# TRANSLOCATION PROPOSAL FOR THREE SPECIES FROM THE SOUTHERN IRONSTONE SHRUBLAND ASSOCIATION
# Butterfly Brachysema - *Brachysema papilio* Crisp (FABACEAE)
# Abba Bell - Darwinia sp. Williamson (MYRTACEAE)
# Laterite Petrophile - *Petrophile latericola* Keighery ms (PROTEACEAE*)*

## 1. SUMMARY

***Brachysema papilio***

*Brachysema papilio* first came to attention during the Swan Coastal Plain Surveys (Gibson *et al.* 1994) in 1991 and was described as a new species in 1995. *B. papilio* is a wiry tangled shrub to 1.5 metres tall (Crisp 1995). Adult leaves are opposite and pairs of leaves resemble butterfly wings. Inflorescences are axillary or terminal on short axillary branchlets with one or 2 opposite pairs of flowers. Flowers are cream to red in colour and are present between September and October (Brown *et al.* 1998). Viability of the seed ranges from 55 to 100% (A. Cochrane, pers. comm.). A small trial, where 2 out of 11 seedlings died, suggests that there may be some level of resistance to dieback in *B. papilio*.

In the summer of 1991/1992 a wildfire burnt through half the population of *B. papilio*. Subsequent regeneration occurred from seed and the population numbers have recovered to around 100 in 2001. Despite extensive surveys of the southern Swan Coastal Plain between 1992 and 1994 only the original population is known.

*Brachysema papilio* was declared as Rare Flora in 1994 and ranked as Critically Endangered in November 1998. Its ranking as critically endangered is a result of the presence of threatening processes such as changes to hydrology, disease, weeds, mineral sands exploration and inappropriate fire regimes as well as the small number of plants in a single locality.

***Darwinia* sp. Williamson**

*Darwinia* sp. Williamson is an erect straggly shrub up to 0.7 m in height with long linear leaves 3 to 5 mm in length crowded at the ends of the branches (Brown *et al.* 1998). The inflorescence is nodding or sometimes erect in young plants. The flowers are enclosed by several rows of red and green bracts and occur between October and November (Brown *et al.* 1998). Seed viability ranges between 31 and 86 % (A. Cochrane, pers. comm.).

The species was first collected in 1990 by Greg Keighery. Subsequent searches were unsuccessful in locating any further populations of this new taxon. Shortly after this species was found, a hot summer fire burnt the population, killing all plants but one of the adults. Good seedling regeneration occurred post-fire and the species is now known from approximately 100 plants. Like many Myrtaceaeous species, *Darwinia* sp. Williamson is likely to be susceptible to dieback (*Phytophthora cinnamomi*) (Stack *et al.* In draft).

*D.* sp. Williamson was declared as Rare Flora in October 1996 and then ranked as Critically Endangered in November 1998. This is due to the small number of plants that only occur in a single locality. Threats to the species include disease, inappropriate fire regimes, mineral sands exploration and mining, waterlogging and salinity.

***Petrophile latericola* ms**

*Petrophile latericola* ms was first discovered in 1991 by Greg Keighery. It is an upright, single-stemmed open shrub to 1.5 m high. Leaves are linear, 15 to 50 mm long and end in a rigid, sharp point. The inflorescences are small and rounded with numerous overlapping brown bracts at the base. The flowers are 20 mm in length, hairy and yellow and occur between October and December (Brown *et al.* 1998). Seed viability ranges between 0 and 97 % (A. Cochrane pers. comm.).

In 1991 the species was known only from a single plant. It is presently known from 3 populations. *P. latericola* ms was declared as Rare Flora in October 1996 and in September 1997 was ranked as Critically Endangered. The main threats to the species are maintenance activities on the roadverge, railverge and firebreak, disease, weeds, hydrological changes, mineral sands exploration and mining and inappropriate fire regimes.

***Brachysema papilio, Darwinia* sp. Williamson and *Petrophile latericola* ms**
All three species are endemic to the same habitat in a small area near Busselton. They grow in the winter-wet flats and slight depressions with shallow red brown sandy clay soils over ironstone, known as the Abba Wet Ironstone Flats (Tille and Lantzke, 1990). The species occurs in vegetation described as shrublands on southern ironstones (Gibson *et al.* 1994), which is a community type listed as critically endangered (English, 1999).

Interim Recovery Plans have been drafted for these species. These plans all recommend the translocation of these species to secure sites (Phillimore *et al*. In draft a,b, Stack *et al*. In draft). The need for translocation is considered to be high due to the small number of individuals and populations of each of these species. Translocation is also a matter of urgency due to the presence of several threatening processes, in particular the recent proposal to mine the area adjacent to the only known population of two of these species, and the largest population of the third species.

The aim of this translocation proposal is to conserve the wild genetic stock of *Brachysema papilio, Darwinia* sp. Williamson and *Petrophile latericola* over a 5 year period by establishing additional populations of at sites with secure tenure and where threats such as weed invasion and dieback have been ameliorated. This will be achieved by translocating to nearby reserves (which are in the process of being listed as Nature Reserves). This translocation proposal outlines the need for translocation of the three critically endangered species, the site selection process, the design of the translocation sites and the provisions for monitoring. In addition it outlines the criteria for success or failure of this proposed translocation.

## 2. PROPONENTS


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# 3. BACKGROUND

## 3.1 History, Taxonomy and Status

***Brachysema papilio***

*Brachysema papilio* first came to attention during the Swan Coastal Plain Surveys (Gibson *et al.* 1994) in 1991. It was then described by M.D. Crisp as a new species in 1995. He used the close resemblance of the leaves to butterflies resting along the stem to name the species (*papilio* is Latin for "a butterfly").

*B. papilio*, is a wiry tangled shrub to 1.5 metres tall (Crisp 1995). Adult leaves are opposite and pairs of leaves resemble butterfly wings. Inflorescences are axillary or terminal on short axillary branchlets with one or 2 opposite pairs of flowers. Flowers droop downwards and are cream changing to red in colour. Flowering occurs between September and October (Brown *et al.* 1998). Seed pods are 13-15 mm long, about 5 mm wide, banana shaped and enclosed by the persistent calyx and petals (Crisp 1995). Viability of the seed ranges from 55 to 100% initially and from 80 to 88% after one year in storage at – 20$^{o}$C (A. Cochrane pers. comm.).

Inoculation of 11 individuals with dieback (*Phytophthora cinnamomi*) resulted in 2 deaths (C. Crane, pers. comm.). Although this was only a small trial (and not statistically valid) it suggests that there may be some level of resistance to dieback in this species.

In 1991 the species was known from approximately 100 plants in one population on land vested as State Forest. In the summer of 1991/1992 a wildfire burnt through the half the population. Subsequent regeneration occurred from seed and the total population number has recovered to around 100 in 2001. Extensive surveys were undertaken of the southern Swan Coastal Plain between 1992 and 1994 by CALM and the Conservation Council of Western Australia. However, this and other surveys specifically targeting this species have failed to find any new populations of *B. papilio*.

*Brachysema papilio* was declared as Rare Flora in 1994 and ranked as Critically Endangered in November 1998. Its ranking as critically endangered is a result of the presence of threatening processes such as changes to hydrology, disease, weeds and inappropriate fire regimes as well as the small number of plants in a single locality.

***Darwinia* sp. Williamson**

*Darwinia* sp. Williamson is an erect, straggly shrub up to 0.7 m in height and 0.4 m in width (Brown *et al.* 1998). The linear leaves are 3 to 5 mm long, curve backwards, are triangular in cross section and are crowded at the ends of the branches. The inflorescence is nodding or sometimes erect in young plants. The flowers are enclosed by several rows of red and green bracts. The floral tube is ribbed, brown, 3 mm long, with small triangular calyx lobes (Brown *et al.* 1998). Flowering occurs between October and November. Seed viability ranges between 31 and 86 % (A. Cochrane, pers. comm.).

The species was first collected in 1990 by Greg Keighery. He found 27 adult plants in a small pocket of ironstone in an area of State Forest, east of Busselton. Subsequent searches during the extensive surveys of the Swan Coastal Plain (Gibson *et al*. 1994) were unsuccessful in locating any further populations of this new taxon. Shortly after this species was found, a hot summer fire burnt the population, killing all but one of the plants. Good seedling regeneration occurred post-fire and the species is now known from approximately 100 plants. Like many Myrtaceaeous species *Darwinia* sp. Williamson is likely to be susceptible to dieback (*Phytophthora* cinnamomi) (Stack *et al.* In draft).

*Darwinia* sp. Williamson was declared as Rare Flora in October 1996 and was ranked as Critically Endangered in November 1998, due to the small number of plants occurring in a single locality. Threats to the species include disease, inappropriate fire regimes, mineral sands exploration and mining, waterlogging and salinity.

***Petrophile latericola* ms**

*Petrophile latericola* ms was first discovered in 1991 by Greg Keighery. He proposes to call the species "*latericola"* to describe the laterite soil type to which it appears to be confined. *P. latericola* ms is an upright, single-stemmed open shrub to 1.5 m high and 0.4 m in width. Leaves are linear, 15 to 50 mm long, circular in cross-section and end in a rigid, sharp point. The inflorescences are small, rounded with numerous overlapping brown bracts at the base and held at the ends of the branchlets. The flowers are 20 mm in length, hairy and

yellow and occur between October and December (Brown *et al.* 1998). Seed viability is highly variable and ranges between 0 and 97 % (A. Cochrane pers. comm.).

The first collection of *P. latericola* came from a population consisting of just one plant along the Tutunup Road and Rail verge. Subsequently one other population of 137 plants was also found in 1991 (Population 2), in an area of State Forest (which was also found to contain *Darwinia sp.* Williamson and *Brachysema papilio*). Population 2 was burnt by a hot summer wildfire in 1991. Good regeneration from seed occurred after this and the population now consists of approximately 150 plants (Phillimore *et al*. In draft). Population one was burnt by a fire in 1992, the population has not been sighted since. However, a further two plants were located to the North East of this area in 2000 (Population 1b). A new population of 3 plants (Population 3) was found further along the Tutunup Road in 1997 and this has since been increased to 7 individuals in subsequent surveys.

*Petrophile latericola* ms was declared as Rare Flora in October 1996 and in September 1997 was ranked as Critically Endangered. The main threats to the species are activities within the road and rail reserve, including firebreak and drain maintenance, disease, weeds, hydrological changes, mineral sands exploration and mining and inappropriate fire regimes.

### 3.2 Distribution and Habitat

The three species are known only from a small area near Busselton. Both *B. papilio* and *D.* sp. Williamson are know from single populations (which co-occur). *P. latericola* is known from three populations (one of which co-occurs with *B. papilio* and *D.* sp Williamson). These populations occur within 5 km of each other.

All three species are endemic to the same habitat. They grow in the winter-wet flats and slight depressions with shallow red-brown sandy clay soils over ironstone, known as the Abba Wet Ironstone Flats (Tille and Lantzke, 1991). The species occur in vegetation described as shrublands on southern ironstones (Gibson *et al.* 1994), which is a community type listed as critically endangered (English, 1999). Common associated species include *Viminaria juncea, Kunzea* aff. *micrantha* and *Pericalymma ellipticum* (Gibson *et al.* 1994)

## 4. THE TRANSLOCATION

#### 4.1 The Need to Translocate

*B. papilio* and *D.* sp. Williamson are both known only from one small population of about 100 individuals. *P. latericola* is known from one population of 150 plants, which co-occurs with the B. papilio, and *D.* sp. Williamson populations. It is also known from two other populations of 7 and 2 plants respectively along the Wonnerup-Tutunup Road. All three species are endemic to the southern ironstone association near Busselton, a community type which has been extensively cleared (over 90%) for agriculture (English, 1999) and is currently listed as critically endangered. Cable Sands issued a Notice of Intent to Mine the locations adjacent to the area where the three species co-occur in November 2000. Whilst the populations are not in the direct path of the proposed mine, the mining activities have the potential to alter the hydrological conditions in the area. This is highly likely to have a detrimental affect on the populations of the three species.

Interim Recovery Plans for each species are being prepared and are expected to be approved in 2001. These plans recommend the translocations of these species to secure sites (Phillimore *et al*. In draft a,b and Stack *et al*. In draft). The populations are also exposed to threats such as dieback (*Phytophthora cinnamomi*), other fungal diseases, rising salinity, problems associated with small population size (such as inbreeding depression) and weed invasion. The numerous threats to *B. papilio, D.* sp Williamson and *P. latericola* and the scarcity of the vegetation type in which they are restricted means there is an urgent need to establish more individuals and more populations.

#### 4.2 Translocation Site Selection

Two sites have been chosen as suitable translocation sites for *B. papilio, D.* sp. Williamson and *P. latericola.* These sites were chosen on the 10$^{th}$ of January 2000, after a survey of serval areas of the southern ironstone association. The site where population 1 of *B. papilio* and *D.* sp. Williamson and population 2 of *P. latericola* occur was not considered suitable as a translocation (augmentation) site due the threat of mineral sands mining adjacent to the area.

The first proposed translocation site, called O Road, is an area of 3.7 hectares of former farmland, which was recently purchased by CALM. The area was then vested as an A Class Nature Reserve (Reserve #). This area is comprised of cleared grazing land and small remnants of the southern ironstone association (Occurrence 6 (English 1999)) and is directly adjacent to the road verge population of *Grevillea maccutcheonii*, which is endemic to the southern ironstone association. Common species found in the remnant vegetation remaining include *Viminaria juncea, Loxocarya magna, Hakea* sp. Williamson and *Pericalymma* sp., which are species commonly found on this soil type (Gibson *et al*. 1994). Soils are typical of the Abba Wet Ironstone Flats, shallow red-brown sandy clay over ironstone, with the exception of the south western corner of the reserve which is dominated by white-grey sand over ironstone.

The second site, called N Block (Reserve #) is listed as Occurrence 2 of the southern ironstone association (English 1999). An area, 24.5 hectares in size, was recently purchased by CALM and is vested as a C Class Nature Reserve. It also contains areas of cleared grazing land and vegetated remnants. The soil in the majority of the reserve consists of the typical ironstone overlaid by shallow red-brown sandy clay. Plant species common to the ironstone soil type are found in the degraded remnant vegetation. These are *Hakea* sp. Williamson, *Grevillea elongata* and *Viminaria juncea*. It is proposed to locate the translocation site in the more cleared south eastern corner of the reserve to avoid further disturbing the southern ironstone association remnants. The soils in this part of the reserve consist of white-grey sand over ironstone, and the remaining native vegetation consists of several, isolated, individuals of *Eucalyptus rudis* (Flooded Gum).

The translocations will only be planted in the cleared areas at the two proposed sites and therefore is highly unlikely to have any detrimental effects on the remnants of southern ironstone association at these sites.

These sites (O Road and N Block) are the same locations used for the translocation and augmentations of *Grevillea maccutcheonii* and *Lambertia echinata* subsp. *occidentalis*, species that are also restricted to the southern ironstone association. Translocations of G. *maccutcheonii* and *L. echinata* subsp. *occidentalis* were undertaken into these sites in 2000. Six months after planting survival of *G. maccutcheonii* at O Road was 85% and at N Block was 78%. For *L. echinata* subsp. *occidentalis* the survival was 85% for O Road and 86% for N Block. The high percentage survival of these ironstone species at these sites indicates that the conditions are suitable for species that are restricted to the Southern Ironstone Shrubland community type.

The security of land tenure at both O Road and N Block combined with the suitable edaphic and hydrological conditions means these are ideal choices as translocation sites. As *B. papilio, D.* sp Williamson and *P. latericola* have not previously been recorded from O Road or N Block these translocations can be considered introductions under the definitions provided by Policy Statement 29 and the Guidelines for Translocation of Threatened Plants in Australia. A map of the proposed translocation sites in relation to the known populations of these species is shown in Appendix one. Endorsement for the use of these sites was received from the Central Forest Region (Appendix two).

**4.3 Translocation Design**

The majority of the translocated plants will be planted into the cleared, former grazing areas, of the two sites. Only at the O Roads site will plants be planted into the native vegetation, and in this case three natural clearings (of approximately three metres squared) will be utilised for planting. Whilst there is remnant vegetation of the critically endangered southern ironstone association at both translocation sites, no native vegetation will be cleared during planting. Therefore, there appears to be no reason that there would be adverse effects on the conservation values of these areas from this translocation.

Threats to the survival of the translocated plants have already been identified and steps taken to ameliorate these. The effectiveness of these steps will continue to be monitored, and modified where necessary. There is already a weed control program in place from the previous translocations into O Road and N Block of *G. maccutcheonii* and *L. echinata* subsp. *occidentalis*. This weed control program involves suppressing weed growth directly around the translocated plants via the use of matting and the use of chemicals applied via wicking to weeds further away from the translocated plants. It is also intended to establish windbreaks to reduce the reinvasion of weed seed from surrounding areas. These windbreaks will consist of common plant species that already occur naturally at the O Road and N Block sites. Seed will be collected from these species and grown in an accredited nursery. The presence of Dieback will be monitored regularly by Regional dieback

interpreters or soil sampling. If dieback is assessed as being a threat to the translocation aerial or hand application of phosphite will be undertaken.

A total of 375 plants of *B. papilio,* 506 plants of *D.* sp. Williamson and 172 plants of *P. latericola* have been raised for this year's translocation. It is proposed to utilise the same experimental design for all three species, therefore, the design described below should be considered for *B. papilio, D.* sp. Williamson and *P. latericola*.

The 150 propagules of each species planted at O Road will be divided into 5 replicates. The proposed experimental treatments are described in Table 2. Each replicate will have 15 plants of each species assigned to the "ripped and mounded treatment" and 15 plants of each species assigned to the "not ripped and mounded treatment" (See Appendix 3 for plot layout). Due to the difficulties working on the ironstone soils the plot layout will not necessarily reflect that shown in Appendix 3. However, the principles of correct experimental design will still be applied to enable the best planting technique to be determined

Table 2. Description of experimental treatments.

| Treatment | Description of Treatment |
|---|---|
| Not Ripped and Mounded | Propagules will be planted directly into the ground without the surface layers of ironstone being shattered and without the creation of a raised planting sites |
| Ripped and Mounded | Shattering the surface layers of ironstone to allow root penetration. Followed by the creation of a raised planting site using local soil to minimise inundation of roots |

Any plants remaining after 150 propagules have been utilised for the experimental design will be evenly split between the N Block and O Road sites. However, no experimental treatments will be applied and all of these nonexperimental plants will be planted on the ripped and mounded areas. This is because there was a trend (although not able to be statistically tested) for plants of *G. maccutcheonii* and *L. echinata* subsp. *occidentalis* translocated in 2000 to fare better on these ripped and mounded areas. In an attempt to maximise the survival it was decided to plant most propagules on the ripped and mounded areas and only test experimental treatments on a small proportion of the translocated plants. As a consequence of undertaking all experimental work at the O Road sites and then splitting the remaining plants evenly between the two sites, the majority of the plants will be planted at O Road. Due to the skeletal nature of the soils of the southern ironstones it is often difficult to find enough soil to mound, or even dig a hole. The O Road site has more spaces available for planting, and because of this is being targeted to receive the majority of the translocated plants.

Seedlings and cuttings have been raised at the accredited Botanic Gardens and Parks Authority nursery at Kings Park and therefore are considered disease free. All equipment used during planting will be maintained under strict disease hygiene.

Each plant will be permanently tagged so that each individual will always be identifiable. The entire O Road site is enclosed in a combination electric and rabbit proof fence, to prevent grazing by mammals. Plants at N Block will be individually caged if any evidence of grazing on plants is observed.

Monitoring of the translocated population will be undertaken immediately after planting then reduced to every third month for a two year period. Monitoring will include counting the number of surviving plants, height of the surviving plants, width of the crown of the surviving plants in two directions, reproductive state, number of inflorescences and fruits, whether second generation plants are present and general health of the plants.

Monitoring of the original populations will also occur every third month in conjunction with monitoring of the translocated populations. This will provide essential baseline data for assessing the performance of the translocated population. Monitoring will include counting the number of individuals, height and crown width of the individuals, reproductive state, number of inflorescences and follicles and general health of the plants.

**4.4 Source of Plants**

Seedlings are being raised at the accredited Botanic Gardens and Park Authority nursery at Kings Park after being germinated at the Threatened Flora Seed Centre. Cuttings are also being raised at Botanic Gardens and Park Authority nursery. Cutting material for *B. papilio* was collected from 1 clone in 1992, from 1 clone in 1995 and from 19 clones in 2000. It is possible that some of these collections represent the same genetic

material and that less than 21 clones are represented in the nursery at present. Cutting material for *D. sp.* Williamson was collected from 17 clones in 2000. Ten clones of *P. latericola* were collected from population2 in 1995, followed by a collection from population 2 of a further 22 clones in 2000. As plants were not tagged when cutting material was collected it is possible that some of these collections represent the same genetic material.

**4.5 Criteria for Success or Failure**

**Criteria for Success**

- **Short Term**: establishment of translocated seedlings and cuttings
  production of flowers and seed
  after one generation the number of individuals is sustained by natural recruitment
- **Long Term**: after two or more generations the number of individuals is sustained by natural recruitment, and a soil stored seed bank has been established.

**Criteria for Failure**

- **Short Term:** failure of translocated seedlings and cuttings to establish
  failure of plants to produce flowers and seed
- **Long Term:** there is a significant decline in the size of the translocated population due to lack of natural recruitment

**Associated aims**

- The production of guidelines for the establishment of future translocations of these three and other closely related species.

## 5. TIMETABLE

| Time | Action |
|---|---|
| November 2000 – April 2001 | Plants raised from germinants and cutting material |
| November 2000 | Translocation site selected. |
| April 2001 | Translocation proposal submitted for review. |
| June 2001 | Translocation of seedlings into O Road and N Block. |
| June 2001 – June 2003 | Three monthly monitoring of translocated plants. |
| November 2001 | Determine the need for a second years planting. If considered necessary collect more propagation material and begin propagation. |
| May - June 2002 | Further translocation of seedlings into the translocation sites as necessary. |
| May 2002 - May 2006 | Once or twice yearly monitoring of translocated plants and soil seed bank and maintenance of translocation sites. |
| May 2006 | Final Report |

## 6. FUNDING

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## 7. ACKNOWLEDGMENTS

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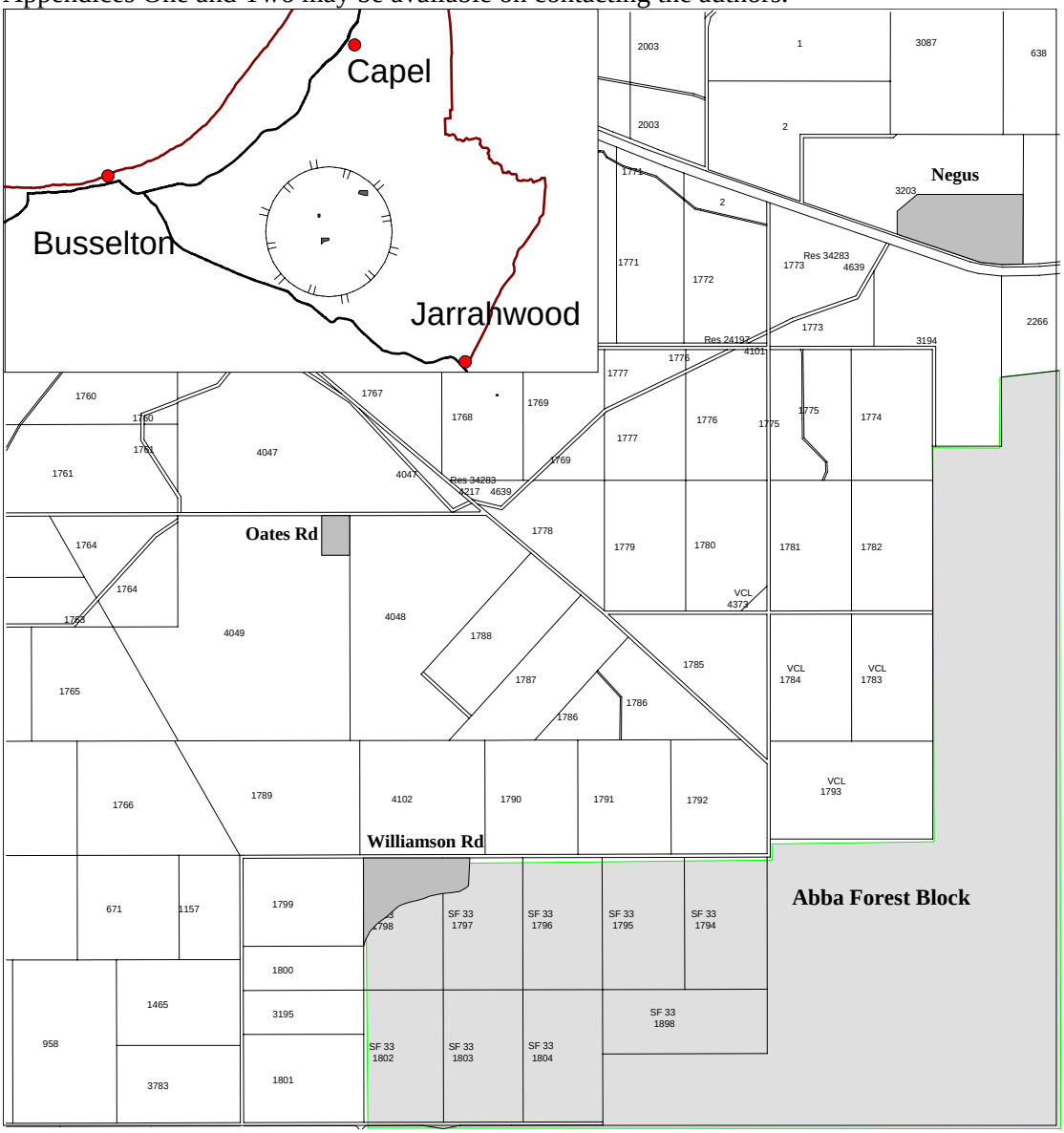
Appendices One and Two may be available on contacting the authors.



## Appendix Three.
## Diagram of the proposed layout of the treatments and plots.

* - Denotes translocated seedling or cutting

**O Road**


Scale: 1.5 m