Attachment H.10

SAPN_GHD_Vegetation Management Bushfire Program

02 July, 2015

SA Power Networks

SA Power Networks

Vegetation Management Program Proposals – 2015 – 2020 Regulatory Proposal

Report

June 2015

Executive Summary

SA Power Networks Original Proposal for the 2015-20 Regulatory Control Period (**RCP**) incorporated a number of strategic vegetation management initiatives. These initiatives included the following tree removal and replacement programs in Bushfire Risk Areas (**BFRAs**) and in Non Bushfire Risk Areas (**NBFRAs**):

- inappropriate 'problem' tree removal and replacement program; and
- sapling removal program.

The Australian Energy Regulator (**AER**), in its Preliminary Determination, rejected the funding for these programs primarily on the basis that it considered SA Power Networks did not provide sufficient justification to demonstrate how these programs would reduce the risk of fires and improve safety relative to SA Power Networks' current practices.

SA Power Networks engaged GHD to prepare this supplementary report, as an attachment to the Revised Proposal, in order to provide the AER with further evidence which builds on that provided with the Original Proposal and to provide detailed support in relation to these tree removal and replacement programs.

Inappropriate 'problem' tree removal and replacement program

There is an accumulation of legacy trees that are now in, or are entering, senescence (ie over-mature or decaying), and the emergent cohort of 'problem' trees that has resulted, in significant part, from the trend in recent decades to plant trees, particularly near power lines and inappropriate planting issues.

These legacy and 'problem' trees constitute significant safety, reliability and fire start risks in relation to the supply of standard control services (**SCS**) through the distribution system that will escalate over the 2015-20 RCP.

This problem has created a situation which is a step up from that addressed by SA Power Networks' historical, clearance-compliance focussed program. For this reason, SA Power Networks has developed, and included in its Original Proposal, an inappropriate 'problem' tree removal and replacement initiative to be carried out in both BFRAs and NBFRAs in addition to its ongoing routine vegetation management program to address this issue.

To comply with its regulatory obligations and maintain the safety, reliability and quality of electricity supply from its distribution system over the 2015-20 RCP, SA Power Networks must take reasonable steps to address these risks and SA Power Networks' proposed inappropriate 'problem' tree removal and replacement initiative will ensure that this is done prudently and efficiently.

Section 2 of this report contains further evidence in relation to the nature of the significant safety, reliability and fire start risks associated with these problem trees, the problems these trees are causing, and why SA Power Networks' proposed removal and replacement initiative is a prudent response to this problem.

Sapling removal program justification

There has been, and will continue to be in the 2015-20 RCP, an increase in the scale of sapling emergence because of the uncommonly experienced pulse-regeneration event associated with La Nina which has followed the 2010/2011 record rainfall period.

If saplings are not removed through a targeted, systematic program of works, then safety, reliability and fire risks will increase across substantial areas of SA Power Networks' distribution system over the 2015-20 RCP. Due to the scale of the sapling emergence, this increase in risk is already, and will continue to be, on a significant scale, and is most evident in some of South Australia's High Bushfire Risk Areas (**HBFRAs**). SA Power Networks must implement its proposed sapling removal initiative to comply with its regulatory obligations and maintain the safety, reliability and quality of electricity supply from its distribution system over the 2015-20 RCP.

Section 3 of this report contains further evidence of the occurrence and nature of the strong La Nina event which has given rise to the pulse-regeneration event, the resulting sapling emergence issue, and why SA Power Networks' proposed removal and replacement initiative is a prudent response to this problem.

Conclusions

The rationale for proposing the BFRA (including the removal of saplings) and the NBFRA tree removal and replacement programs in the 2015-20 RCP are driven by the requirements to comply with regulatory obligations and maintain the safety, reliability and quality of the supply of SCS through its distribution system.

In our view, the proposals for the BFRA and NBFRA programs reflect those that a "*prudent operator—with efficient costs and a realistic expectation of demand and cost inputs—would need to operate its network safely and comply with its obligations and service standards*" (AER, 2015), thus meeting the AER's remit.

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1. Introduction

SA Power Networks submitted its Original Proposal for the 2015-20 RCP to the AER on 30 October 2014 and the AER issued its Preliminary Determination on 30 April 2015.

SA Power Networks' Original Proposal incorporated a number of strategic vegetation management initiatives including BFRA (incorporating the removal of saplings) and NBFRA tree removal and replacement programs. These programs have been resubmitted in the Revised Proposal. The estimated cost of these programs over the 2015-20 RCP, net of savings associated with reduced tree trimming costs, is as follows:

- BFRA tree removal (including the removal of saplings) and replacement program of 1,600 spans per annum at a net cost of $10.5[1] (June 2015, $ million). This includes reduced tree trimming costs of $7.3 (June 2015, $ million); and
- NBFRA tree removal and replacement program of 1,500 trees per annum at a net cost of $6.1 (June 2015, $ million). This includes reduced tree trimming costs of $3.2 (June 2015, $ million).

SA Power Networks considers that these programs are prudent for complying with its regulatory obligations and requirements, and maintaining the safety, reliability and quality of supply of SCS through its distribution system.

The programs address legacy issues (in the case of tree removals), and emerging step changes in vegetation occurrence (in the case of saplings) which, if dealt with when identified, before they become a compliance problem requiring long-term repeated cyclic treatments, will prevent this vegetation from becoming a safety, reliability and fire risk requiring recurrent costly treatment in the future.

A prudent Network Service Provider (**NSP**) would seek to implement risk removal and prevention strategies in their vegetation management rather than confining themselves to line clearance treatments only which leaves untreated known additional emerging risks, and unnecessarily high existing risks.

[1] Revised forecast is $1.3 million higher as it now excludes the $1.3 million saving associated with the Original Proposal program for undergrounding 135 km of line in BFRAs, that does not form part of the Revised Proposal

2. Tree removal program rationale

This section considers SA Power Networks rationale for proposing a tree removal program, with the principal benefits being compliance with regulatory obligations and requirements and maintaining the safety, reliability and quality of the supply of SCS through its distribution system, and that such work is additional to the scope of normal vegetation clearance compliance oriented programs.

2.1 Risk factors relevant to tree removal/replacement justification

One of the major factors affecting NSP vegetation management programs is the extent, type and size of vegetation occupying areas under and adjacent to power lines. The following vegetation risk factors are relevant:

- Vegetation is highly dynamic. Vegetation that has a particular risk profile and recurrent treatment cost now may grow in a way that can substantially increase its risk profile and recurrent treatment cost in the future.
- Removal of trees (as opposed to cyclically trimming them repeatedly over their life which can be hundreds of years) can reasonably be expected to maintain current risk levels and forward costs, however this is particularly the case if the trees targeted are those that are at a point in their growth from which they can be expected to significantly increase their risk profile and treatment cost in the near future. Allowing such trees to transition to their higher risk profile stage by not removing them is effectively a conscious decision to allow risk to increase above current/historic levels, as well as allowing future vegetation management program scale and costs to increase.
- Inappropriate trees allowed to continue to grow can escalate their risk profile in a number of ways:
  - Increasingly senescent trees entering the over-mature state typically start to progressively decay (decay can be in main branches, roots or the stem). Branch decay significantly increases the probability of branches falling on power lines potentially causing significant public safety and reliability impacts. Decaying roots increase the probability that trees may be blown over onto power lines during high winds, similarly increasing public safety and reliability risks. Stem decay increases the probability that the stem may fail in high winds and fall onto power lines increasing risks. Both stem and particularly branch decay significantly increase safety risks of trimming trees.
  - Trees, which due to trimming history, are attaining an increasingly unnatural and potentially hazardous form (highly unbalanced crowns; weakly held branches/secondary leaders) will typically increase their risk of failure, also increasing public safety and reliability risks as they continue grow.
  - Some fast growing species planted in inappropriate places under or too close to power lines by land owners, as they are allowed to reach power line height, rapidly escalate their risk profile. Efforts to cut/prune such trees clear of power lines can serve to increase shoot development/branching making the tree increasingly difficult to manage, and increase these risks as the new branches are less strongly held than older stems previously trimmed.
  - As inappropriate trees continue to grow into areas that are increasingly difficult for cutting crews to access, safety risks increase as does reliability risk due to branches reaching positions where they have increased probability of falling on power lines. Figure 1 below shows an example of inappropriate tree planting in which fast growing Eucalypts (four in

25 metres) have been planted almost directly under the power line (middle foreground). Cutting treatments applied by utility arborists have cut the leader (top) out of the trees. Branching from the cut has been removed on the power line side of the tree but left on the other side. It is apparent that pruning effort is being applied in an attempt to direct stem and branch growth away from the lines. The result of such an approach will be a highly unsightly tree which requires frequent treatment, with access made increasingly difficult as the tree grows above power line height in the next few years, and thereafter for its life. Safety and reliability risks are significantly increased. These trees should be removed, and either replaced with low growing shrubs or setback further from the power line.

Figure 1 - Inappropriate trees requiring removal and replacement

In its Original Proposal, SA Power Networks emphasised the cost-benefits of tree removal, but understated how failure to remove such trees will significantly increase safety and reliability risks (as well as fire risks as senescing trees have higher vulnerability to being damaged by fire, as well as falling on power lines which can start fires).

SA Power Networks may have unintentionally created an impression that the benefits of tree removal are limited to cost savings in avoiding a continuance of existing recurrent trimming costs, and are therefore about efficiency rather than risk reduction. Because the proposed tree removal program is strategically targeted to inappropriate ‘problem’ trees, the benefits accruing are instead the ability for SA Power Networks to continue to comply with its regulatory obligations and requirements and maintain the safety and reliability of the supply of SCS through its distribution system by ensuring that the aforementioned risks (safety, reliability, bushfire) do not increase, and that SA Power Networks' avoids further escalated costs that will otherwise arise.

2.2 Inappropriate 'problem' tree occurrence

A temporary 'step-change' in vegetation management targeting tree removal is appropriate and prudent. Historically, vegetation management programs have been clearance compliance-driven as regulatory compliance is a high priority. A particular focus of SA Power Networks vegetation management program over the current 2010-15 RCP has been to consolidate cutting cycle stability and reduce levels of non-compliance. In the aftermath of several bushfires across South Eastern Australia, including the Black Saturday bushfires, this is considered an appropriate focus. It also remains a valid focus in the context of the recent January 2015 Sampson Flat bushfires affecting the Adelaide Hills and the Adelaide outer metropolitan areas. While the focus of available resources has been on compliance priorities, problem tree removal to reduce risks associated with the highest risk class-vegetation remains to be systematically addressed.

Amongst others, there are two key sources of problem trees:

1. ''Legacy trees' – These are trees that are close to power lines (and in many cases shaped around power lines) that have established naturally or were planted for amenity many decades ago and have been kept clear of power lines through the mature stage of their life cycle by repeated, higher-difficulty level cutting. These trees are now in the senescent phase, and in some cases late-senescence, and undergoing decay. Their risk profile for falling onto or dropping branches onto power lines (generating vegetation/power line interaction related risks) is entering an escalated phase. In some cases, land owners are planning for succession and planting new trees alongside the senescing trees so that by the time the senescent trees reach the end of their life they have been 'replaced'.
2. 'Recent inappropriate plantings' – Over the last decade in particular, and in some places for longer, there has been a strengthening focus on tree planting. Typically, development approvals issued by local governments require that trees removed to facilitate building and development are replaced (mostly not on a one-for-one basis, but applying multipliers – five to one is not uncommon) by planting elsewhere on the subject land. Commonly, land owners seek to avoid planting/shading-out their 'back yards' which they seek to keep clear for amenity, and they focus tree planting along front boundaries close to power lines, often with the intent of screening power lines. In response to this increased drive for tree planting, substantial numbers of trees have been planted over the last decade, many of which have already, or will shortly, enter a growth stage where they will require extensive and higher-difficulty pruning to avoid the power line clearance space, but in any case will present higher risk and treatment effort profiles for decades to come.

These classes of problem trees are among the higher risk profile vegetation faced by SA Power Networks. As a prudent risk manager, SA Power Networks must address this higher-order risk class. If SA Power Networks were to restrict vegetation management efforts to traditional 'clearance compliance' focussed effort only, the risk class will escalate and become a significantly larger proportion of SA Power Networks vegetation risk profile in the future. The proposed removal program is aimed at initiating a systematic effort to reduce the risk profile, and to prevent risk profile escalation. A systematic tree removal program has not been part of SA Power Networks practice in the 2010-15 RCP. The need for a systematic tree removal program is currently emerging as an escalating issue. As such, SA Power Networks considers such a program is a necessary 'step change' in vegetation management program scope.

2.3 Inappropriate 'problem' tree risk reduction treatment

As identified in the SA Power Networks Original Proposal, it intends to:

- initiate a systematic program to identify 'problem' trees as candidates for removal, prioritising the highest risk profile trees;
- pursue a program involving negotiation with local councils and private land owners seeking agreement to remove identified trees – approval is required as SA Power Networks does not have authority to remove trees in these situations; and
- in negotiating tree removal outcomes, identify possible replacement with a more appropriate species, or replacement in a more appropriate location.

SA Power Networks considers that it is important to not just address those trees which are currently at the highest risk profile level. These are typically late senescent trees in close proximity to and in many cases shaped around power lines, and are typically the most expensive to remove. SA Power Networks considers that for the same cost as one high-cost removal, several removals of 'candidate problem trees' can be achieved thus preventing a new cohort of problem trees becoming established.

Tree removal is a substantially different activity to tree trimming/pruning. As it requires removal of the entire tree, not just the recent growth on branches and leaders, different techniques to normal trimming operations are often required, particularly where assets are within the drop zone. This generally requires climbing operations teams (instead of elevated work platforms) and stump grinding. Where replacement is involved, provision of plants and planting crews are involved. It is not practical or efficient to incorporate such works as part of routine line clearance works for which the objective is to keep line clearance teams focussed and working efficiently on line clearance work. A separately scoped program is required to efficiently deliver 'problem tree removal' work.

2.4 Inappropriate 'problem' tree removal and replacement proposal summary

The accumulation of legacy trees that are now in, or are entering, senescence (ie over-mature and decaying), and the emergent cohort of 'problem' trees, has resulted, in significant part, from the trend in recent decades to plant trees, particularly near power lines. This has created a situation which is a 'step change' from that addressed by SA Power Networks' historical, clearance-compliance focussed program. SA Power Networks must therefore address this problem in order to maintain the safety, reliability and quality of electricity supply from its distribution system.

3. Sapling removal program rationale

This section considers SA Power Networks rationale for proposing a sapling removal program, with the principal benefits accruing being compliance with regulatory obligations and requirements and maintaining the safety, reliability and quality of supply of SCS through the distribution system, and that such work is additional to the scope of normal vegetation clearance compliance oriented programs.

3.1 Risk factors relevant to sapling removal justification

One of the major factors affecting NSP vegetation management programs is the extent, type and size of vegetation occupying areas under and adjacent to power lines. The following vegetation risk factors are relevant:

- Higher volumes of woody vegetation under or adjacent to spans means the likelihood of vegetation growing into the clearance space is increased, thereby increasing safety, reliability and fire start risks to SA Power Networks' distribution system. Allowing the amount of woody vegetation to increase by not removing new regeneration is effectively a conscious decision to allow risk to increase above current/historic levels, as well as allowing the scale of future vegetation management programs (and the associated costs) to increase.
- Higher volumes of woody vegetation under or adjacent to spans means that when bushfires burn through locations where power lines are situated, there is a significantly increased risk of direct flame contact and/or very high levels of radiant heat impacting assets causing major damage or destruction to electricity assets. Allowing the amount of vegetation to increase by not removing new regeneration is effectively allowing the amount of fuel under or in close proximity to power lines to increase, and in the case of regeneration under power lines, allowing the fuel to be positioned substantially closer to NSP assets than if they were removed.
- Woody vegetation that grows into a position extending above power lines increases reliability risk (from falling branches), and increases safety risk because vegetation positioned above power lines is more difficult to safely treat than vegetation beneath power lines.
- Woody vegetation that is allowed to establish at the margins of cleared areas will typically grow toward the clear space near power lines (and away from competing trees further away from power lines) seeking to maximise their access to light, and with this will grow with a lean towards power lines which substantially increases the risk that they may fall on power lines in the future as they reach late-senescence or are damaged by events such as bushfires or storms.

In summary, SA Power Networks needs to remove regenerating saplings from under and near power lines in order to continue to comply with its regulatory obligations and requirements and maintain the safety, reliability and quality of supply of SCS through its distribution system over the 2015-20 RCP and beyond.

3.2 Events causing step-changes in sapling occurrence

South Australia’s climate features high rainfall variability. This variability in rainfall has a governing influence on vegetation establishment and growth, and has its greatest influence during the germination and establishment phases of the woody vegetation (particularly trees and tall-growing shrubs) life cycle.

GHD has undertaken a number of compliance audits on SA Power Networks' distribution network focussing on BFRAs just prior to fire danger seasons. Each year a very high proportion of clearance non-compliances are associated with areas of high rainfall, dense vegetation and high population including the Mount Lofty Ranges, the South Eastern Region and the Fleurieu Peninsula. These areas are heavily vegetated with trees from the *Eucalyptus* or *Corymbia* genera commonly known as “Gum trees”, and tall-growing shrub species including wattles.

These locally occurring tree species have evolved with and adapted to South Australia’s highly variable rainfall, as have many non-endemic introduced native species which have naturalised in South Australia due to their adaptations allowing them to survive in the South Australian climate.

A feature of Eucalypt ecology is that dry forest species occurring in drought-prone areas often regenerate in pulse-events as they are adapted to take advantage of narrow windows of opportunity when conditions are favourable to germination and establishment (Jacobs, 1955; Florence, 1996). In less favourable times (e.g. droughts, over hot dry summers) regeneration typically fails.

Moisture availability and mineral earth (or ash) seedbed conditions are two key limiting factors for Eucalypt regeneration. Eucalypt seed has a relatively short viability period. It requires contact with mineral earth or an ash bed to promote germination (germination on organic material such as leaf litter beds or mulched organic matter is very rare). Sufficient soil moisture is required to facilitate seedling growth, including root establishment sufficiently deep in the soil profile so that resilience to soil surface drying is developed, and lignotuber development (Williams and Woinarski, 1998). The critical requirement in South Australia’s Mediterranean climate (cool wet winters and hot dry summers) is to be able to develop and survive through the first two summers. The occurrence of hot dry conditions in summer typically accounts for very high seedling mortality, particularly in the first year, but also in the second year (Stoneman, 1994). Accordingly, sustained periods of above average rainfall through the normally hot dry summer period provides favourable conditions for Eucalypt (as well as many other dry climate adapted genera) regeneration, seedling survival and successful early establishment. Such periods with favourable soil moisture conditions sustained through consecutive summer periods may only occur relatively infrequently (de Mar, 2014).

In South Australia (and most other parts of Southern and Eastern Australia) such conditions occurred in the 2010/2011 strong La Nina event, with the last similar occurrence having occurred in the mid 1970’s. Such periods have in the past been attributed with major pulse-regeneration events for vegetation.

Figure 2 - Annual rainfall (1886 – 2014) at Murray Bridge SA

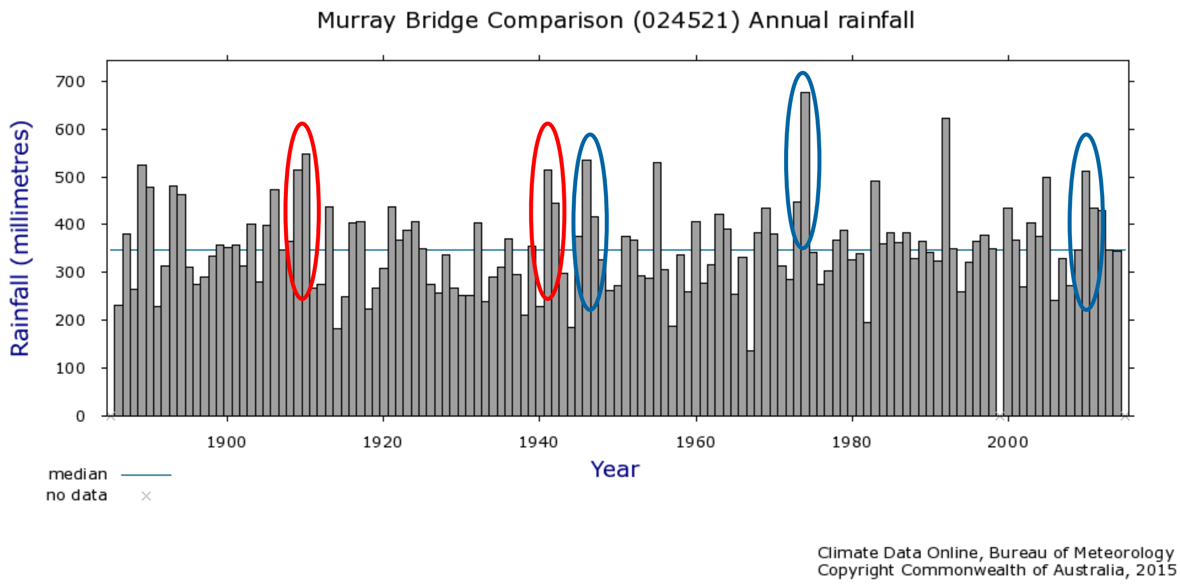


Figure 2 graphs annual rainfall totals from 1886 to 2014 at Murray Bridge in South Australia. This graph demonstrates that years with consecutively above average rainfall are uncommon. Furthermore, of those periods when there are two or more consecutive years of above average rainfall, it is important for pulse-regeneration events to occur that above average rainfall is experienced through the summer periods to facilitate seedling survival. Such conditions occurred in the 2010/2011, 1973/1974, and 1945/1946 (highlighted with blue ellipses). By comparison, for the two years above average rainfall events in 1910/1911 and 1941/1942 (highlighted with red ellipses), dry summer periods occurred. The summers of 1909/10 and 1911/12 were among the driest on record. The 1941/42 summer was drier than average (with five consecutive months of below average rainfall from November to March). The key point is that sustained wet periods with favourable growing conditions in summer are uncommon and unpredictable events, which give rise to pulse regeneration event conditions. SA has recently been through such an event in 2010/2011. It is reasonable to expect that in locations where there are mature Eucalypt trees to provide seed source and ground conditions conducive to germination of seed - such as ground grazed bare by previous drought (as occurred in the millennium drought from 2002 to 2009), features such as graded drains, batter slopes and areas with poor soils - pulse regeneration events are primed to occur.

Figure 3 shows rainfall deciles for the two year period covering the 2010/11 and 2011/12 years. Rainfall across this sustained period was in the highest 10% of all records across most of South Australia. Figure 4 shows that summer rainfall in this period was favourable across a high proportion of South Australia.

Figure 3 - Two year period rainfall deciles for SA (Jul 2010 – Jun 2012)

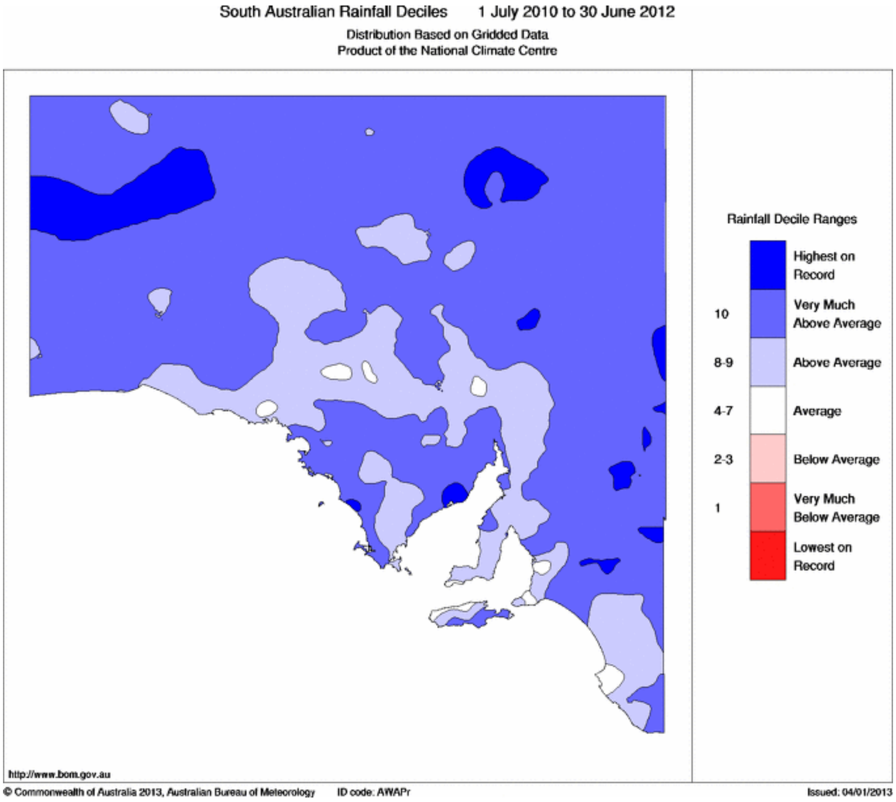


Figure 4 - Summer rainfall deciles in each of 2010/11 and 2011/12

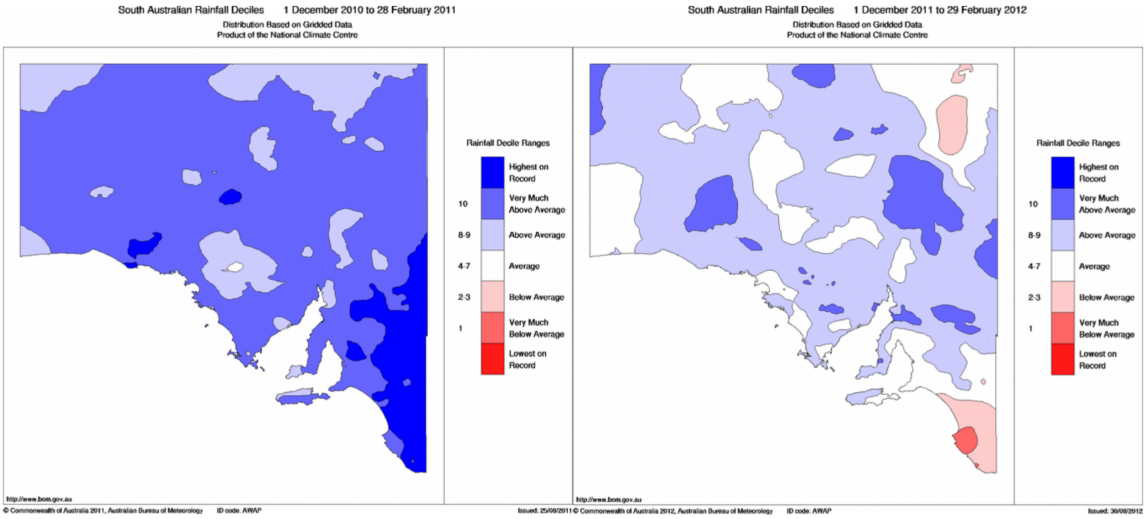


Figure 5 - Pulse-regeneration around a paddock tree

Figure 5 above is illustrative of the pulse regeneration effect that is associated with favourable periods of sustained rainfall. A paddock tree (Eucalypt) can be seen with prolific regeneration surrounding it. In the lead-up to the 2010/2011 ‘big wet’ period, preceding sustained drought led to ‘eating-out’ of pasture and exposing of mineral soils. Drought forced substantial de-stocking. With the advent of the 2010/2011 ‘big wet’, Eucalypt seed released by this tree found exposed soils, with moisture levels recharged and favourable for germination and growth. Favourable summer rainfall through the first two summers following germination has facilitated survival of the seedling cohort (which in hot dry summers typically dies out due to surface soil moisture deficiency). The cohort becomes established with robust lignotuber development and is able to survive subsequent reintroduction of stock which preferentially graze on abundant grasses which reduces grass competition to the cohort of Eucalypt regeneration. The absence of other regeneration cohort age-classes in this scene is indicative that over previous decades conditions have not been favourable for regeneration, and the current event represents an uncommon pulse-event.

While the example in Figure 5 represents an agricultural land example, this regeneration process is occurring widely in Southern and Eastern Australia following the 2010 and 2011 'big wet' and is particularly evident where Eucalypt seed from nearby trees can fall onto bare soil. At Figure 6 below, a cohort of regeneration can be seen surrounding a tree on an alluvial flat in a National Park where livestock grazing was ceased more than two decades before. A pulse regeneration event is established.

While the examples we have given here have focussed on paddock trees, events are in no way restricted to these situations.

Figure 7 on the following page shows a pulse regeneration event extending from a forest/grassland edge, where trees are in the process of reoccupying clear land. Parallel processes are observable in cleared areas under power lines where cohorts of Eucalypt regeneration are establishing under and in close proximity to power lines. Their seed source trees are considered to be at an acceptable distance from power lines, however the new cohort becoming established is not. Many such trees are now much taller than those shown here, and are in the sapling stage. The routine practice for cutting crews is to only begin cutting these saplings as they approach the clearance space.

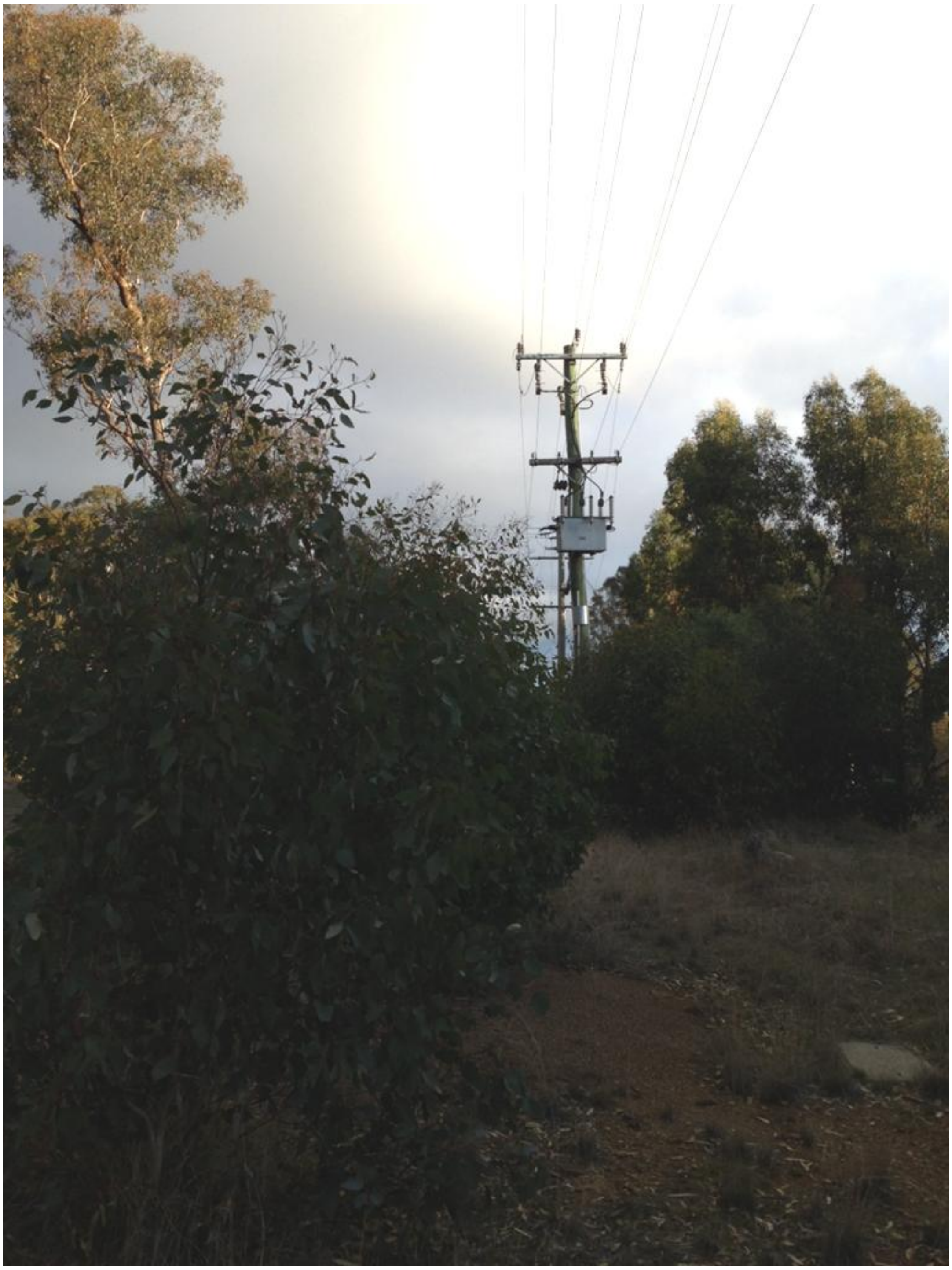
Figure 6 - Pulse-regeneration around an isolated tree (no livestock grazing)

Figure 7 - Pulse regeneration occurring in grassland at the fringe of Eucalypt forest

3.3 Sapling establishment and treatment

In Figure 8 below, an example of Eucalypt regeneration under power lines can be seen. In the foreground is Eucalypt regeneration which if left to grow until it approaches the clearance space will become established trees. In the middle-ground more regeneration can be seen in front of the power pole. Along this feeder section there were hundreds of young saplings that have grown from seed, in sustained favourable growth conditions, in previously cleared areas under the power line.

Figure 8 - Eucalypt regeneration under power lines



In South Australia, SA Power Networks is not allowed to remove such trees without the agreement of the land owner. The normal response of contractors implementing cyclic cut or pre-bushfire season cutting programs is to prune such trees, with progressive pruning over time aiming to shape the tree around the power line. The establishment of such regeneration increases safety risks to SA Power Networks' employees as future vegetation cutting work can be expected to involve work close to and over the top of the live power line, increases reliability risk (more vegetation in close proximity to the power line) and increases bushfire risk, both from:

- the increased potential for the vegetation to come into contact with the power line potentially causing a fault that could ignite a fire; and

- fire risk to the network assets as the Eucalypt vegetation will serve to propagate flames to a height where they directly impact the conductors and pole hardware, damaging assets and also adversely impacting reliability.

In order to estimate the pulse regeneration event potential, SA Power Networks (in 2014) undertook a small-scale case study engaging GHD to survey a limited sample of spans across the network. GHD surveyed a total of 256 spans finding that saplings were present in 29% of spans, and of these, 13% of spans had more than 5 saplings present. Extrapolating this data would suggest that there could be 125,570 spans in the network containing saplings. If such an extrapolation is valid (GHD notes the actual occurrence could be lower but equally it could be higher) this would constitute a significant ‘step-change’ event. If left unaddressed this will lead to increased safety, reliability and bushfire risk across the network, and is likely to generate a ‘step-change’ increase in the amount of vegetation requiring ongoing management once it has grown to a height that it begins to impact the clearance space.

This pulse of regeneration is not accounted for in SA Power Networks' routine vegetation management program as reflected in the 2013/14 base year. That is, SA Power Networks cost proposal for its normal vegetation management program encompasses its cyclic and pre-fire season treatment programs in which vegetation expected to grow into the clearance space within the next treatment period is treated (or in the case of the bushfire program, within the next bushfire danger period).

Further, saplings require different treatment to normal tree pruning practice. A high proportion of saplings will not be removed by cutting alone, even if that cutting is at ground level. Established Eucalypt seedlings and young saplings are very well-adapted to disturbances that remove their above-ground parts such as has commonly occurred throughout their evolutionary history through recurrent events such as fires, grazing by herbivores, or recessing during severe drought. Most dry forest and woodland Eucalypts have evolved lignotubers which are storage organs beneath the soil surface at the root crown from which they can re-sprout if cut or otherwise reduced back to ground level. Those cut or otherwise reduced in height above ground level can coppice or re-sprout from their stem from epicormic buds beneath their bark (Moore, 2014). Accordingly, established Eucalypt seedlings and saplings are in general very resilient to cutting treatments. Their removal requires alternative techniques such as mechanical removal (including lignotuber which is part of the root system) or cutting.

In Figure 9 on the following page, in the left foreground a Eucalypt sapling which has been cut back to ground level can be seen regenerating multiple stems (coppice) and resuming growth toward the overhead power line. A cutting treatment alone has failed to remove this Eucalypt. With a large underground lignotuber already developed from before it was cut, this regenerating Eucalypt will be able to grow at much faster rate than a new seedling. It is possible for saplings with well-established root systems and a large healthy lignotuber, after being cut back to ground level, to re-sprout and grow to overhead power line height in just two or three favourable growth seasons.

Figure 9 - Eucalypt coppice after a sapling was cut at ground level

When Eucalypt regeneration is prolific, and tall grass or regenerating shrub cover is also present, it is not uncommon that some young regenerating Eucalypts are not seen and therefore evade treatment by cutting. In Figure 10 on the following page, in the close foreground (right-side of picture) Eucalypt seedlings can be seen that were not seen/treated at the time this span was treated. In the near-middle ground, regeneration can be seen. In the middle-ground a mix of dying and surviving Eucalypts, previously cut can be seen, with some original saplings that escaped cutting also still present and well-established. Without a rigorous purpose-designed sapling removal program, this span will become more densely occupied by woody vegetation, increasing safety, reliability and bushfire risk, as well as the future vegetation management cost.

Figure 10 - Various stages of Eucalypt regeneration under power lines

3.3.1 Examples of pulse-regeneration of saplings near power lines

Figures 11 to 16 show examples of sapling establishment near power lines in South Australia. Without a program to address saplings, these will become established trees that can grow into clearance spaces increasing safety, reliability and bushfire risks to SA Power Networks' distribution system, SA Power Networks' employees and the community, and the future scope of vegetation line clearance programs.

Figure 11 - Multiple saplings occupying a formerly grassy slope adjacent to power lines

Figure 12 - Sapling occurrence on bare ground under power lines

Figure 13 - Saplings re-occupying a cleared power line easement from adjacent forest

Figure 14 - Saplings regenerating along fence lines under power lines

Figure 15 - Formerly grassy paddock with power lines being occupied by saplings

Figure 16 - Pulse regeneration under roadside power lines

3.4 Sapling proposal summary

There has been, and will continue to be, an increase in the scale of sapling emergence because of the uncommonly experienced ‘pulse regeneration’ event which has followed the 2010/2011 record rainfall period. If saplings are not removed through a targeted, systematic program, then safety, reliability and bushfire risk will increase across substantial areas of our network. Accordingly, SA Power Networks must implement a sapling removal program to maintain the safety of, and the reliability and quality of electricity supply from, its distribution system.

SA Power Networks has incorporated the cost of sapling removals within the total estimated cost of tree removals of $2,000 per span in the BFRA. The annual BFRA tree removal program is based on the removal of trees in 1,600 spans per annum (ie 2.5% of annual infringements).

4. Conclusions

As outlined above, SA Power Networks' proposed inappropriate tree removal and replacement programs, including the removal of saplings in BFRAs, in the 2015-20 RCP, are required in order to enable SA Power Networks to comply with its regulatory obligations and requirements and maintain the safety, reliability and quality of supply of SCS through its distribution system by ensuring that safety, reliability and fire start risks do not increase over the 2015-20 RCP.

In our view, the proposals for these programs reflect those that a “prudent operator—with efficient costs and a realistic expectation of demand and cost inputs—would need to operate its network safely and comply with its obligations and service standards” (AER, 2015), thus meeting the AER’s remit.

These proposals are to address legitimate ‘step-change’ circumstances. In the case of the inappropriate ‘problem’ tree removal and replacement program, the accumulation of legacy trees now in or entering senescence, and the emergent cohort of candidate ‘problem’ trees promoted in significant part to trends in recent decades to plant trees, has created a situation which is a ‘step change’ from that addressed by SA Power Networks historical, clearance-compliance focussed program. In the case of the sapling removal program, the 2010/2011 sustained high rainfall period has resulted in pulse regeneration events affecting SA Power Networks network, and SA Power Networks must take reasonable steps to address this.

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5. References

de Mar, PJ (2014) Vegetation dynamics and strategic vegetation management program design, Arboriculture Australia Conference 2014 – Proceedings

Florence, RG (1996) Ecology and silviculture of eucalypt forests. CSIRO Australia.

Forestry Corporation NSW (2003) Native forest silviculture manual, FCNSW.

Jacobs, MR (1955) Growth habits of the eucalypts, Canberra Government Printer.

Moore, (2014) Lignotubers and Epicormic Buds as Arboricultural Assets, Arboriculture Australia Conference 2014 – Proceedings

Stoneman, GL (1994) Ecology and physiology of establishment of eucalypt seedlings from seed: A review. Australian Forestry 57 (1): 11-30

Williams, J and Woinarski, J - eds. (1998) Eucalypt ecology: Individuals to ecosystems Cambridge University Press.

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