KINGS FOREST

STAGE 1 PROJECT APPLICATION

PRECINCT 1 & 5
BUFFER MANAGEMENT PLAN

AMENDED
OCTOBER 2011

A REPORT PREPARED FOR PROJECT 28 PTY LTD
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List of Abbreviations

APZ - Asset Protection Zone
BMP - Buffer Management Plan
DGEARs - Director General Environmental Assessment Requirements
DoP - NSW Department of Planning
EECs - Endangered Ecological Communities
EPZs - Environmental Protection Zones
FAMP - Feral Animal Management Plan
SEPP - State Environment Planning Policy
TSMP - Threatened Species Management Plan
VMP - Vegetation Management Plan
WMP - Weed Management Plan
1. INTRODUCTION

1.1 Background

The NSW Minister for Planning approved a Concept Plan for the proposed residential community at Kings Forest on the 19th August 2010. The approved documents included a Buffer Management Plan (BMP) (JWA 2009), which proposed the principles upon which the management of buffers would be based.

Subsequently, the Director General issued modified Environmental Assessment Requirements (DGEARs) on the 22nd December 2010. James Warren & Associates (JWA) have been engaged by Project 28 Pty Ltd to complete a Kings Forest Stage 1 Project Application BMP for Precincts 1 & 5 in accordance with requirements of DGEAR 9.4 which states:

*Updates are to be provided, where relevant, for the various management plans for koalas, vegetation, threatened species, feral animals weeds, the buffers, and the golf course providing where relevant details on timelines for implementation of recommended works including maintenance periods and measurable performance and completion criteria. Each plan is to consider all other plans for the site to ensure that management strategies do not conflict and that each plan can be implemented without negatively impacting on the objectives of another.*

1.2 Proposed Development

1.2.1 Kings Forest Stage 1 Project Application

The Kings Forest site consists of 872 hectares of land located at Cudgen between Bogangar to the south-east and Kingscliff to the north in Northern New South Wales (NSW). The concept plan for the Kings Forest site is shown in Figure 1.

The scope of the Stage 1 Project Application works is as follows:

- Construction of the entrance road to the site and associated intersection works on Tweed Coast Road.
- Alignment and construction details of two lanes of Kings Forest Parkway, from Tweed Coast Road via Precincts 2, 3, 4 and 5 through to the roundabout in the western part of the site from which access to the southern part of the site is to be gained.
- Alignment and construction details for the civil works of the two proposed roads to access the southern part of the site.
- Rural retail development in Precinct 1 to the east of Tweed Coast Road.
- Subdivision and construction of residential Precinct 5.
- Bulk earthworks across the site in Precincts 2 - 4 & 6 - 14.

The scope of works is illustrated in Figure 2.
1.2.2 Precincts 1 & 5

This BMP has been prepared for the proposed Precincts 1 & 5 of the Kings Forest Stage 1 Project Application. Precincts 1 & 5 occur in the most north-east portion of the Kings Forest site and development will comprise:

- Precinct 1 - a rural retail development (FIGURE 3); and
- Precinct 5 - residential subdivision (FIGURE 4).

In preparation for the development within Precincts 1 and 5, bulk earthworks will be completed in accordance with Mortons Urban Solutions Plan no. 12301-ALL-040 Amendment C (FIGURE 5).

1.3 Aims & Objectives

1.3.1 Background

State Environmental Planning Policy (Major Projects) 2005 (Amendment No 10) was gazetted in November 2006, resolving the zonings of the Kings Forest site (FIGURE 6). Threatened flora, habitat for threatened fauna, Endangered Ecological Communities (EECs) and (State Environmental Planning Policy) SEPP 14 Wetlands are protected within zoned Environmental Protection Zones (EPZs). Provision was made for a 50 m ecological buffer to these areas.

Subsequent to gazettal of the SEPP Amendment a Concept Plan for Kings Forest was prepared and lodged with DoP. The objectives of ecological buffers at the Kings Forest site were originally discussed in the BMP (JWA 2009) that accompanied the Concept Plan Application. The 2009 BMP included a literature review on the types and purposes of environmental buffers.

1.3.2 Aim of this Report

The aim of this BMP is to provide guidelines, strategies and methods for the treatment and management of ecological buffers to Cudgen Nature Reserve and EPZs within Precincts 1 & 5 of the Kings Forest residential development.

The following section details the objectives of ecological buffers under the State Environmental Planning Policy (Major Projects) 2005 (Amendment No 10) and the Concept Plan approval (06-0318). Compliance with these requirements is discussed in detail in SECTION 7 of this management plan.
1.3.3 **Objectives of buffers at Kings Forest**

**SEPP (Major Projects) Amendment**

Clause 7(2) of the SEPP (Major Projects) Amendment states that the objectives of the ecological buffers are:

(a) To protect wetlands or areas of particular habitat significance;

(b) To restrict development so that, as far as practicable, it does not occur within ecological buffers;

(c) To help ensure that development is designed, sited and managed so as to minimise its impact on the ecological and hydrological functions of the ecological buffers; and

(d) To encourage the restoration and maintenance of the native vegetation and ecological processes of the land within and adjacent to wetlands or areas of particular habitat significance.

Clause 7(3) of the SEPP (Major Projects) Amendment requires that development on land within an ecological buffer is to:

(a) incorporate effective measures to manage wetlands or areas of particular habitat significance, and

(b) be designed and sited to maintain connectivity of vegetation and minimise vegetation clearing, soil disturbance and alterations to the rate, volume or quality of surface and ground-water flows, and

(c) retain and maintain all existing native vegetation outside the area immediately required for the development, and

(d) incorporate measures to regenerate native vegetation for all disturbed areas within the buffer, and

(e) incorporate appropriate stormwater and erosion control measures to protect the buffer from surface water run-off or other disturbance.

Clause 7(4) of the SEPP (Major Projects) Amendment provides that, when considering whether or not there is a practicable alternative to siting development inside an ecological buffer, the consent authority must consider:

(a) the design, type and site cover of the proposed development, and

(b) the physical characteristics of the land on which the development is proposed to be carried out, and

(c) the suitability of the land for the proposed development.

The consent authority may, of course, give consideration to additional matters.
Concept Plan Approval

Condition B3 states that:

“Further heathland is to be provided with long-term protection and allowed to naturally regenerate on the site.

The further heathland to be protected is to be that contained within the 50m ecological buffer in the locations depicted as ‘Heath to be Naturally Regenerated’ in Figure 2A titled ‘Heath Regeneration and Revegetation Areas’ drawn by James Warren and Associates and dated 22 March 2010. The heathland in these locations is to be protected and regenerated for the full 50m width of the ecological buffer.

The details of this further protection are to be submitted along with the preferred long term protection mechanism, such as land use zoning, to the satisfaction of the Director-General prior to determination of Stage 1”.

1.4 Relationship to other Management Plans

The Kings Forest Stage 1 Project Application includes numerous Management Plans that have been prepared for specific areas of the site. Additional to this BMP, the following Management Plans relevant to Precincts 1 & 5 have been prepared for the Stage 1 Project Application, and should be read in conjunction with this BMP:

- Kings Forest Stage 1 Project Application: Precinct 1 & 5 Vegetation Management Plan (Precinct 1 & 5 VMP) (JWA 2011a);
- Kings Forest Stage 1 Project Application: Precinct 1 & 5 Threatened Species Management Plan (Precinct 1 & 5 TSMP) (JWA 2011b); and
- Kings Forest Stage 1 Project Application: Precinct 1 & 5 Weed Management Plan (Precinct 1 & 5 WMP) (JWA 2011c).

A Kings Forest Stage 1 Project Application Feral Animal Management Plan (Stage 1 FAMP) (JWA 2011d) has been prepared for the entire Kings Forest site and is therefore relevant to Precincts 1 & 5.

Furthermore, a Kings Forest Stage 1 Project Application Koala Plan of Management (Stage 1 KPoM) (JWA 2011e) has been prepared for the entire Kings Forest site and is therefore relevant to Precincts 1 & 5.
2. **SUMMARY OF SIGNIFICANT VALUES**

2.1 **Background**

Kings Forest has been comprehensively studied over a period of more than twenty (20) years. A summary of the significant values relevant to the development of Precincts 1 & 5 is provided in the following sections.

2.2 **Endangered Ecological Communities**

Three (3) EECs occur within the vicinity of Precincts 1 & 5 (FIGURE 7):

- Swamp sclerophyll forest on coastal floodplain;
- Freshwater wetlands; and
- Subtropical coastal floodplain forest.

2.3 **Threatened Species**

2.3.1 **Flora**

Four (4) Threatened flora species occur within the vicinity of Precincts 1 & 5 (FIGURE 8):

- Green-leaved rose walnut (*Endiandra muelleri* subsp. *bracteata*);
- Southern swamp orchid (*Phaius australis*);
- Stinking laurel (*Cryptocarya foetida*); and
- White laceflower (*Archidendron hendersonii*).

2.3.2 **Fauna**

Thirteen (13) Threatened fauna species have been recorded (FIGURE 9), or are considered to be provided with potential habitat, within the vicinity of Precincts 1 & 5. These species are as follows:

- Black bittern (*Ixobrychus flavicollis*);
- Black-necked stork (*Ephippiorhynchus asiaticus*);
- Bush stone-curlew (*Burhinus grallarius*);
- Common planigale (*Planigale maculata*);
- Grass owl (*Tyto capensis*);
- Grey-headed flying fox (*Pteropus poliocephalus*);
- Koala (*Phascolarctos cinereus*).
- Little bent-wing bat (*Miniopterus australis*);
- Masked owl (*Tyto novaehollandiae*);
- Rose-crowned fruit-dove (*Ptilinopus regina*);
- Wallum froglet (*Crinia tinnula*);
- Wallum sedge frog (*Litoria olongburensis*); and
- Yellow-bellied sheathtail bat (*Saccolaimus flaviventris*).

### 2.4 SEPP 14 Wetlands

SEPP 14 - Coastal Wetlands are mapped over large areas of the Kings Forest site, including areas adjacent to Precincts 1 & 5 ([FIGURE 10](#)). These wetlands are protected by State Environmental Planning Policy No. 14 - Coastal Wetlands (SEPP 14).

### 2.5 Cudgen Nature Reserve

Cudgen Nature Reserve occurs immediately adjacent to the eastern and southern boundaries of the Kings Forest site ([FIGURE 11](#)).

### 2.6 Vegetation within Ecological Buffers

The vegetation within the ecological buffers of Precincts 1 & 5 is shown in [FIGURE 12](#).
3. ECOLOGICAL BUFFERS WITHIN PRECINCTS 1 & 5

3.1 Introduction

The following sections provide a discussion on the treatment of the ecological buffers within Precincts 1 & 5. Impacts of the buffer treatments and bulk earthworks on the vegetation communities are also analysed.

3.2 Buffer Treatments

3.2.1 Precinct 1

A rural retail development is proposed for Precinct 1 (FIGURE 3). An ecological buffer of 50m width will be provided between the development and the EPZ to the south. The typical proposed buffer arrangement is shown in FIGURES 13a & 13b.

As foreshadowed in the Concept Plan the outer 20m of the ecological buffer will accommodate the Asset Protection Zone (APZ). Management within the outer 20m will be in accordance with the Bushfire Risk Assessment report (Bushfiresafe (Australia) Pty Ltd, 2010). There is no development proposed within the inner 30 m buffer zone however, a koala fence will be constructed between the outer and inner buffer zones (FIGURES 13a & 13b).

Impacts on the vegetation within the outer 20m buffer zone are discussed in SECTION 3.3).

3.2.2 Precinct 5

A residential subdivision is proposed in Precinct 5 (FIGURE 4). In accordance with the approved Buffer Management Plan (JWA 2009) a minimum 50 m buffer (containing inner and outer zones) between the residential development in Precinct 5 and the Environmental Protection Zones (EPZs) to the east is proposed. The typical proposed buffer arrangement is shown in FIGURES 13a & 13b.

As foreshadowed in the Concept Plan, it is proposed that compatible works (i.e. roads, footpaths and cycle ways, an APZ, stormwater management and passive recreation areas), will be undertaken in the 20m outer buffer. For the most part the construction will be restricted to the 20m outer buffer zone however, a slight amendment to the buffer treatment adjacent to Precinct 5 is proposed as part of the Stage 1 Project Application.

The construction of a bio-retention swale treatment system along the eastern edge of Precinct 5 as part the Integrated Water Cycle Management Plan (Gilbert & Sutherland 2011c) will extend into the inner 30m of the buffer zone in some areas. FIGURES 14, 14a & 14b illustrates the impact area of the swale within the inner 30m buffer. Impacts on the vegetation within the buffer zone to Precinct 5 are discussed in SECTION 3.3.
The location and extent of the bio-retention swale is critical for the protection of the adjacent wetlands and areas of habitat significance by virtue of its role in maintaining the existing hydrological regime in the neighbouring Cudgen Nature Reserve (Gilbert and Sutherland 2011c). The filling of Precinct 5 has the potential to alter the current hydrological regime by retaining ground water within Precinct 5 and preventing it from being transmitted to the adjacent land to the east. This may result in some lowering of the water table even though the flow is unchanged.

Gilbert and Sutherland (2011c) have identified that the groundwater regime in the nature reserve could be maintained by recharge comprised generally of stormwater runoff that is infiltrated via vegetated swales located within the buffer along the eastern perimeter of the development (i.e. bio-retention swale within Precinct 5 buffer). Furthermore, the placement of the swale 10m east (within the inner buffer zone rather than the outer buffer zone), delivers the recharge 41 days earlier. The earlier delivery mitigates the impact of extended dry periods.

A koala fence will be constructed between the outer buffer and truncated inner buffer zone (FIGURES 13 & 14). The inner buffer zone east from the koala fence will be part of the land to be dedicated to NPWS.

### 3.3 Impacts on Native Vegetation within Buffers

#### 3.3.1 Introduction

Continued farming practices (i.e. cattle grazing, periodic slashing etc.) and ongoing weed infestations over the site have resulted in some changes to the extent and structure of the vegetation communities since the previous detailed mapping which occurred in 2005. The mapping of vegetation communities within the ecological buffers was therefore recently updated (August 2011) (FIGURE 12). Utilising the updated mapping within the buffers, impacts of the proposed development have been analysed in the following sections.

#### 3.3.2 Impacts on Native Vegetation within Buffers to Precincts 1 and 5

**Precinct 1**

Vegetation within the outer 20 m will be cleared for the APZ. The APZ will then be maintained in accordance with the Bushfire Risk Assessment report (Bushfiresafe (Australia) Pty Ltd, 2010). There will be no impact by the development on the inner 30 m buffer zone.

**TABLE 1** outlines the impact on the vegetation communities, within the Precinct 1 buffer. **FIGURE 15** illustrates the impact.
TABLE 1
IMPACTS ON VEGETATION COMMUNITIES WITHIN PRECINCT 1 ECOLOGICAL BUFFER

<table>
<thead>
<tr>
<th>Vegetation Communities</th>
<th>Total area (ha)</th>
<th>Area to be lost (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community 1 - Highly Modified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1(a) Substantially cleared of native vegetation</td>
<td>0.40</td>
<td>0.25</td>
</tr>
<tr>
<td>1(c) Native plantation/plantings</td>
<td>0.05</td>
<td>0.00</td>
</tr>
<tr>
<td>Subtotal</td>
<td>0.45</td>
<td>0.25</td>
</tr>
<tr>
<td>Community 4 - Swamp Sclerophyll Floodplain Forest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4(e) Broad-leaved paperbark closed forest to woodland</td>
<td>0.15</td>
<td>0.06</td>
</tr>
<tr>
<td>Subtotal</td>
<td>0.15</td>
<td>0.06</td>
</tr>
<tr>
<td>Community 6 - Rainforest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6(a) Littoral rainforest</td>
<td>0.64</td>
<td>0.11</td>
</tr>
<tr>
<td>Subtotal</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1.24</td>
<td>0.42</td>
</tr>
</tbody>
</table>

In summary, the development will result in the loss of 0.42 ha of vegetation within the buffer zone for Precinct 1. Of this 0.42 ha, 0.25 ha or 59.5% of the impact will be to highly modified vegetation (i.e. cleared and/or covered by exotic grasslands).

Impacts on the remaining areas of native vegetation are summarised as follows:

- 0.06 ha (14.3%) of the total impact will be to Broad-leaved paperbark closed forest to woodland; and
- 0.11 ha (26.2%) of the total, impact will be to Littoral rainforest.

Precinct 5

The construction of roads, services and a bio-retention swale within the ecological buffer to the EPZs adjacent to Precinct 5 will result in the removal of all of the vegetation within the 20 m outer buffer zone and portions of the inner 30 m buffer zone.

The bio-retention swale will extend into the inner 30 m of the buffer zone in some areas (FIGURES 14, 14a & 14b). TABLE 2 outlines the degree to which the vegetation communities, within the buffers to the EPZs, will be impacted. FIGURE 15 illustrates the impact areas.
TABLE 2
IMPACTS ON VEGETATION COMMUNITIES WITHIN PRECINCT 5 ECOLOGICAL BUFFER

<table>
<thead>
<tr>
<th>Vegetation Communities</th>
<th>Total area (ha)</th>
<th>Area to be lost (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community 1 - Highly Modified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1(a) Substantially cleared of native vegetation</td>
<td>4.17</td>
<td>1.85</td>
</tr>
<tr>
<td>1(b) Camphor laurel dominant closed forest (with rainforest species)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1(c) Native plantation/plantings</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1(d) <em>Leptospermum petersonii</em> plantation (with heathland species)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1(e) Exotic pine plantation/pine wildings</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1(f) Exotic grassland dominated (with heathland species)</td>
<td>1.83</td>
<td>1.55</td>
</tr>
<tr>
<td>1(g) Exotic grassland dominated (with regrowth Acacia &amp; other native species)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Subtotal</td>
<td>6.00</td>
<td>3.40</td>
</tr>
<tr>
<td>Community 2 - Freshwater Wetland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2(a) Hillside seepage swamp</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2(b) Ponds &amp; fringing wetland</td>
<td>0.04</td>
<td>0.03</td>
</tr>
<tr>
<td>2(c) Sedgeland/rushland</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Subtotal</td>
<td>0.04</td>
<td>0.03</td>
</tr>
<tr>
<td>Community 3 - Heathland &amp; Shrubland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3(a) Dry coastal heathland to shrubland</td>
<td>0.44</td>
<td>0.10</td>
</tr>
<tr>
<td>3(b) Wet coastal heathland to shrubland</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3(c) Mixed wet/dry coastal heathland to shrubland (with Scribbly gum)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3(d) Regenerating wet/dry coastal heathland to shrubland</td>
<td>2.59</td>
<td>1.06</td>
</tr>
<tr>
<td>3(e) Regenerating wet/dry coastal heathland to shrubland (with exotic pines)</td>
<td>0.06</td>
<td>0.00</td>
</tr>
<tr>
<td>Subtotal</td>
<td>3.09</td>
<td>1.16</td>
</tr>
<tr>
<td>Vegetation Communities</td>
<td>Total area (ha)</td>
<td>Area to be lost (ha)</td>
</tr>
<tr>
<td>------------------------------------------------------------</td>
<td>-----------------</td>
<td>----------------------</td>
</tr>
<tr>
<td><strong>Community 4 - Swamp Sclerophyll Floodplain Forest</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4(a) Forest red gum open forest to woodland/Broad-leaved paperbark closed forest to woodland</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4(b) Swamp mahogany open forest to woodland &amp; heathland species</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4(c) Scribbly gum/Swamp mahogany open forest to woodland</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4(d) Swamp box open forest to woodland</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4(e) Broad-leaved paperbark closed forest to woodland</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4(f) Broad-leaved paperbark closed forest to woodland (with rainforest species)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4(g) Broad-leaved paperbark closed forest to woodland/Swamp mahogany open forest to woodland</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4(h) Swamp sclerophyll &amp; heathland species (with exotic pines)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4(i) Regenerating Broad-leaved paperbark closed forest to woodland &amp; heathland species</td>
<td>0.62</td>
<td>0.04</td>
</tr>
<tr>
<td>4(j) Regenerating Swamp mahogany open forest to woodland</td>
<td>0.08</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>0.70</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Community 5 - Dry to Moist Open Forest</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5(a) Blackbutt wet to dry open forest</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5(b) Blackbutt/Tallowwood open forest</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5(c) Blackbutt with grassy understorey</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5(d) Scribbly gum open forest to woodland</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5(e) Regenerating Scribbly gum open forest to woodland &amp; heathland species</td>
<td>1.00</td>
<td>0.03</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>1.00</td>
<td>0.03</td>
</tr>
<tr>
<td><strong>Community 6 - Rainforest</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6(a) Littoral rainforest</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6(b) Regenerating sub-tropical rainforest</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>10.83</td>
<td>4.67</td>
</tr>
</tbody>
</table>
The inner buffer zone (i.e. adjacent the Cudgen Nature Reserve) to a width of approximately 20m is heavily vegetated and includes substantial trees that will be retained (PLATE 1). PLATE 1 also illustrates that the balance area of the inner buffer zone (i.e. approximately 10m) is predominantly comprised of exotic pasture grass.

PLATE 2 shows the southern parts of Precinct 5 and the inner 30m of the ecological buffer is predominantly comprised of exotic pasture grass, with some native vegetation regrowth occurring between periodic slashing.
In summary, the earthworks for Precinct 5 will impact on a total of 4.67 ha of vegetation within the buffer zones. Of this 4.67 ha, 3.40 ha or 73% of the impact will be to highly modified vegetation (i.e. cleared and/or covered by exotic grasslands).

Impacts on the remaining areas of native vegetation are summarised as follows:

- 24.8% of the total impact will be to heath and shrubland communities;
- Of Heath and shrubland communities to be lost (1.16 ha in total) only a very small portion (i.e. less than 10%) is in good condition. The majority of the heath to be lost (1.06 ha) is disturbed but regenerating;
- The remaining impacts will be to Freshwater wetland (0.6%), Swamp Sclerophyll Forest (0.86%), Open Forest (0.64%).
3.4 Amelioration of Buffer Impacts

3.4.1 Precinct 1

The inner 30m buffer zone to the EPZ adjacent to Precinct 1 will be fully restored. A combination of weed control and koala and acid frog habitat enhancement will be implemented in accordance with the relevant management plans (JWA 2011a; JWA 2011b; JWA 2011c; JWA 2011e).

3.4.2 Precinct 5

Regeneration and/or revegetation of heath communities is proposed within the buffer to the EPZ adjacent to Precinct 5. A combination of weed control, heath rehabilitation, and koala and acid frog habitat enhancement will be implemented in accordance with the relevant management plans (JWA 2011a; JWA 2011b; JWA 2011c; JWA 2011e). FIGURES 16a & 16b illustrate the regeneration and/or revegetation areas totaling 8.19 ha.

TABLE 3 below provides a summary of the amount of proposed regeneration/revegetation works within Precinct 5 ecological buffers.

<table>
<thead>
<tr>
<th>Vegetation Community</th>
<th>Current extent</th>
<th>Proposed impacts</th>
<th>Proposed regeneration/ revegetation</th>
<th>Net gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>3(a) Dry coastal heathland to shrubland</td>
<td>0.44</td>
<td>0.10</td>
<td>8.19 ha</td>
<td>7.03 ha</td>
</tr>
<tr>
<td>3(b) Wet coastal heathland to shrubland</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3(c) Mixed wet/dry coastal heathland to shrubland (+ Scribbly gum)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3(d) Regenerating wet/dry coastal heathland to shrubland</td>
<td>2.59</td>
<td>1.06</td>
<td>8.19 ha</td>
<td>7.03 ha</td>
</tr>
<tr>
<td>3(e) Regenerating wet/dry coastal heathland to shrubland with pines</td>
<td>0.06</td>
<td>0.00</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**TOTAL** | **3.09** | **1.16** | **8.19 ha** | **7.03 ha**

Proposed regeneration and revegetation measures will result in a long-term net gain of 7.03 ha of heathland within the Precinct 5 ecological buffers.

Planting of koala feed and shelter trees will be completed where appropriate within the buffers to EPZs. These plantings will generally occur in combination with
heath regeneration/revegetation activities and will contribute significantly as mitigation for the loss of any vegetation within the buffer zones. Areas identified for planting preferred koala food trees are shown in **FIGURE 17. SECTION 4.5 provides further discussion on Koala food tree compensation.**

Furthermore, compensatory habitat for acid frogs will also be created within ecological buffers and will include core breeding habitat and forage habitat areas. The creation of this habitat will also generally occur in combination with heath regeneration/revegetation activities. Details are provided in the Precinct 1 & 5 Threatened Species Management Plan (JWA 2011b).
LEGEND

- Koala food tree planting areas
- Ecological Buffer (50m)
- Precincts 1 & 5
- Kings Forest Boundary

KOALA FOOD TREE PLANTING AREAS

Project 28 Pty Ltd

SCALE: 1 : 20 000 @ A3

SOURCE: JWA Site Investigations
GDP Golf Course Layout

CLIENT
PROJECT
Kings Forest Stage 1 Project Application
Precincts 1 & 5 - Buffer Management Plan
Melaleuca Drive, Duranbah, NSW
Shire of Tweed

PREPARED BY
DATE: 05 October 2011
FILE: N97017_BMP_Koala trees.ai

FIGURE 17

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants
4. **SPECIFIC MANAGEMENT STRATEGIES**

4.1 **Introduction**

The specific management strategies for the Precinct 1 & 5 buffer areas are detailed in the following sections and will include:

- Protective measures;
- Weed control;
- Heath regeneration & revegetation;
- Koala compensatory habitat plantings;
- Acid frog compensatory habitat;
- Pest management; and
- Adaptive management

4.2 **Protective Measures**

4.2.1 **Introduction**

This section outlines the measures that will be taken to protect the significant natural values adjacent to Precincts 1 & 5 during the construction and operational phases.

4.2.2 **Vegetation Protection**

**Construction Phase**

During construction activities, temporary high visibility fencing will be erected along the edge of the 30m inner buffer zone at Precinct 1 and the truncated inner buffer zone at Precinct 5. Temporary signage at approximately 100m intervals will be provided along all temporary fencing during the construction phase stating “Environmental Protection Zone - No Unauthorised Entry”.

This will assist in the protection of the retained vegetation from all construction activities by restricting access from machinery and contractors.

**Operational Phase**

A koala proof fence in accordance with the Kings Forest Stage 1 KPoM (JWA 2011e) will be constructed as follows:

- between the outer and inner buffer zones in Precinct 1 (FIGURE 13); and
- between the outer buffer and truncated inner buffer zone at Precinct 5 (i.e. along the eastern side of the bio-retention swale (FIGURES 13 & 14).

Signage will be provided on or about the fences stating the following:
• No Unauthorised Entry
• Dogs Prohibited
• No dumping of rubbish
• Rehabilitation works in progress

Whilst the primary aim of these fences is the prevention of access by Koalas to residential areas, they will also provide permanent protection to vegetation by precluding pedestrian access and vehicular access during the operational phase.

4.2.3 Protection of Threatened Flora

Construction Phase
None of the identified Threatened flora species occur within the proposed ecological buffers. The Precinct 1 & 5 VMP (JWA 2011a) provides detailed protective measures for threatened flora occurring within EPZs. These protective measures will be implemented during bulk earthworks and construction activities.

Operational Phase
None of the identified Threatened flora species occur within the proposed ecological buffers. The Precinct 1 & 5 TSMP (JWA 2011b) provides detailed protective measures for threatened flora occurring within EPZs. These protective measures will be implemented during the operational phase.

4.2.4 Protection of EECs

Construction Phase
None of the EEC’s occur within the proposed Ecological buffers. The Precinct 1 & 5 VMP (JWA 2011a) provides detailed protective measures for EEC’s occurring within EPZs. These protective measures will be implemented during bulk earthworks and construction activities.

Operational Phase
None of the EEC’s occur within the proposed Ecological buffers. The Precinct 1 & 5 VMP (JWA 2011a) provides detailed protective measures for EEC’s occurring within EPZs. These protective measures will be implemented during the operational phase.

4.2.5 Stormwater Management

Surface water runoff during construction and operations will be managed and mitigated in accordance with the erosion and sediment control measures detailed in the Erosion and Sediment Control Plan (Gilbert & Sutherland 2011a). Temporary stormwater management and treatment measures will be installed prior to disturbance and maintained until such time as the disturbed areas are stabilised by revegetation upon completion of the earthworks. Temporary measures will include the provision of a sediment fence around the perimeter of any disturbed areas.
4.3 Weed Control

Due to the significant disturbance history, Kings Forest supports a variety of weed species of which Slash pine is the most common. Plantations have resulted in the species being naturalised on the site. Progeny range in size from small seedlings to trees 15-20 metres. In some areas there is significant invasion into native vegetation communities, while in other areas there may be only one or two plants.

Weeds will be controlled within the Precinct 1 & 5 ecological buffers to ensure the protection of EPZs and the Cudgen Nature Reserve, particularly during construction. Disturbance during the construction will create a significant opportunity for weeds to colonise and establish. Weed control will be completed in accordance with the Weed Management Plan (WMP) for Precincts 1 & 5 (JWA 2011c) and should begin in conjunction with the bulk earthworks.

4.4 Heath Regeneration and Revegetation

All Rehabilitation/Regeneration works to be carried out within Precinct 1 & 5 ecological buffers will be completed in accordance with the Precinct 1 & 5 VMP (JWA 2011a).

Revegetation should commence immediately upon completion of both the proposed Kings forest Parkway and the constructed bio-retention swale adjacent to Precinct 5 resulting in a vegetative barrier to prevent weed invasion into the EPZs and Cudgen Nature Reserve.

Revegetation of heath communities is proposed within the majority of the buffers to the EPZs within Precincts 1 & 5 (FIGURES 16a & 16b). The re-use of existing topsoil will be important in the process of rehabilitation heath communities (JWA 2011a).

Topsoil is an important source of seeds and propagules and has been effectively used in rehabilitation of native vegetation communities (e.g. Bellairs & Bell 1993; Koch & Ward 1994; Ward et al. 1996). Therefore, handled correctly, the topsoil seedbank can be used to successfully revegetate after disturbances like bulk earthworks.

At the commencement of the Stage 1 earthworks at Kings Forest, stockpiles of topsoil will be created. This soil will then be used in the regeneration of the heath communities within the buffer zones.

To optimise the recovery of native vegetation rehabilitation areas it is important to considered the manner in which the top soil is handled. The following should be considered:

- It is important to consider the timing of topsoil recovery. Stripping topsoil immediately after summer seed drop may improve the germinable seed load (Berg 1975);
• The seed bank is usually concentrated in the upper soil layer (i.e. 40-50 mm) so it is important to only remove this depth of soil. A greater depth will dilute the seed bank and reduce the effectiveness of the soil as a potential mechanism for natural regeneration (Putwain & Gillham 1990);

• Topsoil should be used as soon as possible after stripping to prevent loss of seed viability (Koch et al. 1996; Mahesh et al. 1996); and

• Top soil should be replaced at maximum depths of 100 mm (Rokich et al. 2000).

4.5 Koala Compensatory Habitat plantings

Planting of koala feed and shelter trees, within the inner buffers, will be completed in accordance with the KPoM (JWA 2011e) (FIGURE 17). This will establish linkages between areas of koala habitat and increase foraging resources for the species in the long term. Planting methodology and a species list is outlined in Precinct 1 & 5 VMP (JWA 2011a).

4.6 Acid frog compensatory habitat

The creation of core Acid frog breeding habitat will be completed in Precinct 1 & 5 ecological buffers in combination with heath regeneration/revegetation measures and Koala compensatory habitat plantings. The acid frog compensatory habitat will be created in accordance with the Precinct 1 & 5 TSMP (JWA 2011b).

4.7 Pest Management

Several feral animal species have been identified as a problem on the Kings Forest site (e.g. Red Fox, Cane Toads). A Stage 1 FAMP (JWA 2011d) has been prepared for the Kings Forest site. Various strategies are discussed for the control of feral animals occurring at the site. Recommendations are provided with regard to the timing and implementation of these strategies.

4.8 Adaptive Management

Adaptive management is an approach that involves learning from management actions, and using those lessons to improve upon the overall plan. The principles of adaptive management have been incorporated into the administration of restoration projects within a variety of governmental authorities and programs (Thom 1997). Comprehensive, long-term monitoring is a component of adaptive management as adaptive management strategies rely on the accumulation of evidence supporting decisions that demand changes in action.

An adaptive management approach involves an integrated process of firstly monitoring, then reviewing and responding to the health and conditions of the
plantings, natural regeneration and the status of the weed infestation. Where necessary, alteration to the design and maintenance of works required, to ensure the objectives of the BMP are achieved, are then made.

Adaptive management strategies will be determined by the information provided in monitoring reports. Adaptive management strategies that may be required within this BMP are as follows:

- Amendment of species list for revegetation works;
- Replacement of enhancement plantings that do not survive;
- Alteration of weed control methods or timing.

Before the implementation of any adaptive management strategy a brief report is be provided to Project 28 Pty Ltd and other relevant agencies detailing the proposed management actions and the predicted outcomes. The implementation must be approved by the relevant authority prior to implementation.
5. MAINTENANCE

5.1 Introduction

Ecological buffers will require maintenance during the construction phase to ensure they become well established and fully functioning. This section outlines the maintenance requirements during the construction phase. Maintenance will be completed focusing in three areas:

- General weed control;
- Care and/or labelling of plants natural regenerating in heath communities; and
- Care (i.e. watering, staking, mulching, protection) of heath and koala food plantings.

5.2 Weed Control

Targeted weed control will be completed whilst heath communities and koala food trees are establishing. Weed control methods are outlined in the WMP (JWA 2011c).

5.3 Natural Regeneration

Areas of regeneration should be continually assessed to detect and record seed germination. Seedlings should be marked and/or labelled and any weeds removed to increase the probability of survival.

5.4 Koala Food Tree Plantings

Maintenance for the compensatory koala food tree plantings will include the following:

- ensuring adequate soil nutrient levels by periodic fertilising;
- ensuring adequate soil moisture levels;
- surveying for evidence of over browsing and applying adaptive management strategies (if necessary); and
- replacing any plantings that fail.

5.5 Timing of Maintenance

Maintenance visits will occur:

- On a fortnightly basis for an appropriate time to survey seedling recruitment in heath regeneration areas;
- Two weeks after enhancement plantings;
• Bi-monthly (check on plantings and weeds) for the first year; and
• Six monthly (check on plantings and weeds) for the 2\textsuperscript{nd}, 3\textsuperscript{rd}, 4\textsuperscript{th} and 5\textsuperscript{th} years.
6. MONITORING AND REPORTING

6.1 Introduction

Monitoring is an ongoing part of any rehabilitation works. The condition of revegetation areas can be assessed by checking environmental conditions and matching these with management aims and objectives. The results obtained through monitoring can help managers to prioritise management actions and keep track of the health of rehabilitated areas.

A well-designed monitoring program will allow project managers to detect results months, years, or decades following implementation of a plan. This section outlines the monitoring requirements for the Precinct 1 & 5 ecological buffers.

6.2 Rehabilitation Monitoring

6.2.1 Monitoring Requirements

The monitoring of ecological buffers will include regular visits by a qualified ecologist who is to complete the following:

- **Transects**
  - Ten (10) transects are to be placed within the Precinct 1 & 5 ecological buffers;
  - Transect locations are to be permanently marked;
  - Transects are to be 30 metres in length;
  - During monitoring visits tape measures are to be placed on the ground and the specific measurable features recorded along the transects;
  - Specific measurable features include:
    - Areas of vegetation cover (native species);
    - Areas of weed cover;
    - Areas of bare ground/mud;
    - Number, percentage and species of planted stems surviving;
  - Results are to be shown in a table which is to be presented in the monitoring reports.

- **Quadrats**
  - Three (3) quadrats (1m²) are to be placed along each of the transects;
  - Quadrats must be placed a minimum of 5m apart along the length of the transect;
  - Quadrats are to be placed randomly within five (5) metres of the transect line;
  - The boundary of the quadrat with respect to the tape measure (e.g. between 3.5 - 4.5 metres on tape measure) will be recorded;
  - For each quadrat the following specific measurable features will be recorded:
6.2.2 Timing of Monitoring Visits

The monitoring is to be completed by a suitably qualified ecologist. Site visits should occur:

- Six (6) weeks after primary weeding;
- Six (6) weeks after initial plant-out;
- Every six (6) months thereafter until groundcovers are sufficiently established (i.e. between two (2) - three (3) years)
- Annually after establishment. Monitoring will cease after five (5) years unless performance criteria have not been met, whereby monitoring will continue annually until performance criteria have been met.

6.2.3 Long term Monitoring

Along with the regular monitoring within the ecological Buffers, the overall vegetation composition is to be regularly assessed and recorded. Long term monitoring will use both aerial photos and yearly assessments (ground truthing) of the vegetation communities using a hand held GPS.

The Long term monitoring of the vegetation composition with the Precinct 1 & 5 ecological buffers will include:

- A detailed vegetation map at a scale of 1:5,000 is to be completed within the ecological buffers every twelve (12) months;
Each year, after completion of vegetation mapping, a report is to be completed showing the changes in the composition of the vegetation communities within the ecological buffers. The results are to be shown in a table that shows the vegetation community and the area of the vegetation community as a percentage of the ecological buffers. Monitoring will cease after five (5) years unless performance criteria have not been met, whereby monitoring will continue annually until performance criteria have been met.

6.3 Fauna Monitoring

Further to the monitoring of the progress of rehabilitation, an annual fauna survey will be completed within Precinct 1 & 5 ecological buffers until performance criteria are met (refer Section 6.5). A baseline survey will be completed within the Precinct 1 & 5 ecological Buffers prior to commencement of construction to determine species presence. The fauna surveys will target threatened species recorded, or predicted to occur, within the vicinity of Precincts 1 & 5 and will include the following methodology (where appropriate):

- Elliott trapping;
- Cage trapping;
- Pitfall trapping;
- Arboreal Elliott trapping;
- Spotlighting/stag watching;
- Call playback;
- Dawn & dusk bird surveys;
- Hair tubes; and
- Active searching.

6.4 Water Quality Monitoring

A detailed water quality monitoring regime is included in the Overall Water Management Plan (Gilbert & Sutherland 2011b) and will ensure that significant impacts on ecological buffers and ecologically significant areas are avoided.

6.5 Performance Criteria

A number of criteria will indicate successful rehabilitation of the ecological buffers, including:

- Survival of 95% of stems planted;
- Establishment of a 70% native ground cover after 2-3 years;
- Average percentage cover of 90% native ground cover at the 5th year;
- Noxious weeds are to be eradicated and environmental weeds less than 1% of the area;
- Natural recruitment of native seedlings throughout planting areas;
- Maintenance of 100% of planted diversity; and
- Plantings providing variable habitats for native fauna species.

Performance criteria will be assessed for the ecological buffers as follows:

- The photos taken during monitoring visits, in combination with the annual monitoring and mapping of native vegetation composition and the results of the annual fauna survey, will be used to determine the density and diversity of native flora and fauna species the area is supporting.
- When the Ecologist has determined that all performance criteria have been met, completion will have occurred.

6.6 Reporting

6.6.1 Rehabilitation monitoring reports

Following each inspection by the qualified ecologist, a report will be prepared that will include tables and photographs from the monitoring visits. At the end of each year a detailed report will be prepared for the Department of Environment, Climate Change & Water (DECCW) and Tweed Shire Council (TSC). The report will discuss the following:

- Works undertaken;
- Progress of regeneration/revegetation areas against performance criteria using photos and tables showing the results of the monitoring visits;
- Significant problems encountered (death of seedlings, broken fences, vandalism etc.) and the effect of these on the plantings and aims of the revegetation or regeneration strategy;
- Success or failures of measures implemented to rectify previously identified problems;
- Measures to be taken to rectify new problems; and
- Performance against performance criteria (Section 6.5).

6.6.2 Fauna monitoring reports

A report will be prepared to DECCW & TSC after each annual fauna survey and will include the following:

- Results of the fauna survey;
- A comparison of results with previous years;
- Discussion regarding the absence of previous species/occurrence of new species;
• Any habitat maintenance recommendations (i.e. additional nest boxes etc.);
• Discussion regarding the occurrence of any pest species; and
• Recommendations for controlling pest species (if required).
7. **COMPLIANCE WITH STATUTORY REQUIREMENTS**

7.1 **Background**

This section discusses compliance with the requirements of ecological buffers under the State Environmental Planning Policy (Major Projects) 2005 (Amendment No 10) and the Concept Plan approval (06-0318).

7.2 **The SEPP (Major Projects) Amendment**

7.2.1 **Introduction**

A literature review on the types and purposes of environmental buffers was included in the approved Buffer Management Plan (JWA 2009) prepared for the Concept Plan Application. The approved 2009 Buffer Management Plan established the following principles with respect to ecological buffers (with the exception of the southern zone i.e. Golf Course). Buffers were to consist of:

- Minimum 30 m vegetated inner zone; and
- Maximum 20 m outer zone. The outer zone may contain, subject to approval in each case, roads, footpaths and cycle ways, an asset protection zone (APZ), stormwater management and passive recreation areas.

The 2009 Buffer Management Plan (JWA 2009) also noted that:

> The application of this principle will be the subject of zone-specific Buffer Management Plans submitted in support of each Project Application or Development Application, and is supported by the Department of Environment and Climate Change.

As foreshadowed in the Concept Plan, it is proposed as part of the Project Application that compatible works would be undertaken in the 20m outer buffer.

An exception to the inner 30m and outer 20m buffer arrangement is proposed within the Stage 1 Project Application for Precinct 5. A minimum 50m buffer between the proposed residential development in Precinct 5 and Environmental Protection Zone/Cudgen Nature Reserve to the east is proposed however a bio-retention swale is proposed to be constructed along the eastern edge of Precinct 5 and will encroach slightly into the 30m vegetated inner zone.

7.2.2 **Compliance with Clause 7(2)**

Clause 7(2) of the SEPP (Major Projects) Amendment states that the objectives of the ecological buffers are:

(a) To protect wetlands or areas of particular habitat significance;
(b) To restrict development so that, as far as practicable, it does not occur within ecological buffers;

(c) To help ensure that development is designed, sited and managed so as to minimise its impact on the ecological and hydrological functions of the ecological buffers; and

(d) To encourage the restoration and maintenance of the native vegetation and ecological processes of the land within and adjacent to wetlands or areas of particular habitat significance.

The following details should be taken into consideration when determining compliance with Clause 7(2) of the SEPP (Major Projects) Amendment.

- This management plan for Precincts 1 & 5 provides specific management strategies as well as a detailed monitoring and reporting program to ensure significant values within and adjacent to ecological buffers are maintained, protected and rehabilitated.

- Preliminary groundwater studies by Gilbert & Sutherland identified that the groundwater regime in the nature reserve could be maintained by recharge comprised generally of stormwater runoff that is infiltrated via vegetated swales located within the buffer along the eastern perimeter of the development. Because the net pre-development groundwater flow direction is to the south-west, recharging closer to the nature reserve (in the east) is more efficient at mitigating the identified impacts than recharging in the fill area.

- Furthermore, the placement of the swale 10m east (within the inner buffer zone rather than the outer buffer zone), delivers the recharge 41 days earlier. The earlier delivery mitigates the impact of extended dry periods.

- The stormwater swale enters into the 30 m inner buffer component in various locations along its length. The extent of the swale situated within the inner buffer is a maximum of ten horizontal metres, but typically only seven metres or less (refer Mortons Urban Solutions plan No.’s 12301-SK-027, 12301-SK-028 & 12301-SK-029). The development that is proposed within the 30 m inner buffer is necessary only to accommodate part of the base and the outer batter of the stormwater swale.

- As detailed in this management plan, the existing vegetation of the outer 20-30m is predominantly exotic pasture. The design stage of the swale included a site assessment by scientists from JWA to ensure all adjacent mature trees would not be affected by the construction of the swale.

- The bio-retention swale is proposed to be fully revegetated in accordance with the Precinct 1 & 5 VMP (JWA 2011c).

- The physical alteration to the inner buffer would typically involve less than a one metre variation to the existing surface. However, the proposed revegetated 1-in-4 batters would ensure that the stormwater swale was appropriately integrated with the balance of the buffer area.
• Whilst the construction of this bio-retention swale may result in a short-term impact on the buffering capacity of the 30 m inner zone, the proposed revegetation of the constructed bio-retention swale will increase the functionality of the inner buffer.

• There will be no associated hard infrastructure (concrete, pipes etc.) located within the inner 30m portion of the buffer;

• It is intended that part of the buffer, from and including the koala fence to the adjacent EPZ, will be dedicated to NPWS in conjunction with other Environmental Protection zoned land to be dedicated to it as an addition to Cudgen Nature Reserve.

• The proposed swale fulfils a number of the objectives for ecological buffers under Clause 7(2), primarily the protection of wetlands and areas of habitat significance by virtue of its role in maintaining the existing hydrological regime in the neighbouring nature reserve. In order to maintain the existing groundwater hydrological regime, recharge is required along the eastern boundary (Gilbert & Sutherland 2011c);

• Whilst the runoff directed to the swales is likely to contain nutrients at levels that are relatively higher than groundwater nutrient levels, plant uptake of these nutrients and filtration through the swale will minimise their concentration in waters that ultimately contribute to the groundwater table. This proposal has the dual benefit of stormwater treatment and enhancing the growth rate and vigour of vegetation planted within the buffer as part of the rehabilitation program.

It is considered that the proposed development within the outer 20m of the buffer, limited to roads and services, the maintenance of asset protection zones and provision of a bio-retention swale, is a practicable solution.

7.2.3 Compliance with Clause 7(3)

Clause 7(3) of the SEPP (Major Projects) Amendment requires that development on land within an ecological buffer is to:

(a) incorporate effective measures to manage wetlands or areas of particular habitat significance, and

(b) be designed and sited to maintain connectivity of vegetation and minimise vegetation clearing, soil disturbance and alterations to the rate, volume or quality of surface and ground-water flows, and

(c) retain and maintain all existing native vegetation outside the area immediately required for the development, and

(d) incorporate measures to regenerate native vegetation for all disturbed areas within the buffer, and

(e) incorporate appropriate stormwater and erosion control measures to protect the buffer from surface water run-off or other disturbance.
The objectives for the ecological buffer (per Clause 7(2) of the SEPP Amendment) will be met, considering Clause 7(3), in that:

- measures will be incorporated to satisfy sub-clause (a) - the management of wetlands or areas of particular habitat significance, in conjunction with sub-clause, sub-clause (b) - the minimisation of alterations to the rate, volume or quality of surface and ground-water flows, and sub-clause (e) - the provision of appropriate stormwater and erosion control measures to protect the buffer from surface water run-off or other disturbance. Such measures will include the construction of a bio-retention swale along the entire length of the buffer generally within its outer 20m zone. The swale will be vegetated in the same way as the adjacent 30m inner buffer zone such as to be visually indistinguishable.

- Sub-clause (b) will be further satisfied, and sub-clauses (c) and (d) satisfied, in that the development will
  - maintain connectivity of vegetation and minimise vegetation clearing and soil disturbance and,
  - enable the retention of native vegetation outside the area required for development, and
  - incorporate measures to regenerate vegetation in other buffer areas disturbed by the development, if any.

7.2.4 Compliance with Clause 7(4)

Clause 7(4) of the SEPP (Major Projects) Amendment provides that, when considering whether or not there is a practicable alternative to siting development inside an ecological buffer, the consent authority must consider:

(a) the design, type and site cover of the proposed development, and
(b) the physical characteristics of the land on which the development is proposed to be carried out, and
(c) the suitability of the land for the proposed development.

The objectives for the ecological buffer (per Clause 7(2) of the SEPP Amendment) will be met, considering Clause 7(4) of the SEPP Amendment, having regard for:

(a) the design, type and site cover of the development in the outer 20m, in that:
  - the swale has been designed and positioned to prevent impacts on adjacent ground water dependant ecosystems,
  - the swale will be fully revegetated once constructed,

(b) the physical characteristics of the land on which the development is proposed to be carried out, in that:
  - it is level and contains no significant native vegetation,
• the existing, substantial vegetation approximately 20m in width along most of the boundary with Cudgen Nature Reserve will be retained, so that, from a buffer function perspective,

(c) based on the above points, the land within the 20m outer buffer is suitable for the proposed development.

7.3 Concept Plan Approval (06-0318)

Condition B3 of the Concept Plan Approval (06-0318) states that:

“Further heathland is to be provided with long-term protection and allowed to naturally regenerate on the site.

The further heathland to be protected is to be that contained within the 50m ecological buffer in the locations depicted as ‘Heath to be Naturally Regenerated’ in Figure 2A titled ‘Heath Regeneration and Revegetation Areas’ drawn by James Warren and Associates and dated 22 March 2010. The heathland in these locations is to be protected and regenerated for the full 50m width of the ecological buffer.

The details of this further protection are to be submitted along with the preferred long term protection mechanism, such as land use zoning, to the satisfaction of the Director-General prior to determination of Stage 1”.

The BMP (JWA 2009) approved as part of the Concept Plan application established the following principles with respect to ecological buffers (with the exception of the southern zone i.e. Golf Course). Buffers were to consist of a:

• Minimum 30m vegetated inner zone; and
• Maximum 20m outer zone. The outer zone may contain, subject to approval in each case, roads, footpaths and cycle ways, an asset protection zone (APZ), stormwater management and passive recreation areas.

It is therefore proposed, as part of the stage 1 Project Application, that compatible works would be undertaken in the 20m outer buffer. However, to provide for further retention and protection of regenerating heath communities, as shown in Figure 2A (JWA 22nd March 2010), the extent of bulk earthworks and engineering design in the buffers has been minimised as much as is feasible and practicable.

We have reviewed the road/earthworks proposal prepared by Mortons Urban Solutions (Plan no. 12301-ALL-040 Amendment C) with respect to the heath areas shown in Figure 2A (JWA 22nd March 2010). The original plan 2A showing Heath Regeneration and Revegetation Areas is attached as FIGURE 18. An updated version of 2A is attached as FIGURE 19 and is based on site vegetation mapping work completed in August 2011.

It should be noted that continued farming practices (i.e. cattle grazing, periodic
slashing etc.) and ongoing weed infestations on the site have resulted in some changes to the heath mapping over the site since 2005. Some areas previously mapped as ‘Existing heath to be retained’ have become significantly infested with weeds (particularly Slash pine) and are now mapped as ‘Heath to be naturally regenerated’. Conversely, some areas of heath previously mapped as ‘Heath to be naturally regenerated’ based on 2005 fieldwork are considered to have sufficiently regenerated to now be mapped as ‘Existing heath to be retained’.

**TABLE 4** below shows a comparison of the ‘Heath Regeneration and Revegetation Areas’ shown within ecological buffers in the original Figure 2A and the updated version of Figure 2A.

<table>
<thead>
<tr>
<th></th>
<th>Existing heath to be retained within ecological buffers (ha)</th>
<th>Heath to be naturally regenerated within ecological buffers (ha)</th>
<th>Heath to be revegetated within ecological buffers (ha)</th>
<th>TOTAL HEATH AREAS WITHIN ECOLOGICAL BUFFERS (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 2A (March 2010)</td>
<td>0.04</td>
<td>8.16</td>
<td>21.55</td>
<td>29.76</td>
</tr>
<tr>
<td>Current Figure 2A (September 2011)</td>
<td>0.34</td>
<td>12.83</td>
<td>19.82</td>
<td>32.99</td>
</tr>
<tr>
<td><strong>Net gain/loss</strong></td>
<td><strong>+0.3</strong></td>
<td><strong>+4.67</strong></td>
<td><strong>-1.73</strong></td>
<td><strong>+3.24</strong></td>
</tr>
</tbody>
</table>

The re-mapping of the heath communities has resulted in an additional 3.24 ha of heath being retained and protected within the area defined by FIGURE 2A (JWA 22nd March 2010). This additional area of heath is comprised of 0.3 ha of existing heath plus 4.67 ha of heath that will naturally regenerate minus an area of 1.73 previously proposed to be revegetated.
REFERENCES


