JAMES WARREN & Associates Pty Ltd

ECOLOGICAL CONSULTANTS

Amended

TRANSLOCATION PLAN

Macadamia tetraphylla

Lots 2 & 3 DP 244652

Urliup Road
Bilambil

MAY 2009

A REPORT PREPARED TO PLATEAU NOMINEES PTY LTD

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1.0 Introduction

1.1 *Background*

James Warren and Associates (JWA) have been engaged by Plateau Nominees Pty Ltd (PN) to prepare a Translocation Plan (TP) for one stem of the Vulnerable *Macadamia tetraphylla* on land proposed for development at Bilambil **(FIGURE 1**). An aerial photograph of the site with the position of the *M. tetraphylla* is shown in **FIGURE 2**.

Translocation may be defined as the deliberate transfer of plants or regenerative plant material (Vallee *et al* 2004). The individual, of *M. tetraphylla,* is located within the site proposed for development and is under immediate threat from vegetation clearance (**FIGURE 3**).

Management of *M. tetraphylla* will involve a combination of translocation actions, consisting of translocating the existing plant combined with the establishment of at least an additional 2-3 (1:1.5) propagated plants (re-stocking) into suitable nearby habitat. Re-stocking refers to an attempt to increase population size or diversity by adding further individuals to an existing population. Upon completion of the translocation project, a total of at least three individuals, will be established in the translocation area.

Although there is no specific literature on the translocation of *M. tetraphylla*, anecdotal evidence suggests that the translocation of this species will be successful. The translocation of reproductively mature *Macadamia integrifolia* (i.e. plantation Macadamias) is almost always successful (K. Wilson pers. com. June 2008). Kim Wilson is currently undertaking the translocation of a number of mature *M. tetraphylla* on a development site in the Ballina area, however, the details of post-translocation success are as yet unavailable.

This document has been prepared in accordance with the Guidelines for the Translocation of Threatened Plants in Australia (Vallee *et al*. 2004).

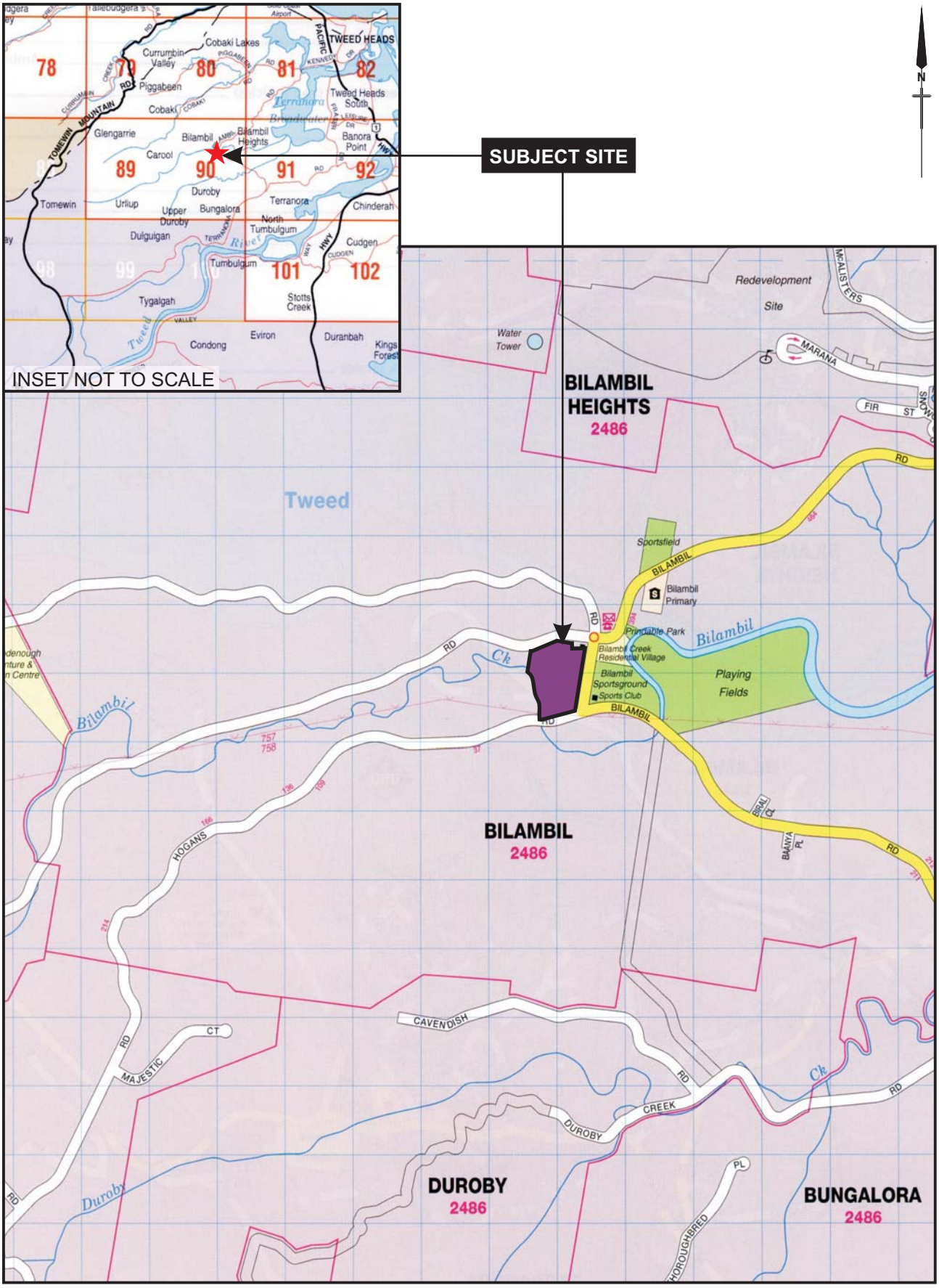
1.2 *Legislative Context*

Macadamia tetraphylla is listed as *Vulnerable* under the Commonwealth *Environment Protection and Biodiversity Conservation Act* (1999) (EPBC) and *Vulnerable* NSW Threatened Species Conservation Act (1995) (TSC).

1.3 *Macadamia tetraphylla* Description

Macadamia tetraphylla is one of 7 endemic *Macadamia* species (9 in the world) in Australia. *Macadamia tetraphylla* is a member of the Proteaceae family. Plants are small to medium-sized trees growing up to 18m. The leaves are 10-25 cm long and narrowly oblong to oblanceolate. Leaves are in whorls of 4 sometimes 5, thick, stiff and hairless. The leaf margins are toothed and prickly. New growth is pinkish-red. The flowers are creamy-pink to purplish and hang in long strings. The fruit is a follicle, globose, 2-3 cm in diameter with 1-2 hard seeds (Harden *et al* 1991).

This species grows in subtropical rainforest from Rous near Lismore to Mt Tamborine and is uncommon in the wild (Williams *et al*. 1984; Floyd 1989).



SOURCE: Brisbane UBD SCALE: 1 : 20 000 @ A4 JAMES WARREN & ASSOCIATES PTY LIMITED Environmental Consultants	CLIENT John Sherwood / Jackson International Pty Ltd PROJECT Translocation Plan for *Macadamia tetraphylla* Lots 2 & 3 DP244652 Urliup Road, Bilambil, NSW Tweed Shire Council LGA	**FIGURE 1** PREPARED: BW DATE: 06 August 2008 FILE: N08003_Locality.cdr	TITLE **LOCALITY PLAN**

Legend
Rough-shelled bush nut (*Macadamia tetraphylla*)
Subject Site

N

0 50m

SOURCE: Google Earth 2008 Aerial Photograph

SCALE: 1 : 2000 @ A4

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Translocation Plan for *Macadamia tetraphylla*
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Urliup Road, Bilambil, NSW
Tweed Shire Council LGA

FIGURE 2

PREPARED: BW
DATE: 06 August 2008
FILE: N08003_Aerial.cdr

TITLE

AERIAL PHOTOGRAPH

Legend

- Riparian Management Zone
- Easement / Landscape Areas / Regeneration Area
- Low creek bank
- High creek bank
- Batter
- Proposed Footpath (2m wide)
- Subject Site

Important Notes:

KERBING SHOWN IS INDICATIVE ONLY AND SUBJECT TO FINAL DETAILED DESIGN

(A) PROPOSED EASEMENT FOR ACCESS 2 WIDE (SUBJECT TO FINAL DETAILED DESIGN)
(B) PROPOSED EASEMENT TO DRAIN SEWER AND WATER 3 WIDE (SUBJECT TO FINAL DETAILED DESIGN)
(C) PROPOSED RESTRICTION ON TITLE TO PROVIDE ADDITIONAL VISTOR CARPARK ONSITE (SUBJECT TO FINAL DETAILED DESIGN)
(D) PROPOSED EASEMENT FOR SERVICES VARIABLE WIDTH (SUBJECT TO FINAL DETAILED DESIGN)
(E) PROPOSED EASEMENT TO DRAIN WATER VARIABLE WIDTH (SUBJECT TO FINAL DETAILED DESIGN)

0 25m
1 : 1 000

SOURCE: JWA Site Investigations; B & P Surveys (Ref: 17154D-D.pdf)
SCALE: 1 : 1000 @ A3

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Translocation Plan for *Macadamia tetraphylla*
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Urliup Road, Bilambil, NSW
Tweed Shire Council LGA

FIGURE 3

PREPARED: BW
DATE: 25 May 2009
FILE: N08003_Layout.cdr

TITLE
PROPOSED DEVELOPMENT LAYOUT

1.4 *Translocation Team*

JWA have prepared this TP and will coordinate the translocation of the *M. tetraphylla.* Trevor Franklin (Horticulturalist) from Australian Plant Nurseries will be preparing the site, propagating the additional *M. tetraphylla* and conducting the translocation. The following additional people have been consulted for information prior to and during the formulation of this plan:

- Brett O'Donnovan (Terania Rainforest Nursery);
- Kim Wilson (Gray Plantation);
- Assoc. Prof. Caroline Cross (University of New England);
- Megan Thomas (Queensland Herbarium).
- Dr Phil Pisanu (South Australian Dept. of Environment and Heritage)

2.0 Biological Assessment of *Macadamia tetraphylla*

2.1 Introduction

Little published literature exists on the biology, ecology and distribution of *M. tetraphylla.* The information in the following section is predominantly derived from Australian Herbaria records (AVH 2006) and personal communication with Botanists who are familiar with the species.

2.2 Distribution of the Taxon

The majority of records of *M. tetraphylla* are from locations situated in South-east Queensland and Northern NSW. There are 83 records held in Herbaria in NSW, Canberra, Victoria and QLD (AVH 2006). Although, isolated occurrences of this species are recorded in remnant rainforest patches, the viability of these small populations is uncertain as little is known about the breeding system or the population size required to sustain *M. tetraphylla* (C. Gross pers. com. July 2008).

Specific information of *M. tetraphylla* populations is unavailable. However, the broad location and size of populations used in research by Dr Pisanu (2001) is as follows:

- Populations with 10-20 adults plants are located in:
  - Lennox Head State Environmental Planning Policy (SEPP) Wetlands;
  - Mullumbimby Creek;
  - Terranora Lakes.

- Populations with greater than 10 adult plants are located in:
  - Amber Drive Lennox Head;
  - Mooball.

- Populations with less than 10 adults are located in:
  - Minyon Falls (FR);
  - Inner Pocket (NR);
  - Limpinwood (NR).

2.3 Taxonomic Assessment

Within Australia there are seven (7) species of Macadamia: *M. tetraphylla; M. integrifolia; M. jansenii; M. whelanii; M. grandis and M. claudiensis.* All of these are endemic in eastern Australia. Outside Australia, one species, *M. hildebrandii* is endemic in Sulawesi, Indonesia (Gross 1996).

2.4 Propagation Potential

Plants for use in the Macadamia Nut industry are readily propagated from cuttings suggesting this may be possible with *M. tetraphylla*.

Macadamia tetraphylla is self-compatible but does require an insect pollinator. However, seed set is significantly higher after cross-pollination compared to self-pollination (Pisanu 2001). Seeds of *M. tetraphylla* are easily germinated and grown but there is a higher success rate with seed harvested from larger populations compared to

smaller populations. This indicates that small populations of *M. tetraphylla* may be affected by inbreeding depression (Pisanu 2001).

2.5 Known Habitat and Co-occurring Flora

Macadamia tetraphylla is primarily found on soils derived from the Tweed volcano and its associated lava flows but is also sometimes found on sedimentary deposits along creek lines and on flood planes (Pisanu 2001).

Macadamia tetraphylla grows in subtropical rainforest. Floyd (1999) divides Subtropical rainforest into Warm-subtropical rainforest, Cool-subtropical rainforest and Littoral rainforest and defines floristic alliances within these categories. *Macadamia tetraphylla* occurs in the *Argyrodendron trifoliolatum* Alliance within Warm-subtropical rainforest and the *Cupaniopsis anacardioides-Acmena* spp. Alliance within Littoral rainforest. Additionally, there is one record for *M. tetraphylla* in Dry rainforest in the *Drypetes australasica-Araucaria* Alliance.

2.6 Disease Susceptibility and Threatened Processes

No information exists on the susceptibility of *M. tetraphylla* to any particular diseases. However, possible threatening processes to *M. tetraphylla* populations have been identified by DECC (2005). These include:

- Clearing and fragmentation of habitat for coastal development, agriculture and roadworks;
- Risk of local extinction due to low numbers;
- Grazing and trampling by domestic stock;
- Fire;
- Invasion of habitat by weeds; and
- Loss of local genetic strains through hybridisation with commercial varieties.

3.0 Ecological Assessment of *Macadamia tetraphylla* on the Subject Site

3.1 Topography and Soil Characteristics

The Subject Site is a highly disturbed block of land (≈ 4.5ha) that was previously used as a quarry. The land consists of a small hill in the centre surrounded by relatively flat land. Bilambil Creek runs along the western border. Soil at the present site of the *M. tetraphylla* is described as sandy-loam.

3.2 Co-occurring Flora

The *M. tetraphylla* occurs in small community which occurs around an old growth Foam bark as the canopy (JWA 2009a) and is representative of an extremely degraded Subtropical rainforest remnant. Co-occurring flora include a White fig, Red Kamala, Brush cherry and Guioa. The ground cover is the common weeds, grasses and herbs that occur across the majority of the site.

4.0 Ecological Assessment of Proposed Translocation Site

4.1 Identification of Potential Sites

Under the current development proposal for the Subject Site, an area along the Creek Bank in the south-west of the Subject Site is considered as a suitable translocation site for *M. tetraphylla.* This area is within a designated Riparian Management Zone of the Vegetation Rehabilitation Plan prepared by JWA (2009b; **FIGURE 3**).

4.2 Suitability of Potential Sites

This area is deemed to be suitable for the translocation of *M. tetraphylla* for the following reasons:

- It is approximately 100m from the existing plant and of similar elevation and soil type;
- The close proximity will ensure the least amount of plant stress;
- The co-occurring flora (Section 3.2) are also found;
- *Macadamia tetraphylla* is found in Subtropical rainforest and MZ1 will be rehabilitated as this vegetation type (JWA 2009a).

5.0 Pre-translocation Assessment

5.1 Site Preparation

5.1.1 Accurate Identification of Translocation Habitat

The exact site of translocation (within MZ1) will be chosen by the Horticulturalist, taking into consideration the progress of rehabilitation and natural regeneration within MZ1. The translocation area will be marked accurately on a map and *in situ* with survey pegs. This area will also be indicated by restricted entry signage outlining the project.

Exclusion fencing will also surround the translocation and will consist of 1.2m star pickets at 4m intervals with four (4) strands of galvanized fencing wire.

5.1.2 Regeneration/Rehabilitation of Translocation Habitat

The translocation area will be subject to regeneration and revegetation outlined in a Vegetation Rehabilitation Plan (JWA 2009b).

6.0 The Translocation

6.1 Time of Translocation

The translocation will be undertaken during favourable site conditions (i.e. morning and afternoon and not during windy conditions) to ensure transpiration rates are minimal.

If soil moisture levels are too low and the ground is too hard where the plants for translocation are growing, the plant may need to be watered several times 1-2 days prior to the actual translocation to lessen the risk of stress or plant mortality during the process.

6.2 Transporting Plants

In general, time in transit will be minimal and the plant will be adequately secured during transit. To minimise transpiration and the root ball drying during transit, the plant will be lightly pruned and wrapped in wet Hessian prior to movement.

6.3 Planting

The translocation hole will be prepared and ready prior to removing the *M. tetraphylla*. The hole will be prepared with water and a small amount of sandy loam to promote root growth following translocation.

Planting will give attention to the following (Vallee *et al*. 2004):

- The spatial arrangement and location of the plantings should reflect the capability of *M. tetraphylla* reaching 18m in height;
- Facilitate cross-pollination via small insects;
- Positioning plants in relation to other vegetation (plants will be planted in close proximity to existing vegetation for shading and protection where possible);
- Positioning plants in relation to other factors (e.g. edge effects) – plants will not planted in close proximity to the community edge, roads or tracks; and
- Backfilling soil around transplant, firming down and leaving slight depression to facilitate watering.

6.4 Plant Densities

Little research has been completed on the breeding system or population Biology of *M. tetraphylla* with the exception of Pisanu (2001). He selected experimental populations of 3 size classes >20, 10 -20 and <20 adult plants in areas on >50ha, 10-50ha and <10ha indicating the *M. tetraphylla* is found in varying densities. The translocation area covers an area of 1000m^2 indicating that the area is suitable to accommodate the existing stem of *M. tetraphylla* and an additional 2-3 plants.

6.5 Additional Plantings

The additional 2-3 plants will be produced from cuttings and/or seed taken from a population in close proximity to the Subject Site. At least double this amount will be propagated.

The propagation and planting of additional plants is to ensure there is a net increase of the local population. Additionally, there will be replacement plants available in case of mortality.

When the propagated plants are of a suitable age to plant in the translocation area, they will also be planted in accordance with that outlined in Section 6.4.

Propagated plants will also be identified with permanent tags to allow them to be distinguishable from the translocated plant.

7.0 Post Translocation Management and Monitoring

7.1 Background

The objective of the management program for *M. tetraphylla* is to ensure the short and long-term persistence of a viable population of the species within the translocation area.

The objectives for the success and management of *M. tetraphylla* at the Subject Site are:

- Successful translocation of the *M. tetraphylla* plant into the translocation area;
- Revegetation of the translocation area with suitable native species (JWA 2009b);
- Prevent and manage weed invasion within the translocation area (JWA 2009b); and
- Any necessary appropriate responses to inadequate performance will be implemented immediately to avoid potential long term negative impacts on the species.

7.2 Short Term Management

7.2.1 Performance Indicators

Indicators which demonstrate short-term performance of translocated *M. tetraphylla* can be linked to both plant and habitat features as detailed below:

- Plant features:
  - Plants persist within the translocation area and increase in biomass; and
  - Plants are able to produce reproductive structures.

- Habitat features:
  - Suitable conditions for *M. tetraphylla* in the translocation area are maintained (e.g. degrading processes affecting the habitat are minimised, such as run-off, human access, erosion and siltation, changes in microclimate, soil moisture and soil chemistry);
  - No significant increase in the level of weed invasion within the translocation area; and
  - Fire is managed appropriately.

7.2.2 Response and Mitigation Measures

7.2.2.1 Flora Management

To minimise the loss of individual plants, 'after-care' will occur following the translocation events on an 'as-needs' basis. After-care will be minimised to improve the chances of self-sustainability. The following will be completed:

- Individuals will be staked and tied only as a last resort;
- Watering plants will occur on a 'as needed basis' considering rainfall received.

On-going cultivation or horticultural requirements will include:

- Weed management using spot spraying on an 'as needed basis);
- Restricted herbicide use (Roundup Biactive © only);
- Weed and propagule-free mulching derived primarily from on-site vegetation.

The risk of fire will be reduced through the maintenance of tracks located within the translocation area.

The success of replanting will be assessed at several stages of the project. Assessment will be required to evaluate and modify the translocation process and to monitor success in relation to the report objectives.

The following factors will be considered and recorded:

- Number and proportion of plants surviving;
- General health of plants;
- Signs of new growth (distinctive pinkish red)
- Number of translocated plants producing flowers; and
- Number of female plants developing fruit.

Monitoring will be undertaken:

- twice weekly for two months;
- weekly to fortnightly intervals for the first six months; and
- six (6) monthly for two years.

Photographs will also be taken at six (6) monthly intervals from at least four (4) vantage points.

If at any stage during the monitoring process, mortalities of translocated *M. tetraphylla* are observed, these plants will be replaced.

7.2.2.2 Habitat Management

The objective of habitat management will be to improve conditions for *M. tetraphylla* in the translocation area. This will occur currently with the implementation of the Vegetation Rehabilitation Plan (VRP) for the Riparian Zone of Bilambil Creek (JWA 2009b).

7.3 Long Term Site Management

7.3.1 Performance Indicators

Indicators which demonstrate long-term performance of the translocated *M. tetraphylla* will be linked to both plant and habitat features as detailed below:

Plant features:

- Successful establishment of revegetated plants community;
- Greater than 70% of the *M. tetraphylla* individuals are surviving; and

- The population is capable of producing flowers and fruit and is likely to survive in the long term (i.e. the flowering of the replanted individuals is consistent with levels of the naturally occurring similar communities in the locality.

Habitat features:

- There is no net increase in weed invasion from a baseline to be determined immediately after the replanting program by the Horticulturalist
- Weed occurrence in the translocation area will be the subject of strict management;
- There is no threat to the translocated population from fire; and
- The translocation area is protected from stormwater, erosion and siltation, changes in microclimate and human access that may negatively affect the success of the translocated population.

7.3.2 Response and Mitigation Measures

Long-term site management of the translocation area will occur concurrently with the implementation of the VRP for the Riparian Zone of Bilambil Creek (JWA 2009b) and will require the following factors to be considered:

- Weed control;
- Fire management;
- Water, nutrient and mulch management; and
- Protective measures such as pedestrian and fauna exclusion.

7.3.3 Site Ownership and Management

Plateau Nominees Pty Ltd will manage the translocation area for five (5) years. After this period, if specific criteria detailed in this plan are achieved, management of the translocation area will be handed to Tweed Shire Council (TSC). This will be dependent on the fulfilment of the following criteria:

- Greater than 70% of the translocated/planted individuals are surviving;
- The flowering and fruiting of replanted individuals is at levels consistent with the naturally occurring populations in the locality; and
- The horticulturalist and translocation co-ordinator are both satisfied the population is self sustaining.

An annual report on all replanting activities, with photographs for the purpose of comparison, will be prepared and distributed to the:

- NSW Department of Environment and Climate Change;
- Commonwealth Department of Environment, Water, Heritage and the Arts; and
- Tweed Shire Council.

Tweed Shire Council will assume responsibility for the management of the translocation area when PN has fulfilled all requirements as set out in this TP. It will be beneficial for the Council to conduct some form of monitoring in the longer term.

8.0 Summary

James Warren and Associates (JWA) have been engaged by Plateau Nominees to prepare a translocation plan for a single stem of the Vulnerable *M. tetraphylla* on land proposed for residential development at Bilambil.

Macadamia tetraphylla is listed as *Vulnerable* under the Commonwealth *Environment Protection and Biodiversity Conservation Act* (1999) (EPBC) and *Vulnerable* NSW Threatened Species Conservation Act (1995) (TSC).

One individual of *M. tetraphylla* was located within a site proposed for residential development and is under immediate threat from vegetation clearance. Management of *M. tetraphylla* will involve a combination of translocation action, consisting of translocating the plant combined with the establishment of at least an additional 2-3 (1:1.5) propagated plants into suitable nearby habitat. Upon completion of the translocation project, a total of at least four individuals will be established in the translocation area creating an increase in the local population.

Following the translocation, a monitoring and management period will be carried out by PN for five (5) years. After this period, if specific criteria detailed in this plan are achieved, management of the translocation area will be handed to TSC.

Annual reporting on all monitoring and management activities will be prepared and distributed to all relevant government agencies.

The TSC will assume responsibility for the management of the translocation area when PN has fulfilled all requirements as set out in this plan. It would be beneficial for Council to conduct some form of monitoring within the translocation area in the longer term.

9.0 References

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