Appendix A

Environmental Impact Assessment and Mitigation Strategy

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Pacific Pines Estate

Environmental Impact Assessment and Mitigation Strategy

Job Number 7801-71

Prepared for Petrac Lennox Head Pty Ltd

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Pacific Pines Estate

Environmental Impact Assessment and Mitigation Strategy

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Executive Summary

On the 12th of November 2008, the New South Wales Minister for Planning issued an approval under Part 3A of the *Environmental Planning and Assessment Act 1979* for the Concept Plan proposed by Petrac Pty Ltd, which provided for a mixed use subdivision of Lot 234 on DP1104071, Lennox Head. Since the issue of the Concept Plan approval, Greg Hall and Ian England have been appointed Receivers and Managers of Petrac Lennox Head Pty Ltd and have engaged Cardno (QLD) Pty Ltd to assist in addressing the following environmental conditions that have been attached to the Concept Plan approval, specifically:

1. B1 – Environmental Management Plan;
2. B2 – Compensatory Plan; and
3. B3 – Ecological Compensation.

Significant environmental features have been recorded within the site, including a number of threatened species and Endangered Ecological Communities (EEC). While the approved Concept Plan makes provision for the retention and protection of the majority of these threatened species and EECs, there will be displacement of some areas of Hairy joint grass and Square-stemmed spike rush and Freshwater wetlands on coastal floodplains EEC, resulting from:

- vegetation clearance;
- a balanced cut and fill operation to achieve necessary flood immunity and stormwater management requirements; and
- the establishment of roadways and other urban infrastructure.

An Amended Concept Plan has been designed in order to further reduce the degree of direct physical impacts on threatened species and the Freshwater wetland EEC. The most significant feature of the Amended Concept Plan is the dedication of approximately 1.65ha of additional land, which forms part of the approved retirement community, into the Conservation Zone. This additional dedication of land represents a 31% increase in the area of the approved Concept Plan's Conservation Zone. More importantly, the inclusion of this area into the Conservation Zone, which now has a total area of 6.5ha, has resulted in the Amended Concept Plan retaining and protecting an additional:

- 0.33ha of existing Hairy joint grass habitat;
- 0.31ha of existing Square-stemmed spike rush habitat; and
- 0.86ha of existing Freshwater wetland EEC.

Within the Conservation Zone areas of potential additional habitat for Hairy joint grass, Square-stemmed spike rush and the Freshwater wetland EEC have also been identified and consist of areas that are either:

- wetland habitat not currently occupied by Hairy joint grass or Square-stemmed spike rush but with the potential to be colonised either through translocation programs and/or rehabilitation works;
- wetland habitat that does not currently have the structure and composition of the Freshwater wetland EEC, but through appropriate management and rehabilitation these elements could be restored; or
- non-wetland habitat that has the potential to be modified and managed to create new habitat for Hairy joint grass, Square-stemmed spike rush and species that typically occur within the Freshwater wetland EEC.

Where displacement cannot be avoided, mitigation for the reduction in the *in situ* extent of Hairy joint grass, Square-stemmed spike-rush and Freshwater wetland EEC will be achieved through the following measures.

1. Investment in the preparation and implementation of an intensive Environmental Management Plan specifically designed to achieve the long-term survival of retained threatened flora populations and the Freshwater wetland EEC within the Conservation Zone.
2. Enhancement of retained populations through the translocation of Hairy joint grass and Square-stemmed spike rush located within the urban development footprint into the Conservation Zone.
3. Creation of additional wetland habitat through modification of areas within the Conservation Zone that currently do not support wetland.
4. Monitoring and research to increase the current understanding of threatened species and EEC biology, ecology and appropriate management within an urban context.

The net of impact on Hairy joint grass, Square-stemmed spike rush and the Freshwater wetland EEC associated with the Amended Concept Plan, taking into account areas of habitat to be lost and those to be rehabilitated/created in the Conservation Zone, is summarised below.

Species / Community	Existing area on site (ha)	% of existing area to be retained	Area of existing habitat to be removed (ha)	Maximum area of potential new habitat to be rehabilitated / created (ha)	Ratio: Loss:Gain
Hairy joint grass	3.64	70%	1.08	3.49	1:3.2
Square-stemmed spike rush	3.96	77%	0.91	3.16	1:3.5
Freshwater wetland EEC	4.12	87%	0.54	2.39	1:4.4

In conclusion, the Amended Concept Plan provides a superior outcome for threatened species and EECs that occur on the site then that which would be achieved if the site was developed in accordance with the approved Concept Plan.

1 Introduction

This Environmental Impact Assessment and Mitigation Strategy (EIAMS) has been prepared on behalf of Petrac Lennox Head Pty Ltd (Receivers and Managers Appointed) in relation the implementation of approvals for the development of Pacific Pines Estate, Lennox Head, northern New South Wales ("the site").

The majority of the site, which is comprised of Lot 234 on DP1104071, is zoned 2(b) – Village Zone under the *Ballina Local Environmental Plan 1987*, with a small portion of the site along the south-western boundary zoned as 7 (a) Environment Protection – Wetland Zone.

On the 12th of November 2008, the New South Wales Minister for Planning issued an approval under Part 3A of the *Environmental Planning and Assessment Act 1979* for the Concept Plan proposed by Petrac Pty Ltd, which provided for a mixed use subdivision consisting of:

1. residential subdivision comprising of large lots, traditional lots duplex lots, small affordable lots, rear lane lots and park lots;
2. a neighbourhood centre;
3. a multi-purpose "community use" hall;
4. a retirement community;
5. low-medium density housing;
6. road network and service infrastructure; and
7. a 25.1ha green space network, comprised of areas of public park/open space and private open space, that encompasses:
    - a water quality control pond and associated open space;
    - buffers around SEPP 26 Littoral Rainforest and SEPP14 Wetlands; and
    - most areas of identified on-site habitat for EECs and threatened species.

A copy of the current approved Concept Plan site is provided as Figure 1.

At the same time, the Minister issued a Project Approval under the Act relating to Stage 1 of the Concept. The Project Approval authorises a 63 lot residential subdivision comprising:

1. 54 residential lots ranging in size from 632m^2 to 907m^2 (Stage 1A);
2. 6 super lots for future development (Stage 1B);
3. extension of Hutley Drive from northern property boundary to proposed super lot 1 (Stage 1C);
4. 2 open space lots of 910m^2 and 641m^2 (part of Stage 1A); and
5. associated earthworks, roads and civil works.

Since the issue of the Concept Plan approval, Greg Hall and Ian England have been appointed Receivers and Managers of Petrac Lennox Head Pty Ltd and have engaged Cardno (QLD) Pty Ltd to assist in addressing the following environmental conditions that have been attached to the Concept Plan approval, specifically:

1. B1 – Environmental Management Plan;
2. B2- Compensatory Plan; and
3. B3 – Ecological Compensation.

This EIAMS provides an analysis of the manner in which development of the site is proposed to occur such that compliance with environmental conditions B1, B2 and B3 will be achieved. This EIAMS is based on further investigations and assessments carried out at the site and also draws upon information and data provided within the following reports which were submitted in support of the original development application:

- Pacific Pines Ecological Assessment (September 2007) prepared by GeoLINK;
- Pacific Pines Estate, Lennox Head, Part 3A Application No. MP 07_0026 Environmental Assessment Report (February 2008), prepared by GeoLINK;
- Species Profile – *Arthraxon hispidus* (Thunb.) Makino – Hairy Joint Grass (11 July 2007), prepared by Cardno (QLD) Pty Ltd; and
- Hairy Joint Grass Management Strategy (12 March 2008) prepared by Cardno (QLD) Pty Ltd.

2 Significant Environmental Features

2.1 Overview

Significant environmental features that have been recorded within the site consist of a number of threatened species and Endangered Ecological Communities (EEC) as detailed in Table 1 below.

Table 1: Threatened Species and Endangered Ecological Communities recorded within the site.

Scientific Name	Common Name	Conservation Status	On-site habitat type
Archidendron hendersonii	White laceflower	NSW V	Littoral rainforest fragments
Arthraxon hispidus	Hairy joint grass	NSW V C V	Sedgeland / rushland
Eleocharis tetraquetra	Square-stemmed spike rush	NSW E	Sedgeland / rushland
Macadamia tetraphylla	Rough-shelled bush nut	NSW V C V	Littoral rainforest fragments
Szygium hodgkinsonidae	Red lilly-pilly	NSW V C V	Littoral rainforest fragments
TInospora tinosporoides	Arrow head vine	NSW V C V	Littoral rainforest fragments
Freshwater wetlands on coastal floodplains		NSW EEC	Sedgeland / rushland
Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions		NSW EEC	Littoral rainforest fragments
Swamp Sclerophyll Forest on Coastal floodplains		NSW EEC	Low-lying areas integrating with sedgeland / rushland
Swamp oak floodplain forest		NSW EEC	Low-lying areas integrating with sedgeland / rushland

C V = Commonwealth (Vulnerable) – Environment Protection and Biodiversity Conservation Act1999

NSW E, NSW V, NSW EEC = Endangered, Vulnerable, Endangered Ecological Community – New South Wales Threatened Species Conservation Act 1995.

The approved Concept Plan makes provision for the retention and protection of all of the habitat currently occupied by:

- four of the six threatened species recorded on site, namely White laceflower, Rough-shelled bush nut , Red lilly pilly, Arrow head vine; and
- the Littoral rainforest and Swamp oak floodplain EECs.

More specifically, these threatened species and communities will be protected either within areas of:

- open space that have been designated for a combined usage of conservation and passive recreation; or
- included on private land that will be protected by an Environmental Covenant (i.e. an 88B Instrument) registered at the Land Titles Office, that will prevent the clearance of this vegetation.

The relationship between each of these significant environmental features and the approved Concept Plan is provided in Figure 1b.

However, the approved Concept Plan will necessitate the displacement of some areas of Hairy joint grass and Square-stemmed spike rush, Freshwater wetlands on coastal floodplains EEC and Swamp sclerophyll forest EEC. It has previously been established and generally accepted by DoP, that the removal of approximately 0.1 ha of Swamp Sclerophyll Forest will have little impact on this community at the landscape and/or regional scale given that:

- this small remnant within the site is in a highly degraded state owing to weed invasion and impacts from cattle grazing; and
- this community type is widely distributed in the adjacent Ballina Nature Reserve.

As such, the impact of the approved Concept Plan on Hairy joint grass, Square stemmed spike rush and the Freshwater wetland EEC will be the focus of this EIAMS.

Given the time that has elapsed since the issue of the Concept Plan approval, it was necessary to re-assess the location and extent of these two threatened flora species and the Freshwater wetland EEC within the site for the purposes of this EIAMS.

2.2 Assessment Methodology

An additional flora survey was completed between the 9th and 10th of November 2009 by appropriately qualified ecologists (refer Appendix A for current Curriculum Vitae). The main objectives of the survey were to:

1. identify the location and extent of Hairy joint grass and Square-stemmed spike rush within the site during the current growing season;
2. collect data relating to environmental variables (i.e. aspect, altitude, soil saturation etc) within the preferred habitat for these threatened species; and
3. verify the location and extent of the Freshwater wetland EEC within the site.

The survey was limited to areas of the site that have previously been identified as supporting wetland vegetation and/or threatened species populations. The location and extent of Hairy joint grass and Square-stemmed spike rush was assessed by overlaying a 20 x 20m quadrat grid on high resolution aerial photography of the target area and assessing the percentage cover of each species within each quadrat. Environmental variables for each quadrat were also recorded.

Verification of the location and extent of the Freshwater wetland EEC was completed by visual inspection of the previously mapped area in the field.

The results of the survey for each threatened species and the EEC are provided in sections 2.3 to 2.5 below.

2.3 Location and Extent Hairy Joint Grass (*Arthraxon hispidus*)

Hairy joint grass was recorded within areas of the site that are wet, but not necessarily subject to permanent inundation, such as the drainage lines. There were some differences in the extent of cover of this species recorded during previous surveys, particularly around the eastern extent of the wetland habitat. As such, data collected during the survey completed between the 16th and 18th of January 2008 were combined with the data collected during this growing season to provide a comprehensive assessment of the extent of populations within the site.

Hairy joint grass was recorded across approximately 3.64ha of habitat within the site as illustrated within Figure 2. With reference to this figure, it is noted that:

- the majority of Hairy joint grass was recorded within the central portion of the site that is influenced by a ground-fed spring;
- within this central area a large proportion of the quadrats were recorded with 30-70% cover with very low coverage (<5%) recorded within quadrats around the periphery of the ground-fed spring;
- a small population of the species was recorded along the drainage line to the east of the existing water-quality control pond; and
- fragmented occurrences of the species were recorded along drainage line in the north-western corner of the site and north of the central spring area.

2.4 Location and Extent of Square-stemmed Spike Rush (*Eleocharis tetraquetera*)

Detailed surveys of the full location and extent of Square-stemmed spike rush have not previously been conducted within the site. As such, data collected during the 2009 survey is the only data available for assessment of the location and extent of this species within the site.

The distribution of Square-stemmed spike rush was largely sympatric with Hairy joint grass, but this species was also found within areas of permanent inundation such as the beds of drainage lines that traverse the site. Square-stemmed spike rush was recorded within approximately 3.96ha of the site as illustrated within Figure 3. With reference to this figure, it is noted that:

- the species was fairly ubiquitous within the site's wetland areas, but in most instances was only recorded in very low densities (i.e. <5% cover);
- the highest coverage of this species was recorded within quadrats along the drainage line to the east of the existing water-quality control pond; and
- fragmented occurrences of the species were recorded along drainage line in the north-western corner of the site and north of the water-quality control pond..

It is also noted that the mapped extent of this species encompasses the survey quadrats where the species was originally recorded by GeoLINK (refer Appendix B).

2.5 Location and Extent Freshwater Wetlands on Coastal Floodplains

The site supports a degraded sedgeland/rushland community associated with a drainage line and ground-fed spring located in the central portion of the site. Prior to approval, the Department of Environment and Climate Change (DECC) requested that further investigation into the floristic composition of this community be undertaken in order to establish whether the community classified as the Freshwater Wetlands on Coastal Floodplains (Freshwater Wetlands) EEC. As such, a systematic flora survey was completed on the 14th May 2008 by GeoLINK, using quadrat based sampling. A total of seven quadrats were surveyed (refer Appendix B) with species richness and cover assessed using the Braun-Blanquet cover abundance method. Analysis of the data collected revealed that quadrats 4-7 support elements of the Freshwater wetlands on Coastal Floodplains EEC given the following.

1. These quadrats satisfied the following locational descriptors provided in the Scientific Committee's final determination:
   - geomophological - floodplain (periodic or semi-permanent inundation by freshwater);
   - elevation - generally below 20m;
   - Bioregional - North Coast Bioregion; and
   - Local Government Area – Ballina.

2. The species composition of these quadrats satisfied the following floristic descriptors provided in Scientific Committee's final determination:
   - vegetation encompassed by these quadrats can be described as ranging from grassland, sedgeland, and reedland; and
   - the observed floristic composition is comparable to that described for freshwater wetlands that often lack permanent standing water and may be dominated by dense grass cover by species such as *Leersia hexandra* (Swamp Rice-grass).

Approximately 4.12ha of wetland habitat were identified by GeoLINK as supporting the aforementioned elements of the Freshwater Wetland on Coastal Floodplain EEC as illustrated in Figure 5. Observations during the recent (November 2009) field surveys indicated that the area of Freshwater wetland EEC identified by GeoLINK within the site remains an accurate representation of the location and extent of this EEC within the site.

3 Impact Assessment

3.1 Direct Impacts

The approved Concept Plan will have a direct physical impact on areas occupied by Hairy joint grass, Square-stemmed spike rush and the Freshwater wetland EEC, resulting from:

- vegetation clearance;
- a balanced cut and fill operation to achieve necessary flood immunity and stormwater management requirements; and
- the establishment of roadways and other urban infrastructure.

As previously stated, the approved Concept Plan provides for the retention and protection of all habitat occupied by other threatened species and EECs within the site (refer Section 2.1).

The relationship between the site's threatened species populations and Freshwater wetland EEC and the patterns of land use proposed within the Concept Plan is illustrated in Figures 5a-5c. Based on the relationship provided within Figures 5a-5c, a summary of the impact of the approved Concept Plan on Hairy joint grass, Square-stemmed spike rush and the Freshwater wetland EEC is provided in Table 2 below.

Table 2: Extent of threatened species and EEC removal/modification and retention associated with the approved Concept Plan

Scientific Name	Common Name	Conservation Status	Area within site (ha)	Area (%) to be removed	Area (%) to be retained
Arthraxon hispidus	Hairy joint grass	C V NSW V	3.64	1.41 (39%)	2.23 (61%)
Eleocharis tetraquetra	Square-stemmed spike rush	NSW E	3.96	1.22 (31%)	2.74 (69%)
Freshwater wetlands on coastal floodplains		NSW EEC	4.12	1.40 (33%)	2.72 (66%)

C V = Commonwealth (Vulnerable) – Environment Protection and Biodiversity Conservation Act1999

NSW E, NSW V, NSW EEC = Endangered, Vulnerable, Endangered Ecological Community – New South Wales Threatened Species Conservation Act 1995.

Areas of Hairy joint grass, Square stemmed spike rush and the Freshwater wetland EEC that will not be displaced by development of the site, will be retained within the Conservation Zone, which will be managed in a manner that provides:

- protection to threatened flora species and the Freshwater wetland EEC;
- increased connectivity values between fragments existing within and adjacent to the site; and
- passive recreation (i.e. boardwalks) and educational opportunities for future residents.

3.2 Indirect Impacts

Development of the site is likely to have some indirect impacts on retained threatened flora species and the Freshwater wetland EEC, resulting from:

- potential changes to the hydrological regime within the Conservation Zone;
- potential invasion by ornamental and weed species from surrounding residences;
- enhanced community awareness and appreciation of threatened flora and EEC of the locality; and
- enhanced understanding of the management requirements of threatened flora and EEC within an urban land use context.

The magnitude of potentially negative impacts can be minimised through appropriate environmental management and implementation of a storm water management plan that takes into consideration the sensitive nature of the Conservation Zone. The magnitude of potentially positive impacts will be maximised by designing, implementing and documenting a comprehensive management plan for all threatened species and EECs.

4 Impact Mitigation

4.1 Changes to Concept Plan Layout

In order to reduce the degree of direct physical impacts on threatened species and the EEC within the site, it is proposed to increase the area of the green space network dedicated for conservation purposes. The additional area proposed to be included within the green space network encompasses approximately 1.65ha of land that was approved as part of super lot 5. The Concept Approval indicated that this super lot would be developed in the future for a retirement community. Specifically, the additional 1.65ha area now proposed for conservation was intended to be developed for a three-storey buildings containing around 100 retirement apartments and assisted living units plus a range of recreational /community facilities for retirees.

The inclusion of this area into the Conservation Zone has provided the following additional areas:

- 0.33ha of Hairy Joint Grass;
- 0.31ha of Square-stemmed spike rush; and
- 0.86ha of Freshwater wetland EEC.

The relationship between the amended Concept Plan and threatened species and the EEC within the site is provided in Figures 6a-6c. Based on the relationship provided in Figures 6a-6c, Table 3 below provides a comparison between the extent of retention associated with the approved and amended Concept Plans.

Table 3: Comparison of threatened species and EEC removal and retention associated with the approved and amended Concept Plans

Species / Community	Area on site (ha)	% Retained	
		Approved Concept Plan	Amended Concept Plan
Hairy joint grass	3.64	61%	70%
Square-stemmed spike rush	3.96	69%	77%
Freshwater wetland EEC	4.12	66%	87%

With the additional contribution into the Conservation Zone, the amended Concept Plan provides approximately 6.5ha of open space that will be wholly dedicated to the retention and protection of Hairy joint grass, Square-stemmed spike rush and the Freshwater wetland EEC. While providing an upfront benefit of simply retaining a greater area currently occupied of these threatened species and the Freshwater wetland EEC, the long-term survival of retained populations and habitat will be increased owing to:

- the potential for greater genetic diversity within and between populations to develop and be sustained;
- a greater number of individuals being present in the locality such that populations are buffered from localised extinction that may result from stochastic events; and
- a larger area available for threatened flora populations and the Freshwater EEC to expand into.

4.2 On-site Retention and Enhancement

The amended Concept Plan provides for the expansion of the Conservation Zone to 6.5ha which encompasses the greater proportion of Hairy joint grass and Square-stemmed spike rush populations, and the Freshwater wetland EEC. It is also noted that the amended Conservation Zone provides for the retention and protection of the majority of areas where Hairy joint grass (90%) and Square-stemmed spike rush (69%) were recorded with a coverage of 30-70% (refer Figures 6a-6c).

Notwithstanding the above, displacement of some areas of threatened flora species and the Freshwater wetland EEC will be necessary to facilitate the orderly development of the site in general accordance with the Concept Plan and Project Plan approvals. It should be noted that the majority of areas that will be displaced support low to very low coverage of Hairy joint grass and Square-stemmed spike rush.

Where displacement cannot be avoided, mitigation for the reduction in the *in situ* extent of Hairy joint grass, Square-stemmed spike-rush and Freshwater wetland EEC will be achieved through the following measures.

1. Investment in the preparation and implementation of an intensive Environmental Management Plan specifically designed to achieve the long-term survival of retained threatened flora populations and the Freshwater wetland EEC within the Conservation Zone (refer Section 4.3 below).
2. Enhancement of retained populations through the translocation of Hairy joint grass and Square-stemmed spike rush located within the urban development footprint into the Conservation Zone.
3. Creation of additional wetland habitat through modification of areas within the Conservation Zone that currently do not support wetland.
4. Monitoring and research to increase the current understanding of threatened species and EEC biology, ecology and appropriate management within an urban context.

4.2.1 Environmental management within the Conservation Zone

The survival of Hairy joint grass, Square-stemmed spike-rush and the Freshwater wetland EEC within the on-site Conservation Zone will in the most part be dependent on sound environmental management, including implementation of measures focussed on:

- the removal of cattle from the site, which are currently a source of degradation and disturbance within areas of Hairy joint grass, Square-stemmed spike rush and the Freshwater wetland EEC;
- the removal and control of existing weed populations;
- extensive rehabilitation and revegetation works; and
- on-going monitoring of the condition of the Conservation Zone to identify and manage any degrading factors/processes that may occur therein (e.g. establishment of new weed species, inappropriate public access etc).

With regard to the above, an intensive Environmental Management Plan will be prepared for the Conservation Zone, and broader Open Space Network, as described in Section 4.3 below.

4.2.2 Translocation of threatened species

The proposed new Conservation Zone supports wetland habitat, including some areas of Freshwater wetland EEC, that is not currently occupied by Hairy joint grass or Square-stemmed spike rush. More specifically, within the Conservation Zone there exists approximately:

- 2.47ha of wetland habitat that does not currently support Hairy joint grass; and
- 2.14ha of wetland habitat that does not currently support Square-stemmed spike rush.

The potential therefore exists for the translocation of individuals from areas of the site that will be disturbed into these unoccupied wetland sections of the Conservation Zone. Translocation works will be detailed within the intensive EMP and will be designed to minimise the risk of failure by:

- comparing the success of *in situ* and *ex situ* propagation and translocation techniques;
- conducting translocation trials across stages of the plant life-cycle (i.e. seeds, seedlings, adults); and
- providing a formal monitoring, maintenance and reporting period of four years in order to ensure the success of establishing self-sustaining populations.

Translocation of threatened species will contribute to the:

- enhancement of populations within the Conservation Zone; and
- extensive rehabilitation and revegetation works proposed for the Conservation Zone.

In this regard, approximately 1.37ha of wetland habitat within the Conservation Zone do not contain the floristic elements of the Freshwater wetland EEC. Rehabilitation of degraded wetland habitats will be aimed at re-instating the values and functions of the Freshwater wetland EEC that have been lost through historic land management practices, as well as providing habitat for Hairy joint grass and Square-stemmed spike rush.

4.2.3 Creation of additional wetland habitat

The new proposed Conservation Zone contains approximately 1.02ha of land that does not support wetland habitat, mostly owing to a slightly higher elevation and the predominance of pasture grasses. The potential exists to increase the area of wetland habitat within the Conservation Zone through the physical modification of these areas. Minor earthworks would be employed to lower these areas to the same level as surrounding wetlands and an active revegetation program undertaken to merge these constructed wetlands with surrounding areas of natural wetlands.

The actual extent of high-ground within the Conservation Zone available for modification will be subject to other development and design requirements including storm water management requirements, bulk earthworks, road design and drainage requirements. All of these issues will be resolved during the detailed phase of development.

4.2.4 Monitoring and research within the Conservation Zone

A key issue associated with the management of the Conservation Zone is sustaining populations of threatened species and the values of the Freshwater wetland EEC in the long-term. There are few, if any, documented examples of the successful retention and protection of Hairy joint grass, Square-stemmed spike rush and the Freshwater wetland EEC within an urban development footprint. The Pacific Pines Conservation Zone therefore provides a valuable opportunity to increase our current body of documented knowledge into to the management of these species within an urban development scenario.

Given this opportunity, all management actions and research within the Conservation Zone will be developed, implemented and documented in a manner that:

- has been reviewed and approved by the Department of Environment, Water, Heritage and the Arts (DEWHA), Department of Planning (DoP), Department of Environment, Climate Change and Water (DECCW) and Ballina Shire Council (Council);
- contributes to conservation measures and recovery strategies that have been identified Hairy joint grass, Square-stemmed spike rush and the Freshwater wetland EEC; and
- is scientifically sound and has the potential for publication in suitable scientific and/or land management based journals.

In order to achieve this goal there will need to be a significant financial and resource-based investment into the development and implementation of the EMP, the terms of which will need to be negotiated between the relevant stakeholders in due course. It is recommended that five years would be the minimum period for implementation of intensive management actions within the Conservation Zone.

4.2.5 Long-term protection of the Conservation Zone

The long-term protection of the Conservation Zone is pivotal to the success of the mitigation measures that have been detailed in Sections 4.2.1 to 4.2.4 above. To ensure the security of the Conservation Zone in perpetuity, it is intended to transfer ownership of the Conservation Zone to Council, after an agreed establishment and maintenance period, for inclusion into the Environmental Protection Zone 7(a) - Wetlands pursuant to the Ballina Local Environmental Plan. A minimum of five-years is recommended to ensure that retained populations of threatened flora and the Freshwater Wetland EEC will reach a self-sustaining state and that all population enhancement works achieve the desired performance indicators.

It is noted that Amended Concept Plan includes a group of five (5) Park Court allotments that have direct interface with the boundary of the Conservation Zone. To reduce the potential for on-going indirect impacts that may arise from private residences being in close proximity to the Conservation Zone (i.e. informal access, dumping of garden waste), these allotments will be fenced in a manner that prohibits access to the Conservation Zone and the construction of gates along the common boundary will be also be prohibited.

4.3 Development and Implementation of Management Plans

4.3.1 Environmental Management

The long-term success of the retention and protection of Hairy joint grass, Square stemmed spike rush and the Freshwater wetland EEC on-site will be dependent on appropriate management of the Conservation Zone during the Detailed Design Phase, Construction Phase and Occupational Phase of development of the Pacific Pines Estate. Specifications pertaining to environmental management will be provided within:

- an over-arching Environmental Management Plan that encompasses all areas of green space in the Amended Concept Plan;
- a Conservation Zone Management Plan that will sit within the over-arching EMP and provide specific management actions for the Conservation Zone; and
- separate Construction Environmental Management Plans that provide management actions to be implemented during the construction of each stage of the development.

Recommendations pertaining to management during Detailed Design, Construction and Occupational phases of development are outlined below.

Detailed Design Phase

No physical development activities will be carried out during the Detailed Design Phase of each stage of the development, rather this period will be used to formulate more detailed land use and engineering plans upon which the physical development of the each stage will be based.

During the Detailed Design Phase of the development the following environmental management tasks will be completed.

1. As a priority the boundaries of the Conservation Zone should be clearly marked in the field, with access to this area by people and cattle being restricted as far as practicable.
2. Trials involving the translocation of seed and seedlings within retained populations of threatened flora species will be developed and implemented in order to enhance the retained populations.
3. A detailed ground level survey will be carried out to assist with the identification and design of wetland habitat creation opportunities.
4. An over-arching Environmental Management Plan (EMP) will be prepared and will detail specific management actions for all green space areas included in the Amended Concept Plan. The EMP will address at a minimum:
    - vegetation management;
    - fauna habitat management;
    - landscaping and revegetation requirements;
    - integrated weed management;
    - stormwater management;
    - asset protection zone management; and
    - waste management.
5. A specific Conservation Zone Management Plan (CZMP) will be prepared and will detail specific management actions for the Conservation Zone that address the following issues:
    - delineation of the proposed Conservation Zone;
    - protection measures for retained vegetation;
    - weed removal and control;
    - surface and sub-surface hydrology;
    - revegetation and landscaping within the Conservation Zone;
    - the provision of suitable access to facilitate management of Conservation Zone;
    - community awareness and education;
    - the staging of management actions and works;
    - performance indicators against which the success of the CZMP is to be assessed at specified intervals;
    - ongoing monitoring and maintenance;
    - adaptive management mechanisms and processes;
    - documentation and reporting; and
    - roles and responsibilities.

A copy of the EMP and CZMP will be provided to DEWHA, DoP, DECCW and Council for consideration and approval prior to issue of a Construction Certificate for Stage 1.

Construction Phase

The Conservation Zone will be protected with highly visible fencing for the duration of works.

Prior to the commencement of any operational works on the site stage-specific Construction Environmental Management Plans (CEMP) will be prepared that clearly state the restrictions associated with the presence of threatened flora species and the Freshwater wetland EEC, and the penalties that will be enforced should construction activities result in any unauthorised disturbance to the retained populations and community. The CEMPs will be consistent with the requirements of the over-arching EMP but will be presented in a format that is targeted directly at contractors involved in the construction of the estate.

The CEMPs should specify that the clearance, removal or disturbance to threatened flora species and the Freshwater wetland EEC within the Conservation Zone is prohibited as are any of the following activities:

- storage and mixing of materials;
- vehicle parking;
- liquid disposal;
- machinery repairs and/or refuelling;
- construction property office or shed;
- combustion of any material;
- stockpiling of soil, rubble or debris;
- any filling or excavation including trenchline, topsoil skimming and/or surface excavation, unless otherwise approved by the relevant authority; and
- unauthorised pesticide, herbicide or chemical applications.

Copies of each CEMP will be issued to DEWHA, DoP, DECCW and BSC prior to issue of construction certificates for each stage of the development.

The Concept Plan provides for staged development of the site, with the first stage of development affecting Hairy joint grass populations in the central portion. In this regard, construction works within threatened flora species habitat affected by Stage 1 will be timed in a manner that does not interfere with components of the Hairy joint grass and Square-stemmed spike rush life-cycle that involve the production of seed and emergence of seedlings. More specifically, construction works within Hairy joint grass and Square-stemmed spike rush habitat during Stage 1 that have the potential to interrupt these important life-cycles stages will be delayed to allow for:

- sufficient numbers of seedlings to emerge during the nearest growing season;
- the translocation of seedling cohorts of an appropriate age; and
- remaining seedlings in the field to mature into adults and produce seed for collection.

Securing sufficient number of seeds and seedlings from populations that will eventually be displaced by urban development of the site will be critical to the success of population enhancement proposed for the Conservation Zone.

Occupational Phase

A public awareness campaign will be undertaken that educates future land owners/occupants of the threatened status of Hairy joint grass, Square-stemmed spike rush and the Freshwater wetland EEC and the penalties that may be applied under the *EPBC Act* and *TSC Act* should any unlawful disturbance of threatened species populations and/or Freshwater wetland EEC occur. At a minimum this public awareness campaign will involve the establishment of interpretive signage within the

Conservation Zone to enhance the public's appreciation of the biodiversity values of the Conservation Zone and the measures that have been taken as part of the development to preserve and manage those values.

Appropriate management of these areas will be undertaken throughout the life of the development to ensure the long-term viability of Hairy joint grass, Square-stemmed spike rush and the Freshwater wetland EEC within the Conservation Zone. Details and specifications pertaining to maintenance, landscaping, access and monitoring of the Conservation Zone will be provided in the CZMP that will form part of the over-arching EMP prepared during the Detailed Design Phase.

As ownership of the Conservation Zone will be transferred to Ballina Shire Council in due course, it is intended to liaise with relevant officers within Council during preparation of the EMP to ensure that proposed management actions and monitoring time-frames are consistent with Council's requirements and resourcing capacity.

4.3.2 Storm Water Management

A revised storm water management plan that achieves New South Wales storm water quality and quantity objectives will be developed for the amended Concept Plan. This plan will be cognisant of the ecological values of the Conservation Zone and will take into account the potential impacts of changes to hydrological regime on wetland habitats and threatened flora species within the Conservation Zone. More specifically, the storm water management plan will be designed in manner that ensures there are no significant adverse impacts on ground and surface water in the Conservation Zone. Adverse impacts will essentially be avoided by managing the post-development hydrology to maintain groundwater/surface flows to this Conservation Zone, effectively mimicking the key aspects of the existing pre-development hydrology using the following mechanisms.

- Bioretention/infiltration trenches will be provided at appropriate locations to provide treatment and infiltration of surface runoff emanating from the subdivision. This will minimise impacts on groundwater by ensuring that the bulk of rainfall infiltrates where it falls.
- The majority of rainfall from frequent small-medium rain events would be conveyed into trenches (via conventional drainage systems) where it would subsequently infiltrate.
- The existing surface flow link between the new conservation area and the original conservation area will be preserved by providing a relatively unrestricted flow path between the two areas (i.e. with a bridge, culvert or similar structure). The new conservation area would therefore effectively become part of the stormwater detention area, with the outlet to the stormwater detention area remaining in its original proposed location.

These stormwater measures will be detailed and modelled as part of the work required to address Condition B6 of the Concept Approval, which requires the development of a comprehensive Stormwater Management Plan to address these (and other) issues.

4.4 Rehabilitation of off-site wetland habitat

The approved and amended Concept Plans also provided for the rehabilitation of 5.9ha of degraded wetland vegetation (refer Figures 6a -6c), owned by Petrac Lennox Head Pty Ltd that adjoins the Ballina Nature Reserve SEPP 14 Wetland (no. 88). Rehabilitation of this land will occur in general accordance with the Ballina Nature Reserve Plan of Management and will provide the following additional benefits:

- the removal and management of source populations of wetland weed species and thereby increasing the long-term viability of threatened species populations that occur within the site locality;
- improving the conservation value of degraded freshwater wetlands that occur within the site locality; and
- increasing the functional contribution that vegetation communities within the site make towards movement opportunities for native wildlife throughout the site locality.

It is noted that a Specific Management Objective of the Ballina Nature Reserve Plan of Management is to "*encourage Reserve neighbours in conserving adjoining natural areas*".

5 Proposed Amendments to Concept Approval Statements of Commitment

The intent of this EIAMS is to address specific conditions attached to the Concept Plan approval and provide proposed conditions relevant to the amended Concept Plan.

5.1 Environmental Management Plan

Approved Concept Plan Condition – B1

The proponent's commitment to prepare an Environmental Management Plan for the site is modified to the following:

An Environmental Management Plan (EMP) will be prepared and implemented for the site in consultation with the Department of Environment and Climate Change and Council. The EMP will address all retained endangered ecological communities (EECs) and threatened species on the site and will specifically address, but not be limited to, the following:

1. *A detailed plan specifying all areas of EECs and threatened species habitat to be retained and the areas to be revegetated;*
2. *Annual mapping of the location and extent of Hairy Joint Grass and Square-stemmed Spike Rush;*
3. *The manner in which retained populations of Hairy Joint Grass and Square-stemmed Spike Rush will be enhanced;*
4. *A rehabilitation plan that details the manner in which the functions and values of the Freshwater Wetlands EEC will be restored;*
5. *A water management plan that addresses the manner in which the hydrological regime of the Freshwater Wetlands EEC will be maintained and includes, but is not limited to:*
    a) *Mapping of the extent of the seepage areas and measures to ensure their ongoing protection;*
    b) *Detailed design of the proposed weirs to ensure the maintenance of the existing hydrological regime.*
6. *Details of the revegetation work proposed within the 100m buffer to the SEPP26 Littoral Rainforest northwest of the site;*
7. *Details of the rehabilitation works within and revegetation works around the Littoral Rainforest EECs. The EMP shall include consideration of the ongoing recreational use of this land and how recreational activities will be managed to ensure that the ecological objectives of revegetation are achieved.*
8. *Details of the translocation of Hairy Joint Grass to the area south of the water quality control pond. The plan will address how the translocation will occur and how the ongoing management of the translocated plants will comply with the ongoing management of the water quality control pond;*
9. *An integrated weed management strategy;*
10. *A concise set of ongoing management requirements to achieve a self-sustaining system;*
11. *Methods to be utilised to protect all threatened flora and fauna habitat and EECs on the site during construction;*

12. *A comprehensive mosquito management plan that addresses, but is not limited to:*
    a) *Details of an ongoing monitoring program;*
    b) *Breeding patterns;*
    c) *Sources of control;*
    d) *Sources of mitigation; and*
    e) *Complaint management.*
13. *The manner in which public access will be managed during both construction and operation;*
14. *Details of interpretive signage to be installed; and*
15. *The objectives of the 3 year ecological research program (refer to B2) and the mechanism for the transfer of the required money.*

The EMP shall consider any required asset protection zones (APZ) in proposing revegetation across the site and outline how the ongoing management of the APZs will be achieved.

The EMP shall be submitted to and approved by the Department prior to the issue of a construction certificate for Stage 1A.

Proposed Amended Concept Plan

As detailed in Section 4.3, it is intended to implement environmental management strategies throughout the Detailed Design, Construction and Occupational Phases of the development. As such, it would be appropriate to modify this condition as follows.

All environmental management plans will be prepared in consultation with the Department Environment, Climate Change and Water (DEECW) and Ballina Shire Council (Council).

The over-arching Environmental Management Plan (EMP) is to be prepared during the Detailed Design phase and shall include, but not be limited to:

1. details of the revegetation work proposed within the 100m buffer to the SEPP26 Littoral Rainforest northwest of the site;
2. details of the rehabilitation works within and revegetation works around the Littoral Rainforest EECs. The EMP shall include consideration of the ongoing recreational use of this land and how recreational activities will be managed to ensure that the ecological objectives of revegetation are achieved.
3. an integrated weed management strategy;
4. a concise set of ongoing management requirements to achieve a self-sustaining system;
5. the manner in which public access will be managed during both construction and operation;
6. details of interpretive signage to be installed;
7. the locations of any required asset protection zones (APZ) and how the ongoing management of the APZs will be achieved; and
8. a comprehensive mosquito management plan that addresses, but is not limited to:
    i. Details of an ongoing monitoring program;
    ii. Breeding patterns;
    iii. Sources of control;
    iv. Sources of mitigation; and
    v. Complaint management.

The Conservation Zone Management Plan (CZMP) is to be prepared during the Detailed Design phase and shall include but not be limited to:

1. a detailed plan specifying all areas of EECs and threatened species habitat to be retained and the areas to be revegetated;
2. annual mapping of the location and extent of Hairy Joint Grass and Square-stemmed Spike Rush;
3. the manner in which retained populations of Hairy Joint Grass and Square-stemmed Spike Rush will be enhanced;
4. a rehabilitation plan that details the manner in which the functions and values of the Freshwater Wetlands EEC will be restored;
5. details of the translocation of Hairy Joint Grass to within the Conservation Zone;
6. an integrated weed management strategy;
7. a concise set of ongoing management requirements to achieve a self-sustaining system;
8. the objectives and methodologies for all ecological research programs to be implemented;
9. details of interpretive signage to be installed;
10. a water management plan that addresses the manner in which the hydrological regime of the Freshwater Wetlands EEC will be maintained and includes, but is not limited to:
    a) mapping of the extent of the seepage areas and measures to ensure their ongoing protection; and
    b) detailed design of the proposed weirs to ensure the maintenance of the existing hydrological regime.

In addition to the above, the period of intensive management prior to hand-over of the Conservation Zone to Council needs to be negotiated. A period of five-years is recommended to ensure that retained populations of threatened flora and the Freshwater wetland EEC will reach a self-sustaining state and that all population enhancement works achieve the desired performance indicators.

Construction Environmental Management Plans (CEMP) are to be prepared prior to the Construction Phase of each stage of the development and shall include, but not be limited to:

1. the manner in which public access will be managed during both construction and operation; and
2. methods to be utilised to protect all threatened flora and fauna habitat and EECs on the site during construction.

The EMP and CZMP shall be submitted to and approved by DoP, DEECW and Council prior to the issue of a construction certificate for Stage 1A.

Each CEMP shall be submitted to and approved by DoP, DEECW and Council prior to the issues of construction certificates for each stage of the development.

5.2 Compensatory Plan

Approved Concept Plan Condition B2

The proponent must prepare a Compensation Plan for the loss of all endangered ecological communities and threatened flora species on site. The extent of endangered ecological communities and threatened flora species on site is to be identified by the plan required by B2(1) of this approval. The Compensation Plan is to detail the provision of land (at a minimum rate of 2:1), or

otherwise agreed by the Department) that offsets the loss of endangered ecological communities and threatened flora species on the site. The Plan is to include a program (timeline) to achieve the implementation of the measures identified.

The Compensation Plan is to be developed in consultation with the Department of Environment and Climate Change and submitted to and approved by the Department prior to the issue of a construction certificate for Stage 1B, or as otherwise agreed by the Department.

Proposed Amended Concept Plan

The amended Concept Plan satisfies this condition through the following measures.

1. Contribution of an additional 1.65ha of land into the Conservation Reserve, resulting in the in-situ retention and protection of approximately:
   - 2.56ha, or 70% of Hairy joint grass;
   - 3.05ha, or 77% of Square-stemmed spike rush; and
   - 3.58ha, or 87% of Freshwater wetland EEC.

   Of key importance is the retention and protection of the majority of areas of Hairy joint grass and Square-stemmed spike rush that were recorded with a Low to Medium coverage during targeted surveys.
2. The provision of on-site offsets for the loss of threatened flora species and the Freshwater wetland EEC through translocation and extensive rehabilitation and revegetation works within the expanded Conservation Zone. More specifically the Conservation Zone supports approximately:
   - 2.47ha of wetland habitat that does not currently support Hairy joint grass (2.4 times the area being displaced);
   - 2.14ha of wetland habitat that does not currently support Square-stemmed spike rush (2.3 times the area being displaced); and
   - 1.37ha of wetland habitat that does not currently have the floristic elements of the Freshwater wetland EEC (2.5 times the area being displaced).
3. The provision of an additional 1.02 ha of degraded grazing land within the Conservation Zone that can, in parts, be modified to create wetland habitat suitable for colonisation by threatened flora species and species characteristic of the Freshwater wetland EEC.

Given the above facts and circumstances, the requested 2:1 offset for the loss of threatened flora species and the Freshwater wetland EEC can generally be accommodated within the expanded Conservation Zone.

5.3 Ecological Compensation

Approved Concept Plan Condition B3

A monetary contribution of $30,000 per year for a period of three years shall be paid to compensate for the loss of Hairy joint grass habitat and Freshwater Wetlands endangered ecological community.

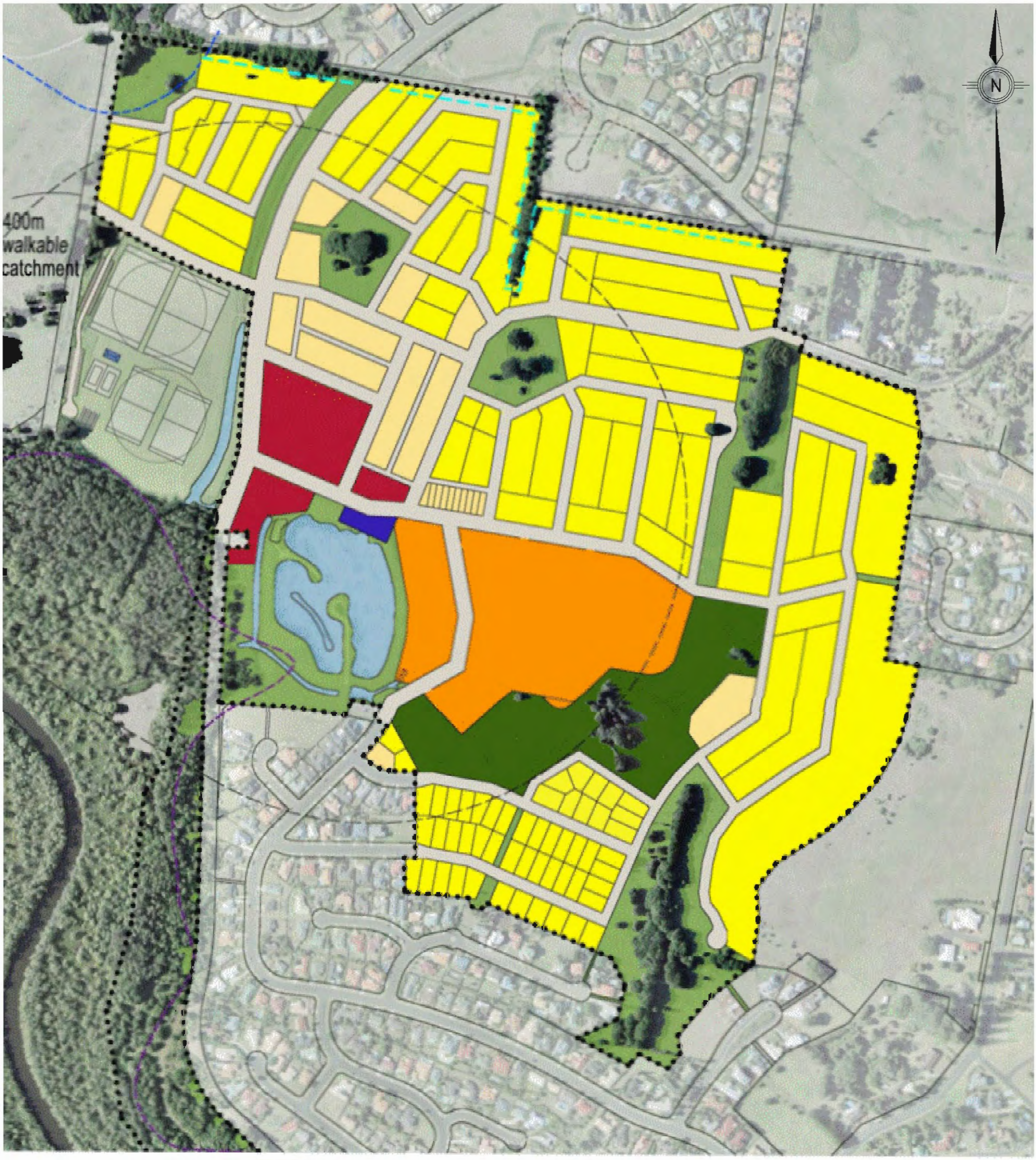
The proponent shall prepare a brief for the research to be funded in consultation with the Department of Environment and Climate Change and Council and submit it to the Department for approval prior to the issue of construction certificate of Stage 1B.

The first $30,000 shall be paid to the selected research body prior to the release of the subdivision certificate for stage 1B of the project approval. Subsequent payments are to be made on or before the anniversary of the first payment.

Proposed Amended Concept Approval

The Environmental Management Plan and Conservation Zone Management Plan that will be prepared for the site will involve a comprehensive range of management actions designed to achieve the long-term sustainability of retained threatened flora species and the Freshwater wetland EEC. As such, it is proposed that a more appropriate form of ecological compensation would be dedication of resources and funds into the development and implementation of this EMP. It is noted that the EMP will include trials and monitoring that will make a significant contribution to the existing body of knowledge concerning the biology, ecology and management of the site's threatened flora species and Freshwater wetland EEC.

FIGURES



Concept plan sourced from Drawing No. 06115p3A1J

Rev: Orig. Date: 8 June 2010

Petrac Lennox Head Pty Ltd

CAD FILE: I:\7801-71\Acad\Environmental Impact Assesment and Mitigation Strategy\Figure 1a - Approved Concept Plan.dwg
XREF's: 0C0B

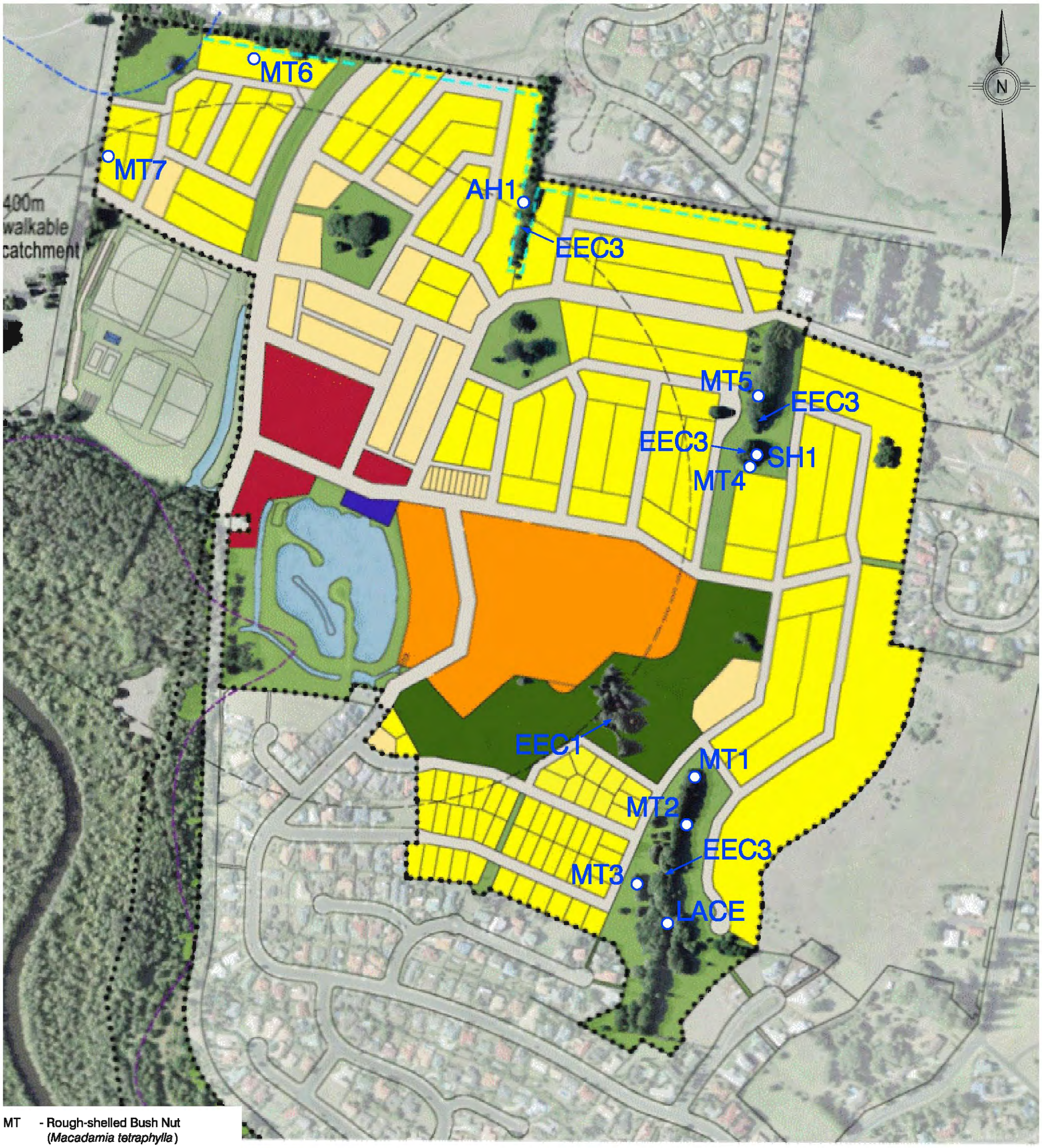
Scale 1:5,000 (A3)

FIGURE 1a

APPROVED CONCEPT PLAN

Project No.: 7801/71

PRINT DATE 10 June, 2010 - 4:02pm



MT - Rough-shelled Bush Nut (*Macadamia tetraphylla*)

LACE - White Laceflower (*Archidendron hendersonii*)

SH - Red Lily Pily (*Syzygium hodgkinsoniae*)

AH - Arrow head Vine (*Tinospora tinosporoides*)

EEC1 - Swamp oak flood plain forest

EEC3 - Littoral rainforest int he NSW North Coast bioregion

Threatened species EEC data sourced from GeoLINK June 2007
Concept plan sourced from Drawing No. 06115p3A1J

Rev: Orig. Date: 8 June 2010

Scale 1:5,000 (A3)

FIGURE 1b

SIGNIFICANT ENVIRONMENTAL FEATURES RETAINED WITHIN THE APPROVED CONCEPT PLAN

Project No.: 7801/71

Petrac Lennox Head Pty Ltd

PRINT DATE 10 June, 2010 - 4:02pm

CAD FILE: I:\7801-71\Acad\Environmental Impact Assesment and Mitigation Strategy\Figure 1b - Significant environmental features retained within the approved concept plan.dwg
XREF's: DCDB

Cover of Hairy Joint Grass	Area of Occupancy
Very low (0 - 5%)	1.32ha
Low (5 - 30%)	1.08ha
Medium (30 - 70%)	1.24ha
TOTAL	**3.64ha**

50 0 50 100 150 200 250m
1:5000

Scale 1:5,000 (A3)

FIGURE 2
LOCATION AND EXTENT OF HAIRY JOINT GRASS

Project No.: 7801/71

Rev: Orig. Date: 9 June 2010

Petrac Lennox Head Pty Ltd

CAD FILE: I:\7801-71\Acad\Environmental Impact Assessment and Mitigation Strategy\Figure 2 – Location and extent of hairy joint grass.dwg
XREFs: DOS6

PRINT DATE: 10 June, 2010 - 1:34pm

Cover of Square-stemmed Spike Bush	Area of Occupancy
Very low (0 - 5%)	3.06ha
Low (5 - 30%)	0.72ha
Medium (30 - 70%)	0.16ha
TOTAL	3.96ha

50 0 50 100 150 200 250m
1:5000

Scale 1:5,000 (A3)

FIGURE 3
LOCATION AND EXTENT OF SQUARE-STEMMED SPIKE RUSH

Project No.: 7801/71

Rev: Orig. Date: 9 June 2010

Petrac Lennox Head Pty Ltd

CAD FILE: I:\7801-71\Acad\Environmental Impact Assessment and Mitigation Strategy\Figure 3 – Location and extent of Square-stemmed spike rush.dwg
XREFs: DOP8

PRINT DATE: 10 June, 2010 - 1:45pm

LEGEND

Freshwater Wetland EEC (4.12ha)

Freshwater wetland EEC mapping provided by GeoLINK, May 2008

50 0 50 100 150 200 250m
1:5000

Scale 1:5,000 (A3)

FIGURE 4

LOCATION AND EXTENT OF FRESHWATER WETLAND EEC

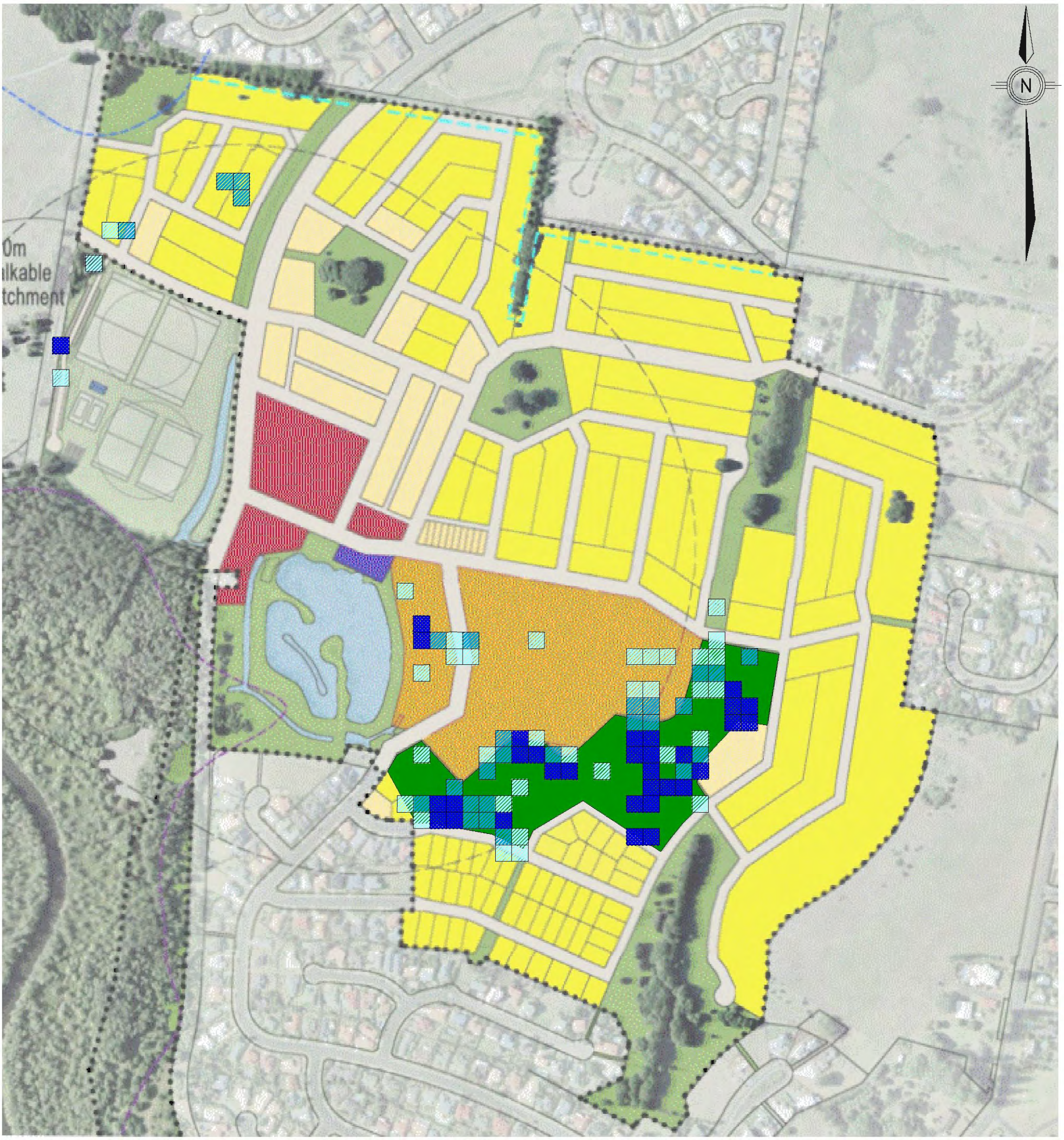
Rev: Orig. Date: 9 June 2010

Project No.: 7801/71

Petrac Lennox Head Pty Ltd

CAD FILE: I:\7801-71\Acad\Environmental Impact Assessment and Mitigation Strategy\Figure 4 – Location and extent of freshwater wetland EEC.dwg
XREFs: DOP8

PRINT DATE: 10 June, 2010 - 1:41pm



Cover of Hairy Joint Grass

- Very low (0 - 5%)
- Low (5 - 30%)
- Medium (30 - 70%)

Cover	Total Area	Retained	Removed
Very Low	1.32ha	0.55ha	0.77ha
Low	1.08ha	0.64ha	0.44ha
Medium	1.24ha	1.04ha	0.20ha
TOTAL	**3.64ha**	**2.23ha**	**1.41ha**

LEGEND

- RESIDENTIAL
- RETIREMENT COMMUNITY
- LOW- MEDIUM DENSITY HOUSING
- NEIGHBOURHOOD CENTRE
- COMMUNITY USE
- PARK/ OPEN SPACE
- CONSERVATION ZONE 4.9ha
- REMNANT VEGETATION
- 100m SEPP 26 BUFFER
- SEPP 14 WETLAND
- 10m BOUNDARY BUFFER
- SITE BOUNDARY

50 0 50 100 150 200 250m
1:5000

Scale 1:5,000 (A3)

Concept plan sourced from Drawing No. 06115p3A1J

Rev: Orig. Date: 9 June 2010

FIGURE 5a
REMOVAL AND RETENTION OF HAIRY JOINT GRASS ASSOCIATED WITH APPROVED CONCEPT PLAN

Project No.: 7801/71

Petrac Lennox Head Pty Ltd

PRINT DATE: 27 August, 2010 - 11:16am

CAD FILE: I:\7801-71\Acad\Environmental Impact Assesment and Mitigation Strategy\Figure 5a - Removal and retention of Hairy Joint Grass associated with Approved Concept plan.dwg
XREF's.

Cover of Square Stemmed Spike Bush

- Very low (0 - 5%)
- Low (5 - 30%)
- Medium (30 - 70%)

Cover	Total Area	Retained	Removed
Very Low	3.08ha	2.31ha	0.77ha
Low	0.72ha	0.40ha	0.32ha
Medium	0.16ha	0.00ha	0.16ha
TOTAL	**3.96ha**	**2.71ha**	**1.25ha**

LEGEND

- RESIDENTIAL
- RETIREMENT COMMUNITY
- LOW- MEDIUM DENSITY HOUSING
- NEIGHBOURHOOD CENTRE
- COMMUNITY USE
- PARK/ OPEN SPACE
- CONSERVATION ZONE 4.9ha
- REMNANT VEGETATION
- 100m SEPP 26 BUFFER
- SEPP 14 WETLAND
- 10m BOUNDARY BUFFER
- SITE BOUNDARY

50 0 50 100 150 200 250m
1:5000

Scale 1:5,000 (A3)

Concept plan sourced from Drawing No. 06115p3A1J

FIGURE 5b

REMOVAL AND RETENTION OF SQUARE-STEMMED SPIKE RUSH ASSOCIATED WITH APPROVED CONCEPT PLAN

Rev: Orig. Date: 9 June 2010

Project No.: 7801/71

Petrac Lennox Head Pty Ltd

PRINT DATE: 27 August, 2010 - 11:18am

CAD FILE: I:\7801-71\Acad\Environmental Impact Assesment and Mitigation Strategy\Figure 5b - Removal and retention of Square-stemmed spike rush associated with Approved Concept plan.dwg
XREF's.