

Revision History

This standard replaces amendment no 5. All changes are highlighted in this document with grey colouring.

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For any enquiries relating to the content of this document please contact the Standards Coordinator on 13 10 81.

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- **SDI 524 – Fencing and perimeter security at zone and transmission substations, and switching stations**
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1 Purpose

To set out in detail the minimum requirements for fencing and perimeter security at zone and transmission substations, and switching stations.

2 Scope

This instruction **must** be read in conjunction with SDI 505 - Minimum design and construction requirements for transmission and zone substations. It defines the minimum requirements for fencing and perimeter security in and around zone and transmission substations and switching stations.

3 References

External Regulations

Electricity Supply Act 1995 (as amended)

Electricity Supply (Safety and Network Management) Regulation 2014

Work Health and Safety Act 2011(NSW)

Work Health and Safety Regulation 2017 (NSW)

National Electricity (NSW) Law 1997

National Electricity Rules

External Standards

ENA National Electricity Network Safety Code (DOC 01-2008)

ENA National Guidelines for prevention of unauthorised access to electricity infrastructure (ENA Doc 015-2006)

AS 2067:2016 - Substations and high voltage installations exceeding 1 kV a.c.

AS/NZS 2312.1:2014 - Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings - Paint coatings

Company Policies and Procedures

Group Board Policy (Health & Safety) 3.0 – Work Health and Safety

Group Board Policy (Environment) 4.0 - Environment

Company Policy (Network) 9.2.5 – Network Asset Design

Company Policy (Network) 9.9.1 – Network Asset Maintenance

Company Procedure GSY 1066 - Worksite Hazard and Risk Assessment

Endeavour Energy Electrical Safety Rules

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Company Standards

Earthing Design Instruction EDI 516 - Major substation earthing design, construct and commissioning

Mains Maintenance Instruction MMI 0013 - Vegetation Clearance Management

Substation Design Instruction SDI 505 - Minimum design and construction requirements for transmission and zone substations

Substation Design Instruction SDI 509 - Fire hydrants

Substation Design Instruction SDI 510 - Buildings

Substation Design Instruction SDI 528 - Substation signs and equipment labels

Substation Design Instruction SDI 532 - Plumbing and drainage

Substation Maintenance Instruction SMI 100 - Minimum requirements for maintenance of transmission and zone substation equipment

Substation Maintenance Instruction SMI 119 - Transmission and zone substation data entry, asset structure and details

4 Definitions and Abbreviations

Abbreviation	Meaning
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SDI	Substation Design Instruction
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Intruder resistant fence	A fence designed to minimise the likelihood of access without the aid of tools.
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Term	Definition
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Ellipse	Endeavour Energy's asset management database
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5 Actions

5.1 General

All fenced areas **must** allow for the installation and maintenance of equipment and the movement of large items of plant and equipment such as low loaders, cranes, oil filtering units, generators and large power transformers.

Open style fencing **must** be used for the part of the fencing or gates that face the street and, wherever practical, **must** be used for all applications, as it is less subject to graffiti and allows potential problems at the substation to be readily seen.

The use of boundary fences to identify the perimeter of the site can be considered, and barriers such as fences, landscaping, dirt mounds or bollards **must** be used to limit the access of unauthorised vehicles to the site.

Where the requirements of this Standard are not practical for a particular site, written approval **must** be sought from the **Engineering Delivery Manager, Asset Planning & Performance** so that an approved solution can be developed.

5.2 Minimum design requirements

The design, materials and installation of all fences constructed in accordance with this Standard **must** fulfil their intended structural function (refer to SDI 505 - Minimum design and construction requirements for transmission and zone substations).

Metallic fence panels and associated fittings, rails and support posts **must** be protected with galvanising or equivalent. The minimum protective metallic coating classification **must** be Category C3, as defined in AS/NZS 2312.1:2014.

Where small amounts of the protective or aesthetic coating are removed during installation, protective paint and aesthetic coating (if applicable) **must** be applied to the affected area.

When barbed wire on fences is required, it **must** be heavy galvanised 2.5mm stranded barbed wire or equivalent (refer to clause 5.4.2).

The fence design and construction **must** consider the use of bushfire resistant walls in bushfire prone areas to reduce the risk of fire spreading into the substation or switching station. In addition, the vegetation around the substation **must** be cleared to safe distances as specified in MMI 0013 - **Vegetation Clearance Management**.

5.3 Location

When the location of fences is being decided, issues such as landscaping and earthing **must** be considered (refer to clause 5.11).

All fences (including all barbed extensions) and associated fence earthing **must** be kept entirely within the boundary of the substation site.

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5.4 Intruder resistant fences

5.4.1 General

All zone and transmission substation and switching station live and outdoor equipment, such as transformers, capacitor banks and switchyards, **must** be effectively enclosed by intruder resistant fences that comply with this Standard.

Intruder resistant fences and gates **must** provide a barrier that will minimise the likelihood of an intruder gaining unauthorised access to live equipment (or equipment that could be expected to become alive), or major equipment that is subject to vandalism, either over or through the fence, without external assistance or the use of hand tools.

An open style fence is preferred; however, the use of enclosed fencing, such as *Colorbond*, masonry/brick or timber cladding, may be considered where:

- ventilation of equipment does not need to be considered;
- the boundary is shared with a residential property;
- noise issues would be alleviated by its use;
- it is a local council requirement; or
- it is deemed to be the only suitable alternative after agreement with the Security Manager, Network Environment Assessment Manager and the Engineering Delivery Manager, Asset Planning & Performance.

Intruder resistant fences may require an alcove to accommodate the initial fire hydrant and hydrant booster (refer to SDI 509 - Fire hydrants).

5.4.2 Fence heights

The heights of intruder resistant fences (including gates) **must** be as set out below.

The effective height includes the barbed wire topping that may be required as an additional deterrent.

a. Fences with no adjacent climb points

Fences **must** be fitted with a barbed wire topping and they **must** have a minimum effective height of 3250mm.

Fences with effective heights of 4000mm or greater do not require a barbed wire topping.

b. Fences with adjacent climb points

Fences **must** be fitted with a barbed wire topping and they **must** have a minimum effective height of 3250mm above the climb point.

Angled metallic caps **must** be used as an addition to the barbed wire topping on masonry/brick fences to further minimise the likelihood of an opportunistic intruder gaining unauthorised access to the site.

5.4.3 Open fencing

Where intruder resistant open fencing requires a barbed wire topping (refer clause 5.4.2) it **must** comprise straight extension on top of the 2400mm (minimum) panel. The extension **must be** an 850mm long with 8 strands of barbed wire at equal centres.

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All intruder resistant open fences **must** be constructed from welded mesh that is manufactured from 4mm (minimum) wire.

The vertical wires **must** be at 75mm centres and the horizontal wires at 13mm centres. The horizontal wires **must** be on the outside of the fence.

The mesh panels **must** be joined only at the fence posts.

The posts and welded mesh **must** be securely fastened with tamper resistant self-tapping screws and washers to the fence posts equally spaced screws at maximum 200 mm spacings.

It is preferred that the metallic protective coating be applied during the manufacturing process after the fabric is welded.

A galvanised (uncoated) finish can be considered for remote locations; however, a powder-coated black or mist green finish, or other suitable colour approved by the Network Environment Assessment Manager, **must** be used in all other areas.

Where powder coated finishes are used, the connection points between the posts, panels and mesh **must** be such that there is electrical continuity of less than 20 milli-ohms across each section of the fence. It is preferred that this is achieved by masking adjoining sections and components during the powder coating process.

5.4.4 Solid fencing

Where intruder resistant solid fencing requires a barbed wire topping (refer to clause 5.4.2) it **must** comprise of a 45° inward crank, with four (4) equally spaced strands of barbed wire, with only the top strand visible from outside the fence.

a. Colorbond clad welded mesh

Where *Colorbond* fencing is used, the fence panels **must** be secured with non-removable tamper-resistant screws. *Colorbond* cladding **must** be fixed vertically onto the outside of the welded mesh panels and extend to the full height of each panel. Any additional rails required to allow the fixing of the *Colorbond* cladding **must** be fitted on the inside of the welded mesh panels.

Fence colour **must** be adjusted to suit, but as a guide dark green *Rivergum*, light green *Mist Green* or cream *Primrose*, or other suitable col or approved by the Network Environment Assessment Manager, **must** be used.

Changes to the typical welded mesh fence design will need to be considered to address fixing and mechanical issues, such as wind loading.

b. Timber clad welded mesh

Due to associated maintenance issues, timber clad welded mesh fencing may be considered only if other solid fencing types cannot be used.

Where used, the timber cladding **must** be fixed vertically to the outside of the welded mesh panels and extend to the full height of each panel. Any additional rails required to allow the fixing of the timber cladding **must** be fitted on the inside of the welded mesh panels.

Changes to the typical welded mesh fence design will need to be considered to address fixing and mechanical issues, such as wind loading.

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c. Masonry/brick

New masonry or brick fences **must** be installed with full flush mortar to avoid potential climb points. Angled metallic caps are required as an addition to the barbed wire topping on masonry/brick fences with adjacent climb points (refer to clause 5.4.2).

5.5 Secure working area

Where the normal work area is not within the intruder resistant fence, a secure area **must** be provided in order to provide safety for staff working at the site. This area **must** be surrounded by a secure fence or barrier and all major assets, vehicle and plant parking, equipment and at least one of the building's personnel doors **must** be accessible from within this area.

Depending on the site, various levels of security may be required for this purpose. Where the fence or barrier is shared with a residential property, the minimum height is 1800mm, however, where the fence or barrier is shared with a public or commercial/industrial property, a minimum height of 2400mm **must** be considered.

Access to and from this area **must** be through a lockable gate, in accordance with clause 5.13.

5.6 Non-intruder resistant fencing

Non-intruder resistant fencing may be needed on a site-by-site basis in areas that do not need to be effectively enclosed by intruder resistant fences.

The fencing **must** comply with the requirements of this Standard; and, its final design **must** be approved by the Security Manager and the Engineering Delivery Manager, Asset Planning & Performance in consultation with the Network Environment Assessment Manager and the Regional Transmission Manager.

The fencing does not need to be equal in design, configuration and construction to the intruder resistant fence, and fences to match the existing streetscape can be used, however, the use of timber fencing **must** be avoided due to the high maintenance requirements.

Where further protection is required, the use of fencing that offers higher security such as a palisade fence **must** be used. This higher security fencing **must** have a concrete kerb, and access to and from this area **must** be through a lockable gate, in accordance with clause 5.13.

5.7 Gates

5.7.1 General

All gates **must** be equal in design, configuration and construction to the chosen fence, and **must** provide the same effective height as the fence into which they are being fitted.

Where the site permits, all perimeter gates **must** open inwards only, towards the substation.

A concrete driveway or pad **must** be provided under all gates.

All gate locking pins and drop bolts **must** be fabricated using stainless steel.

Reference **must** be made to clause 5.11.

5.7.2 Personnel gates

Personnel access gates **must** be constructed within a suitable steel support frame.

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Fence openings **must** be nominally 2000mm high and 1000mm wide.

The personnel gate **must** be located typically adjacent to the main vehicle access gate. The number of personnel gates **must** be kept to a minimum at each site.

5.7.3 Vehicle and equipment access gates

The typical width of vehicle and equipment access gates **must** be 6100mm.

The use of barbed wire topping **must** not restrict the inward movement of the gate or present a hazard to large vehicles entering the site.

Access gates **must** have facilities so that they can be held in the open position.

Access gates **must** be secured with a sliding bolt and padlock, as well as interlocking tower bolts of a long slot design, to allow easy removal of debris. Bolts and locks **must** be on the inside so they are not accessible from outside the gate.

5.8 Typical arrangements

The following fence arrangements show the basic concepts relating to indoor substation (figures 1, 2 and 3) and outdoor substation (figures 4 and 5) intruder resistant and secure work areas.

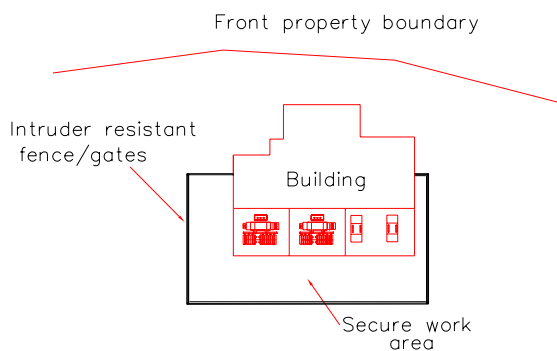


Fig. 1

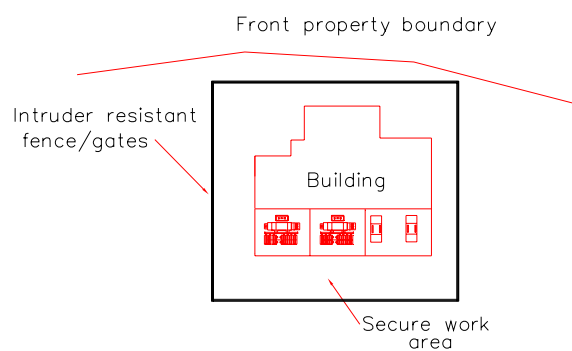


Fig. 2

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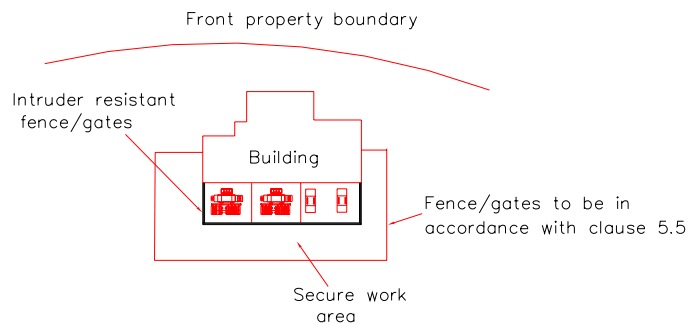


Fig. 3

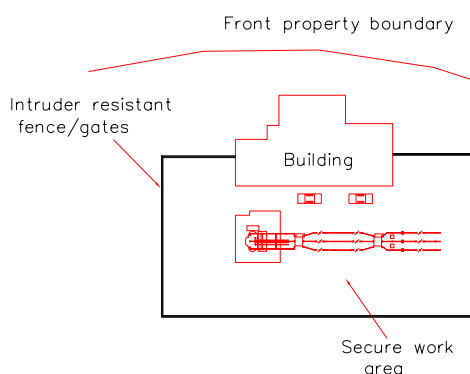


Fig. 4

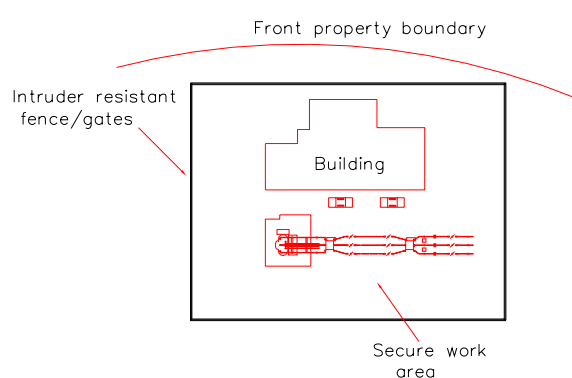


Fig. 5

Note: Additional fencing, such as boundary fencing, may be required at some sites on a case-by-case basis. Buildings that are not shown within the intruder resistant fence **must** comply with clause 5.9.

5.9 Buildings

Buildings that are located in areas subject to excessive graffiti and/or vandalism, or are located in high security risk areas **must** be protected by a fence. Intruder resistant fences, or non-intruder resistant fences that offer high security in accordance with clause 5.6 **must** be considered for this purpose.

Where buildings are not enclosed by an intruder resistant fence, the building **must** have the same level of security as the intruder resistant fence.

In addition to SDI 510 - Buildings, the minimum requirements for buildings that are not enclosed in an intruder resistant fence are:

- Doors **must** be solid block board core construction. Where a risk assessment identifies possible physical attacks on doors, steel clad doors **must** be considered.
- External doors **must** be fitted with hinge bolts and a protector plate over the lock latch.
- Grilles **must** be fitted to windows and other unsecured openings, such as pressure relief panels, using tamper resistant fasteners.

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- Access to the roof **must** not be able to be achieved without the use of climbing devices, such as ladders.
- There **must** be no building protrusions that could be used as climbing aids.

Where the building is used as an intruder resistant barrier, the minimum effective height of the building walls **must** be equivalent to the minimum effective intruder resistant fence heights indicated in clause 5.4.2.

5.10 Perimeter management

Consideration **must** be given to the balance between screening with manufactured objects or plants, and the security benefits of uninhibited visibility to staff and the general public.

To prevent people from concealing themselves or aiding their activities, vegetation **must** not screen the entire length of the substation perimeter.

Vegetation that could provide a climbing point, and all objects, including equipment and stores, **must** not be located within 2000mm of either side of the intruder resistant perimeter fence or intruder resistant barrier.

5.11 Earthing

Substation fences **must** be electrically insulated from the fences of neighbouring properties.

Allowance **must** be made to accommodate earthing equipment such as grading rings, external bitumen strips, additional earthing and additional separation from adjacent fences, structures or properties, if required.

All earthing requirements **must** be in accordance with EDI 516 - **Major substation earthing design, construct and commissioning.**

5.12 Signs

High voltage danger signs in accordance with SDI 528 - Substation signs and equipment labels, **must** be installed on every third fence panel as well as on each entrance to a substation enclosure or building. However, non-intruder resistant fences shared with private residential properties do not require high voltage danger signs.

Reference **must** be made to Drawing no. 057943, High Voltage Danger Sign.

Signs **must** be positioned at eye level, and installed so that they do not create a climb point.

Refer also to SDI 528 - **Substation signs and equipment labels.**

5.13 Locking

Provision **must** be made for secure locking of the entire substation.

The arrangement **must** allow locks on personnel gates to be locked and unlocked from both inside and outside the substation. Locks on vehicle access gates **must** be accessible from within the substation only.

Personnel gates **must** be secured using a stainless steel lock pin and padlock, protected by a sloping shield (or equivalent). This is to prohibit foot holds and prevent bolt cutters from cutting the lock.

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Padlocks **must** have a minimum-security standard of **intruder resistant**, as defined in the Security Construction and Equipment Committee, *Security Equipment catalogue*.

At the completion of a project, all locks on substation gates **must** be keyed to Endeavour Energy standard Abloy D4.

5.14 Concrete kerbs

To overcome factors that may compromise the integrity of the fence such as soil erosion or burrowing, concrete kerbs **must** be provided between the intruder resistant fence and the ground. They are also required under non-intruder fencing where higher security is required in accordance with clause 5.6.

The gap between the base of the fence and the concrete kerb **must** be no more than 50mm.

Concrete kerbs **must** be designed to limit the amount of cracking and they **must** be a minimum of 300mm wide by 150mm deep.

When the concrete kerb is located in a position that could bank up water, drain holes **must** be provided through the concrete kerb.

5.15 High voltage cages

As high voltage cages are within the intruder resistant fence, they only need to be surrounded by a standard chain wire fence with a lockable gate.

The lock **must** be keyed to Abloy D5, so that it is accessible only by authorised operators.

A sign in accordance with SDI 528 – Substation signs and equipment labels, **must** be prominently fitted that clearly identifies the area as a HV cage and warns against unauthorised entry.

The minimum effective enclosure height **must** be 1800mm; however, at existing substations, the height will be site dependant due to the need to maintain clearances from items such as overhead live busbars.

Gates **must** be the same height as the fence and have a minimum width of 1000 mm. The gate swing **must** be designed so that the gate can only open outward away from high voltage equipment.

The asphalt within the enclosure **must** extend to the edge of the HV cage's perimeter concrete kerb. The concrete kerb does not need to be equal in design, configuration and construction to the intruder resistant fence concrete kerb.

Earthing of high voltage cages **must** be in accordance with EDI 516- Major substation earthing design, construct and commissioning.

5.16 Demarcation fences

In substation switchyards with joint high voltage customer (HVC) and Endeavour Energy use, a small fence with gates and signage **must** be provided to clearly delineate between the different areas.

Standard chain wire construction can be used for this purpose; however non-metallic alternatives can be used if earthing issues are identified.

The fence and gate height **must** be 1800mm (typical).

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5.17 Drawings

Typical design drawings for welded mesh fences are listed below. Similar concepts from these drawings must be followed for solid fencing designs.

Drawing number	Title
057943	Zone substations high voltage danger sign 350mm x 700mm LG
366070 (Sheet 1)	Standard Palisade Fence and Gates for Transmission and Zone Substation Cover Sheet and Construction Notes
366070 (Sheet 2)	Standard Palisade Fence and Gates for Transmission and Zone Substation Fence and Gates Arrangement Elevation And Plan
366070 (Sheet 3)	Standard Palisade Fence and Gates for Transmission and Zone Substation Fence and Gates Arrangement Fence Arrangement Details
366070 (Sheet 4)	Standard Palisade Fence and Gates for Transmission and Zone Substation Gates Details Vehicle Gate Details
366070 (Sheet 5)	Standard Palisade Fence and Gates for Transmission and Zone Substation Gates Details Personnel Gate Details
366070 (Sheet 6)	Standard Palisade Fence and Gates for Transmission and Zone Substation Gate Details Vehicle Gate Locking Mechanism
518105 (Sheet 1)	Transmission and Zone Substation Perimeter Security Fence- 3280 High Cover Sheet & Construction Notes
518105 (Sheet 2)	Transmission and Zone Substation Perimeter Security Fence - 3280 High Plan and Elevations
518105 (Sheet 3)	Transmission and Zone Substation Perimeter Security Fence- 3280 High Fence and Gate Details
518105 (Sheet 4)	Transmission and Zone Substation Perimeter Security Fence- 3280 High Vehicle Entry Gate Details
518105 (Sheet 5)	Transmission and Zone Substation Perimeter Security Fence- 3280 High Personnel Gate
518105 (Sheet 6)	Transmission and Zone Substation Perimeter Security Fence- 3280 High Personnel Gate Frame Details
518105 (Sheet 7)	Transmission and Zone Substation Perimeter Security Fence- 3280 High Personnel Gate Details

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5.18 Approvals

Where a particular fencing or locking concept design has not been previously endorsed, the Designer/Project Manager **must** obtain approval for use from the **Engineering Delivery Manager, Asset Planning & Performance**.

6 Authorities and Responsibilities

The **Head of Asset Planning & Performance** has the authority and responsibility for **approving the amendments to this Standard in accordance with GAM0001**.

The **Engineering Delivery Manager, Asset Planning & Performance** has the authority and responsibility for keeping the content of this instruction is kept up to date.

The **Endeavour Energy Project Manager** has the authority and responsibility for:

- managing that fence construction and building and perimeter security is in accordance with this Standard and all other relevant Endeavour Energy Standards;
- maintaining that Energy employees and/or contractors engaged to perform the work have appropriate qualifications;
- verifying that the necessary concept design approvals have been obtained; and
- confirming that fence details are entered into the Endeavour Energy Ellipse database.

The **Security Manager and Engineering Delivery Manager, Asset Planning & Performance** have the authority and responsibility for promptly responding to the project manager's request for concept design approval.

The **Regional Transmission Manager** has the authority and responsibility for maintaining substation fences and barriers in a serviceable condition.

All **Endeavour Energy employees and contractors** have the authority and responsibility for:

- confirming that the requirements of this instruction and SDI 505 are met;
- working in accordance with local and statutory requirements;
- maintaining that public safety is not compromised; and
- working in accordance with Endeavour Energy's Electrical Safety Rules.

Produced by Asset Planning & Performance Branch

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