

Substation Landscaping

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EMS 0005 am3 – Substation Landscaping

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Contact Information

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1 Documentation Scope

This standard defines the necessary requirements where landscaping is required at Endeavour Energy's zone and transmission substations or switching stations. The landscaping may be a requirement of an environmental approval associated with the establishment of a new facility or the replacement or restoration of landscaping at an existing site.

All landscaping works must be carried out to comply with Endeavour Energy's landscape concept plan for that facility. The formation of that landscape concept plan will consider the requirements of this standard, Substation Design Instruction SDI 505 – Minimum design and construction requirements for transmission and zone substations and switching stations, and also incorporate any condition(s) of approval that may relate to any proposed landscaping, as contained in the Decision Statement in accordance with Environmental Management Standard EMS 0001 – Environmental impact assessment and environmental management plans when zone and transmission substations and switching stations are developed or refurbished.

2 References

External Regulations

Biodiversity Conservation Act 2016 (NSW)
Electricity Supply Act 1995 (NSW)
Environmental Planning and Assessment Act 1979 (NSW)
ENA National Electricity Network Safety Code (Doc 01-2019)
Planning for Bushfire Protection 2019 – Publication of NSW Rural Fire Service
State Environmental Planning Policy (Transport and Infrastructure) 2021

External Standards

Standard No.	Year	Title
4373	2007	Pruning of amenity trees
4419	2018	Soils for landscaping and garden use
4970	2009 (am 1 2010)	Protection of trees on development sites
4454	2012 (am 2 2018)	Composts, soil conditioners and mulches

Company Policies and Procedures

Board Policy (Environment) 4.0 – Environmental Sustainability
Company Policy (Network) 9.2.5 – Network Asset Design
Company Policy (Network) 9.7.1- Network Asset Construction

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Company Standards	
Environmental Management Standard EMS 0001	Environmental impact assessment and environmental management plans
Environmental Management Standard EMS 0004	Managing Vegetation Near Electrical Infrastructure and Pest, Weed and Disease Mitigation
Environmental Management Standard EMS 0013	Spoil and Imported Material Management
Mains Maintenance Instruction MMI 0013	Vegetation Clearance Management
Substation Design Instruction SDI 505	Minimum design and construction requirements for transmission and zone substations and switching stations
Substation Design Instruction SDI 510	Major Substation Building Design
Substation Design Instruction SDI 523	Switchyard surfaces
Substation Design Instruction SDI 524	Fencing and perimeter security at zone and transmission substations and switching stations
Substation Design Instruction SDI 527	Clearances
Substation Design Instruction SDI 536	Environmental considerations for transmission/zone substations and switching stations
Substation Maintenance Instruction SMI 106	Zone and transmission substation accommodation

3 Definitions and Abbreviations

Term	Definition
AS	Australian Standard
Authorised Person	An Endeavour Energy employee that has the required capabilities and has undertaken the relevant SER Online training to be deemed an authorised person on behalf of Endeavour Energy, to either Prepare or Determine a Summary Environmental Report (SER) or a Review of Environmental Factors (REF). If authorised to Determine an SER or REF, then the authorised person is given the authority to discharge the ANO's duty as a determining authority under Section 5.5 of the EP&A Act and prepare an accompanying Decision Statement. Refer to EMS 0001 Environmental impact assessment and environmental management plans for further information.
Decision Statement	A document which formally records a determination made by an authorised person on behalf of an ANO.
Landscape Concept Plan	A site specific design for a substation or switching station facility.
Landscape maintenance and warranty period	A prescribed period, typically 12 months, after the landscaping has been installed. During this period the watering, fertilising, weeding, re-mulching and replacement of any vandalised or failed plants is carried out in accordance with an approved landscape concept plan.
MMI	Mains Maintenance Instruction
SDI	Substation Design Instruction
SMI	Substation Maintenance Instruction
Substation	For the purposes of this standard, a substation infers an Endeavour Energy zone or transmission substation and switching station.

4 Technical Requirements

4.1 General

A landscape concept plan is formulated through the environmental impact assessment process in accordance with Environmental Management Standard EMS 0001 – Environmental impact assessment and environmental management plans prior to the refurbishment or development of substations.

All landscape concepts for substations will be designed, where practical, to complement the existing local environment surrounding these facilities, whilst aiming to minimise the maintenance costs of the landscape outcome. To this end, all landscape concept proposals will seek to positively enhance the aesthetic appearance of the overall image of the substation, and therefore minimise their visual impact on the surrounding environment.

Notwithstanding the above, public safety, security and reliability of the network and the access for essential substation maintenance work must not be compromised.

Any landscape plan developed specifically for any site must be complied with, and any landscaping established in accordance with such plans will continue to be maintained in accordance with that plan.

4.2 Considerations when developing a landscape concept design

A site assessment of each individual site should be undertaken during the development of the environmental assessment by the assessor before a landscape concept plan is developed.

At least one site visit is required to ascertain the prevailing characteristics of the site. Issues such as topography, slope, soil type, orientation, sunlight, and shading, the scale of surrounding buildings, visual prominence, potential maintenance costs and other local influencing factors will help to determine the ultimate landscape concept design and deliver the most effective result for the project.

4.3 Condition of approval for any development

The construction of a new substation or the refurbishment of an existing substation will require development approval in accordance with Environmental Management Standard EMS 0001 – Environmental impact assessment and/or environmental management plans. That approval will be contingent on a set of conditions contained within the Review of Environmental Factors (REF) and Decision Statement that must be met, which may include conditions with regards to landscaping requirements.

A landscape concept plan must be developed in conjunction with any proposed development plans for any substation. Although such developments are self-determined by Endeavour Energy under the Environmental Planning and Assessment Act 1979 and the State Environmental Planning Policy (Transport and Infrastructure) 2021, the formulation of landscape plans will also take into account the development controls and standards for landscaping under any relevant development control plans for that local government area.

The requirement for the implementation of a landscape plan will be included in the REF and Decision Statement for the proposed development. The actual implementation of the landscape plan will be the responsibility of the project manager managing the construction and/or refurbishment of the substation.

For new substation sites, input by an Environmental Specialist with regards to landscaping requirements should be made in the early stages of the procurement process of any land for the development. This early input will determine an appropriate and effective landscape concept design is accommodated in the preliminary design stages without compromising any aspect of the development. This will influence the amount of land purchased so as to accommodate the necessary setback of any fencing, buildings and yard equipment for security and access purposes (Figure 1 and Figure 2).

4.4 Consultation

The project team including Environmental Specialist will meet up and discuss the development of the landscaping plan and suitability for the site prior to engaging a landscape architect.

Prior to external consultation, the Authorised Person will consult with the ultimate asset owner and Substation Civil when developing the concept plan. As the asset owner and Substation Civil have the responsibility to maintain substation landscape post the warranty period, it is important that they are given the opportunity to comment and to provide maintenance costing considerations on the landscape concept plan.

Consultation with the local residents and other interested community groups may provide valuable input in the development of an appropriate landscape concept plan for the site. The community will have the opportunity to comment on the proposal following notification as part of the environmental impact assessment process in accordance with Environmental Management Standard EMS 0001 – Environmental impact assessment (i.e. will be carried out as part of Endeavour Energy's Consultation Protocol and requirements per the EP&A Act and SEPP (T&I)) and environmental management plans.

4.5 Local environment in the vicinity of the substation or switching station

The local environment immediately surrounding the facility to be landscaped should be considered and be an influence in the formation of the landscape concept plan.

For instance, a substation that is located in an urban street containing residential dwellings and formal gardens containing exotic species may result in a more formal landscape concept design proving more suitable for the site. Alternatively, a substation located in a naturally vegetated environment, for example within a bushland setting, may lead to the development of a more informal concept design containing native species.

Broadly the land uses surrounding the substation could be classified into the following categories:

- Residential.
- Commercial/business.
- Rural/village.
- Industrial.

4.6 Visual impact

The extent of the landscaping required for a substation will be influenced by the level of visual impact afforded by its location. The land uses surrounding the site will therefore be a strong influence on the level of potential visual impact and, in turn, the level of mitigation required from the landscape concept design.

However, the surrounding land use should not be the sole determining factor for the level of landscaping required. Locations will exist where the substation has a relatively low level of visual impact, even though it may be located within a highly patronised area.

Generally, outdoor substation arrangements are considered to provide a much higher level of visual impact than indoor substation arrangements.

4.7 Corporate responsibility

The appearance of any substation and level of maintenance provided will reflect directly on Endeavour Energy's corporate image.

4.8 Security and fencing arrangement

The security of a facility is of paramount importance when developing the landscape plan.

The removal of all vegetation within a clear three metre area around the fence line, denoted as the security zone, has generally been adopted. As such, the overall depth of the landscaping allowance within the landscape concept plan will be a combination of the security zone (three metres) and the minimum actual landscape depth (determined by the crown diameter of the proposed tree or shrub) as denoted in Figure 1 and Figure 2.

4.9 Specific location of landscaping on site

Typically, there are two possible locations available for the implementation of landscaping at substations and switching stations:

- external to the substation perimeter fence; or
- along the roadside nature strip.

An assessment will need to be made on an individual site basis to determine the appropriate location for the installation of any proposed landscaping, and have regard to the following:

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- Safety clearances of the proposed landscaping and the electrical equipment and power line landing spans (refer also to Mains Maintenance Instruction MMI 0013 – Vegetation Clearance Management and Substation Design Instruction SDI 527 – Clearances).
- Consideration of bushfire risk as per Mains Maintenance Instruction MMI 0013 – Vegetation Clearance Management (refer to Section 4.12 below).
- Vandalism and theft of landscaping
- Available planting space outside and/or inside the security fence including a consideration of the security zone and the locations of any overhead and/or underground services (determined by cable searches and incorporated into the landscape concept plan). Endeavour Energy must provide the project's concept design drawings which contain underground assets to the landscape architect to indicate on landscape design.

Because of the characteristic features of the site, including site specific limitations, alternate or additional locations for landscaping opportunities may have to be considered. Such locations may not be in the immediate vicinity of the site. However, they may still be an effective mitigation strategy to reduce the visual impact of the facility and should be considered as a component of the environmental assessment.

4.10 Condition of the existing landscaping at any substation or switching station

Any existing remnant and viable vegetation that will not compromise the operation of the facility should be retained if it is determined it will enhance the landscape concept plan and not jeopardise the security of the facility or add to unnecessary ongoing maintenance costs.

In the case for existing substations, some level of landscaping will typically be pre-existing. Where the landscaping of these sites is planned, assessment will determine whether the project should be one of restoration of the existing landscaping or whether a totally new landscape concept plan should be developed and implemented. In some cases, the existing vegetation will be commensurate to a threatened ecological community and additional plantings will consider the scientific final determinations for species listings.

The following considerations will be made in this assessment:

- Species of plant(s) within the existing planting.
- Security of the facility and the availability of any climbing points that may be present on existing vegetation.
- Health and projected longevity of these plants.
- Effectiveness of that species in that location.
- Overall anticipated success in the restoration of any planting.

4.11 Substation layout

The assessment for the landscape concept plan should include consideration of the layout of the substation, that is, outdoor or indoor type. This may influence the potential security and safety risks associated with any proposed landscape concept design, and in turn influence the design of such landscaping.

An outdoor substation arrangement is generally considered to have inherent features which provide a greater visual impact than those features generally associated with indoor substation arrangements. It is in this context that the screening qualities of any proposed landscaping for outdoor substations is therefore more critical and the allowance for available landscaping space in the preliminary design phase of the substation layout, more crucial.

4.12 Bush fire prone areas

Consideration must be given to the type and density of vegetation used near to facilities located in bush fire prone areas where nearby vegetation could be a fire risk. Advice sought from an appropriately qualified bushfire consultant and Mains Maintenance Instruction MMI 0013 – Vegetation Clearance Management should be incorporated into the landscaping concept plan for substations located in bushfire prone areas.

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Reference should be made to the NSW Rural Fire Services, *Planning for Bush Fire Protection* publication for more information.

4.13 Landscape concepts

4.13.1 Plant species type

- **Native**

The planting of native species is highly recommended, and in certain natural settings, native species are the most suitable species to use. However, each site and individual species should be assessed to determine the preferred species for each situation. Some native species are relatively short lived and as these substations are not replanted on a frequent basis a depleted landscape can often result where short lived plants are used.

Preference, where practicable, will be to select native species that do not shed branches nor require frequent pruning and have limited growth (radius and height) so as to not present a risk to the substation and equipment, and increase long-term maintenance costs.

- **Longevity**

The longevity of the proposed species should be one of the prevailing factors in the choice of any plant for landscaping purposes. That is, the longer the life expectancy of the plant the more appropriate that species will be for the purposes of such landscape concept designs.

4.13.2 Trees

The tree species selected should be of a species type not renowned for the propensity to shed limbs readily or be prone to be uprooted in strong winds. Rather, trees should be selected where they can be used in an effective manner to enhance the appearance of the facility (Figure 3).

Fast growing trees that may introduce unnecessary pruning issues and deciduous trees due to leaf litter build up are to be avoided where possible.

4.13.3 Landscape height and density

The predicted landscape density should be considered when developing the landscape concept design. Each individual location may demand variations on the density of any proposed landscaping.

Where possible (space permitting), a landscape concept design that incorporates the planting of large trees may be appropriate where nearby taller buildings dominate the surrounding environment. A landscape concept design incorporating such trees will also soften the visual impacts associated with taller aspects of the substation electrical equipment such as any landing spans and lightning masts. Clearly, such vegetation would not be planted in the vicinity of such equipment, but would be planted as a foreground screening (Figure 3, refer also to Mains Maintenance Instruction MMI 0013 – Vegetation Clearance Management and Substation Design Instruction SDI 527 – Clearances).

The predicted height and density of any individual plant species will determine the effectiveness in using that species as a screening plant. Small token plantings of ground covering plants or grasses do little to enhance or mitigate the visual impact of substations (Figure 4).

Group plantings of dense, globe shaped shrub species with sufficient height (some 3-5 metres) to afford some mitigation of the more visually prominent aspects of the substation are preferred when choosing a medium height screening (Figure 5 and 6).

The selection of medium height sized (approximately 5-7 metres) domed shaped trees generally provide an effective screening of the majority of the elements considered to afford most of the visual impact in any substation outdoor switchyard (Figure 7).

4.14 Imported Material

Any imported material used for landscaping purposes must comply with AS 4419, relevant NSW EPA resource recovery orders and resource recovery exemptions, and Environmental Management Standard EMS 0013 – Spoil and Imported Material Management. Further guidance on controls required when importing material (such as soils, mulch, aggregate etc) can be found in Environmental Management Standard EMS 0013 – Spoil and Imported Material Management.

4.15 Maintenance

The maintenance of any landscaping is essential and will determine the continuing overall effectiveness of that landscaping. Failure to carry out follow-up maintenance or carrying out only token maintenance, will more than likely lead to the failure of the landscaping.

A minimum landscape maintenance and warranty period of 12 months should be incorporated into any landscape project. During this period, maintenance will include the watering, fertilising, weeding, re-mulching (75-100mm thickness) and replacement of any vandalised or failed plants in accordance with an approved landscaping plan. During the maintenance period, the engaged contractor maybe required to supply their own water.

Substation landscaping must be maintained into the future in the manner in which it has been originally established. This will be undertaken through the provision of the landscaping plan to Substation Civil by the project manager during the handover process to enable the maintenance prescriptions set down in this plan to be followed.

The maintenance of substation landscaping by Substation Civil must consider the three metre security zone. Trees and tree branches within the three metre security zone that may be used to climb security fencing should be removed where an assessment has determined that they are likely to provide unauthorised access to substations. However, if the vegetation within the three metre security zone is not presenting potential access points by climbing and is not preventing passageway for the inspection of the fence line, the security zone should be relaxed and not be considered mandatory (Figure 8 and Figure 9).

An assessment should be undertaken to consider the potential effect on the visual appearance of the crown of such trees or shrubs in these areas prior to any maintenance works being undertaken. This assessment will be used as a guide for the tree worker in the execution of this trimming, with the aim being to leave the tree in a reasonably aesthetic state as a result of this work.

The removal of trees surrounding facilities may be subject to approval and trigger consultation requirements with Councils and neighbouring landowners. Substation Civil will consult with the relevant Environmental Specialist in these circumstances. Where this level of maintenance is required during the landscaping warranty period, the relevant Environmental Specialist will determine if there are any additional approval requirements (e.g. for threatened ecological communities).

5 Authorities and Responsibilities

Chief Data, People and Sustainability Officer has the authority and responsibility for approving this standard.

General Manager Future Grid and Asset Management has the authority and responsibility for endorsing this standard.

Head of Sustainability has the authority and responsibility for administering this standard.

Project Managers and Design Engineering Specialists have the responsibility for monitoring that the requirements of this standard are met.

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Environmental Services Manager and Environmental Specialists have the responsibility for:

- providing advice on the approval requirements associated with the design and maintenance of vegetation surrounding substations and switchyard stations.

Substation Civil has the responsibility for:

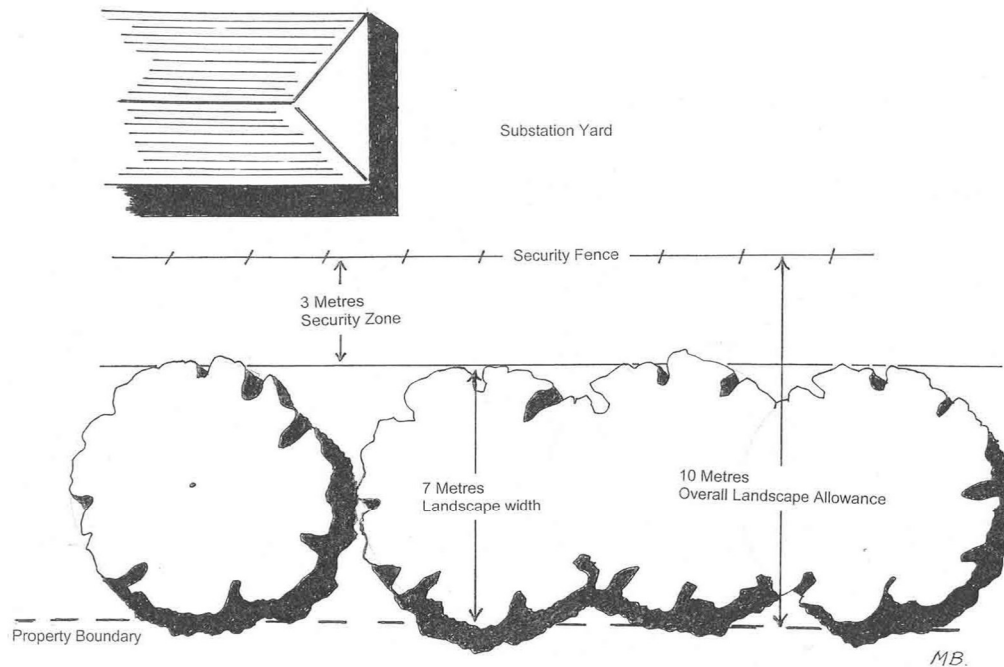
- the maintenance of substation and switching yard landscaping during and after the prescribed landscape warranty period in accordance with the landscaping concept plan and in consultation with the relevant Environmental Specialist; and
- monitoring that maintenance requirements of this standard are met.

Endeavour Energy employees and/or contractors have the responsibility for:

- monitoring that the requirements of this standard 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.

Appendix A- Figures

Figure 1 Calculating landscape width when planting outside a security fence of a substation/switching yard (note depth of the actual area required for landscaping will vary)



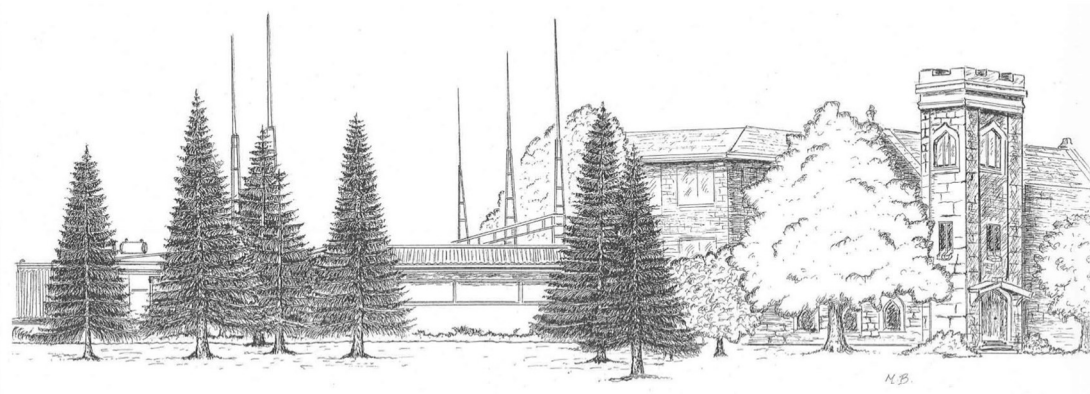
The depth of the actual area required for landscaping will vary according to the bushfire risk and the landscape concept proposed. As a minimum guide, the mature crown diameter of the proposed tree or shrub together the three metre security zone will indicate the very **minimum** depth of the actual landscaping area. The depth of the overall landscaping allowance required from the security fence line in this instance will be 10 metres (three metres – security zone) + seven metres (mature crown diameter of tree).

Note: This is allowing for a single row of planting, planted at the midway point of the landscape bed. The actual landscaping depth and landscaping allowance will need to increase should the landscape concept require a staggered planting configuration.

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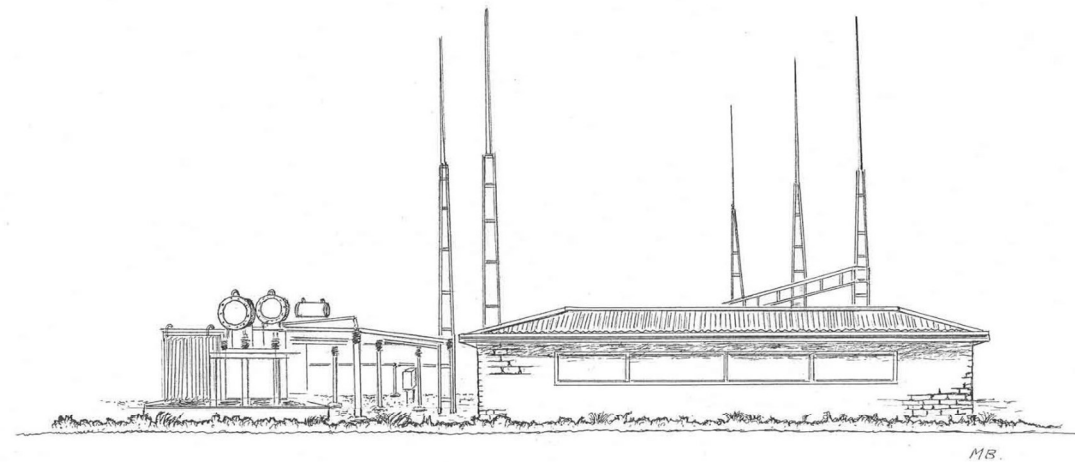
Figure 3 Landscape concept plan using large trees planted to provide screening scale

A landscape concept plan design that incorporates the planting of large trees may be appropriate where nearby taller buildings dominate the surrounding environment. A landscape concept design incorporating such trees will also soften the taller aspects of the substation electrical equipment such as any landing spans and lightning masts. Obviously such vegetation would not be planted in the vicinity of such equipment but would be planted as a foreground screening if space permits.



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Figure 4 Token or minimal landscaping height

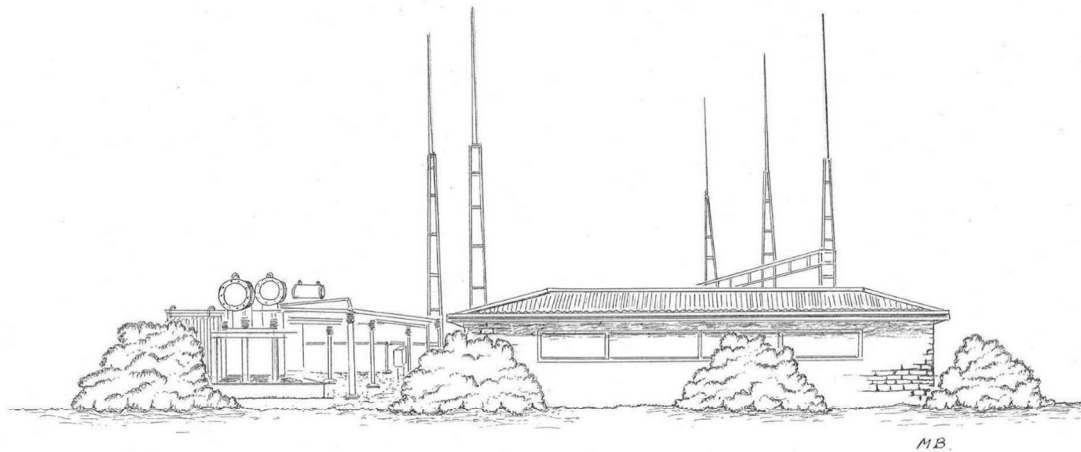


This type of landscape treatment using low growing plants such as low shrubs, ground covering plants or grasses generally does little to reduce the overall impact of the substation or switching station's visual appearance.

This type of treatment is particularly ineffective when used with an outdoor switching arrangement. The only situation that this type of treatment would possibly be employed is where an indoor switching arrangement exists. This treatment, however, is considered token and generally ineffective for screening purposes. In addition, this type of landscaping is more susceptible to weed infestation, potentially introducing more costly and frequent management practices, and if left untreated, a poor corporate image associated with the site.

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Figure 5 Spaced shrub planting

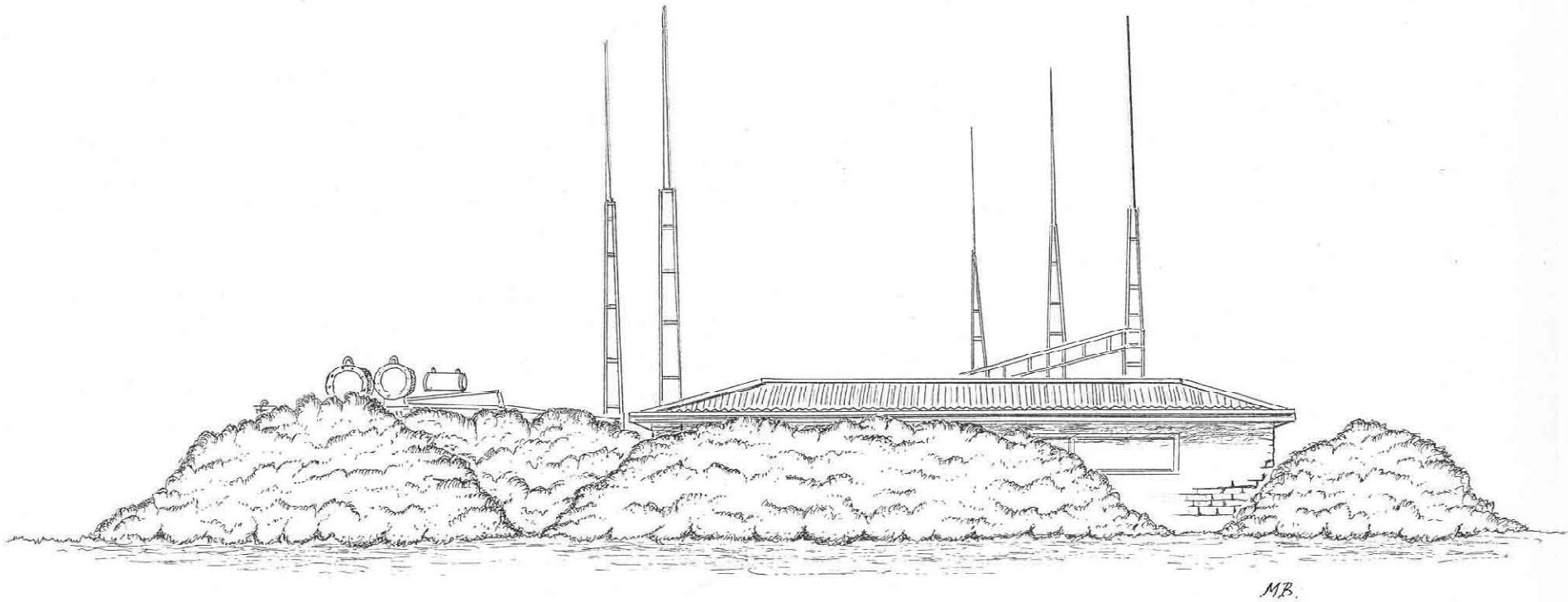


The major area that presents the greatest level of visual impact in substations with outdoor switching arrangements is from ground level to the top of the electrical power transformer and the electrical busbar. This area is generally the most visually complex and 'industrial' in appearance and is the area that benefits from visual screening.

Dense, globe shaped shrubs of approximately three to five metres in height are most useful in screening this area. Due to security concerns a "broken" or spaced arrangement is preferred to allow for some view into the substation yard. This however reduces the overall effectiveness as compared to a continuous shrub planting as shown in Figure 5.

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Figure 6 Continuous shrub planting (or hedge planting)

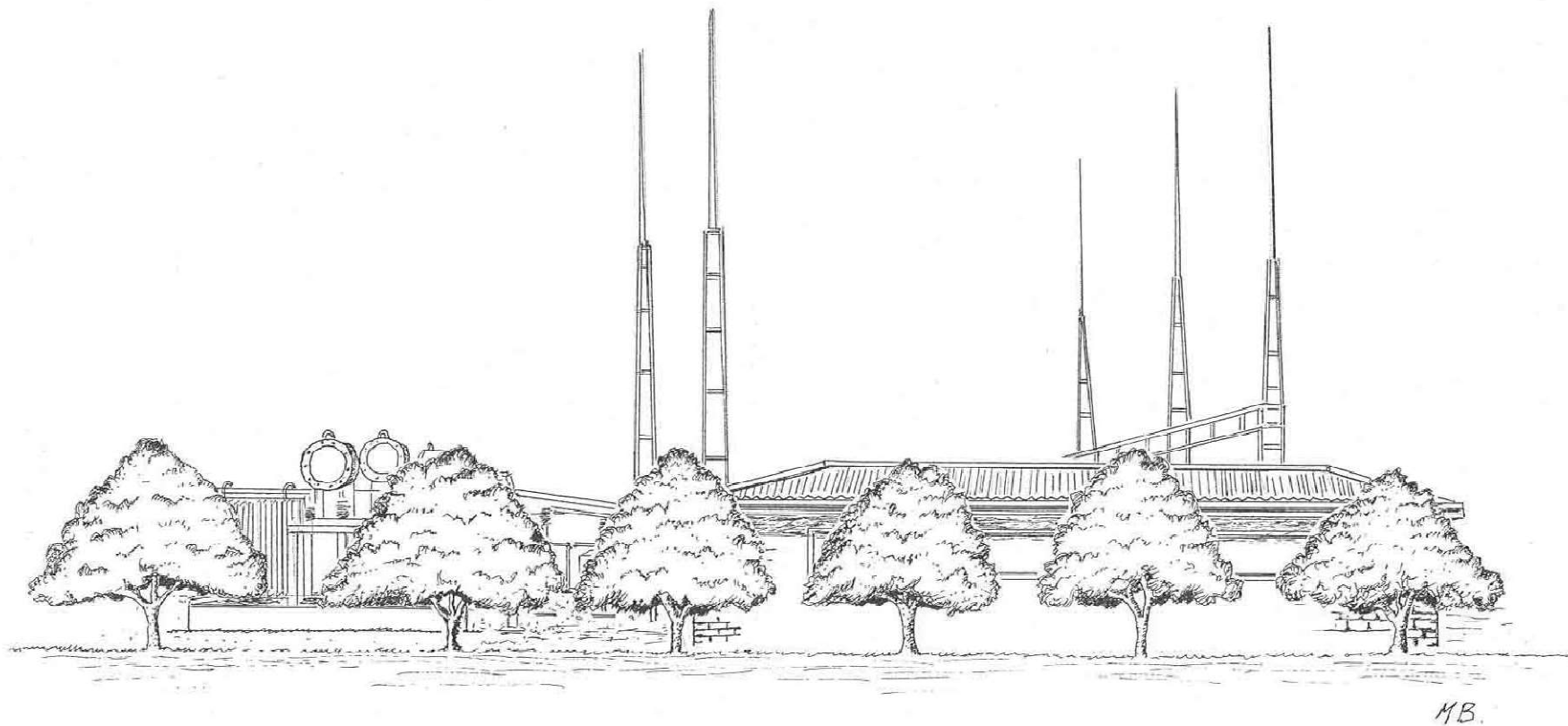


The major area that presents the greatest level of visual impact in substations with outdoor switching arrangements is from ground level to the top of the electrical power transformer and the electrical busbar. This area is generally the most visually complex and 'industrial' in appearance and is the area that benefits from visual screening.

Dense, globe shaped shrubs of approximately three to five metres in height are the most useful in screening this area. A continuous screen planting will provide the optimum screening but somewhat reduce the visual security of the site. However, the visual security of many sites is already reduced due to the close proximity of taller adjacent buildings, solid fences, homes or the substation control building itself.

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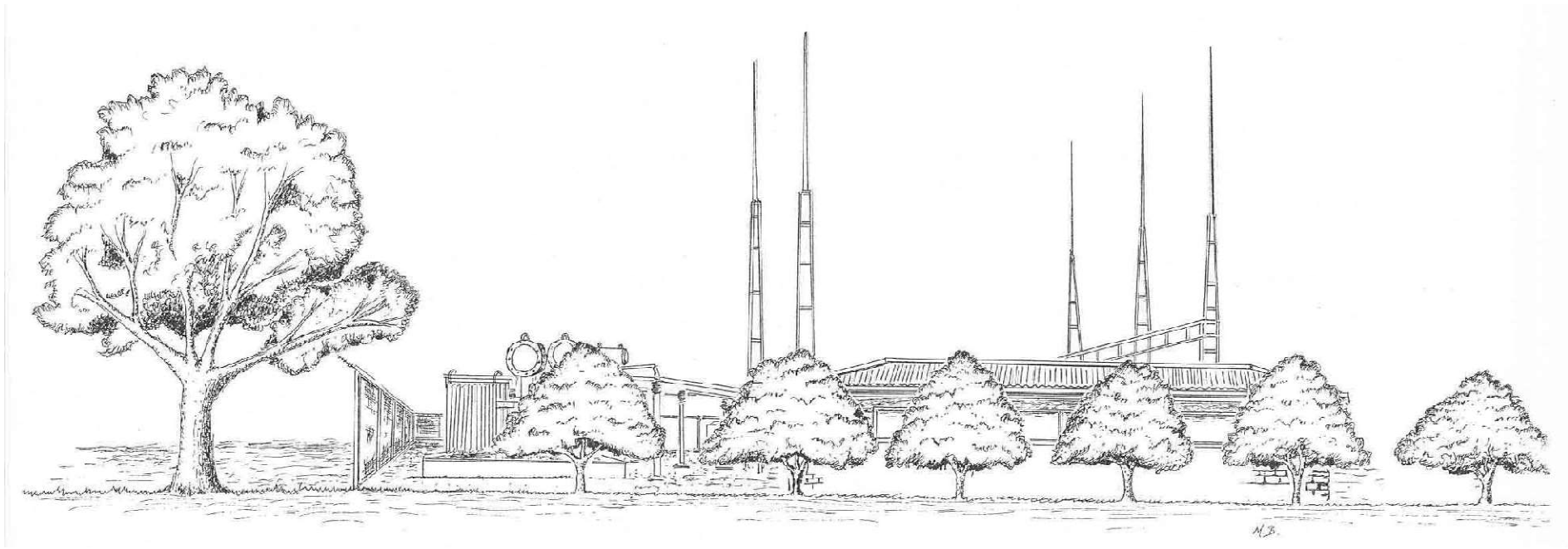
Figure 7 Medium sized trees spaced



To provide maximum screening potential and to allow some vision inside the substation yard the landscape concept plan should consider a spaced landscape of medium sized trees five to seven metres in height which species characteristically present a thick domed shaped crown. The crown of such trees will cover or screen the majority of the area considered the most visually prominent, that is, the power transformer and the outdoor yard equipment.

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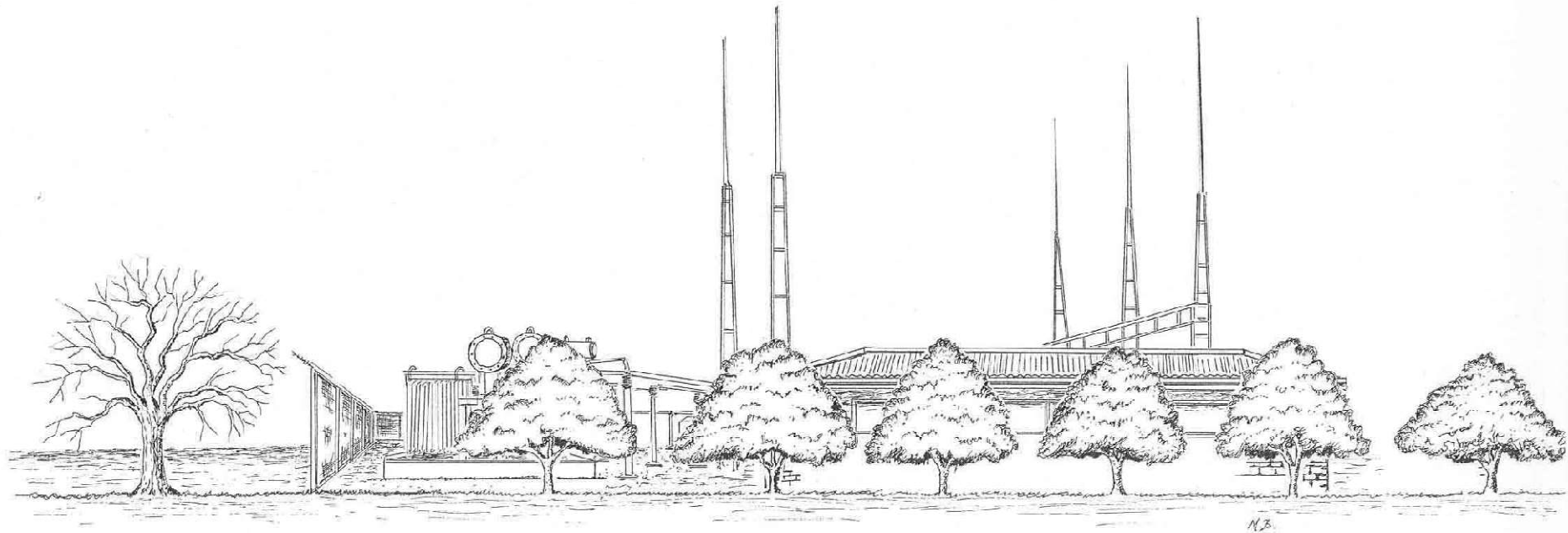
Figure 1 Removal of tree branches for substation security



The removal of substantial tree branches (able to support a person) near security fences will remove that means by which a person could illegally enter any substation facility. The cleared three metre security zone corridor has been adopted as the distance to guide the assessment of any such vegetation. However, this does not refer to the removal of small frangible branches which would not support the weight of a person even though those branches may be within the three metre zone unless those branches are preventing access for the inspection of the security fence. The final overall appearance of the tree or shrub should be considered prior to the removal of any branches. Such consideration may influence the extent of any contemplated branch removal.

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Figure 9 Branches within the inspection zone but do not present a security threat



Many trees or shrubs that are growing within the inspection zone do not present a threat to security. They are frangible branches that do not support the weight of a person and should not be considered a threat to security. If they are not preventing access to the inspection zone they should be retained, providing the tree or shrub with its natural form.

