Engineering System Integrity

Engineering Specification
Electrical Distribution Unit

SP D 79036

Sydney Trains Electricity Distribution Network Bushfire Risk Management Plan

Version 1.1

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Transport Sydney Trains

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2.0	11 August 2017	Nick Loveday	This plan supersedes SP E 70956 Sydney Trains Network Management Plan Chapter 4 - Bush Fire Risk Management Version 1.0 and is integrated with SP E 70953.
2.1	1 March 2019	Nick Loveday	Updated to reflect organisational changes Replaced ICON, RMS with ROC Inserted new sections 8, 12. Updated references to SP E 70953 v2.2, Sydney Trains Bushfire Safety Risk Assessment Report 30 June 2017, and risk assessment by CSIRO/Data61.

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1 Introduction

This document was prepared for use by persons in connection with works on or near the rail network electricity distribution network operated by Sydney Trains. Sydney Trains makes no warranties, express or implied, that compliance with the contents of this document shall be sufficient to ensure safe systems or work or operation. It is the document user's sole responsibility to ensure that the copy of the document they are viewing is the current version of the document as in use by Sydney Trains. To the extent permitted by law, Sydney Trains excludes any and all liability for any loss or damage, however caused (including through negligence), which may be directly or indirectly suffered in connection with the use of this document.

1.1 Objective

Sydney Trains operates and maintains an electricity distribution network to provide an adequate, safe, and reliable supply of electricity to fulfil the operational needs of both Sydney Trains and NSW Trains. The railway infrastructure (including the electricity distribution network) is regulated by state and federal legislation, as well as a range of standards and codes of practice for which compliance is strongly recommended.

This bushfire risk management plan presents Sydney Trains approach to managing the risks of bushfire, in the context of the electricity distribution network with respect to the design, construction, commissioning, operation and decommissioning of the electricity distribution network (or any part of its network).

This plan:

a. Presents Sydney Trains' approach to ensuring:
   - the safety of members of the public
   - the safety of persons working on networks
   - the protection of property (whether or not belonging to a network operator)
   - the management of safety risks arising from the protection of the environment (for example, preventing bush fires that may be ignited by electrical network assets)
   - the management of safety risks arising from loss of electricity supply.

b. Presents Sydney Trains' Electrical Network Safety Management System (ENSMS) as the means to accomplish the above.

c. Provides guidance to the electricity supply industry regulator, electricity distribution network employees within Sydney Trains, TfNSW and Technically Assured Organisations (TAOs) engaged by agencies within the NSW Transport "cluster" of the manner in which the safety of the rail electricity distribution network is achieved.

References are included throughout to relevant documentation including publicly available documents as well as resources within Sydney Trains intranet. Links may change without notice after publication of this plan.

Compliance and implementation of this plan (as required by clause 8 of the regulation) is verified by formal audit as described in *SP D 79035 Sydney Trains Electricity Distribution Network Management Plan*.

1.2 Intended Audience

The relevant stakeholders for whom this plan applies include, but are not limited to all organisations working on or near high-voltage electricity network assets. These include TfNSW, Sydney Trains, TAO and contractors engaged by a TAO.

1.3 Terms and Definitions

For the purposes of this plan the definitions given in the Act, Electricity Supply (Safety and Network Management) Regulation 2014, Rail Safety National Law (NSW) 2012, and **Electrical Safety Definitions** page available on the **RailSafe** site apply. In addition, the following definitions used:

AMB	Asset Management Branch, a division of TfNSW
ENA NENS	Electricity Networks Association National Electricity Network Safety (code)
ENSMS	Electrical Network Safety Management System, comprises components of the Sydney Trains Safety Management System that are relevant and necessary to meet electrical regulatory requirements.
HV	High Voltage
ISSC	Industry Safety Steering Committee
NSW	New South Wales
OHW	Overhead Wire
REF	Review of Environmental Factors
RFS	Rural Fire Service of NSW
ROC	Sydney Trains Rail Operations Centre, responsible for monitoring the status of rail operations and responsible for monitoring the status of the electrical distribution network and carrying out de-energisation/re-energisation of the electrical distribution network.
SFAIRP	So Far As Is Reasonably Practicable
TAO	Technically Assured Organisation
TfNSW	Transport for NSW

1.4 Bushfire Risks

Fire (including bushfire) is considered a risk with the potential to affect or be caused by all aspects of the Sydney Trains enterprise. The electricity distribution network contributes a small portion of the total fire risk, as shown in Figure 1.

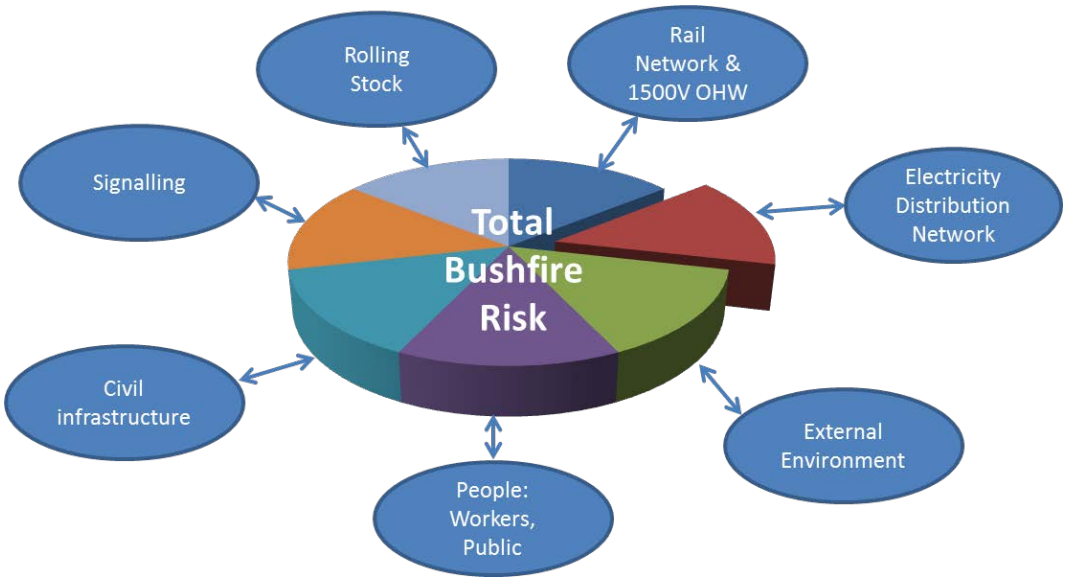

Figure 1: Contributors to/affected by bushfire

Sydney Trains has a holistic approach[1] encompassing all sources of fire and assets at risk from fire. This includes the electrical distribution network, the rail and 1500V OHW, rolling stock, signalling, civil infrastructure and facilities, as well as workers, passengers and public, and integrates competency, design, operational and maintenance considerations. The plan presents the approach to:

a. Manage bush fire risks arising from the operation and maintenance of the railway and the actions of persons.

b. Manage the risks to the railway and persons from bush fires within or external to the railway.

c. Liaise with external agencies (NSW RFS, fire brigade, emergency services) in the event of fire.

d. Providing advice to staff and passengers of bushfire activity[2].

[1] Refer MN C 10501 Bushfire Hazard Management
[2] Refer http://intranet.sydneytrains.nsw.gov.au/__data/assets/pdf_file/0003/113394/Standard-Operating-Instruction-Providing-advice-to-staff-of-bushfire-activity-v1.3-2018.pdf

This includes:

a. Ensuring the safety of persons, including workers and the public.

b. Risk controls to be applied in hot weather.

c. Establishing requirements that must be observed with respect to clearing vegetation near electricity network assets.

d. Minimising interruptions to electricity supply related to bush fire and vegetation.

e. Minimising the possibility of fire ignition by electricity lines.

f. Liaison with landowners, RFS and other external stakeholders.

Sydney Trains applies the following codes of practice:

a. *ISSC 3 Guideline for Managing Vegetation Near Power Lines*

b. *ISSC 33 Guideline for Network Configuration during High Bushfire Risk days*.

Additional references to Australian Standards and other Sydney Trains documents are listed within the various sections of this document.

2 Electricity Network Safety Management System

The *Electricity Supply (Safety and Network Management) Regulation 2014* (referred to as "the regulation")[3], Regulation 7 requires Sydney Trains establish and implement an Electricity Network Safety Management System which complies with AS 5577. Sydney Trains Electricity Network Safety Management System is presented in the SP E 79035, and the following aspects must be observed in respect of bushfire risk management:

a. Corporate policy, control of the ENSMS, review and modifications.

b. Regulatory requirements, including the various Acts and regulations, standards and codes of practice.

c. Safety management, ensuring the controls identified in Formal Safety Assessments are implemented and effective, assurance, risk identification, risk register, specific hazards, risk causes, consequences and controls; risk treatments (SFAIRP), communication and consultation and periodic review.

d. Incident management, including safety incident action management, electrical safety incident investigations and reporting.

e. Audits and reporting, including regulatory reports, internal reports, internal and external audits, corrective action.

f. Organisation and accountabilities, including the transport cluster, Sydney Trains role as a TAO, and external TAO's training, communications, resourcing and competency.

g. Safety performance measurement and reporting.

h. Asset management, including system integrity, capacity, performance, configuration management, maintenance and renewals, safety, security and environmental programs; customer connections; and public safety awareness.

[3] http://www5.austlii.edu.au/au/legis/nsw/consol_reg/esanmr2014601/

3 Managing Bushfire Risk

The strategy to manage bushfire risk is comprised of the following elements.

3.1 Assess the Risk Posed at Asset Locations

The network assets are assigned a bushfire risk priority (1=worst, 5=least) based on their location (i.e. the individual poles). This is based on the location, terrain, vegetation in the vicinity and proximity to urbanisation (i.e. people and property downwind). This risk assessment is reviewed and updated every 5 years to reflect changes in the network, asset condition, changes in land use (e.g. rezoning) and developments near the network that may affect its risk assessment. A priority is assigned to each HV asset in Sydney Trains enterprise asset management system.

Where a change occurs an environmental study is initiated to assess the impact of the change i.e. assess the risks arising at those locations and update the asset data accordingly.

See for example:

Electricity Network Fire Risk — An Analysis for Sydney Trains, CSIRO/Data61, 4 December 2018
DSYD2017/148710 Sydney Trains Bushfire Safety Risk Assessment Report 30 June 2017
Northern Sydney Electricity feeder REFS – Bushfire Risk Assessment", Ecological Australia, 24th January 2013
Bushfire Risk Assessment - City West Feeder Lines", Aurecon, 5 January 2016
Bushfire Risk Assessment – West and Illawarra Region Electrical Feeders, Ecological Australia, July 2015.

3.2 Maintenance – Annual Survey of Network Assets

A survey of the assets is conducted to find defects (vegetation as well as asset defects). This includes a helicopter + LIDAR patrol of the whole network over summer (January).

Defects may also be reported from foot patrols and inspections.

3.3 Assess Defects

Defects will be associated with the nearest pole (not the feeder).

All defects (both vegetation and asset defects) must be assessed in respect of whether they pose a fire risk using a documented rule.

3.4 Prioritise Maintenance Tasks

The combination of bushfire risk priority and the defect assessment are then used to prioritise work orders for maintenance to clear the defect within a defined timeframe (the due date).

There are other factors constraining the scheduling of work such as:

- The need for an electrical isolation.
- The available dates for isolations and possessions, particularly those that affect rail operations.
- Constraints from other electricity distributors, notably the Blue Mountains (where the railway feeder is the backup for Endeavour Energy at Lawson and Blackheath).
- Constraints from other organisations (e.g. TfNSW permission to block a road);
- Constraints from landowners concerning access.
- Community-related where rail services cannot be restricted or halted (e.g. Easter, Yulefest, major sporting events).

Ideally the work is done by the planned date. If it can't be, the REVCOM process may invoked in which an engineer assesses the risk of the asset remaining in its current state and a new due date set.

3.5 Extreme Weather

Maintenance tasks may be postponed due to extreme weather posing safety risks. The ROC routinely monitors weather conditions and may initiate responses accordingly as described in *NMD-ICON-GD-425 Extreme Weather Preparedness Procedure*. In this event the REVCOM process may be applied to re-plan the work.

3.6 Conduct Follow-up Survey

A helicopter survey is carried out for priority 1 or 2 locations by helicopter + LIDAR in August. Outstanding defects identified in the survey are rectified in September.

3.7 Verification by Foot Patrols

Foot patrols of the feeders are carried out in September-October to confirm defects have been cleared.

3.8 Final Defect Rectification

Defects identified from foot patrols are rectified during October-December.

3.9 Performance Targets

Target: Zero defects outstanding in priority 1 or 2 locations by 1 September.

Target: Zero defects outstanding by 15 December.

Note: Regulatory reporting is based on the year ending 30 June, consequently it is expected that there will be defects reported outstanding. Secondly, data from the Follow-up survey in August is expected to identify additional defects which will be cleared subsequently.

4 Bush Fire Prone Areas

The feeders with poles in high risk areas are listed at Appendix A. The risk assessed for each pole is identified in Sydney Trains enterprise asset management system.

5 Design of Network Assets in Bush Fire Prone Areas

The design of HV assets is required to consider bushfire risk in accordance with TfNSW Standard *T HR EL 10001 ST HV Aerial Line Standards for Design and Construction* Section 8.6. This standard requires no new feeders to be constructed in bushfire prone areas.

TfNSW and Sydney Trains engineering procedures require safety assurance, including formal safety assessments demonstrating risk is reduced SFAIRP for new or significantly modified assets.

6 Formal Safety Assessments

Formal Safety Assessments are required for all **new or significantly modified** electricity network assets as described in SP D 79035. With respect to assets located in bushfire-prone locations these assessments shall be based on the following strategy.

The risk-based strategy must consider:

a. Bushfire started by electricity network assets.

b. Bushfire started by human activities and other electrical causes.

c. Bushfire risk to personnel and public, including passengers.

The strategy is:

a. Determine the bushfire risk priority for the asset, by location (i.e. at poles), this includes the risk of fire caused by the network as well as the risk to the network from an external fire.

b. The consequences are assumed to be potentially equal (the worst-case being C6).

c. The likelihood is determined from bushfire risk surveys[4] conducted from time to time; this identifies the risk present at specific locations and takes into account effects such as the local topography, fire behaviour and local wind patterns.

d. Defects are identified by periodic inspections of the assets in the bushfire-prone areas.

e. Defects are prioritised for corrective action according to their severity and bushfire risk.

The assessment must include a SFAIRP determination (bowtie diagram) which clearly identifies:

a. The potential causes identified.

b. The potential impacts identified.

c. The preventive controls that are implemented, linked to the causes controlled.

d. The mitigating controls that are implemented, linked to the impacts mitigated.

e. The controls rejected, and the rationale for that rejection.

f. Possible controls recommended for implementation, further analysis or consideration.

The above must identify the sources used to identify the causes and controls, and the evidence of the implementation of the controls (e.g. referenced documents or procedures).

The assessment must include acceptance of the respective control owners.

Examples are available from Sydney Trains Electricity Distribution Unit and the bowtie template is available from the Safety Environment and Risk division.

[4] See for example:
- Eco Logical Bushfire Risk Assessment (West & Illawarra Electrical Feeders)
- Eco Logical Bushfire Risk Assessment (Northern Sydney Electrical Feeders)
- Ausgrid/Endeavour/Essential Energy Vegetation Management Plan.

7 Maintenance Standards

The electricity distribution network is maintained in accordance with Sydney Trains' Engineering Standards and Technical Maintenance Plans. The documents are also published on the Sydney Trains Engineering Information intranet page.

For each asset category the minimum serviceable conditions and key defects are defined in technical standards and Technical Maintenance Plans. Patrols are also carried out immediately after feeder trip, bush fire, or flood. Pole top examinations (with power off) and pole base inspections are carried out at regular intervals in accordance with the Technical Maintenance Plan.

Vegetation clearances to aerial lines are maintained in accordance with the following Standards:

a. T HR EL 10006 ST HV Aerial Line Maintenance Standard.

b. EP 10 00 00 00 MP – Technical Maintenance Plan – Aerial Transmission Lines.

The vegetation clearances stipulated in TfNSW Standards comply with those of *ISSC 3 Guideline For Managing Vegetation Near Power Lines*, and include allowance for fire hazard areas.

Vegetation clearance to HV aerial lines are monitored through regular and post feeder trip patrols in accordance with the Technical Maintenance Plan.

Maintenance of vegetation clearances to power lines is done in consultation with local councils and landowners.

8 Hazardous Trees

Large trees near overhead lines may pose risks to overhead lines, e.g. branches or the tree may fall onto overhead lines, and/or the railway. In addition to the risk to overhead power lines there is also comparable risk to trains and in this respect Sydney Trains applies the same procedures to identify and manage hazardous trees in the vicinity of the HV distribution network as well as the rail corridor. For further details refer *EMS-06-ES-0176 Hazard Tree Program – Risk Assessment Environmental*.

9 Vegetation Clearance

Sydney Trains recognises the risks associated with the presence of bare aerial conductors in bush fire prone areas. There are other risks:

- Hazardous trees may fall onto the railway, possibly striking trains.
- Vegetation management activities may destabilise embankments and cuttings, resulting in rockfalls or landslips onto the tracks and potentially being struck by a train, or weakening the formation supporting the track.

These safety risks are considered the greater risk and consequently vegetation is managed under the civil engineering discipline.

These risks are controlled by maintaining adequate vegetation clearances in accordance with the following:

a. *ISSC 3 Guideline for Managing Vegetation Near Power Lines*
b. *ISSC 20 Guideline for the Management of Activities within Electricity Easements and Close to Electricity Infrastructure*
c. *ENA DOC 023-2009 ENA Guidelines for Safe Vegetation Management*
d. *Code of Practice Electricity Transmission and Distribution asset management*
e. *T HR EL 10001 ST HV Aerial Line Standard for Design and Construction (Section 5.2 Vegetation Clearance)*
f. *T HR EL 00007 ST Management of Activities Within RailCorp Easements and Close to the RailCorp HV Distribution System*
g. *T HR EL 08011 ST Overhead Wiring Maintenance Standards*
h. *T HR CI 12105 ST Vegetation Hazard Management in the Corridor*
i. *EMS-06-GD-0067 Guide to Vegetation Management in the Rail Corridor*
j. *50707-JB1162 Vegetation Manual*
k. *EMS-06-TP-0152 Vegetation Management Scope of Work Template*
l. *EMS-06-WI-0071 Bush Fire Hazard Reduction*
m. *NMD-SER-GUI-182 Environmental Planning – Electrical Routine Maintenance*
n. *EMS-06-WI-0178, Fauna Impact Mitigation when Clearing Vegetation.*

In determining the vegetation clearances to be applied Sydney Trains takes a worst-case view and does not vary the clearances according to the location, terrain, bushfire behaviour or the season in which vegetation clearance is carried out.

The whole network is patrolled twice each year to identify defects requiring maintenance, including vegetation clearance, defective poles, aerial lines and equipment.

EP 10 01 00 E, Transmission Line Equipment Manual, table 4-10A provides explicit guidance as to the minimum clearance required from conductors.

Problem network constructions are also identified during patrols and recorded for later analysis and monitoring. These are referred to the relevant network base for corrective action.

All current design, construction and maintenance standards for network assets are published on the Sydney Trains Engineering intranet or the Transport for NSW Asset Standards Authority website. Network bases are notified of any changes in the status of any of the standards.

10 Vegetation and Easements

The management of vegetation and hazards within Sydney Trains easements are managed in accordance with:

a. *MN C 10501 Bush Fire Hazard Management*

b. *T HR EL 00007 ST Management of Activities Within RailCorp Easements and Close to the RailCorp HV Distribution System*.

These documents are published on the Sydney Trains and TfNSW AMB intranet/internet pages respectively.

11 Special Procedures – Very High Fire Danger

MN C 10501 details the activities that are prohibited during a total fire ban, and the control measures required for any exemption.

During days of high fire danger or total fire ban the automatic reclose function is disabled on 33kV and 66kV feeders.

As standard practice, when a high voltage feeder trips out on fault, the feeder must be patrolled whether or not it has reclosed successfully and irrespective of the time of day.

Special procedures (Trouble Instruction No. 2011) are also in place at ICON controlling the operation of the electricity distribution network to reduce the risk of starting a bush fire during periods of high fire danger. During a total fire ban, the auto reclosing feature on circuit breakers controlling high voltage feeders in identified high bush fire risk areas are inhibited. Where pilot wire protection is provided for such feeders, the feeder is to be left de-energised after a trip until the feeder has been patrolled and conditions are satisfactory for the feeder to be returned to service.

The automatic reclose function is not disabled on 11kV feeders:

a. The fault levels on the 11kV feeders are lower than the fault levels on the 33kV and 66kV feeders, to the extent it is considered unlikely (though not impossible) that the 11kV feeders could start a bushfire.

b. The 11kV feeders provide power to the signalling. In the event these trip the signalling is disabled trains in that section may be stranded.

c. The need to evacuate a train possibly carrying 2000 passengers from the path of a fire is considered a higher priority than the likely consequences of the fire.

12 Tree Trimming

Tree-trimming is part of the vegetation control activities conducted near high-voltage aerial lines as part of planned maintenance of the electrical assets. This task is one of the safety controls applied by Sydney Trains to mitigate the risk of bushfires caused by vegetation coming into contact with the electrical infrastructure.

A safety accreditation has been introduced for an Accredited Tree Trimmer, for workers employed or contracted by Sydney Trains to control vegetation near high-voltage aerial lines. This allows tree trimmers to work to the safe approach distance for an accredited person, rather than the safe approach distance an ordinary person.

The approach is aligned with the practices recognised by AusGrid and Endeavour Energy, in which tree trimming is permitted near live exposed electrical equipment at a reduced SAD by accredited persons with recognised national competencies. While reducing the SAD increases the risk of contact with electricity, there are specific controls which must be implemented to offset the increased risk of contact with energised equipment.

13 Bushfire Training

Bush fire training is provided for field maintenance personnel with regular refreshers. These activities are recorded in a training register. Skills needs are identified as descried in *NMD-NOM-PR-227 Network Bases Operations Maintenance Skills & Versatility Procedure*.

14 Information for Customers with Private Overhead Lines

There are no private overhead lines attached to the electricity distribution network utilised by Sydney Trains.

15 Maintenance of Private Overhead Lines

There are no private overhead lines attached to the electricity distribution network maintained and operated by Sydney Trains.

16 Complaints in Relation to Bush Fire Risk Management

External parties can provide feedback or make complaints via the Transport Infoline (131500), by email or online via the Transport website at https://www.transport.nsw.gov.au/about-us/contact-us.

All complaints in relation to the electricity distribution network are recorded for subsequent analysis and action. Procedures (Trouble Instruction No. 1001) are in place to ensure that a high priority is given to any requests, reports or complaints regarding the risks of bush fires being caused by equipment faults, the activities of rail staff or for the removal of supply for firefighting and/or safety.

17 Advice to Workers, Passengers and Public

In the event advice of an emergency or bushfire is received from the RFS or other emergency services Sydney Trains will advise Sydney Trains staff in accordance with Standard Operating Instruction OI-1343[5]. The possible responses may include the closure of rail lines in accordance with Standard Operating Instruction OI-887[6]. Advice to passengers may include:

a. Advice from guards to passengers on-board trains.

b. Signage at stations.

c. Public alerts on the Sydney Trains' website concerning the operational status of lines.

The Sydney Trains policy on bushfire risk management is set out in MN C 10501. This document is published on the Sydney Trains Engineering Information intranet page. Under this manual, action plans to manage fire hazards are developed and implemented in consultation with District Bush Fire Management Committees. Liaison with landowners, Bushfire Brigades, Councils, Emergency Services, NPWS and other relevant organisations are part of the procedures of such action plans.

The Incident and Emergency Response Unit co-ordinates joint exercises involving Bushfire Brigades, Councils, Emergency Services, and other relevant organisations to assist in the co-ordination of the various parties in the event of major incidents.

18 Liaison with Electricity Suppliers, Emergency Services and RFS

Sydney Trains has a standard operating instruction for liaison with external agencies including the RFS, emergency services and high voltage electricity suppliers, particularly when the fire danger is high. This liaison is handled by the ROC. Examples include:

a. Requests to evacuate and isolate sections of the rail corridor and/or electricity network – including 11kV and 1500VDC and substations – while back burning close to the rail corridor.

b. Requests to evacuate and isolate sections of the rail corridor and/or electricity network – including 11kV and 1500VDC - due to approaching fire.

c. Liaison with RFS and emergency services as to the location and status of fires in proximity to the rail corridor and electricity feeders.

d. Advice that the external supply to a high voltage feeder may be isolated, for any reason.

e. Requests from Sydney Trains to a supplier to de-energise the external supply a feeder.

The ROC is responsible for managing the operational impact (train services, train crews, station staff and passengers) while ICON Electrical is responsible for advising electrical personnel in the area.

[5] http://intranet.sydneytrains.nsw.gov.au/__data/assets/pdf_file/0003/113394/Standard-Operating-Instruction-Providing-advice-to-staff-of-bushfire-activity-v1.3-2018.pdf
[6] http://intranet.sydneytrains.nsw.gov.au/__data/assets/pdf_file/0004/113395/SOI-Closure-of-rail-lines-during-emergency-situations-Version-1.5-21-10-2019.pdf

19 Hardship

Sydney Trains hardship policy is published and publicly accessible[7].

20 Bushfire Risk Management Reporting

Sydney Trains' produces an annual report to the regulator (IPART) including data on bush fire risk management, and the following performance indicators:

a. Percentage of network assets inspected in bush fire prone areas.

b. Outstanding network risk defects in bush fire prone areas.

c. Number of fires (where it appears ignition may have caused by electricity network assets).

21 Referenced Documents

21.1 Versions

The following sections lists the documents referenced in this plan at the date of issue. All users of this plan are reminded to obtain current copies of referenced documents from the publisher of the document (e.g. Sydney Trains intranet, TfNSW or SAI Global); it is not acceptable to rely on uncontrolled local or printed copies.

21.2 Standards, Industry Codes and Guides

AS/NZS 5577 2013 Electricity network safety management systems

Code of Practice Electricity transmission and distribution asset management

ENA DOC 023-2009 ENA Guidelines for Safe Vegetation Management

ISSC 20 Guideline for the Management of Activities within Electricity Easements and Close to Electricity Infrastructure

ISSC 3 Guideline for Managing Vegetation Near Power Lines

ISSC 33 Guideline for Network Configuration during High Bushfire Risk Days

21.3 Sydney Trains

50707-JB1162 Vegetation Manual

DSYD2017/148710 Sydney Trains Bushfire Safety Risk Assessment Report 20 June 2017

EMS-06-ES-0176 Hazard Tree Program – Risk Assessment Environmental

EMS-06-GD-0067 Vegetation Management in the Corridor

EMS-06-TP-0152 Vegetation Management Scope of Work

[7] https://www.transport.nsw.gov.au/system/files/media/documents/2019/Sydney%20Trains%20Hardship%20Policy-Sept%202019.pdf

EMS-06-WI-0071 Bush Fire Hazard Reduction

EMS-06-WI-0178 Fauna Impact Mitigation when Clearing Vegetation

MN C 10501 Bush Fire Hazard Management

NMD-ICON-GD-425 Extreme Weather Preparedness Procedure

NMD-NOM-PR-227 Network Bases Operations Maintenance Skills & Versatility Procedure

NMD-SER-GUI-182 Environmental Planning – Electrical Routine Maintenance

SP E 79035 Sydney Trains Electricity Distribution Network Management Plan

21.4 TfNSW

EL 10 00 00 00 MP Technical Maintenance Plan – Aerial Transmission Lines

EP 10 01 00 E Transmission Line Equipment Manual

T HR CI 12105 ST Vegetation Hazard Management in the Rail Corridor

T HR EL 00007 ST Management of Activities Within RailCorp Easements and Close to the RailCorp HV Distribution System

T HR EL 08011 ST Overhead Wiring Maintenance Standards

T HR EL 10001 ST HV Aerial Line Standard for Design and Construction

T HR EL 10006 ST HV Aerial Line Maintenance Standard

21.5 Other

Electricity Network Fire Risk – An Analysis for Sydney Trains, CSIRO/Data61, 4 December 2018

IPART Electricity Network Reporting Manual, ISBN 978-1-925340-54-9

Northern Sydney Electricity feeder REFS – Bushfire Risk Assessment, Ecological Australia, 24th January 2013

Bushfire Risk Assessment – City West Feeder Lines, Aurecon, 5 January 2016

Bushfire Risk Assessment – West and Illawarra Region Electrical Feeders, Ecological Australia, July 2015.

Appendix A Feeders in Bushfire Prone Areas

The following table indicates whether each feeder poses a bushfire risk, i.e. 2 or more poles assessed as category 1, 2 or 3 ("yes") vs those that do not ("no"). The risk assessed for each pole is identified in the Enterprise Asset Management system.

Feeder #	Voltage	Territory	Starting SS	Ending SS	Bushfire risk?
286	132	City South	HEATHCOTE	ENGADINE ZONE (AUSGRID)	YES
512	11	City South	SYD SIGNAL BOX 2 SS	ERSKINEVILLE SS	NO
513	11	City South	ERSKINEVILLE SS	NORTH EVELEIGH SS	NO
514	11	City West	NORTH EVELEIGH SS	LEWISHAM SS	NO
515	11	City South	EVELEIGH LOCO SS	NORTH EVELEIGH SS	NO
516	11	City South	REDFERN 2 SS	SYD SIGNAL BOX 2 SS	NO
524	11	City North	CHATSWOOD STN 1 TX RM	CHATSWOOD STN 2 TX RM	NO
526	11	City North	CHATSWOOD STN 2 TX RM	CHATSWOOD NORTH SS	NO
527	11	City North	ST LEONARDS SS	CHATSWOOD STN 1 TX RM	NO
528	11	City North	CHATSWOOD STN 1 TX RM	CHATSWOOD NORTH SS	NO
531	11	City North	HORNSBY SS	PENNANT HILLS DISTRIBUTION	NO
532	11	City North	STRATHFIELD SS	DEVLINS CREEK SH	NO
534	11	City West	STRATHFIELD SS	STRATHFIELD SIG BOX 1 SS	NO
535	11	City West	STRATHFIELD SIG BOX 1 SS	STRATHFIELD SIG BOX 2 SS	NO
537	11	Western	GRANVILLE SS	PARRAMATTA STATION SS	NO
538	11	City South	SYD SIGNAL BOX 1 SS	SYD SIGNAL BOX 2 SS	NO
539	11	City South	SYD SIGNAL BOX 1 SS	REDFERN 1 SS	NO
545	11	City South	NORTH SYDNEY 1	NORTH SYDNEY 2	NO
546	11	City North	NORTH SYDNEY 2	ST LEONARDS SS	NO
551	11	City North	CHATSWOOD NORTH SS	LADY GAME DRIVE SS	NO
552	11	City North	CHATSWOOD NORTH SS	LADY GAME DRIVE SS	NO
553	11	City North	LADY GAME DRIVE SS	LADY GAME DRIVE SERVICE SS	NO
554	11	City North	LADY GAME DRIVE SS	LADY GAME DRIVE SERVICE SS	NO
555	11	City North	LADY GAME DRIVE SERVICE SS	DELHI ROAD STN EAST SS	NO
556	11	City North	LADY GAME DRIVE SERVICE SS	DELHI ROAD STN WEST SS	NO

Feeder #	Voltage	Territory	Starting SS	Ending SS	Bushfire risk?
557	11	City North	DELHI ROAD STN EAST SS	MACQUARIE PARK STN EAST SS	NO
558	11	City North	DELHI ROAD STN WEST SS	MACQUARIE PARK STN WEST SS	NO
559	11	City North	MACQUARIE PARK STN EAST SS	MACQUARIE UNI STN EAST SS	NO
560	11	City North	MACQUARIE PART STN WEST SS	MACQUARIE UNI STN WEST SS	NO
561	11	City North	MACQUARIE UNI STN EAST SS	EPPING STATION STH SS	NO
562	11	City North	MACQUARIE UNI STN WEST SS	EPPING STATION NTH SS	NO
563	11	City North	EPPING STATION STH SS	DEVLINS CREEK SH	NO
564	11	City North	EPPING STATION NTH SS	DEVLINS CREEK SH	NO
581	11	South West	GLENFIELD SOUTH SS	LEPPINGTON SS	NO
588	11	City West	BELMORE SWITCHING STATION	SEFTON SS	NO
597	11	Central Coast	A.G 11KV BROOKLYN FEEDER	SIG. LOC HR164	YES
598	11	Central Coast	A.G 11KV BROOKLYN FEEDER	SIG. LOC HR113AT	YES
599	11	Central Coast	A.G 11KV BROOKLYN FEEDER	SIG. LOC HR107	YES
600	11	City South	PRINCE ALFRED SS	STR 2	NO
602	11	City West	CHULLORA SS	CHULLORA WORKSHOPS	NO
603	11	City South	NORTH EVELEIGH SS	MEEKS RD SS	NO
604	11	City South	NORTH EVELEIGH SS	MEEKS RD SS	NO
605	11	South West	SEFTON SS	CABRAMATTA SS	NO
606	11	City West	SEFTON SS	SEFTON DEPOT SS	NO
608	11	City South	ERSKINEVILLE SS	MEEKS RD SS	NO
609	11	City West	LEWISHAM SS	STRATHFIELD SS	NO
614	11	City West	STRATHFIELD SIG BOX 1 SS	FLEMINGTON SS	NO
615	11	City South	SYDENHAM PLAN DEPOT SS	MEEKS RD SS	NO
616	11	City South	PRINCE ALFRED SS	WYNYARD STATION 1 SS	NO
617	11	City South	PRINCE ALFRED SS	EDGECLIFF SS	NO
618	11	City South	PRINCE ALFRED SS	EDGECLIFF SS	NO
619	11	City South	PRINCE ALFRED SS	REDFERN 1 SS	NO
620	11	City South	PRINCE ALFRED SS	REDDFERN 2 SS	NO
621	11	City West	STRATHFIELD SS	STRATHFIELD SIG BOX 2 SS	NO

Feeder #	Voltage	Territory	Starting SS	Ending SS	Bushfire risk?
622	11	City West	LEWISHAM SS	STRATHFIELD SS	NO
623	11	City West	CLYDE SS	GRANVILLE SS	NO
624	11	City West	CHULLORA SS	ENFIELD MARSHALLING YARD	NO
625	11	South West	KINGSGROVE SS	REVESBY SS	NO
627	11	City South	EDGECLIFF SS	BONDI JUNCTION 2	NO
628	11	City South	EDGECLIFF SS	BONDI JUNCTION 2	NO
629	11	City North	CHATSWOOD NORTH SS	HORSNBY SS	NO
630	11	City North	HORSBY SS	HORNSBY CAR SHED SS	NO
631	11	City South	PRINCE ALFRED SS	STR 1	NO
632	11	City South	PRINCE ALFRED SS	STR 1	NO
633	11	City South	PRINCE ALFRED SS	ARGYLE SS	NO
634	11	City South	PRINCE ALFRED SS	WYNYARD STATION 2 SS	NO
635	11	City South	TRANSPORT HOUSE SS	ARGYLE SS	NO
636	11	City South	TRANSPORT HOUSE SS	ARGYLE SS	NO
637	11	City South	PRINCE ALFRED SS	TRANSPORT HOUSE SS	NO
638	11	Western	PARRAMATTA STATION SS	BLACKTOWN NORTH SS	NO
639	11	City West	STR 2	LEWISHAM SS	NO
640	11	City South	PRINCE ALFRED SS	SYD SIGNAL BOX 1 SS	NO
641	11	South West	GRANVILLE SS	CABRAMATTA SS	NO
642	11	City South	TRANSPORT HOUSE SS	WYNYARD STATION 1 SS	NO
643	11	South West	GLENFIELD SOUTH SS	GLENFIELD STATION 1 SS	NO
644	11	City South	ARGYLE SS	NORTH SYDNEY 1	NO
645	11	City West	CLYDE SS	COMPONENT SHOP SS	NO
646	11	City West	CLYDE SS	COMPONENT SHOP SS	NO
647	11	City South	WYNYARD STATION 2 SS	ARGYLE SS	NO
648	11	City North	HORNSBY SS	HORNSBY CONTROL CENTRE SS	NO
649	11	City North	HORNSBY SS	COWAN	YES
650	11	Central Coast	COWAN	HAWKESBURY	YES
651	11	Central Coast	HAMILTON	WTI SWITCHING STATION	NO
652	11	Central Coast	HAMILTON	WTI SWITCHING STATION	NO
653	11	Central Coast	ADAMSTOWN SH	HAMILTON	NO

Feeder #	Voltage	Territory	Starting SS	Ending SS	Bushfire risk?
654	11	Central Coast	ADAMSTWON SH	HAMILTON	NO
655	11	Western	BLACKTOWN NORTH SS	ST MARYS	NO
656	11	Western	ST MARYS	EMU PLAINS	NO
657	11	Western	EMU PLAINS	BLAXLAND	YES
658	11	Western	BLAXLAND	FAULCONBIDGE	YES
659	11	Western	FAULCONBRIDGE	LAWSON	YES
660	11	South Coast	PORT KEMBLA WAGON MAINT	I.E FEEDER PCA2	NO
661	11	City South	SUTHERLAND SS	SIG LOCATION 20.7	YES
662	11	Airport	UNDERCLIFFE SS	GREEN SQUARE SS	NO
663	11	City South	HURSTVILLE SS	SUTHERLAND SS	NO
664	11	South Coast	WOLLONGONG STN	WOLLONGONG CONTROL CTR	NO
665	11	South Coast	I.E FEEDER SWH2	WOLLONGONG CONTROL CTR	NO
666	11	South Coast	CONISTON	INNER HARBOUR	NO
667	11	South Coast	WOLLONGONG CONTROL CTR	CONISTION	NO
668	11	South Coast	BOMBO QUARRY	I.E FEEDER KMC2	NO
669	11	South Coast	WOLLONGONG CONTROL CTR	INNER HARBOUR	NO
670	11	Central Coast	HAWKESBURY	WOY WOY	YES
671	11	Central Coast	WOY WOY	GOSFORD	YES
672	11	Central Coast	GOSFORD	OURIMBAH	YES
673	11	Central Coast	OURIMBAH	WALLAHRAH CREEK	YES
674	11	Central Coast	WALLAHRAH CREEK	MORISSET	YES
675	11	Central Coast	MORISSET	AWABA	YES
676	11	Central Coast	AWABA	COCKLE CREEK	YES
677	11	Central Coast	COCKLE CREEK	ADAMSTOWN SH	YES
680	11	Western	LAWSON	KATOOMBA	YES
681	11	Western	KATOOMBA	MT VICTORIA	YES
682	11	Western	MT VICTORIA	NEWNES JUNCTION	YES
683	11	Western	NEWNES JUNCTION	OAKEY PARK	YES

Feeder #	Voltage	Territory	Starting SS	Ending SS	Bushfire risk?
684	11	Western	OAKEY PARK	BOWENFELS HV AREA	YES
685	11	Western	BOWENFELS HV AREA	WALLERWANG T.G	YES
686	11	City South	REDFERN 1 SS	MEEKS RD SS	NO
687	11	City West	MEEKS RD SS	BELMORE SWITCHING STATION	NO
688	11	City South	MEEKS RD SS	WOLLI CREEK SH	NO
689	11	City South	WOLLI CREEK SH	KINGSGROVE SS	NO
690	11	City South	WOLLI CREEK SS	HURSTVILLE SS	NO
693	11	City West	SEFTON SS	LC 11.5 SIG LOC SS	NO
694	11	City West	GRANVILLE SS	GRANVILLE SIGNALLING SS	NO
695	11	City West	FLEMINGTON SS	CLYDE SS	NO
696	11	Central Coast	MT SUGARLOAF	MT SUGARLOAF	YES
699	11	Western	EDGECOMBE	11KV FEEDER I.E	YES
700	33	City South	COMO	SUTHERLAND	YES
702	33	City South	UNDERCLIFFE	HURSTVILLE	NO
703	33	City West	MEEKS RD	CANTERBURY A.G	NO
704	33	City West	CANTERBURY A.G	BELMORE	NO
705	33	South West	UNDERCLIFFE	EARLWOOD	NO
706	33	City South	SUTHERLAND	LOFTUS	YES
707	33	South West	EARLWOOD	CANTERBURY A.G	NO
708	33	South West	EARLWOOD	KINGSGROVE	NO
709	33	City West	BELMORE	CHULLORA	NO
710	33	City North	WAVERTON	ST LEONARDS	NO
711	33	City North	ST LEONARDS	WILLOUGHBY A.G	NO
712	33	City North	ST LEONARDS	WILLOUGHBY A.G	NO
713	33	City West	REVESBY	YAGOONA	NO
714	33	City South	SUTHERLAND	PORT HACKING A.G	NO
715	33	City West	STRATHFIELD	FLEMINGTON	NO
716	33	City West	FLEMINGTON	SEFTON	NO
717	33	South West	SEFTON	CABRAMATTA	NO
718	33	City West	AUBURN	GRANVILLE	NO
719	33	Western	GRANVILLE	YENNORA	NO
720	33	Central Coast	HAMILTON	WARATAH E.A	NO
721	33	City West	STRATHFIELD	GRANVILLE	NO

Feeder #	Voltage	Territory	Starting SS	Ending SS	Bushfire risk?
722	33	City West	GRANVILLE	CLYDE	NO
723	33	City South	GYMEA	SUTHERLAND	NO
724	33	South Coast	CROOM	CROOM I.E	NO
725	33	City North	WEST RYDE	EPPING	NO
726	33	City North	BEECROFT	HORNSBY	NO
727	33	City North	LINDFIELD	GORDON	NO
728	33	City North	WARRAWEE	HORNSBY	NO
729	33	City South	HURSTVILLE	CARINGBAH	NO
730	33	South Coast	BOMBO	KIAMA I.E	NO
732	33	City South	ARGYLE	WAVERTON	NO
733	33	South West	PLEASURE POINT	GLENFIELD SOUTH	YES
734	33	South West	REVESBY	PLEASURE POINT	NO
735	33	South West	WARWICK FARM	GLENFIELD	NO
736	33	City West	STRATHFIELD	STRATHFIELD A.G	NO
737	33	City West	STRATHFIELD	STRATHFIELD A.G	NO
738	33	City West	ASHFIELD	STRATHFIELD	NO
739	33	City South	KINGSGROVE	HURSTVILLE	NO
740	33	South West	GLENLEE	NEPEAN E.E	YES
741	33	South West	KINGSGROVE	NARWEE	NO
742	33	South West	NARWEE	REVESBY	NO
743	33	City West	CHULLORA	SEFTON	NO
744	33	City West	STRATHFIELD	CHULLORA	NO
745	33	City South	ARGYLE	PYRMONT A.G	NO
746	33	City South	PRINCE ALFRED	ARGYLE	NO
747	33	City South	PRINCE ALFRED	PYRMONT A.G	NO
748	33	City South	PRINCE ALFRED	PYRMONT A.G	NO
749	33	Western	GRANVILLE	WESTMEAD	NO
750	33	Central Coast	CARDIFF	HAMILTON	YES
751	33	Central Coast	SULPHIDE JUNCTION	CARDIFF	YES
752	33	Central Coast	AWABA	AWABA E.A	YES

Feeder #	Voltage	Territory	Starting SS	Ending SS	Bushfire risk?
753	33	Central Coast	HAMILTON	WARATAH E.A	NO
754	33	City South	EDGECLIFF	SURRY HILLS A.G	NO
755	33	City South	PRINCE ALFRED	EDGECLIFF	NO
756	33	City South	EDGECLIFF	SURRY HILLS A.G	NO
757	33	City North	EPPING	DEVLINS CREEK SH	NO
758	33	Central Coast	SULPHIDE JUNCTION	CARDIFF MAINTENANCE CENTRE	NO
759	33	City West	ROZELLE SWITCHING STATION	ROZELLE SS A.G	NO
761	33	City West	MEEKS RD	LEWISHAM	NO
762	33	City West	ERSKINEVILLE	NEWTOWN	NO
763	33	City West	NEWTOWN	LEWISHAM	NO
764	33	City West	LEWISHAM	ASHFIELD	NO
765	33	City South	MEEKS RD	UNDERCLIFFE	NO
766	33	City South	PYRMONT A.G	ROZELLE SWITCHING STATION	NO
768	33	City North	ST LEONARDS	CHATSWOOD NORTH	NO
769	33	City North	CHATSWOOD NORTH	LADY GAME DRIVE	NO
770	33	City North	LADY GAME DRIVE	DELHI ROAD	NO
771	33	City North	DELHI ROAD	MACQUARIE UNI	NO
772	33	City North	MACQUARIE UNI	DEVLINS CREEK SH	NO
773	33	City North	DEVLINS CREEK SH	BEECROFT	NO
774	33	South Coast	DUNMORE	BOMBO	NO
775	33	South Coast	CROOM	DUNMORE	YES
776	33	South Coast	ALBION PARK	CROOM	NO
777	33	South Coast	DAPTO	ALBION PARK	YES
778	33	South Coast	KEMBLA GRANGE	DAPTO	NO
779	33	South Coast	CONISTON	KEMBLA GRANGE	NO
780	33	City South	LOFTUS	HEATHCOTE	YES
781	33	City South	HEATHCOTE	CAWLEY	YES
782	33	South Coast	CAWLEY	LILYVALE	YES
783	33	South Coast	LILYVALE	STANWELL PARK	YES
784	33	South Coast	STANWELL PARK	CLIFTON	YES

Feeder #	Voltage	Territory	Starting SS	Ending SS	Bushfire risk?
785	33	South Coast	CLIFTON	AUSTINMER	YES
786	33	South Coast	AUSTINMER	CORRIMAL	NO
787	33	South Coast	CORRIMAL	CONISTON	NO
788	33	South Coast	CONISTON	PORT KEMBLA NORTH	NO
789	33	South Coast	PORT KEMBLA NORTH	OUTER HARBOUR I.E	NO
790	33	South Coast	PORT KEMBLA NORTH	OUTER HARBOUR I.E	NO
791	33	Western	BLACKTOWN E.E	BLACKTOWN NORTH	NO
792	33	Western	BLACKTOWN NORTH	SCHOFIELDS	NO
793	33	Western	SEVEN HILLS	BLACKTOWN NORTH	NO
794	33	Western	SCHOFIELDS	VINEYARD	YES
795	33	Western	VINEYARD	CLARENDON	NO
796	33	Western	CLARENDON	HAWKESBURY E.E	NO
797	33	City South	PRINCE ALFRED	ROZELLE SWITCHING STATION	NO
798	33	City South	PRINCE ALFRED	ERSKINEVILLE	NO
799	33	City South	ERSKINEVILLE	MEEKS RD	NO
800	66	Western	WALLERWANG SUBSTATION TRANSGRID	WALLERWANG	YES
821	66	Western	BLACKTOWN NORTH	ROOTY HILL	NO
822	66	Western	ROOTY HILL	ST MARYS	NO
829	66	City North	HORNSBY	BEROWRA	YES
830	66	City North	BEROWRA	COWAN	YES
831	66	Central Coast	COWAN	HAWKESBURY RIVER	YES
832	66	Central Coast	HAWKESBURY RIVER	WOY WOY	YES
833	66	Central Coast	WOY WOY	GOSFORD	YES
849	66	City North	BEROWRA	BEROWRA E.A	NO
850	66	Central Coast	GOSFORD	OURIMBAH	YES
851	66	Central Coast	OURIMBAH	OURIMBAH E.A	NO
852	66	Central Coast	OURIMBAH	WYONG	YES
853	66	Central Coast	WYONG	WALLAHRAH CREEK	YES

Feeder #	Voltage	Territory	Starting SS	Ending SS	Bushfire risk?
854	66	Central Coast	WALLAHRAH	WYEE	YES
855	66	Central Coast	WYEE	MORISSET	YES
856	66	Central Coast	MORISETT	ERARING	YES
857	66	Central Coast	ERARING	AWABA	YES
858	66	Central Coast	AWABA	BOORAGUL	YES
859	66	Central Coast	BOORAGUL	SULPHIDE JUNCTION	YES
861	66	Western	ST MARYS	PENRITH	NO
862	66	Western	PENRITH	EMU PLAINS	NO
863	66	Western	EMU PLAINS	BLAXLAND	YES
864	66	Western	BLAXLAND	FAULCONBRIDGE	YES
865	66	Western	FAULCONBRIDGE	LAWSON	YES
871	66	Western	LAWSON	KATOOMBA	YES
872	66	Western	KATOOMBA	MT VICTORIA	YES
873	66	Western	MT VICTORIA	NEWNES JUNCTION	YES
874	66	Western	NEWNES JUNCTION	OAKEY PARK	YES
875	66	Western	OAKEY PARK	WALLERWANG SUBSTATION TRANSGRID	YES
877	66	Western	LAWSON	LAWSON E.E	NO
878	66	Western	LAWSON	LAWSON E.E	NO
533A&B	11	City West	LEWISHAM SS	STRATHFIELD SS	NO
701/1	33	City South	MORTDALE C.S	COMO	YES
701/2	33	City South	HURSTVILLE	MORTDALE C.S	NO
731/1	33	South West	LEUMEAH	CAMPBELLTOWN	NO
731/3	33	South West	MACQUARIE FIELDS	LEUMEAH	NO
731/4	33	South West	GLENFIELD SOUTH	MACQUARIE FIELDS	NO
760/1	33	City West	ROZELLE SWITCHING STATION	13B	NO
760/2	33	City West	13B	LEWISHAM	NO
7A4	33	City North	STRATHFIELD	WEST RYDE	NO
7A6	33	City West	FLEMINGTON	AUBURN	NO
7H9	33	City North	GORDON	WARRAWEE	NO
7M1	33	South West	GLENFIELD	GLENFIELD SOUTH	NO

Feeder #	Voltage	Territory	Starting SS	Ending SS	Bushfire risk?
7M5	33	South West	CAMPBELLTOWN	GLENLEE	NO
7S1	33	South West	EDMONDSON PARK	DENHAM COURT E.E	NO
7S2	33	South West	EDMONDSON PARK	LEPPINGTON	NO
7S3	33	South West	EDMONDSON PARK	LEPPINGTON	NO
7S4	33	South West	GLENFIELD SOUTH	EDMONDSON PARK	NO
7S5	33	South West	GLENFIELD SOUTH	EDMONDSON PARK	NO
7T8	33	City North	CHATSWOOD NORTH	LINDFIELD	NO
7U3	33	City South	ART GALLERY	EDGECLIFF	NO
7U4	33	City South	ARGYLE	ART GALLERY	NO
7W1	33	Western	WESTMEAD	TOONGABBIE	NO
7W2	33	Western	TOONGABBIE	SEVEN HILLS	NO
7W3	33	Western	TOONGABBIE	BLACKTOWN E.E	NO
7W4	33	South West	CABRAMATTA	WARWICK FARM	NO
7Y1	33	South West	CABRAMATTA	YENNORA	NO
7Y2	33	City West	YAGOONA	SEFTON	NO
7Y4	33	City South	CARINGBAH	GYMEA	NO
EA653	33	South West	REVESBY	BANKSTOWN A.G	NO