MODULE (SU200:8) | SU200 | 20/10/2007 |
| H035-SSS-1SVC-CONTSYS | SVC CONTROLLER | SIMATIC TDC UR5213 | 20/10/2007 |
| H035-SSS-1SVC-DATCONV | DATA CONVERTER COMPUTER | IPC 191_A | 20/10/2007 |
| H035-SSS-1SVC-DISTREC | TRANSIENT FAULT RECORDER (=X2+SB2-A4) | PADU | 20/10/2007 |
| H035-SSS-1SVC-DISTREC | TRANSIENT FAULT RECORDER (=X2+SB2-A5) | PADU | 20/10/2007 |
| H035-SSS-1SVC-DISTREC | TRANSIENT FAULT RECORDER (=X2+SB2-A6) | PADU | 20/10/2007 |
| H035-SSS-1SVC-DISTREC | TRANSIENT FAULT RECORDER COMPUTER | IBA RACK PC | 20/10/2007 |
| H035-SSS-1SVC-HMI | MONITOR | 17 INCH | 20/10/2007 |
| H035-SSS-1SVC-INDMET | WATT TRANSDUCER | ISTAT300 | 20/10/2007 |
| H035-SSS-1SVC-INDMET | VOLT TRANSDUCER | ISTAT300 | 20/10/2007 |
| H035-SSS-1SVC-INDMET | VOLT ADAPTOR (=U1+SJ1-T15) | | 20/10/2007 |
| H035-SSS-1SVC-INDMET | VOLT ADAPTOR (=U1+SJ1-T11) | | 20/10/2007 |
| H035-SSS-1SVC-INDMET | VOLT ADAPTOR (=U1+SJ1-T12) | | 20/10/2007 |
| H035-SSS-1SVC-INDMET | CURRENT ADAPTOR (=U1+SJ1-T13) | | 20/10/2007 |
| H035-SSS-1SVC-INDMET | CURRENT ADAPTOR (=U1+SJ1-T14) | | 20/10/2007 |
| H035-SSS-1SVC-OWCOVERT | DC/DC CONVERTER | QUINT-PS-100 | 20/10/2007 |
| H035-SSS-1SVC-OWINVERT | INVERTER 125VDC/240VAC 1600W | 415-BKZ-CN125 | 20/10/2007 |
| H035-SSS-1SVC-OWNTWK | SWITCH (=X1+SB1-A5) | RS8000H | 20/10/2007 |
| H035-SSS-1SVC-OWNTWK | SWITCH ETHERNET 3 x 8 PORT | MS888G2 | 20/10/2007 |
| H035-SSS-1SVC-OWNTWK | LOCAL CONTROL FACILITY PC X TERMINAL | 7010 | 09/05/2018 |
| H035-SSS-1SVC-OWNTWK | GEN 4 SERVER OPSWAN | | 09/05/2018 |
| H035-SSS-1SVC-OWNTWK | CHECK POINT IAS U1 APPLIANCE DC PS | | 22/11/2017 |
| H035-SSS-1SVC-OWNTWK | CHECK POINT IAS U1 APPLIANCE DC PS | | 09/05/2018 |
| H035-SSS-1SVC-OWPRINT | PRINTER | HP5200TN | 20/10/2007 |
| H035-SSS-1SVC-OWPSA | CHECK POINT FIREWALL +4 | | 02/05/2019 |
| H035-SSS-1SVC-OWSTNTWK | SWITCH (=X1+SB1-A10) | RS8000H | 20/10/2007 |
| H035-SSS-1SVC-RTU | REMOTE TERMINAL UNIT FOXBORO C50 | C50 | 20/10/2007 |

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| H035-SSS-1SVC-SVCNTWK | SWITCH (=X1+SB1-A3) | RS8000H | 20/10/2007 |
| H035-SSS-1SVC-SVCXPROT | RELAY MULTIFUNCTION DIFF SIEMENS 7UT613 | 7UT613 | 20/10/2007 |
| H035-SSS-1SVC-SVCYPROT | RELAY MULTIFUNCTION DIFF SIEMENS 7UT613 | 7UT613 | 20/10/2007 |
| H035-SSS-1SVC-TCRVBE | VALVE CONTROL UNIT (VBE) | A5E 0089 0092 | 20/10/2007 |
| H035-SSS-1SVC-TCRXPROT | RELAY MULTIFUNCTION DIFF SIEMENS 7UT612 | 7UT612 | 20/10/2007 |
| H035-SSS-1SVC-TCRYPROT | RELAY OVERCURR & OVERLOAD SIEMENS 7SJ602 | 7SJ602 | 20/10/2007 |
| H035-SSS-1SVC-TIMING | GPS CLOCK | SICLOCK TS | 20/10/2007 |
| H035-SSS-1SVC-TRFXPROT | RELAY VOLTAGE & FREQUENCY SIEMENS 7RW600 | 7RW600 | 20/10/2007 |
| H035-SSS-1SVC-TRFXPROT | RELAY VOLTAGE & FREQUENCY SIEMENS 7RW600 | 7RW600 | 20/10/2007 |
| H035-SSS-1SVC-TSCVBE | VALVE CONTROL UNIT (VBE) | A5E 0089 0115 | 20/10/2007 |
| H035-SSS-1SVC-TSCXPROT | RELAY MULTIFUNCTION DIFF SIEMENS 7UT612 | 7UT612 | 20/10/2007 |
| H035-SSS-1SVC-TSCXPROT | RELAY CAPACITOR/FILTER TRENCH CPR04 | CPR04 | 06/07/2015 |
| H035-SSS-1SVC-TSCYPROT | RELAY OVERCURR & OVERLOAD SIEMENS 7SJ602 | 7SJ602 | 20/10/2007 |
| H035-SSS-1SVC-VCOOLCON | CONTROL UNIT | SIMATIC TDC UR5213 | 20/10/2007 |
| H035-SSS-1SVC-VCOOLCON | PROGRAMMABLE LOGIC CONTROLLER | S7300 | 20/10/2007 |
| H035-SVI-DCSU-125DCX | SWITCHED MODE DC SUPPLY | RT4B-110V/12A | 20/10/2007 |
| H035-SVI-DCSU-125DCX | DC CONTROL/MONITOR | MINICSU-2 125.0 V | 20/10/2007 |
| H035-SVI-DCSU-125DCY | SWITCHED MODE DC SUPPLY | RT4B-110V/12A | 20/10/2007 |
| H035-SVI-DCSU-125DCY | DC CONTROL/MONITOR | MINICSU-2 125.0 V | 20/10/2007 |
| H035-M01-VLV--COOLSYS | SVC COOLING WATER SYSTEM | Project 409857 | 20/10/2007 |
| H035-M01-VLV--TCRAB | TCR THYRISTOR VALVE | T2563N80TS35 | 20/10/2007 |
| H035-M01-VLV--TCRBC | TCR THYRISTOR VALVE | T2563N80TS35 | 20/10/2007 |
| H035-M01-VLV--TCRCA | TCR THYRISTOR VALVE | T2563N80TS35 | 20/10/2007 |
| H035-M01-VLV--TSCAB | TSC THYRISTOR VALVE | T2563N80TS35/01 | 20/10/2007 |
| H035-M01-VLV--TSCBC | TSC THYRISTOR VALVE | T2563N80TS35/01 | 20/10/2007 |
| H035-M01-VLV--TSCCA | TSC THYRISTOR VALVE | T2563N80TS35/01 | 20/10/2007 |