7.0 IMPLEMENTATION STRATEGY

7.1 Urban Design Implementation

The strategy adopted for the project to minimise risk is to ensure that the urban and landscape design consultants who have prepared this aspect of the concept design remain fully involved in the Project through to completion of construction.

The methodology proposed is:

- Full participation of the urban and landscape design consultants in all aspects of project design development, detailed design and documentation which are relevant to urban and landscape design. The consultants will be involved in engineering design team meetings and processes to the full extent necessary to achieve this commitment;
- Full construction documentation by the urban design consultant of all structures not documented by others. Where structures are documented by other members of the project team (primarily the engineering consultants), the urban designer will thoroughly and consistently review and mark up their construction drawings in relation to the urban design aspects of the structures to ensure appropriate outcomes which are consistent with the design principles and quality established in this report;
- Regular and comprehensive reviews of the design up to 100% Detail Design are required by the RTA's Urban Design representative; and
- Attendance at the construction site on a sufficiently frequent and as required basis to ensure that, for all urban design components, design changes which arise during construction, construction standards generally, the quality of materials and finishes and the selection of colours and finishes not already specified are all in accordance with the construction documents and/or to the level of quality envisaged in this proposed design and established in the detailed design.

7.2 Landscape Implementation

The upgrade nature of this project makes the implementation of landscape works both piecemeal and subject to existing conditions. Despite this, landscape re-vegetation works need to consider the implementation strategy as a whole considering all inputs from ground conditions, slopes and access to create a sustainable and long-term solution. The soil preparation will form a critical component of this response particularly where addressing the management of cut slopes.

7.2.1 Clearing and Construction Protocol

Seed for planting or seeding operations is to be collected as part of the works from remnants within the corridor and/or from adjoining reserves. Collection of local seed will ensure that the community is maintained and enhanced along the corridor. The ability to collect seed will be influenced by the timing of construction and the need for seed for re-vegetation. In some instances, stock seed may need to be used to achieve construction objectives. In such instance seed should be sourced from the Sydney Basin as a minimum.

Clearing limits will be restricted to the footprint of the works, plus a 5 metre margin for movement and operational envelopes, in order to minimise disturbance and reconstruction on adjoining landscape zones. This extent will be delineated by the use of construction paraweb fencing or similar with signage indicating that the area is an "environmental area with no construction work allowed".

Generally material cleared from site (both vegetative and soil) should be disposed of off site. This reflects the presence of significant weed populations within the corridor and the difficulty in managing the control of these weeds and storage within the work area.

Large native trees required to be cleared could be used for habitat creation, hardwood milling or mulched if space and time makes this an effective operation.

7.2.2 Cultivation of Sub-grade

The cultivation of sub-grade is a critical component of the soil preparation in terms of successful plant growth. If a compacted soil or rock profile is present it may be difficult to both successfully key in topsoil but also to maintain a level of moisture to the plant and sufficient media to ensure stability of the plantings in the long term. In preparing the sub-grade it should be ripped to a depth of 200mm to facilitate the achievement of this objective.

Prior to ripping, the slope should be assessed by the project geotechnical engineer and landscape architect, in terms of stability and the potential for landscape rehabilitation. Re – vegetation of batter slopes will only occur where the exposed material is weak and is unlikely to be stable in the long term and is at a slope flatter than 1:2.

To ensure the support of strong stable plant growth, the assessment of slope material strength and potential for amelioration will be undertaken progressively as part of the implementation process. Design response may need to be varied to reflect conditions discovered on site.

7.2.3 Topsoiling and Fertiliser

Topsoil is to be imported for all landscape works. This is based on the altered nature of the site soils, the lack of potential material stripped from site and the significant weed presence within the corridor.

Generally spread soils at the following depths;

- Landscape Treatment Type 1 - 200mm of quality garden bed mix 60% loam: 20% sand: 20% organic material.
- Landscape Treatment Type 2 - 150mm General Garden bed mix
- Landscape Treatment Type 3 - 150mm General Garden bed mix
- Landscape Treatment Type 4 - n/a
- Landscape Treatment Type 5 - 75mm General Garden bed mix
- Landscape Treatment Type 6 - 150mm Turf Underlay composed of 80% loam: 20% sand

General garden bed mix should be a low phosphorous, low nitrogen mix suited to native plants. A mix with low nutrient levels should also limit weed potential enhancing the ability to resist weed growth. The potential to utilise sandstone quarry fines as a mix will be investigated in the design development phase.

Testing of soil to be used for the project is to be done prior to delivery to the site.

The application of organic fertiliser will be undertaken to all areas and will be included as part of the hydro mulching application or as part of soil amelioration.

7.2.4 Mulching

Mulching will be provided for all garden beds, and planted areas. Imported woodchip mulch will be used for all mass plantings, medians and individual plantings.

Site mulch if able to be sourced from grubbing and clearing will be used as a mulch ring at 50-75mm deep to all individual plantings. Mulch rings are to be 1 metre diameter.

7.2.5 Plant Material

A temporary vegetation cover crop is to be sown on all disturbed areas, soils stockpiles and interim works at a rate of 65kg per hectare. For longer term stockpiles a perennial crop will be used.

7.2.6 Seed Mixes

Seed collection is to be carried out by experienced seed collectors in a manner that preserves the parent plant and that removes only a small percentage of reproductive material from the overall population in a particular area, in accordance with Flora Bank guidelines.

Seed shall be gathered from remnant vegetation within the corridor or from reserves adjoining the corridor.

Propagated material will be used to re-vegetate disturbed areas located adjacent to the naturally occurring population of this species if habitat conditions are suitable.

The following planting methods and plants sizes will be installed as part of the re-vegetation works. Seeding Mixes are composed of the component listed in Table 7.2.6 Seeding Mixes.

A number of different mixes are to be developed to reflect the various plant communities along the route. These mixes are based around the core mix parameters, defined above, and are to be implemented as a hydromulch mix.

Table 7.2.6 Seeding Mixes

SEED	QUANTITY
Cover Crop	
Japanese Millet (Sep-Mar)	35 kgs/ha
Rye Corn (Apr-Aug)	35 kgs/ha
Eclipse/Crusader Rye	25 kgs/ha
Red Clover	5 kgs/ha
Native Grass	
Microlaena stipoides "Griffin" seed	2 kgs/ha
Themeda "Tangara" seed	1 kgs/ha
Native Seed Mix	
Native trees, shrubs and ground covers	5 kgs/ha**
Fertiliser	
Organic Fertiliser	250 kgs/ha

Table 7.2.7 Key Species for Vegetation Communities

SANDSTONE RIDGE TOP COMMUNITY	
Angophora costata	Smooth-barked Apple
Eucalyptus haemastoma	Scribbly Gum
Eucalyptus gummifera	Red Bloodwood
Eucalyptus oblonga	Narrow-leaved Stringybark
Eucalyptus piperita	Sydney Peppermint
Allocasuarina littoralis	Black She-oak
Banksia integrifolia	Coast Banksia
Banksia serrata	Old Man Banksia
Hakea sericea	Needlebush
Hakea teretifolia	Dagger Hakea
Kunzea ambigua	Tick Bush
Leptospermum attenuatum	Slender Tea Tree
Leptospermum flavescens	Swamp Tea tree

TURPENTINE IRON BARK AND TURPENTINE IRON BARK MARGIN FOREST	
Corymbia gummifera	Red Bloodwood
E. creba	Narrow-leaved Ironbark
E. fibrosa	Red Ironbark
E. punctata	Grey Gum
E. saligna	Sydney Blue Gum
Syncarpia glomulifera	Turpentine
Acacia falcata	Sickle leafed wattle
Acacia floribunda	Wattle
Acacia implexa	Hickory Wattle
Acacia parramattensis	Wattle
Breynia oblongifolia	
Dodonaea triquetra	Hop Bush
Leucopogon juniperinus	
Notelaea longifolia	
Ozothamnus diosmifolius	
Pittosporum revolutum	
Pittosporum undulatum	Sweet Pittosporum
Polyscias sambucifolia	
Maytenus silvestris	
Austrostipa pubescens	
Dianella caerulea	Blue Flax Lily
Dichondra repens	Kidney Weed
Entolasia stricta	Wiry Panic
Lomandra longifolia	Matt Rush
Poa affinis	
Themeda australis	Kangaroo Grass
Glycine clandestina	
Pandorea pandorana	

BLUE GUM HIGH FOREST AND GULLIES	
Angophora costata	Smooth-barked Apple
Eucalyptus pilularis	Blackbutt
Eucalyptus saligna	Sydney Blue Gum
Allocasuarina torulosa	Forest Oak
Acmena smithii	Lily Pilly
Austromyrtus tenuifolia	
Backhousia myrtifolia	
Callicoma serratifolia	Black 'Wattle'
Ceratopetalum apetalum	Coachwood
Ceratopetalum gummiferum	Christmas Bush
Clardendron tomentosa	
Cyathea cooperi	Treefern
Dodonaea triquetra	Hop Bush
Elaeocarpus reticulatus	Blueberry Ash
Pittosporum undulatum	Sweet Pittosporum
Tristaniopsis laurina	Water Gum

HINTERLAND SANDSTONE GULLY FOREST	
Angophora costata	Smooth-barked Apple
Corymbia gummifera	Red Bloodwood
Eucalyptus pilularis	Blackbutt
Syncarpia glomulifera	Turpentine
Allocasuarina littoralis	She Oak
Allocasuarina torulosa	Forest Oak
Banksia serrata	Old Man Banksia
Ceratopetalum gummiferum	Christmas Bush
Elaeocarpus reticulatus	Blueberry Ash
Acacia linifolia	Wattle
Dodonaea triquetra	Hop Bush
Grevillea linearifolia	Grevillea
Leptospermum trinervium	Tea Tree
Persoonia linearis	Narrow leafed Geebung
Pultanea flexilis	
Pittosporum undulatum	Sweet Pittosporum

Sandstone Riparian Scrub	
Acmena smithii	Lily Pilly
Austromyrtus tenuifolia	
Backhousia myrtifolia	Carrol, Grey Myrtle
Callicoma serratifolia	Black 'Wattle'
Ceratopetalum apetalum	Coachwood
Ceratopetalum gummiferum	Christmas Bush
Dodonaea triquetra	Hop Bush
Pittosporum undulatum	Sweet Pittosporum
Tristaniopsis laurina	Water Gum
Adiantum aethiopicum	Maiden Hair
Blechnum ambiguum	
Calochlaena dubia	
Sticherus flabellatus	
Lomandra longifolia	Matt Rush

7.2.7 Bush Regeneration

While the bulk of works is likely to involve the re-establishment of a naturalistic community, the focus of the revegetation works, potential exists for the undertaking of bush regeneration activities. The focus of these activities is the encouragement of natural processes to maintain and enhance the natural diversity of the remnant communities. These activities are only proposed for where a robust, intact bushland setting exists and changes in natural ground profile are minimal.

Implementation issues associated with this zone include:

- Topsoiling - The stripping and direct return of bushland topsoil to the location from which it was removed within 6 months. This provides the greatest potential for the natural soil seed bank to influence natural regeneration.
- Planting and Seeding - the implementation of a complete suite of species, sourced using only local provenance material which together constitute the full structural layers of the community being reinstated.
- Maintenance and management - area to be managed using bush regeneration techniques which minimise disturbance and maximise regeneration of the natural plant communities so as to achieve a robust, species diverse landscape outcome.

7.2.8 Planting Rates and Sizes

Plant material is to be planted at a range of sizes to create a balance in terms of initial impact and cost. The following sizes are nominated to be used:

- Virotubes
- Forest Tube
- Semi Advanced - 2.5 litre
- Advanced - 5 litre
- Super Advanced - 25 litre
- Semi advanced and super advanced sizes are to be used in interchange garden beds.

Planting rates and sizes are as follows:

- Virotube planted at 9 plants per m2
- Forestry Tubes/ semi advanced planted at the rate of 1 plant per 1.5 m2 for shrub plantings
- Forestry Tubes/ advanced planted at the rate of 1 plant per 4 m2 for tree plantings
- Rates of planted areas have been assessed based on the following assumption.

Trees are only to be planted to ensure appropriate distribution, cover and compliance with sightlines and clear zones. The use of trees within the seed mix is generally not proposed, except where clear breaks in implementation exist such as benches on cuts.

Details of the plants scientific and common name are provided with different mix types outlined in Table 7.2.7. Key species for vegetation communities with colour illustrations is provided on the following pages.

7.2.9 Turf

Turf is to be used at interchanges. The selection of turf has considered the appearance and maintenance requirements for its proposed location. Zoysia ''Empire" has been selected as the most appropriate with minimal mowing requirements and drought tolerance as key aspects of this grass.

Where works adjoin public spaces the grass species may need to be reviewed to match the adjacent species.

7.2.10 Stakes and Ties

Staking is to be provided for initial support and to act as a marker for plantings. This enables monitoring of plant response/performance. The following plant sizes are to be tied with hessian webbing ties 50mm wide.

- Forestry tube - bamboo stake, heavy duty
- Semi Advanced - bamboo stake, heavy duty
- Advanced - hardwood stake
- Super Advanced - hardwood stake

7.2.11 Construction Compound Sites

Construction compound sites are temporary work areas on land generally leased from another owner. To ensure provision is made for the revegetation of the land to a stable state, theses areas have generally been indicated as being grassed. Grasses may either be native grasses or exotic depending on context. Final treatment for these lots will be determined as a part of lease agreements. Where construction compounds occur within the corridor, the areas will be revegetated back to reflect the natural community.

7.2.12 Maintenance

The appearance of the landscape of the corridor affects the appearance of the motorway as a whole. It is vital that landscape works are implemented in such a way that they are able to establish and thrive. As part of the project works a Landscape Maintenance Plan (LMP) must be prepared and implemented to ensure that the ongoing management of the landscape achieves the design outcomes and that weed growth is managed and contained.

Regular maintenance inspections are to be undertaken of the new works required as part of the proposal and a log of activities maintained to record actions being undertaken to achieve the design outcome. In the first year inspections should be undertaken quarterly to ensure that response is as expected and that potential weed infestations are managed before they dominant the emergent landscape.

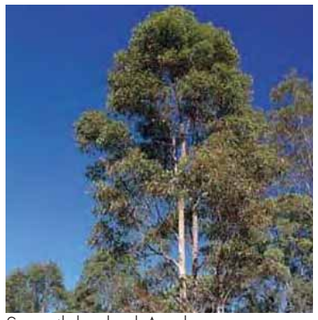
Activities should include, but not limited to the following:

- Areas of weed infestation must be managed and remedial landscape works undertaken to minimise potential for re-infestation;
- Failed planting should be replaced where losses are higher than 20%;
- Areas of bare soil should be prepared and retreated to match;
- Grassed areas to be mown to maintain a well kept appearance;
- Mulch beds maintained weed free;
- Noxious weeds to be managed and removed from new works;
- Short comings in canopy development identified and remedial actions identified and actioned.

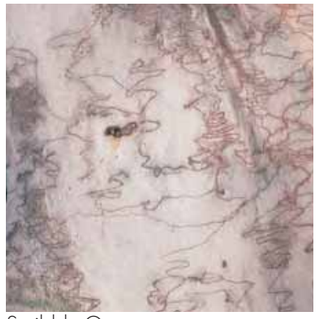
Landscape activities must minimise risk to contractor and road user. Works need to be timed to minimise disruption to traffic flows and appropriate traffic controls put in place.

Implementation Strategy

Sandstone Ridge Top Community

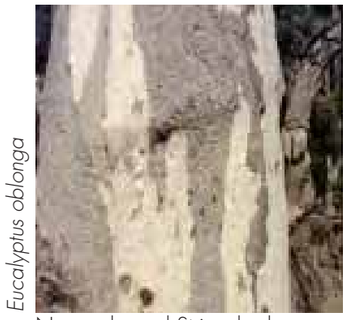


Angophora costata
Smooth-barked Apple



Eucalyptus haemastoma
Scribbly Gum

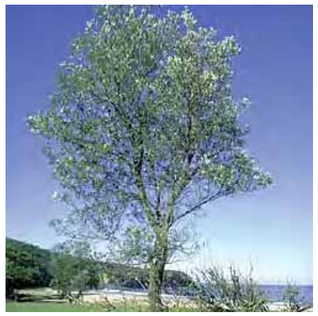
Eucalyptus gummifera
Red Bloodwood



Eucalyptus oblonga
Narrow-leaved Stringybark

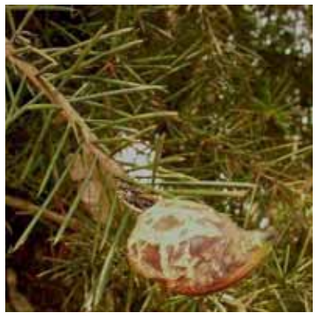
Eucalyptus piperita
Sydney Peppermint

Allocasuarina littoralis
Black She-oak

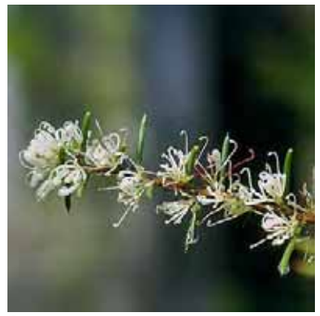


Banksia integrifolia
Coast Banksia

Banksia serrata
Old Man Banksia



Hakea sericea
Needle Bush



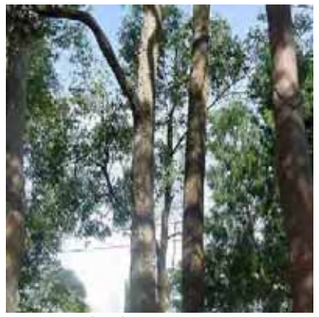
Hakea teretifolia
Dagger Hakea

Kunzea ambigua
Tick Bush

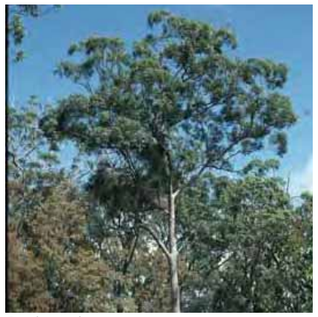
Leptospermum attenuatum
Slender Tea Tree

Turpentine Iron Bark and Turpentine Iron Bark Margin Forest

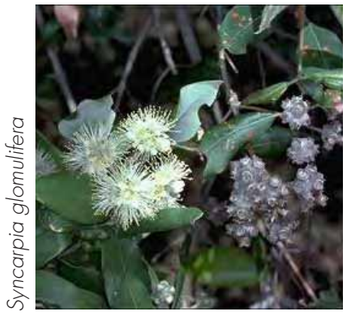
Eucalyptus globoidea
White Stringybark



Eucalyptus paniculata
Grey Ironbark

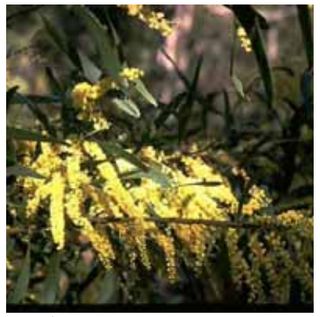


Eucalyptus resinifera
Red Mahogany



Syncarpia glomulifera
Turpentine

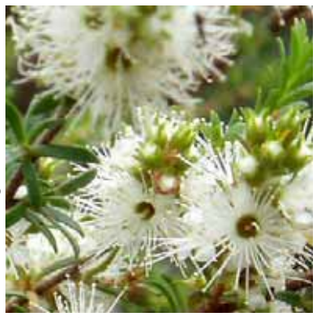
Acacia falcata



Acacia floribunda
Wattle

Banksia ericifolia
Heath-leaved Banksia

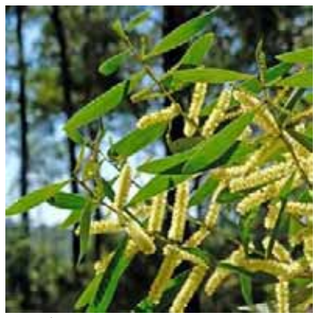
Hakea sericea
Needlebush



Kunzea ambigua
Tick Bush

Leptospermum flavescens
Swamp Teatree

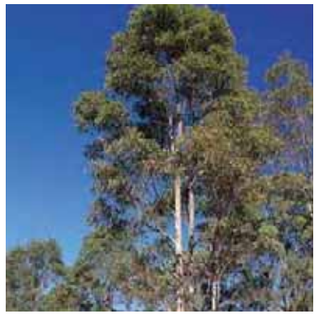
Acacia implexa
Hickory Wattle



Acacia longifolia
Wattle

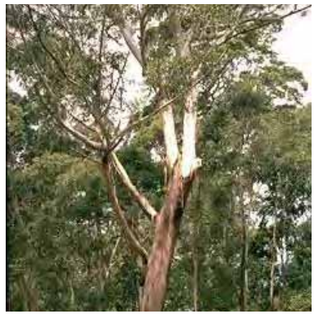
Blue Gum Forest and Gullies

Angophora costata



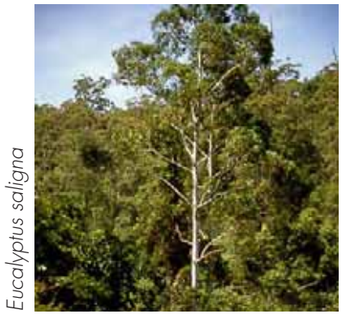
Smooth-barked Apple

Eucalyptus pilularis



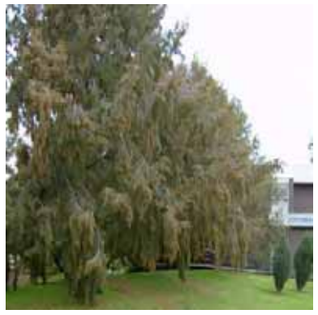
Blackbutt

Eucalyptus saligna



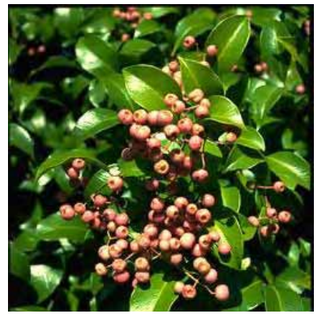
Sydney Blue Gum

Allocasuarina torulosa



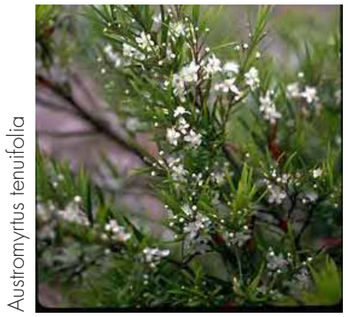
Forest Oak

Acmena smithii



Lily Pilly

Austromyrtus tenuifolia

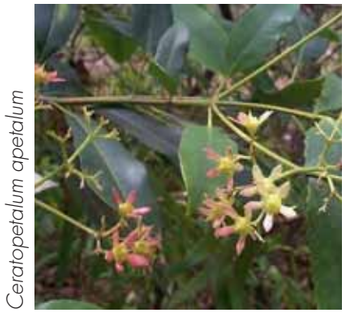


Backhousia myrtifolia

Callicoma serratifolia

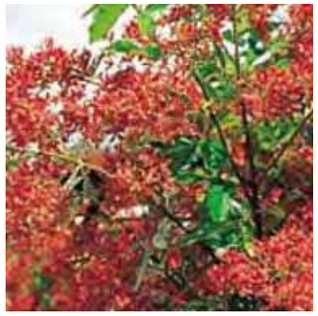
Black 'wattle'

Ceratopetalum apetalum



Coachwood

Ceratopetalum gummiferum



Christmas Bush

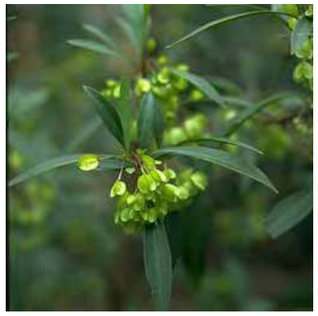
Cyathea cooperi

Treefern

Tristaniopsis laurina

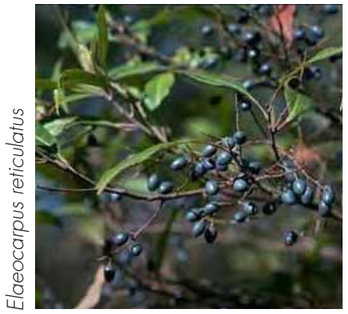
Water Gum

Dodonaea triquetra



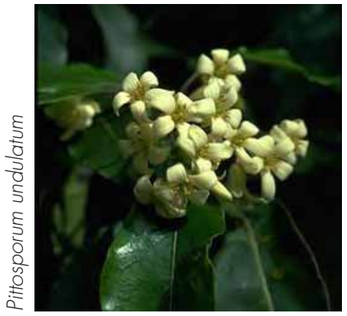
Hop Bush

Elaeocarpus reticulatus



Blueberry Ash

Pittosporum undulatum



Mock Orange

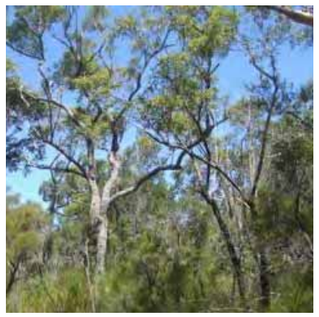
Implementation Strategy

Western Sandstone Gully Forest

Angophora costata

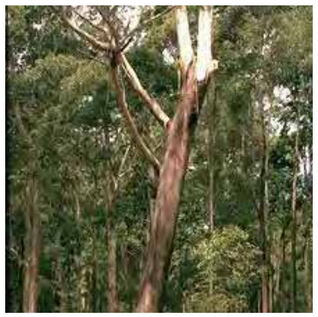
Smooth-barked Apple

Eucalyptus gummifera



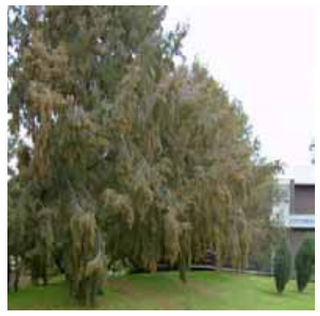
Red Bloodwood

Eucalyptus pilularis



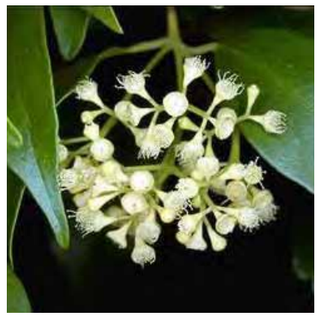
Blackbutt

Allocasuarina torulosa



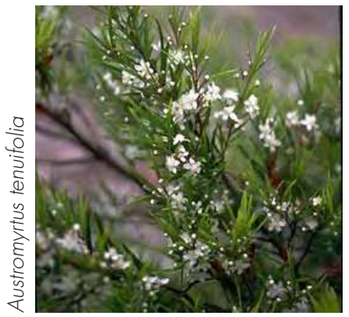
Forest Oak

Acmena smithii



Lily Pilly

Austromyrtus tenuifolia



Backhousia myrtifolia

Grey Myrtle

Callicoma serratifolia

Black 'Wattle'

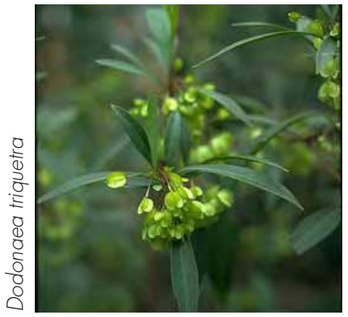
Ceratopetalum apetalum

Coachwood

Ceratopetalum gummiferum

Christmas Bush

Dodonaea triquetra



Hop Bush

Tristaniopsis laurina

Water Gum

7.3 Landscape Management

7.3.1 Maintenance

Weed Control

Weed control is to be an integral part of the construction process, with weed management prior to construction defined in the documentation. The ongoing management plan will be implemented during and post construction to minimise regeneration or infestation of weeds. This systematic approach will reduce the weed potential into the future.

Weed control is to be carried out by the contractor in all areas re-vegetated/ planted as part of the contract works for a period of 12 months beyond practical completion.

Supplementary Watering and Mulching

Planting will be watered and maintained until plants have become established. If extended periods without rain are experienced, during the establishment period, then watering over and above normal construction practise will be required to supplement natural rainfall.

Follow-up Fertiliser

Fertilising post planting may be required where specific nutrient deficiencies are identified. The need for additional fertiliser has been minimised by the use of slow release fertiliser.

Pruning and Thinning

Pruning and thinning is likely to form a minor component of maintenance. Pruning may be required to ensure retention of sightlines where seeded shrubs have grown obscuring signage or views around bends.

Pests and Diseases

Generally pest / disease management are not viable over large areas. Planting will rely on developing an environmental balance through the establishment of improved habitat conditions. Should an outbreak be identified which will impact on the establishment of landscape outcomes an appropriate action plan will be determined.

Plant Replacements

Dead, diseased or dying plants are to be replaced to ensure 90% of planting has established after 12 months.

Monitoring and Evaluation

The ongoing surveillance of the road corridor for weed management and landscape establishment is required.

7.3.2 Occupational Health and Safety

The design of the highway needs to consider the safety of workers during construction and the ongoing maintenance of the road. Both periods provide distinct, as well as overlapping risks.

Slopes are a key risk and the alignment has a number of areas of concern;

- Slopes of 1V:2H are not easily traversed by vehicle or on foot resulting in construction and maintenance access issues.
- Bridge abutments and culverts where slopes increase and drops may pose risks in terms of public and maintenance a need to be addressed in the design.

Maintenance risks are associated with the conflict of workers adjacent to traffic. The design needs to consider issues such as sightlines, the need for lane closures and other activities adjacent to the road when workers are completing the following activities;

- Maintenance of garden beds in medians/ interchanges
- Mowing of verges and turf areas
- Weed management.

Although it is not possible to completely eliminate all maintenance risks, they can be minimised by reducing the frequency of the occurrence, which can be addressed through appropriate plant selection and density.

Implementation Strategy

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