Asset Management Plan

Telecommunications Site Infrastructure

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Authorisations

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Review cycle	2.5 Years	

Responsibilities

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

The approval of this document is the responsibility of the General Manager, Strategic Asset Management.

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

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

Record of revisions

Section number	Details

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Glossary of Terms

a.c	Alternating Current
A/C	Air Conditioning
AC	Alternating Current
ACA	Australian Communications Alliance
ACMA	Australian Communications and Media Authority
AD	Active Directory
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AGM	Absorbed Glass Mat Sealed Lead Acid Cells/Batteries
AS	Australian Standard
AUGEX	Augmentation Expenditure. This is a subset of CAPEX.
battery	A collection of electrochemical cells electrically connected to form a single unit.
bearer	A physical medium for the carriage of telecommunications services.
CAD	Computer Aided Design
CAPEX	Capital Expenditure
CCTV	Closed Circuit Television
cell	Electrochemical Cell
contract	A written or spoken agreement, especially one concerning employment, sales, or tenancy that is intended to be enforceable by law.
culvert	A tunnel carrying a stream or open drain under a road or railway.
d.c	Direct Current
DC	Direct Current
desiccant	A hygroscopic substance that induces or sustains a state of dryness (desiccation) in its vicinity
DNS	Domain Name System
DNSP	Distribution Network Service Provider
DVR	Digital Video Recorder
electrolyte	A substance that produces an electrically conducting solution when dissolved in a electrically polar solvent.
embankment (1)	a wall of stone or earth made to keep water back or to carry a road or railway/railroad over low ground

embankment (2)	A slope made of earth or stone that rises up from either side of a road or railway/railroad
ERP	Enterprise Resource Planning
GIS	Geographic Information System
HEC	Hydro Electric Commission
HVAC	Heating Ventilation and Air Conditioning
hygroscopic	Readily taking up and retaining moisture.
ISO	International Standards Organisation
IT	Information Technology
ITU	International Telecommunications Union
KPI	Key Performance Indicator
LAN	Local Area Network
laser	Light Amplification by Stimulated Emission of Radiation.
lease	A contract by which one party conveys land, property, services, etc. to another for a specified time, usually in return for a periodic payment.
mains (electricity)	A connection to the pubic electricity grid.
MAN	Metropolitan Area Network
NER	National Electricity Rules
NMS	Network Management System
NZS	New Zealand Standard
OPEX	Operational Expenditure
OSI	Open Systems Interconnection
PS	Power Supply
PSU	Power Supply Unit
R19	The regulatory period from the financial years 2019 to 2024.
REPEX	Replacement Expenditure. This is a subset of CAPEX.
RF	Radio Frequency
SAN	Storage Area Network
SAP	System Application Products
SCADA	Supervisory Control and Data Acquisition
SLA	Sealed Lead Acid
tenure	The conditions under which land or buildings are held or occupied.
TESI	Tasmanian Electricity Supply Industry
TNSP	Transmission Network Service Provider

TOTEX	Total Expenditure defined as Operational Expenditure + Capital Expenditure
verge	The verge of a road is a narrow piece of ground by the side of a road usually with grass or other vegetation.
VRSLA	Valve Regulated Sealed Lead Acid Battery/Cell
WAN	Wide Area Network

1 Purpose

The purpose of this document is to describe the management of Telecommunications Site Infrastructure and related assets:

- TasNetworks' approach to asset management, as reflected through its legislative and regulatory obligations and strategic plans
- The key projects and programs underpinning its activities
- Forecast CAPEX and OPEX, including the basis upon which these forecasts are derived

2 Scope

2.1 Telecommunications Site and Asset Boundaries

This asset management plan addresses the site infrastructure assets which comprise of the following locations:

- Telecommunications repeater sites;
- Equipment rooms within substations and power stations allocated to telecommunications use; and
- The telecommunications racks and cabinets (including telecommunications power supplies and battery racks/banks) which are alongside other electrical equipment racks.

2.2 Inclusions

The scope of this Asset Management Plan document includes, but is not limited to, the following prescribed telecommunications assets:

- Site tenure – ownership and lease arrangement for TasNetworks' occupation of the site;
- Site access tracks – Roads providing vehicular access to repeater sites including boom gates and security controls;
- Vegetation management;
- Site security – Fences, alarming and video surveillance systems;
- Earthing and Lightning protection;
- Antenna support structures;
- Buildings and equipment rooms;
- AC Mains supply;
- DC power systems;
- Waveguide dehydrators; and
- Pits, ducts, pipes and trenches for telecommunications asset exclusive use owned by TasNetworks.

2.3 Exclusions

The scope of this Asset Management Plan document excludes:

- Non-Prescribed telecommunications assets and systems
- Prescribed assets covered under other Telecommunications portfolio asset management plans

- Transmission and distribution electricity network operational and management systems
- Transmission and distribution electricity network Supervisory Control and Data Acquisition systems
- Virtual and/or physical servers and associated storage access networks (SAN).
- Operating systems and associated supporting software such as anti-virus, patch-management, DNS and Windows Active Directory Services
- Corporate and Administrative Information Technology systems and assets managed by the Information Technology group
- Sites and Infrastructure managed by other TasNetworks' Asset Management Plans such as Network and Facilities; and
- Sites and Infrastructure managed by other owners (shared sites);

3 Strategic Alignment and Objectives

This asset management plan has been developed to align with both TasNetworks' Asset Management Policy and Strategic Objectives. This management plan describes the asset management strategies and programs developed to manage the Telecommunications, with the aim of achieving these objectives.

3.1 Overall business objectives

For these assets the management strategy focuses on the following objectives:

- Safety will continue to be our top priority and we will continue to ensure that our safety performance continues to improve
- Service performance will be maintained at current overall network service levels, whilst service to poorly performing reliability communities will be improved to meet regulatory requirements
- Cost performance will be improved through prioritisation and efficiency improvements that enable us provide predictable and lowest sustainable pricing to our customers
- Customer engagement will be improved to ensure that we understand customer needs, and incorporate these into our decision making to maximise value to them
- Our program of work will be developed and delivered on time and within budget

3.2 Strategic asset management objectives

- Present an overview of the telecommunications management systems asset populations;
- Manage business risk presented by the assets to within acceptable limits;
- Achieve reliable asset performance consistent with prescribed service standards;
- Assess the risks specific to the assets and identify corresponding risk mitigation strategies;
- Ensure the effective and consistent management and coordination of asset management activities relating to the assets throughout their life-cycle;
- Ensure our team members are trained, authorised and competent to undertake their work activities;
- Demonstrate that the assets are being managed prudently throughout their life-cycle;
- Ensure asset management issues and strategies, as they relate to the assets, are taken into account in decision making and planning; and

- Define future operational and capital expenditure requirements of the assets.

4 Asset Information Systems

4.1 Systems

Prescribed telecommunications asset data and information is currently stored and managed using the following systems and methods:

- Autodesk AutoCAD and Microsoft Visio drawings stored within the Information Management systems. Each telecommunication site has a detailed set of drawings including:
    - site drawings
    - building drawings
    - rack layout drawings
    - schematic diagrams
    - wiring diagrams
    - manufacturer drawings
- Excel Spreadsheets for information such as krone termination details
- Network Management System software as detailed in section 5
- Geographic Information System (GIS) used for fibre optic cable management
- The Australian Communications and Media Authority (ACMA) radio frequency (RF) database and associated RF Hazard folders
- A Microsoft Access database that is scheduled to be replaced by a SAP based ERP system in 2018

4.2 Asset Information

The asset data for TasNetworks' Network Management Systems Assets has been well documented and detailed using the current Asset Information systems TasNetworks has in place.

5 Description of the Assets

5.1 TasNetworks Telecommunication Site Infrastructure Overview

TasNetworks owns and manages a state-wide operational telecommunications network. The Tasmanian Electricity Supply Industry (TESI) relies on this network for its operational telecommunications needs. The network is a fully integrated platform consisting of microwave radio and optical fibre bearers supporting the provision of the following services to TESI:

- Electrical protection and control;
- Supervisory Control and Data Acquisition (SCADA);
- Telephony and voice services for operational and corporate use including interfaces with the Tasmanian Government Trunk Mobile Radio Network; and
- Data telecommunication services for operational and corporate use.

In addition, some difficult to access locations utilise low bandwidth power line carrier systems as either their primary or backup communications bearer.

The TasNetworks Telecommunications Network which is a critical operational component of the Tasmanian Electricity Network comprises 146 physical sites which are described in the following table.

It is important to note that some of the sites accommodate more than one type of telecommunication network node.

Table 1 - TasNetworks' Telecommunications Network Nodes

TasNetworks' Telecommunications Node Classification	Number of Telecommunications Network Nodes
Digital microwave radio backbone nodes	20
Small radio repeater nodes	17
Terminal radio nodes (Generation)	48
Terminal radio nodes (Substation)	51
Passive reflector	3
Optical fibre nodes	80
Office nodes	9
Total	**228**

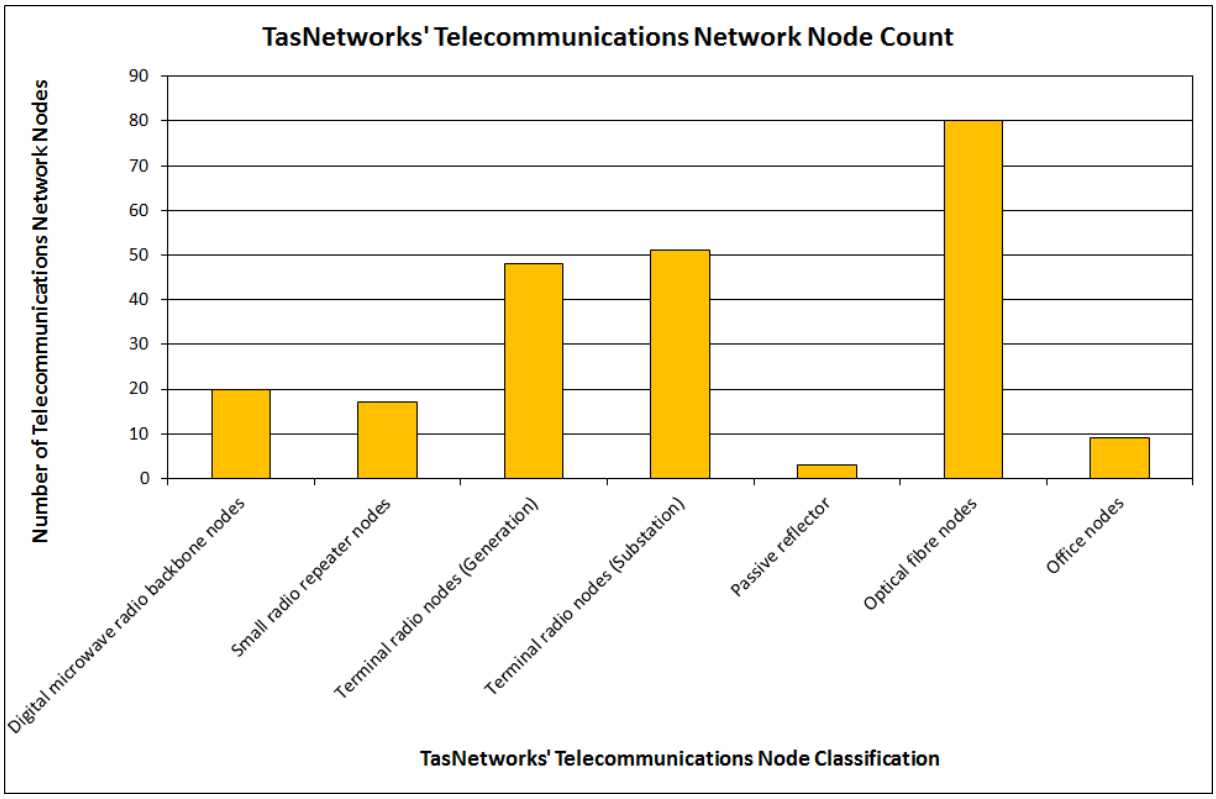

Figure 1 - TasNetworks' Telecommunications Network Node Count

The telecommunications network is designed and operated to provide high performance in terms of the telecommunications service availability. In order to ensure compliance with National Electricity Rules, system diversity is provided where necessary to further increase the system performance, safety, security and reliability for the operation of the electric power system.

The telecommunications network nodes mentioned above rely on site infrastructure to house, protect and power them. This asset management plan deals with that infrastructure and the associated sites.

5.2 Telecommunications Site Infrastructure Asset Categories

The site infrastructure provides the safe and secure site facilities within which the bearer network operates, and the performance of the bearer network is directly affected by the performance of these assets. These assets are categorised as follows:

- Telecommunications sites:
    - Site tenure;
    - Site Security and access controls;
        - Fences and gates;
        - Locks;
        - Security alarms;
        - Closed circuit surveillance systems;
    - Vegetation management;
- Roads and tracks;
- Earthing systems and lightning protection;

- Towers and support structures;
- Buildings and rooms;
    - Climate control systems;
- Alternating current (AC) power supplies;
- Direct Current Power Supplies;
    - Battery banks;
    - Rectifiers/Battery Chargers;
    - DC-DC converters;
- Waveguide dehydrators; and
- Telecommunications pits, conduits, ducts and trenches.

The description of these asset types will be described in the following sections of this asset management plan.

5.2.1 Telecommunications Sites

5.2.1.1 Site Tenure

TasNetworks has rights of tenure over land on which telecommunications infrastructure has been constructed, or is proposed for installation to facilitate the supply of electricity.

These rights of tenure establish the legal right for TasNetworks to construct, maintain, develop access and remove its telecommunications and associated infrastructure necessary for the safe, secure and reliable supply of electricity.

TasNetworks' current tenure of land for telecommunications use may be one of the following types:

- Freehold title where TasNetworks is the registered land owner;
- Site lease; or
- Site license to operate a telecommunications facility.

The following table and graph summarise the different types of site tenure TasNetworks' holds:

Table 2 - TasNetworks' Telecommunications Site Tenure Summary

TasNetworks' Telecommunications Site Tenure Types	Number of Sites
Freehold Title	63
Site Lease	20
Site License	63
Total	**146**

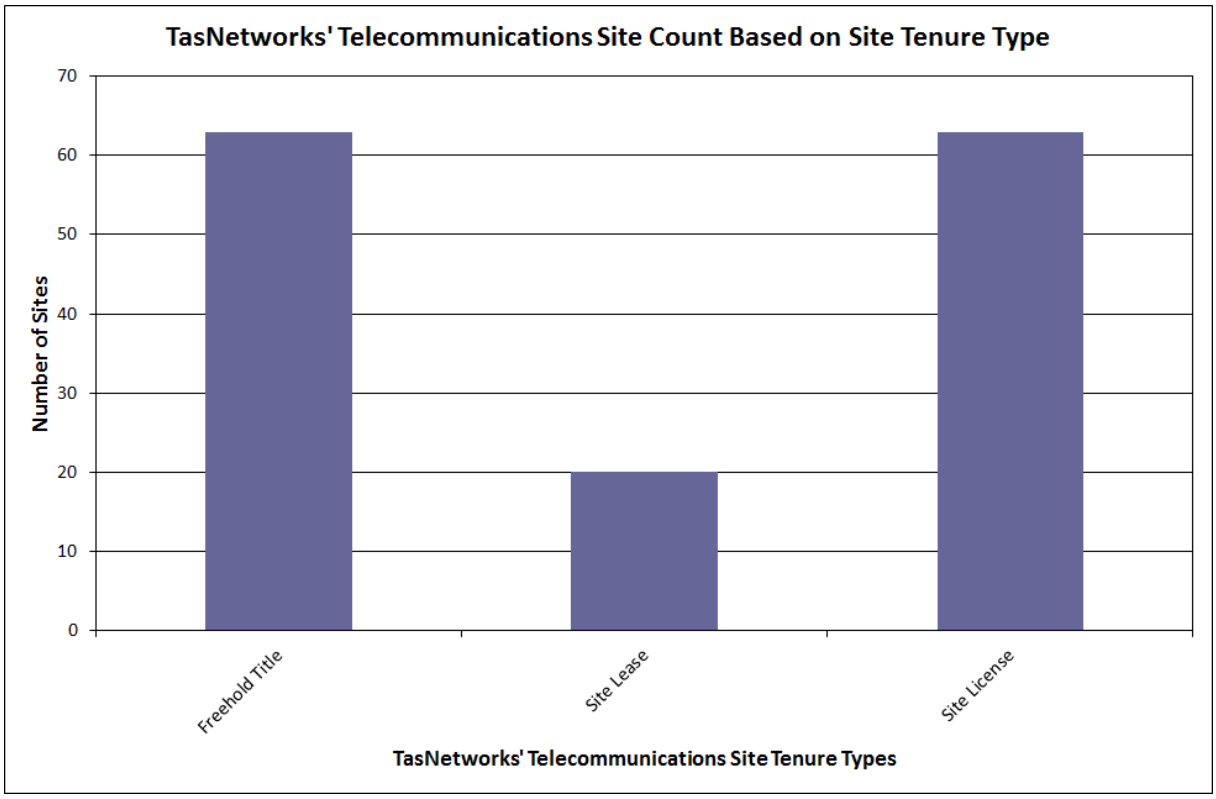

Figure 2 - TasNetworks' Telecommunications Site Count Based on Site Tenure Type

TasNetworks' interest in telecommunications sites servicing the operational telecommunications network is long term and the strategy for the sites is to obtain and maintain long term tenure. TasNetworks' preference is to own the freehold title to the site, alternatively, long term site leases or licences are sought and negotiated.

In relation to site leases and licenses, TasNetworks enters into negotiations with the site owners to renew, once the leases and licences are nearing expiry. Terms generally range from 5 to 20 years.

5.2.1.2 Site Security and access controls

Controlled access to TasNetworks' telecommunications sites is essential to site and telecommunications network security, which, in turn, impacts power system security. There are several levels of security at TasNetworks' remote telecommunications sites. The levels of security are dependent on risks assessed against the TasNetworks' Risk Management Framework.

It is important to note that the security systems covered by this asset management plan relate only to those at TasNetworks' dedicated telecommunications sites.

5.2.1.2.1 Fences

In terms of site security, the first line of defence at the remote telecommunications sites is the security fence which is installed around the compound. The remote telecommunications sites are provided with a chain mesh perimeter fence which includes a double width vehicle access gate, allowing where site configuration permits, for vehicle access to the front of the building. All new telecommunications site fencing and fence upgrades are being installed to comply with a variation to TasNetworks' Substation Security Fences and Gates Standard. The variation to the as TasNetworks' Substation Security Fences and Gates Standard is that telecommunications site

fences are not installed with concrete plinths or possum guard and backstays are only included every second post.

The telecommunications site fence maintenance history is shown in the following figure:

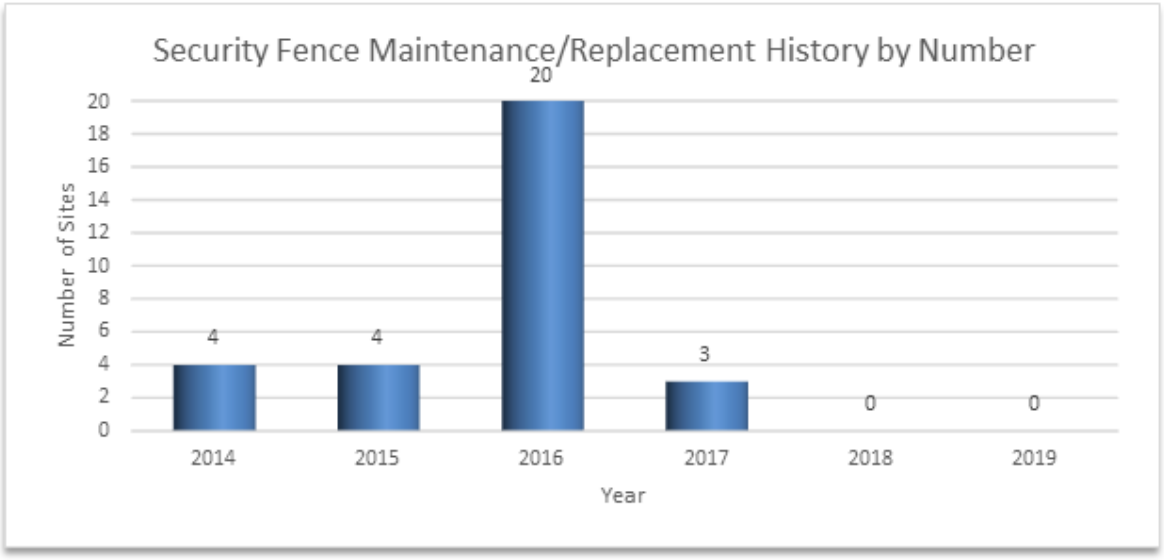

Figure 3 – TasNetworks' Telecommunications Site Fences Maintenance and Replacement History

The next figure shows the condition and TasNetworks' standards compliance of the telecommunications site fences.

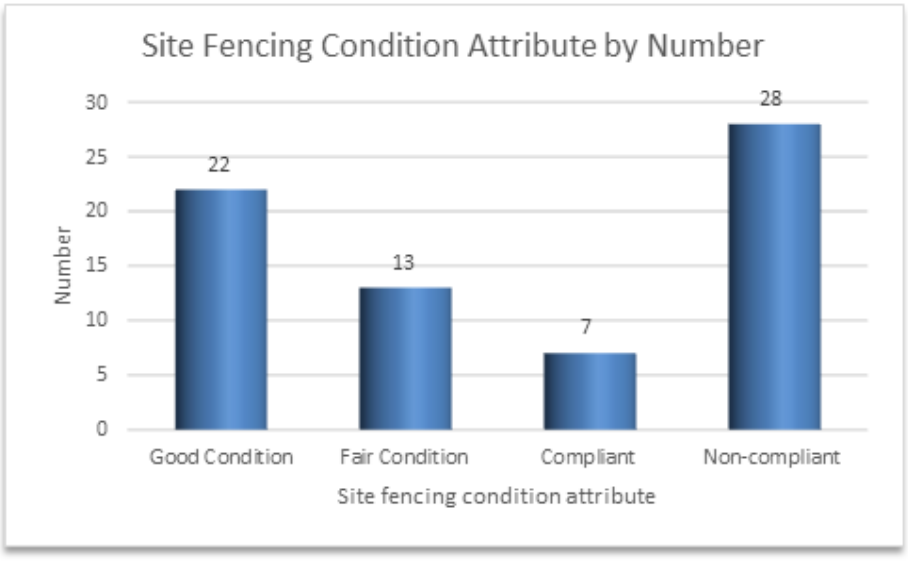

Figure 4 - TasNetworks' Telecommunications Site Fences Condition and TasNetworks' Standards Compliance

5.2.1.2.2 Gates, doors, alarms and locks

The site access boom gates, main gates, secure doors in telecommunications buildings, and anti-climb barriers on towers are equipped with security locks. An alarm monitoring system is also used to monitor access to the buildings and security breaches. A new registered key system for doors and locks was installed during the R14 revenue period to replace an obsolete and aging lock and key system.

Electronic monitoring relies on the supervisory Programmable Logic Controllers (PLCs) located at each of the telecommunications sites. The site Programmable Logic Controllers (PLCs) are used to consolidate all site alarms and monitoring information. The PLCs are managed under the Telecommunications Bearer Network Asset Management Plan. These PLCs also allow for the connection of site security alarms for central monitoring. Each of the buildings is fitted with a door alarm and a temperature sensor which are interfaced to the site PLCs.

5.2.1.2.3 Video Surveillance Systems/Closed Circuit Television Systems

Closed Circuit Television Systems (CCTV) systems have currently been installed at 4 of the highest risk telecommunications sites as recommended by a Tasmanian Police report as a deterrent to criminal activity and unauthorised access.

The feeds from the surveillance systems are recorded by local digital video recorders and sent over the TasNetworks' telecommunications network to TasNetworks' Telecommunications Operations for remote monitoring and recording.

In the 2019-2024 regulatory period there is a capital program of work to extend this network to the other telecommunications sites based on the security risk to the assets.

5.2.1.3 Vegetation Management

Routine vegetation management is undertaken for the following assets:

- Sites; and
- Roads and Tracks; and
- Telecommunications radio paths

This work is done on an annual basis commencing in spring each year. Some corrective works are done as required to make sites safe and to remove obstructions on radio paths and roads.

Appropriate permissions from land owners on private land and government bodies on crown land are negotiated as required to make sure that work is done on good terms and that it is done in an environmentally responsible manner.

5.2.1.4 Site Access Roads and Tracks

Vehicular access is required to TasNetworks' remote telecommunications sites to facilitate the construction, maintenance and other operational activities at those sites. TasNetworks utilises over 65km of roads and tracks (or parts thereof) for this purpose and assumes responsibility for 28 roads and tracks comprising a total length of approximately 23km.

TasNetworks' telecommunications roads and tracks are provided from the nearest public or private road. They are not provided for access by the general public and they are generally constructed to a Tasmanian Forestry Class 4 standard.

The following graph depicts a profile of the roads and tracks utilised by TasNetworks' based on distance.

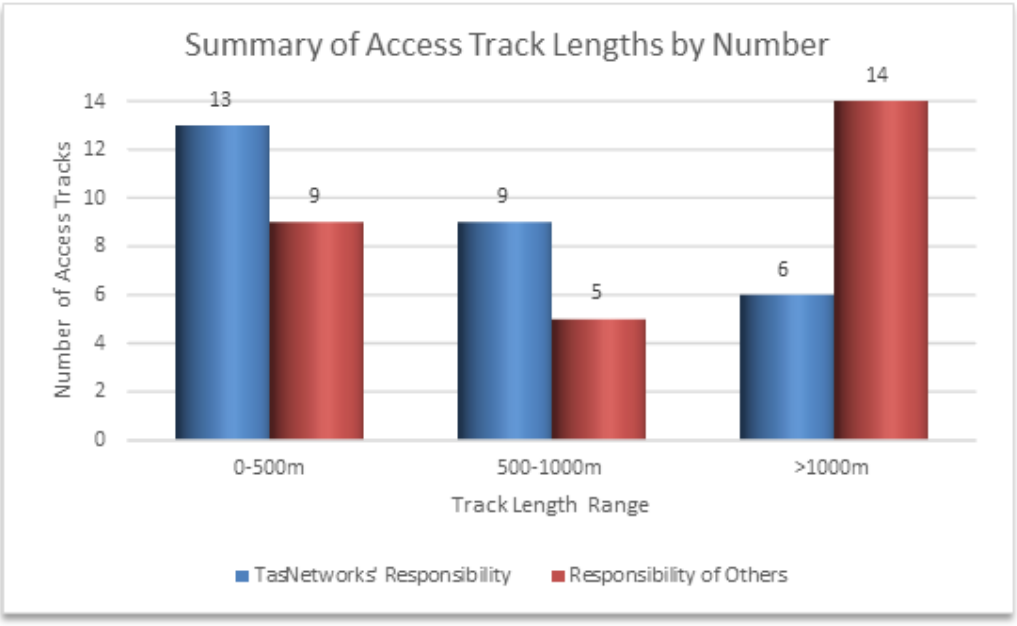

Figure 5 - TasNetworks' Road and Track Count Based on Road Length

TasNetworks' aims to maintain roads and tracks in a serviceable condition so as to allow access to remote telecommunications sites at all times particularly during adverse weather conditions. Notwithstanding this, from time to time there may be seasonal restrictions on access to some sites due to snow, flooding, wildlife protection requirements, bushfire activity and occasions of high wind.

Maintaining the serviceability of access roads and tracks requires attention to watercourse crossings and drainage infrastructure. Very few bridges are utilised, however culverts of varying construction are common.

Access road and track maintenance also requires attention to the following tasks:

- effective drainage management;
- maintaining the surface in a serviceable condition;
- clearing debris and fallen trees from the roads and tracks; and
- Trimming undergrowth on embankments and verges of the roads and tracks.

TasNetworks' telecommunications site access roads and tracks are maintained regularly and road upgrades are undertaken to ensure an adequate road quality to allow the maintenance of the telecommunications network. The following graph depicts the access roads and tracks maintenance history from the period 2014 to 2019 inclusive.

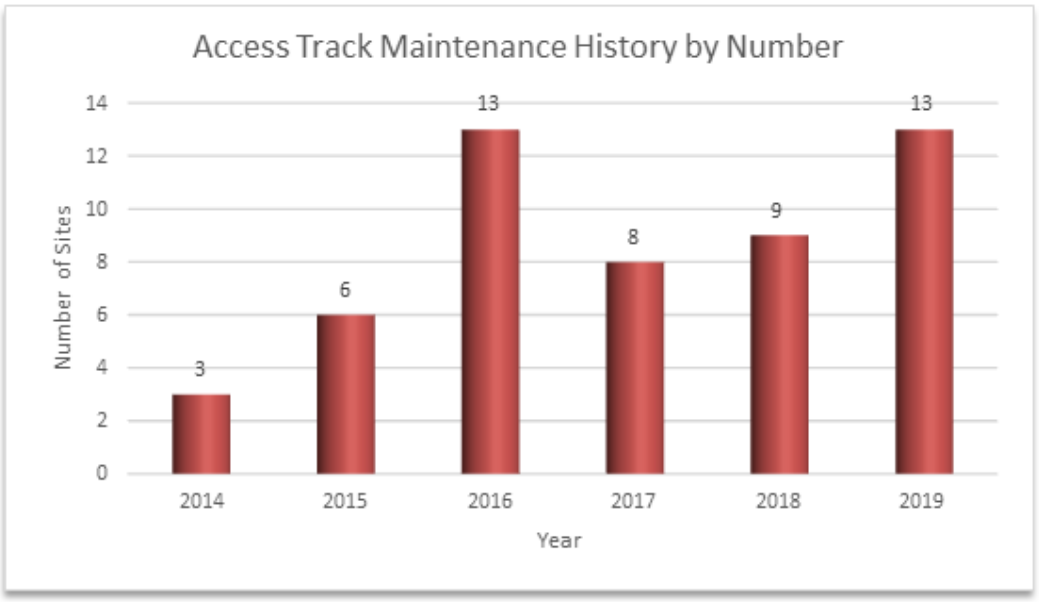

Figure 6 - TasNetworks' Roads and Tracks Maintenance History Count

5.2.2 Earthing and Lightning Protection

An adequate site earthing and lightning protection system is critical to the successful operation of a telecommunications network. Equipotential bonding of the various components on site can improve the overall system performance. All equipment within the building has an earth connected to a common earthing bar to maintain the equipotential bond. The equipment is attached to the site earth mat.

The earth mat provides a critical function for the dissipation of lightning across the site as well as for providing the common reference potential for all of the equipment. The site earthing and lightning protection system includes:

- The earth mat and grading ring around the perimeter of the site;
- The building Earthing systems and connections to the earth mat;
- Earth electrodes and connections to structures and equipment;
- Lightning rods and associated earth conductors down structures; and
- The support structures/towers.

All system earthing connections are maintained as good quality connections without corrosion, mechanical damage or poor jointing to maintain a safe, secure and reliable Earthing system.

The earthing and lightning protection systems have been installed with the major civil works undertaken at the sites. The infrastructure upgrades in 1995 as part of the original Digital Microwave Radio Project included earthing system and lightning protection upgrades at the major sites around the state.

Greenfield sites have been provided with earthing systems during design and construction. These systems are designed specifically to the site and local conditions.

5.2.2.1 Towers and support structures

TasNetworks utilises 57 towers across its 146 telecommunications sites. The towers range in height from 5m to 50m and they are used to support antennas for TasNetworks' digital microwave

radio network and other smaller antennas for other miscellaneous radio systems. The towers vary in height, structure type and design depending on the requirements of the site, the number and size of antennas they are expected to support, and environmental conditions (for example expected wind load).

The towers used for TasNetworks' telecommunications are categorised into three basic construction types:

- steel lattice towers;
- monopoles; and
- Concrete stobie poles.

The following graphs show the asset counts of TasNetworks' towers based on type, based on the tower heights, and the age profiles for the tower and support structure assets.

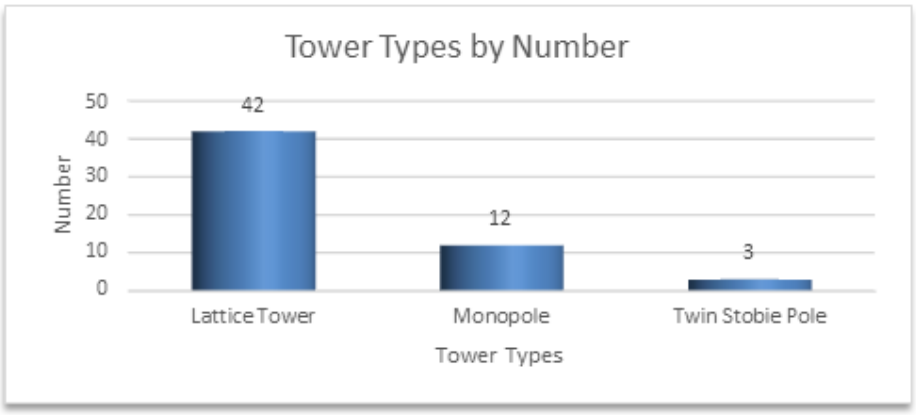

Figure 7 - TasNetworks' Telecommunications Tower Asset Count by Structure Type

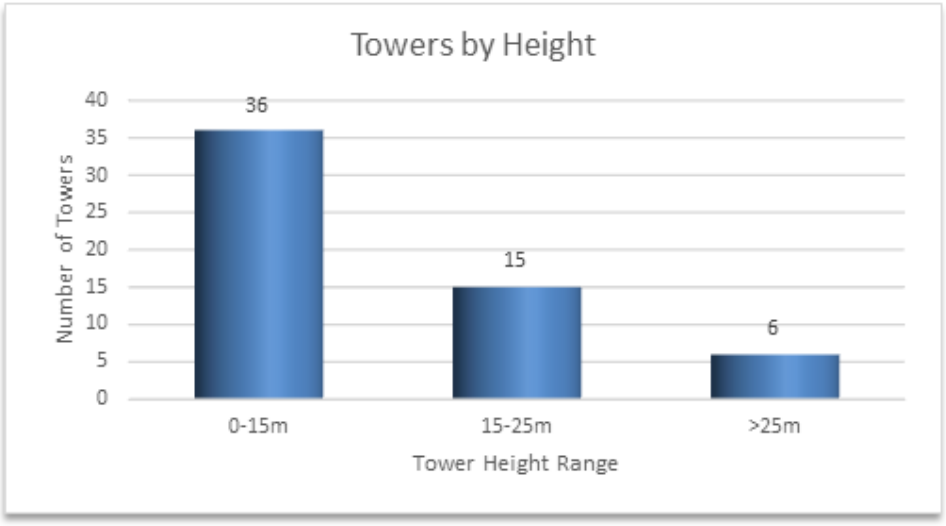

Figure 8 - TasNetworks' Telecommunications Tower Asset Count by Structure Count by Structure Height

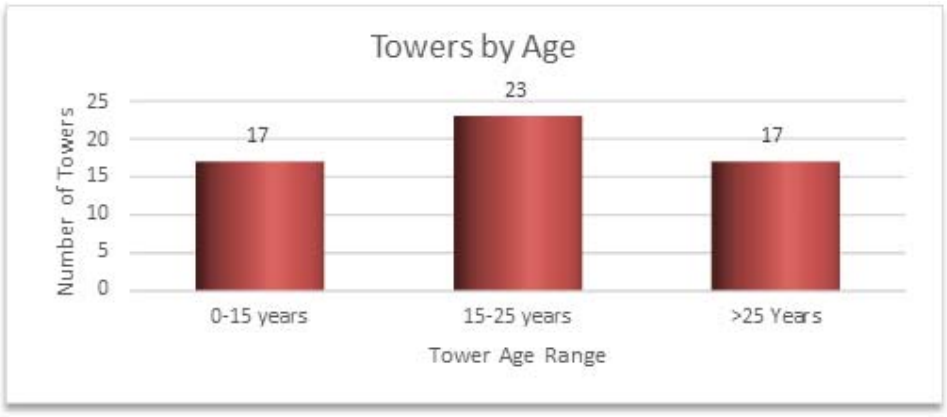

Figure 9 - TasNetworks' Telecommunications Towers and Support Structures Age Profile

A description of each tower type is described in the following sections.

5.2.2.1.1 Steel lattice towers

The following photograph depicts a typical steel lattice telecommunications tower. These towers consist of numerous steel members jointed with plates and bolts for structural strength. All steelwork is hot dipped galvanised for corrosion protection. There are various designs of lattice towers and they range in height from 10m to 50m.

Steel lattice towers have fixed climbing ladders (usually with a cage) for ease of access to the tower platforms and to maximise safety, all of the ladders have a certified compliant climbing system installed.

In order to minimise corrosion, vegetation is kept clear of lattice tower base steelwork.

Figure 10 - An example of a steel lattice telecommunications tower

5.2.2.1.2 Monopoles

A monopole is a free standing support structure with a single footing attachment. TasNetworks' uses of monopoles are at locations where the antenna wind loading at a site is low. Two styles of monopole are in use:

- Steel lattice monopole; and
- Tapered hollow steel monopole.

Both types are hot dipped galvanised for corrosion protection.

5.2.2.1.2.1 Steel lattice monopoles

The following photograph shows an example of a steel lattice monopole with pegs in one corner for climbing the structure with a certified compliant climbing system.

Figure 11 - An example of a steel lattice monopole support structure

5.2.2.1.2.2 Tapered hollow steel monopoles

The following photograph shows an example of a tapered hollow steel monopole this type of structure is hot dipped galvanised and access to the antenna is only provided by an elevated work platform or a crane.

Figure 12 - An example of a tapered hollow steel monopole support structure

5.2.2.2 Concrete stobie poles

Concrete stobie poles have been installed in the past by TasNetworks for the shorter antenna mounting poles with a low antenna wind loading. A tapered hollow steel monopole is now used in preference to concrete stobie poles as a more suitable option for larger microwave antennas. The TasNetworks' telecommunications network includes some Stobie poles as single poles to mount antennas, or twin Stobie poles joined with a platform and mounting arrangement.

The following photographs show the different styles of concrete stobie pole designs used for TasNetworks' telecommunications sites.

Figure 13 - An example of a single concrete stobie pole support structure

Figure 14 - An example of a twin concrete stobie pole support structure

5.2.2.3 Telecommunications buildings and rooms

Safe, secure, weather proof equipment accommodation is a requirement for the safe, secure and reliable operation of the TasNetworks' telecommunications network. This is achieved in a variety of ways by utilising:

- Dedicated equipment huts – usually at telecommunications repeater sites;
- Dedicated equipment rooms – usually within power stations and some substations; or
- Equipment racks in a common equipment room – usually within substations and power stations.

The equipment huts and rooms are fitted with dedicated telecommunications cable runways, rack suites and 48V DC power. Where required, dedicated optical fibre ducts and Ethernet cable ducts are provided. Conduits and ducting are also used to provide the physical separation needed between telecommunications and power cabling as required by Australian Communications and Media Authority (ACMA) rules. Where the telecommunications equipment is installed in a common equipment room, the telecommunications racks are fully self-contained with integrated 48V DC power supply.

The building and equipment room infrastructure category includes building services such as the AC mains connection (the connection point and the last span), the AC switchboard, the AC generator inlet connection and where applicable heating, ventilation and/or air conditioning. Surge suppression devices are fitted to the building AC mains supplies to protect the equipment contained within the building from lightning strike and mains power surges. In some cases, the AC supply is provided as a non-metered supply. AC mains connections date back to the time of the initial site development.

Temperature monitoring is provided in the equipment rooms using appropriate sensors and transmitters. Some temperature monitoring units are also installed within closed equipment racks.

There are four types of telecommunications buildings in use by TasNetworks. These are:

- Pre-fabricated concrete huts;
- Transportable steel clad huts (legacy);
- Transportable polystyrene sandwich huts; and
- Masonry/Brick building.

A graph of the telecommunications building types by number is shown in the following figure.

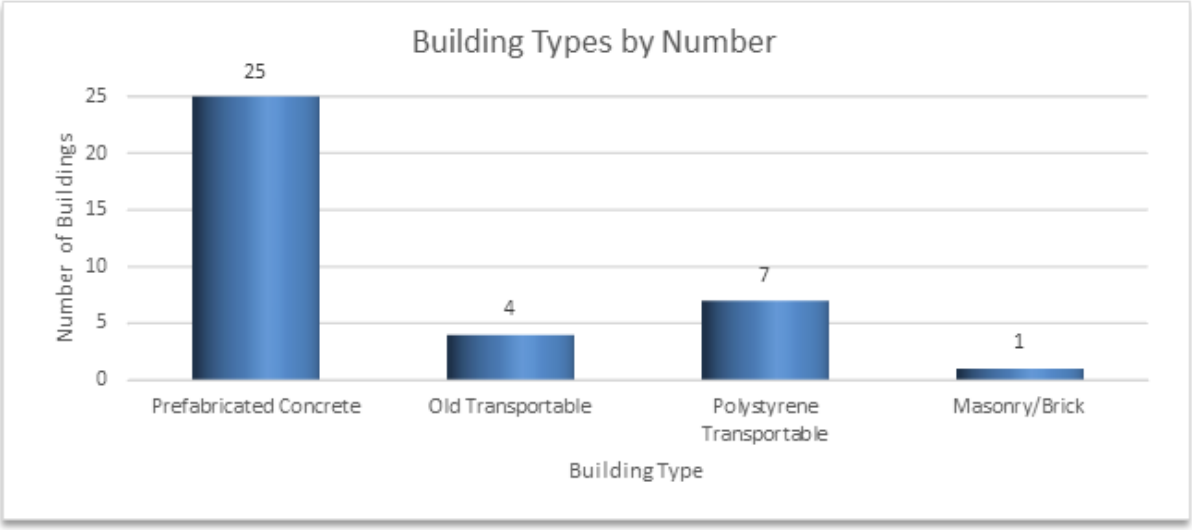

Figure 15 - TasNetworks' Telecommunications Buildings Asset Count by Building Type

Some of TasNetworks' repeater site buildings date back to the late 1960s and were installed during the construction of the Gordon Power Scheme. A large number of pre-fabricated concrete shelters were constructed during the major Digital Microwave Upgrade project in 1995 which was associated with the state-wide de-manning of power stations and implementation of centralised control centres. In some cases the pre-fabricated concrete shelters replaced older huts and some of these huts remain on site for use by other site users.

The age profile of the buildings used by TasNetworks is provided below in the following graph.

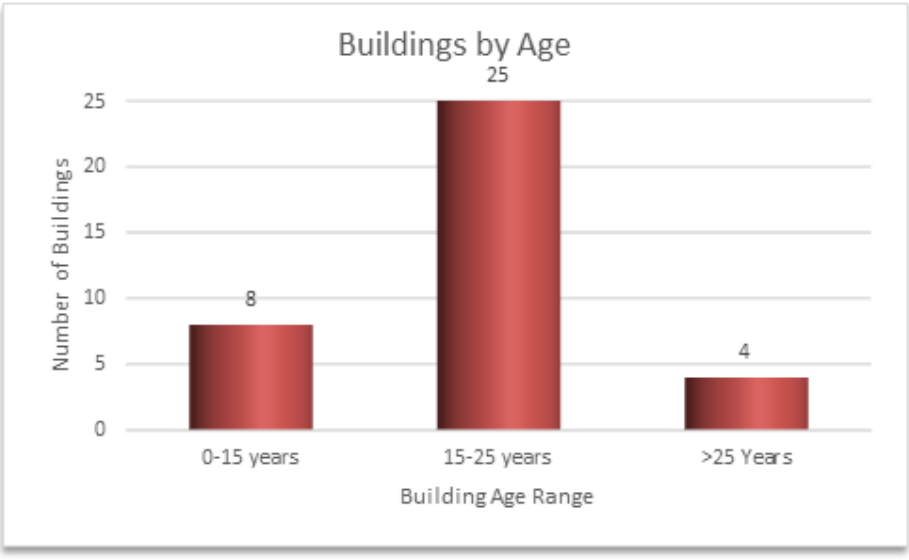

Figure 16 - TasNetworks' Telecommunications Buildings Age Profile by Building Type

The description of the different types of telecommunications buildings used by TasNetworks is described in the following sections.

5.2.2.3.1 Prefabricated Concrete Huts

The prefabricated concrete huts are the main type of equipment shelters deployed throughout the network providing good environmental stability inside the hut and a high level of physical security. The following photograph shows an example of a prefabricated telecommunications hut.

Figure 17 - An example of a pre-fabricated concrete telecommunications hut

5.2.2.3.2 Transportable steel clad hut (legacy)

The original Hydro Electric Commission design transportable steel clad huts were installed over 30 years ago. Only 4 of the original huts remain. These huts are confined, not climate controlled and the internal environment is not stable. These huts will be replaced in future regulatory periods with the standardised prefabricated concrete hut type.

The following photograph shows an example of this type of telecommunications hut.

Figure 18 - An example of a transportable steel clad telecommunications hut

5.2.2.3.3 Transportable Polystyrene Sandwich Huts

The transportable polystyrene sandwich huts are a prefabricated hut constructed with steel clad polystyrene panels for the walls and ceiling and typically utilise a standard wooden floor. The huts are typically positioned on plinths. There are 7 of these huts. These huts have very limited floor space and are used for some of the smaller repeater sites only. These huts are being replaced with the standardised prefabricated concrete type in future regulatory periods.

An example of this type of telecommunications hut is shown in the following photograph.

Figure 19 - An example of a transportable steel clad polystyrene telecommunications hut

5.2.2.3.4 Brick/Masonry Buildings

This type of building is of a standard commercial brick/masonry construction. TasNetworks' shares one brick building site with other users.

An example of this type of telecommunications building is shown in the following photograph.

Figure 20 - An example of a brick/masonry telecommunications building

5.2.3 Direct Current (DC) Power Supply Systems

The telecommunications equipment relies heavily on duplicated DC power supply systems as a critical system component. Telecommunications equipment operates on -48V DC power with a minimum of 24 hours battery backup provided for critical systems (48 hours for remote, difficult to access sites). TasNetworks' telecommunications sites are provided with DC rectifiers and batteries according to the site load design. System criticality and business risk drives the need for the battery systems to be duplicated. In addition to the 48V AC-DC rectifiers, a small number of sites are provided with isolated DC-DC converter systems operating from the site 125V DC batteries (substations and power stations).

5.2.3.1 Electrochemical Batteries Cells

The electrochemical batteries used in the telecommunications systems are sealed lead acid type batteries of either:

Absorbed Glass Mat Cells (AGM); or

Valve Regulated Sealed Lead Acid Cells (Gel Electrolyte).

Based on risk, the provision of redundancy at telecommunications sites also requires batteries to be deployed as duplicated A and B 48V DC battery banks.

The failure modes and typical asset lives of lead-acid batteries are well understood. The typical useful life of the 48V DC lead-acid battery banks is 10 years. The cells used by TasNetworks are the maintenance free type and the first cells start to fail close to the 10 year mark. When a single cell fails, typically others will follow after the faulty cell is replaced. Therefore, when a cell of this age fails, the entire bank is replaced, with the duplicate bank also being replaced shortly after.

The age profile of the current fleet of battery banks are shown in the following graph.

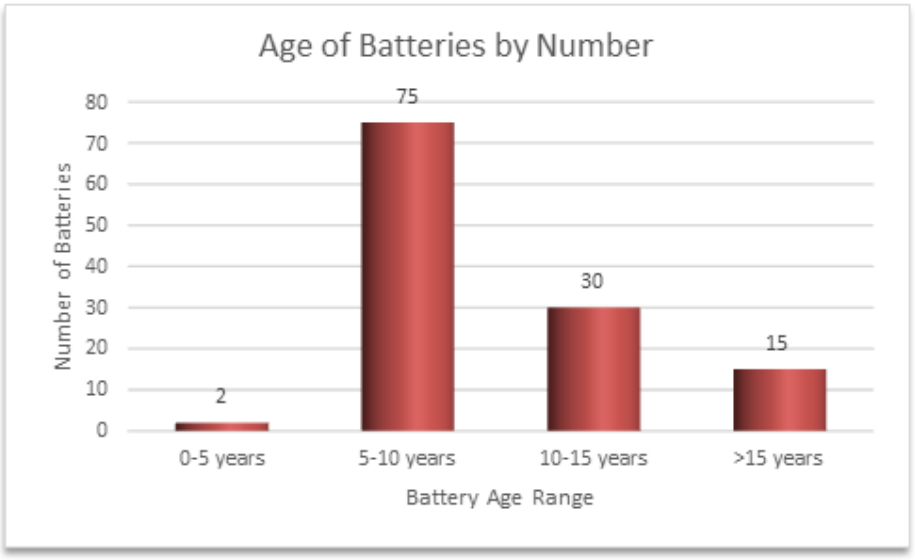

Figure 21 - TasNetworks' Telecommunications Battery Banks Age Profile

5.2.3.2 AC-DC Rectifier Assets

The following types of AC-DC rectifiers are used on the TasNetworks' telecommunications network:

- Exicom
- M+H Power Systems – Harmer and Simmons SM1800
- M+H Power Systems – Harmer and Simmons SM600
- Invensys IMPS 300
- Eaton APS 3/6 v1
- Eaton APS 3/6 v2
- Eaton APS 3/6 – 3G (latest model)
- Powerware IAP300

These rectifiers charge and monitor the 48VDC battery banks and provide load power to the telecommunications equipment when the AC supplies are online and functioning normally.

5.2.3.3 DC-DC Converter Assets (legacy)

As stated previously, some existing sites utilise isolated DC-DC converters to obtain 48V DC from the 125V DC from the substation/power station DC supplies. The DC-DC converters used have to be the isolated type as the grounding requirements of the telecommunications equipment are different from the DC systems used in substations and power stations.

This design approach is no longer used as there are significant risks as these DC-DC converters provide a single point of failure for the telecommunications equipment DC supplies. In the future, these sites will be retrofitted with their own independent 48 V DC systems and rectifiers exclusively for the telecommunications equipment.

The current model of DC-DC converter used for these sites is:

- The Amtek 125V-48V DC-DC Converter System

5.2.3.4 AC-DC Rectifiers and DC-DC Converters Asset Information

5.2.3.4.1 Asset Age Profile

The age profile of the AC-DC Rectifiers and DC-DC Converter assets is provided in the following graph.

The Exicom and M+H systems have exceeded the typical 10 year life of the power electronic assets and are targeted for replacement. The Eaton APS 3G series of AC-DC rectifiers is the current model rectifier used in the network. The legacy DC-DC converters are all greater than 10 years of age. Operational concerns with the DC-DC converter systems will see the replacement of the DC-DC converters with 48V DC battery banks and AC-DC rectifier systems going forward.

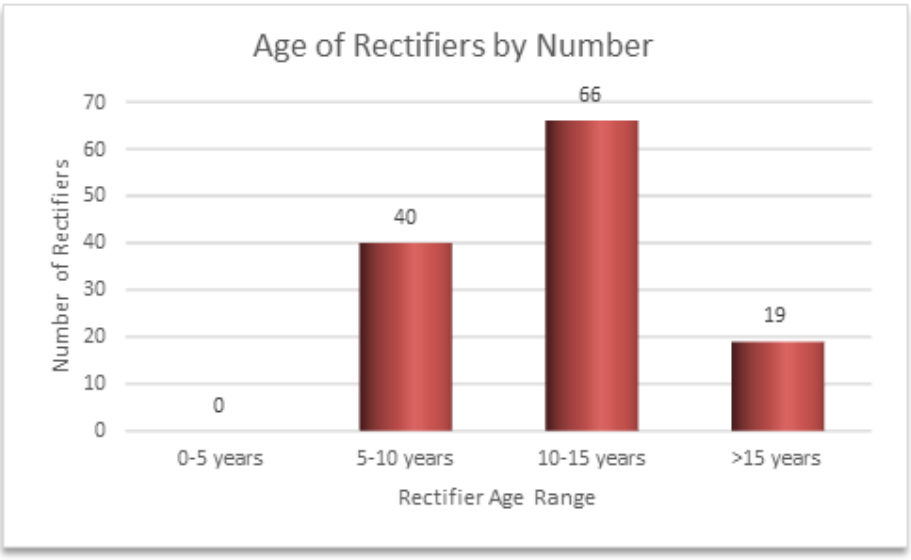

Figure 22 - AC-DC Rectifier and DC-DC Converter Asset Age Profile

5.2.4 Waveguide Dehydrators

Radio Frequency (RF) signals are attenuated when the RF path is presented with excessive moisture. This includes moisture that may be present in the waveguide and antenna feed-horn (or illuminator) subsystem. Moisture is excluded from the waveguide and antenna feed-horn subsystem by utilising the following systems:

- an electromechanical waveguide dehydrator;
- a static moisture desiccant; or
- a combination of the two systems;

These systems are connected to the waveguide through the connector flange.

Electromechanical waveguide dehydrators utilise an air compressor to pressurise microwave radio waveguides with clean, dry air to exclude moisture from the waveguide sections of the radio systems. Static desiccants are used to absorb moisture.

TasNetworks currently utilises the Andrew Corporation XT300 waveguide dehydrator at larger sites to service multiple waveguide feeders on the site. Sites with up to 2 radio links are provided with the smaller desiccant style MR050 systems. Some sites use only a SD-003 static desiccant canister on each individual waveguide.

The XT300 systems are now obsolete and future maintenance work will require the replacement of the current units with the new Andrew Corporation MT050 units.

All of the old XT300 electromechanical waveguide dehydrators that are present in TasNetworks' telecommunications network were installed during the Digital Microwave Radio upgrade in 1995.

5.2.4.1 Waveguide dehydrators age profile and asset count

The waveguide dehydrators age profile and asset counts are shown in the following graphs.

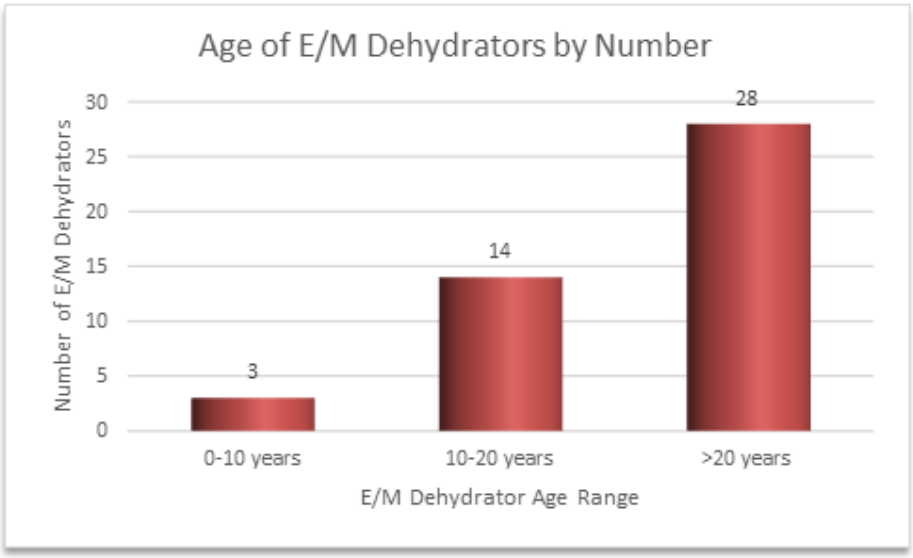

Figure 23 - Waveguide Dehydrators Age Profile

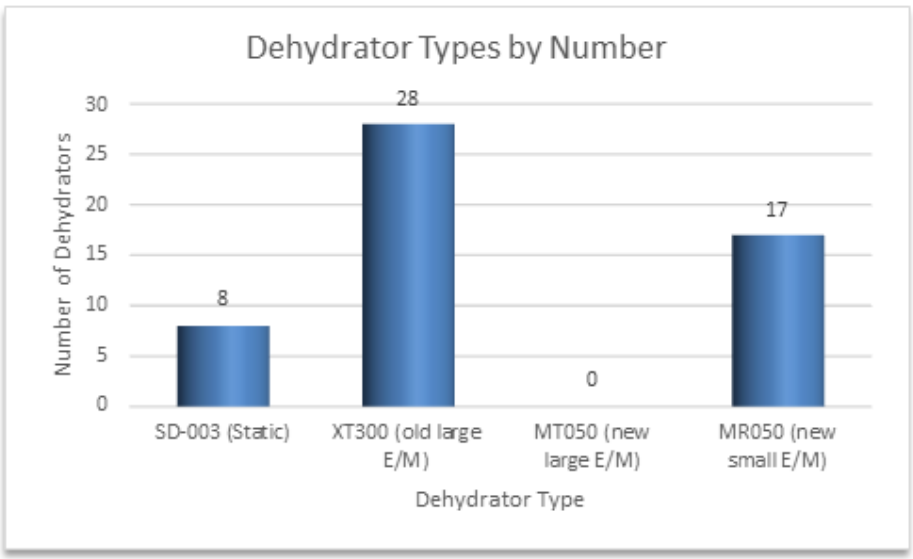

Figure 24 - Waveguide Dehydrators Asset Count

6 Standard of Service

6.1 Technical Standards

The following table lists the standards and general requirements of the TasNetworks' Telecommunications Site Infrastructure assets.

The TasNetworks' standards also refer to Australian and international standards in their respective scopes.

Table 3 - TasNetworks' Telecommunications Site Infrastructure Applicable Standards and Requirements

Infrastructure Category	Applicable Requirements and Standards
Site tenure	TasNetworks' approved lease / license
Fences and Gates	TasNetworks' Security Fences and Gates Standard, R0000579297, http://reclink/R0000579297
Site access roads and tracks	Tasmanian Forest Practices Authority, Forest Practices Code (current code), http://www.fpa.tas.gov.au/publications
Earthing and lightning protection	TasNetworks' Substation Lightning Protection and Earthing Standard, R0000522692, http://reclink/R0000522692
Towers and antenna support structures	AS/NZS 1170.0 Structural design actions - General principles, ranked as "Importance Level 4" with a lifespan of 50 years, https://www.saiglobal.com/online/
Buildings and equipment rooms	All new telecommunications huts are to be of pre-fabricated concrete construction. Building standards are generally in accordance with the following TasNetworks' Standard: TasNetworks' Substation Civil Design and Construction Standard, R0000590634, http://reclink/R0000590634
DC power systems	AS 2676.2 Australian Standard - Part 2 Sealed Cells, https://www.saiglobal.com/online/ AS/NZS 3000 - Wiring Rules, https://www.saiglobal.com/online/ AS/CA S009, Installation requirements for customer cabling (Wiring rules), http://www.commsalliance.com.au/Documents/all/Standards/s009

Infrastructure Category	Applicable Requirements and Standards
AC supply systems	AS/NZS 3000 - Wiring Rules , https://www.saiglobal.com/online/ AS 2067 - Substations and high voltage installations exceeding 1 kV a.c. , https://www.saiglobal.com/online/ AS/NZS 3008.1.1 - Electrical installations - Selection of cables for (>=0.6/1kV AC), https://www.saiglobal.com/online/ AS/CA S009, Installation requirements for Customer Cabling (Wiring Rules), http://www.commsalliance.com.au/Documents/all/Standards/s009
Waveguide dehydrators	Manufacturer Specifications and Equipment Condition

6.2 Performance Objectives

The condition of assets in their relevant categories relates to their safety, security and reliability to provide their required functions. The most common condition issues for the various asset categories are presented in the following table.

Table 4 - Condition factors of Telecommunications Site Infrastructure Assets

Infrastructure Category	Condition factors
Sites	Vegetation and obstructions
Fences and Gates	Corrosion and mechanical damage
Site access roads and tracks	Road surface deterioration and obstructions
Earthing and lightning protection	Corrosion, mechanical damage, loose connections, resistivity to earth
Towers and antenna support structures	fastener and tower member corrosion, mechanical damage, missing or loose members and fasteners
Buildings and equipment rooms	Corrosion, mechanical damage, leaks, animal proofing, weatherproofing, seal condition, coating conditions (paints and sealants)
DC power systems	Battery and cell voltage, battery capacity, rectifier load capability, rectifier output voltage and current ratings, DC cabling and wiring condition
AC supply systems	Corrosion, mechanical damage, loose connections, insulation condition, cables and wiring condition
Waveguide dehydrators	Air compressor run time (run hours), filter condition, water catcher condition (compressed air dryer), static desiccant saturation levels (usually colour indicator)

6.3 Key Performance Indicators

The asset sub-categories are described below with details of the performance measures and the resulting Key Performance Indicators (KPIs). Asset faults and non-conformances are managed by Telecommunications Design and Field Services Group and are recorded in the telecommunications network management system as a fault. Asset condition issues are subsequently rectified, whilst systemic issues are subject to an investigation to establish the root cause and to recommend remedial strategies.

The record of equipment failures is maintained in the telecommunications network management system enabling internal performance monitoring and trending of all infrastructure related faults and defects. This allows design faults and poor component performance levels to be identified and adequately addressed.

6.3.1 Site Tenure, Access and Security Systems, and Vegetation

Telecommunications infrastructure is typically situated in remote locations at elevated altitudes and is subject to harsh environments. Since regular site visits only occur every 6 months, it is important to ensure that vegetation is cleared within and around the site to minimise the risk of bushfire damage. It is also important to be assured of the integrity of the site fence and gates and that the security and lock systems are fully operational between site visits.

The Key performance indicators for site tenure access and security systems, and vegetation are provided in the following table.

Table 5 - Key Performance Indicators for Site Tenure, Access and Security Systems and Vegetation

Asset Type	Performance Measure	Performance Target
Site tenure	Lease or licence	Leases and licences renewed 6 months before expiry
Vegetation	Clearance of vegetation within the site perimeter and to a distance from the site perimeter	To a distance of 20 metres
	Height of cleared vegetation outside the site perimeter	0 millimetres within the site perimeter < 100 millimetres height for up to 3 metres < 1 metre height for further 17 metres
Fences and gates	Surface corrosion/rust on site fences and gates	< 5%
	Structurally sound	0% structural mechanical damage
	Structural corrosion/rust (deep, heavy pitting)	0%

Asset Type	Performance Measure	Performance Target
Security systems and locks	Security system operation	Security alarm tests 100% Local functionality 100% Bidirectional remote status and control to Telecommunications Operations 100%
	Video Surveillance Systems	Closed circuit cameras and local digital video recorders functioning normally Remote audio and/or video feeds available to Telecommunications Operations Bidirectional remote status and control to Telecommunications Operations 100%
	Keys and locks	Smooth operation 0% corrosion Mechanically uncompromised

6.3.2 Site Access Roads and Tracks

Vehicular access is crucial for the maintenance of the telecommunications network. The site access roads and tracks need to provide unimpeded access for authorised vehicles and should be maintained to Tasmanian Forestry Class 4 standard.

The Key performance indicators for telecommunications site access roads and tracks are provided in the following table.

Table 6 - Site Access Roads and Tracks Key Performance Indicators

Asset Type	Performance Measure	Performance Target
Site access roads and tracks	Culverts and drains	Clear of obstructions
	Road/track Surface	Smooth, free of erosion, and free of potholes
	Vegetation (sides)	Clear of roadway
	Vegetation (overhang)	No vegetation overhang below 5 metres

6.3.3 Earthing and Lightning Protection Systems

The earthing and lightning protection system is to provide performance based on the key performance indicators in the following table.

Table 7 - Earthing and Lightning Protection Systems Key Performance Indicators

Asset Type	Performance Measure	Performance Target
Site earthing and lightning protection system	Earth mat impedance	< 5 Ohms
	Earthing connections	Secure with no signs of serious corrosion

6.3.4 Towers and Support Structures

The key performance indicators for telecommunications towers and support structures are provided in the following table.

Table 8 - Telecommunications Towers and Support Structures Key Performance Indicators

Asset Type	Performance Measure	Performance Target
Telecommunications Towers and Support Structures	Surface corrosion/rust	< 5%
	Structural corrosion/rust (deep, severe pitting)	0%
	Number of missing and loose fasteners	0
	Number of missing/broken structural members	0
	Structure foundation	Structurally sound

6.3.5 Buildings and Rooms

The buildings and rooms used for the housing of telecommunications equipment are to provide a controlled dust-free environment within which the equipment can operate. The key performance indicators for the site buildings are provided in the following table.

Table 9 - Telecommunications Buildings and Rooms Key Performance Indicators

Asset Type	Performance Measure	Performance Target
Telecommunications Buildings and Rooms	Water Ingress	None
	Internal ambient temperature (no HVAC)	0 degrees to 40 degrees Celsius
	Internal ambient temperature (with HVAC)	0 degrees to 25 degrees Celsius
	HVAC systems	100% trouble free operation with filters cleaned/replaced each routine visit
	Building/room condition	Structurally sound and defects logged during routing and corrective site visits. Corrections addressed based on risk and severity of the defect.

6.3.6 Direct Current (DC) Supply Systems

The DC power supply systems at telecommunications sites must be maintained to the highest standard in order for the telecommunications bearer network to meet the required performance standards, even during times of AC Mains failure. To ensure this high level of performance, duplicate power supply systems are required with the correct capacity and ratings based on fault response time and the equipment used.

The key performance indicators for telecommunications DC supply systems are provided in the following table. These KPIs are based on Australian Standards and the requirements of the National Electricity Rules.

Table 10 - Telecommunications Direct Current (DC) Supply Systems Key Performance Indicators

Asset Type	Performance Measure	Performance Target
Battery banks	Capacity	33% in excess of site continuous load per bank
	Run Time (urban sites)	>= 24 hours per bank
	Run Time (rural/remote sites)	>= 48 hours per bank
	Battery casings	No damage or leaks
	Battery terminals and connections	Secure with no corrosion
Rectifiers	Power Rating	Sized for the connected loads (Watts) and battery bank capacity (Ampere hours)
	Availability	>= 99.995%

6.3.7 Alternating Current (AC) Power Supplies Key Performance Indicators

The key performance indicators for telecommunications AC supply systems are provided in the following table. These KPIs are based on Australian Standards and the requirements of the National Electricity Rules.

The AC supplies must be restored before the DC battery banks are exhausted during an AC supply fault. This is achieved using fixed or portable diesel generators until grid AC supplies are restored.

Table 11 - Telecommunications Alternating Current (AC) Supply Systems Key Performance Indicators

Asset Type	Performance Measure	Performance Target
AC service span/underground connection	Connected in accordance with AS/NZS: 3000 with secured connections and connected correctly to the earthing system.	100% Compliant
Surge arrestors	Not exhausted and operational (usually fail open circuit)	Operational
AC Generators	Fully operational and load tested and serviced regularly. Must be available to run when required.	>= 99.95%
Metering	Compliance from Metering Service Provider	100% Compliant
AC supply system	Working as designed and compliant with AS/NZS: 3000 and TasNetworks' standards.	100% Compliant

6.3.8 Waveguide Dehydrators

The key performance indicators for the Waveguide Dehydrators are provided in the following table.

Table 12 - Waveguide Dehydrators Key Performance Indicators

Asset Type	Performance Measure	Performance Target
Waveguide Dehydrators	Availability	>= 99.90%
Static desiccants	Saturation Level Chemical Indicator (Colour)	Not saturated

7 Associated Risk

7.1 Risk Management Framework

TasNetworks has developed a Risk Management Framework for the purposes of assessing and managing its business risks, and for ensuring a consistent and structured approach for the management of risk is applied.

An assessment of the risks associated with the Telecommunications Site Infrastructure has been undertaken in accordance with the Risk Management Framework. For each asset in this class the assessments have been made based on:

- Condition of the Telecommunications Site Infrastructure in service across the network
- Criticality of the Telecommunications Site Infrastructure and associated assets
- Probability of failure (not meeting business requirement)
- Consequence of failure
- Performance
- Safety risk
- Environmental risk
- Customer

Due to the level of risk identified in some of the assessment criteria a requirement to actively manage these risks has been identified.

7.2 Risk Matrices for the proposed programs of work and assets

The proposed programs of work in this Asset Management Plan will manage the risks to TasNetworks at an acceptable level in accordance with the TasNetworks' Risk Management Framework. The risk matrices for the different Telecommunications Site Infrastructure assets are detailed in the following section of this Asset Management Plan.

7.2.1 Telecommunications Sites Risk Matrix

Table 13 - Telecommunications Sites Risk Matrix

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Customer	Not addressing poor asset performance will likely result in telecommunications system outages which may result in subsequent power system compliance issues. This results in poor service to connected customers.	Possible	Minor	Low	Low
Environment and Community	Site Security Risk: There is an increased risk of environmental damage by trespassers damaging the local ecosystem with vehicles and illegal dumping of rubbish. Vehicles may damage the environment/ecosystems in the local area.	Likely	Minor	Medium	Low
Financial	Intentional and/or unintentional damage to TasNetworks Assets due to criminal activity. Risk of telecommunications faults and damage causing unplanned replacements/repairs of assets. Possibility of financial penalties due to operational telecommunication service downtime. Loss of revenue due to telecommunications network downtime. Risk of public liability litigation.	Likely	Moderate	High	Low

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Network Performance	There is an increased risk of prescribed telecommunications system failures and faults which may cause power system events/issues due to poor site maintenance and security. The consequences of this would be a major telecommunications outage which will prevent SCADA (Supervisory Control and Data Acquisition), operational communications and protection and control communications from working.	Possible	Moderate	Medium	Low
Regulatory Compliance	Non-compliance with National Electricity Rules. A decline in network availability affects the ability of TasNetworks to maintain compliance with the National Electricity Rules. Risk of non-compliance with current Telecommunications Acts/Codes/Standards due to poor asset management and increase telecommunications network downtime.	Possible	Moderate	Medium	Low
Reputation	There is unlikely to be any significant risk to TasNetworks' reputation.	Rare	Negligible	Low	Low
Safety and People	Risk of unauthorised persons trespassing and other actions causing an injury or fatality to themselves or to TasNetworks staff/contractors. This is due to the introduction of new hazards due to criminal acts and unauthorised persons not being trained in TasNetworks Health and Safety procedures. If the sites/land is not maintained correctly there is a risk of injury or death.	Possible	Severe	High	Medium

7.2.2 Telecommunications Vegetation Management Risk Matrix

Table 14 - Telecommunications Vegetation Management Risk Matrix

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Customer	Not addressing poor asset performance will likely result in telecommunications system outages which may result in subsequent power system compliance issues. This results in poor service to connected customers.	Possible	Minor	Low	Low
Environment and Community	Possibility of bushfires on remote telecommunication sites where the alternating current feeders connect to the site infrastructure. If vegetation on the sites and site access roads and tracks is not kept in check there is a risk that vegetation may come in contact with the conductors connecting the distribution transformer to the telecommunications site. Although this is a relatively small length of conductor, the space around it and under it needs to be kept clear of vegetation. TasNetworks' remote telecommunications sites are in high risk bushfire areas that can cause significant damage if set alight.	Possible	Severe	High	Medium
Financial	There is a possibility of financial risks to the TasNetworks' business if a bushfire occurs and it is caused by a TasNetworks' Telecommunications asset. Poor vegetation management will increase this risk.	Possible	Moderate	Medium	Low

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Network Performance	Vegetation may affect radio paths if it interferes with line of sight. Roots can damage underground infrastructure, foundations and footings of buildings, towers and other structures causing unplanned outages. Parts of the prescribed Telecommunications network will be non-operational or severely compromised including operational voice/telephony communications. The non-prescribed services such as general administrative business communications may be compromised. Protection and control and SCADA (supervisory control and data acquisition) systems will be compromised. This may risk the security and stability of the power system.	Possible	Moderate	Medium	Low

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Regulatory Compliance	Non-compliance with National Electricity Rules. Overall network compliance may be jeopardised if staff/contractors are unable to access the sites. Reasonable and safe road conditions are essential to enabling access. Non-compliance with Australian and/or Tasmanian Standards/Codes with regards to asset management of roads and tracks may cause compliance, safety, environmental and litigation issues. Non-compliance of vegetation management codes in high bushfire risk areas. Poor access roads and tracks will result in TasNetworks being non-compliant with the telecommunications industry standards, legislation and codes due to lack of timely fault resolution.	Possible	Moderate	Medium	Low
Reputation	If poor vegetation management on a Telecommunications Site causes a bushfire. There is a significant risk of damage to TasNetworks' reputation.	Possible	Major	High	Low

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Safety and People	Risk of fatalities if a bushfire occurs due to not clearing vegetation around a remote telecommunications site. Possibility of bushfires on remote telecommunication sites where the alternating current feeders connect to the site infrastructure. If vegetation on the sites and site access roads and tracks is not kept in check there is a risk that vegetation may come in contact with the conductors connecting the distribution transformer to the telecommunications site. Although this is a relatively small length of conductor, the space around it and under it needs to be kept clear of vegetation. If roads and tracks are not kept clear of vegetation, emergency services may not be able to access someone in an emergency situation.	Possible	Severe	High	Medium

7.2.3 Telecommunications Roads and Tracks Risk Matrix

Table 15 - Telecommunications Roads and Tracks Risk Matrix

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Customer	Not addressing poor asset performance will likely result in telecommunications system outages which may result in subsequent power system compliance issues. This results in poor service to connected customers.	Possible	Minor	Low	Low
Environment and Community	There is unlikely to be any significant risk to the environment and community.	Rare	Negligible	Low	Low
Financial	There is a minor risk to TasNetworks' financial position.	Unlikely	Minor	Low	Low
Network Performance	Poor condition of access roads and tracks will not allow for the timely resolution of faults. Access roads in poor condition may cause power outages due to emergency generators not being able to be connected to the sites. Poor access roads may impede or prevent staff/contractors access to the site for fault resolution, maintenance and upgrades which may cause compliance and regulatory issues. Outage times of the telecommunications network will be extended due to staff not being able to access the sites.	Possible	Moderate	Medium	Low

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Regulatory Compliance	Non-compliance with National Electricity Rules. Overall network compliance may be jeopardised if staff/contractors are unable to access the sites. Reasonable and safe road conditions are essential to enabling access. Non-compliance with Australian and/or Tasmanian Standards/Codes with regards to asset management of roads and tracks may cause compliance, safety, environmental and litigation issues. Poor condition access roads and tracks will result in TasNetworks being non-compliant with the telecommunications industry standards, legislation and codes due to lack of timely fault resolution.	Possible	Moderate	Medium	Low
Reputation	There is unlikely to be any significant risk to TasNetworks' reputation.	Rare	Negligible	Low	Low
Safety and People	Access roads and tracks become dangerous to drive on with an increased risk of vehicle accidents. Vehicles can get stuck impeding access and escape if there is a natural disaster such as a bushfire. People may get injured or killed as a result of poor road conditions. Access by emergency services may be impeded by poor road conditions.	Possible	Severe	High	Medium

7.2.4 Telecommunications Towers and Antenna Support Structures Risk Matrix

Table 16 - Telecommunications Towers and Antenna Support Structures Risk Matrix

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Customer	Not addressing tower integrity issues will likely result in telecommunications system outages. This may result in subsequent power system compliance issues. This results in poor service to connected customers.	Possible	Minor	Low	Low
Environment and Community	There is unlikely to be any significant risk to the environment and community.	Rare	Negligible	Low	Low
Financial	Intentional and/or unintentional damage to TasNetworks Assets due to criminal activity. Risk of telecommunications faults and damage causing unplanned replacements/repairs of assets. Possibility of financial penalties due to prescribed and/or non-prescribed service downtime. Loss of revenue due to telecommunications network downtime. Risk of public liability litigation.	Likely	Moderate	High	Low

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Network Performance	There is an increased risk of prescribed telecommunications system failures and faults which may cause power system events/issues due to inadequate tower structural integrity. The towers could fail and fall over disabling and severely damaging any telecommunications equipment mounted on the towers. The consequences of this would be a major telecommunications outage which will prevent SCADA (Supervisory Control and Data Acquisition), operational communications and protection and control communications from working. There may be partial or total loss of operational telecommunications services. This may cause major compliance issues with telecommunications regulations and the National Electricity Rules.	Possible	Moderate	Medium	Low
Regulatory Compliance	Non-compliance with National Electricity Rules. A decline in network availability affects the ability of TasNetworks to maintain compliance with the National Electricity Rules. Risk of non-compliance with current Telecommunications Acts/Codes/Standards due to poor asset management and increase telecommunications network downtime.	Possible	Moderate	Medium	Low
Reputation	There is unlikely to be any significant risk to TasNetworks' reputation.	Rare	Negligible	Low	Low

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Safety and People	There is a risk of workers falling off the towers causing severe injuries or fatalities if the existing towers are not fit for purpose or not structurally sound. The towers also need to be designed and constructed to minimise the risk of accidental exposure to radio frequency radiation hazards for workers on the towers. There is a risk that the towers could fall down due to poor condition potentially causing severe injuries or fatalities if any persons are in the vicinity of the fall zone. There is a risk of unauthorised persons climbing up the towers without the proper training or safety equipment. They could fall off the towers and suffer severe injury or death. There is also the risk of exposure of unauthorised persons to radio frequency radiation hazards where radio equipment has been installed on the towers.	Possible	Severe	High	Medium

7.2.5 Telecommunications Trenches, Ducts, Pits, Conduits Risk Matrix

Table 17 - Telecommunications Trenches, Ducts, Pits, Conduits Risk Matrix

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Customer	Not addressing poor asset performance will likely result in telecommunications system outages which may result in subsequent power system compliance issues. This results in poor service to connected customers.	Possible	Minor	Low	Low
Environment and Community	There is no significant risk to the Environment and Community.	Rare	Negligible	Low	Low
Financial	There is a minor risk to TasNetworks' financial position.	Unlikely	Minor	Low	Low
Network Performance	Poorly maintained pits, conduits, trenches and ducts may cause fibre optic and copper telecommunications cables to become damaged. Parts of the prescribed Telecommunications network will be non-operational or severely compromised including operational voice/telephony communications. Protection and control and SCADA (supervisory control and data acquisition) systems will be compromised. This may risk the security and stability of the power system.	Possible	Moderate	Medium	Low

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Regulatory Compliance	There is a risk of non-compliance with the National Electricity Rules for prescribed telecommunications services. A decline in network availability affects the ability of TasNetworks to maintain compliance with the National Electricity Rules. There is a risk of non-compliance with current Telecommunications Acts/Codes/Standards due to poor asset management and increase telecommunications network downtime.	Possible	Moderate	Medium	Low
Reputation	There is no significant risk to TasNetworks' reputation.	Rare	Negligible	Low	Low
Safety and People	Broken pit covers/exposed pits are a trip and fall hazard. If someone trips or steps on or in a broken/exposed pit, depending on how they fall, can cause permanent injuries. In the case of a head injury, could result in fatal consequences.	Possible	Severe	High	Medium

7.2.6 Telecommunications Buildings and Rooms Risk Matrix

Table 18 - Telecommunications Buildings and Rooms Risk Matrix

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Customer	Not addressing poor asset performance will likely result in telecommunications system outages which may result in subsequent power system compliance issues. This results in poor service to connected customers.	Possible	Minor	Low	Low
Environment and Community	There is unlikely to be any significant risk to the environment and community.	Rare	Negligible	Low	Low
Financial	There is a minor risk to TasNetworks' financial position.	Unlikely	Minor	Low	Low
Network Performance	There is an increased risk of prescribed telecommunications system failures and faults which may cause power system events/issues due to inadequate protection of equipment from the outside environment. This may subsequently cause regulatory/compliance issues.	Possible	Moderate	Medium	Low
Regulatory Compliance	Non-compliance with National Electricity Rules. A decline in network availability affects the ability of TasNetworks to maintain compliance with the National Electricity Rules. Risk of non-compliance with current Telecommunications Acts/Codes/Standards due to poor asset management and increase telecommunications network downtime.	Possible	Moderate	Medium	Low
Reputation	There is unlikely to be any significant risk to TasNetworks' reputation.	Rare	Negligible	Low	Low

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Safety and People	Poorly maintained buildings and rooms may introduce a number of hazards with risks of injuries which may cause permanent disability/impairment. Trips, slips and falls are common in poorly maintained buildings. Loose parts of the structure can fall causing injury. Biological hazards from damp including mould and mildew can introduce respiratory hazards.	Possible	Major	High	Medium

7.2.7 Telecommunications Site Fences and Gates Risk Matrix

Table 19 - Telecommunications Site Fences and Gates Risk Matrix

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Customer	Not addressing site security issues will likely result in telecommunications system outages which may result in subsequent power system compliance issues. This results in poor service to connected customers.	Possible	Minor	Low	Low
Environment and Community	There is an increased risk of environmental damage by trespassers damaging the local ecosystem with vehicles and illegal dumping of rubbish. Vehicles may damage the environment/ecosystems in the local area. Animals entering telecommunications sites may become injured, trapped, or killed by telecommunications assets due to poor physical security measures.	Likely	Minor	Medium	Low
Financial	Intentional and/or unintentional damage to TasNetworks Assets due to criminal activity. Risk of telecommunications faults and damage causing unplanned replacements/repairs of assets. Possibility of financial penalties due to prescribed and/or non-prescribed service downtime. Loss of revenue due to telecommunications network downtime. Risk of public liability litigation.	Likely	Moderate	High	Low

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Network Performance	There is an increased risk of prescribed telecommunications system failures and faults which may cause power system events/issues due to inadequate site security. The increased risk of telecommunications faults due to poor site security will present compliance and safety issues.	Possible	Moderate	Medium	Low
Regulatory Compliance	Non-compliance with National Electricity Rules. A decline in network availability affects the ability of TasNetworks to maintain compliance with the National Electricity Rules. Risk of non-compliance with current Telecommunications Acts/Codes/Standards due to poor site security and increase telecommunications network downtime.	Possible	Moderate	Medium	Low
Reputation	There is unlikely to be any significant risk to TasNetworks' reputation.	Rare	Negligible	Low	Low
Safety and People	Risk of unauthorised persons trespassing and other actions causing an injury or fatality to themselves or to TasNetworks staff/contractors. This is due to the introduction of new hazards due to criminal acts and unauthorised persons not being trained in TasNetworks Health and Safety procedures.	Possible	Severe	High	Medium

7.2.8 Telecommunications Heating, Ventilation and Air Conditioning Risk Matrix

Table 20 - Telecommunications Heating, Ventilation and Air Conditioning Risk Matrix

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Customer	Not addressing poor asset performance will likely result in telecommunications system outages which may result in subsequent power system compliance issues. This results in poor service to connected customers.	Possible	Minor	Low	Low
Environment and Community	There is unlikely to be any significant risk to the environment and community.	Rare	Negligible	Low	Low
Financial	There is a minor risk to TasNetworks' financial position.	Unlikely	Minor	Low	Low

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Network Performance	Telecommunications in buildings rooms without climate controls may cause equipment faults due to: Temperature fluctuations; Temperatures outside design limits; Humidity outside design limits; Condensation of water inside buildings/rooms; and Pollutants and contaminants such as dust. This can cause unplanned telecommunications outages and compliance risks with regards to power system security and the National Electricity Rules. May result in downtime of prescribed and non-prescribed telecommunications services due to equipment faults.	Possible	Moderate	Medium	Low
Regulatory Compliance	Non-compliance with National Electricity Rules. A decline in network availability affects the ability of TasNetworks to maintain compliance with the National Electricity Rules. Risk of non-compliance with current Telecommunications Acts/Codes/Standards due to poor asset management and increase telecommunications network downtime.	Possible	Moderate	Medium	Low
Reputation	There is unlikely to be any significant risk to TasNetworks' reputation.	Rare	Negligible	Low	Low

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Safety and People	Telecommunications Buildings and Rooms without climate controls may get hot with the heat generated by the running equipment. Condensation and/or high humidity levels can cause mould and mildew growth in buildings with poor airflow. This could result in respiratory and/or allergy hazards. Condensation may cause short circuits in equipment. Overheating equipment may catch on fire in extreme cases.	Possible	Moderate	Medium	Low

7.2.9 Telecommunications Alternating Current Supplies Risk Matrix

Table 21 - Telecommunications Alternating Current Supplies Risk Matrix

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Customer	Not addressing poor asset performance will likely result in telecommunications system outages which may result in subsequent power system compliance issues. This results in poor service to connected customers.	Possible	Minor	Low	Low
Environment and Community	There is a possibility of bushfires occurring at telecommunications sites with overhead feeders. If these feeders aren't maintained the conductors/poles could drop causing a bushfire. Poorly maintained AC systems may cause a fire risk inside telecommunications buildings. Bushfires cause severe damage to the local ecosystems dependant on the time of year, climatic and/or weather conditions and fuel loads.	Likely	Minor	Medium	Low
Financial	There is a minor risk to TasNetworks' financial position.	Likely	Moderate	High	Low

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Network Performance	Failure of the Alternating Current (AC) supply systems at any of the telecommunications sites will cause an outage once the Direct Current (DC) supply batteries are exhausted. Parts of the prescribed Telecommunications network will be non-operational or severely compromised including operational voice/telephony communications. If TasNetworks does not restore the AC power supplies in the required timeframe, the protection and control and SCADA (supervisory control and data acquisition) systems will be compromised. Loss of these systems can cause power system instability and delays in clearing power system faults.	Possible	Moderate	Medium	Low
Regulatory Compliance	There is a risk of non-compliance with the National Electricity Rules for prescribed telecommunications services. A decline in network availability affects the ability of TasNetworks to maintain compliance with the National Electricity Rules. There is a risk of non-compliance with current Telecommunications Acts/Codes/Standards due to poor asset management and increase telecommunications network downtime.	Possible	Moderate	Medium	Low
Reputation	A bushfire caused by a poorly maintained AC supply at a telecommunications site may cause damage to TasNetworks' reputation.	Rare	Negligible	Low	Low

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Safety and People	Poorly maintained AC supply systems may cause electric shocks, electrocutions, and arc flash burns. Poorly maintained AC supply systems may be a fire risk. The hazards of fire and electricity may cause injury or fatalities.	Possible	Severe	High	Medium

7.2.10 Telecommunications Direct Current Supplies Risk Matrix

Table 22 - Telecommunications Direct Current Supplies Risk Matrix

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Customer	Not addressing poor asset performance will likely result in telecommunications system outages which may result in subsequent power system compliance issues. This results in poor service to connected customers.	Possible	Minor	Low	Low
Environment and Community	Sulphuric Acid leaks due to faulty cells may get into the environment via water/soil contamination. Lead may get into the environment via water/soil contamination. Lead and its associated compounds are highly toxic and have long term effects and can contaminate biological systems and ecosystems.	Unlikely	Moderate	Medium	Low
Financial	There is a minor risk to TasNetworks' financial position.	Unlikely	Minor	Low	Low
Network Performance	Poor condition assets due to lack of vendor support adds increased risk of non-compliance of prescribed services and increase risk of outages. Lack of sales support and systems spares may limit support staff ability to repair faults with rectifiers. Failure of a telecommunications site DC supply during an AC supply outage will cause any powered telecommunications equipment to be non-operational. Affecting protection and control systems, telephony systems, SCADA (supervisory control and data acquisition), and business and operational data communications. Loss of these systems can cause power system instability and delays in clearing power system faults.	Possible	Moderate	Medium	Low

Risk Category	Risk	Likelihood	Consequence	Untreated Risk Rating	Residual Risk Rating
Regulatory Compliance	Non-compliance with National Electricity Rules. A decline in network availability affects the ability of TasNetworks to maintain compliance with the National Electricity Rules. Risk of non-compliance with current Telecommunications Acts/Codes/Standards due to poor asset management and increase telecommunications network downtime. Non-compliance with Australian Standards with regards to asset management of sealed batteries and wiring may cause compliance, safety, environmental and litigation issues.	Possible	Moderate	Medium	Low
Reputation	There is unlikely to be any significant risk to TasNetworks' reputation.	Rare	Negligible	Low	Low
Safety and People	Faulty lead acid cells may explode or leak splashing/spraying sulphuric acid on persons. May blind persons and cause severe chemical burns to exposed skin. Fumes caused by chemical reactions are highly toxic. Exploding lead plate fragments and/or battery casing fragments can cause injury or a fatality. Exposure to Lead and Lead compounds, which are highly toxic, may cause permanent biological damage to persons with long term effects. Risk of fire and explosions due to escaped Hydrogen gas from cell charging/overcharging.	Unlikely	Severe	High	Medium

8 Management Plan

8.1 Historical

In general, telecommunications site infrastructure comprises of long life assets. To be assured of the longevity of those assets, the assets have been designed and constructed using quality techniques and materials. Once constructed, appropriate preventative maintenance programs have been implemented to preserve them.

The preventative (routine) maintenance programs that have been implemented are designed to ensure that the telecommunications site infrastructure assets are inspected and tested at appropriate intervals. The operation of the active (electrical and electronic) site infrastructure equipment, such as the DC power supply systems, are monitored locally by the supervisory systems and remotely monitored by the TasNetworks' Telecommunications Network Management System.

TasNetworks has a library of documentation (including standards, specifications and preventative maintenance procedures) that it has developed over time to develop and maintain these assets. This documentation is subject to continuous improvement.

The following sections describe specific management practices and issues which are applicable to the telecommunications infrastructure assets.

8.1.1 Telecommunications Site Tenure

8.1.1.1 Site Fences and Gates

A condition assessment has been undertaken for all TasNetworks' telecommunications site fences and gates in the last revenue period. The condition of site fencing and gates are also monitored and recorded during the 6 monthly preventative maintenance routine visits. As mentioned earlier in this asset management plan, not all security fences and gates conform to the present TasNetworks' Telecommunications Security Fences and Gates Standard (telecommunications variation).

For reasons of economic efficiency and business risk, a decision has been taken to continue to maintain existing fences, even if they do not conform to the latest TasNetworks' standard. However, when they deteriorate to the point that they need to be replaced or if new fences/gates are installed, the new fences/gates will be installed with a fence/gate that conforms to the TasNetworks' TasNetworks' Telecommunications Security Fences and Gates Standard (telecommunications variation).

8.1.1.2 Closed Circuit Video Surveillance Systems

In 2011, TasNetworks (then Transend) requested the Counter Terrorism Unit of Tasmania Police to undertake a security assessment of TasNetworks' Telecommunications Network assets and sites. One of the recommendations of the report was to implement a CCTV video surveillance system.

The availability of high telecommunications bandwidth at the repeater sites coupled with advancements in CCTV camera technology means that the cost of implementing and operating such a system is relatively low. CCTV systems have already been installed at the highest risk telecommunications sites with more sites to follow in the 2019 to 2024 regulatory period.

8.1.2 Site Access Roads and Tracks

TasNetworks' strategy for the management of access roads and tracks is aimed at ensuring that roads and tracks permit safe access to telecommunications sites for operational purposes and capital works.

To achieve this, TasNetworks has continued to maintain the access tracks at its telecommunications sites to the Tasmanian Forestry Class 4 standard. The condition of site access roads and tracks is monitored and recorded during the 6 monthly preventative maintenance routine visits. Road maintenance is performed as part of the operational budget. Road improvements, such as installation of drainage and culverts, are funded as part of the capital budget as well as road reconstructions.

TasNetworks also endeavours to recover some of the costs of road maintenance from other users.

8.1.3 Site Earthing and Lightning Protection Systems

In some cases, the earthing and lightning protection systems at the telecommunications sites date back as far as 1975, although upgrade and renewal work was performed at most sites in 1995 as part of the original Digital Microwave Radio construction project. The condition of site earthing and lightning protection systems is monitored and recorded, to the extent possible, during the 6 monthly preventative maintenance routine visits. It is important to note that it is difficult to assess the condition of the underground components and connections.

In general, the practice has been to review the adequacy of site earthing when the opportunity arises. Such an opportunity includes the replacement of site fences and gates which are connected to the site earthing system. At this time, the following activities are undertaken:

- earth mat resistance tests are conducted and the earthing system design and installation is reviewed;
- the earthing connections are inspected including;
    - the connection to the support structures/towers and associated lightning protection system;
    - the connection to the telecommunications building and associated lightning protection system;
    - connections of the site fences and gates to the site earthing system; and
    - Inspection of any equipotential bonding or galvanic isolations of earthing system components.

In some cases where remedial actions are required, a site earthing audit may be required to determine the actions required to address safety hazards and risk to the telecommunications assets.

8.1.4 Towers and Antenna Support Structures

The condition of the telecommunications towers/structures is monitored and recorded during the 6 monthly preventative maintenance routine visits and in more detail during the annual tower inspection visits. Also, in order to ensure that loading limits are not exceeded, structural engineering assessments are undertaken on towers whenever the antenna configuration is altered.

Some of TasNetworks' telecommunications towers date back to 1975. Approximately one third of the structures are more than 25 years old. TasNetworks' is actively managing the assets to keep business risks at acceptable levels and prevent premature asset failures.

8.1.5 Telecommunications Buildings and Equipment Rooms

The condition of the telecommunications buildings and equipment rooms is monitored and recorded during the 6 monthly preventative maintenance routine visits.

As described earlier, TasNetworks utilises three types of remote telecommunications hut. They are the pre-fabricated concrete huts, the transportable polystyrene sandwich huts and the original HEC transportable steel clad huts. The latter two classifications of hut that are not constructed of concrete are inferior because they offer a less stable internal environment and they are more susceptible to bushfire. This is particularly the case for the four original HEC transportable steel clad huts. Where it is justified, the strategy will be to replace these four buildings over time and the preference will be to use concrete buildings for future installations.

The pre-fabricated concrete repeater huts were installed around 1995. The protective coating and the concrete panel joint seals have deteriorated since that time. This allows moisture and dust to enter the buildings. An engineering report was commissioned in late 2011 which described the procedure for the remedial works to be performed in relation to each of the types of joints, i.e. internal and external roof and wall joints; and the sealing of the roof and wall surfaces.

The work to replace the protective coating and the concrete panel joint seals has been completed on approximately half of the huts, with the remainder to be completed during the 2019-2024 regulatory period. The work is being prioritised on the basis of need.

8.1.6 Telecommunications Direct Current (DC) Supply Systems

TasNetworks' DC power supply systems are continually monitored and inspected and tested on a six monthly basis to ensure that service performance are at acceptable levels. Historically, the following strategies are applied to the design and selection of TasNetworks' telecommunications DC power supply systems:

- Independent DC rectifiers are duplicated and must provide remote monitoring capability for both the power supply and battery banks.
- Dual independent DC battery banks are supplied and must provide a backup supply to the operational telecommunications equipment for a minimum of 24 hours (48 hours for remote sites);
- Batteries must charge to 75% of capacity in 8 hours and 100% in 24 hours; and
- Batteries are replaced after 10 years or earlier if the performance is reduced according to AS 2676.2.

8.1.7 Waveguide Dehydrators

A large number of waveguide dehydrators deployed in TasNetworks' telecommunications network are the Andrew Corporation XT300 membrane type dehydrator which has been discontinued by the manufacturer. Notwithstanding that the asset life for these dehydrators is 10 years; the majority of them have been very reliable over time.

Waveguide dehydrators provide an important function within the telecommunications network, however the failure of a device does not warrant an immediate maintenance response. Spare waveguide dehydrators are held in the spares stock and a strategic decision has been taken to run the dehydrators to failure and to replace them from the spare stock when that occurs. When these spares run out, a supported make and model will be used as replacements for the failed units. These are currently the Andrew Corporation MT050 models.

8.2 Strategy

8.2.1 Overall philosophy

The underlying philosophy driving the development and management of the Telecommunications Site Infrastructure assets is to provide:

- safe, secure and reliable site infrastructure to house telecommunications equipment and assets;
- safe, secure and reliable towers and support structures to mount telecommunications antennas and associated equipment;
- safe, secure and reliable alternating current power supplies to the telecommunications sites;
- safe, secure, reliable and duplicated direct current power supply systems for telecommunications equipment; and
- Safe, secure and reliable site access roads and tracks so TasNetworks' staff and contractors have access to the telecommunications sites to perform operational and capital works.

8.2.2 Overall strategy

The broad strategy that is adopted in relation to TasNetworks' Telecommunications Site Infrastructure to implement the above management philosophy includes:

- the use of safe, secure and reliable assets in the network to underpin overall network performance and are fit for purpose;
- to ensure telecommunications sites are secure from unauthorised access and criminal activity;
- ensuring the site environment and conditions remain suitable for modern telecommunications equipment and assets;
- minimising the need and use of "one-off" installations/bespoke designs that are difficult to maintain due to the lack of appropriate expertise and spares;
- That electrical and electronic assets covered by this asset management plan such as DC rectifiers are in a supported state by the vendor/manufacturers;
- the implementation of a rolling capital programs of work to ensure that the telecommunications site infrastructure is safe, secure, reliable and adapts to current and future Australian and International standards;
- that routine inspections and maintenance routines are in place to detect and mitigate problems and potential issues as they arise; and
- The timely resolution of faults of telecommunications site infrastructure and assets to maintain the safety, security and reliability of the electricity and telecommunications network.

8.2.3 Preventative Maintenance Strategy

The TasNetworks’ Telecommunications Site Infrastructure is dispersed widely throughout Tasmania and with some assets interstate. This geographical spread of site infrastructure requires routine inspections to actively manage these assets. These preventative routines are a practical way to ensure that the condition of the assets does not deteriorate to the point at which the safety, security and reliability of the TasNetworks’ telecommunications network are compromised.

These site visits undertaken by TasNetworks are part of a regime of physical inspections and preventative maintenance which is performed on all of the infrastructure, plant and equipment at the site. When a defect or deterioration of the condition of an asset is observed it is logged in the TasNetworks' asset management systems. For some defects, the remedial actions may be able to done at the routine site visit. If this is not the case, the defect report is modified to include additional information to rectify the defect at a later time based on the TasNetworks' business risk, the criticality of the asset and regulatory requirements.

Preventative maintenance routines which constitute inspection go/no-go tests and other more detailed tests are also conducted on active equipment such as DC power supplies and waveguide dehydrators. Where possible, the state of this equipment is also continuously, remotely monitored by the TasNetworks' Telecommunications Network Management System.

8.2.4 Routine Maintenance versus Non Routine Maintenance

The failure of the TasNetworks' telecommunications site infrastructure may result in serious or catastrophic damage and may impact the performance of the operational telecommunications network performance with consequent adverse impacts on the electric power system.

Failure of infrastructure such as towers or other structures can expose the public, employees and contractors to unacceptable risk and is likely to have an immediate adverse impact on the performance of the telecommunications network and reliability of the electric power system.

Deterioration of the condition of telecommunications huts or buildings may expose the equipment inside the buildings to the outside environment and most likely cause it to deteriorate or fail.

The DC power supplies are critical to maintaining service during AC power outages at TasNetworks' telecommunications sites and waveguide dehydrators are vital to ensuring that moisture does not impact the performance of microwave radio links.

These assets also have a high unit value to TasNetworks. Therefore, a preventative, routine maintenance strategy represents a cost effective alternative to a reactive, corrective maintenance strategy.

8.2.5 Refurbishment

Where telecommunications site infrastructure assets are removed from the network in good operating condition as a result of capital works, these assets are assessed for redeployment back into the network where such refurbishment is deemed to be an economic proposition. These assets may also be used in the TasNetworks' spares holdings if this is deemed appropriate.

8.2.6 Planned Asset Replacement versus Reactive Asset Replacement

Overall, a reactive asset replacement strategy for the Telecommunications Site Infrastructure is not the optimal strategy. This strategy exposes TasNetworks’ to unacceptable risk and may compromise the safe, secure and reliable operation of telecommunication services and the electric power system.

Reactive replacements are unplanned which means that project costs will likely be greater than planned asset replacements. There will be increased costs in the procurement of plant and materials and labour costs would be greater due to the fact that labour has to be sourced at emergency rates for non-standard hours.

This approach also exposes TasNetworks' to the risk of one-off/bespoke designs and installations which makes management of a fleet of assets difficult and with increased long term costs. The management and procurement of spares is very difficult to achieve with this strategy.

Therefore, as an overall approach, TasNetworks capital programs of work for the Telecommunications Site Infrastructure assets follows planned capital replacements as opposed to reactive/corrective asset replacements.

8.2.7 Non Network Solutions

For the Telecommunications Site Infrastructure asset class, there are no non-network solutions that can be used to manage these assets.

8.2.8 Network Augmentation Impacts

TasNetworks' requirements for developing the power transmission and distribution systems are principally driven by five elements:

- Demand forecasts
- New customer connection requests
- New generation requests
- Network performance requirements
- National electricity rules (NER) compliance

The TasNetworks' telecommunications network, including the telecommunications site infrastructure, has to adapt and accommodate the operational requirements of the TasNetworks' transmission and distribution electricity assets.

8.3 Capital programs and projects

8.3.1 Replacements and upgrades

8.3.1.1 R19 01753 Telecommunications Site Infrastructure - Telecommunications Hut Replacement Program

This program of work is for the replacement of the remaining older style telecommunications huts with the standard prefabricated concrete design. This will improve the housing of the telecommunications equipment by providing a stable environment and reduce the risk of damage to the telecommunications assets caused by bushfires.

8.3.1.2 R19 01750 Telecommunications Site Infrastructure – Tower Rectification/Replacement Works Program

This program of work is for the improvement modifications of existing towers and replacements of towers and antenna support structures as required.

8.3.1.3 R19 01700 Telecommunications Site Infrastructure - Site Fences/Gates Replacement Program

This program of work is for the replacements of site fences and gates which are in poor condition. The fences and gates which are not compliant to TasNetworks' Site Security Fences and Gates

Standard (modified for Telecommunications use case) will be constructed and procured to this standard.

8.3.1.4 R19 01561 Telecommunications Site Infrastructure - DC (Direct Current) Power Supplies Replacement Program

This program of work is for the replacement of telecommunications DC Power Supply systems that have reached end of life and are no longer fit for purpose.

This program of work also includes the modification/conversion of some remaining sites which have DC-DC converters connected to substation/power station DC supply systems. These sites will be modified to have a separate and duplicated telecommunications DC power supplies to replace these DC-DC converters.

8.3.1.5 R19 01513 Telecommunications Site Infrastructure - Roads and Tracks Works Program

This program of work is for road reconstructions of existing telecommunications roads and access tracks. Activities include road reconstructions and route modifications if required.

This is a rolling program of work.

8.3.2 Augmentations

8.3.2.1 R19 01767 Telecommunications Site Infrastructure - Disaster Recovery Materials Project

This project is to allocate enough materials to rebuild a complete telecommunications link in an event of a major disaster such as a major bushfire. This is to enable the restoration of some of the telecommunications network if it has been compromised by such a major event.

8.3.2.2 R19 01763 Telecommunications Site Infrastructure - AC (Alternating Current) Supplies Site Hardening Program

This program of work is for the installation and connection of a permanent AC backup generator to high risk sites. The sites chosen were based on the criticality of the telecommunications sites, the site locations and the DC battery bank supply time for the sites. For these sites, portable AC generators may not be able to be provided in the timeframe of an outage or are not feasible due to other factors such as the site location. This program of work will reduce the risk of extended outages due to AC supply failures at these sites.

8.3.2.3 R19 01715 Telecommunications Site Infrastructure - Concrete Hut Weatherproofing Program

This program of work is for improvement to the weatherproofing systems on existing telecommunications prefabricated concrete huts.

The program involves the installation of banding to supplement the existing building seals and sheeting/sealing on the building roofs to prevent seepage through the concrete. This has been identified as an issue with the first generations of the concrete hut designs.

The newer huts will have this as standard to prevent this issue from occurring on future hut replacements.

8.3.2.4 R19 01683 Telecommunications Site Infrastructure - Staged Air Conditioning Additions Program

At many of the telecommunications buildings, in particular some of the older buildings, there is no climate control for the equipment housed inside. Telecommunications Equipment as well as other electrical and electronic equipment achieves optimum reliability at the correct temperature range as specified by the manufacturer (typically 0 degrees to 25 degrees Celsius).

TasNetworks' telecommunications sites vary in location and altitude and experience ambient environmental conditions outside these ranges. To mitigate the risk of premature equipment failure due to temperature fluctuations, air conditioning units will be installed at the telecommunications sites that currently do not have climate control.

The additional benefits are also better room air quality due to the filters and better temperature for staff to work in when performing work at these buildings.

8.3.2.5 R19 01672 Telecommunications Site Infrastructure - Site Security Program

Due to criminal activity and trespassing on TasNetworks' telecommunications sites, sites that are deemed to be high risk or have been compromised will be fitted with closed circuit security surveillance systems.

This program was also in response to a recommendation by Tasmania Police who wrote a report on how to deter this activity from happening at TasNetworks' telecommunications sites. This will also aid law enforcement and prosecution if an offence has occurred on TasNetworks' telecommunication sites by providing vital evidence.

Additional benefits include another means to visually monitor telecommunications assets from telecommunications operations.

8.4 Operational Programs

8.4.1 Preventative Maintenance

The TasNetworks telecommunications site infrastructure preventative maintenance routines are applied as rolling programs of work for the various asset types. The preventative maintenance routines are done in the following periodic intervals:

- 6 Monthly Maintenance Routine
- 2 Yearly Maintenance Routine
- Annual Tower/Support Structure Inspection Routine
- Annual Vegetation Management Routine

The preventative maintenance routines are described in detail in the following sections. Detailed procedures, check lists and record sheets are provided to maintenance staff to ensure that preventative maintenance routines are conducted without omission and that data is recorded to an appropriate standard. These processes are subject to be modified as TasNetworks transitions to its SAP-ERP implementation in 2018.

Where systemic faults or issues are identified, separate programs of work are initiated and completed within an appropriate timeframe to ensure that the fault or issue does not have a deleterious effect on the infrastructure or equipment that it houses. These programs may utilise external skills or expertise as necessary.

In addition, because telecommunications sites at which the above preventative maintenance programs are conducted are remote sites, the preventative maintenance programs for infrastructure are scheduled so that they are conducted at the same time as the preventative maintenance programs for the telecommunications equipment that is contained within it. The telecommunications equipment is covered by the Telecommunications Bearer Network Asset Management Plan.

8.4.1.1 TasNetworks Site Infrastructure 6 Monthly Maintenance Routines

The 6 monthly preventative maintenance routine inspection and testing is described below:

8.4.1.1.1 External Site Infrastructure

- Vegetation should not pose a fire hazard or restrict work within the compound and should be cleared within a metre of the fence line.
- Inspect gates and fences for defects and damage; check earths; locks should operate freely – apply a graphite or silicon lubricant if required.
- Inspect exterior of building; check walls and roof for damage; check for cracks or holes in panel joints; check gutters for damage, corrosion, vegetation or blockages.
- Inspect other building mounted structures such as mounting brackets on the exterior building walls. They should be earthed and in good condition.
- Inspect earth cable terminations on the tower and exterior to the building. They should be secure and corrosion free. Earth cables should be buried or appropriately secured.
- Visual inspection of the tower from the ground to verify that there is no obvious defects.
- Inspect water tank (where applicable). Ensure water tank is secure and that taps, intake and drainage are working normally.
- Inspect site access roads and tracks. They should be adequate to allow safe travel for four wheel drive (4WD) vehicles, without risk of damage to vehicle or safety of personnel. The inspection involves looking for potholes and ruts in the road surface; deterioration of boom gates and their associated locking system; and vegetation growing through the road or track surface and overhanging the roads and tracks.

8.4.1.1.2 Telecommunications Building and Room Interiors

- Inspect the interior of the building; check internal panel/wall joints and ensure seams are free of cracks and holes; check the door seal and hinges.
- Inspect cable entries, check they are sealed and cable glands/boots are secured appropriately; check cable trays and ducts are secure, free of sharp edges and that they are properly earthed.
- Inspect cabling and verify it is in accordance with ACMA and Australian Standards requirements.
- Ensure door alarm operates and remote signal appears on the console at the Telecommunications Network Management System.
- Where applicable, ensure that DC lights operate normally.
- Inspect fire extinguisher and record servicing details. Replace if a level 4 service is due.
- Activate fire alarm at the fire alarm panel and ensure an alarm appears on the console at the Telecommunications Network Management System. Reset vent and fan shutters where equipped.

- Verify fan, heater and/or air conditioning operation and temperature settings. Ensure that the fan running indication is shown the console at the Telecommunications Network Management System and that the fan can be isolated remotely. Verify that the fan ceases to operate if the fire alarm is activated
- Check the filters on individual equipment such as air vents and air conditioning systems, and perform inspections on static desiccant (where applicable);
- Inspect and verify operation of the door lock from inside and outside the building.
- Record the AC meter number and reading.

8.4.1.1.3 DC Power Supplies

- Verify that the DC power supply equipment is clean and inspect for abnormalities; clean and remove corrosion from battery terminals and coat with grease as necessary.
- If the batteries are not contained within an enclosure, verify that rubber shrouds cover all battery terminals.
- Record current AC Voltage and the minimum and maximum voltages over the previous month for each rectifier.
- Record the battery, rectifier and load current for each DC power supply
- Switch off the AC feed to the rectifiers for 30 minutes duration. Monitor the cell voltages of the battery banks under load and compare the results to the previous battery measurements to determine if there has been a deterioration (ensure that battery voltage does not drop below 48V during this test).
- Monitor the battery bank impedance and compare the results to the previous impedance measurements.
- Verify that AC Fail and PSU Fail alarms appear on the monitors at the Telecommunications Network Management System.
- Once the AC feed to the rectifiers is restored and in-rush current has subsided, verify that the rectifiers are clear of alarm indications.
- If DC-DC Converter(s) (125VDC to 48VDC) are installed, measure and record the input and output voltage of each converter.

8.4.1.1.4 AC Power Supplies

- Inspect the service connection from the feeder to the site and check for defects including clearance violations and vegetation obstructions.
- Check the service fuse and service attachments at the building for defects and unsafe conditions.
- Inspect external AC connections and wiring to site AC generators and the connection point for portable AC generators.
- Inspect building/room AC wiring to ensure it remains compliant with TasNetworks standards and AS/NZS: 3000 wiring rules.

8.4.1.1.5 Waveguide Dehydrators (electromechanical and static)

- Verify that filters are clean and free of excessive moisture. Observe the colour of the desiccant to determine if it is dry or hydrated (colour dependant on desiccant type) and change if necessary.
- Verify that all necessary manifold feeds are open.

- Record manifold output pressure and verify that the readings fall within the acceptable range for the equipment type
- Record waveguide dehydrator run time
- Where applicable for the particular equipment installed measure the pressure at the back pressure regulator using the manufacturer's instructions.
- After all tests, restore the waveguide feeds to the on position.

8.4.1.1.6 Site safety inspections

- Site safety inspections
- Verify that all warning signs (including RF radiation, battery hazards, and laser light sources) are present, as appropriate.
- Verify that there is adequate lighting for the work area.
- Verify that there is ventilation.
- Verify that no trip hazards exist and entry and egress points are not obstructed.
- Verify that headroom is sufficient throughout the site. If low headroom exists then adequate warning tape or a barrier must be provided.
- Verify that the site is clean and tidy and that necessary cleaning equipment is present; clean site as necessary and empty rubbish bin if required.
- Check for and report any other hazards at the site.

8.4.1.2 Telecommunications Site Infrastructure 2 Yearly Maintenance Routines

- The 2 yearly routines include all the activities of the 6 monthly routines
- Includes a 3 hour battery load test instead of the 30 minute test in the 6 monthly routine
- A comprehensive review of the microwave radio paths is undertaken in conjunction with the annual tower inspections to ensure the radio paths are free of obstructions (i.e. trees encroaching into the radio path).
- Critical performance measures for all systems are also thoroughly reviewed and tested as required and measurement points recorded.

8.4.1.3 Telecommunications Site Infrastructure Annual Tower/Support Structure Inspections

Annual telecommunications tower/support structure inspections involve a detailed inspection of the structure from bottom to top as described with the following activities:

- Verify that the tower/support structure is earthed at two diagonally opposite legs and as per the earthing system design. Earth points/connections should be secure and free of damage or corrosion.
- Check the tower/support structure and mounts for structural integrity; they should be free from excessive corrosion or rust. Around 20% of the tower/support structure fasteners will be visually checked for rust or damage and physically checked for tension/torque settings.
- Verify that concrete footings are free of cracks and corrosion.
- Ensure tower/support structure or pole barriers exist and are locked; locks should operate freely, apply a graphite or silicon lubricant if required.
- Ensure all railings and ladder rungs are secure and in good condition; ensure there is no loose grid mesh at each landing.

- Check antenna and feeders for structural integrity; ensure there are no loose fittings or anchor points; check feeders for ice damage; if there are tower/support structure mounted static desiccants, replace the desiccant canisters.
- Ensure the lightning protection systems are in good repair. Inspect lightning diverter conductors/cables are in good condition and do not have sharp bends. Check that the cables and cable terminations are in good condition; verify that earth kits and/or inline surge suppressors are installed on feeders.
- Using an appropriate RF monitoring device, check all antenna-feeder connectors for RF leaks.
- For each microwave radio path, check for near end obstructions such as trees or other vegetation.
- Verify that the information contained in the RF folder is correct; complete an RF amendment form for any new or removed antenna and provide pictures of each of the tower/support structure faces.

8.4.1.4 Telecommunications Site Infrastructure Annual Vegetation Management Routine

Vegetation clearance is undertaken annually (at sites as necessary) across the network, commencing in spring each year. It is also conducted on an as required basis on access roads and tracks and when vegetation is observed to exceed limits during preventative maintenance or corrective maintenance site visits.

The annual vegetation clearance work is planned and executed to maximise the benefit. The vegetation clearance contractors are required to keep a log of the work undertaken each year and details such as the types of weeds that are encountered at each site. This log is reviewed prior to commencement the following year to improve effectiveness and ensure appropriate treatment techniques, for example an appropriate spraying regime for weed control, are deployed.

Vegetation clearance involves:

- Clearing vegetation that is encroaching on the sites;
- Clearing of vegetation that is growing through the road and track surfaces and overhanging the roads and tracks; and
- Ensure that vegetation is not violating the AC power supply service connection clearances and if it does, clear as required.

8.4.1.5 R19 2019-2024 Operational Programs - Preventative

The 2019-2024 regulatory line items have been assigned based on the asset type. The operational costs include the day to day operations of the telecommunications site infrastructure as well as the preventative maintenance routines.

The R19 Regulatory Period line items that correspond to the preventative maintenance routines are described in the following assignment matrix.

Table 23 - R19 2019-2024 Operational Programs - Preventative Line Item Assignment Matrix

R19 Line Item	Category Code	CAPEX/ OPEX	Description	6 Monthly Routine	2 Yearly Routine	Annual Tower/Support Structure Routine	Annual Vegetation Management
02321	TPBSO	OPEX	Telecommunications Site Infrastructure - Telecommunications Vegetation Management Preventative OPEX Program				✔
02310	TPBSO	OPEX	Telecommunications Site Infrastructure - Telecommunications Trenches, Ducts, Pits, Conduits Preventative OPEX Program	✔	✔		
02308	TPBSO	OPEX	Telecommunications Site Infrastructure - AC (Alternating Current) Power Supplies Preventative OPEX Program	✔	✔		
02305	TPBSO	OPEX	Telecommunications Site Infrastructure - Telecommunications Sites Preventative OPEX Program	✔	✔		
02303	TPBSO	OPEX	Telecommunications Site Infrastructure - Telecommunications Buildings/Rooms Preventative OPEX Program	✔	✔		
02301	TPBSO	OPEX	Telecommunications Site Infrastructure – Towers and Structures Preventative OPEX Program	✔	✔	✔	

R19 Line Item	Category Code	CAPEX/ OPEX	Description	6 Monthly Routine	2 Yearly Routine	Annual Tower/Support Structure Routine	Annual Vegetation Management
02285	TPBSO	OPEX	Telecommunications Site Infrastructure - Roads and Tracks Preventative OPEX Program	✔	✔		
02283	TPBSO	OPEX	Telecommunications Site Infrastructure - DC (Direct Current) Power Supplies Preventative OPEX Program	✔	✔		
02268	TPBSO	OPEX	Telecommunications Site Infrastructure - Site Fences/Gates Preventative OPEX Program	✔	✔		

8.4.2 Corrective Maintenance

Corrective maintenance of passive site infrastructure such as towers, buildings and site fencing is usually initiated following the onsite inspections and routine maintenance where an issue has been highlighted, reported and recorded in the Telecommunications Network Management System.

In the case of active equipment such as DC power systems and waveguide dehydrators, remote supervision is also used to continually monitor the equipment. If a fault is detected, corrective maintenance is initiated. If the fault is critical in nature that fault is repaired within 4 hours of occurrence of the fault.

8.4.2.1 R19 2019-2024 Operational Programs – Corrective

The TasNetworks' R19 line items for the 2019 to 2024 regulatory period are classified by the asset type. The line items include the associated costs associated with corrective operations, fault response and repairs for the TasNetworks' Telecommunications Site Infrastructure. The R19 line items are summarised in the following table.

Table 24 - R19 2019-2024 Operational Programs – Corrective Line Items

R19 Line Item	Category Code	CAPEX/OPEX	Description
02341	TPBSO	OPEX	Telecommunications Site Infrastructure - Telecommunications Vegetation Management Corrective OPEX Program
02311	TPBSO	OPEX	Telecommunications Site Infrastructure - Telecommunications Trenches, Ducts, Pits, Conduits Corrective OPEX Program
02309	TPBSO	OPEX	Telecommunications Site Infrastructure - AC (Alternating Current) Power Supplies Corrective OPEX Program
02306	TPBSO	OPEX	Telecommunications Site Infrastructure - Telecommunications Sites Corrective OPEX Program
02304	TPBSO	OPEX	Telecommunications Site Infrastructure - Telecommunications Buildings/Rooms Corrective OPEX Program
02302	TPBSO	OPEX	Telecommunications Site Infrastructure – Towers and Structures Corrective OPEX Program
02286	TPBSO	OPEX	Telecommunications Site Infrastructure - Roads and Tracks Corrective OPEX Program
02284	TPBSO	OPEX	Telecommunications Site Infrastructure - DC (Direct Current) Power Supplies Corrective OPEX Program
02269	TPBSO	OPEX	Telecommunications Site Infrastructure - Site Fences/Gates Corrective OPEX Program

8.5 Program Delivery

The needs assessment and options analysis for undertaking an asset management activity is documented in the Investment Evaluation Summary for that activity.

The delivery of these activities follows TasNetworks' end to end (E2E) works delivery process.

8.6 Spares Management

Spares holdings for equipment are maintained so as to comply with TasNetworks' Systems Spares Policy. The policy states that spares are to be kept at an 8:1 in-service to spares ratio based on region (either north or south), to a maximum of three of each type per region.

This asset management plan includes passive site infrastructure and some active equipment such as DC power supplies and waveguide dehydrators. With the exception of a number of spare telecommunications tower members, spares are not kept for passive site infrastructure. Spares are, however, kept for the active site equipment covered by this asset management plan, including DC power supply components such as rectifiers, DC-DC converters and batteries; waveguide dehydrators and static desiccants; and other miscellaneous equipment.

Only limited spares are kept for battery installations because of their limited shelf life. Battery installations are continually being replaced, so if more spares are required they can be sourced through:

- Diverting internal project orders;
- Expediting manufacturer replacements; or
- Sourcing smaller systems from alternative suppliers on a temporary basis.

8.7 Disposal Plan

Generally, the installed base of telecommunications site infrastructure is stable and disposal of site infrastructure is relatively infrequent. Where it is required, the infrastructure is de-commissioned and removed from site as part of the relevant capital replacement project. Depending upon condition and age, infrastructure assets which are no longer required may be transferred to the primary store for future re-use, offered for sale, recycled or otherwise disposed of in an environmentally responsible manner.

9 Summary of Programs

An overall view of the programs of work described in this asset management plan, including volumes and financial information, is located in the following document:

Telecommunications Site Infrastructure Asset Management Plan Summary, Record Number: R0000862008, http://reclink/R0000862008

10 Related Standards and Documentation

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

1. Australian Energy Market Commission, National Electricity Rules (Current Rules), http://www.aemc.gov.au/Energy-Rules/National-electricity-rules/Current-Rules
2. TasNetworks Telecommunications CAPEX/OPEX Budget Long Term, R0000768704, http://reclink/R0000768704
3. TasNetworks Corporate Plan - Planning period: 2017-18 to 2021-22, R0000745475, http://reclink/R0000745475
4. TasNetworks Strategy on a page 2017-18, R0000764312, http://reclink/R0000764312
5. TasNetworks Business Plan 2017-18, R0000779008, http://reclink/R0000779008
6. TasNetworks Roadmap – 2025, https://www.tasnetworks.com.au/customer-engagement/submissions/
7. TasNetworks Zero Harm Policy, https://www.tasnetworks.com.au/about-us/policies/zero-harm/
8. TasNetworks Risk Management Framework, R0000238142, http://reclink/R0000238142
9. Telecommunications Site Infrastructure Asset Management Plan Summary, Record Number: R0000862008, http://reclink/R0000862008
10. TasNetworks' Security Fences and Gates Standard, R0000579297, http://reclink/R0000579297
11. Tasmanian Forest Practices Authority, Forest Practices Code (current code), http://www.fpa.tas.gov.au/publications
12. TasNetworks' Substation Lightning Protection and Earthing Standard, R0000522692, http://reclink/R0000522692
13. Australian Standard, AS/NZS 1170.0 Structural design actions - General principles, https://www.saiglobal.com/online/
14. TasNetworks' Substation Civil Design and Construction Standard, R0000590634, http://reclink/R0000590634
15. Australian Standard, AS 2676.2 Part 2 Sealed Cells, https://www.saiglobal.com/online/
16. Australian/New Zealand Standard, AS/NZS 3000 - Wiring Rules, https://www.saiglobal.com/online/
17. Australian Standard, Australian Communications Alliance, AS/CA S009, Installation requirements for customer cabling (Wiring rules), http://www.commsalliance.com.au/Documents/all/Standards/s009
18. Australian/New Zealand Standard, AS/NZS 3008.1.1 - Electrical installations - Selection of cables for (>=0.6/1kV AC), https://www.saiglobal.com/online/
19. Australian Standard, AS:2067, Substations and high voltage installations exceeding 1 kV a.c., https://www.saiglobal.com/online/
20. Tasmania Police, Telecommunications site security assessment-SSU, D11/110681, http://viewdoc/D11/110681