

# Native Restoration Management Plan Scamander Pine Plantation, Tasmania June 2013



*Figure 1 Sunshine Hill, restoration area north west of Skyline Tier.*

Prepared for the Northeast Bioregional Network



Bushways

Environmental Services - Tasmania

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**Prepared for:**  
The North East Bioregional Network

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## EXECUTIVE SUMMARY

The Northeast Bioregional Network has been undertaking ecological restoration works at Skyline Tier, Scamander Pine Plantation since July 2007. Active management of the east facing slopes has involved broad scale pine control and promotion of native vegetation regeneration with impressive results. The proposed scope of restoration has now extended to include the western slopes of the plantation connecting the restoration areas with the Scamander Forest Reserve and the proposed Constable Creek - Loila Tier Reserve.

The management plan draws on the knowledge and experience gained through active on ground restoration since 2006. It is a component of a living project that applies knowledge and experience as it evolves and progresses. This report assesses the current status of native forest and pine within the Scamander Plantation, the progress of the restoration project and makes recommendations to guide management for native restoration of the entire area.

The plantation was assessed for the proportion of native species and pine present in coupes, the vegetation cover and stage of regrowth, and the management regimes known or likely to have preceded this stage. Areas of special ecological value and high priority for either ongoing maintenance or management intervention were noted, as well as areas where native regeneration has been successful.

Management methods were documented and mapped into zones in order to identify desirable management regimes for adoption within future restoration efforts. The learnt efficiencies and benefits of past works were taken into account when making recommendations.

Three broad classes of vegetation cover in the Scamander Plantation were identified as: all or mostly native vegetation, all or mostly pine, and little or no vegetative cover. These were further categorised as:

- Remnant native forest;
- Successful native forest regeneration with little pine;
- Little or no vegetation cover at time of survey - recently harvested pine followed by burning;
- Native regeneration mixed with pine; and
- Mostly pine - either first or second rotation.

Native forest in adjacent reserves, private land, roadsides and riparian areas was also considered for pine control.

Management issues for restoration works include pine control in sensitive areas (riparian zones, threatened vegetation communities), steep slopes (erosion, access), choices of pine control methods (fire, manual and mechanical weeding), and pine invasion of neighbouring land. Other issues (weeds, erosion, stream sedimentation, rubbish dumping, firewood taking, theft of plants and road management) were also recognised.

Recommendations for continuing and extending restoration include:

- Monitor and maintain successful native regeneration areas and remnant forest;
- Promote native regeneration at all sites;
- Remove pine wildlings from roadsides, neighbouring reserves and private land;
- Use fire in for the most efficient and effective pine control and native regeneration;
- Use machinery, such as the Feller Buncher or bull dozers in target areas for efficient and effective pine control;
- Use manual pine removal with hand saws and chainsaws where appropriate;
- Integrated methods in complex and sensitive areas;
- Establish buffer zones on streams;
- Control other weeds like Spanish heath; and
- Reseed with natives where necessary.

Priority areas are identified according to the condition of native vegetation, the stage and quality of its recovery, threat levels to and from sites, their position in the landscape and contribution to connectivity. A pictorial management key is included to assist field assessments for works plans.



# 1 INTRODUCTION

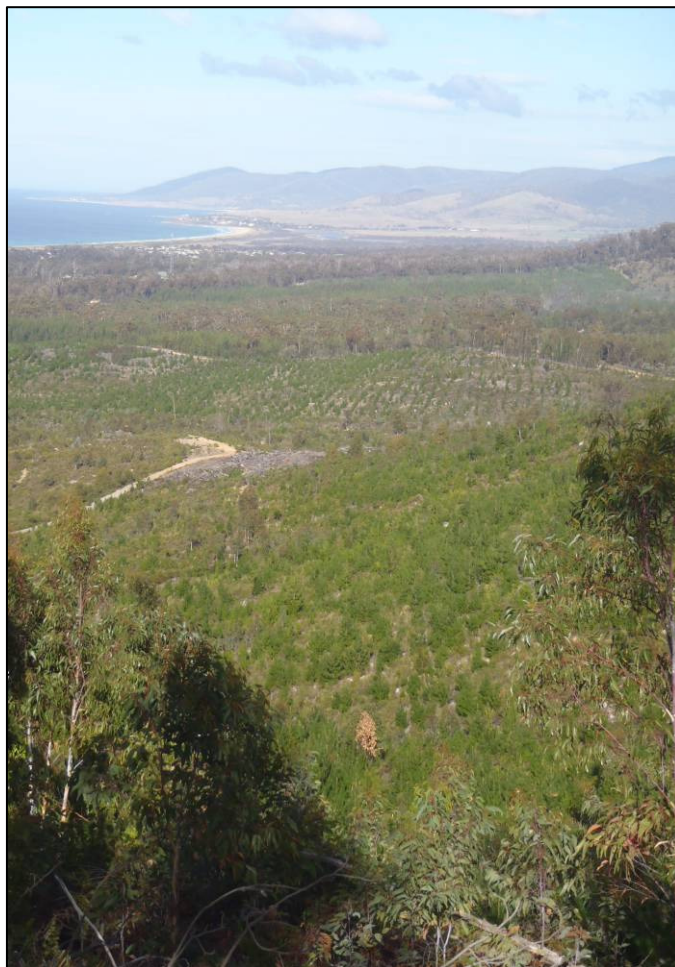
## 1.1 Background

The restoration project at Scamander Plantation is a significant and unique ecological restoration project in Tasmania. The North East Bioregional Network oversees and implements restoration works on nominated sites at Scamander Plantation under a contractual agreement with the leaseholder, New Forests. Since 2007 this has covered an area of 350 ha.

The scope of the proposed restoration area has now extended to include the entire plantation, a total area of 2160 ha. This will connect the existing restoration areas with the Scamander Forest Reserve and the proposed Constable Creek - Loila Tier Reserve.

This report assesses the current status of native forest and radiata pine within the Scamander Plantation, the progress of the restoration project and makes recommendations to guide management for native restoration of the whole area.

*Figure 2 East facing slopes of Skyline Tier restoration area*



## 1.2 Supporting documentation

The high conservation values of this area and the methods recommended and employed on site for restoration have been documented by Bushways in previous reports in 2006, 2009 and 2011.

In 2006 Bushways Environmental Services Tasmania conducted an assessment of the potential of the Scamander Pine Plantation for natural regeneration following harvest. *The Report on Natural Regeneration, Scamander Plantation, Scamander, Tasmania* (2006) documented high conservation values to be restored and protected including threatened flora habitat, potential threatened fauna habitat, threatened vegetation communities and catchment areas of high conservation value wetlands and streams. The report provided management recommendations and priorities for pine removal, promotion of natural regeneration, and enhancement of the conservation values.

A survey of radiata pine wildings at the Scamander Pine Plantation was carried out several months after weeding works commenced (Fitzgerald 2007). This survey mapped the extent of pine invasion in native forest adjacent to the pine plantation, documented the effectiveness of pine control works and identified priorities for pine control.

In the same year, 2007, the North East Bioregional Network proposed the Constable Creek - Loila Tier Reserve protecting a large area of intact dry forest with largely undisturbed naturalness and high conservation values. This proposal surrounds and connects with the Scamander Plantation and has been approved for reserve under the Tasmanian Forest Agreement 2013.

A review of the ecological restoration works undertaken at Skyline Tier was carried out by Bushways in 2009 and documented in the report *Skyline Tier Restoration Review, Scamander Plantation*.

The social and economic benefits of the restoration project were presented in the 2011 Bushways report, *Benefits of Restoring Skyline Tier, Scamander Plantation, Tasmania*.

### 1.3 Summary of conservation values

Restoration of Skyline Tier is extremely significant for its rehabilitation and protection of:

- habitat for threatened flora and fauna species;
- threatened vegetation communities;
- native riparian buffer zones;
- connecting and regenerating native forest;
- high conservation value catchment areas; and
- scenic values.

“Potential habitat for threatened fauna species occurring on site has been enhanced, including areas of thatch saw-sedge (which could support chaostola skipper), areas of blue and black gums (habitat for swift parrots) and streams (Australian grayling). Regeneration of moist vegetation in some of the gullies indicates that potential giant velvet worm habitat may be restored in the future. Similarly, regeneration of heath species in the lower areas may provide potential habitat for the New Holland mouse.



Figure 3 Ironbark juvenile tree

Populations of threatened flora species *Hovea corrickiae*, *Heiroychloe rariflora* and *Glycine latrobeana* have been discovered regenerating on site since the restoration works began. Pine control has been successful in the two threatened vegetation communities, blue gum forest and black gum forest, which are recovering well.



Figure 4 Sunshine wattle

Regeneration of native flora was found to be excellent across most of the site. Eucalypt and understorey species are diverse and continuing to regenerate vigorously in all sites where work has progressed. The high priority Trout Creek site has five species of eucalypt naturally regenerating and has advanced regeneration of understorey and a high level of connectivity to the surrounding high conservation value forests and wetlands. Direct seeding with *Eucalyptus obliqua* has been implemented on several steep slopes where eucalypt regeneration was not occurring naturally.

Across large areas, where pines were prolific in 2006, there are now few. Pine control through hand-pulling or manual cutting out has been an effective means of control, made possible with many hours of volunteer labour. Controlling the spread of pines into surrounding native vegetation, along Skyline Tier, as well as remnants within the site, and post-harvest areas has been a priority with successful results. Machinery has been used successfully in areas where large or mature pine removal was undertaken from existing threatened native vegetation.”

“Threatened vegetation communities being restored and protected include Black Gum Forest (TASVEG code DOV), Blue Gum Forest (TASVEG code DGL) and several high conservation value wetland communities associated with the coastal and freshwater systems. All these communities are improving in condition with increased species diversity, improved structure and expanding habitat availability due to the restoration works.”

(Skyline Tier Restoration Review, Scamander Plantation (2009) Bushways Environmental Services Tasmania)

## 2 METHODOLOGY

### 2.1 Background research

A Natural Values Report was conducted (May 2013) for all threatened flora and fauna recorded within 5 kilometres of the site.

Todd Dudley has co-ordinated and implemented the works since 2006 and guided the field survey and provided information on restoration works. A map of the Scamander Forest plantation coupes was provided by Timberlands for the survey.

### 2.2 Site description

The plantation is situated 1-2 km inland from the coast and north of the township of Scamander (GDA coordinates E604000, N5415000). The land was planted with pines as an employment program in the 1960s and 1970s. Coupes were harvested and replanted with pines from 1998.

Until recently, restoration sites were mostly on the east facing slopes with one smaller site on Trout Creek on the western slopes. Now the entire plantation is being proposed for restoration to native forest and some of the western slopes are already regenerating with native forest.

The plantation is surrounded by the new Constable Creek - Loila Tier Reserve to the north and west (this was State Forest), private land on the eastern side and Scamander Forest Reserve on the south-western edge. It is hilly with many small streams and steep gullies.

### 2.3 Field survey

Helen Morgan conducted the field survey with Todd Dudley on 30<sup>th</sup> and 31<sup>st</sup> May 2013.

The major roads through the plantation were driven, similarly to the previous surveys, to gain an overview of the different sites and the status of pine and native vegetation.

The plantation was surveyed by road and each plantation coupe was viewed from an observation point and photographed, with short walks into some. Sites were numbered based on coupes, sub-catchments, vegetation status and stage of current management, although not all these elements were consistent throughout.

Coupes were assessed for:

- the presence and proportion of native species and pine;
- species composition and structure of native vegetation;
- the stage of regrowth (pine and native) since harvest or planting;
- the management regimes known or likely to have preceded the current status;
- the stage of restoration; and
- management issues and suitable methods of restoration.

Areas of special ecological value and high priority for either ongoing maintenance or management intervention were noted, as well as areas where native regeneration has been exceptionally successful. Reserves, roadsides and private land adjacent to the plantation were also considered for pine management. Management issues other than pine control were noted.

Progress of restoration works towards implementing recommendations made in previous reports was noted and discussed at each site. This included recommendations that were successful as well as not achievable, and methods that will be most likely to succeed for continuing works. The physical limitations and efficiencies of methods were considered for each site.

Observation points and locations of any notable features were recorded by handheld GPS. Locations given in this report were taken in WGS 84 (=GDA94).



All botanical names are in accordance with the recently updated “A Census of the Vascular Plants of Tasmania” (Baker and de Salas 2012).

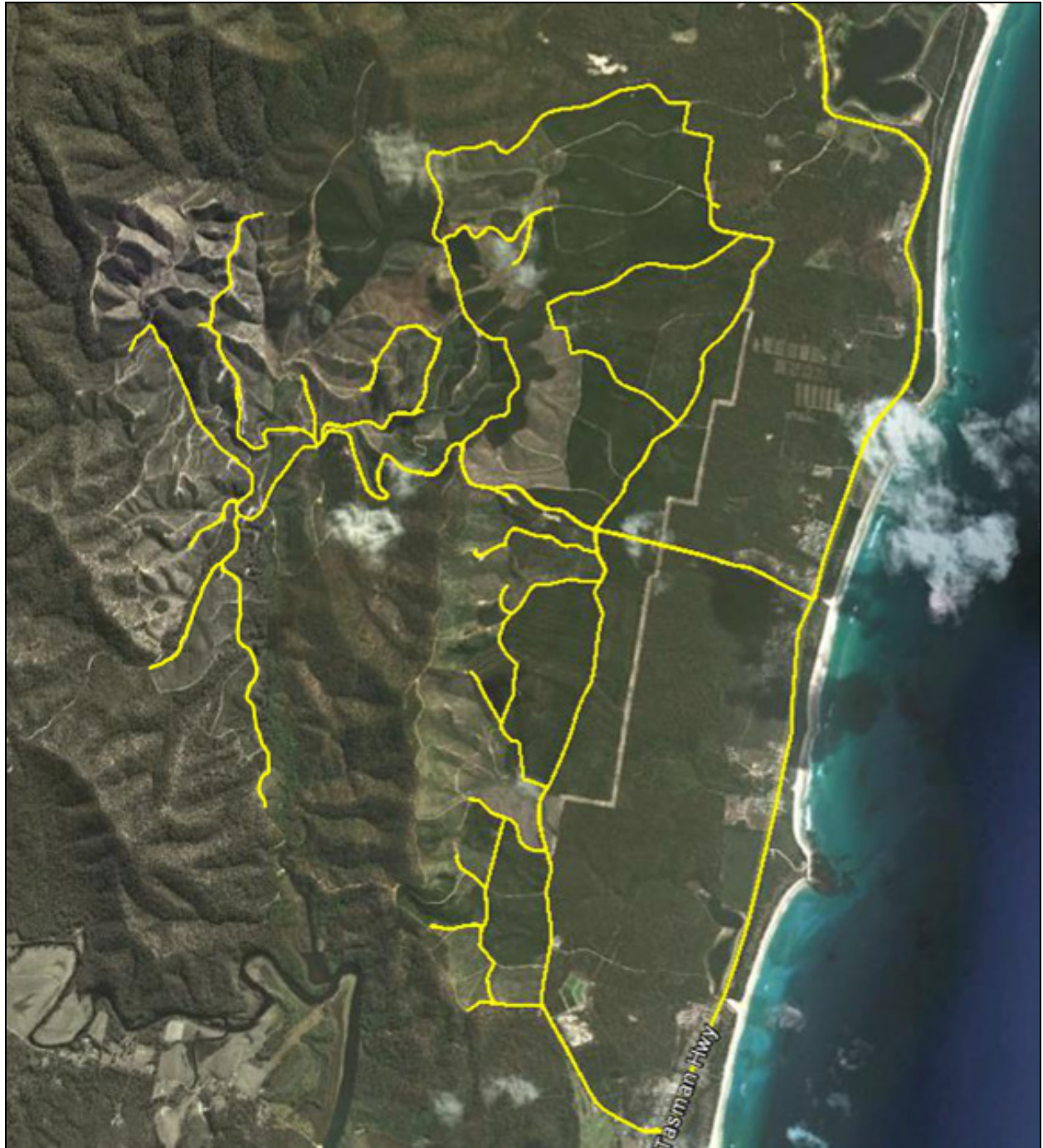


Figure 5. Survey route taken in May 2013.

## 2.4 Limitations

This survey has briefly revisited the natural values of the area which have been previously well documented. It reviewed restoration works to apply to this restoration plan. Due to time constraints and the scale of the plantation, the sites were broadly assessed to develop management recommendations. The complexities of each site were impossible to address completely within the given time. The management key was developed to assist with site assessments for site specific management strategies.

Riparian areas and streams were included in the assessments for restoration of vegetation. A biophysical assessment of fluvial geomorphic processes and aquatic habitat would be necessary to further inform management for stream rehabilitation.

Application of fire for promoting natural regeneration and as an efficient and effective pine control method is evidently a very successful restoration tool, as found during the field survey. The regenerative effects and economic benefits of using fire in this way are clear and have been documented. However, fire management is not within the expertise of Bushways to address and a strategic fire management plan developed by a qualified expert is recommended.

### 3 SITE ASSESSMENT

A total of forty five sites were assessed across 2160 ha, and from these six broad vegetation covers were identified based on native vegetation species composition and structure, pine presence, density and height of pines, the history of pine harvest, and follow up treatment (either already carried out or required) including burning, aerial spraying, replanting, thinning, natural regeneration.

#### 3.1 Vegetation cover

Three broad classes of vegetation cover in the Scamander Plantation were broadly categorised as: all or mostly native vegetation, little or no vegetative cover, and all or mostly pine. These were further defined as:

- Reserves roadsides and private land adjacent to the plantation;
- Remnant native forest within the plantation;
- Successful native forest regeneration following pine harvest;
- Recently burnt - little or no vegetation cover at time of survey;
- Native regeneration mixed with pine; and
- Mostly pine.

*Table 3.1 Summary of vegetation cover and sites*

Zone	Vegetation cover	Sites	Hectares (Approx.)	Description
1	Reserves roadsides and private land adjacent to the plantation	(e.g.: near 20,38, riparian sites 46, 47)		Native forest in reserve, on roadside edges or on private land (east) with some pine invasion, either wildlings or mature trees.
2	Remnant native forest	8, 10, 13a, 16a, 18, 22, 40, 41, 42, 45	202	Existing remnant native forest ( <i>Eucalyptus globulus</i> forest, <i>Eucalyptus ovata</i> forest, <i>Eucalyptus sieberi</i> forest) within the plantation, pine present in most sites.
3	Successful native forest regeneration following pine harvest	2, 3, 7, 12, 12a, 14, 15, 17, 23, 26, 27, 35	342	Successful native forest regeneration with very little pine remaining, many of these sites have been the focus of restoration work to date or have benefited from recent post harvest burning regimes.
4	Little or no vegetation cover at time of survey	25, 29	134	Sites which have been recently harvested and burnt and are almost devoid of vegetation.
5	Regeneration native mixed with pine	1, 4, 5, 6, 11, 16, 17b, 21, 24, 28, 29a, 32	479	Native regeneration mixed with pine. A range of age classes and pine densities but generally with 50:50 native and pine or more native than pine.
6	Mostly pine either first or second rotation	9, 13, 16a, 19, 20, 26a, 28, 30, 31, 32, 33, 34, 36, 37, 39, 43, 44	924	Many sites come into this category, where pine is dominant as result of plantation management. They include sites where harvest has or has not occurred and pines have been either managed or neglected.



## 3.2 Vegetation descriptions

### 3.2.1 Adjoining native forest

Native forest in reserves on roadside edges or on private land (east) adjoining the plantation were mostly dominated by *Eucalyptus sieberi*, ironbark, but also present was the threatened forest community, *Eucalyptus ovata*, black gum forest. Most of the adjoining native forest is in good condition, provides habitat for threatened species and is valuable on a landscape scale for conservation, connectivity, water quality and scenic value. It is also a seed source for native regeneration within the plantation. Parts of the adjoining forest have pine invasion, either wildlings or mature trees, scattered or occasionally in patches, especially along roadsides.



Figures 6 and 7. Adjoining native forest on reserved land with pine invading from roadside, near sites 38 and 20.

### 3.2.2. Remnant native forest communities

Remnant native forest communities *Eucalyptus globulus*, blue gum forest, *Eucalyptus ovata*, black gum forest and *Eucalyptus sieberi*, ironbark, forest occur within the plantation. Two of these forest types, the black gum and blue gum forests, are threatened vegetation communities. All provide important habitat for threatened species, as well as non threatened species (see Appendices 2 and 3) and are a valuable seed source for the regenerating areas. They also provide reference sites for the types of vegetation and species representation present on site prior to the pine plantation being established.



Figure 9. Site 45: Ironbark remnant in excellent condition, adjacent to pine plantation.



Figure 8. Site 10: Blue gum remnant, in excellent condition following pine removal.

Some of these remnants, such as the blue gum forest at site 10, are floristically intact and, having undergone some previous pine control, are in good condition. One small ironbark forest remnant, site 45, is in excellent condition with no pine present and a diverse understorey with twiggly waxflower and grasstrees.



Other remnants are in progressive stages of restoration and have either established or regenerating understorey with a diversity of species present, such as the black gum forest at site 15.

There are patches of remnant forest, a blue gum patch at site 41 and ironbark remnant at site 42, which still have pine invasion. In these forests the canopy and understorey is weak and pine removal is recommended.

*Figure 10. Site 42: Ironbark remnant with white gum and sheoak.*

### 3.2.3 Successful native forest regeneration

Successful native forest regeneration with very little pine occurs on sites that have been the focus of restoration work or that have benefited from recent burning regimes following pine harvest.

On the east facing slopes of Skyline Tier at several sites (e.g. sites 2, 3, 7, 14, 15 and 17) native regeneration is excellent with high species diversity and good structure developing. Pine control has been highly successful at these sites leaving little pine (<1 pine per 10 m<sup>2</sup>). Most of these sites have a history of effective burning following pine harvest and have since been treated with mechanical or manual weeding.



*Figure 11. Site 2: May 2013, nearly all native after burning and hand weeding.*



*Figure 12. Sites 2 & 3: May 2013, very little pine remaining.*



*Figure 13. Site 10: Blue gum and black gum regeneration after pine control, This site is adjacent to the blue gum forest remnant.*



*Figure 14. Site 17: Prolific ironbark regeneration after burning and aerial reseeded with four eucalypt species, pine control since then has been manual.*



The effect of fire on promoting native forest regeneration is evident at sites 23, 26 and 27 where native regeneration is vigorous and very little pine is present two years after a post harvest burn. Species diversity is high and includes ironbark and blue gum, blackwood, sunshine wattle, mint bush, prickly box, red stem wattle and daisy bush.

*Figure 15. Site 23 in the foreground with sunshine wattle flowering profusely, and site 27 in the background.*



A few sites with a predominately eucalypt canopy and little or no understorey, at this stage, are the result of recent mechanical pine removal. On Skyline Tier a small patch of ironbark forest adjoining the reserve has recently been pine harvested and the eucalypts remain without much understorey (site 3). The black gum forest at site 15 was at a similar stage of pine removal three years ago and its understorey is regenerating well now.



*Figure 16. Site 3: Ironbark canopy remaining after pine harvest with Feller Buncher six months ago.*



*Figure 17. Site 15: Black gum remnant three years ago after Feller Buncher pine removal.*

#### 3.2.4 Recently burnt - little or no vegetation cover

Sites which have been recently harvested and burnt and are almost devoid of vegetation are evident on the western side of Skyline Tier. The burns have evidently been hot and thorough.

Steep hills prone to soil loss are a risk for these sites. A heavy storm event at this time may cause issues for stream sedimentation downhill and seed germination on site. However, the fire could be seen as a onetime event, similar to a hot bush fire, with positive benefits for restoration of native vegetation as experienced on sites 23 and 27.

*Figure 18. Site 29: Recently burnt , bare of vegetation.*

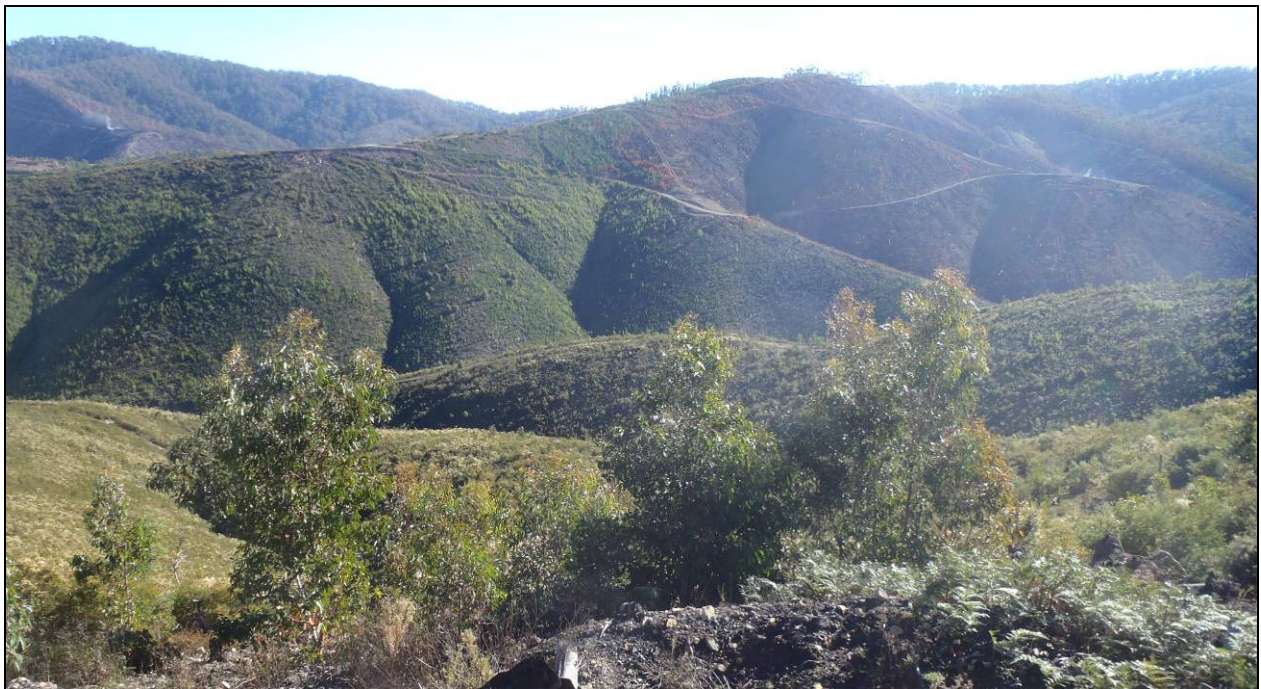






*Figure 19. Site 25: Hills with little or no vegetation cover at all at the time of survey - the result of recent pine harvest followed by a hot fire.*

The regenerative effects of a hot burn following harvest are clearly apparent in site 23, Sunshine Hill, (see 3.5 before and after images) which underwent an unplanned burn two years ago following harvest. Now, in May 2013 Sunshine Hill is covered with native regeneration and is on the way to being a successful restoration site with very little input of other resources. Site 27 is similarly regenerating following post harvest fire. It is likely that sites 25 and 29 will regenerate similarly and they should be monitored and follow up pine control management applied as a priority.



*Figure 20. North west from site 23 to site 27 regenerating following post-harvest fire, with site 25 recently burnt.*

#### 3.2.5 Regeneration - native mixed with pine

Native regeneration mixed with pine occurs across a large amount of the site. A range of age classes and pine densities are apparent within this group but it includes mainly sites with a mix of native and pine regeneration. In many of these sites local native diversity is well represented with ironbark being very common and a wide range of understorey species. The pine is vigorous in these sites.

These sites reflect a regime with little or no burning, or ineffective burning which was possibly too cool (Todd Dudley pers. com. 30/05/13), allowing pine regrowth to progress. This group of sites poses the most



complex management questions as it includes some riparian areas. All these sites exhibit diverse and well grown native species and prolific pine.

Many are steep to very steep where either manual or mechanical pine control is not a viable proposition. The areas are mostly large, and the inefficiency of weeding, either manually or mechanically is significant. They are often connected to an area in good condition or in a more advanced stage of restoration, therefore threatening those areas and it is strategically important to restore them.



*Figure 21. Site 16: Has many pines with native regeneration and needs burning for efficient pine control.*



*Figure 22. Site 4: Similar to site 16, but taller in places.*



*Figure 23. Site 28: Looking south from the northern end, regeneration of native and pine mixed, unlikely to have been burnt, or if burnt in patches the burn was not hot enough to kill pine.*

### 3.2.6 All or mostly pine

Sites containing all or mostly pine occupy the largest proportion of the plantation. Many sites come into this category, where pine is dominant as result of plantation management. In some of these sites native species are present, but in many there is very little.

These sites may include those under first or second rotation, some of which have been harvested and allowed to regenerate, some have been aerial sprayed following harvest, some have been replanted with pine, some thinned and rowed, some have been neglected either after harvest or have not been harvested yet. Quite a large area of unharvested pine appears to be poor quality and may not be an economic proposition. These areas should be identified and managed for strategic restoration in stages. Most of these sites share boundaries with native forest in reserve or on private land and the potential for escaped wildlings onto this land is high.





*Figure 24. Site 20: Pine dense and getting tall, up to four metres high. Mixed with good native regeneration, and a large area on a steep slope, pine control methods other than fire are not viable.*



*Figure 25. Site 9: Was aerial sprayed and replanted with pine which are yellowing and there is no native regeneration.*



*Figure 26. Site 19: A very large area of mostly pine in the Diana's Basin catchment. The occasional eucalypt patch is evident, good native remnants adjoin and good native restoration areas are upslope.*



*Figure 27. Site 37: Dense pine adjacent to and surrounded by native forest reserve.*



### 3.3 Riparian areas

The condition of riparian areas in the plantation varies from being good to very poor. There is a range of vegetation cover in riparian zones which varies according to coupe management. Some riparian areas retain native vegetation, while others have been partially or completely planted to pine, and some are devoid of vegetation due to recent burning.

Sites which have retained their native vegetation or have been restored usually have riparian areas in reasonably good or very good condition. The Yarmouth Creek catchment is in this category where careful restoration work has been carried out. There is further pine removal to be undertaken in this catchment and the same degree of care should be taken to maintain the quality of restoration works and riparian habitat.



*Figure 28. Yarmouth Creek catchment, ironbark forest regeneration: site 14 in foreground having undergone pine removal with chainsaws; mature eucalypts remaining in site 15 in the middle where the Feller Buncher has recently been removing pine; and site 19 in the background, still to be harvested.*

As an upper catchment area, the topography of Scamander Plantation is featured by small gullies with ephemeral watercourses. Several sites exhibit streams such as the one pictured right in site 11, a harvested and regenerating area with a steep gully actively eroding. In time vegetation will help to stabilise this but meanwhile sediment transfer is occurring constantly. There is risk of major erosion and soil loss with severe storm events. There are sites across the plantation where erosion is occurring before it can be arrested by revegetation. In some instances erosion may prevent the establishment of seedlings.



*Figure 29. Site 11: Gully erosion evident.*



Some recently harvested coupes have streams totally devoid of vegetation and pine has clearly been harvested from stream banks and channels followed by burning. Arm Creek and its tributaries have been heavily impacted by plantation activities, indicated by lack of vegetation, wide and deep channels, bank and channel erosion, excessive sedimentation and discoloured water.

Riparian zones in or adjoining the recently harvested or burnt areas are currently lacking in vegetation cover and are at high risk of erosion and sedimentation, lineal downstream impacts. These streams are without shade and are therefore subject to temperature extremes. Habitat opportunity in these sites is currently very poor. Sites downstream of these sites are impacted by sedimentation and erosion.

*Figure 30. Riparian zone of Arm Creek in site 29: Recently harvested and burnt. Leaving the patch of wattles and other natives in downstream riparian zone, site 29a, is essential until the upstream zone recovers, then follow up with low impact pine removal.*



Sites which have a mix of pine and native at least have some vegetation cover, providing some shade and structure, although these areas are mostly not linearly continuous.



It is evident that currently a greater proportion of streams are degraded or at risk of degradation than in good condition throughout the plantation.

*Figure 31. Arm Creek downstream of site 29: Regeneration and channelling is occurring in widened stream channel. Pine removal from the riparian zone should be mechanical or manual. Note the accrued coarse sediment and discoloured water from upstream impacts.*

### 3.4 Weeds

The Scamander Plantation has relatively few weeds other than pine. Weed hygiene protocols such as vehicle cleanliness and keeping boots and tools clean, have been implemented with success during restoration works. Works teams have implemented weed control of ragwort, stinkweed, pampas grass and cape wattle. Sites are identified on the map and follow up monitoring and control is needed.

The west side is likely to be more vulnerable to weed invasion, with a complex road network for weed conveyance and more machinery activity. Weeds such as Californian thistle, fleabane, and foxglove are present on the roadsides and in some gullies on the western side.

Table 3.3 Weeds in Scamander Plantation

<b>Scientific name</b>	<b>Common name</b>	<b>Location</b>
<i>Dittrichia graveolens</i>	stinkweed	Found on eastern slopes site 1 and site 7 by work crew and controlled immediately – monitor for other occurrence
<i>Cortaderia selloana</i>	silver pampas grass	Site 1 – found by work crew and controlled immediately – monitor for further invasion State forest area central eastern side site 16a
<i>Paraserianthes lophantha</i>	cape wattle	Site 23 foothill Monzanite Rd
<i>Psoralea pinnata</i>	blue butterfly bush	State forest area central eastern side site 16a Site 5 along roadside
<i>Acacia retinodes</i>	wirilda	Site 5 off road – possibly bird dispersed
<i>Leonotis sp.</i>	lion's tail	Site 14 near road
<i>Erica lusitanica</i>	Spanish heath	Site 19 roadside, creek gully, site 21 outside boundary
<i>Onopordum acanthium</i>	scotch thistle	Scattered throughout
<i>Senecio jacobaea</i>	ragwort	Site 2 near road, hand pulled years ago by work crew and controlled immediately – monitor for further invasion
<i>Cirsium arvense</i>	Californian thistle	Site 40 Arm Creek crossing E602089 N5415104 And site 11 in gully above native corridor
<i>Digitalis purpurea</i>	foxglove	Creek gully on Monzanite Rd, Site 23, E602896 N5415837
<i>Conyza sp.</i>	fleabane	On tracks E603246 N5415916



### 3.5 Photographic monitoring of three sites 2006, 2009, 2013

The images below illustrate the changes seen in regeneration at three sites.

#### 3.5.1 Trout Creek

The Trout Creek site has been an exceptional success as a result of manual weeding and having a viable native seed source on site and close by.



*Figures 32 and 33. Trout Creek site: 2006, southeast and south.*



*Figures 34 and 35. Trout Creek site: 2009, southeast and south.*



*Figures 36 and 37. Trout Creek site: 2013, southeast and south.*



### 3.5.2 Diana's Basin

The Diana's Basin site below was not burnt after harvest 7 years ago and, although native regeneration has been excellent, the pines are dense and persistent. The steepness of the slope and extent of the area means that manual and mechanical controls are not ideal and are inefficient. Had the site been burnt it is likely that regeneration now would be as good as site 2.



*Figure 38. Diana's Basin site: 2006, harvested and not burnt.*



*Figure. 39. Diana's Basin site: 2009, good native regeneration.*



*Figure 40. Diana's Basin site: 2013, good native regeneration with dense pine regrowth on lower slopes.*

### 3.5.3 Sunshine Hill

Site 23, Sunshine Hill, was a dramatically bare sight following an unplanned burn two years ago. However, the hill is now covered in native regeneration with very few pines. Follow up manual weeding will remove the pine in a short time and then it is a matter of maintenance with follow up annual weeding until pines are eradicated.



*Figure 41 Sunshine Hill: 2011 after hot fire. Figure 42. in 2013 with hardly a pine and excellent native regeneration.*

## 4 Management Issues and Recommendations

### 4.1 Pine control

The experience of pine control at Scamander Plantation has shown it to be both simple and complex, depending on the site and the stage of pine regrowth.

Pine control is relatively simple where:

1. sites are not too steep or areas not too large for machinery or manual labour – factors of steepness and area affect the efficiency, effectiveness and even the possibility of mechanical or manual weeding being an option;
2. the low density (1-5 pines/10m<sup>2</sup>) and height (<3m) of pines allows manual and/or mechanical weeding to be a viable option;
3. mechanical weeding can be used to remove taller individuals or clumps from native remnants or regeneration areas;
4. burning or weeding has been applied in a timely manner, i.e. when fire has been used to prevent pines re-establishing vigorously after harvest. On these sites manual follow up weeding is likely to be the only restoration task required; and
5. early treatment of pine wildlings - critical, to limit the extent of the future pine problem and reduce the resources ultimately necessary for pine wildling control (Kasel et al, 2005).

The sites which are now well on the way to being successfully restored to native vegetation have the above characteristics, enabling available resources to be applied effectively. In general, these sites fall into management zones 2, 3 and 4 and require protection, monitoring and either manual or mechanical follow up treatment.



*Figure 43. Site 17: Was harvested, burnt and aerial seeded with eucalypts. Follow up pine control has been possible manually.*



Pine control becomes more complex when pines are:

1. well established in sensitive areas like riparian zones;
2. are dense ( $>5/10\text{m}^2$ ) and tall ( $>3\text{m}$ ) on steep slopes difficult to access;
3. in areas which have a mixed collection of previous management regimes i.e. patches of cool burns, no burns, old pines, young dense pines; and
4. interspersed with different stages of native regeneration.

The complex pine control sites are generally within management zones 5 and 6 and these sites will require use of all control methods: fire, manual and mechanical weeding.

*Table 4.1 Past and recommended treatment of regeneration sites*

Management zone	Site	Past treatment	Recommended treatment
Reserves and roadsides adjacent to plantation 1	All edges and specifically near sites 20, 38, 46 and 47	Manual removal of pines	Continue manual and mechanical pine removal as a priority along Skyline Tier Rd, Eastern Creek Rd, Trout Creek Rd and Loila Tier Rd
Remnant eucalypt forest 2	2a, 3, 7, 10, 12, 12a, 40,	Successful pine removal	Protect, monitor and maintain as a priority
2	8, 13a, 18,	Mature pine in native forest, planted and neglected	Feller Buncher pines, knock down and burn
2	41, 42,	Pine wildlings and scattered mature pine in native remnants	Manual pine removal, then monitor
Successful regeneration with very little pine 3	3, 15	Pine removed with Feller Buncher and/or bulldozer and/or manual weeding	Monitor and maintain, manual or mechanical follow up control
3	2, 7, 14, 17, 23, 27, 35	Sites <b>burnt</b> post harvest and exhibiting excellent native regeneration with few pines	Monitor and maintain, manual or mechanical follow up control of small patches of pine and individuals
Recently burnt areas 4	25, 29	Sites <b>burnt</b> post harvest very recently, no regrowth yet	Monitor regeneration and remove pine, manual and/or mechanical follow up control
Regeneration – native and pine mix 5	5	Not harvested, pines tall, black gum forest to protect	Mechanical pine removal, knockdown and burn, restore and connect to black gum in 2a
5	1, 4, 6, 11, 17b, 20, 21, 24	Sites <b>not burnt</b> post harvest and exhibiting native regeneration with many pines	Strategically burn large and complex sites, hot burn to kill pine, mechanical control in places, monitor and maintain, manual or mechanical follow up control
Mostly pine 6	16, 26, 26a, 28, 32, 33, 34	Failed or incomplete burn post harvest	Feller Buncher large pine, strategically burn large and complex sites, ensure hot fire, monitor and maintain, manual or mechanical follow up control
6	29, 30, 37, 44	Harvested, replanted, thinned	Ensure post harvest burn, monitor and maintain, manual or mechanical follow up control, may require re-seeding with eucalypts and understorey species
6	9, 43,	Harvested, aerial sprayed, replanted, thinned	Ensure post harvest burn, may need to introduce slash for fuel to ensure hot burn, sites may

			require re-seeding with eucalypts and understorey species, monitor and maintain, manual or mechanical follow up control
6	13, 16a, 19, 31	No apparent management	Ensure post harvest burn, or Feller Buncher and leave native vegetation, monitor and maintain, manual or mechanical follow up control
6	39, 36, 29a	Pines either planted or regenerated in riparian areas, some areas recently burnt	Allow burnt areas to regenerate and manually weed out pines. Mostly leave until impacted upstream riparian zones have recovered. Strategic mechanical or manual pine control with small careful patch burns of stacks (off stream ~20 m buffers) where necessary. Leave all native vegetation in place. Do not clear large areas at once and ensure stream retains vegetative cover as much as possible. May need reseedling with natives

#### 4.1.2 Use of fire for pine control

Pine is fire sensitive and unable to withstand a moderately hot burn. Fire is the most successful pine wildling control technique across a range of sites in eastern Australia (Kasel et al, 2005). Fire may kill wildlings and pine seed, as well as promote germination of soil stored native seed (Kasel et al, 2005).

Use of fire in controlling pines and promoting natural regeneration has proven very successful at Scamander Plantation, especially when fire is used following harvest when fuel loads can be manipulated to create the effective temperature for killing pine. Sites treated with fire post-harvest have significantly reduced pine seedling density and excellent natural regeneration.

Post-harvest burning is proving to be the most efficient method for pine wildling control in large regeneration areas. Fire has the advantage of being relatively labour-efficient, of potentially enhancing native regeneration, and of killing pine seeds as well as seedlings, thus reducing follow-up treatments. Some follow-up manual or mechanical control of remaining seedlings is likely to be necessary, but this is on a significantly smaller scale than is necessary without fire.

The optimum time for burning appears to be soon after harvest. All the sites that underwent a hot fire post-harvest (2, 7, 14, 17, 23 and 27) have excellent native regeneration with little pine.

Sites that did not receive an effective burn have regenerated with a mix of pine and natives. Some of these sites have been managed for restoration with manual and mechanical pine control. However, the scale and vigour of growth is outstripping the resources available for these methods. These sites should be burnt to re-start the regenerative process without the pine.

Both blue gum and ironbark regenerate from lignotubers, enabling eucalypt regeneration from rootstock, an adaptation for survival in areas of frequent fire or drought (Reid et al 2005). This regenerative capacity accommodates burning for controlling pine in areas that have started natural regeneration and in areas that may have had an ineffective fire applied previously. Many sites come into this category and a strategic regenerating fire management plan is advisable.

Issues involved with using fire include safety, escapes onto surrounding land, effects on native regeneration (positive or negative), patchiness of burns due to loss of temperature, or other influences such as wind, fuel distribution, slope, and possible encouragement of pine establishment where mature pines remain.

The strategic fire plan should consider the above factors for each site and use available features, and prior experience and knowledge gained on site, to advantage such as:

- the road network for access, boundaries and fire breaks;
- age specific clumps or tracts of pine to provide a suitable fuel base;
- trial sites with mechanical pine removal providing fuel in prescribed amounts at strategic locations;
- proximity to native forest for reseedling;
- buffer adjacent native forest and restored sites by felling edge pines and stacking in burn area; and
- use of slopes to manage fire temperature.

For many sites, a trial burn is likely to indicate a good response i.e. vigorous natural regeneration, with species diversity and little or no pine.

Some sites, however, may not respond as well, such as:

- the second rotation sites which have been aerial sprayed and have lost soil seed store and organic matter and have little or no native species (site 9);
- the sites which have been thinned and rowed and may lack fuel and soil vigour; and
- sites that have already undergone a failed, ineffective burn.

These sites may need introduced fuel and reseedling following the burn.



*Figure 44. Site 16: Pine regrowth is too dense and vigorous here for manual or mechanical weeding to be an effective or efficient option. A hot fire is recommended - use tracks as firebreaks and burn in sections.*





Figure 45. Site 24: In foreground and on left of hill opposite, pine regrowth vigorous, native regeneration present but pine requires burning for optimum control and native regeneration (red line). Good patch of native regeneration with little pine on hill to north (yellow line), protect from fire and manual weed control recommended.

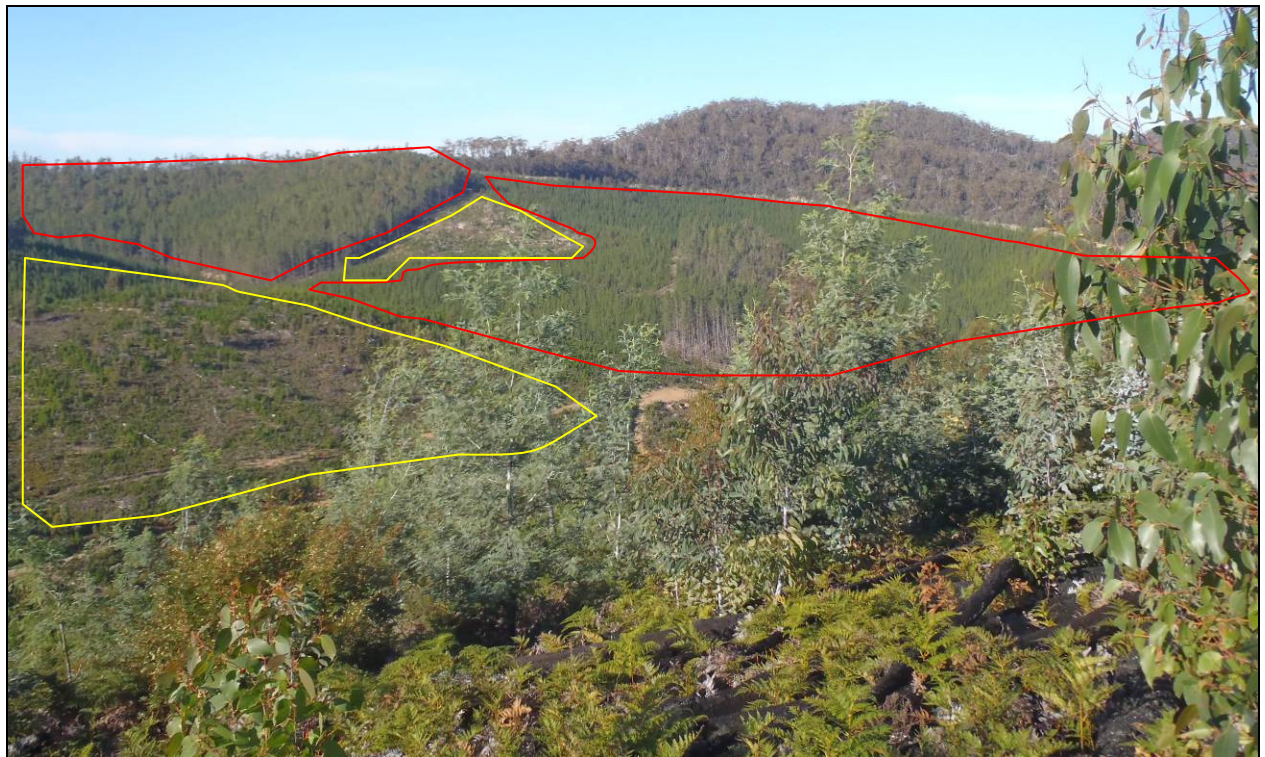


Figure 46. Site 20: Looking east from Sunshine Hill, pines in different age groups, require burning soon to promote native restoration (yellow line) and harvesting and burning in stages (red lines).



#### 4.1.3 Manual and mechanical pine control

Integrated with the use of fire, manual and mechanical methods are very effective and they have a place as the best method in certain situations such as follow up pine control on regenerating burnt sites, in riparian areas, and as maintenance on sites already successfully treated.

**Manual pine control** includes:

- Hand-pull or dig out seedlings and small plants (less than about 60 cm high);
- Lop or cut down skinny pines (below the first branch - does not require herbicide on the stump); and
- using hand saws, machetes, brushcutters and chainsaws.

*Figure 47. A work crew of eight embarking on what seems a daunting project on the eastern slopes, 2008.*



Choice of manual pine control is governed by the size of the trunk, and loppers, hand saws and chainsaws may be used. The density of the pines and size and accessibility of the site governs whether manual control is possible, effective or efficient. Manual work crews can be very effective in areas where gain can be made for the effort, time and money involved.

Many of the restoration sites on the eastern slope have been weeded with manual work crews. However, this method and available resources have not been able to keep up with the growth of pine in regenerating sites 4, 6 and 16 and is not a sustainable management approach. Manual weeding alone cannot be considered as an effective method for treating the remaining restoration sites. However, the result to date clearly demonstrates what can be achieved and provides guidance on how to go about operating more efficiently in the future.

Manual methods are most efficient and effective as control and follow up treatment on sites where pine is small and sparse. It is a suitable method for pine in existing forest and in riparian areas where small control sites are recommended. Chainsaws are most useful when trees are too big for hand sawing, (over a hand width across the trunk) and not dense enough for machinery to be worthwhile. Chainsaws and machinery together on sites with mature pine in clumps in native bush are very efficient.

**Mechanical pine control** used successfully at Scamander includes:

- Bull dozers used for knocking down (scalping, smashing or mulching) pine (Kasel *et al*, 2005; Todd Dudley pers. com. 31/05/13);
- The Feller Buncher used very effectively on pine in existing native vegetation to remove pines that are too large for chainsaws, and are growing either individually or in clumps; and
- Machinery to knock down and stack pine for burning, to create buffers and manage fuel for fires.

Machinery use has achieved restoration of several sites with the added benefit of encouraging and supporting manual work crews to achieve their goals.

The benefit of machinery use can be most profoundly seen in the Yarmouth Creek catchment where black gum forest has been restored with use of the Feller Buncher working in conjunction with ground crews on chainsaws and handsaws and bulldozers have been used to knock down pine patches threatening native forest.

*Figure 48. Feller Buncher working at Scamander Plantation.*



### 4.3 Riparian areas

Riparian areas in Scamander Plantation have been impacted by pine planting and harvesting (see 3.4). The issues for riparian areas are complex and due to loss of the original vegetation cover. Many of the streams are small, upper catchment tributaries of the Scamander River and impacts such as turbidity, sedimentation, erosion of banks and channels cause downstream impacts. Restoring the vegetation cover will make a large contribution to reducing downstream impacts and assist aquatic and riparian habitat rehabilitation.

Many riparian areas have been cleared, planted with pine, harvested and replanted. In order to restore them to native forest, further disturbance is unavoidable, especially in the short term. Avoiding use of fire in riparian areas (Kirkpatrick & Gilfedder, 1999) is recommended, but this aim should be balanced with the desired outcomes for vegetation restoration and some use of fire may be necessary in some riparian areas. As restoration progresses there will be less, and eventually no need for further disturbance. Buffer zones are recommended as a temporary measure to be applied in work zones as necessary for stream and riparian health.

Some broad strategies for working in riparian areas are recommended:

- Assess sites prior to work starting and take a strategic approach to riparian areas, especially on steep slopes where run off and erosion is a high risk;
- Observe ~20m stream buffer zones during works;
- Do not burn within stream buffer zones;
- Leave native vegetation in situ;
- Leave all sizes of woody debris in streams and on banks to trap sediment. In some cases they may need re-alignment with the bank to reduce erosion;
- Allow burnt riparian areas to regenerate naturally, monitor regrowth and manually weed out pines;
- Avoid work in riparian zones downstream of burnt sites until impacted upstream riparian zones have recovered. e.g: Arm Creek is bare of riparian vegetation for several kilometres upstream of Site 29a;
- Strategic manual and mechanical pine control with small patch burns of stacks (observe stream buffers) where necessary;
- Do not clear large areas at once;
- Work on one side of the stream at a time to ensure stream retains vegetative cover and shade on one side;
- Some riparian areas may need reseeding with natives; and
- Gain expert advice for sites where erosion is seriously active e.g.: head cuts.

*Figure 49. On Monzenite Rd below site 23: This stream channel and riparian area are likely to recover over time, native vegetation is regenerating well, the debris in the stream channel will support banks and channel structure and little pine is present so further impacts from pine control are likely to be minimal. Future upstream coupe management should consider the rehabilitation issues for downstream sites.*





#### 4.4 Threatened species habitat

Threatened species habitat on site is largely in a state of rehabilitation and will benefit from restoration works. Several threatened flora species recorded on site have been found and protected by works teams. It is likely that potential threatened flora habitat will be enhanced by restoration. However, site surveys prior to pine control activity are recommended in order to avoid any damaging impacts to threatened flora habitat.

The eagle nest in the Scamander Forest Reserve should be monitored for activity with special attention paid to the early breeding season (July – September) when reconnaissance and nest building may take place. There are strict protocols for works in areas where eagle nest activity is occurring and these should be observed.

Further assistance and information regarding eagle nest and other threatened species habitat management is available from the Threatened Species Unit DPIPWE.

#### 4.5 Weeds and other issues for management

Weeds and other management issues for restoration works were identified.

##### 4.4.1 Weeds other than pine

Several weeds with a high capacity for invasion have been recorded at Scamander Plantation, most of them found by work crews who have eradicated them at the time. The weeds are tabled in 3.3 and mapped.

Sound hygiene protocols are observed by the restoration team including washing down machinery, vehicles, boots and equipment prior to entering the site. This is likely to reduce weed entry and help to maintain the site in good condition.

Continuing hygiene procedures, weed identification on site during works and taking immediate action towards eradication should all continue. Ongoing monitoring and recording of weed species as work proceeds and adding location data to maps is essential so that when any changes to management occur the information is not lost.

The extensive road network is the biggest risk for weed invasion. Closing unnecessary roads is recommended. Some roads are unusable due to failed bridges or crossings, and could be closed and revegetated. Others could be closed at a later date once restoration works have finished, especially at sites on one way tracks.

Spanish heath is highly invasive and present along some tracks (site 19) and should be a high priority to control. Prior to works in areas where there are known weed invasions, a control program should be initiated.

##### 4.4.2 Access for firewood taking, theft of plants and dumping of rubbish and green waste

Taking of firewood and plants from the bush in and around the plantation occurs regularly. Some tracks through the plantation to neighbouring reserves and state forest showed signs of a lot of use.

Woody debris in the understorey is extremely valuable for seedling recruitment sites, habitat niches and sediment trapping and should be a highly protected resource in the restoration area. Collection of firewood represents a considerable loss of habitat, structure and organic matter from the forest.



Figure 50. Well used road opposite site 20: a known firewood gathering area.

Plant theft occurs, and grasstrees in particular are attractive plants to steal for gardens. The dumping of green waste and rubbish is another problem as it introduces weeds and possibly harmful substances and encourages disregard for the area.

The size of the area, the easy access and number of roads, and traditional use all make control of access very difficult. Close some roads to reduce access, install signage about the project and its aims to raise awareness, and impose and increase fines for theft and dumping.



#### 4.4.3 Road management – wash outs, culverts

Road management is an issue as there is an extensive gravel road network. Most of the roads are in good condition and have been well maintained but some are eroding. Roads on steep slopes and across creeks are prone to wash out in the light sandy soils. Culverts and drains will need maintenance while some roads and creek crossings should be closed to further use.

*Figure 51. Washed out creek crossing in site 39: This would be a good road to close as sites 23 and 27 beyond this up a steep hill have better alternative access. Access across this creek is not needed.*



## 5 PRIORITIES FOR MANAGEMENT

### 5.1 High priority sites

Priority areas are identified according to the condition of native vegetation, the stage and quality of its recovery, threat levels to and from sites, their position in the landscape and contribution to connectivity; i.e. good condition sites with intact native vegetation, little or no pine and with potential to connect to other good sites of similar robustness. Priorities are described below and mapped to assist management, depending on available resources.

#### Protect and maintain

Native remnants in the plantation and surrounding forest are a high priority for pine control, as pine is currently jeopardising natural values of these forests and creating a further source of pine seeds. This includes sites 10, 40, 41, 42, 45.

All sites where restoration and native regeneration have been successful are a high priority to monitor, protect and maintain. This includes sites 2, 3, 7, 12, 14, 15, 17, 23, 26, 27, 35.

These sites need to be protected from pine and maintained. Manual methods or in some cases mechanical methods, are the best techniques to use in these areas.

#### Strategic

Sites that are strategically important to work on are those that contain pine and:

- are adjacent to and may threaten good condition sites;
- are adjacent to a threatened vegetation community;
- require burning soon before pines get larger and become more of a management hazard;
- require burning as the most efficient control method, before pines reproduce; and/or
- have recently been burnt and should regenerate well.

This includes sites 4, 5, 6, 11, 16, 17b and 21, 22, 25, 29, 37. These sites are likely to need a combination of burning, and weeding manually and with machinery.

#### Connectivity

Connectivity through the plantation and with the surrounding native forest is very important for biodiversity conservation. There is an opportunity now to promote connectivity across the widest part of the plantation through sites 17, 23, 27, 25, and 29 that are all mostly native regeneration. Maintenance of these sites is a high priority. Sites 18, 20, 24, 28 and 32 are strategically located to connect with these sites and create a large wide native corridor from the coast to the inland Constable Creek - Loila Tier area.

Similarly, on the Skyline Tier east facing slope, a few coupes harvested and burnt would provide a second corridor across the plantation. Sites 19 and 16a in the Yarmouth Creek catchment and sites 5 and 8 in the Reedy Creek catchment are well positioned and contain good natural values to be a corridor priority.

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## 8 APPENDICES

### Appendix 1. Vascular plant list – Skyline Tier regeneration areas

Plants noted during site visits in October 2006, December 2009, May 2013 and during works between 2006 and 2013. These plants were found across the regenerating plantation area, with both dry and damper aspects. Many more plant species could be expected to be found with a thorough survey.

**Key:**

i = introduced and naturalised in Tasmania; e = endemic in Tasmania; **threatened plants are in bold**.

Family	Species name	Common name	Endemism
	<u>Broad-leaved plants (Dicotyledonae)</u>		
APIACEAE	<i>Hydrocotyle hirta</i>	hairy pennywort	
	<i>Xanthosia pilosa</i>	woolly crossherb	
ASTERACEAE	<i>Bedfordia salicina</i>	Tasmanian blanketleaf	e
	<i>Cassinia aculeata</i>	dollybush	
	<i>Chrysocephalum apiculatum</i>	common everlasting	
	<i>Dittrichia graveolens</i>	stinkweed	i
	<i>Helichrysum scorpioides</i>	curling everlasting	
	<i>Lagenophora stipitata</i>	blue bottledaisy	
	<i>Leptorhynchus sp.</i>	shiny buttons	
	<i>Olearia argophylla</i>	musk daisybush	
	<i>Olearia lirata</i>	forest daisybush	
	<i>Olearia myrsinoides</i>	silky daisybush	
	<i>Olearia ramulosa</i>	twiggy daisybush	
	<i>Olearia viscosa</i>	viscid daisybush	
	<i>Onopordum acanthium</i>	scotch thistle	i
	<i>Ozothamnus ferrugineus</i>	tree everlastingbush	
	<i>Ozothamnus thyrsoides</i>	arching everlastingbush	
	<i>Senecio jacobaea</i>	ragwort	i
	<i>Senecio sp.</i>	groundsel	
CAMPANULACEAE	<i>Lobelia sp.</i>	lobelia	
CAMPANULACEAE	<i>Wahlenbergia sp.</i>	bluebell	
CARYOPHYLLACEAE	<i>Stellaria pungens</i>	prickly starwort	
CASUARINACEAE	<i>Allocasuarina littoralis</i>	black sheoak	
CLUSIACEAE	<i>Hypericum gramineum</i>	small st johns-wort	
CONVOLVULACEAE	<i>Dichondra repens</i>	kidneyweed	
DILLENACEAE	<i>Hibbertia empetrifolia</i>	scrambling guineaflower	
	<i>Hibbertia riparia</i>	erect guineaflower	
DROSERACEAE	<i>Drosera sp.</i>	sundew	
EPACRIDACEAE	<i>Astroloma humifusum</i>	native cranberry	
	<i>Epacris impressa</i>	common heath	
	<i>Epacris lanuginosa</i>	swamp heath	
	<i>Lissanthe strigosa</i>	peachberry heath	
ERICACEAE	<i>Erica lusitanica</i>	spanish heath	i
EUPHORBIACEAE	<i>Amperea xiphoclada</i>	broom spurge	

Family	Species name	Common name	Endemism
FABACEAE	<i>Beyeria viscosa</i>	pinkwood	
	<i>Phyllanthus gunnii</i>	shrubby spurge	
	<i>Poranthera microphylla</i>	small poranthera	
	<i>Bossiaea cinerea</i>	showy bossia	
	<i>Bossiaea prostrata</i>	creeping bossia	
	<i>Glycine clandestina</i>	twining glycine	
	<b><i>Glycine latrobeana</i></b>	<b>clover glycine</b>	
	<i>Goodia lotifolia</i>	smooth goldentip	
	<b><i>Hovea corrickiae</i></b>	<b>glossy purplepea</b>	
	<i>Indigofera australis</i>	native indigo	
	<i>Kennedia prostrata</i>	running postman	
	<i>Platylobium triangulare</i>	arrow flatpea	
	<i>Psoralea pinnata</i>	blue butterflybush	i
	<i>Pultenaea daphnoides</i>	heartleaf bushpea	
	<i>Pultenaea gunnii</i>	golden bushpea	
GERANIACEAE	<i>Pultenaea juniperina</i>	prickly beauty	
	<i>Pelargonium australe</i>	southern storksbill	
GOODENIACEAE	<i>Dampiera stricta</i>	blue dampiera	
	<i>Goodenia lanata</i>	trailing native-primrose	
	<i>Goodenia ovata</i>	hop native-primrose	
HALORAGACEAE	<i>Gonocarpus tetragynus</i>	common raspwort	
	<i>Gonocarpus teucroides</i>	forest raspwort	
LAMIACEAE	<i>Prostanthera lasianthos</i>	christmas mintbush	
LAURACEAE	<i>Leonotis</i> sp.	lion's tail	i
	<i>Cassytha</i> sp.	dodder	
MENYANTHACEAE	<i>Villarsia</i> sp.	marshflower	
MIMOSACEAE	<i>Acacia dealbata</i>	silver wattle	
	<i>Acacia genistifolia</i>	spreading wattle	
	<i>Acacia sophorae</i>	coast wattle	
	<i>Acacia melanoxylon</i>	blackwood	
	<i>Acacia mucronata</i>	erect caterpillar wattle	
	<i>Acacia myrtifolia</i>	redstem wattle	
	<i>Acacia retinodes</i>	wirilda	i
	<i>Acacia stricta</i>	hop wattle	
	<i>Acacia suaveolens</i>	sweet wattle	
	<i>Acacia terminalis</i>	sunshine wattle	
	<i>Acacia verniciflua</i>	varnish wattle	
	<i>Acacia verticillata</i>	prickly moses	
	<i>Paraserianthes lophantha</i>	cape wattle	i
	<i>Eucalyptus amygdalina</i>	black peppermint	e
	<i>Eucalyptus barberi</i>	Barbers gum	
MYRTACEAE	<i>Eucalyptus brookeriana</i>	Brookers gum	
	<i>Eucalyptus globulus</i>	Tasmanian blue gum	
	<i>Eucalyptus obliqua</i>	stringybark	
	<i>Eucalyptus ovata</i>	black gum	
	<i>Eucalyptus sieberi</i>	ironbark	
	<i>Eucalyptus viminalis</i>	white gum	
	<i>Kunzea ambigua</i>	white kunzea	
	<i>Leptospermum scoparium</i>	common teatree	



Family	Species name	Common name	Endemism
OLEACEAE	<i>Notelaea ligustrina</i>	native olive	
ONAGRACEAE	<i>Epilobium</i> sp.	willowherb	
OXALIDACEAE	<i>Oxalis perennans</i>	grassland woodsorrel	
PITTOSPORACEAE	<i>Billardiera</i> sp.	purple appleberry	e
	<i>Bursaria spinosa</i>	prickly box	
	<i>Rhytidosporum procumbens</i>	starry appleberry	
PLANTAGINACEAE	<i>Plantago varia</i>	variable plantain	
POLYGALACEAE	<i>Comesperma volubile</i>	blue lovecreeper	
	<i>Muehlenbeckia gunnii</i>	forest lignum	
PROTEACEAE	<i>Lomatia tinctoria</i>	guitarplant	e
	<i>Persoonia juniperina</i>	prickly geebung	
RANUNCULACEAE	<i>Clematis aristata</i>	mountain clematis	
RHAMNACEAE	<i>Pomaderris aspera</i>	hazel dogwood	
	<i>Pomaderris elliptica</i>	yellow dogwood	
	<i>Pomaderris pilifera</i>	hairy dogwood	
ROSACEAE	<i>Acaena novae-zelandiae</i>	common buzzy	
RUBIACEAE	<i>Coprosma hirtella</i>	coffeeberry	
	<i>Coprosma quadrifida</i>	native currant	
	<i>Opercularia varia</i>	variable stinkweed	
	<i>Correa reflexa</i>	common correa	
RUTACEAE	<i>Philotheca virgata</i>	twiggy waxflower	
	<i>Zieria arborescens</i>	stinkwood	
SANTALACEAE	<i>Exocarpos cupressiformis</i>	common native-cherry	
SCROPHULARIACEAE	<i>Veronica calycina</i>	hairy speedwell	
	<i>Veronica formosa</i>	speedwell bush	e
SOLANACEAE	<i>Solanum laciniatum</i>	kangaroo apple	
STACKHOUSIACEAE	<i>Stackhousia monogyna</i>	forest candles	
STYLIDIACEAE	<i>Stylidium graminifolium</i>	narrowleaf triggerplant	
THYMELAEACEAE	<i>Pimelea humilis</i>	dwarf riceflower	
	<i>Pimelea linifolia</i>	slender riceflower	
TREMANDRACEAE	<i>Tetratheca</i> sp.	pinkbells	
VIOLACEAE	<i>Viola hederacea</i>	ivyleaf violet	
<u>Conifers (Gymnospermae)</u>			
PINACEAE	<i>Pinus radiata</i>	radiata pine	i
<u>Narrow-leaved plants (Monocotyledonae)</u>			
CYPERACEAE	<i>Carex appressa</i>	tall sedge	
	<i>Gahnia radula</i>	thatch sawsedge	
	<i>Lepidosperma concavum</i>	sand swordedge	
	<i>Lepidosperma ensiforme</i>	arching swordedge	
	<i>Lepidosperma gunnii</i>	narrow swordedge	
	<i>Lepidosperma laterale</i>	variable swordedge	
IRIDACEAE	<i>Diplarrena moraea</i>	white flag-iris	
JUNCACEAE	<i>Juncus pauciflorus</i>	looseflower rush	
LILIACEAE	<i>Burchardia umbellata</i>	milkmaids	
	<i>Caesia parviflora</i>	pale grasslily	
	<i>Dianella</i> sp.	forest flaxlily	

Family	Species name	Common name	Endemism
ORCHIDACEAE	<i>Dipodium roseum</i>	rosy hyacinth-orchid	
	<i>Dipodium spp.</i>		
POACEAE	<i>Austrodanthonia sp.</i>	wallaby grass	
	<i>Austrostipa sp.</i>	speargrass	
	<i>Cortaderia selloana</i>	silver pampas grass	i
	<i>Ehrharta sp.</i>	weeping grass	i
	<i>Ehrharta stipoides</i>	weeping grass	
	<b><i>Hierochloa rariflora</i></b>	<b>cane holygrass</b>	
	<i>Poa rodwayi</i>	velvet tussockgrass	
XANTHORRHOEACEAE	<i>Lomandra longifolia</i>	sagg	
	<i>Xanthorrhoea australis</i>	southern grasstree	
<u>Ferns (Pteridophyta)</u>			
BLECHNACEAE	<i>Blechnum nudum</i>	fishbone waterfern	
CULCITACEAE	<i>Calochlaena dubia</i>	rainbow fern	
CYATHEACEAE	<i>Cyathea australis</i>	rough treefern	
DENNSTAEDTIACEAE	<i>Histiopteris incisa</i>	batswing fern	
	<i>Pteridium esculentum</i>	bracken	
LINDSAEACEAE	<i>Lindsaea linearis</i>	screw fern	



## Appendix 2. Threatened fauna possible on site

Species that have been recorded within 5 km (Natural Values Atlas June 2013) (excluding marine species), or that may occur in similar habitat on the Beaumaris mapsheet (Bryant & Jackson 1999). Chaostola Skipper may be found wherever there is *Gahnia radula* (P. Bell, pers.comm.1/11/06).

**Species possible on site are in bold.** \*No habitat on site but will benefit from restoration work.

Common name	Scientific name	Tas. status TSPA 1995	Cwth status EPBC 1999	Comments
Australian grayling	<i>Prototroctes mareana</i>	v	VU	Middle and lower Scamander River is known site. Possible stream habitat on site (e.g. Arm Creek), and management of streamside vegetation may affect downstream habitat.
Australian bittern	<i>Botaurus poiciloptilus</i>		EN	Potential habitat on creeks with native vegetation.
Chaostola skipper	<i>Antipodia chaostola</i>	e		Abundant areas of <i>Gahnia radula</i> habitat in the southeast of the site.
Eastern barred bandicoot	<i>Peremeles gunnii</i>		VU	Recorded within 5kms, likes grassy habitat for foraging within reach of forest for refuge.
Fairy tern	<i>Sterna nereis nereis</i>	v		* Coastal shoreline species.
Green and golden frog	<i>Litoria raniformis</i>	v	VU	Potential habitat in creeks and dams on site and Trout Creek wetlands.
Giant velvet worm	<i>Tasmanipatus barretti</i>	r		Possible wet habitat with rotting logs in adjacent gullies, but currently no habitat on site. Eucalypt logs on site and gullies could provide habitat once regenerated. Habitat improving in regeneration areas. Recorded.
Caddis fly (upper Scamander)	<i>Hydroptila scamandra</i>	r		Upper Scamander catchment aquatic species.
Little tern	<i>Sterna albifrons sinensis</i>	e		*Coastal shoreline species.
Masked owl (Tasmanian)	<i>Tyto novaehollandiae castanops</i>	e		Few mature trees in remnants on site that may have large enough hollows for nesting.
New Holland Mouse	<i>Pseudomys novae- hollandiae</i>	e		Possible in regenerating heath on site. Some habitat-indicator flora species are present but still sparse.
Spotted-tailed quoll	<i>Dasyurus maculatus maculatus</i>	r	VU	Possible habitat in dense heathy vegetation on site, with some logs, though lacking ideal wet forest. Regeneration would improve habitat. Eastern quoll (of high conservation significance and extinct on the mainland) also possible here.
Swift parrot	<i>Lathamus discolor</i>	e	EN	Very likely to forage in Blue and Black Gums on site, may nest in mature trees.
Wedge-tailed eagle	<i>Aquila audax fleayi</i>	e	EN	Near Skyline Tier is known nest site. Unlikely to nest within plantation area itself, but may be affected by operations.
White-bellied sea-eagle	<i>Haliaeetus leucogaster</i>	v		Seen on site, future potential habitat here.
White fronted tern	<i>Sterna striata</i>	v		*Coastal shoreline species.

**Appendix 3. Threatened flora previously recorded within 5 km of site**

(Natural Values Atlas June 2013 and pers. com. Todd Dudley).

Habitat comments are in reference to Listing Statements (TSU 2003), and relate to potential habitat restoration proceeds. Threatened species known on site are in **bold**.

**Key:**

Tasmanian status (*Threatened Species Protection Act 1995*):

en = Endangered; x = Presumed Extinct; v = Vulnerable; r = Rare

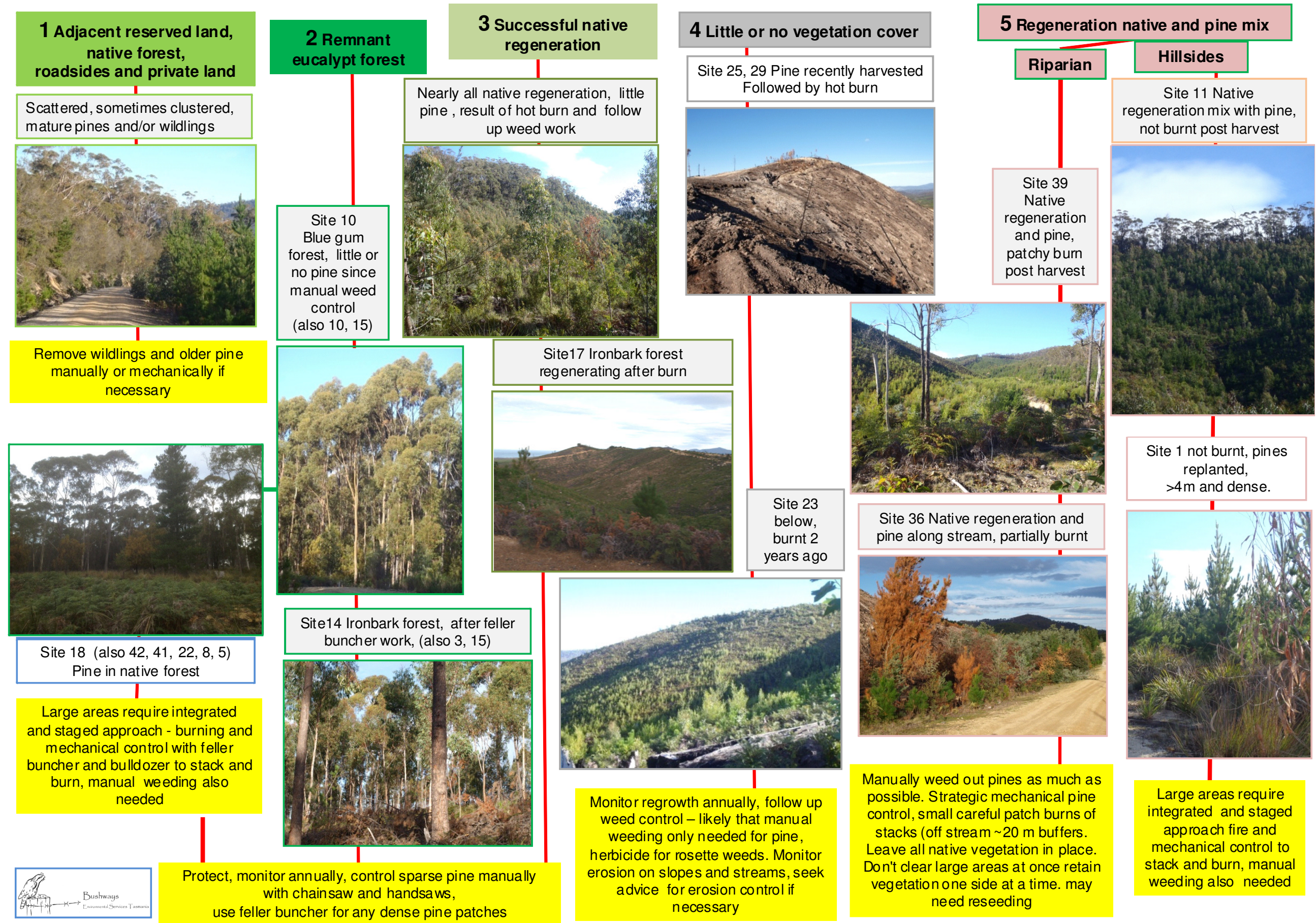
Commonwealth status (*Environment Protection and Biodiversity Conservation Act 1999*):

EX = extinct; CR = Critically Endangered; EN = Endangered; VU = Vulnerable.

Scientific name	Common name	Tas. status TSPA 1995	Cwth status EPBC 1999	Comments
<i>Acacia ulicifolia</i>	juniper wattle	r		Heath and open forest habitat on site.
<i>Austrostipa blackii</i>	crested spear grass	r		Open woodland habitat on site.
<i>Austrostipa nodosa</i>	knotty speargrass	r		Recorded in grassland or open forest, possible here.
<i>Caladenia filamentosa</i>	daddy long-legs	r		Heathy and sedgey open forest habitat on site.
<i>Conospermum hookeri</i>	variable smoke bush	v		Heathy woodland habitat on low nutrient soils on site.
<i>Cynoglossum australe</i>	Australian hound's tongue	r		Dry open forest habitat on site.
<i>Desmodium gunnii</i>	Southern ticktrefoil	v		
<i>Epilobium pallidiflorum</i>	showy willowherb	r		Inhabits wet places.
<i>Euphrasia collina deflexifolia</i>	eastern eyebright	r		Disturbed open areas with high soil moisture in heath or open woodland habitat possible on site.
<i>Glycine latrobeana</i>	clover glycine	v	VU	<b>Found on site throughout the regeneration area.</b>
<i>Hibbertia calycina</i>	lesser guinea flower	v		<b>Ironbark forest on mudstone habitat on site. Found immediately adjacent to plantation edge, over road in ironbark forest.</b>
<i>Hierochloe rariflora</i>	cane holy grass	r		<b>Eucalypt forest on granite, habitat on site. Recorded on site see map.</b>
<i>Hovea corrickiae</i>	glossy hovea	r		<b>Rocky riparian wet sclerophyll or open forest habitat Recorded on site see map.</b>
<i>Plantago debilis</i>	shade plantain	r		Found in boulder crevices and both wet and dry forest/woodland on the East Coast and in the north-east, not recorded yet but likely on site.
<i>Prostanthera rotundifolia</i>	roundleaf mintbush	v		Occurs in the north and east along riverbanks and on rocky hillsides, possible on site.
<i>Schenkia australis</i>	spike centaury	pr		Found in cleared forest pasture, rainforest/wet sclerophyll forest and heathland in the east and north of the State.
<i>Sporobolus virginicus</i>	salt couch	r		Salt marshes and sand hills near the coasts.
<i>Thelymitra malvina</i>	mauvetuft sunorchid	e		Occurs in coastal heath and sedgeland, and in heathy open eucalypt forest, on sandy loams or clay loams.



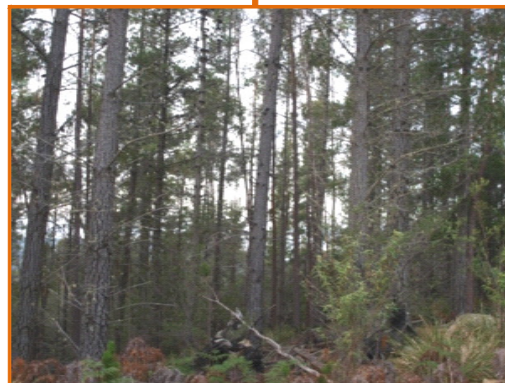
Appendix 4a. Management key zones 1-4





## Appendix 4b. Management key zones 5-6

**Not harvested, site 21**



**No apparent management**

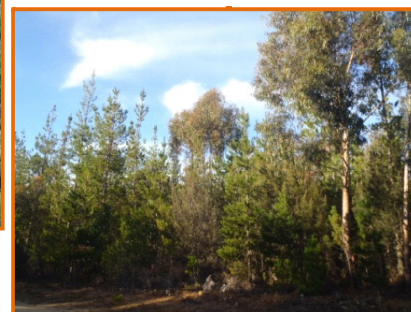
Site 13 Appears poor



**Harvested, planted,  
thinned into rows**



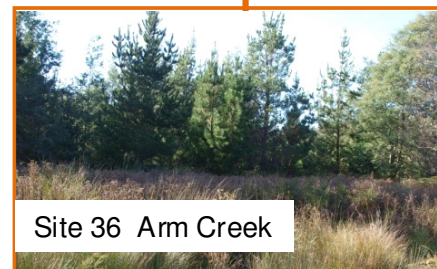
Site 19 Second rotation



**Riparian pine**  
Pine and native vegetation  
Dense pine regrowth  
Areas planted and harvested  
through water bodies  
No native buffer zone or buffer  
zone less than required



Site 39 Riparian pine



Site 36 Arm Creek



Site 29 Arm Creek

**Harvested and followed by a failed burn, or not burnt at all**

Site 20 Failed or poor quality  
dense pine , steep slopes, native  
regeneration present but not viable  
without a burn, burn soon before  
pines get very big.



### Harvested and replanted after aerial spraying

Site 9 no understorey, little native regeneration, pine appears to be failing



Site 20 pines thinned



Site 30, 31 pines thinned,  
native forest reserve behind.

Harvest pine, hot burn and allow regeneration to restore native forest with natives.

Should regenerate well with native vegetation but some sites may need reseedling, monitor and control pine

Site 37, Second rotation



Burn post harvest or mechanical control with feller buncher and bulldozer - knock down and burn; manual control with chainsaw and/or handsaw if necessary around native vegetation

Allow burnt areas to regenerate before working downstream sites, manually weed out pines. Strategic mechanical or manual pine control with small careful patch burns of stacks (off stream ~20 m buffers) where necessary. Leave all native vegetation in place. Do not clear large areas at once and ensure stream retains vegetative cover one side at a time. Some sites may need reseeding with natives.

Allow surrounding site 29 to regenerate  
before burning 32



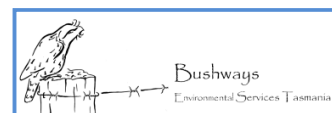
Site 16

Hot bum, use tracks as breaks and burn in sections, monitor regeneration and control any pine and other weeds

Site 43, poor native understorey,  
pines producing cones



Ensure post harvest burn, may need to introduce slash for fuel to ensure hot burn, sites may require re-seeding with eucalypts and understorey species, monitor and maintain, manual or mechanical follow up control





Appendix 4c. Landscape Connectivity

Tall ironbark regeneration on upper slope, site 17 in foreground. Regenerating sub-catchment (site 17) and gully, very little pine remaining. Harvest pine (site 19) in stages and restore to native with hot burns and pine control.



Restoration will connect the east coast with Skyline Tier (upslope in foreground) and restoration areas on the western slopes of the plantation below left, sites 23, 27.

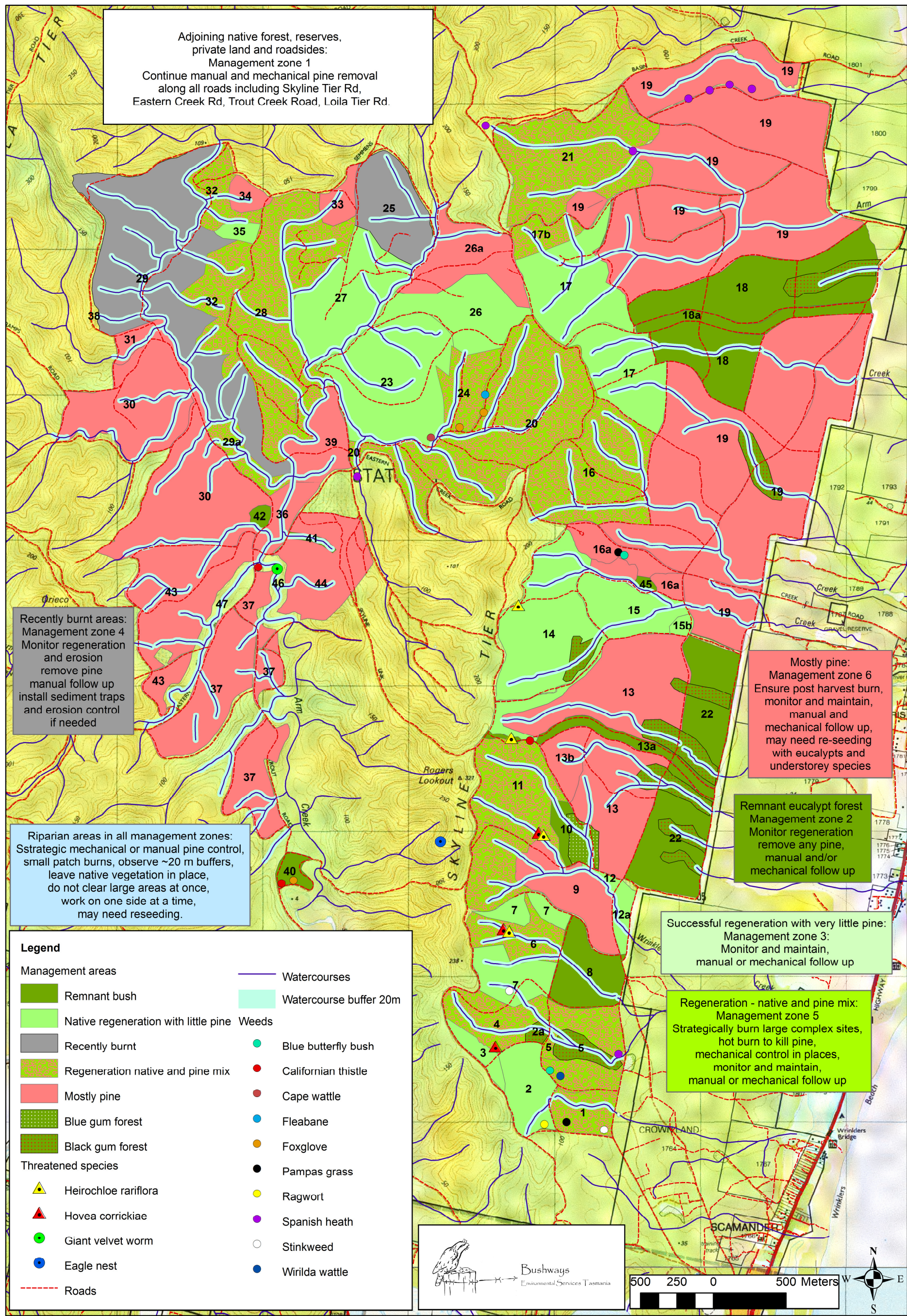


From Sunshine Hill ,site 23, looking north west to site 27 regenerating after a burn, and sites 25 and 29, recently harvested and burnt. This whole area is well on the way to being native regeneration with very little pine and will connect the eastern side of the plantation (via sites 26 and 17) with the Constable Creek - Loila Tier Reserve.

Sites 15 and 14 from Yarmouth Creek to Skyline Tier, black gum and ironbark forest almost completely restored with feller buncher, chainsaws and handsaws. Restore site 19 to complete the connection.



Appendix 5. Map - Scamander Plantation restoration management areas





Appendix 6. Map - Scamander Plantation restoration priorities

