TasNetworks
Delivering your power

Asset Management Plan

SCADA Systems - Transmission

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Authorisations

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Responsibilities

This document is the responsibility of the Asset Strategy Team, Tasmanian Networks Pty Ltd, ABN 24 167 357 299 (hereafter referred to as "TasNetworks").

Please contact the Asset Strategy Team Leader with any queries or suggestions.

- Implementation All TasNetworks staff and contractors.
- Compliance All group managers.

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Record of revisions

Section number	Details
General	*Included Automation systems to document*

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1 Purpose

The purpose of this document is to describe for the substation Supervisory Control and Data Acquisition (SCADA) system assets:

(a) TasNetworks' approach to asset management, as reflected through its legislative and regulatory obligations and strategic plans;

(b) The key projects and programs underpinning its activities; and

(c) Forecast capital and operational expenditure, including the basis upon which these forecasts are derived.

2 Scope

This document covers the SCADA and Automation systems and associated strategic devices installed within TasNetworks Extra High Voltage (EHV) and zone substations. This Asset Management Plan (AMP) does not cover the telecommunications equipment used to transmit the data from the substations to the network control centres or the equipment within the network control centres.

3 Strategic alignment and objectives

This asset management plan has been developed to align with both TasNetworks' Asset Management Policy and Strategic Asset Management Plan.

It is part of a suite of documentation that supports the achievement of TasNetworks strategic performance objectives and, in turn, its mission. The asset management plans identify the issues and strategies relating to network system assets and describes the specific activities that need to be undertaken to address the identified issues.

The asset management objectives are to:

(a) manage and meet the strategic goals, measures and initiatives outlined in the Corporate Plan;

(b) comply with relevant legislation, licences, codes of practice, and industry standards ; and

(c) continually adapt, benchmark and improve asset management strategies and practices and apply contemporary asset management techniques, consistent with industry best practices.

This asset management plan describes the asset management strategies and programs developed to manage the SCADA and Automation system assets, with the aim of achieving these objectives:

(a) Present an overview of the SCADA and Automation system asset populations;

(b) Manage business risk presented by the assets to within acceptable limits;

(c) Achieve reliable asset performance consistent with prescribed service standards;

(d) Assess the risks specific to the assets and identify corresponding risk mitigation strategies;

(e) Ensure the effective and consistent management and coordination of asset management activities relating to the assets throughout their life-cycle;

(f) Ensure our team members are trained, authorised and competent to undertake their work activities;

(g) Demonstrate that the assets are being managed prudently throughout their life-cycle;

(h) Ensure asset management issues and strategies, as they relate to the assets, are taken into account in decision making and planning; and

(i) Define future operational and capital expenditure requirements of the assets.

4 Asset information systems

4.1 Systems

TasNetworks maintains an Asset Management Information System (AMIS) that contains detailed information relating to the SCADA asset population. AMIS is a combination of people, processes and technology applied to provide the essential outputs for effective asset management.

4.2 Asset information

Asset information is recorded in the WASP asset register, which is used for attribute data, spares management, works scheduling and defect management. The asset breakdown structure shows the physical relationship of the SCADA and Automation devices, attached to a logical scheme which is then linked to the substation that the scheme is operating within. The Ajilis team are working to replace the WASP system with System Application and Products (SAP) by March 2018.

5 Asset description

SCADA systems provide real-time data to monitor the primary equipment within a substation and allow a centralised view of the operation and health of the entire transmission network. SCADA systems provide remote control keeping personnel out of the substations for safer operation of the primary equipment. Automation systems are also used for automatic operational sequences to rapidly maintain a secure operating state of power supply following system contingency events. With transmission system faults reported to a centralised area in real-time, allowing easier and more accurate fault analysis ensuring faster transmission system restoration.

Modern protection equipment provides more information than previous equipment relying extensively on the SCADA system to transport the information to a centralised area for processing.

The SCADA systems also provide a number of other critical functions required to operate the transmission network, such as remote access of protection relays, Remote Terminal Unit (RTUs) and Ethernet switches, online condition monitoring of expensive primary assets and system disturbance and power quality record retrieval.

The SCADA system asset category boundary is between the protection scheme and the telecommunications circuits connecting to the Network Operations Control System (NOCS).

A typical SCADA system includes of the following components:

(a) Human Machine Interface (HMI) for local operator ;

(b) Engineering computer for system access;

(c) Gateway RTU with a redundant RTU at critical sites;

(d) Station RTU or distributed Inputs and Outputs (I/O) and Programmable Logic Controller (PLCs);

(e) Global Positioning System (GPS) time synchronisation;

(f) Communication network equipment such as modems, serial servers, routers, network switches, hardware interfaces, media converters and protocol converters;

(g) Monitoring equipment such as disturbance recorders and power quality monitors; and

(h) Data cabling such as optical fibre, cat 5, twisted pair and coaxial.

Modern SCADA and Automation systems utilise an Ethernet Local Area Network (LAN) configured as a ring topology to gather the information from the protection schemes and monitoring devices. With the installation of a modern SCADA systems the majority of substations have multiple RTUs in service. This occurs when the existing SCADA system is replaced with a standard system but the protection relays that are not capable of Ethernet communications require the copper wire connections to the old RTU to continue to transfer data. As protection schemes are upgraded, the reliance on the older RTU diminishes until the old RTU can be decommissioned. Generally, the old RTU processor is upgraded to allow it to connect to the new Ethernet as a data concentrator to transfer its data to the new gateway RTU and the interface equipment of the old RTU is left untouched for the legacy protection relays.

The following sections provides high-level information on TasNetworks' SCADA and Automation assets, including age and type profile, and performance and condition summaries.

5.1 Operator HMI

TasNetworks provide an operator workstation within each substation. The workstation includes a desk and chair for the preparation of work permits and a monitor, keyboard and mouse as the HMI for local control and monitoring of the primary equipment through the SCADA system. An industrial Windows based computer is used with Citect automation and control software installed. The Citect software is widely used in the power and water industry worldwide and is highly configurable. TasNetworks also have two sites where ABB Micro SCADA systems are installed which have their own proprietary HMI built into the Micro SCADA workstation.

5.2 Engineering Computer

An engineering computer is installed as part of the SCADA system for use by technical personnel to configure the SCADA systems automation systems and protection relays. It is also used for post fault analysis and is able to be remotely connected to interrogate or change the SCADA, automation and protection systems via a firewall router over the TasNetworks' engineering Substation Wide Area Network (SUBWAN). The engineering computer does not have a keyboard or mouse and is accessed either locally or remotely using Windows Remote Desktop Connection. For security, a Firewall is connected between the SUBWAN and the engineering computer. The SUBWAN connects substation equipment to the corporate network. The Communication Group manages the SUBWAN.

5.3 Gateway RTU

The gateway RTU polls and collects the data from the devices connected to the substation Ethernet based on a list of points. Every four seconds the NOCS master station polls each gateway RTU requesting the information as per the list of points in its database. NOCS also performs idle polling that will continuously poll static data during quiescent communications.

At important substations, the gateway RTU is backed up by a 'hot' standby gateway RTU. In the event that the main gateway RTU fails, the system will automatically switch over to the backup gateway RTU. Most substations have redundant telecommunications circuits to the NOCS and NOCS also have a backup system at a different location for system security. The two telecommunications circuits can be controlled at NOCS and can be connected to either main or back up RTU.

5.4 Station RTU

The station RTU is used as an interface for the collection of discrete alarms and controls. Equipment such as the substation fire system, security system or Alternating Current (AC) and Direct Current (DC) supply systems have alarms that need to be monitored through hard-wired connections. The station RTU provides inputs and outputs (I/O) used to interface to the substations basic equipment.

With the introduction of more SCADA aware devices such as battery chargers or where PLCs or small RTUs can be installed to collect SCADA information from AC and DC boards these devices will be used in preference to using a Station RTU as this reduces the complexity of the SCADA Panel and the number of multicore required within the substation.

5.5 Remote I/O device

Future installations will utilise remote I/O devices to collect discrete alarms and controls. Devices such as PLCs and RTUs will be utilised to provide the I/O services. These devices will be installed in preference to utilising the Station RTU to minimise cable runs. Equipment such as the substation fire system, security system or AC and DC supply systems shall have data collected or be controlled via remote I/O devices.

5.6 GPS time synchronisation

Several devices are installed as part of the SCADA system to provide time synchronisation to the connected devices. These devices include a GPS clock, GPS antenna, media converters and signal amplifiers.

Sequence of Event (SOE) time reporting is accurate to the millisecond because the GPS clock transmits an Inter-Range Instrumentation Group B (IRIG-B time), Network Time Protocol (NTP), Simple Network Time Protocol (SNTP) and Precision Time Protocol (PTP) synchronisation signals to the devices where the SOEs are generated. The Distributed Network Protocol (DNP3) protocol contains the time stamp of the SOEs within the data message that is sent to the gateway RTU and eventually to the NOCS.

5.7 Network switches and serial servers

Communications between the protection relays and the gateway RTU requires network switches and serial servers. Layer two network switches installed in the substation Ethernet network are selected to be robust enough to withstand the electrically noisy substation environment. A serial server is used to connect a non-Ethernet device to the Ethernet. The non-Ethernet device is connected serially to the serial server and the data from the device is polled over the Ethernet through the serial server, which acts like a switch or data concentrator at the Ethernet level.

5.8 Monitoring equipment

Monitoring equipment is used to collect power system data during either system disturbances or quiescent conditions to assess the quality of power supply. These devices are classified as either a Phasor Measurement Unit (PMU) or Power Quality Meter (PQM). Modern devices utilise Synchrophasor technology, which is an accurately synchronised time stamped electrical phasor quantity. As technology advances, synchrophasor technology is more readily available within the protection relays and discrete monitoring devices are becoming redundant. Future use of synchrophasor data includes Special Protection Schemes (SPS) replacing RTU based schemes currently employed by TasNetworks.

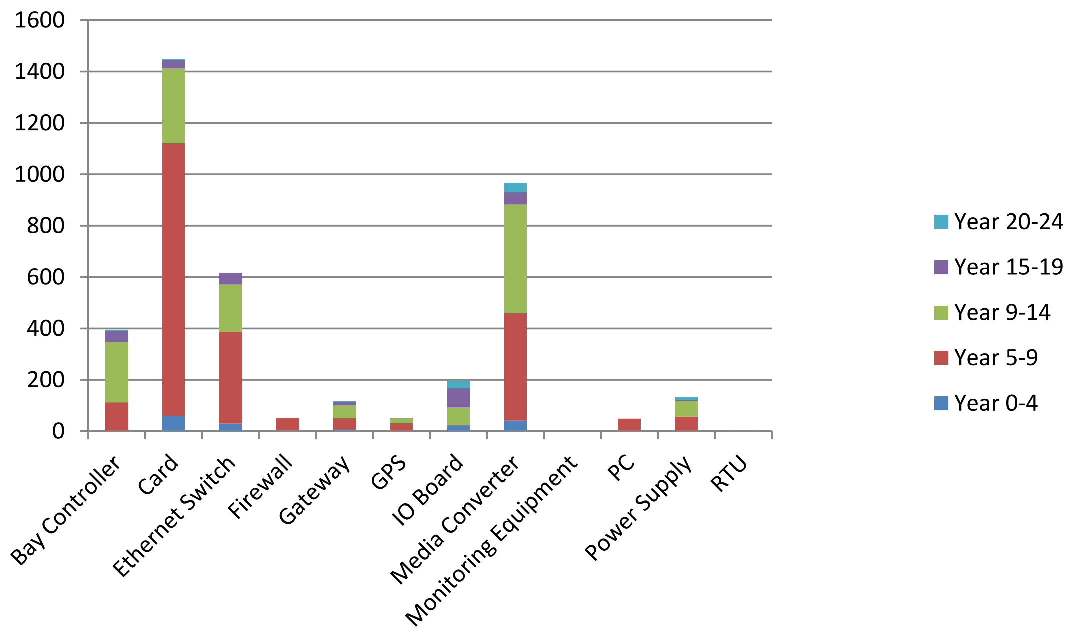
5.9 SCADA population and age profiles

Table 1 shows the population of SCADA systems and monitoring equipment and their associated devices in TasNetworks' transmission substations and Figure 1 shows the age profile for the SCADA and monitoring devices.

Table 1 SCADA systems population

Description	Systems	Devices	Locations
SCADA systems equipment	53	2897	53
Monitoring equipment	17	43	17
Total	**70**	**2940**	**52**

Figure 1 SCADA equipment age profile



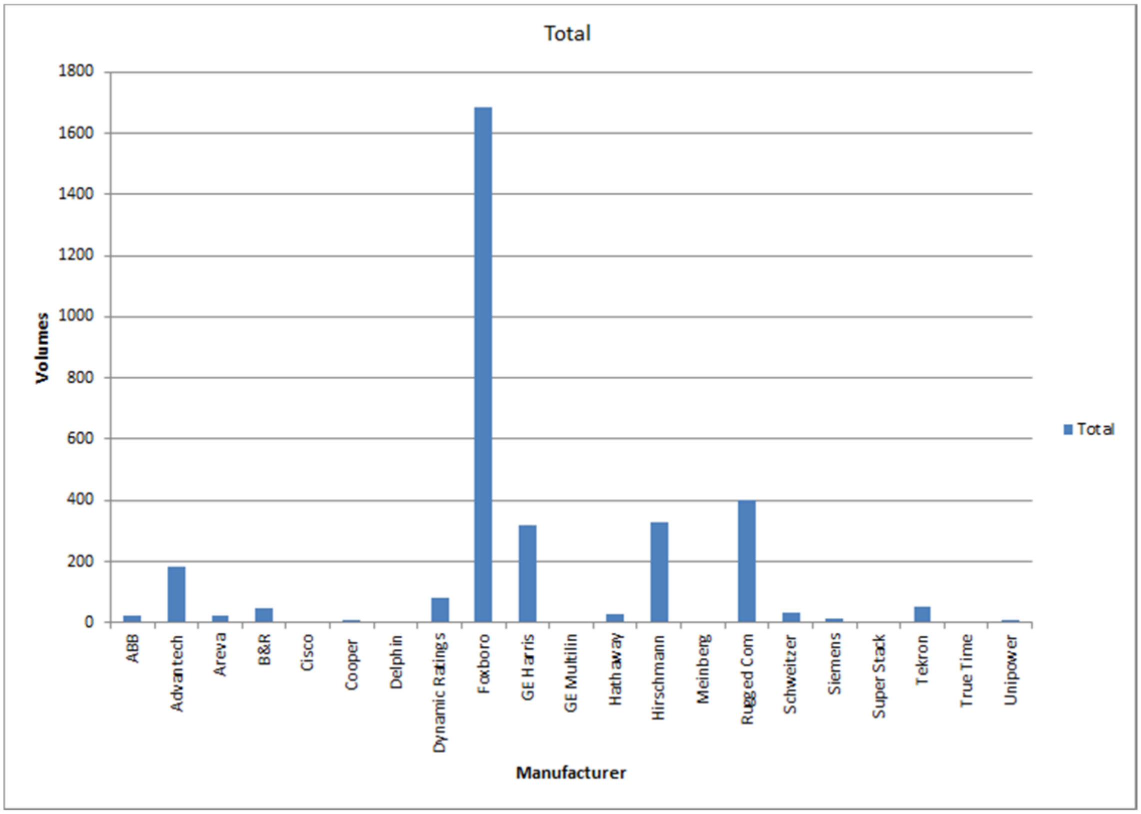
The majority of TasNetworks' SCADA devices are aged between 5 to 9 years.

5.10 SCADA equipment manufacturers and models

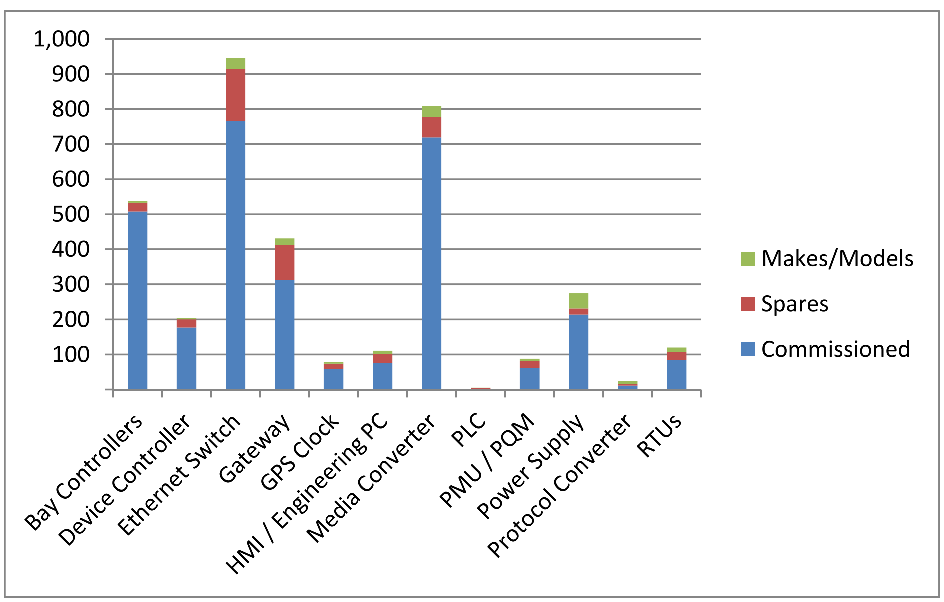
There are currently 70 different manufacturers of SCADA equipment used by TasNetworks greater than 200 different models of equipment, including discrete cards of gateway RTUs. The average number of devices across the entire fleet is 30 with a range between 1 and 320.

Figure 2 shows the quantity of devices from each manufacturer. Figure2 below also shows the top 21 manufacturers of SCADA equipment utilised by TasNetworks. This demonstrates that the majority of equipment is manufactured by Foxboro that was selected as the standard gateway RTU replacing the GE Harris gateway RTU during extensive replacement work between 2005 and 2015. The next fifteen year cycle will see an increase in Cooper equipment as it is the current preferred supplier for Gateway RTUs.

Figure 2   SCADA equipment manufacturers



5.10.1 Equipment types and volumes



6 Standard of service

6.1 Technical standards

TasNetworks manage a suite of technical standards for each asset category. There are three technical standards applicable for SCADA system assets:

- R246439 SCADA System Standard
- R246444 Secondary Systems – General Requirements Standard; and
- R246497 Testing, Commissioning and Training Standard.

6.2 Performance objectives

Performance levels of TasNetworks' SCADA systems population are assessed using a combination of internal performance monitoring measures and external benchmarking.

Australian Energy Market Operator (AEMO), National Electricity Rules (NER) and TasNetworks standards call for 99.9543 per cent availability for communication networks or for Transmission SCADA, which allows for a four hour outage per annum.

The introduction of System Protection Schemes (SPS) requires increased reliability of SCADA assets. A failure of a SCADA system may cause the SPS not to operate correctly under fault conditions. There is also a risk of triggering a SPS operation when work is being carried out on a SCADA system.

TasNetworks have a number of direct connections to major industrial customers through EHV and High Voltage (HV) substations. The monitoring and control of these vital connections are through the following SCADA systems:

- Boyer Substation (6.6 kV);
- Emu Bay Substation (11 kV);
- George Town Substation (110 kV);
- Hampshire Substation (110 kV);
- Huon River Substation (11 kV);
- Port Latta Substation (22 kV);
- Que Substation (22 kV);
- Queenstown Substation (11 kV);
- Risdon Substation (11 kV);
- Rosebery Substation (44 kV);
- Savage River Substation (22 kV); and
- Temco Substation (110 kV).

The voltage levels specified in the above list are indicative of the controlling point of the customer connection by the TasNetworks owned SCADA system.

The individual connection agreements describe the level of service and performance obligations required from the associated connection assets.

6.3 Key performance indicators

TasNetworks monitors SCADA system performance by the quality of data received at the NOCS, latency of data and service availability. Monthly data quality reports are generated giving frequency of alarms at the different levels of severity. Note that specific Key Performance Indicators (KPI) are currently under development. For these KPI to be effective, a clear differentiation between the performance of the SCADA system, the telecommunications systems and NOCS systems needs to be determined. Some data latency and outage periods cannot be contributed solely to the SCADA system.

6.4 Benchmarking

TasNetworks participates in various formal benchmarking forums with the aim to benchmark asset management practices against international and national transmission and distribution companies. Key benchmarking forums include:

(a) International Transmission Operations & Maintenance Study (ITOMS);

(b) The Australian Energy Regulator's Regulatory Information Notice (RIN);

(c) Transmission survey, which provides information to the Electricity Supply Association of Australia (ESAA) for its annual Electricity Gas Australia report; and

(d) Actively participating in other benchmarking surveys.

In addition, TasNetworks works closely with companies in other key industry forums, such as CIGRE (International Council on Large Electric Systems), The Asset Management Committee and the Asset Management Council to compare asset management practices and performance.

6.4.1 ITOMS

The ITOMS provides a means to benchmark performance (maintenance cost and service levels) between related utilities from around the world. The benchmarking exercise combines all protection, SCADA and communications assets into one distinct category. Further details relating to ITOMS is provided in the ITOMS reports that are held by TasNetworks' Asset Performance team.

6.4.2 RIN

Because of changes to the NER in November 2012, the Australia Energy Regulator (AER) serve a Regulatory Information Notice (RIN) to all Australian Transmission Network Service Providers (TNSP) and Distribution Network Service Providers (DNSP) to assist in the determination of their revenue proposal. The RIN data provides benchmarking information across TNSPs and DNSPs and is conducted annually to assess network performance trends. TasNetworks have the ability to obtain all of the benchmarking results through an external consultant and their web-based data portal. TasNetworks aim to leverage off this data once sufficient knowledge is gained about its relevance to each asset category.

7 Asset performance

7.1 Condition assessment

The condition of the SCADA system assets is assessed for each device model using the recorded failure rates, availability of manufacturer support, quantity and health of spares, and inherent design issues.

The failure rate is calculated using the number of failures per year over the last five years per device currently in service. By using the failures per device of a fleet of a model, the figures are normalised so that maintenance personnel do not single out models with higher populations as poor performers in relation to models with lower populations, which is a common misconception.

Figure 3 shows the failures of SCADA system devices over the past five years.

SCADA device manufacturers provide a model of device for an undetermined period of time because, as technology develops, new models are created and the older models become obsolete. For a period of time after the cessation of an old model, the manufacturer provides support through repair services and firmware development. However, the manufacturer has to concentrate their efforts on the newer models so once full product support ceases, network asset managers have to plan the replacement of obsolete models before spares deplete and further firmware issues begin to develop.

Figure 4 shows the quantity of relays with their associated manufacturer support.

Figure 3 SCADA equipment failures

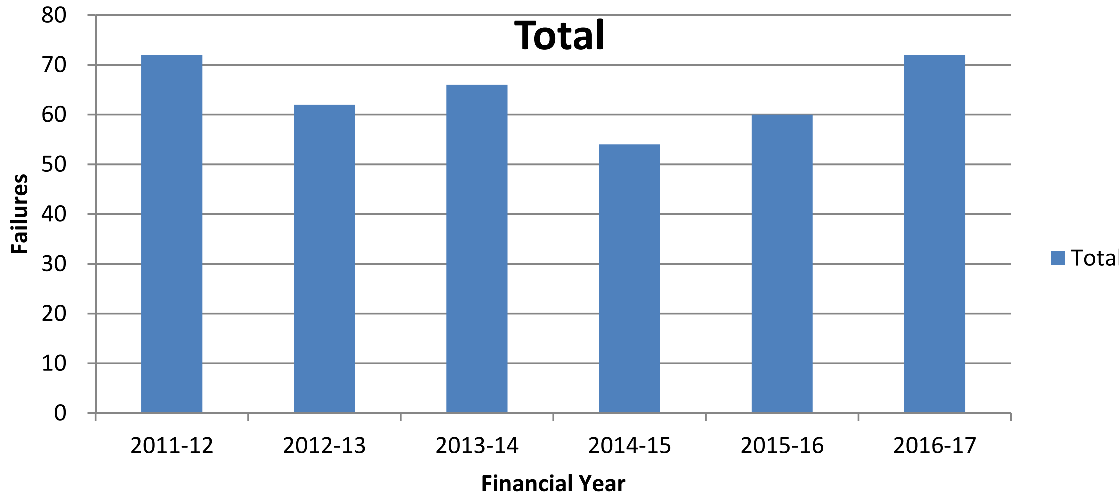
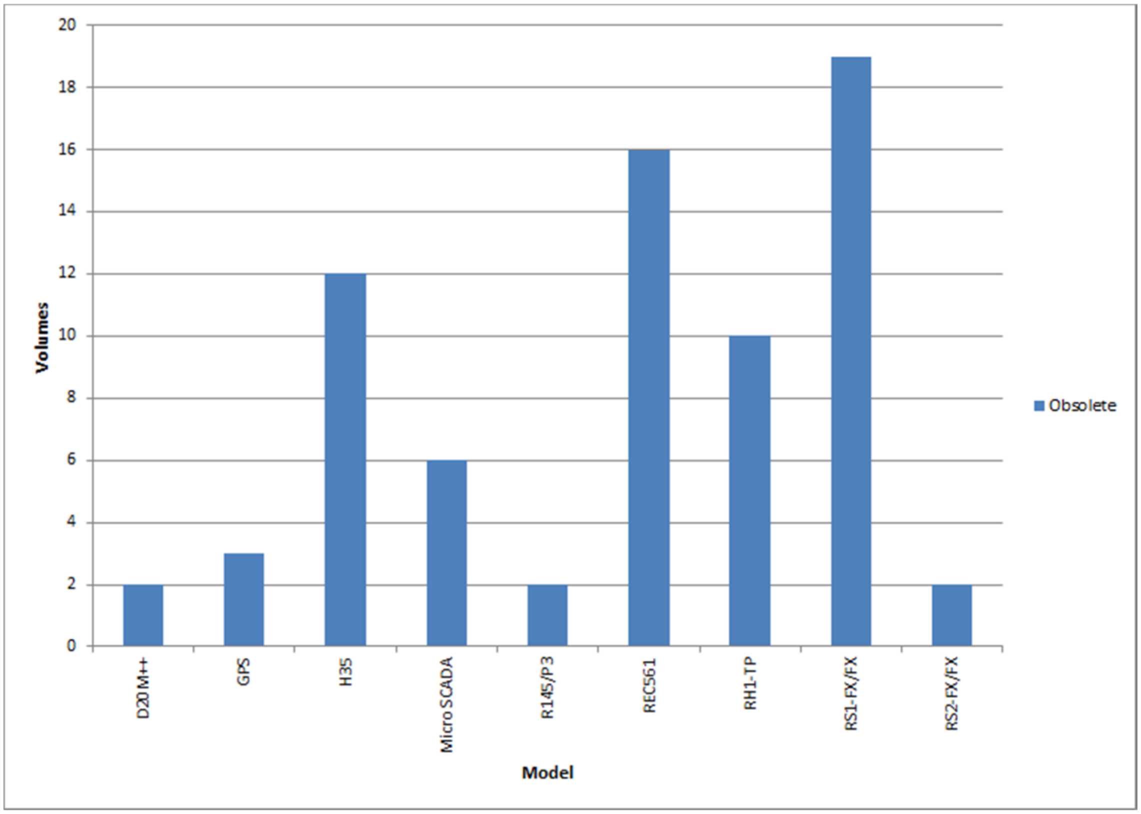


Figure 4 SCADA equipment obsolescence



7.1.1 Condition rating criteria

The criteria used to determine a device model with poor condition is as follows:

(a) A static model with an Mean Time Between Failures (MTBF) less than 3 years;

(b) An obsolete model that will deplete all spares within 5 years; and

(c) An obsolete model that has no spares.

The criteria used to determine a device model with average condition is as follows:

(d) An obsolete model with only one spare;

(e) An obsolete model that will deplete all spares within 5 to 10 years;

(f) An obsolete static model where the spares have an average age exceeding 30 years;

(g) An obsolete model with a design issue that affects the devices reliability; and

(h) A supported model with no spares.

A supported model with no spares is immediately referred to the Protection and Control maintenance team to order the sufficient quantity of spares to align with the spares policy of this asset management plan.

Examples of design issues include an identified failure trend within a model that results in spurious communication failure or functions that cannot be performed by a model that are now a requirement due to changes within the transmission system.

Figure 5 below shows the distribution of devices across each of the condition ratings demonstrating the overall condition of the SCADA assets, and figure 6 shows the number of devices for each model assessed with an average or poor condition.

In general, the condition of TasNetworks' transmission SCADA assets is good with the majority of devices being modern Ethernet technology still supported by their manufacturer.

Figure 5 SCADA fleet equipment condition rating

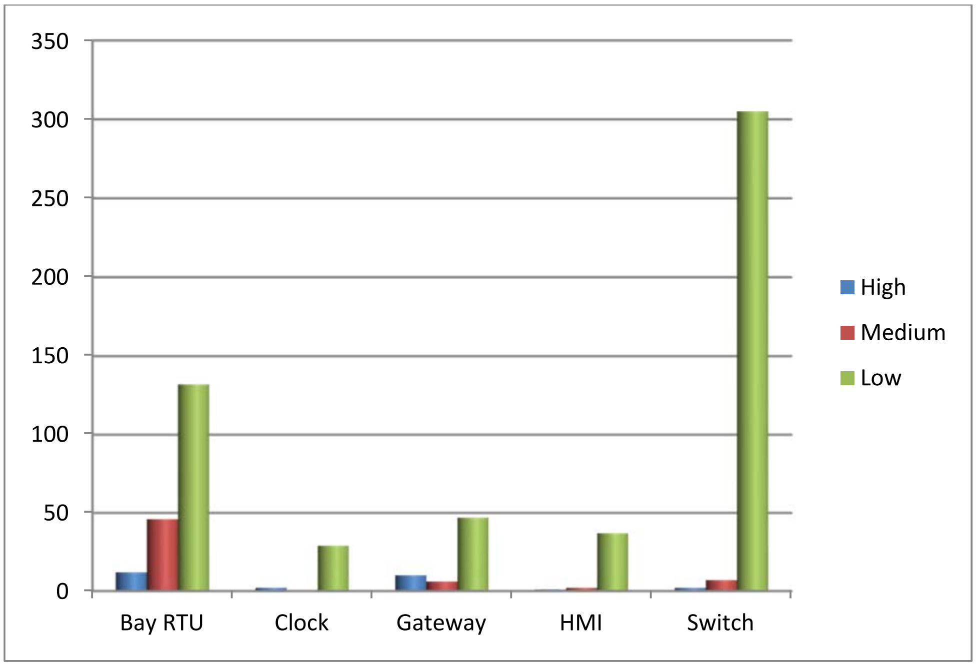
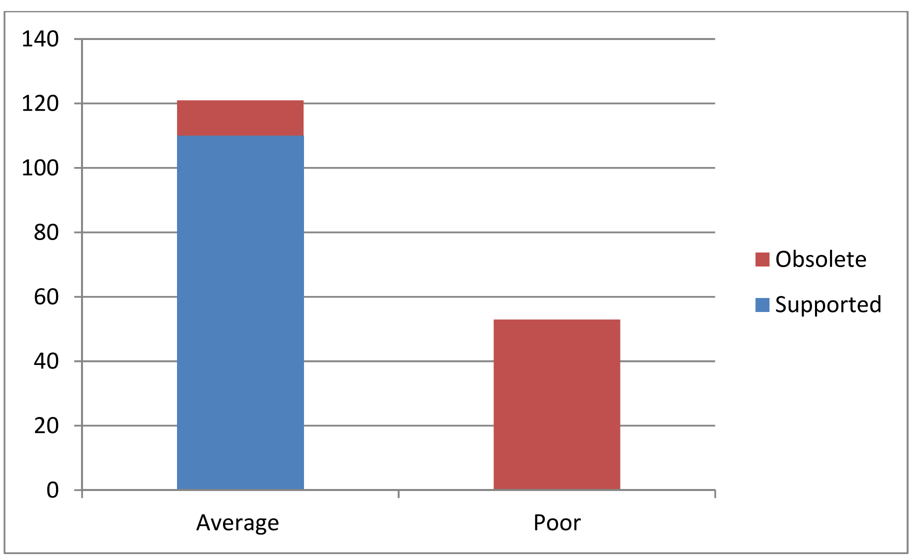


Figure 6 SCADA equipment with average or poor condition rating



7.2 Associated risk

The risk from transmission SCADA equipment failure is assessed, in accordance with TasNetworks' Corporate Risk Management Framework, using the condition information for each device model to determine the likelihood and consequences of failure.

The likelihood of failure is derived from the current failure rate of the model by converting the failure rate to a MTBF. In accordance with the Corporate Risk Management Framework, a MTBF between 10 and 100 years gives a likelihood of rare, an MTBF between 1 and 10 years is possible, and a MTBF between 0 and 1 year is classified as unlikely.

The main consequence associated with transmission SCADA assets arises when dedicated spares have fully depleted and manufacturer support has ceased. For this situation, the rectification of a failed device becomes an unplanned refurbishment by installing a different model of device, in place of the failed device that involves redesign and re-commissioning of the SCADA scheme as emergency work. These unplanned costs are not included in normal operational or capital budgets but tend to have a negligible effect on corporate finances; however, the flow on effect on protection and control resources can have a more significant effect on the delivery of the normal program of work. This emergency work can also leave the SCADA scheme in a precarious state as most new SCADA installations require significant design work to be undertaken by experienced SCADA engineers.

Another consequence associated with SCADA device failure comes from loss of monitoring and control of the primary and secondary assets associated with the SCADA device. This usually occurs directly due to a devices internal component breaking down or more commonly due to power supply failures from aging electronic components. The consequence of these failures are usually very low as the protection equipment is usually operating correctly when a SCADA device has failed.

Most of TasNetworks' transmission Substations have redundant SCADA Gateways, therefore a failure of a single device usually only affects one bay. This is not always the case, especially for TasNetworks' Zone Substations or HV feeders, where the failure of a single SCADA device does not have a redundant gateway or for HV feeders many feeders are connected to a single Ethernet switch. The consequence of losing control is the inability to remotely control reclosing which is essential in high bush fire risk days to minimise the risk of bushfire starts.

Table 2 shows the transmission SCADA schemes that have associated devices presently identified with poor or average condition that presents a risk to the operation of the transmission system.

Table 2 SCADA systems present risk assessment

Location	Scheme type	Schemes	Likelihood	Consequences	Risk rating
Trevallyn	ABB MicroSCADA	Gateway	Almost certain	Minor	Medium
Hadspen	ABB MicroSCADA	Gateway	Almost certain	Minor	Medium
Derwent Bridge	GE Harris D25	Gateway	Likely	Minor	Medium

8 Management plan

8.1 Strategies

The asset management strategies for transmission SCADA schemes are described in the following sections.

8.1.1 Routine maintenance

All TasNetworks current SCADA systems are self-monitored reporting to the NOCS, therefore the only routine maintenance carried out on TasNetworks SCADA/Automation systems is the Network Control Special Protection Scheme (NCSPS) and Frequency Control Special Protection Scheme (FCSPS).

The NCSPS and FCSPS tests are to be undertaken by the associated participants, as per schedule 5 of the SPS participation deed.

The method for testing Hydro Tasmania's generator/s includes:

(i) simulated receipt by the participants remote assets of an interrupt signal; and

(j) timing tests for:

  (i) trip signal receipt within 10 ms (main and duplicate);

  (ii) circuit breaker opening within 200 ms (main and duplicate); and

  (iii) governor solenoid tripping within 15 seconds (main and duplicate).

(k) Tests are to be performed within 42 months following the later of:

  (i) the date of the most recent tests; or

  (ii) the date of the most recent successful provision of an interruption service.

The method for testing participating industrial loads includes:

(l) simulated receipt by the participants remote assets of an interrupt signal; and

(m) timing tests for:

  (i) circuit breaker opening within 200 ms (main and duplicate); and

  (ii) Participant’s circuit breaker trip status to be received by TasNetworks. If any circuit breaker status indication fails, it is required to carry out the test within 1 month of the interruption service.

(n) Tests are to be performed within 36 months following the later of:

  (i) the date of the most recent tests; or

  (ii) the date of the most recent successful provision of an interruption service.

8.1.2 Corrective maintenance

Corrective maintenance of transmission SCADA assets is initiated by:

- SCADA device failures alarmed by self-supervision through the NOC SCADA system; and
- manufacturer product notices.

The process to rectify a failed SCADA device is to remove the failed device and replace it with an identical spare. When a microprocessor device locks up, similar to a “frozen” computer, a power-cycle is attempted first which usually rectifies the lockup. If the lockup continues, the microprocessor device is replaced with a spare and returned to the manufacturer.

8.1.3 Technical support

Other operational costs, which cannot be classified as corrective maintenance, are allocated to the general P&C Technical Support budget. These tasks include:

(a) system fault analysis and investigation;

(b) preparation of asset management plans;

(c) standards management;

(d) management of the service providers;

(e) resources management, particularly professional and technical skills availability;

(f) training;

(g) group management; and

(h) general technical advice.

8.1.4 Unplanned Renewal

The term refurbishment, as applied to SCADA Systems, refers to the replacement of a component of the SCADA scheme, which is mostly the case for corrective maintenance that is required for a failed device that has no dedicated spare. This requires replacing the failed device with a different model, which may include modification to the circuitry and drawings, creation of new settings and complete scheme re-commissioning. This work usually occurs under maintenance processes and does not go through the quality controls of a planned renewal project, which can have an effect on future operations of the SCADA scheme/s. Refurbishment is currently not planned and requires a forced outage of the primary circuit to re-commission the scheme. This can result in constraints being placed on the network and customers until the scheme is restored to normal operation.

TasNetworks do not have a documented process for this type of work but will investigate refining the refurbishment process to improve the quality and economics in comparison to planned renewal. A planned SCADA scheme refurbishment may involve contingency plans to be produced including detailed design drawings, settings and equipment procurements in preparation for the emergency replacement of a failed main SCADA device by internal maintenance resources.

8.1.5 Planned Renewal

Generally, SCADA systems are replaced during major protection scheme replacement programs. This is because the modern protection systems communicate on Ethernet LANs, which result in lower installation costs from installing less copper cables and lesser requirement for equipment I/O. As previously discussed, where some protection schemes are not upgraded during the project, the old RTU remains to support the technology of the remaining protection schemes and is configured as a slave to the new SCADA gateway RTU.

At some sites not requiring protection scheme replacements, where the SCADA systems have been identified as having a high risk of failure, the systems require replacement as an independent project. This requires the installation of a new system and a systematic cutover of each protection scheme to the new system until the old system can be decommissioned. The ABB Micro SCADA and Siemens Substation Automation Systems will fit into this category.

As previously identified, at some sites shared by TasNetworks and Hydro Tasmania, the existing SCADA system is owned and maintained by Hydro Tasmania. In these cases, TasNetworks may be required to construct a dedicated building within the boundary of the switchyard and install a dedicated SCADA system for the monitoring and control of TasNetworks equipment. This has been the case in the past at Liapootah Switching Station and presently at Tungatinah Substation and has been proposed for the Wayatinah Switching Station in 2015.

Additionally, future plans are being considered to implement the International Electroechnical Commission (IEC) 61850 communication protocol at a station bus level at TasNetworks substations. In order to maximise the full effect of implementing IEC 61850 designs, protection, control and SCADA systems should be replaced concurrently. The strategy for implementing the IEC 61850 protocol is described in more detail in the TasNetworks preparation for IEC 61850 document.

A combination of the above strategies will eventuate into the best option for SCADA asset replacements.

The strategy to renew a complete protection scheme in comparison to refurbishment of a single relay is based on the efficiency of attending the site once to replace all components of the scheme rather than piecemeal replacements, as is the case for refurbishment. The asset renewal strategy targets specific models of relay that presents a risk to the operation of the transmission system. By renewing obsolete relays with standardised models, benefits are achieved in technological advancement, maintenance processes and spares management.

Due to the relatively short lifespan of protection and control relays and the volatility of the associated technology, planning the future renewal program is difficult to predict and in order to prepare for the future renewals, forward projections of potential asset failures and obsolescence is used.

TasNetworks is also developing a strategy to retain the protection panel, internal wiring, terminal blocks and external control cables until switchgear renewal is required. In this case, the protection and control relays can be renewed in situ with minimal disturbance of the control cabling and will address the asset refurbishment options discussed in the previous section of this document. This strategy is yet to be finalised but is expecting to achieve significant cost savings for TasNetworks.

8.1.6 Network augmentation

TasNetworks' requirements for developing the transmission system are principally driven by five elements:

- Demand forecasts;
- New customer connection requests;
- New generation requests;
- Network performance requirements; and
- National Electricity Rules (NER) compliance.

The implementation of new SCADA scheme/s is primarily driven by all five of these elements.

8.1.7 Settings and configuration management

Prior to 2006, TasNetworks contracted the management of all SCADA settings to the Hydro Tasmania consulting department. At present, TasNetworks utilise the Digsilent StationWare software for storage of all hard and soft copies of SCADA settings.

Details of the settings management process can be found in the Device Settings and Configuration Management Procedure for CAPEX Projects document – issue 3.0 August 2013.

8.2 Investment evaluation

Investment evaluation is undertaken using TasNetworks' Investment Evaluation Summary template. The template includes:

- a brief description of the asset(s);
- a description of the issues and investment drivers;
- alignment with regulatory objectives;

- alignment with TasNetworks' corporate objectives;
- alignment with TasNetworks' corporate risks;
- impacts to customers;
- analysis of options to rectify the issues including operational and capital expenditures;
- a summary of Net Present Value (NPV) economic analysis for the identified options;
- the preferred option and why;
- the timing of the investment; and
- the expected outcomes and benefits.

8.3 Spares management

The management of spares is the responsibility of the Asset Engineering team. Deficiencies in spares holding are identified during the asset management plan development and where these models of SCADA devices are not obsolete, spares are ordered in alignment with the systems spares policy document number R51737.

TasNetworks currently keep SCADA device spares in two locations in alignment with the field services maintenance teams. The southern location is the Secondary Store Maria Street and the northern location is the Devonport office.

8.3.1 Spares policy

Sufficient spares are required in the northern and southern regions to enable a replacement SCADA device to be installed within the restoration times defined in the National Electricity Market (NEM) operating procedures or associated connection agreements.

8.4 Disposal plan

Transmission SCADA devices that are de-commissioned and removed from substation sites as part of capital replacement projects are disposed of by the project Contractor. Required assets are retained for system spares, as identified by project representatives from the Asset Engineering team.

9 Works program

9.1 Routine maintenance

The TasNetworks transmission assets routine maintenance program of work is developed and managed using a business-wide software tool known as Basix. Basix is linked to the asset and works register (WASP) and is programmed to automatically apply routine maintenance tasks using regimes set by the criteria described in this asset management plan. In March of 2018, SAP will be the asset management tool. There is no budget allocation for routine maintenance of SCADA assets.

9.2 Corrective maintenance

The transmission SCADA corrective maintenance budget is produced by the Protection and Control team in the Asset Engineering department of the Works and Services Delivery group. The corrective costs and volumes are calculated based on historical figures.

9.3 Renewals

9.3.1 SCADA system renewals expenditure

Appendix A show the number of schemes that have been renewed over the past 5 years or are planned for renewal within the next 10 years.

9.4 Budget and volumes

The forecast budget and volumes are contained in the AMP two page summary document http://reclink/R0000863469 .

9.5 Governance

TasNetworks purpose is to deliver electricity and telecommunications network services, creating value for our customers, our owners and our community.

TasNetworks Program of Work (POW) system is designed to integrate the program of works governance that certifies that the strategies identified in this plan are aligned to TasNetworks overall business strategies.

TasNetworks, Asset Strategy and Performance team has established specific goals, quarterly measures and reports its progress towards meeting these goals, which are an integral part of TasNetworks business practices and are tracked along with other business objectives.

This document is owned by Asset Strategy and Performance and is reviewed every two and half years.

10 Related documents

The following documents either have been used to in the development of this asset management plan, or provide supporting information to it:

- R246439 SCADA System Standard
- Z-809-0085-SD-001/022 SCADA System Standard Panel Drawings
- TasNetworks Risk Management Framework
- D13/39576 Assessment of Proposed Regulatory Asset Lives
- R611370 IEC61850 Implementation Strategy
- R51737 System Spares Policy

Appendix A Planned SCADA system renewals

Table 3 2014 – 2018 planned SCADA and Automation scheme renewals

Location	Existing Assets	Existing Asset Age at 2019	Comments/Strategy/Associated Projects
Burnie	GE Harris RTU and IO Boards	20	110kV SCADA system replacement
Farrell	D20ME	22	Transformer protection replacement program (removal)
Hadspen	ABB MicroSCADA	17	SCADA System replacement program
Hampshire	GE Harris D20	22	SCADA System replacement program
Kingston	GE Harris D20M+	21	Huon Area augmentation project (removal)
Knights Road	GE Harris D20M+	23	Knights Road 110kV redevelopment
Meadowbank	GE Harris D20M++	21	Meadowbank 110kV redevelopment
Newton	GE Harris D20	17	Transformer protection replacement program
Trevallyn	ABB MicroSCADA	17	SCADA System replacement program
Wayatinah	GE Harris D20EME, D25	(age at 2024 =20)	Complete SCADA scheme and bay controller replacement

Table 4 2019 – 2024 planned SCADA and Automation scheme renewals

Location	**Existing Assets**	**Existing Asset Age at 2024**	**Comments/Strategy/ Associated Projects**
Boyer	GE Harris RTU and IO Boards	20	Scheme replacement from co-ordinated with 6.6kV switchboard replacement
Chapel Street	GE Harris RTU and IO Boards	19	Complete SCADA system replacement co-ordinated with 11kV switchboard works
Devonport	Areva C264 and Foxboro	18	Complete SCADA system replacement and C264 replacement
Emu Bay	D20M and I/O Boards	27	Removal project associated with switchboard replacement and protection works
Gordon	GE Harris and Foxboro equipment	19	Complete SCADA system replacement co-ordinated with Bus Bar protection works
Kermandie	GE Harris D25 and D20	19	Complete SCADA scheme and bay controller replacement
Lindisfarne	Foxboro and C264	20	Complete SCADA scheme and bay controller replacement except Bay Z1
New Norfolk	GE Harris D20	29	Remove as part of 22kV switchgear and protection works
Palmerston	GE Harris D20, D25, Foxboro, Areva C264	24	Complete SCADA scheme and bay controller replacement except Bay O1 and R1 bays
Queenstown	GE Harris D20EME, D25	20	Complete SCADA scheme and bay controller replacement
Sheffield	GE Harris D20EME, D25, C264	20	Complete SCADA scheme and bay controller replacement except N1,V1,U1,T1,S1, T1 and B4 bay controllers
Smithton	GE Harris D20ME and D25	21	Complete SCADA scheme and bay controller replacement
Temco	D20ME, D20EME,D25, C264	20	Complete SCADA scheme and bay controller replacement except A1 bay controller
Waddamana	D20EME, D25	20	Replace 110kV GE Harris equipment only

Table 5 2025 – 2029 planned SCADA and Automation scheme renewals

Location	Existing Assets	Existing Asset Age at 2029	Comments/Strategy/ Associated Projects
Burnie	GE Harris D25	29	Remove 22kV bay controllers as part of the protection upgrade
Comalco	GE Harris D20ME	23	SPS Scheme Replacement
Derby	GE Harris D20EME, D25	23	Complete SCADA scheme and bay controller replacement, except D1
Electrona	GE Harris D20EME, D25	22	Complete SCADA scheme and bay controller replacement
Liapootah	Foxboro, Areva C264	24	Complete SCADA scheme and bay controller replacement
Mowbray	GE Harris , D20EME, D25	24	Complete SCADA scheme and bay controller replacement
Port Latta	Foxboro, D25, Areva C264	24	Complete SCADA scheme and bay controller replacement
Risdon	GE Harris , D20EME, D25	23	Complete SCADA scheme and bay controller replacement for 33kV and 11kV equipment
Savage River	Foxboro, Areva C264	23	Complete SCADA scheme and bay controller replacement
Scottsdale	GE Harris D20EME, D25	23	Complete SCADA scheme and bay controller replacement
Triabunna	GE Harris D20ME, D25	23	Complete SCADA scheme and bay controller replacement

Appendix B AEMO time interval requirements

Column 1	Column 2	Column 3	Column 4
		Time Interval	
Type	Category	Normal standard	Interim standard
analogue value	a high resolution measurement of system frequency or electrical time required by AEMO from a Transmission Network Service Provider for central dispatch	2 seconds	2 seconds
status indication	main dispatch data	6 seconds	7 seconds
analogue value or discrete value	main dispatch data	6 seconds	7 seconds
status indication	main system data or dispatch data that is not main dispatch data	8 seconds	9 seconds
analogue value or discrete value	main system data or dispatch data that is not main dispatch data	14 seconds	15 seconds
status indication	neither main system data nor dispatch data	12 seconds	13 seconds
analogue value or discrete value	neither main system data nor dispatch data	22 seconds	23 seconds

Appendix C AEMO outage allowance

Column 1	Column 2	Column 3
Category of remote monitoring equipment and remote control equipment	**Total period of critical outages**	
	normal standard	**interim standard**
remote control equipment	24 hours	48 hours
remote monitoring equipment not transmitting or receiving main system data or dispatch data	24 hours	48 hours
remote monitoring equipment transmitting main system data or dispatch data but not main dispatch data	12 hours	24 hours
remote monitoring equipment transmitting or receiving main dispatch data for which AEMO has agreed that it has substitute values for that dispatch data	12 hours	24 hours
remote monitoring equipment transmitting main dispatch data for which AEMO has not agreed that it has substitute values for that dispatch data	6 hours	12 hours