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2023-27 Transmission Revenue Reset

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Table of Contents

1 Executive Summary

This document states the asset management strategy for all Civil infrastructure assets situated within the boundaries of terminal stations in the AusNet Services transmission network.

Civil infrastructure assets include buildings, roads, footpaths, surfaced areas, foundations, support structures, metallic cabinets, 415-volt supply systems including changeover boards, signage, security systems, fences, cable ducting & trenching, water pipes, fire protection assets, sewerage pipes and drains.

The strategies are aimed at ensuring the effective, economic and consistent management of civil infrastructure assets in all terminal stations.

Condition assessments for civil infrastructure assets at 54 installations, including 42 terminal stations and 12 switchyards inside power stations, indicate that approximately 30 per cent of these assets require refurbishment /replacement within the next 10 years. This can be achieved through targeted civil infrastructure work programs or inclusions in planned station rebuild projects.

The following summarises the key civil infrastructure asset management strategies:

1.1 Strategies

1.1.1 Buildings

- Ensure new buildings comply with the requirements of Building Code of Australia and Australian Standard AS2067: *Substations and high voltage installations exceeding 1000 volts, AC*.

- Where economic use relocatable buildings for new or major building refurbishments.
- Investigate the use of prefabricated concrete slab foundations for selected primary plant such as power transformers and capacitor banks.

1.1.2 Environmental System

- Continue to maintain existing environmental to meet the requirements new EPA legislation.

1.1.3 Security Fences

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1.1.4 Civil Infrastructure – Roads, surfaces, drainage system and AC supplies

- Include recurring civil infrastructure condition assessments in the scheduled maintenance program and record results in Asset Management System (SAP).

- Where possible implement civil works and improved infrastructure security, and removal of asbestos containing material (ACM) as part of major project/ rebuild works.

- Supplement renewal, replacement, or augmentation of condition C4 & C5 civil infrastructure in the scopes of major augmentation and station re-build projects as and when economic.

- Initiate targeted civil infrastructure (in condition C4 & C5) upgrade projects for sites with no major projects/rebuild planned in next 10 years.

1.1.5 Fire Protection Systems

- Continue to upgrade fire protection system assets in compliance with AMS 10-61: Fire Detection and Suppression.
- Maintain fire protection systems in line with AS1851: Maintenance of Fire Protection Systems and Equipment.

2 Introduction

2.1 Purpose

This document outlines the inspection, maintenance and replacement activities required for the economic life-cycle management of civil infrastructure associated with the regulated AusNet Services electricity transmission network.

This document is to be used as reference for asset management decisions and communicate the basis of such activities. It forms part of AusNet Services' Asset Management System for compliance with relevant standards and regulatory requirements. Its intention is to demonstrate responsible asset management practices by outlining economically justified outcomes.

2.2 Scope

The scope of this asset management strategy is the regulated asset base civil infrastructure assets in the Victorian electricity transmission network, Terminal stations and power station switchyards. Standalone communication sites are excluded however, communication rooms within the main control /switch buildings in terminal stations are covered in this document.

Civil infrastructure assets include buildings, roads, footpaths, surfaced areas, foundations, support structures, metallic cabinets, 415-volt supply systems including changeover boards, signage, security systems, fences, cable ducting & trenching, water pipes, fire protection assets, sewerage pipes and drains.

Only regulated assets.

The following infrastructure assets are also covered in more detail in the following strategies:

AMS 10-63	Infrastructure Security.
AMS 10-61	Fire Detection and Suppression

2.3 Asset Management Objectives

As stated in *AMS 01-01 Asset Management System Overview*, the high-level asset management objectives are:

- Comply with legal and contractual obligations;
- Maintain safety;
- Be future ready;
- Maintain network performance at the lowest sustainable cost; and
- Meet customer needs.

As stated in *AMS 10-01 Asset Management Strategy -Transmission Network*, the electricity transmission network objectives are:

- Maintain top quartile benchmarking;
- Maintain reliability;
- Minimise market impact;
- Maximise network capability;
- Leverage advances in technology and data analytics;
- Minimise explosive failure risk.

3 Asset Description

3.1 Asset Function

Civil Infrastructure assets include buildings, roads, footpaths, drains, surfaced areas, foundations, support structures, metallic cabinets, 415 volt supply systems including changeover boards, signage, security systems, fences, cable ducting & trenching, water pipes, fire protection assets, sewerage pipes and drains found within the boundaries of terminal stations and power station switchyards. These assets are mostly located at 54 sites across Victoria.

3.2 Asset Population

The population of civil infrastructure in terminal stations vary widely across the transmission network.

Approximately 20 sites have undergone major equipment replacement or partial rebuilds over the last 17 years which have included civil infrastructure upgrade works. They are listed in Table 1 below.

Table 1: Major terminal station refurbishments and rebuilds

Terminal Station	Code	Region
Brooklyn Terminal Station	BLTS	Greater Melbourne & Geelong
Keilor Terminal Station	KTS	Greater Melbourne & Geelong
Malvern Terminal Station	MTS	Greater Melbourne & Geelong
Ringwood Terminal Station	RWTS	Greater Melbourne & Geelong
Thomastown Terminal Station	TTS	Greater Melbourne & Geelong
Ballarat Terminal Station	BATS	Regional Victoria
Bendigo Terminal Station	BETS	Regional Victoria
Dederang Terminal Station	DDTS	Northern Corridor
Eildon Power Station Yard	EPSY	Northern Corridor
Geelong Terminal Station	GTS	Greater Melbourne & Geelong
Horsham Terminal Station	HOTS	Regional Victoria
Kerang Terminal Station	KGTS	Regional Victoria
Mount Beauty Terminal Station	MBTS	Northern Corridor
Redcliffe Terminal Station	RCTS	Regional Victoria
Shepparton Terminal Station	SHTS	Regional Victoria
Glenrowan Terminal Station	GNTS	Regional Victoria
Morwell Terminal Station	MWTS	Regional Victoria
Heatherton Terminal Station	HTS	Greater Melbourne & Geelong
South Morang Terminal Station	SMTS	Regional Victoria
Richmond Terminal Station	RTS	Greater Melbourne & Geelong

Major terminal station projects and rebuilds generally result in the replacement of 20% to 80% of civil infrastructure in the station. Major rebuilds that are in progress at Fishermen's Bend (FBTS), East Rowville (ERTS), West Melbourne (WMTS) and Springvale (SVTS). The Table 2 shows the major station asset replacement expected to be completed and proposed in the next five to ten years:

Table 2: Major terminal stations rebuilds in next ten years

Terminal Station	Code	Region
Fishermen's Bend	FBTS	Greater Melbourne & Geelong
East Rowville	ERTS	Greater Melbourne & Geelong
West Melbourne	WMTS	Greater Melbourne & Geelong
Springvale	SVTS	Greater Melbourne & Geelong
Shepparton	SHTS	Regional Victoria
Redcliffe	RCTS	Regional Victoria
Templestowe	TSTS	Greater Melbourne & Geelong
Thomastown	TTS	Greater Melbourne & Geelong
South Morang	SMTS	Regional Victoria
Wodonga	WOTS	Regional Victoria
Keilor	KTS	Greater Melbourne & Geelong

Significant civil infrastructure replacements will take place during these stations rebuild. The move from outdoor air-insulated switchgear to indoor gas-insulated switchgear will also result in a substantial renewal of civil infrastructure assets at these stations.

Designs for the RTS and WMTS rebuilds have been influenced heavily by the local community and council expectations with a focus on improving the stations' aesthetics. Support structures, embankments, station buildings and security fencing are designed to be more visually discreet at these stations.

Details on the population of the different types of civil infrastructure in terminal stations are covered in the sections below.

3.2.1 Buildings

Approximately 480 buildings[1] provide all-weather housing for control equipment, protection relays, communication equipment, batteries, rotating machinery, diesel generators, compressors, switchgear, stores, workshops, laboratories, equipment spares, worker amenities and office equipment. Good building conditions are necessary to minimize safety risks for all this equipment and to provide adequate temperature, dust and humidity control for the increasing volume of digital protection, control and communications equipment.

Terminal station buildings vary widely in materials and type of construction. These range from multi-storied brick and masonry construction to single story timber and asbestos cement sheet and metal sheet construction.

3.2.2 Roads and Drains

Approximately 16 km of reinforced roads[2] in terminal stations provide transport access for heavy equipment, such as large power transformers. A further 29 km provide all-weather access to electrical equipment located in switchyards. Reinforced roads are bitumen sealed or in some cases concrete with kerbing and/or concrete spoon drain. Switchyard access roads are commonly bitumen sealed with concrete spoon drains. Some of the switchyard perimeter roads are gravel surfaced without edging and rely on natural drainage.

3.2.3 Switchyard Surfacing

About 168 hectares of switchyard surfaces[3] have been graded, drained and surfaced (selected crushed rock is used for the surfacing) to assist with the installation, operation and maintenance of electrical equipment in all weather conditions.

[1] Station design manual Vol.5 Section.30 – Civil designs buildings.
[2] Station design manual Vol.5 Section.5 – Civil designs roads
[3] Station design manual Vol.5 Section. 6 – Civil design switchyard surfacing.

More than 17 km of cable trenches exist in switchyards, protecting 43,000 secondary cables totalling over 6,000 km in length. The cable trenches are largely comprised of preformed concrete[4] trenching with galvanised steel covers. There are also significant quantities of direct-buried secondary cabling protected by concrete or plastic cover slabs. Secondary cable ducts and trenches are usually replaced as part of major station upgrade works.

3.2.4 Water Pipes

There is a substantial network of underground water pipes, associated fittings and valves supplying fire hydrants[5], transformer water deluge systems and domestic water supply[6]. The strategies that apply to fire systems are described in AMS 10-61 Fire Detection and Suppression.

3.2.5 Support Structures, Earth Embankments and Retainer Walls

There are numerous support structures[7], earth embankments[8] and retainer walls[9] for various plant items in terminal stations. The structures are typically galvanised steel in bolted lattice or welded component arrangements. They are normally mounted on concrete foundations with weather sealing grout installed beneath their feet. Earth embankments are constructed to support initial excavation at terminal stations. They also improve the aesthetics of stations whilst providing barriers against flooding. Retainer walls provide support to raised ground levels at terminal stations ensuring soil movement or subsidence is prevented.

3.2.6 Signage

There are many equipment nameplates and signs[10] installed in all terminal stations. Most nameplates are installed to physically identify plant items for operational and electrical safety purposes.

3.2.7 Foundations

There are numerous concrete[11] foundations installed in terminal stations supporting plant items, structures and buildings. Foundations are generally replaced along with associated equipment but are sometimes re-used during station augmentation and rebuild projects, depending on their suitability and condition.

3.2.8 Security Fencing

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3.2.9 Oil Containment and Treatment Systems

A large number of stations plant equipment contains significant quantities of oil. Oil containment and treatment systems are installed at all terminal stations to reduce the risk of contamination of stormwater drainage systems

[4] Station design manual Vol.5 Section.20 – Civil designs concrete.
[5] Station design manual Vol.5 Section.15 – Civil designs switchyard hydrant systems.
[6] Station design manual Vol.5 Section.10 – Civil designs water supply.
[7] Station design manual Vol.5 Section.22 – Civil designs steel structures.
[8] Station design manual Vol.5 Section.4 – Civil designs earth work.
[9] Station design manual Vol.5 Section.120 – Civil designs concrete construction.
[10] Station design manual Vol.5 Section.13 – Civil designs security fencing and signage.
[11] Station design manual Vol.5 Section.20 – Civil designs concrete.

in the event of a spill. AusNet Services' oil containment and treatment system design standards[12] are set in accordance with EPA and State Environmental Planning Policies (SEPP) guidelines.

3.3 Asset Age Profile

In many cases existing civil infrastructure designs date back to the initial station construction but partial or full replacement of some of these assets as part of the station rebuild works or station infrastructure projects have resulted in improved condition.

The age profile of civil infrastructure across all the terminal stations is illustrated in Figure 1.

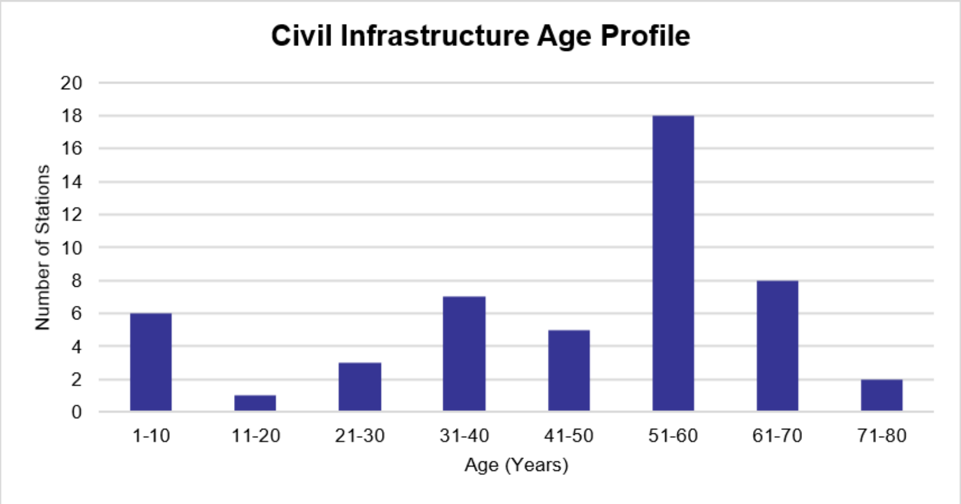

Figure 1 – Civil infrastructure age profile

3.4 Asset Condition

The condition of civil infrastructure assets is at average condition, even though majority of the stations' service life is beyond 50 years. This is due to recent upgrades/refurbishments of some of the assets in the stations during rebuilds and/or equipment replacement programs. With stations showing improvement such as Brunswick (BTS), Richmond (RTS), West Melbourne (WMTS), Frankston, (FTS), Keilor, (KTS) and Sydenham (SYTS).

The condition of civil infrastructure assets is influenced by several factors such as:

- Operating conditions;
- Climatic and environmental conditions;
- Differing designs and construction material;
- Past opportunities to integrate civil infrastructure replacement works into rebuild projects/programs.

Civil infrastructure assets in poor condition pose risks associated with asset failure. These issues are more prominent at stations which do not have extensive rebuild or asset replacement works planned in the next five to ten years.

The condition assessment for the civil infrastructure in all terminal stations was formulated to inspect all major stations to be incorporated into the existing civil infrastructure maintenance program.

Civil infrastructure assets are assigned condition scores which correspond to the remaining service potential (remaining life). Table 3 below lists details of condition scores including descriptions and the expected remaining service potential.

[12] Station design manual Vol.5 Section. 8 – Civil designs oil containment.

Table 3: Condition Scores

Condition	Description	Remaining Service Potential
C1	As New	90%
C2	Good	75%
C3	Average	50%
C4	Poor	25%
C5	Very Poor	10%

Details on the condition of specific civil infrastructure assets in terminal stations are covered in the sections below.

3.4.1 Buildings

Buildings at terminal stations vary widely in the construction material used, age and condition. Almost 60% of the buildings in terminal stations are in Very Good to Average condition, C1 to C3, while approximately 40% of buildings are in Poor to Very Poor condition (i.e. C4 and C5). These sites will need to be refurbished in the next five to ten years.

Table 4 below is a list of recent building construction/upgrade works done at various terminal stations, while the condition of the buildings is shown in Figure 2.

Table 4: Recent Civil Works in Terminal Stations

Terminal Station	Code	Works completed
Fishermen's Bend	FBTS	Battery/charger building, roof, asbestos floor tiles removed, toilets upgraded, rebuild underway
East Rowville	ERTS	Battery rooms rebuilt, floor tiles replaced, old mess room removed
West Melbourne	WMTS	New control bldg. built, rebuild underway
Springvale	SVTS	Battery rooms upgraded, building extended, rebuild underway
Glenrowan	GNTS	Removed asbestos floor tiles with vinyl tiles, 2-new battery rooms, external doors on main building and workshop upgraded, new roller doors fitted to spare equipment store, building fire hardened by removing external windows, internal electrical switchboards replaced and upgraded
Heatherton	HTS	Old battery room removed, new battery/charger room building installed, asbestos floor tiles replaced
South Morang	SMTS	New battery/charger room building installed
Richmond	RTS	Old machine building improved, refitted mess room on ground floor and new toilets, refitted offices on first floor, new 220kV GIS and control building, new 66kV building, 22kV switch room, new mess room built, new toilets, all asbestos floor tiles removed, new lights, new roof.

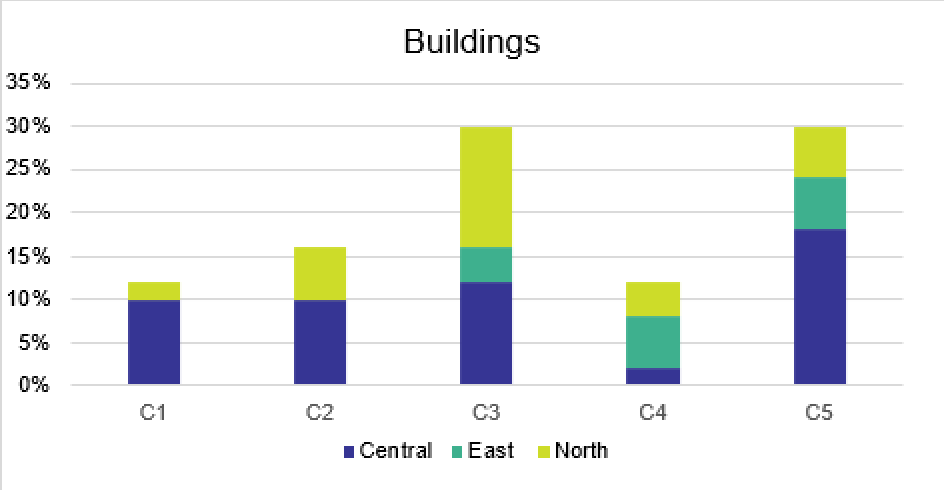

Figure 2 – Condition profile of Buildings inside terminal stations

3.4.2 Roads and Drains

Heavy vehicle transport roads have been used rarely at their load bearing capacity and hence are in good condition. However, with transformer service age and conditions suggesting increasing refurbishment and replacement works, the next few years will involve more frequent movement of heavy equipment on these roads, thereby making road augmentation and repairs more likely in the future.

The condition profile of roadways and drainage systems is shown in Figure 3.

The condition of most of the switchyard access roads (72%) is Very Good to Average condition, C1 to C3, due to investment in civil infrastructure over the past few years. However, some switchyard roads are currently only suitable for light operational traffic and will require improvement to facilitate access for construction traffic associated with equipment refurbishment or replacement. The Poor to Very Poor scores, C4 to C5, (28%) is currently driven by the poor condition of some minor roads in terminal stations and not by the major road conditions.

Drains[13] in all terminal stations are in good condition. However, the increasing Environmental Protection Agency (EPA) requirements around controlling the discharge of rainwater from switchyards, which may have low oil contamination levels, are driving increased investment in purpose designed collection drains, piping of existing open drains and extensive oil interceptor traps and water treatment works.

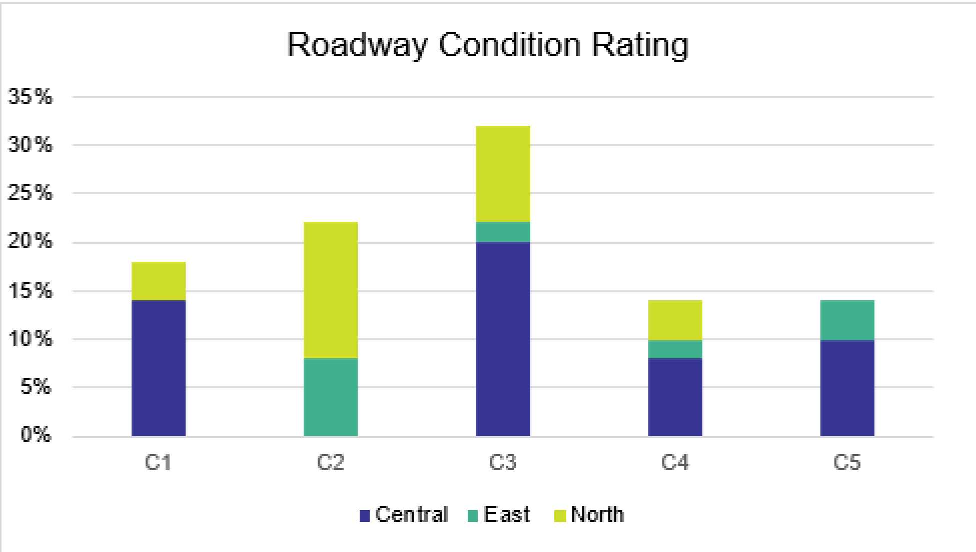

Figure 3 – Condition profile of roadways and drainage systems

[13] Station design manual Vol.5 Section.7 – Civil designs storm water drainage.

3.4.3 Switchyard Surfacing

The increased traffic in switchyards due to high volume of augmentation works are having a negative impact on the switchyard surface conditions. The condition profile of switchyard surface roadways is shown in Figure 4.

There have been large investments in the last five years that have maintained the switchyards in good conditions and with forecasts of continuing asset replacement work over the next five years. This suggests the requirement of continuing to invest in the switchyard re-surfacing.

Extensive switchyard resurfacing has been completed at BATS, BETS, EPS, MTS, and TTS during the last five years which saw the improvement of their condition.

Secondary cable ducts and trenches in switchyards are usually replaced as part of major upgrade works. Cable trench and covers upgrades have recently been completed at BETS, EPS, MTS, and TTS.

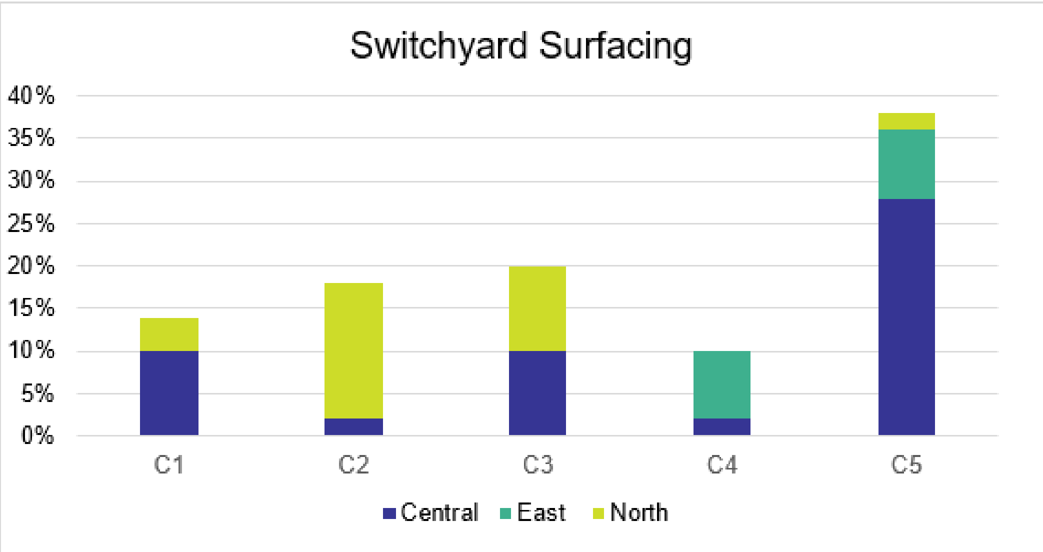

Figure 4 – Condition profile of switchyard surface

3.4.4 Support Structures, Earth Embankments and Retaining Walls

The support structures condition reasonably good, however there are signs that some of the assets are showing age related degradation which has been accelerated due to extreme weather incidents over the past few years. There is also changing community expectations to reduce the visual impact of terminal stations, especially those that are in close proximity to high density residential areas.

Support structures are sometimes re-used during station augmentation and rebuild projects, depending on their suitability and condition.

At Redcliffe Terminal Station (RCTS), the protection wall was recently completed which assures the safety and structural integrity of the buildings, as well as protection of the station from any flooding due to extreme rainfall.

3.4.5 Signage

Plant nameplate conditions are generally good across all sites; however, nameplates and signs have a limited life and will need ongoing replacement. Security signage is generally replaced as part of fencing replacements.

3.4.6 Foundations

Foundations can sometimes deteriorate due to corrosion of the steel reinforcement. There are very few instances where foundations are replaced/repaired as independent targeted works and are usually included in the scopes of rebuild projects at various stations.

3.4.7 Security Fencing

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Figure 5 – Condition profile of security fencing

3.4.8 Oil Containment and Treatment Systems

A major environmental upgrade program was initiated in 2002 to achieve compliance with EPA guidelines. The program involved the upgrade of oil containment / bunded areas which contains the power transformer, introduction of triple interceptor pits and the installation of above-ground water treatment plants.

Five stages of the program have been completed successfully across all terminal stations, including Eildon Power Station (EPS) and Morwell Power Station (MPS). The completion of the environmental upgrade projects has resulted in majority (92%) of stations having an environmental system in Good condition (C1), with the remaining 8% in Average (C3) condition. The condition profile of environmental systems is shown in Figure 6.

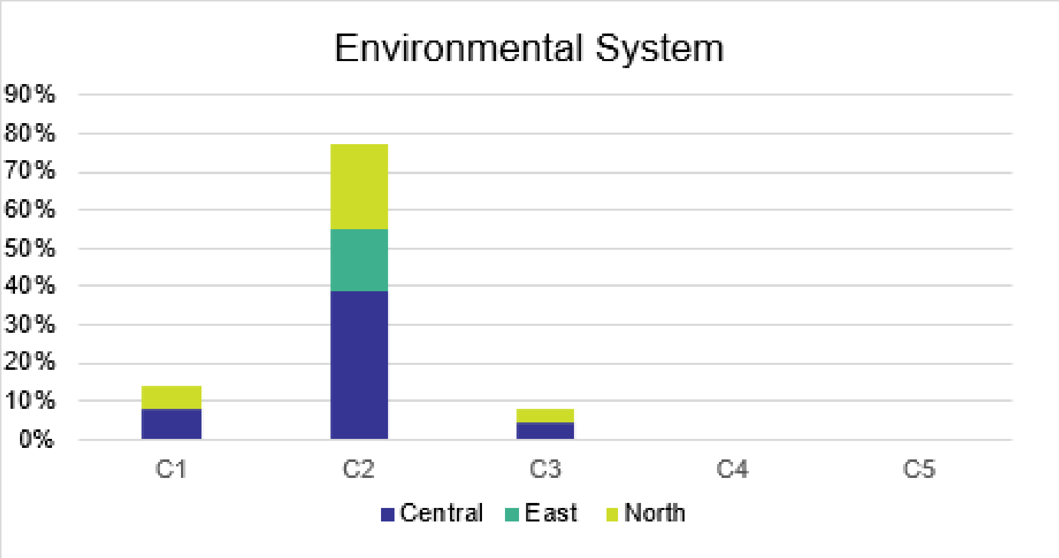

Figure 6 – Condition on environmental systems

3.5 Asset Performance

3.5.1 Suspended failures

Defects in the various categories which comprise Civil Infrastructure which are identified prior to a failure or fault are defined as suspended failures. Suspended failures are also referred to as “preventative actions” which are identified during routine stations inspections.

The station inspector raises a ZA notification in SAP and assigns appropriate priority rating (PT rating) to the issue commensurate to the risk of the asset failing. The following figures 7,8,9 and 10 illustrates the top 10 items identified for the various Civil Infrastructure components inside stations for the past years.

3.5.1.1. Environmental System

The most prevalent issue in the environmental system used in terminal stations concerns the pump system of the oil-water separator unit. Pump issue represents more than 50% of the ZA notifications raised concerning this aspect of the Civil Infrastructure, with the rest involving the oil containment unit being damaged, filter being defective and the coalesce unit being damaged. Suspended failures of environmental systems during the period 2015-2019 is shown in figure 7.

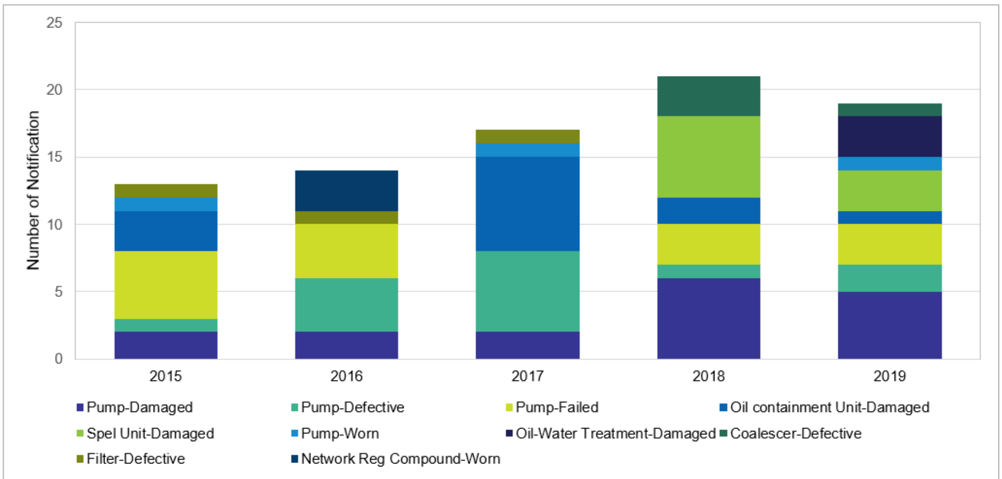

Figure 2 – Environmental system suspended failures

3.5.1.2. Buildings, Perimeter Fence, and Switchyard

The most prevalent issue for buildings concerns lighting at 24% of all ZA notifications raised for this category, followed by the doors and windows at 16%, and then damage to the building structure at 15%. The rest is comprised of damage reported to the roof, toilet, foundation of the structure, floors, external walls, ceiling, and air conditioning. Figure 8 provides the civil infrastructure suspended failures during the period 2015-2019.

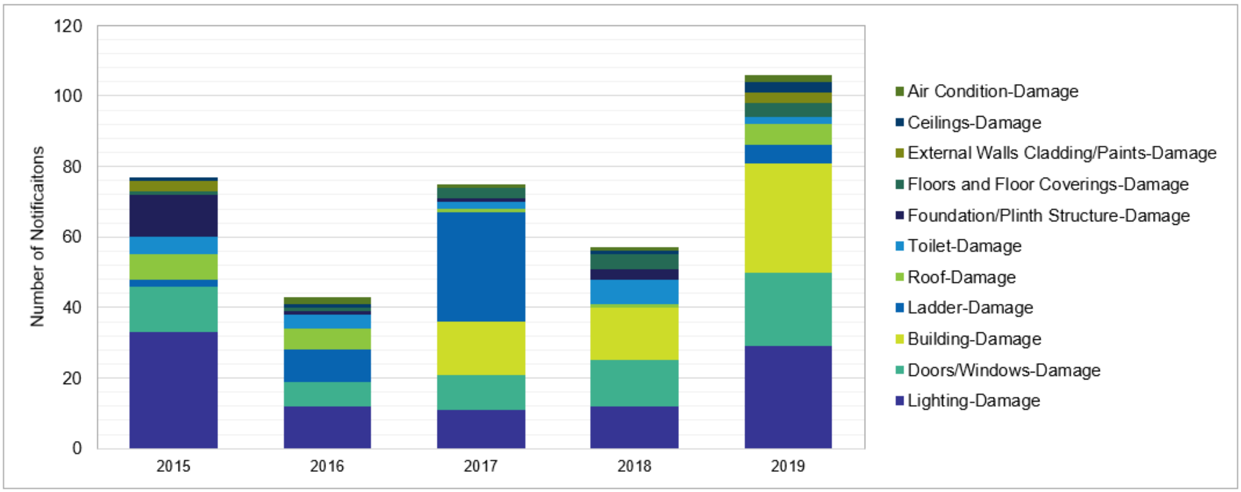

Figure 3 – Building, perimeter fence, and switchyard suspended failures

3.5.1.3. Fire Protection

Fire protection system has the fire hydrants as the most common item flagged to be an issue at 24% of all notification raised. This is followed by the fire indicator panel at 14%, then issues associated with the VESDA system at 9%, then the balance is made-up of the fire indicator panel, fire equipment and valves. Fire protection system suspended failures during the period 2015-2019 is shown in Figure 9.

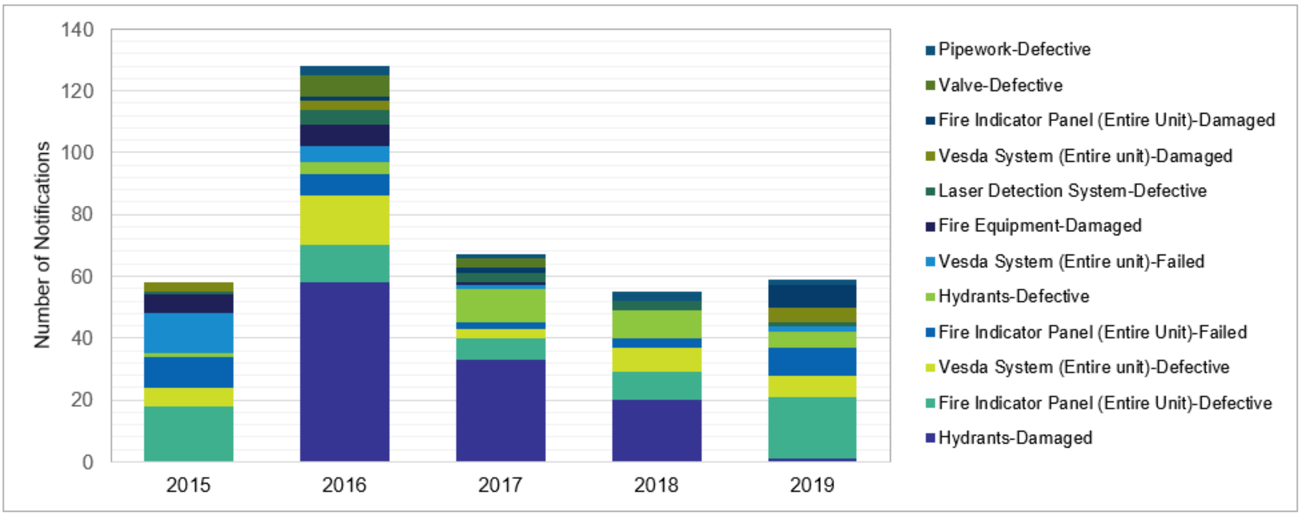

Figure 4 – Fire protection system, suspended failures

3.5.1.4. Security Fencing

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Figure 5 – Infrastructure Security, suspended failures

3.5.2 Functional failures

Functional failures, also known as Faults, result in the system not being able to perform its intended purpose and therefore, appropriate action is necessary to maintain the performance and security of the system.

Like Suspended failures, assets that have experienced functional failure are flagged in the system and a ZK notification (action required after a Fault) is raised. The following sections identify the functional failures that have occurred over the past five years.

3.5.2.1. Environmental System

All faults in the environmental system involve the pumping unit of the oil-water separator unit experiencing some issue as shown in figure 11. Since 2017, there have been 2-failures involving the pump.

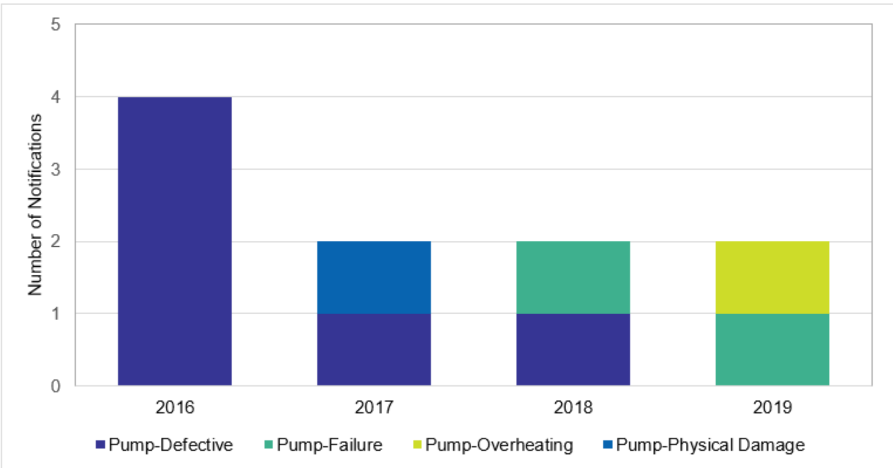

Figure 6 – Environmental system, functional failure

3.5.2.2. Buildings, Perimeter Fence, and Switchyard

Power supply failures is the most prevalent fault in buildings at 27%, followed by failures with the doors and windows at 18%, then the rest is composed of faults associated with the fence wire mesh, air conditioner, water supply, and then lighting as shown in figure 12.

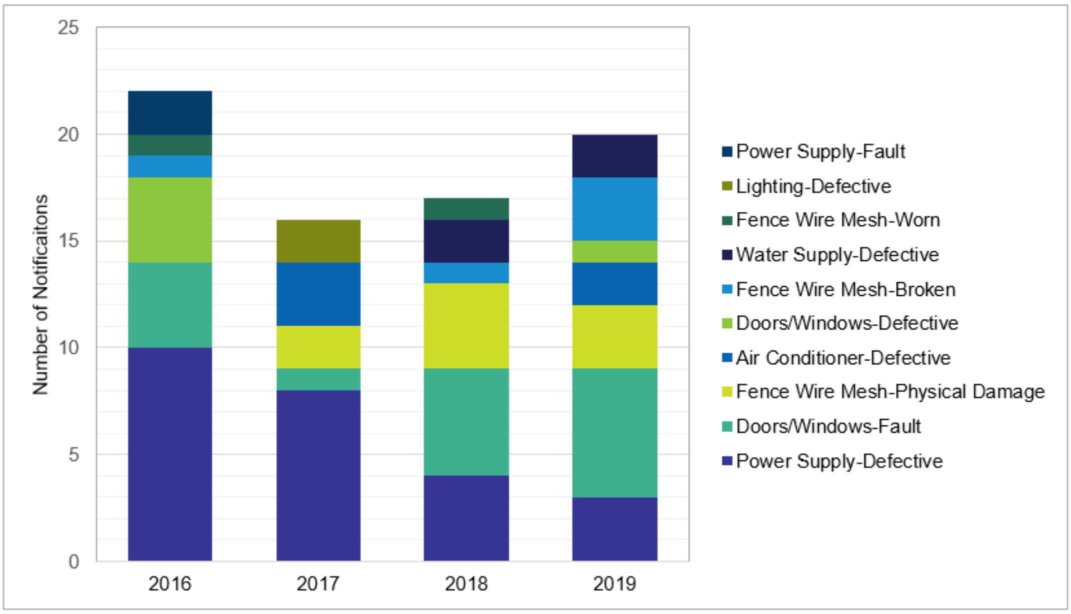

Figure 7 – Buildings, perimeter fence, and switchyard functional failure

3.5.2.3. Fire Protection

Fire protection failures is dominated by issues with the VESDA system at 24%, followed by faults at the laser detection issues at 21%, then fire indicator panel issues at 19%, then water supply issues. Figure 13 shows the distribution of the issues.

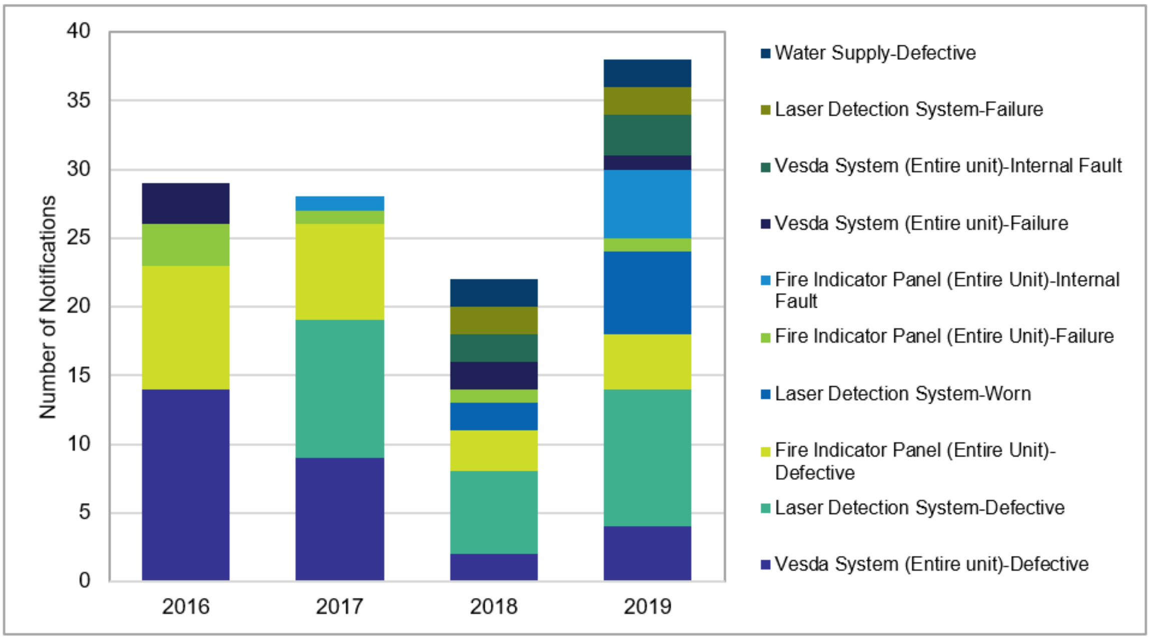

Figure 8 – Fire protection system, functional failure

3.5.2.4. Security Fencing

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Figure 9 – Security fencing, functional failure

3.6 Asset Criticality

The consequence of failure of the any of the various components within the Civil Infrastructure category in a Terminal Station can vary significantly, ranging from collateral asset damage for the building condition, environmental contamination for environmental systems and personnel safety with regards to buildings and switchyard condition.

To get a quantitative value of the system's criticality, the economic impact of each potential outcome is pondered and analysed. For this analysis, the condition of the Building, Environmental System, and Switchyard are assessed.

The economic impact is calculated by adding these components:

- Collateral damage of station equipment and assets
- Health and Safety
- Environment and community

3.6.1 Collateral Asset Damage

Stations have buildings which contain different type of equipment and materials. Control Rooms and Battery Rooms have expensive equipment and hazardous items, respectively. Failure of the structure to safely contain these items can result to huge financial loss such as damage to relays, circuit boards, protection equipment, etc. while damage to battery rooms may result to a fire and even explosion.

Switchyard condition, specifically the surface and items such as cable tray covers/lids can impact the movement of plant and equipment in the yard. Uneven surfacing and unstable ground have caused mobile plant to topple-over result in unloading its load and delaying works.

3.6.2 Health and Safety

The building's over-all condition may impact the health and safety of personnel working inside, as they may be exposed to hazardous substance such as asbestos from old wall panels and ceilings, floor tiles, etc. or fumes inside the battery rooms. Also, un-maintained buildings can result to injuries to personnel such as slips and trips, uneven flooring, etc.

Switchyards can likewise cause injury to personnel when walking on uneven surface, unmaintained cable tray covers, etc.

3.6.3 Environmental Impact

Unmaintained, faulty, or damaged environmental systems/infrastructure can cause hazardous substance like oil or wastewater to escape into the environment. The Environmental Protection Agency (EPA) can impose hefty fines to the company polluting the environment depending on the damage caused, as well as the number of times the event has occurred, i.e. a company that has caused a previous incident will be fined heavier for a second offence.

3.6.4 Overall Criticality

The consequences of a fragile fire hydrant system can be allocated into five criticality bands based on their economic impact as the result of the failure. These asset criticality or consequence impacts are irrespective of the likelihood of the actual failure of the FHS.

The five criticality bands are tabulated given in Table 5 below:

Table 5 – Criticality Band

Criticality Band	Economic Impact due to a failure
1	<= 1 replacement cost
2	1 to 3 x replacement cost
3	3 to 10 x replacement cost
4	10 to 30 x replacement cost
5	>30x replacement cost

The criticality assessment compares calculated consequence cost over the replacement cost. For the FPS, the criticality value is the ratio of the consequences of a fire in a Control Building and the cost to replace the system.

The various Tables in Section 5 presents the criticality -condition risk matrix for the Buildings (Table 6), Environmental System (Table 7), and Switchyards and Roads (Table 8). The numbers indicate the quantity of terminal stations which have a component of the Civil Infrastructure under a specific condition score and have a consequence of failure within a Criticality Band.

4 Other Issues

These are other issues related to Civil Infrastructure:

- Asbestos hazards identified including solid asbestos in walls, floor tiles, ceilings, roofs, and equipment mounting panels and possible asbestos dust in cable trenches and ducts.
- Records for civil infrastructure assets are inadequate and do not include essential information such as installation date, material type, quantity, and asset-specific condition.
- Stability of mobile work platforms and vehicles involved in maintenance and construction activities manoeuvring on switchyard surfaces made of crushed rock.
- Increasing security standards and changes in neighbouring land usage often render the existing security fencing inadequate before reaching its nominal service life.
- Increasing severity and frequency of extreme weather events such as floods, storms, and high temperature days impact civil infrastructure assets either by damaging or exacerbating condition deterioration.

5 Risk Assessment

There are varying risks associated for each component of a station's Civil Infrastructure, ranging from asset and public safety for the security system/fence, environmental contamination for environmental systems and personnel safety with regards to buildings and switchyard condition.

Depending on the nature and scale of the deficiencies of the civil infrastructure assets, solutions vary from targeted asset replacement, station refurbishment or whole station rebuild. The integration of civil infrastructure upgrades should be considered during the scope development phases of such projects as it has been proven to be the most economical solution.

A semi-quantitative risk analysis was undertaken for each station by considering the components that were given a condition rating of Poor to Very Poor (C4 to C5), using the criticality values from penalties caused by non-compliance to relevant regulations, as well as unit rates for repair/replacement.

5.1 Buildings

From section 3.4, the civil infrastructure components that need to be addressed within terminal station sites are the physical condition of Buildings. The risk assessment for terminal stations is shown in Table 6, using the Corporate Risk Matrix.

Table 6 – Buildings Risk Matrix

		Buildings					
		C1	C2	C3	C4	C5	Consequence / Replacement Cost
CRITICALITY	5	0	0	0	0	0	> 30.0
	4	0	0	0	0	0	10.0 - 30.0
	3	0	5	8	2	7	3.0 -10.0
	2	0	0	3	1	5	1.0 - 3.0
	1	6	3	4	3	3	< 1.0

There are seven terminal stations in Level A Risk, having a Criticality Rating 3 with a condition score of C3, then sixteen terminal stations in Level B Risk. In the coming Regulatory RESET, buildings in fifteen terminal stations with are in Very Poor condition, C5 will be addressed either as part of station rebuilds, or by refurbishing the building to comply with the Building Code of Australia (BCA).

The seven terminal stations which have buildings with a Criticality Rating of 3 and condition score of C5 are BLTS, MPS, RWTS, SHTS, SVTS, TSTS and YPS. Eight other stations with buildings in Very Poor condition and Criticality Rating of 1 to 2 are BATS, BETS, HWTS, KTS, ROTS, SMTS, TBTS and TTS.

One of the fifteen terminal stations with C5 condition buildings, SVTS is currently undergoing a rebuild and already had its battery rooms upgraded. It is anticipated that the rebuild will be completed prior to the start of the new Regulatory Period in 2022.

For the six terminal stations with building in Poor Condition, C4 and Criticality ranging from 1 to 3, these may require minor maintenance on an ad-hoc basis.

5.2 Environmental System

As all the environmental upgrade projects have been completed, the environmental systems of all terminal stations are in Very Good to Average condition. The risk matrix for the environmental system in the fifty terminal stations is shown in Table 7 below.

Table 7 – Environment Systems Risk Matrix

		Environmental System					
		C1	C2	C3	C4	C5	Consequence / Replacement Cost
CRITICALITY	5	0	0	0	0	0	> 30.0
	4	7	31	3	0	0	10.0 - 30.0
	3	1	8	0	0	0	3.0 -10.0
	2	0	0	0	0	0	1.0 - 3.0
	1	0	0	0	0	0	< 1.0

There are no terminal stations which have an environmental system belonging to Level A risk, with the highest risk systems found in 3-terminal stations assigned a Level B risk with an Average condition, C3 and a Criticality Ranking of 4.

5.3 Fire Protection Systems (FPS) and Fire Suppression Systems (FSS)

There are several risks which have been identified around the pipe works supplying the Fire Protection System and Fire Suppression System assets in terminal stations, details of which can be found in *AMS 10-61 Fire Detection and Suppression*.

5.4 Infrastructure Security

Several terminal stations have been deemed critical by Victoria Police and therefore, are requiring some upgrades in their infrastructure security systems. Details of risks specific to infrastructure security can be found in *AMS 10-63 Infrastructure Security*.

5.5 Overall Switchyard

There are eighteen terminal stations which have switchyards in Very Poor condition, C5 as shown in Table 8 below. Among these sites, three station switchyards have Level A risks, eleven have Level B risks, and the remaining four are Level C risks.

These eighteen sites can have its switchyard risk profile lowered by resurfacing the yard, refurbishing the roads, and replacing defective items such as the covers, cable trenches, yard lighting, etc.

Experience has shown that switchyard refurbishment is best undertaken during station rebuild projects. During these projects, the yard will be subject to plant movement, used as stockyard of materials, etc. so its refurbishment should be included during site reinstatement of the project.

Table 8 – Switchyard & Roads Risk Matrix

		Switchyard and Roads					
		C1	C2	C3	C4	C5	Consequence / Replacement Cost
CRITICALITY	5	0	0	0	0	0	> 30.0
	4	0	0	0	0	0	10.0 - 30.0
	3	6	5	1	4	3	3.0 -10.0
	2	1	2	8	0	11	1.0 - 3.0
	1	0	2	2	1	4	< 1.0

5.6 Program of Works

The proposed program of works for Regulatory Period 2023 to 2027 is provided in Table 9 below.

For buildings, the first option to improve its condition is to refurbish the structure. If this option is not practical, the introduction of separate modular buildings has become a legitimate alternative due to its cost effectiveness compared to constructing a new building of the same material as the original structure.

During the next Regulatory Period, station re-build or refurbishment projects will be able to accommodate some of the sites provided in Table 9 below.

Table 9: Civil Infrastructure, Program of Works -2023-2027

Name of Program	Stations	Scope of works
Building replacement or refurbishment	Priority (Level A risk): BLTS*, MPS, RWTS, SHTS*, SVTS+, TSTS and YPS BATS, BETS, HWTS*, KTS, ROTS, SMTS*, TBTS, TTS	Structural aspects of building including walls, panels, ceiling, windows, doors, roofs, floor tiles, toilets and any ancillary areas, e.g. mess room, storage room, battery room.
Switchyard refurbishment	Priority (Level A risk): ATS, FTS, TBTS BLTS*, CBTS, ERTS*, HTS, HWTS*, KGTS*, KTS, MPS, MWTS, ROTS, RWTS, SMTS*, SVTS, TSTS*, YPS	Re-surfacing of switchyard, replacement of cable tray lids, repair of cable trays, repair of yard drainage, etc.
Access roads	BLTS*, HTS, HWTS*, KTS, LYPS*, SMTS*, SYTS*	Resurfacing or repair of road, drainage, gutters, etc.

NOTES:

1. Stations which have a (*) are scheduled for a re-build during 2022-2027.
2. + SVTS is currently being re-built and is expected to be completed by 2021.

6 Asset Strategies

6.1 Buildings

- Ensure new buildings comply with the requirements of Building Code of Australia and Australian Standard AS2067: *Substations and high voltage installations exceeding 1000 volts, AC*.
- Where economic use relocatable buildings for new or major building refurbishments.
- Continue to repair or refurbish buildings during Major Rebuilds

6.2 Environmental System

- Continue to maintain existing environmental to meet the requirements new EPA legislation.

6.3 Security Fences

- [C-I-C]
- [C-I-C]
- [C-I-C]

6.4 Civil Infrastructure - Roads, switchyard surfaces, drainage system and AC supplies

- Include recurring civil infrastructure condition assessments in the scheduled maintenance program and record results in Asset Management System (SAP).
- Where possible implement civil works and improved infrastructure security and removal of asbestos containing material (ACM) as part of major project/ rebuild works.
- Supplement renewal, replacement, or augmentation of condition C4 & C5 civil infrastructure in the scopes of major augmentation and station re-build projects as and when economic.
- Initiate targeted civil infrastructure (in condition C4 & C5) upgrade projects for sites with no major projects/rebuild planned in next 10 years

6.5 Fire Protection Systems

- Continue to upgrade fire protection system assets in compliance with AMS 10-61: Fire Detection and Suppression.
- Maintain fire protection systems in line with AS1851: Maintenance of Fire Protection Systems and Equipment.