Investment Evaluation Summary (IES)

Project Details:

Project Name:	Fire Mitigation Projects
Project ID:	00676
Thread:	Overhead
CAPEX/OPEX:	CAPEX
Service Classification:	Standard Control
Scope Type:	D
Work Category Code:	SIFIC
Work Category Description:	Fire mitigation projects - Conductor
Preferred Option Description:	Implement Fire Mitigation Projects : mplement fire mitigation projects as described focusing on the following projects: • Replace EDO fuses with Boric Acid fuses in HBCA • Install Vibration Dampers • Install LV Spreaders
Preferred Option Estimate (Nominal Dollars):	$20,000,000

	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
Unit ($)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Volume	1	1	1	1	1	1	1	1	1	1
Estimate ($)										
Total ($)	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000

Governance:

Project Initiator:	Erin Cook	**Date:**	26/03/2015
Thread Approved:	David Ellis	**Date:**	02/11/2015
Project Approver:	David Eccles	**Date:**	30/10/2015

Document Details:

Version Number:	1

Related Documents:

Description	URL
SIFIC NPV	http://projectzone.tnad.tasnetworks.com.au/business-projects/nis-program/DD17SAM/Deliverables/Overhead%20Systems%20and%20Structures/SIFIC%20Fire%20Mitigation%20Projects/TasNetworks%20NPV%20SIFIC.xlsm
SIFIC IES	http://projectzone.tnad.tasnetworks.com.au/business-projects/nis-program/DD17SAM/Deliverables/Overhead%20Systems%20and%20Structures/SIFIC%20Fire%20Mitigation%20Projects/TasNetworks%20-%20IES%20SIFIC.docx

Section 1 (Gated Investment Step 1)

1. Background

High Bushfire Consequence Area

Defining high bushfire consequence areas (HBCA) allows effective application of asset and vegetation management strategies. The 2009 Victorian Bushfire Royal Commission approach has been adopted that includes the highest 80 per cent of the State' s fire loss consequence into the defined HBCA.

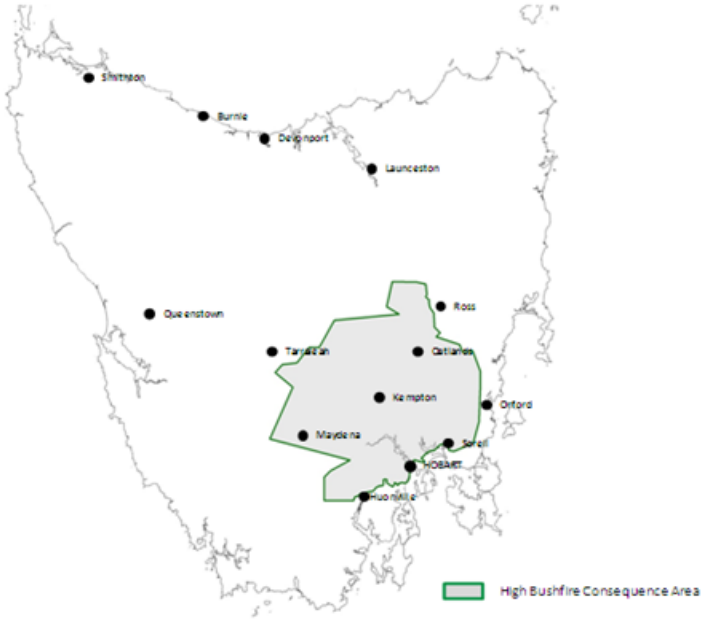

Figure 1: High Bushfire Consequence Area

Fire History

Like all overhead electricity distribution networks in fire prone environments, TasNetworks' network assets have varying degrees of vulnerability to bushfires.

In Tasmania, bushfires usually occur during the warmer months from November to March, with a peak in January and February. They are unusual during the winter months however, major fires have occurred as early as October and as late as April.

As Tasmania has relatively mild summer weather conditions, generally, these fires burn slowly and are controlled by fire fighting crews.

A notable exception to this were the 'Black Tuesday' fires around Hobart on 7 February 1967, which killed 62 people, injured 900, and rendered 7,000 people homeless.

The 1966/1967 summer was preceded by an unusually wet spring (September and October 1966 rainfall was more than twice the long-term average for that period) resulting in prolific grass growth. Conditions then turned very dry, with November 1966 to February 1967 rainfall being little more than a third of the long-term average rainfall for that period. Grasslands cured and forest fuels dried out significantly.

The occurrence of extreme fire weather on 7 February 1967 resulted in numerous fires moving into dry, heavy forest fuels, subsequently merging and forming an extreme forest fire event. This event is a case of a short-term drought contribution to a severe fire event.

Whilst the high impact fire events are more common on the mainland, this illustrates high consequence fires can occur in Tasmania. When drought and severe fire weather combine, and fires start in areas with extensive eucalypt forest cover, fires with fire behaviour at the upper levels of possible severity can occur.

There is no history of powerlines in Tasmania starting catastrophic bushfires, however, the experience in mainland Australia is that powerlines can start bushfires. Whilst the average number of bushfires started by powerlines is relatively low (1- 4% of all bushfires) (reference 3), inquiries into catastrophic bushfires in Victoria have found that disproportionate number have been started by powerlines. As a result, the risk of TasNetworks' assets and/or operations starting a bushfire is rated as one of the highest risks to the business.

TasNetworks also recognises that there is the potential to lose a significant number of its assets during a bushfire due to the spread of the assets across the state. An event of this kind would severely impact TasNetworks' ability to provide continuous electricity supply, which has serious consequences for TasNetworks and for the fire management capability of the emergency services and the safety of the public.

HV Fuses

HV fuses are used in TasNetworks' distribution system to protect spur lines on feeders and pole mounted distribution transformers. The main types of HV fuses in the system are Expulsion Drop Out (EDO) fuses.

An EDO unit (Figure 2) consists of a fibreglass fuse holder or carrier, a fuse element and a porcelain mount. The fuse holder consists of a tube, the lower casting and the tube top with a pull ring. The mount consists of an insulator, a bracket, the top and bottom terminals, bottom hinge and top contacts.

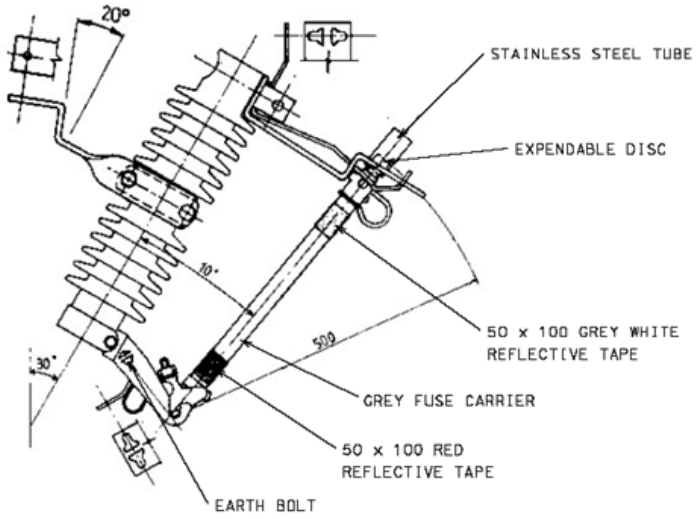

Figure 2: Expulsion Drop Out (EDO) Fuse

Figure 2: Expulsion Drop Out (EDO) Fuse

Under fault or overload conditions, the fuse element in the fuse holder will melt. This causes the fuse holder to drop down and interrupt supply, sectionalising the fault and protecting the spur or transformer. The hanging fuse holder provides a clear visual indicator that the fuse has operated.

When EDO fuses operate, there is an expulsion of hot plasma and particles from the base of the fuse tube, which has the potential to start a fire. Whilst spark catchers are available on the market, TasNetworks' experience is that these do little to mitigate the risk of fire starts.

As the tube of an EDO fuse weathers due to exposure to the elements the internal fibres to swell. This may cause the fusible link to stick preventing it from releasing following a downstream fault, that is the fuse switch does not drop out as designed. This results in electrical tracking inside the tube, which creates heat that in turn, results in the fuse tube catching fire, burning in half, dropping to the ground and potentially starting a fire. This is known as an EDO Hang Up.

On average, TasNetworks records approximately 200 outages where HV fuses operate as protection every year.

HV fuse related fire starts are considered an extreme fire risk to TasNetworks.

Clashing Conductors

Clashing of bare overhead conductors can result in molten metal falling to the ground with the potential to start a fire.

The conductor separation required to avoid clashing of conductors is dependent on:

1. The type of conductor;
2. The span length;
3. The conductor sag;
4. The size of the cross-arm; and
5. The pole top configuration.

Slack spans, uneven sags and span lengths that are too long for the pole top configuration can result in result in poor conductor spacing.

Previous design and construction standards allowed for shorter sized cross-arms to be installed in the system. With the advent of

newer, larger conductors that are now being used in the system, these cross-arms no longer provide adequate horizontal clearances between the conductors.

Vertical LV construction is particularly sensitive to variations in spacing and span length. An error in either of these elements can result in poor vertical conductor spacing.

Leaning poles also increase the risk of clashing conductors, as the angle of the leaning pole can detrimentally affect the spacing between the conductors.

On average, Aurora records approximately 50 outages caused by clashing conductors every year.

Clashing conductors are considered an extreme fire risk to TasNetworks.

2009 Victorian Bushfires Royal Commission Recommendations

Recommendations from the 2009 Victorian Bushfires Royal Commission state that

Victorian distribution businesses are required to:

- fit spreaders to any lines with a history of clashing or the potential to do so
- fit or retrofit all spans that are more than 300 metres long with vibration dampers as soon as reasonably practicable.

While these recommendations are only mandatory to Victorian utilities, TasNetworks intends to implement this recommendation where suitable in the Network as a matter of prudency.

1.1 Investment Need

Over this period the Fire Mitigation Projects program is focusing on 3 main components:

- Replace EDO fuses with Boric Acid fuses in HBCA
- Install Vibration Dampers
- Install LV Spreaders

Fault & Fire Start Data:

Analysis of fault data and fire starts show that in 2014 the leading asset cause for a ground fire was the EDO fuse.

Calendar Year

Failed asset owner	Aurora
Ground fire?	Y
Calendar Year	2014

Count of FIRE CAUSE	Month								
FIRE CAUSE	1	2	3	4	7	9	11	12	Grand Total
Conductor Clashing due Wind Long Span		1							1
Conductor Clashing due Wind Slack Span		1							1
Conductor Failure - Bare Wire - Broken		1							1
Connector Failure	1								1
EDO Fuse Element		1	2			3			6
Insulator Broken/Damaged		1							1
Vandalism/Accidental Damage								1	1
Vegetation Inside Clearance	1								1
Vegetation Outside Clearance		1	1	1		2	1		6
Turret					1				1
Conductor Failure						1			1
Grand Total	2	6	3	1	1	3	4	1	21

Replace EDO fuses with Boric Acid fuses:

The aim of this program is to replace EDOs with fire safe alternatives, such as boric acid fuses, to reduce the risk of fire start

associated with the operation of EDO fuses.

Devices such as boric acid fuses only expel gases and not plasma and particles like EDOs, are more resilient to lightning strikes and do not 'hang up' like EDOs.

The program is to be prioritised by sites in the HBCA first then once these are complete sites in other areas of bushfire concern will be addressed. There are approximately 2590 EDO fuse sites in the HBCA. The proposed volumes for this program are 723 sites per year. At this rate it is expected that the HBCA be completed within 4 years. The program will be prioritised so that transformers and control stations in areas of high fault levels (>6 kA) and with large loads are replaced first.

It is estimated that $1,500,000 per annum will be required for this program.

Install Vibration Dampers:

This program to install vibration dampers and armour rods on long spans greater than 300m. A desk top audit and prioritisation will be performed to get volumes. At this stage it is estimated that $250,000 per annum will be required for this program.

Install LV Spreaders:

This program is to retrofit LV Spreaders within all rural areas. Priority will first be within HBCA. Desktop audit is still required to be performed to get exact volumes. At this stage it is estimated that $250,000 per annum will be required for this program.

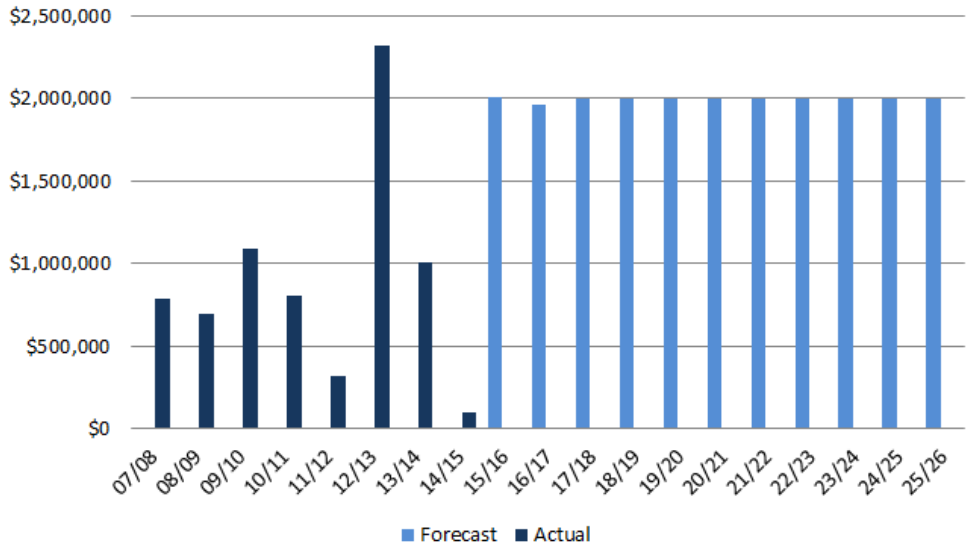

Figure 3: Fire Mitigation Programs Expenditure

1.2 Customer Needs or Impact

TasNetworks continues to undertake consumer engagement as part of business as usual and through the voice of the customer program. This engagement seeks in depth feedback on specific issues relating to:

- how it prices impact on its services
- current and future consumer energy use
- outage experiences (frequency and duration) and expectations
- communication expectations
- STPIS expectations (reliability standards and incentive payments)
- Increasing understanding of the electricity industry and TasNetworks

Consumers have identified safety, restoration of faults/emergencies and supply reliability as the highest performing services offered by TasNetworks.

Consumers also identified that into the future they believe that affordability, green, communicative, innovative, efficient and reliable services must be provided by TasNetworks.

This project specifically addresses the requirements of consumers in the areas of safety and affordability.

1.3 Regulatory Considerations

This project is required to achieve the following capital and operational expenditure objectives as described by the National Electricity Rules section 6.5.7(a) and 6.5.6(a). 6.5.7 (a) Forecast capital expenditure

(2) comply with all applicable regulatory obligations or requirements associated with the provision of standard control services;

(4) Maintain the safety of the distribution system through the supply of standard control services.

2. Project Objectives

The purpose of these projects is to reduce the risk of distribution assets starting fires.

3. Strategic Alignment

3.1 Business Objectives

Strategic and operational performance objectives relevant to this project are derived from TasNetworks 2014 Corporate Plan, approved by the board in 2014. This project is relevant to the following areas of the corporate plan:

- We understand our customers by making them central to all we do.
- We enable our people to deliver value.
- We care for our assets, delivering safe and reliable networks services while transforming our business.

3.2 Business Initiatives

The business initiatives that relate to this project are as follows:

- Safety of our people and the community, while reliably providing network services, is fundamental to the TasNetworks business and remains our immediate priority
- We care for our assets to ensure they deliver safe and reliable network services

The strategic key performance indicators that will be impacted through undertaking this project are as follows:

- Price for customers – lowest sustainable prices
- Zero harm – significant and reportable incidents
- Sustainable cost reduction – efficient operating and capital expenditure

4. Current Risk Evaluation

Do nothing is not an acceptable option to TN's risk appetite. The level of risk identified above is such that a treatment plan is required to reduce the risks to a tolerable level, in line with TasNetworks' Risk Management Framework.

4.1 5x5 Risk Matrix

TasNetworks business risks are analysed utilising the 5x5 corporate risk matrix, as outlined in TasNetworks Risk Management Framework.

Relevant strategic business risk factors that apply are follows:

Risk Category	Risk	Likelihood	Consequence	Risk Rating
Environment and Community	Asset failure results in bushfire with some loss to property	Unlikely	Major	Medium
Environment and Community	Asset failure results in catastrophic bushfire with widespread loss of property and potential fatality	Rare	Severe	Medium
Financial	Asset failure results in catastrophic bushfire, insurance providers refuse to cover TasNetworks for future events	Rare	Severe	Medium
Reputation	Asset failure results in bushfire with significant media coverage	Possible	Moderate	Medium
Safety and People	Asset failure starts fire that results in injury or death to member of the public	Rare	Severe	Medium

Section 1 Approvals (Gated Investment Step 1)

Project Initiator:	Erin Cook	**Date:**	26/03/2015
Line Manager:		**Date:**	
Manager (Network Projects) or Group/Business Manager (Non-network projects):		**Date:**	
[Send this signed and endorsed summary to the Capital Works Program Coordinator.]			

Actions			
CWP Project Manager commenced initiation:		**Assigned CW Project Manager:**	
PI notified project initiation commenced:		**Actioned by:**	

Section 2 (Gated Investment Step 2)

5. Preferred Option:

The preferred option is to implement fire mitigation projects as described focusing on the following projects:

- Replace EDO fuses with Boric Acid fuses in HBCA
- Install Vibration Dampers
- Install LV Spreaders

5.1 Scope

Mitigate asset related bushfires by replacing EDO fuses with Boric Acid fuses, installing vibration dampers and armour rods on long spans greater than 300m, and installing LV spreaders in rural areas. All tasks are prioritised by HBCA.

5.2 Expected outcomes and benefits

The expected outcomes of this program are continued safe and reliable running of the network. Replacing pole based on their condition presents the lowest life cycle cost while reducing environmental and safety risk as well as reducing fault response and customer outages.

5.3 Regulatory Test

6. Options Analysis

Option 0: Do Nothing

Do not implement fire mitigation projects.

Advantages:

- No upfront costs

Disadvantages:

- Does nothing to reduce the likelihood of TasNetworks equipment starting a bushfire

Option 1: Implement Fire Mitigation Projects

Implement fire mitigation projects as described focusing on the following projects:

- Replace EDO fuses with Boric Acid fuses in HBCA
- Install Vibration Dampers
- Install LV Spreaders

Advantages:

- Costs in completing this work are sustainable
- Minimises likelihood of TasNetworks equipment starting a bushfire
- The tasks recommended in this option have been implemented in utilities across the country, following these would bring TasNetworks in line with common industry practise.

Disadvantages:

- Cannot completely eliminate the risk of TasNetwork equipment starting a bushfire

6.1 Option Summary

Option description	
Option 0	Do nothing

Option 1 (preferred)	Implement Fire Mitigation Projects : mplement fire mitigation projects as described focusing on the following projects: • Replace EDO fuses with Boric Acid fuses in HBCA • Install Vibration Dampers • Install LV Spreaders

6.2 Summary of Drivers

<table>
<tr><th>Option</th><th></th></tr>
<tr><td>Option 0</td><td>
<table>
<tr><th>Minimise risks to public safety</th><th>Minimise outage frequency and duration</th><th>Deliver the most cost effective solution</th></tr>
<tr><td>The risks to public safety from bushfire started by TasNetworks assets are high.</td><td>There will be a higher incident of unplanned outages due to asset failure</td><td>This option has the lowest upfront costs. Additional costs to the Business are incurred in the form of NECF and STPIS payments. As this option does not address the risk to public safety and environment it is highly likely to involve further costs due to incidents and legal proceedings.</td></tr>
</table>
</td></tr>
<tr><td>Option 1 (preferred)</td><td>
<table>
<tr><th>Minimise risks to public safety</th><th>Minimise outage frequency and duration</th><th>Deliver the most cost effective solution</th></tr>
<tr><td>The risks to public safety from bushfire started by TasNetworks assets are reduced, but cannot remove the risk entirely.</td><td>There will be a lower incident of unplanned outages due to asset failure.</td><td>This is the lowest cost option that addresses the risk of TasNetworks assets starting a bushfire.</td></tr>
</table>
</td></tr>
</table>

6.3 Summary of Costs

Option	Total Cost ($)
Option 0	$0
Option 1 (preferred)	$20,000,000

6.4 Summary of Risk

The below table shows the residual risks with the preferred option in place. The preferred option reduces the residual risk from the uncontrolled risk rating. The residual risk ratings are reduced to Medium or lower, which is within TasNetworks' risk appetite.

Risk Category	Risk	Likelihood	Consequence	Residual Risk
Financial	Asset failure results in catastrophic bushfire, insurance providers refuse to cover TasNetworks for future events	Rare	Severe	Medium
	Asset failure results in serious injury or fatality	Unlikely	Major	Medium
Customer	Localised interruption to supply	Possible	Minor	Medium
Regulatory Compliance	Increased number of unplanned outages leads to systemic NCEF breaches	Unlikely	Moderate	Medium
Network Performance	Localised interruption to supply	Possible	Minor	Medium
Reputation	Asset failure results in bushfire with significant media	Unlikely	Moderate	Medium

	coverage Asset failure results in catastrophic bushfire with significant media coverage	Rare	Major	Medium
Environment and Community	Asset failure results in bushfire with some loss to property Asset failure results in catastrophic bushfire with widespread loss of property and potential fatality	Unlikely Rare	Major Severe	Medium Medium
Safety and People	Asset failure starts fire that results in injury or death to member of the public	Rare	Severe	Medium

6.5 Economic analysis

Option	Description	NPV
Option 0	Do nothing	$0
Option 1 (preferred)	Implement Fire Mitigation Projects : mplement fire mitigation projects as described focusing on the following projects: • Replace EDO fuses with Boric Acid fuses in HBCA • Install Vibration Dampers • Install LV Spreaders	-$12,192,013

6.5.1 Quantitative Risk Analysis

-

6.5.2 Benchmarking

In terms of Bushfire Mitigation many Australian utilities are looking at the actions of the Victorian Utilities post 2009 Victorian Bushfires Royal Commission Recommendations, and where appropriate aligning their practices. The bushfire mitigation projects strategy is intended to bring TasNetworks' asset bushfire mitigation practices closer to aligning with the Victorian Utilities. Replacing EDO fuses with Boric acid fuses in high bushfire areas has been common practice for some years now. Victorian utilities have mandated recommendations regarding LV spreaders and vibration dampers, TasNetworks intend to implement similar strategies as a matter of prudency and to fit with industry standard practice.

6.5.3 Expert findings

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6.5.4 Assumptions

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Section 2 Approvals (Gated Investment Step 2)

Project Initiator:	Erin Cook	**Date:**	26/03/2015
Project Manager:		**Date:**	

Actions			
Submitted for CIRT review:		**Actioned by:**	
CIRT outcome:			