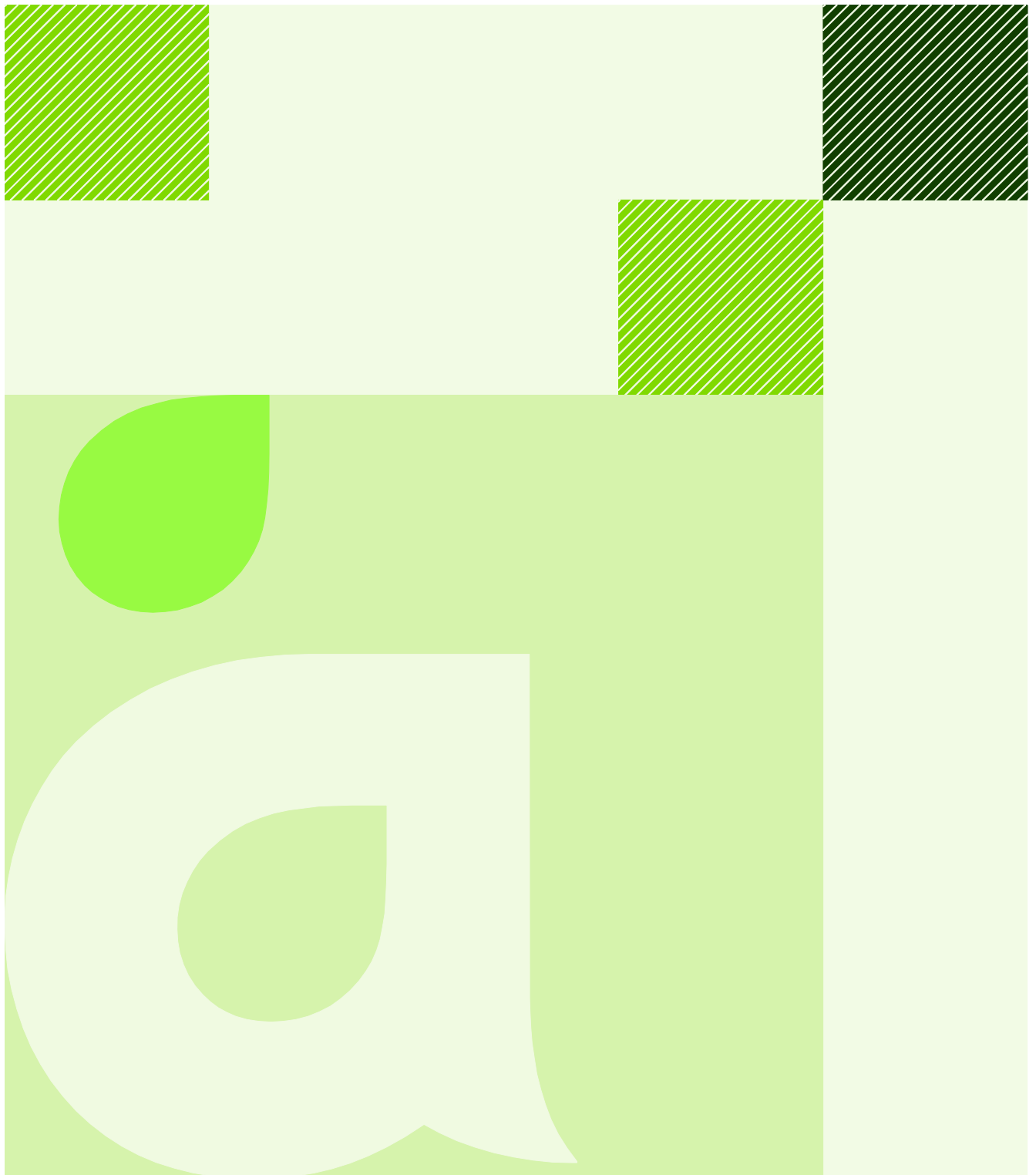




**Chullora 11kV and 33kV Relocation
of HV Aerial lines**

Concept Design Report for System
Definition Review

**Charter Hall Core Plus Industrial Fund,
Bieson Pty Limited as trustee of the CPIF Hume
Highway Logistics Trust and
Prepared for Commercial & Industrial Property Pty
Limited**

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Appendices

Appendix A

Existing Layout Drawing, 11 kV System Diagram, Reticulation Diagram, DSS

Appendix B

Hazard Log

1 Executive Summary

Commercial and Industrial Property (CIP) Pty Ltd is planning to develop the former Fairfax site at 2 Hume Highway Chullora. As a part of this project, Sydney Trains 11 kV Feeder 624/2 and 33 kV Feeder 709 are to be relocated to allow for development of the site. The design scope is for the relocation of the two HV aerial feeders passing over the site either by a cable or aerial sections or a combination of both.

The purpose of this Concept Design Report for System Definition Review (SDR) is to confirm the scope of design with Sydney Trains for the works prior to development of the detailed design work and to progress through CCB Gate 1. The report presents two options and the intention is to agree on the preferred option at the CCB meeting. This preferred option will then be progressed to preliminary or detailed design.

2 Business Requirement

2.1 Requirement

Presently, Sydney Trains feeders 624/2 and 709 are constructed as aerial feeders and are located in an easement which straddles the Australia Post property and the former Fairfax site. As part of former Fairfax site development, 11kV Feeder 624/2 and 33kV Feeder 709 are to be relocated out of this easement, and the easement is to be extinguished. This is required to allow the integration of buildings across the two sites. Initial discussions between CIP and Sydney Trains have explored the possibility of undergrounding the two feeders in the existing easement. This option was discarded since CIP's requirements include building or structures above the easement area. This report proposes some options for the relocation of the feeders including the creation of new easements where appropriate.

2.2 Operational Requirements

2.2.1 Maintenance

Sydney Trains requires 24 hour access to the feeder. Any pole needs to be accessible by a crane and any underground section needs to be accessible by an excavator.

2.2.2 Switching arrangement

The present switching arrangement of 11 kV feeders is to be maintained, so that 624/2 could be fed either from 624/1 or from 624/3 while the other feeder segment is out of service.

2.2.3 Feeder fault finding

Sydney Trains requires access to their feeders in order to locate a fault.

2.2.4 Feeder protection

11kV and 33kV feeders shall have appropriate protection settings at the substation.

2.2.5 Earthing

For safe operation of the feeders, Sydney Trains requires appropriate earthing design. Earthing design will be covered in detailed design. The UGOH poles will require to be earthed and additional OHEW to be installed if HV feeders are partially undergrounded. The down leads are to be inspected every 2 years.

2.2.6 Management of buried assets

Sydney Trains must maintain data on buried assets as part of its obligations towards the dial before you dig service.

2.2.7 Feeder impedance and cable sizing

Feeder impedances and cable sizes shall be appropriate such that unnecessary electrical losses are avoided.

3 Options for service relocation

Aurecon has performed an options study for the relocation of the HV feeders and following options have been considered:

3.1 Option 1

The proposed route for the two feeders is shown in Figure 1, and proposed changes to Reticulation Diagram 111 are shown in Figure 3 and proposed changes to 11 kV System Diagram are shown in Figure 5. Figure 2 and Figure 4 show the existing diagrams.

3.1.1 Scope of works

In this option a new pole 57A is inserted into the feeder on the eastern side of Worth Street. The 33kV aerial route is extended north along Worth Street to 500m from the substation in order to comply with the ASA standard T HR EL 10001 ST, which does not allow shorter segments of aerial 33kV feeder. If a concession can be obtained, feeder 709 could also be transitioned to underground at a new UGOH pole in the vicinity of new pole 54, thus avoiding the additional distance back and forth to new pole 52. Otherwise the 33kV feeder 709 aerial route then transitions to underground at new pole 52.

11kV feeder 624/2 transitions to underground at new pole 54 and is routed in the proposed easement alongside the Sydney Water easement to pole 27A, located nearby existing pole 27. 27A and 27 are connected aerially. The existing cable between 27A and J51 completes the circuit.

709 feeder will be undergrounded from new pole 52, which continues along the same route and terminates at new pole 51A, located near existing pole J51. The length of the cable route will be approximately 600m.

Three single core cables will be required for 33kV feeder 709 and one multicore cable required for 11kV feeder 624/2. There is a requirement of one spare duct for each of the feeders, therefore a total of six ducts will be required for the common underground cable route. The section of underground cable route from new pole 52 to new pole 54 is for 33kV only and will require 4 ducts. Four new underground to overhead transition (UGOH) poles are required in this option: 11kV poles 27A and 54 and 33kV poles 52 and 51A. The overhead earth wire protecting feeder 709 will also be extended from pole J51 for 800m towards Belmore. Some pole top arrangements may need to be changed in order to install this earth wire, and some existing poles may need replacement.

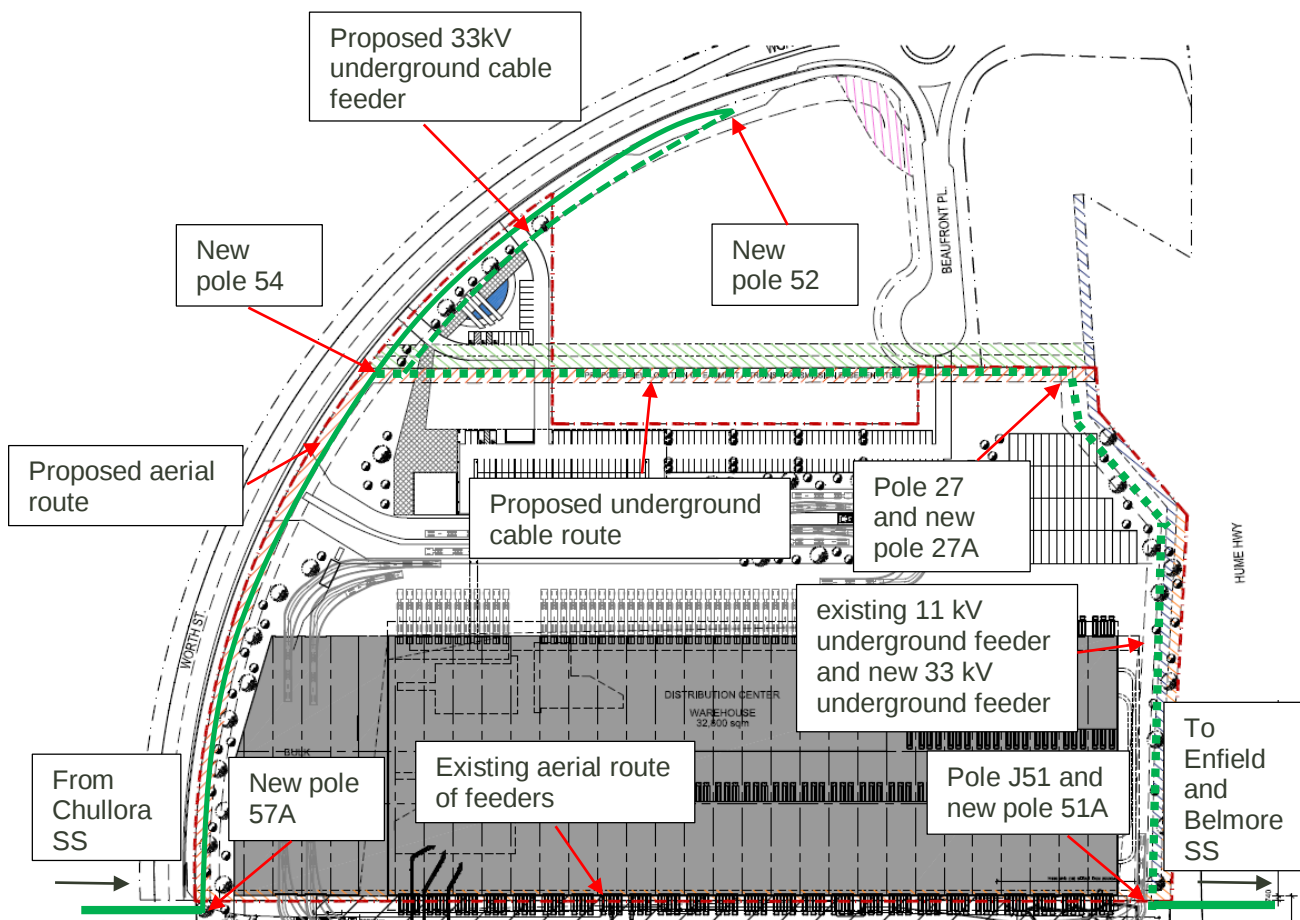


Figure 1 Option 1 proposed aerial and underground cable route

Legend

- Aerial feeder
- - - - - Underground feeder

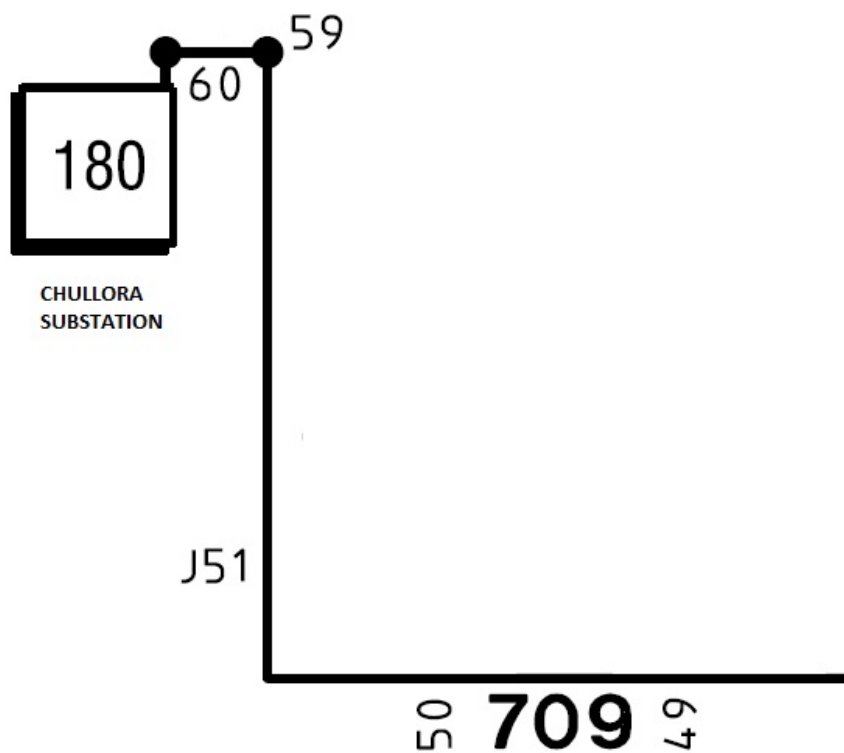


Figure 2 Existing Reticulation Diagram 111

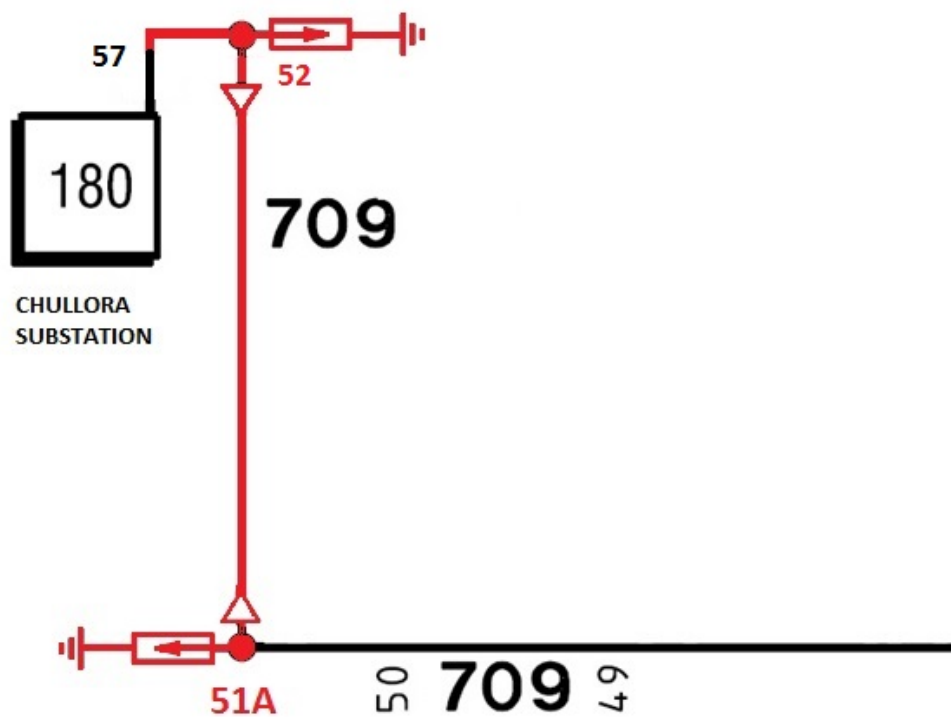


Figure 3 Option 1 proposed changes to Reticulation Diagram 111

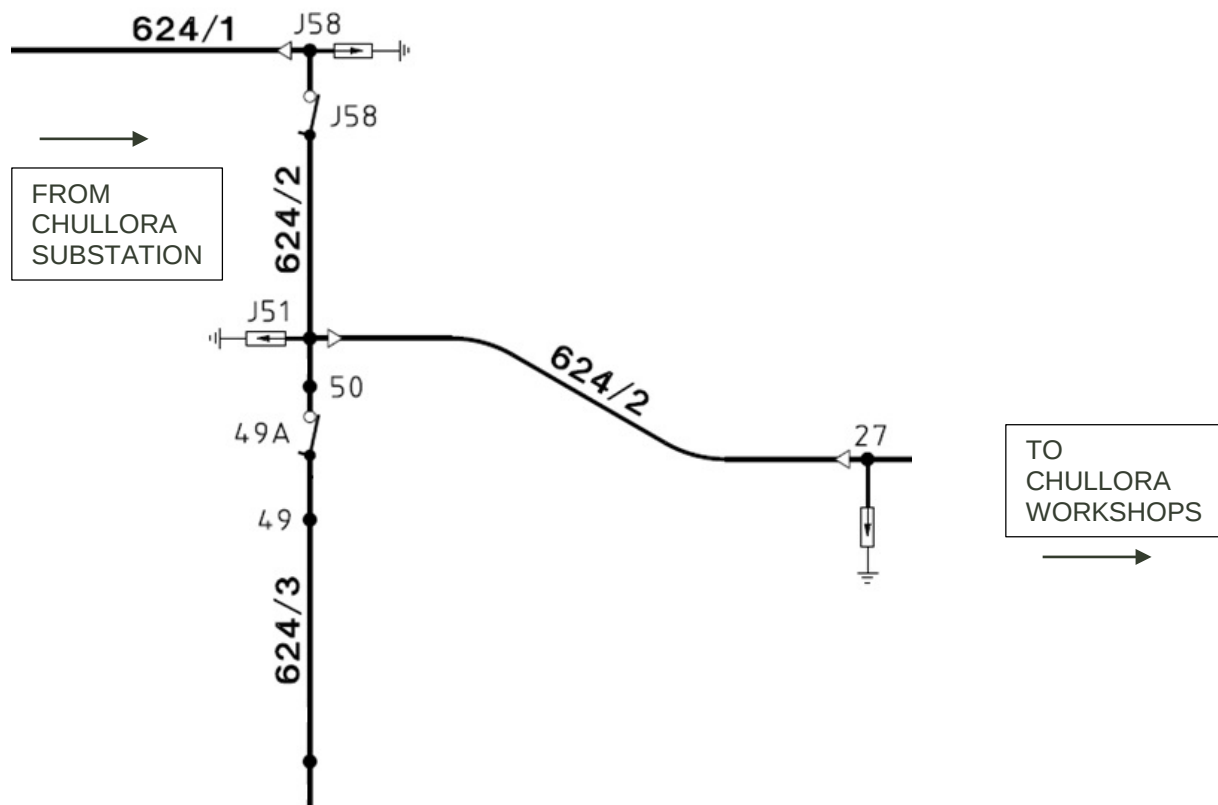


Figure 4 Existing 11 kV System Diagram 553

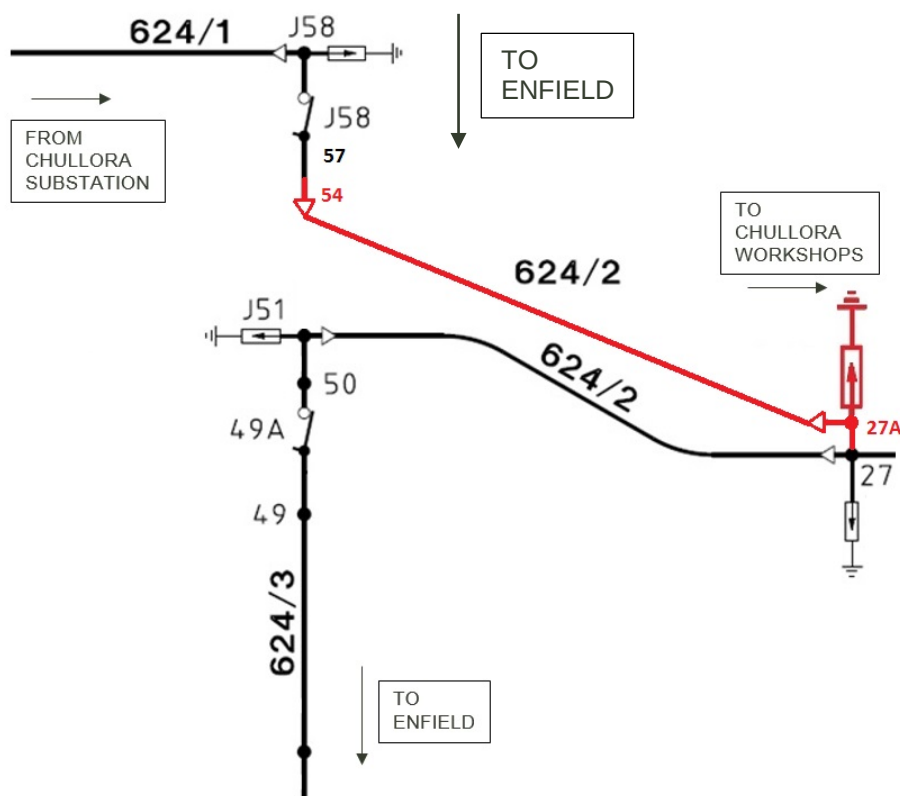
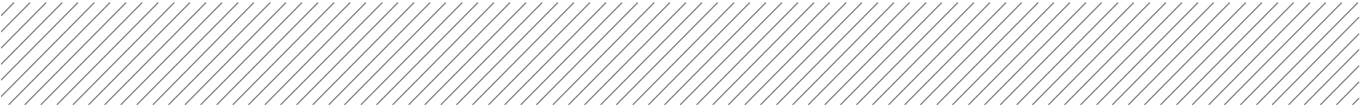


Figure 5 Option 1 proposed changes to 11 kV System Diagram 553



The operational implications and construction constraints for this option are discussed in the sections below.

3.1.2 Existing underground services

The proposed location for new pole 27A is near to existing Ausgrid distribution assets. The location of the pole shall be coordinated to avoid these assets.

Ausgrid distribution assets are co-located with the proposed easement for the Sydney Trains 11kV and 33kV route near new pole 27A, however they are not protected by an easement. Sydney Trains cable routes need to pass under the Ausgrid distribution services in this area.

The proposed location for new pole 27A is also nearby some Telstra optic fibre assets. Pole and cable routes at this location are to be coordinated with the Telstra assets.

The route across the site is designed to be alongside the existing 10m width sewer easement, which contains a 600mm concrete sewer. The 33kV route at Worth Street can cross over the sewer, which is several metres deep. The Sydney Water requirement for vertical clearance between electricity cables and sewer is 300mm, which will easily be exceeded.

The route alongside the Hume Highway is designed to be located in an existing Sydney Trains power easement 4 m wide presently containing a segment of 11kV feeder 624/2. A 225mm vitrified clay sewer is located in an adjacent 4m easement. Although the plan DP834734 shows that the power easement is closer to the road, site inspection shows that the sewer appears closer to the road. This can be confirmed by potholing in a later stage of the works. At this point it seems most likely that the new cable route does not need to cross the sewer.

The existing section of 624/2 between pole 27 and J51 in this easement is to be retained. The new cable route can be installed alongside the existing cable route in a new trench approximately 600mm wide. Two new 11kV ducts between pole 27 and J51 can be provided as spares in case the existing cable needs to be replaced in future.

3.1.3 Easement requirement

According to plan DP834734 the current easement of the existing cable route is 4m wide. The new cable route is proposed to have an easement of 4.5m and the section of aerial feeder will require an easement extending 7.5m either side of the centreline of poles.

3.1.4 Feeder fault finding

Faults in underground sections can be difficult to locate compared with aerial lines, which can often be located simply by visual inspection. However, the proposed underground cable route will be of a short length and is to be installed in ducts, and accordingly, it is only necessary to identify which phase is faulted. Once this is done, the feeder may be returned to service by drawing a new cable into the spare duct, re-terminating at both UGOHs, testing and commissioning, and pulling out the faulted cable.

Primarily, faults that occur in underground cables result from accidental damage to cables from excavation works. Due to the short length of underground route (600m), the likelihood of this occurring is low, especially considering the route is located in private property. In addition, cable faults tend to occur at weak points in the network such as cable joints and terminations. The proposed cable route is only 600m in length and will not require any joints.

To reduce the risk of accidental damage, the proposed cable route will be accurately surveyed and submitted to Sydney Trains with "Work-as-Executed" drawings, so that the GIS can be updated, and accurate data provided in response to dial-before-you-dig requests. This will also assist to locate the underground feeder in future to carry out emergency maintenance on the cable. According to ASA Standard T HR EL 20003 section 11.1, cable markers for the underground route will also be installed.

3.1.5 Reclosure procedures

The system operating diagram of Chullora substation (diagram 180) indicates that the 709 feeder circuit breaker is fitted with single shot auto-reclose.

EP 19 00 00 02 SP states that “a feeder that is partially cable and partially aerial is treated as aerial line”. Accordingly there should be no change to the protection and single-shot auto-reclose should remain in place.

3.1.6 Management of buried assets

The 600m underground cable section of the feeders introduces the need to record and manage data on the buried asset. The proposed underground section will be a fully ducted system with spare conduits installed as per Sydney Train's requirements. This will allow installation of additional cable or replacement of existing cable with minimum inconvenience.

The proposed underground section is entirely contained within the site of new developmental works. Therefore, a suitable corridor which meets the requirement of Sydney Trains and has necessary clearances from other utility services has been allocated for Sydney Trains HV cable installations, and is to be protected by an easement.

RailCorp standard EP 20 00 04 06 SP describes the requirements for location recording of underground cable. The data will then need to be managed by Sydney Trains as part of its obligations towards the dial before you dig service.

3.1.7 Feeder impedance and cable sizing

The impedances of the feeders will be determined in detailed design along with cable sizing according to the load on the cables.

3.2 Option 2

The proposed cable route for the two feeders is shown in Figure 6, and proposed changes to Reticulation Diagram 111 are shown in Figure 8 and proposed changes to 11 kV System Diagram are shown in Figure 10. Figure 7 and Figure 9 shows the existing diagrams.

3.2.1 Scope of works

In this option a HV cable route will be installed for the two HV Feeders from Chullora substation to pole 57. The cable route continues to pole 27 and then transitions to aerial at pole J51. The length of the cable route will be approximately 900m. Three single core cables will be required for 33kV feeder 709 and one multicore cable required for 11kV feeder 624/1. There is a requirement of one spare duct for each of the feeders, therefore a total of six ducts will be required for the underground cable route. Three new poles are required for this option -11kV UGOH pole 27A, pole 27B supporting an air break switch and 33kV UGOH pole 51A. The overhead earth wire will also be required to be extended from pole J51 for 800m on feeder 709 and some pole top arrangements may need to be changed in order to install OHEW above them.

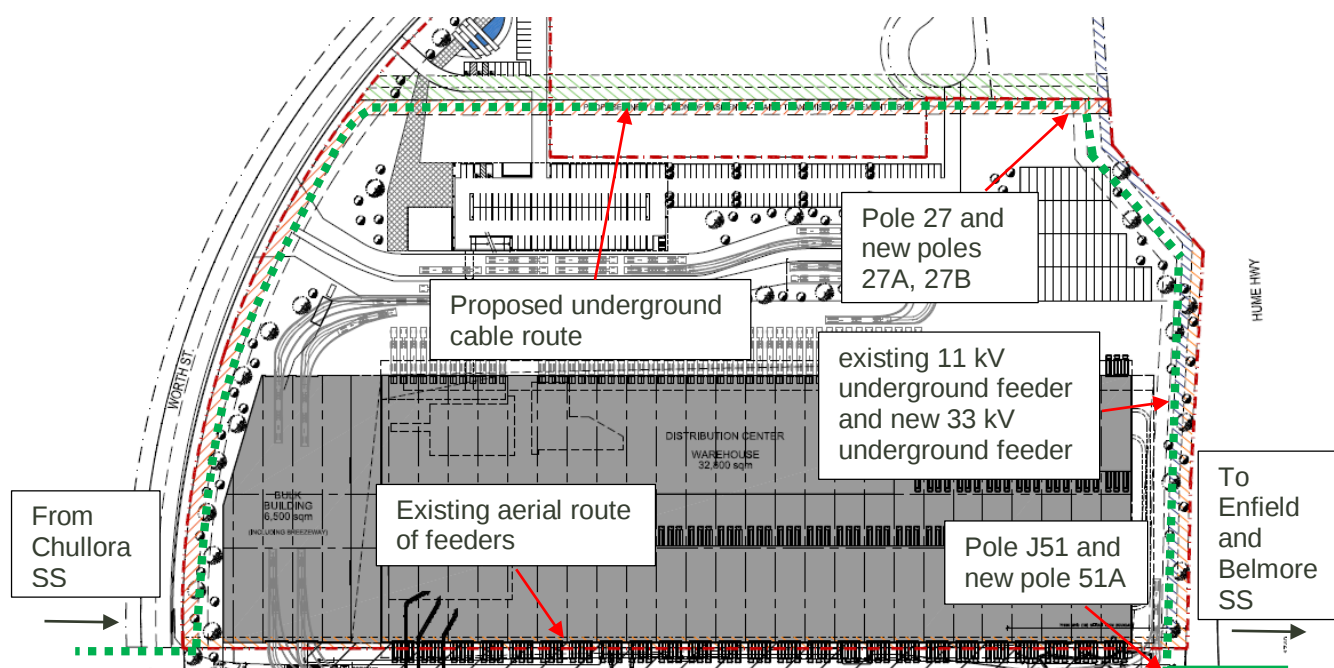


Figure 6 Option 2 proposed underground cable route

Legend

- Aerial feeder
- - - - - Underground feeder

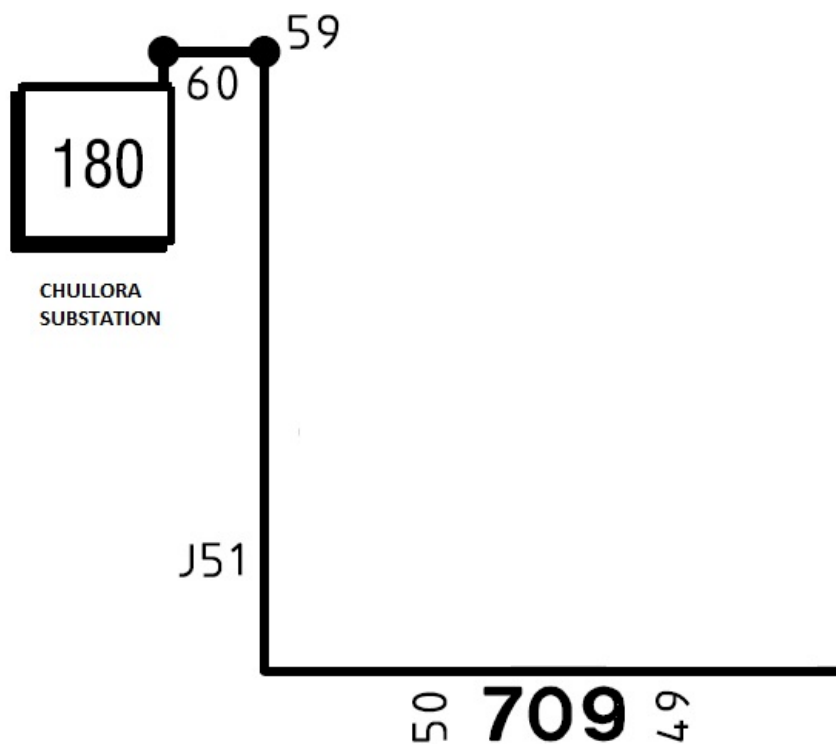


Figure 7 Existing Reticulation Diagram 111

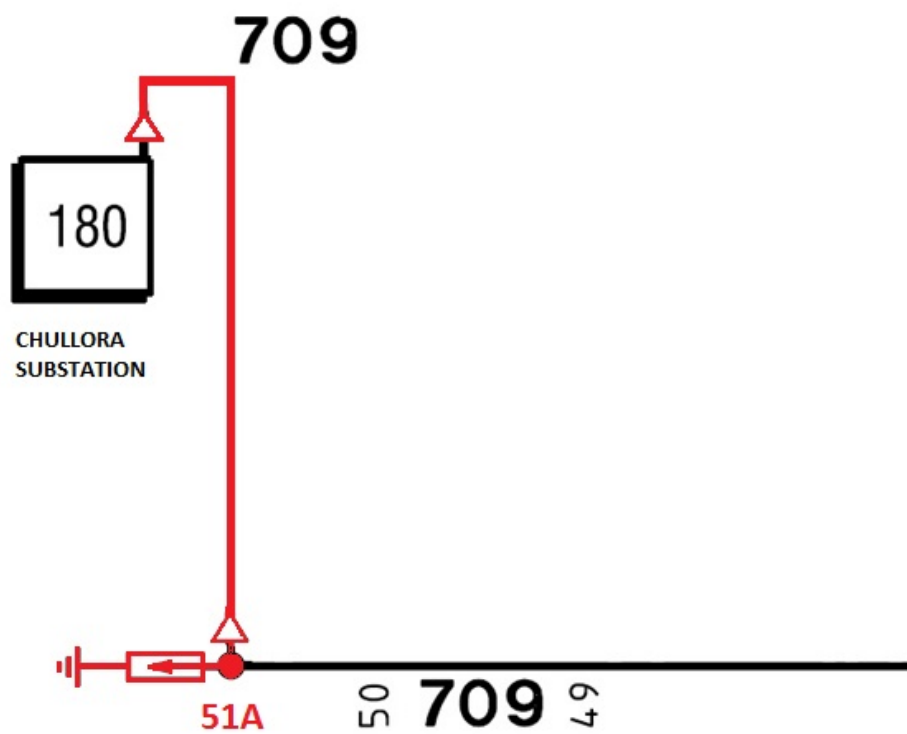


Figure 8 Option 2 proposed changes to Reticulation Diagram 111

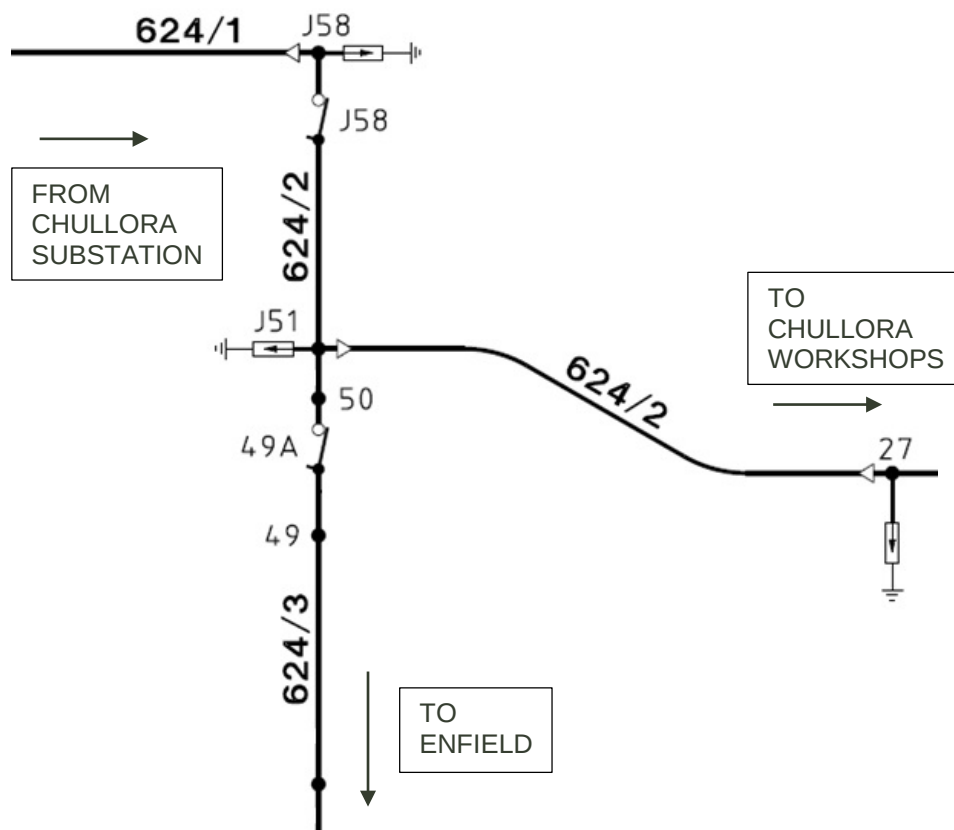


Figure 9 Existing 11 kV System Diagram 553

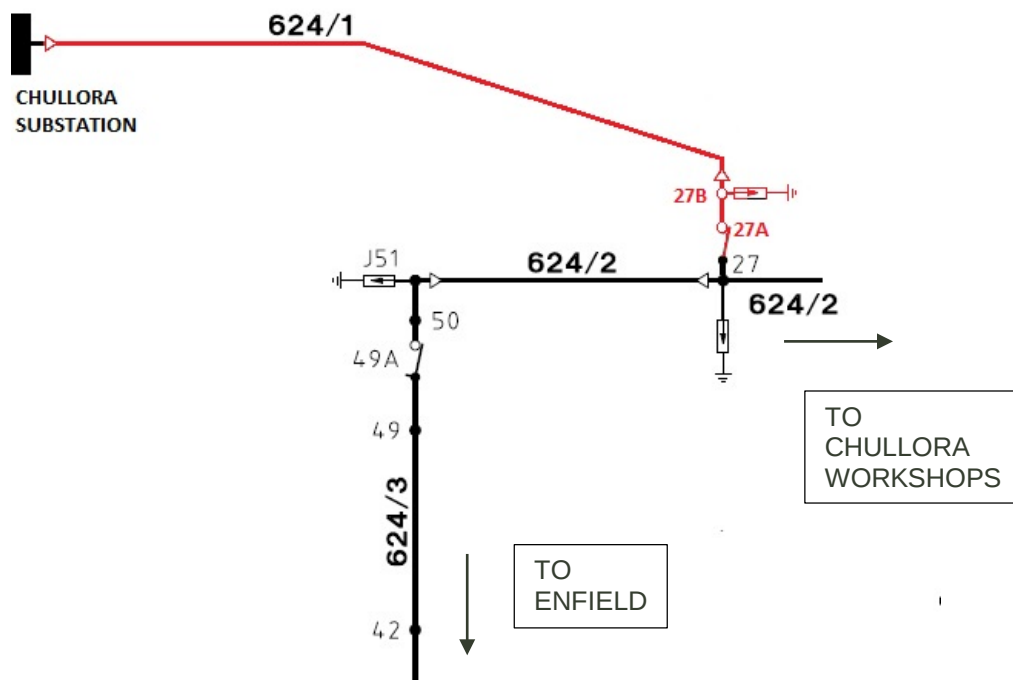


Figure 10 Option 2 proposed changes to 11 kV System Diagram 553

3.2.2 Existing underground services

The interface with existing underground services in this option is similar to option 1 except for the following considerations:

- Two new poles are required near existing pole 27, making this area more congested. As mentioned above, this area is shared with Ausgrid distribution assets and Telstra optic fibre, and poles and cable routes must be coordinated with these assets.
- In this option, there is no need for the 33kV cable route to cross the sewer near Worth St.

3.2.3 Easement requirement

In this option, an aerial easement 15m wide is not required in Worth Street. Instead an easement for underground cable 4.5m is proposed along Worth Street.

3.2.4 Feeder fault finding

The fault finding implications for Option 2 are similar to Option 1. The 11kV and 33kV cables are typically supplied on drums up to 1000m, so it may be necessary to include a cable joint. This will need to be confirmed in detailed design.

3.2.5 Reclosure procedures

The auto-reclose implications of Option 2 are similar to Option 1.

3.2.6 Management of buried assets

The implications to management of buried assets in Option 2 are similar to Option 1.

3.2.7 Feeder impedance and cable sizing

The impedances of the feeders will be determined in detailed design along with cable sizing according to the load on the cables.

3.2.8 Construction interfaces

In option 2, some works are required within Chullora Substation. The landing gantry for 709 feeder needs to be modified to accommodate the cable sealing ends for the new underground cable, similar to the arrangement at Cabramatta substation, for example. The timing of works within the substation and within rail land will imply timing constraints on the construction task.

In addition, a trench will be required across Worth St which will imply a more involved traffic management plan than option 1.

4 Reference Standards

4.1 Australian and International Standards

Table 4-1 Australian and International Standards

Standard	Reference
AS 1824.1 - 1995	Insulation co-ordination – Definitions, principles and rules
AS 1824.2 - 1985	Insulation coordination (phase-to-earth and phase-to-phase, above 1 kV) - Application guide
AS 1931.1 - 1996	High-voltage test techniques – General definitions and test requirements
AS 2067 - 2008	Substations and high voltage installations exceeding 1 kV a.c.
AS 3851-1991/Amdt 1-1992	The calculation of short-circuit currents in three-phase a.c. systems

Standard	Reference
AS 3865-1991/Amdt 1-2003	Calculation of the effects of short-circuit currents
AS 4436 - 1996	Guide for the selection of insulators in respect of polluted conditions
AS/NZS 4853 – 2012	Electrical Hazards on Metallic Pipelines
AS1170.0-2002/Amdt1-2003	Structural design actions – General principles
AS/NZS 1170.2 – 2011	Structural design actions – Wind actions
AS/NZS 1768 – 2007	Lightning protection
AS/NZS 2344 – 1997	Limits of electromagnetic interference from overhead a.c. power lines and high voltage equipment installations in the frequency range 0.15 to 1000 MHz
AS/NZS 3000 – 2007	Electrical installations
AS/NZS 3835.1 – 2006	Earth potential rise—Protection of telecommunications network users, personnel and plant – Code of practice
AS/NZS 3835.2 – 2006	Earth potential rise—Protection of telecommunications network users, personnel and plant – Application guide
AS/NZS 3931 - 1998	Risk analysis of technological systems—Application guide
AS/NZS ISO 31000 – 2009	Risk management – Principles and guidelines
AS4799 – 2000	Installation of underground utility services and pipelines within railway boundaries
AS/NZS 7000 – 2010	Overhead Line Design – Detailed Procedures
AS/NZS 60479.1 – 2010	Effects of current on human beings and livestock – general aspects
AS/NZS 61000	Electromagnetic compatibility (EMC)
IEC 60826 – 2003	Design criteria of overhead transmission lines
IEC 61140 – 2009	Protection against electric shock—Common aspects for installation and equipment
ENA 11 - 2006	Pole Supply and Performance Specification
ENA 12 - 2006	Cross-arm Supply and Performance Specification
ENA DOC 15 - 2006	National guidelines for prevention of unauthorised access to electricity infrastructure
ENA NENS 03 - 2006	National guidelines for safe access to electrical and mechanical apparatus
ENA NENS 04 - 2006	National Guidelines for Safe Approach Distances for Electrical and Mechanical Apparatus
AS 3008.1.1:2007	Wiring Rules

4.3 ASA/ RailCorp Standards

Table 4-2 ASA/ RailCorp Standards

Standard	Reference
Engineering Procedures/All Disciplines	
EPD 0010 – V3.0	Design Approval
EPD 0011 – V2.1	Design Verification
EPD 0012 – V2.1	Design Validation
EPD 0013 – V3.0	Technical Reviews
TS 10765 – V1.0	Concessions to ASA Requirements
TS 10765 F1 – V1.0	Request for concession to ASA requirement
Electrical - General	
EP 00 00 00 16 SP – V2.1	Electrical Power System Signage
T HR EL 17001 ST – V1.0	Electrical Distribution System Installation Connection and Inspection
T HR EL 20003 ST – V1.0	Underground Installation Configurations for High Voltage and 1500 V dc Cables
Aerial	
EP 10 00 00 04 SP – V3.1	Transmission Line Easement Conditions
EP 10 01 00 02 SP – V2.2	Aerial Line Maintenance Standards
EP 10 01 00 03 SP – V3.2	Aerial Line Base Safety and Operating Standards
EP 10 01 00 05 SP – V2.1	Requirements for Electric Aerials Crossing RailCorp Infrastructure
T HR EL 10001 ST – V1.0	HV Aerial Line Standards for Design and Construction
EP 10 01 00 07 SP – V1.0	Timber Poles
T HR EL 10002 ST – V1.0	HV Aerial Lines - Standard Conductors and Current Ratings
T HR EL 10003 ST – V1.0	Wood Pole Serviceability Policy
SMS-06-GD-0268 – V3.0	System Guide – Working around Electrical Equipment
LV, Earthing and Electrolysis	
EP 12 00 00 01 SP – V3.0	High Voltage and 1500 System Earthing references and Definitions
EP 12 10 00 12 SP – V3.0	Transmission Line and Cable Earthing
ETN 11/02	Earthing Designs for RailCorp's High Voltage AC System
T HR EL 12002 GU – V1.0	Electrolysis from Stray DC Current

5 Abbreviations & Definitions

Table 3.1 Acronyms

Acronym	Meaning
AEO	Authorised Engineering Organisation
ASA	Asset Standards Authority
CCB	Configuration Change Board
CDR	Critical Design Review
EA	Engineering Authority
DBYD	Dial Before You Dig
HV	High Voltage
LV	Low Voltage
PDR	Preliminary Design Review
SDR	System Definition Review
TfNSW	Transport for New South Wales
TMP	Technical Maintenance Plan

6 Design inputs

Input	Comment
Existing High Voltage Feeders Drawings	Aurecon has obtained Sydney Trains drawing EL0090364, EL0090365, EL0090013 and EL0090014. We have verified the Sydney Trains drawings on site. Refer to Appendix A.
HV Reticulation Diagram and 11 kV System Diagram	Aurecon has obtained the existing 11 kV System Diagram 553 (EL0044274) Rev. R1 and HV Reticulation Diagram 111 (EL0478970) Rev. U for the relevant Transmission line in the Sydney Trains network. Refer to Appendix A.
Dial Before You Dig (DBYD)	DBYD has been obtained in order to evaluate the proposed options.
Fault Levels and clearance time	Fault level data for 11 kV and 33 kV at the location will be required at detailed design stage.
Pole Inspection Report	Pole inspection reports from Sydney Trains for the feeders will be required at detailed design stage.
Survey	Some initial survey data has been made available by CIP.
Easement	Existing Lot and easement deeds have been used to evaluate the proposed options.

7 Design

7.1 Design criteria

Table 7-1 Design Criteria

System	Details
HV Aerial	In accordance with TfNSW Standard T HR EL 10001 ST V1.0 and AS 7000:2010.

7.2 HV Reticulation Diagram and 11 kV System Diagram

The 11 kV System Diagram (553) and Reticulation Diagram (111) are required to be modified due to the proposed work.

8 Safety in Design

8.1 Process

A hazard workshop shall be held during the Detailed Design stage in order to capture the risks related to the project.

Workshops and reviews will consider the full life cycle:

- Design
- Construction
- Installation
- Commissioning and Testing
- Maintenance
- Decommissioning and demolition

8.2 Project Hazard Log

The Project Hazard Log is provided in Appendix B.

9 Interface Management

9.1 Physical Interfaces

The physical interface is between the 11kV and 33kV relocation and the civil works planned in order to develop the site, in particular the steep embankment proposed to be alongside the sewer and electrical easement running along the Hume Highway side of the site. Coordination is required between the civil design and the location of the proposed trench so that there is no risk to the embankment from future excavation of the trench.

9.2 Stakeholder Interfaces

Table below summaries the stakeholder interface for HV and LV relocation work.

Table 9-1 Stakeholder Interfaces

Interface	Primary Stakeholder	Details
LV and HV assets	Sydney Trains	Electrical isolations will be required for construction work.

Interface	Primary Stakeholder	Details
Construction	Council	Road closure or traffic management will be required during construction stage. Options involving relocation into road reserve will require discussion with council.
Easements	Sydney Trains	Termination of the existing easement and establishment of new easements will be required.
Underground assets	Ausgrid	Coordination with existing cables
Underground assets	Telstra	Coordination with existing optic fibre

10 Value management

10.1 Reliability & Maintainability

Standard Sydney Trains equipment will be installed in all cases and maintenance required will be as per Sydney Trains' TMPs.

New easements will be required to allow Sydney Trains to access their assets. Location of the underground cable needs to be recorded in order to update DBYD services. According to ASA Standard T HR EL 20003 section 11.1, cable markers for the underground route shall also be installed. The underground cable route needs to be protected with polymeric cable protection covers and warning marker tapes installed above the protection cover as per the TfNSW standard (T HR EL 20003 ST).

Experienced construction contractors shall be engaged to terminate the underground cables at each underground to overhead transition. Cable terminations shall be standard Sydney Trains items as used throughout the network.

Option 2 may involve the need for cable joints, which shall similarly be selected from standard items and be installed by experienced contractors.

10.2 Design Life

The design life for the HV Aerial and LV system components shall be as follows:

- HV Aerial Line 50 years
- HV cables and cable systems 25 years

10.3 Constructability

A track possession is not required for potential construction activities inside Sydney Trains land (in option 2), as relocation is at a sufficient distance from live running tracks. The proposed cable routes and aerial feeders are located in easily accessible land and will consist of standard arrangements.

10.4 Safety

Both favourable options (option 1 and 2) have no particular safety advantage over the other considering operations and maintenance of the feeders. Considering construction, option 1 is favourable over option 2 because option 2 will require traffic management on Worth Street during the excavation of the street in order to lay down the underground cable ducts. Temporary closure of half of Worth Street may be required for one or two nights in order to complete the underground cable route of the feeders. The construction work of option 1 is inside the private property.



11 Asset Management

11.1 Asset List

This will be confirmed in the detailed design stage based on the preferred design option.

11.2 Asset Maintenance Strategy

ASA Standard equipment will be installed in all cases. Maintenance required will be as per Sydney Trains TMPs.

11.3 Asset Operation Strategy

HV Aerial and LV cable route will be operated as per Sydney Trains standard asset operation plan.

11.4 Asset Decommissioning Strategy

The redundant section of HV will be decommissioned as per the decommissioning plan provided in detailed design.

12 Assurance and guarantee

The detailed design of the project shall be taken by Authorised Engineering Organisation (AEO) and the organisation shall progress the concept design through Configuration Management Gates by mean of presenting the design at the regular Sydney Trains West Region CCB meetings. The preferred solution is expected to be agreed between CIP and Sydney Trains at the Gate 1 CCB meeting. The initial project risk register developed with this report shall be reviewed at each stage. A construction contractor shall be appointed who is a qualified AEO with capabilities in HV Aerial and underground construction, commissioning and decommissioning. Stakeholders have been identified as local council (Bankstown City Council), the future tenant, and Australia Post the current tenant of the adjacent site, and CIP has been in discussion with these stakeholders. Other stakeholders (Ausgrid, Telstra) shall be consulted during detailed design.

13 Conclusion and recommendations

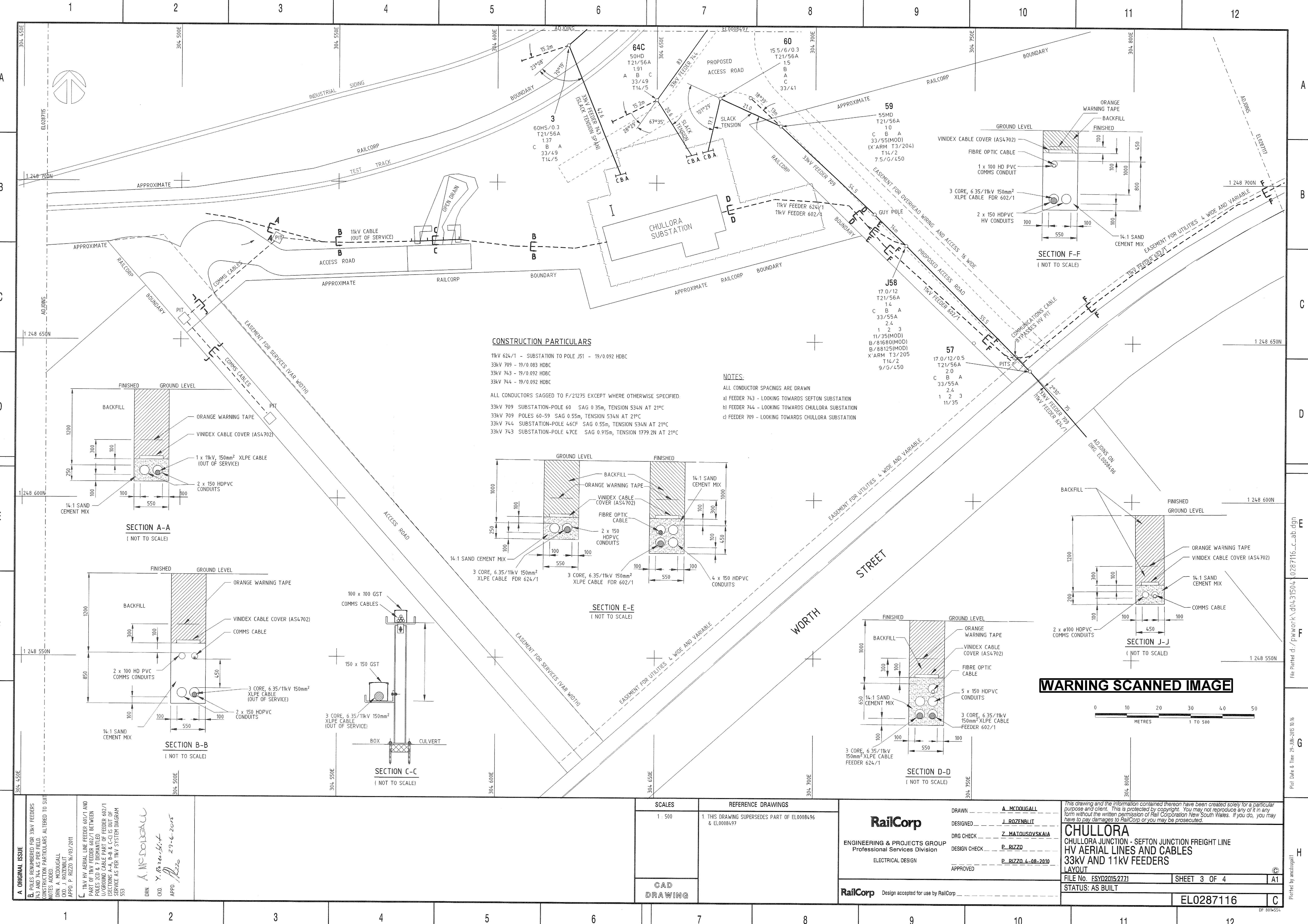
Aurecon consider both option 1 and option 2 will meet Sydney Trains operational requirements and CIP's business requirement. Option 1 is favourable over option 2 due to its reduced construction cost and avoidance of works at the Chullora substation and Worth Street which could impose timing contingencies into the construction task. We look forward to discussing the favoured option with Sydney Trains at the CCB meeting.



Appendix A

Existing Layout Drawing, 11 kV System Diagram, Reticulation Diagram, DSS

Drawing Number	Drawing Description	Revision
EL 0287116	Chullora Junction – Sefton Junction Freight Line HV Aerial Lines and Cables 33kV and 11kV Feeders Layout	C
EL 0090365	High & Low Voltage Feeders Chullora Workshop Area Layout	U
EL 0478970	Metro Area Sefton to Pleasure Point Belmore & Chullora Reticulation Diagram	U
EL 0044274	Metropolitan Area Chullora Workshops 11kV System Diagram	R1



A ORIGINAL ISSUE
B. POLES REMOVED FOR 33kV FEEDERS 743 AND 744 AS PER FIELD NOTES AND CONSTRUCTION PARTS ALTERED TO SUIT NOTES ABOVE
C. 11kV HV AERIAL LINE FEEDER 601/1 AND PART OF 11kV FEEDER 602/1 BETWEEN POLES 202 & 7 DISMANTLED
D. GROUND CABLE PART OF FEEDER 602/1 (SECTIONS A-A, B-B & C-C) IS OUT OF SERVICE AS PER HV SYSTEM DIAGRAM 555
DRN A. McDougall
CKD Y. Rozenblit
APPD P. Rizzo 16/03/2011
29-6-2015
P. Rizzo

SECTION A-A
(NOT TO SCALE)
FINISHED GROUND LEVEL
BACKFILL
ORANGE WARNING TAPE
VINIDEX CABLE COVER (AS4702)
1 x 11kV, 150mm² XLPE CABLE (OUT OF SERVICE)
2 x 150 HDPVC CONDUITS
14.1 SAND CEMENT MIX

SECTION B-B
(NOT TO SCALE)
FINISHED GROUND LEVEL
BACKFILL
ORANGE WARNING TAPE
VINIDEX CABLE COVER (AS4702)
COMMS CABLE
2 x 100 HD PVC COMMS CONDUITS
3 CORE, 6.35/11kV 150mm² XLPE CABLE (OUT OF SERVICE)
2 x 150 HDPVC CONDUITS
14.1 SAND CEMENT MIX

SECTION C-C
(NOT TO SCALE)
100 x 100 GST
COMMS CABLES
150 x 150 GST
BOX
CULVERT

SECTION D-D
(NOT TO SCALE)
FINISHED GROUND LEVEL
BACKFILL
ORANGE WARNING TAPE
VINIDEX CABLE COVER (AS4702)
FIBRE OPTIC CABLE
5 x 150 HDPVC CONDUITS
3 CORE, 6.35/11kV 150mm² XLPE CABLE FEEDER 602/1
14.1 SAND CEMENT MIX

SECTION E-E
(NOT TO SCALE)
FINISHED GROUND LEVEL
BACKFILL
ORANGE WARNING TAPE
VINIDEX CABLE COVER (AS4702)
FIBRE OPTIC CABLE
2 x 150 HDPVC CONDUITS
14.1 SAND CEMENT MIX
3 CORE, 6.35/11kV 150mm² XLPE CABLE FOR 624/1
3 CORE, 6.35/11kV 150mm² XLPE CABLE FOR 602/1
4 x 150 HDPVC CONDUITS

SECTION F-F
(NOT TO SCALE)
FINISHED GROUND LEVEL
BACKFILL
ORANGE WARNING TAPE
VINIDEX CABLE COVER (AS4702)
FIBRE OPTIC CABLE
1 x 100 HD PVC COMMS CONDUIT
3 CORE, 6.35/11kV 150mm² XLPE CABLE FOR 602/1
2 x 150 HDPVC HV CONDUITS
14.1 SAND CEMENT MIX

SECTION J-J
(NOT TO SCALE)
FINISHED GROUND LEVEL
BACKFILL
ORANGE WARNING TAPE
VINIDEX CABLE COVER (AS4702)
COMMS CABLE
2 x 100 HDPVC COMMS CONDUITS
14.1 SAND CEMENT MIX

CONSTRUCTION PARTICULARS

11kV 624/1 - SUBSTATION TO POLE J51 - 19/0.092 HDBC
33kV 709 - 19/0.083 HDBC
33kV 743 - 19/0.092 HDBC
33kV 744 - 19/0.092 HDBC
ALL CONDUCTORS SAGGED TO F/21275 EXCEPT WHERE OTHERWISE SPECIFIED.
33kV 709 SUBSTATION-POLE 60 SAG 0.35m, TENSION 534N AT 21°C
33kV 709 POLES 60-59 SAG 0.55m, TENSION 534N AT 21°C
33kV 744 SUBSTATION-POLE 46CF SAG 0.55m, TENSION 534N AT 21°C
33kV 743 SUBSTATION-POLE 47CE SAG 0.915m, TENSION 1779.2N AT 21°C

NOTES

ALL CONDUCTOR SPACINGS ARE DRAWN
a) FEEDER 743 - LOOKING TOWARDS SEFTON SUBSTATION
b) FEEDER 744 - LOOKING TOWARDS CHULLORA SUBSTATION
c) FEEDER 709 - LOOKING TOWARDS CHULLORA SUBSTATION

RailCorp

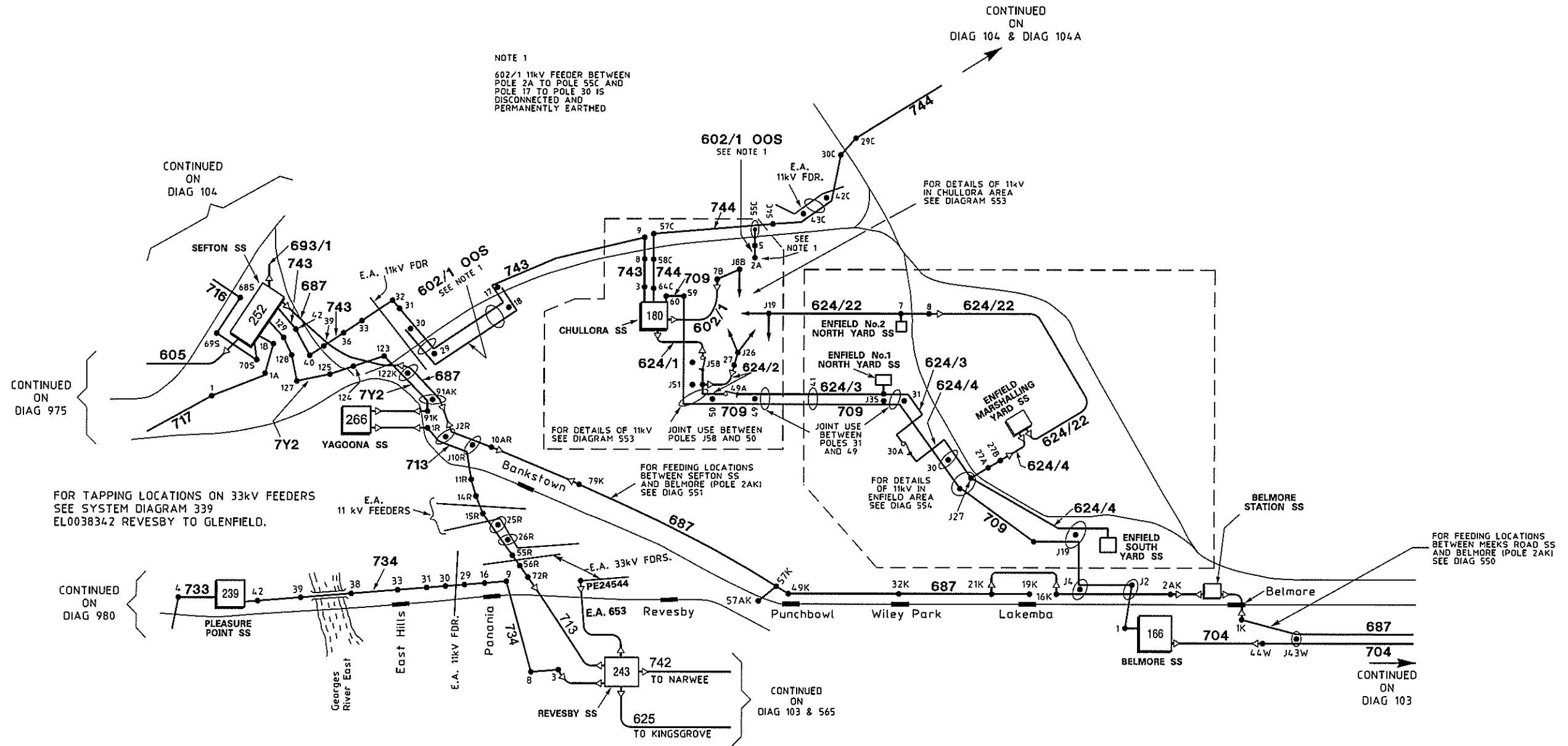
ENGINEERING & PROJECTS GROUP
Professional Services Division
ELECTRICAL DESIGN

RailCorp Design accepted for use by RailCorp

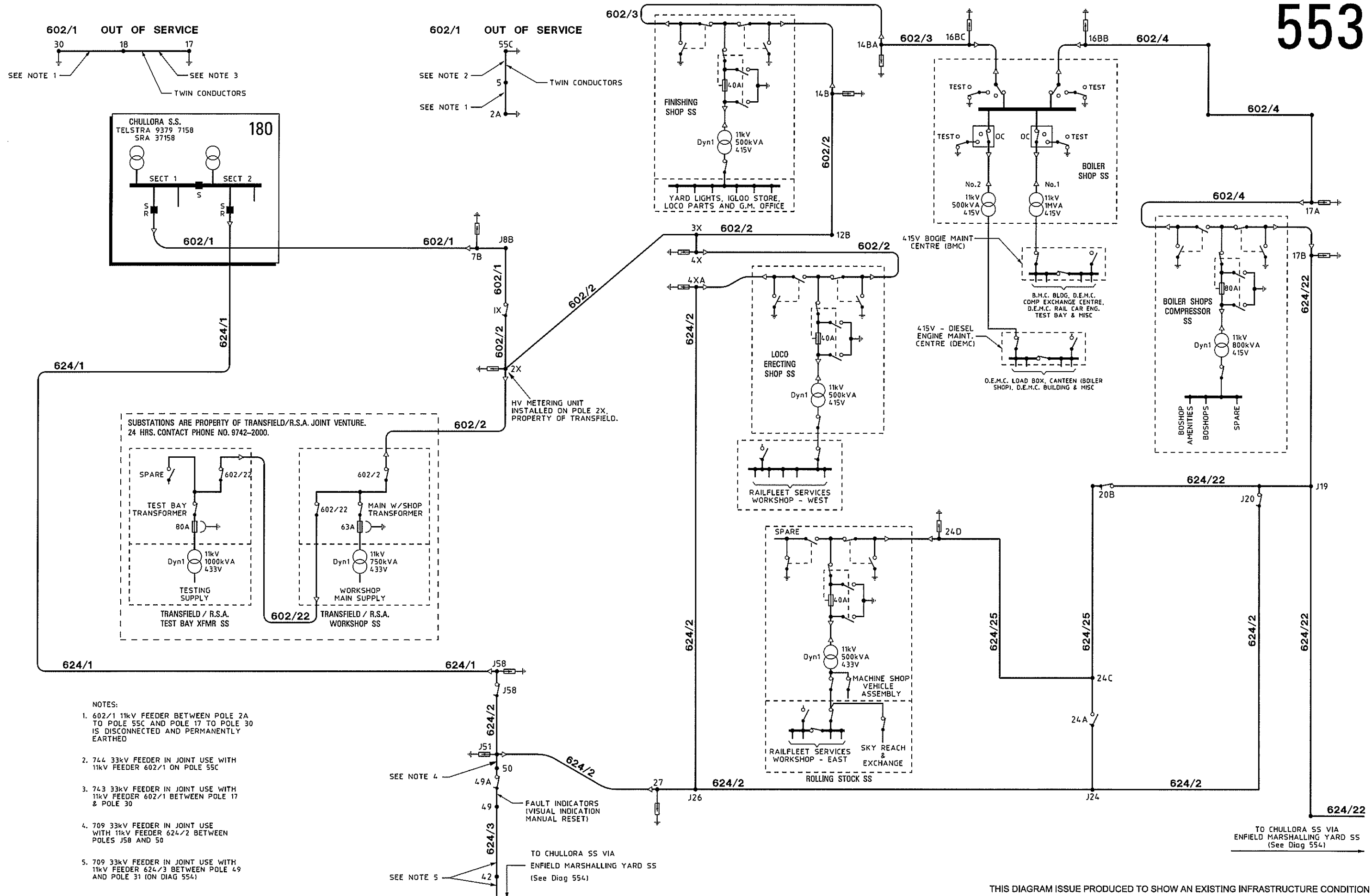
DRAWN A. McDougall
DESIGNED J. ROZENBLIT
DRG CHECK Z. MATOUSOVSKAIA
DESIGN CHECK P. RIZZO
APPROVED P. RIZZO 4-08-2010

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CHULLORA
CHULLORA JUNCTION - SEFTON JUNCTION FREIGHT LINE
HV AERIAL LINES AND CABLES
33kV AND 11kV FEEDERS
LAYOUT
FILE No. FSYD2015/2771
SHEET 3 OF 4
STATUS: AS BUILT
EL0287116



THIS DIAGRAM ISSUE PRODUCED TO SHOW AN EXISTING INFRASTRUCTURE CONDITION



THIS DIAGRAM ISSUE PRODUCED TO SHOW AN EXISTING INFRASTRUCTURE CONDITION



Appendix B

Hazard Log

PROJECT SPECIFIC RISK REGISTER: CHULLORA HV FEEDERS RELOCATION PROJECT

Project Code:			Project Name:		Chullora HV Relocation - Safety in Design Hazard Log		Issue Date:	9/9/2015	Review Date:		Rev. No (New revision of Log to be created at each Safety Hazard Analysis Workshop):						
Spreadsheet Notes: --->		1	Entries are limited to those contained in the Drop Down Menu		Entries are calculated by spreadsheet cell imbedded formula (need to ensure this exists and/or is correctly copied to other cells)		Entries in drop-down should be changed (in Drop Down Menu) as required										
Risk Identification							Risk Analysis (TfNSW Safety Risk Matrix)			Risk Evaluation and Treatment (TfNSW Safety Risk Matrix)						Monitoring, Review and Continuous Improvement	Action
Hazard Ref.	Project Phase Hazard First May Occur	Operating Mode	Hazard	Potential causes	Potential consequence(s)	Safety Controls currently in place (which are considered when determining the risk rating)	Consequence	Likelihood	Risk rating (cell formula used)	SFAIRP Justification Reference, Benefit Analysis or Description of Tasks Required to achieve SFAIRP	Hazard Status / SFAIRP Achieved	Additional Risk controls (operations and maintenance)	Consequence	Likelihood	Risk rating (cell formula used)	Accountability & Responsibilities (Risk Owner)	Notes and Comments
Chullora HV Feeders Relocation - Hazard Log																	
1. Proposed HV Relocation																	
1.1	Construction	Existing underground services close to proposed cable route	Clash with unidentified services including live cables	Contractor using excavating equipments	Injury, Electrocution, Damage to existing services	1. Check DBYD/DSS 2. Follow SWMS and RailCorp/ASA procedures.	Major - C3	Unlikely - L4	B - High	Further assessment will for clearance with underground services will be done in CDR stage	Being Reviewed		Major - C3	Unlikely - L4	B - High	Design and Construction	
1.2	Construction	Ground condition and excavation	Instability of excavations	Excavation close to the existing HV aerial lines	Destabilisation or damage to pole foundation	Overseer to inspect ground conditions during excavation and alert project engineer if conditions show instability	Moderate - C4	Unlikely - L4	C - Moderate	Chullora geotechnical report for the releve area shall be used for design	SFAIRP		Moderate - C4	Rare - L5	C - Moderate	Construction	
1.3	Operations	Ground condition and excavation	Instability of excavations at some future time when a steep embankment is located alongside the electrical easement	Excavation close to a steep embankment	Destabilisation or damage to embankment or collapse of trench	Overseer to inspect ground conditions during excavation and alert project engineer if conditions show instability	Moderate - C4	Unlikely - L4	C - Moderate	Civil design and trench route location to be coordinated during detailed design phase	Being Reviewed		Moderate - C4	Rare - L5	C - Moderate	Design	
1.4	Operations	11kV Aerial Feeder Earth Fault	Earth Potential Rise under fault conditions outside safe limits near HV poles	HV earth fault on Feeder 624/2 and 709	Public exposed to unsafe voltages under fault conditions, Major injury, Multiple Fatality	1. Design to standards 2. EPR study to determine extent of EPR.	Critical - C2	Unlikely - L4	B - High	Further earthing assement will be done during CDR stage	Being Reviewed		Critical - C2	Unlikely - L4	B - High	Design	
1.5	Construction	Construction crew working on site	Slip, trip, fall	stuck with uneven ground surfaces	Minor injury	1. Follow SWMS and RailCorp/ASA procedures. 2. Be extra vigilant during construction work	Minor - C5	Likely - L3	C - Moderate		SFAIRP		Minor - C5	Likely - L3	C - Moderate	Construction	
1.6	Construction	Construction crew working on site	Hit by traffic	Traffic along Worth St and Hume Highway	- Major injury, fatality	1. Follow SWMS and RailCorp/ASA procedures. 2. Follow instructions from protection officer and traffice controller	Critical - C2	Rare - L5	B - High	Traffice controller will be available for any work close to road	SFAIRP		Critical - C2	Incredible - L6	C - Moderate	Construction	
1.7	Operations	Large coonstruction equipments used for site development	Development work	Site development work may damage new cable route	- Damage to cable route, injury	1. Follow SWMS and RailCorp/ASA maintenace procedures. 2. RailCorp/ASA document SMS-06-GD-268.	Critical - C2	Rare - L5	B - High	- Warning signage shall be installed around the cable route	SFAIRP		Critical - C2	Incredible - L6	C - Moderate	Construction	



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