

# NEED/OPPORTUNITY STATEMENT (NOS)



Line 5A1/5A2 500kV Transmission Lines Renewal

NOS- 000000001278 revision 2.0

**Ellipse project no.:** P0005747

**TRIM file:** [TRIM No]

**Project reason:** Reliability - To meet overall network reliability requirements

**Project category:** Prescribed - Replacement

## Approvals

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<b>Endorsed</b>	Steve Stavropoulos	Transmission Lines and Cables Asset Manager
<b>Approved</b>	Lance Wee	Manager/Asset Strategy
<b>Date submitted for approval</b>	26 July 2016	

## Change history

Revision	Date	Amendment
0	24 April 2016	Initial issue
1	27 July 2016	Minor changes
2	10 November 2016	Update to format

## 1. Background

Line 5A1/5A2 is a double circuit steel tower 500kV transmission line between Eraring and Kemps Creek 500kV substations, with a route length of 143 km. The transmission line is a key link between generation from the Central Coast region and the Sydney metropolitan area. This transmission line was constructed in 1976 and consists of 312 structures. The majority of this line passes through isolated, heavily timbered ridgetops and State Forests. Within the Sydney basin, the line traverses small rural holdings and more populated suburban developments.

Condition assessment NACA-1278<sup>1</sup> performed in October/November 2015 has identified a number of issues with Line 5A1/5A2 which require rectification in the short – medium term to ensure that the asset remains operational in the long term. Corrosion of steel is the main contributing factor leading to a decline in the health of the asset.

## 2. Need/opportunity

Condition assessment NACA-1278 has identified issues which require rectification, these are summarised in Table 1.

**Table 1 – Transmission Line 5A1/5A2 Condition Issues**

Issue	Extent (% line)	Cause	Impact
Ground line corrosion of steel at footing	3%	Buried steelwork at footing	Steel corrosion of critical member, can lead to structural failure of tower
Buried concrete foundations	5%	Erosion of soil building up around footings	Accelerated corrosion of critical member
Corrosion of earth strap	1%	Corrosion as buried at footing	Possible transfer potential, earth current and voltage gradient issues, can lead to serious injury or possible death
Corroded fasteners	2%	Zinc galvanising end of life	Structural failure
Corroded insulators	5%	Corrosion of steel caps Zinc sleeve protection end of life	Conductor drop

The risk cost associated with the issues identified in Table 1 is \$0.91m per annum (refer Attachment 1). The most significant element of concern is conductor drop as a result of insulator failure.

Corrosion of steel caps and pins on ceramic insulators is a significant issue. Corona discharge at the base of the insulator cap on V-strings appears to cause localised melting of the zinc coating and subsequent rusting of the insulator cap. Climbing inspections have identified widespread corrosion of insulator caps, pins and rust staining. Records indicate that minimal numbers of insulators have been replaced. Asset Strategy Project No. 4995 requires 5 yearly sampling discs to conduct electro-mechanical testing.

<sup>1</sup> Refer [NACA-1278](#) on PDGS Need Site

Ground line corrosion of steel transmission tower legs is of also of concern with excess soil at the tower footings. As these are the critical load bearing members of the tower, they cannot be easily remediated if the condition passes a stage where rectification work is not possible.

Corrosion of fasteners and fittings is as expected given the age of the asset. These items are original and the sacrificial zinc galvanising layer has reached end of life. These items generally had a significantly thinner layer of galvanising at the time of manufacturing compared with the steel tower members due to fabrication processes. Fasteners also have no galvanising on the nut thread which explains their poor condition relative to the main tower steelwork.

The benefit of addressing the condition issues on Line 5A1/5A2 is to continue providing the service at a lower risk of failure.

### 3. Related needs/opportunities

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No related needs/opportunities have been identified.

### 4. Recommendation

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It is recommended that options be considered to address the identified need/opportunity by 2023.

# Attachment 1 - Risk costs summary

Summary of results is attached below. Refer to supporting document in PDGS for full risk assessment.

## Current Option Assessment - Risk Summary



Project Name: Line 5A1/5A2

Option Name: 1278 - Base Case

Option Assessment Name: 1278 - Base Case - Assessment 1

Rev Reset Period: Next (2018-23)

Major Component	No.	Minor Component	Sel. Hazardous Event	LoC x CoF (\$M)	Failure Mechanism	NoxLoC xCoF (\$M)	PoF (Yr <sup>-1</sup> )	Total Risk (\$M)	Risk (\$M) (Rel)	Risk (\$M) (Op)	Risk (\$M) (Fin)	Risk (\$M) (Pco)	Risk (\$M) (Env)	Risk (\$M) (Rep)
Conductor	2304	Insulators	Conductor Drop (Conductor)	\$4.95	Insulator Failure	\$11,402.73	0.01%	\$0.62	\$0.00	\$0.00	\$0.00	\$0.17	\$0.44	\$0.00
Conductor	2304	Insulators	Unplanned Outage - HV (Conductor)	\$0.00	Structural Failure	\$11.15	0.01%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Conductor 2	2304	Fittings	Conductor Drop (Conductor 2)	\$4.95	Fitting Failure	\$11,402.73	0.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Conductor 2	2304	Fittings	Unplanned Outage - HV (Conductor 2)	\$0.00	Structural Failure	\$11.15	0.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Earth Wire	0	Earth Wire (inc Joints)	Earth Wire Drop (Earth Wire)	\$1.40	Break	\$0.00	0.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Earth Wire	0	Earth Wire (inc Joints)	Unplanned Outage - HV (Earth Wire)	\$0.00	Break	\$0.00	0.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Earth Wire	768	Fittings (inc Attachment)	Earth Wire Drop (Earth Wire)	\$1.40	Fitting Failure	\$1,074.12	0.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Earth Wire	768	Fittings (inc Attachment)	Unplanned Outage - HV (Earth Wire)	\$0.00	Structural Failure	\$3.72	0.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Structure	1	Earthing	Uncontrolled Electrical Contact / Discharge (Structure)	\$0.00	Earthing Failure	\$0.00	10.83%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Structure	312	Steel Structure	Unplanned Outage - HV (Structure)	\$0.03	Structural Failure	\$10.47	0.02%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Structure	312	Steel Structure (inc Footings)	Conductor / Earth Wire / OPGW Drop (Structure)	\$5.22	Structural Failure	\$1,628.36	0.02%	\$0.29	\$0.02	\$0.02	\$0.08	\$0.20	\$0.00	\$0.00
								\$17.97	\$0.91	\$0.00	\$0.02	\$0.25	\$0.64	\$0.00

Total VCR Risk: \$0.00      Total ENS Risk: \$0.00

## **Number of Components**

The number of components used in the - Risk costs summary model has been derived as follows:

- > Steel Structures: The extent of the steel structures on the transmission line with advanced corrosion condition issues identified in Table 1 (5%) multiplied by the total number of original structures (312).
- > Steel Structure Earthing: The number of steel structures on the line in areas readily accessible by members of the general public (1).
- > Insulators: The extent of insulators on the transmission line with advanced corrosion condition issues identified in Table 1 (5%) multiplied by the total number of suspension insulators on the line (6 per suspension structure).

## **Probability of Failure**

As per - Risk costs summary model.

## **Consequence of Failure**

As per - Risk costs summary model.