JAMES WARREN & Associates Pty Ltd

ECOLOGICAL CONSULTANTS

WETLAND MANAGEMENT PLAN

PEREGIAN SPRINGS STATE SCHOOL
YARRAN ROAD, COOLUM RIDGES

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A REPORT PREPARED FOR BROAD CONSTRUCTION SERVICES (QLD) PTY LTD

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TABLE OF CONTENTS

1 INTRODUCTION

1.1 Background

James Warren and Associates (JWA) have been engaged by Broad Construction Services (QLD) Pty Ltd. to prepare a Wetland Management Plan for a wetland adjacent to the future Peregian Springs State School site.

The Wetland Management Plan includes the following:

- An assessment of the current wetland vegetation values;
- Identification of potential impacts on the wetland imposed by the development of the Peregian Springs State School; and
- Recommendations to ameliorate potential development impacts on vegetation and fauna values of the wetland.

1.2 Site Description

The Peregian Springs State School site is located on Yarran Road, Peregian Springs on land described as Lot 99 on SP162070. The wetland (unnamed) occurs to the north of the school site. The location of the subject site and wetlands is shown in **FIGURE 1**.

An aerial photograph of the site is shown in **FIGURE 2**.

The wetland is known to support populations of several species of Acid frog, including the Commonwealth listed Wallum Sedge Frog (*Litoria olongburensis*).

1.3 Aims & Objectives

The Wetland Management Plan aims to ensure that the wetland is protected and continues to represent a functional and healthy ecosystem. In particular, potential impacts on the Wallum sedge frog need to be minimised.

This report provides an assessment of the current values of the wetland community, assesses risks posed by the adjacent school development (**FIGURE 3**) and will recommend management and amelioration measures to ensure ongoing protection of the wetland.

2 WETLAND ASSESSMENT

2.1 Background

This section discusses the methods used in the assessment of the subject wetlands and presents the results of the assessment.

The wetland is considered to provide important habitat for a variety of fauna. Previous studies by James Warren and Associates have identified three (3) threatened frog species within the wetland area, including the Wallum froglet (*Crinia tinnula*), Wallum sedge frog (*Litoria olongburensis*) and Wallum rocket frog (*Litoria freycineti*).

2.2 Methods

2.2.1 Site survey

The Coolum Ridges site has been the subject of various assessments by James Warren and Associates. An Ecological Assessment for the Coolum Ridges land was completed in 2001.

More recently a wetland survey was completed on the subject site in June 2009 by two (2) scientists in order to verify and update earlier assessments. The methodology employed was as follows:

- Prior to conducting the field survey, vegetation mapping (e.g. RE maps) for the site was obtained.
- A "Random Meander" was completed to verify vegetation units and to search for threatened flora.
- A plant list was compiled.

2.2.2 Review of Existing Mapping

Current certified Regional Ecosystem (RE) maps (Version 5.2) produced by the Department of Natural Resources and Water (DNRW), were reviewed to determine the distribution of remnant regional ecosystems in the locality of the subject site.

The Sunshine Coast Regional Council website was searched to determine if wetlands on the subject site were mapped under relevant planning policies and codes.

2.3 Results

2.3.1 Results of vegetation assessment

Two (2) wetland communities were identified on the subject site and are shown in **FIGURE 4**. These communities are:

- Mid-high/Tall Open Forest/Woodland (*Melaleuca quinquenervia/Eucalyptus robusta with sedge understorey)*

- Tall Closed Heathland (*Baumea articulata/Gahnia sieberiana +/- Empodisma minus)*

A plant list is provided as **APPENDIX 1**.

2.3.2 Regional Ecosystem Mapping

The current certified (RE) mapping (Version 5.2) shows two (2) RE's as occurring on the subject site (**FIGURE 5**). These are:

- RE 12.2.12 (Not of Concern) - Closed heath on seasonally waterlogged sand plains
- RE 12.9-10.22 (Of Concern) - Closed sedgeland/shrubland on sedimentary rocks. Coastal parts

Of Concern Regional Ecosystems are those of which between 10 – 30% of the pre-clearing extent of the RE currently remains uncleared, and/or less than 10,000ha currently remain.

RE 12.9-10.22 is described as a palustrine wetland Remnant Ecosystem. It is therefore expected that the measures prescribed in this plan to protect the wetland will also provide suitable protection to this vegetation.

2.3.3 EPA/Sunshine Coast Regional Council mapping

The eastern portion of the wetland area is mapped as Wetland under the Maroochy Plan (2000) – Regulatory Map 1.2 (**FIGURE 6**) and as a referable wetland by the Environmental Protection Agency (**FIGURE 7)**.

2.4 Summary

The wetland contains a number of ecological values, most notably:

- Habitat for Threatened fauna species
- 'Of Concern' Remnant Ecosystems.

The wetland is mapped as a Coastal Wetland by the EPA, and as a Wetland on Regulatory Map 1.2 under the Maroochy Plan.

Potential impacts on these values are identified in Section 3, while suggested mitigation measures are outlined in Section 4. It is considered that adherence to the prescribed mitigation measures will result in the preservation of the ecological values of the wetland.

3 IMPACT ASSESSMENT

3.1 Background

The potential ecological impacts of the development on the wetland have been identified and are listed below:

- Disturbance of Acid Sulphate Soils;
- Decline/alteration in water quality (eg. sediment load, pH, influx of pollutants);
- Alteration to run-off rates;
- Erosion;
- Nutrient loading;
- Altered drainage and hydraulic regimes including hydraulic loading;
- Modification of habitat particularly through the introduction of weed species and bushfire; and
- Introduction of exotic predators and/or competitors, as well as amphibian diseases (ie. Chytridiomycosis).
- Alteration of fire regimes

The potential impacts of the development are discussed below in more detail.

3.2 Disturbance of Acid Sulphate Soils

An assessment of the potential of occurrence of Acid Sulphate Soils (ASS) on the school site was conducted by Golder and Associates in 2004. It was determined that although soils in the area are acidic by nature, ASS are unlikely to occur on the site.

Under the Maroochy Plan (2000) Acid Sulphate Soils Area Special Management Area Regulatory Map 1.4, the School site and wetland are mapped as Area 2: Land above 5m AHD and below 20m AHD (**FIGURE 8**).

It is therefore unlikely that ASS will be disturbed as a result of the development of the school site.

3.3 Decline in Water Quality

Potential impacts of the development on water quality include;

- Increases in water turbidity;
- Increased flow rates resulting in erosion and sedimentation of waterbodies and scouring of vegetation;
- Increases in organic and inorganic nutrients, resulting in eutrophication of waterbodies;
- Increase in salinity of waterbodies;
- Introduction of pollutants such as oils or chemical residues originating from household activities and sources.

High nutrient levels from domestic sewage and urban run-off are a problem in localised areas of some wetland habitats (Robertson & Alongi 1995). Where water run off reaches water bodies, nutrients such as nitrates and phosphates can cause significant degradation to water quality (EPA 2005).

3.4 Weed Invasion

Many weed species are better adapted to survival in disturbed environments than native plants. The invasion processes rely on primary dispersal vectors such as wind, water animals or insects, and removal of native vegetation. Possible factors allowing the invasion of weed species may include the following events or influences: soil disturbance (natural or human), fire (or alteration to fire regimes), introduction and influence of specific vectors, altered hydrology, decline of native vegetation cover, or changing climatic conditions.

Development adjacent to the wetland may cause alterations to the immediate hydrology which may encourage the occurrence of weeds in the affected area. Runoff may potentially contain water of nutrient levels that are unfavourable for native vegetation and may promote growth of weed species, resulting in increased weed prevalence in the wetland. In the event that weed invasion occurs and is not controlled the weeds will likely spread to surrounding areas.

In relation to weed invasion, Buchanan (1989) notes the following:

- Invasion of weeds is most likely after disturbance;
- The greater the degree of disturbance the greater the degree of invasion;
- The greater the diversity of the natural community the less likely weeds are to invade.

Weeds may reduce native biodiversity within habitat areas (which may affect forage and shelter resources), alter hydrological regimes through dense vegetation and increased competition for resources (i.e. light, nutrients, space) with vulnerable native species and promote fire.

The development may create edge effects including invasion by weeds. Weeds invading areas of remnant or wetland vegetation will compete with native plant species and may become dominant within some communities.

3.5 Introduction of diseases and non-native fauna

Chytrid fungus is a waterborne pathogen that causes the disease Chytridiomycosis in frogs. The fungus grows in the keratinised epidermis of adult frogs and in the keratinised mouthparts of tadpoles, however it is not currently known how the chytrid fungus kills infected frogs. Only adults are susceptible and mortality can be high, depending upon the species infected and local environmental conditions. Once the chytrid zoospores are released into water, they remain viable for up to 24 hours. The fungus is known to be spread by humans through the handling or handling of infected frogs and tadpoles or the transport of zoospores in water. Although no reports of chytrid infection of Acid Frogs has occurred, Chytridiomycosis has the potential to significantly impact on the Wallum sedge frog population at the Coolum Ridges site.

A range of exotic fauna are likely to occur in the study area and impact on native fauna communities, including the Red fox, Cane toad, Gambusia (Mosquitofish) and domestic Cats and Dogs.

In recent years the impact of cat predation on native Australian Fauna has become a prominent public issue. The impacts of domestic dogs are not readily quantified. Dogs are however, known to attack Koalas and thus should be considered a management problem at the urban/bushland interface.

Cane toads are a generalist species that are able to breed in almost any permanent or temporary water source (including acidic and saline waters) and have no specialised dietary requirements. They have a tough, leathery epidermis, (in contrast to most other Australian frogs), which allows them to tolerate water loss up to 50% and variability in ambient temperature. This feature, combined with a tolerance to broad environmental and climatic conditions, has enabled them to occupy a variety of habitats generally to the detriment of endemic amphibians. Cane toad tadpoles are also known to predate smaller tadpoles of their own or other species (Crossland 1998). Despite their adaptability to the environment, Cane toads prefer habitats with open space, generally avoiding dense ground cover.

Gambusia, or the Mosquitofish, is a small freshwater fish originally introduced into Australian waterways in the 1920's to control mosquito larvae. This species is recognised as a voracious predator that will feed on other fish (adults and larvae), arthropods and amphibians (tadpoles and eggs). The impact of Gambusia on Australian frog populations is such that it has been listed as a key threatening process under the NSW TSCA (1995). The introduction of this species into the site has the potential to permanently exclude amphibians, including Wallum sedge frogs, from the site.

3.6 Alterations to Drainage and Hydrological Regimes

The development of the school site has the potential to affect drainage and hydrological regimes within the wetland by altering the amount and entry point of stormwater runoff from the south.

Changes in hydrological regime may have some effect on the composition and distribution of vegetation in the wetland areas. However, the extent of these changes is often difficult to quantify. Alterations to hydrological regimes, increased sedimentation and nalyzing may alter specific conditions required by some species.

3.7 Alterations to Fire Regimes

There is potential for accidental or deliberate ignition of fire within habitat areas. These include; lighting strikes, encroachment of bushfire from the adjacent Noosa National Park, lit cigarettes and deliberate lighting of fires.

The occurrence of fire within Acid Frog habitat has the potential to seriously impact on the local Wallum sedge frog population. Fire has the potential to cause frog deaths and/or alteration of their habitat. Alteration to natural fire regimes (i.e. duration and intensity of the burn, interval between burns and time of year) may alter the suitability

of the habitat on the site for Acid Frogs (Lewis & Goldingay 2005). Alterations to wallum vegetation may include modification of the floristics and structural complexity of the community, and natural recruitment may be suppressed by inappropriate fire regimes. The severity of impact of fire on Acid Frogs may be dependent upon the availability of free-standing water within habitat areas. It has been suggested that water within habitats allow frogs to shelter from the passage of fire (Lewis & Goldingay 2005). Without free-standing water available, frogs are susceptible from even low intensity fires.

Vegetation within the wetland is largely comprised of hydrophytic, fire-retardant species. Additionally, free standing water is present beneath the vegetation. It is therefore considered that the wetland is unlikely to be at high risk of fire.

4 RECOMMENDATIONS FOR IMPACT MITIGATION

4.1 Background

Under the proposed development all wetland vegetation occurring in the lot to the north of the school site will be retained. Management strategies and amelioration measures designed to prevent detrimental impacts upon the wetland as a result of the construction of the school are outlined below.

4.2 Recommended Management Strategies

While the schools Operations and Facilities management may utilise alternate strategies to prevent detrimental impacts upon the adjacent wetland, it is necessary to propose at least one strategy to address the issue of Wetland Management. In this instance the proposed measures have been adopted using the recommendations and requirements of the Green Star Education V1 2008 Environmental Rating System.

Proposed management strategies are outlined in **TABLE 1**.

TABLE 1 – Recommended Management Strategies

Potential Impact	Recommended Management/ Amelioration Measures
Disturbance of Acid Sulphate Soils	Soils in the region of the School site and wetland do not occur below 5m AHD and are therefore regarded as a low risk for Acid Sulphate Soils. It is not anticipated that amelioration or management strategies will be required.
Decline in Water Quality	• The recommendations of the approved Stormwater Management Plan must be adhered to at all times in order to prevent increased erosion/ sedimentation. • The measures outlined in the Erosion and Sediment Control program (Bornhost and Ward) are to be strictly adhered to. • All sediment control devices are to be in place as shown in the ESC Program documents prior to and during construction, and will not be removed post construction until the contractor is satisfied that all disturbed and/or exposed soil has been stabilised. • Topsoil will be stripped and stored prior to commencement of earthworks. • Water will not be released from detention basins until samples have been analysed and shown to meet the criteria outlined in the ESC Program, i.e. <50mg/L TSS and Ph 6.5 – 8.5. • Regular (three monthly) water quality testing is to be undertaken within the wetland to ensure that acceptable water quality parameters are maintained.

Potential Impact	Recommended Management/ Amelioration Measures
Weed Invasion	• Plant species to be used for landscaping purposes within the school are to be comprised of native species representative of local assemblages. • Mulch created from cleared onsite vegetation must not contain fertile weed material. Weeds should be separated from native species where feasible. • Mulch acquired offsite for use during landscaping or soil stabilisation must be certified as weed free.
Introduction of Diseases and Non-native Fauna	• As far as practicable, no dogs or cats are to be allowed access to the wetland. • Any cats or dogs will be immediately removed from habitat areas by a qualified animal control officer. • Dense fringing vegetation should be maintained around the perimeter of the wetland in order to restrict access and breeding by cane toads. • Toad 'round ups' should be conducted bi-annually within the warmer months (i.e. Spring – Autumn) following rainfall events. • Toads collected during round ups are to be humanly nalyzing and removed from the site (pending ethics approval). • Acidic conditions within the wetland will be maintained to limit potential breeding sites for toads. • Efforts shall be made to reduce the permanent ponding of water within habitat areas and to retain the natural hydrology (i.e. periodic saturation and drying out) of the habitat areas in order to control potential invasions of Gambusia.
Alterations in Drainage and Hydrological Regime	• All requirements of SCRC and the approved Stormwater Management Plan must be adhered to. • Release of water from detention basins should occur at suitable rates so as to maintain the water table of the wetland, as outlined in the approved Stormwater Management Plan. • Peak stormwater flow rates should not exceed those of a 01 in 02 year storm.

4.3 Specific Management Strategies for Threatened Fauna

Three (3) species of Acid frog have been identified within previous studies within the wetland area. This includes the Commonwealth listed Wallum sedge frog (*Litoria olongburensis*). It is recommended that an Acid Frog Management Plan be prepared for the wetland in order to ensure the persistence of viable acid frog populations following the development of the school site. The Acid Frog Management Plan should include:

- Acid frog population monitoring protocol;
- Measures to prevent the introduction of Chytrid fungus to the wetland, and control measures should Chytrid fungus be present;
- Measures for the prevention and control of pest species/competitor invasion
- Maintenance of suitable water quality, vegetation and other habitat features within the Acid frog habitat.

5 MONITORING AND REPORTING

It is understood that baseline water quality data from within the wetland has been collected prior to the commencement of construction.

Data collected to date will provide baseline water quality value ranges for comparison with future monitoring results within the wetland during construction and upon completion of the school development.

Monitoring of Acid frogs should be completed as outlined in an Acid Frog Management Plan.

Monitoring of water quality and Acid frog populations is to continue for a minimum of five (5) years following the commencement of construction. Monitoring is to take place on a minimum quarterly basis (i.e. every three (3) months). A report analyzing and analyzing the results of the monitoring is to be submitted on an annual basis.

TABLE 2 summarises the resources/actions required in implementation of this Wetland Management Plan.

TABLE 2 – Resources/actions required

Action required	Frequency	Total
Acid Frog Management Plan	Initial	One (1) plan
Monitoring of water quality	Quarterly for a period of five (5) years	Twenty (20) monitoring efforts
Monitoring of acid frog populations	Quarterly for a period of five (5) years	Twenty (20) monitoring efforts
Annual report on water quality	Annually for a period of five (5) years	Five (5) reports
Annual report on acid frog populations	Annually for a period of five (5) years	Five (5) reports
Cane toad round up	Bi-annually for a period of five (5) years	Ten (10) round ups (may be conducted in conjunction with acid frog monitoring)

Costs of carrying out the above actions will be dependent on quotes from individual contractors.

6 SUMMARY & CONCLUSIONS

James Warren and Associates (JWA) have been engaged by Broad Construction Services (QLD) Pty Ltd. to prepare a Wetland Management Plan for a wetland adjacent to the future Peregian Springs State School site.

The Wetland Management Plan includes the following:

- An assessment of the current wetland vegetation values;
- Identification of potential impacts on the wetland imposed by the development of the Peregian Springs State School; and
- Recommendations to ameliorate potential development impacts on vegetation and fauna values of the wetland.

Monitoring of water quality and the Acid frog population is to occur on a quarterly (i.e. 3 monthly) basis for a total of five (5) years following the commencement of construction, with an annual report summarising monitoring results.

7 REFERENCES

Crossland M.R. (1998) *A comparison of cane toad and native tadpoles as predators of native anuran eggs, hatchlings and larvae.* Wildlife Research *25*, 373-381.

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Lewis, B.D. & Goldingay, R.L. (2005) *Population monitoring of the vulnerable wallum sedge frog (Litoria olongburensis) in north-eastern New South Wales*, Australian Journal of Zoology, **53:** 185 – 194.

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APPENDIX 1 - PLANT LIST

Grouping	Family	Botanical Name	Common Name
Ferns	Blechnaceae	*Blechnum indicum*	Swamp water fern
Ferns	Gleicheniaceae	*Gleichenia mendellii*	Coral fern
Ferns	Schizaeaceae	*Lygodium microphyllum*	Climbing maidenhair fern
Gymnosperms	Pinaceae	*Pinus elliottii**	Slash pine
Monocotyledons	Cyperaceae	*Baumea articulata*	Jointed twigrush
Monocotyledons	Cyperaceae	*Cyperus exaltatus*	
Monocotyledons	Cyperaceae	*Cyperus haspan*	
Monocotyledons	Cyperaceae	*Cyperus polystachyos*	
Monocotyledons	Cyperaceae	*Fuirena ciliaris*	
Monocotyledons	Cyperaceae	*Gahnia sieberiana*	Sword grass
Monocotyledons	Cyperaceae	*Isolepis nodosa*	Knobby club rush
Monocotyledons	Cyperaceae	*Lepironia articulata*	
Monocotyledons	Juncaceae	*Juncus usitatus*	Common rush
Monocotyledons	Laxmannicaceae	*Lomandra longifolia*	Mat rush
Monocotyledons	Restionaceae	*Baloskion pallens*	
Monocotyledons	Restionaceae	*Empodisma minus*	Spreading rope rush
Monocotyledons	Philydraceae	*Philydrum lanuginosum*	Frogsmouth
Monocotyledons	Poaceae	*Andropogon virginicus*	Whiskey grass
Monocotyledons	Poaceae	*Imperata cylindrica*	Blady grass
Monocotyledons	Poaceae	*Setaria sphacelata*	Pidgeon grass
Monocotyledons	Poaceae	*Themeda triandra*	Kangaroo grass
Monocotyledons	Poaceae	*Paspalum dilatum**	Broad-leaved paspaulum
Monocotyledons	Typhaceae	*Typha orientalis*	Cumbungi
Lower Dicots	Lauraceae	*Cassytha glabella*	
Dicotyledons	Apocynaceae	*Parsonsia straminea*	Monkey rope vine
Dicotyledons	Asclepiadaceae	*Gomphocarpus physocarpus**	Balloon cotton bush
Dicotyledons	Asteraceae	*Ageratum houstonianum**	Blue billygoat weed
Dicotyledons	Asteraceae	*Bidens pilosa**	Cobbler's pegs
Dicotyledons	Asteraceae	*Conyza so.*	Fleabane
Dicotyledons	Casuarinaceae	*Casuarina glauca*	Swamp oak
Dicotyledons	Droseraceae	*Drosera binata*	Forked sundew
Dicotyledons	Ericaceae	*Sprengelia sprengelioides*	Sprengelia
Dicotyledons	Fabaceae	*Crotalaria sp.**	Rattle pod
Dicotyledons	Fabaceae	*Glycine sp.*	Glycine
Dicotyledons	Fabaceae	*Pultenaea retusa*	Eggs and bacon
Dicotyledons	Melastomataceae	*Melastoma malabathricum*	Blue tongue

Grouping	Family	Botanical Name	Common Name
Dicotyledons	Mimosaceae	*Acacia concurrens*	Black wattle
Dicotyledons	Mimosaceae	*Acacia fimbriata*	Brisbane wattle
Dicotyledons	Myrtaceae	*Callistemon pachyphyllus*	Wallum bottlebrush
Dicotyledons	Myrtaceae	*Eucalyptus racemosa*	Scribbly gum
Dicotyledons	Myrtaceae	*Eucalyptus robusta*	Swamp mahogany
Dicotyledons	Myrtaceae	*Leptospermum liversidgei*	Lemon scented leptospermum
Dicotyledons	Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved paperbark
Dicotyledons	Proteaceae	*Banksia robur*	Broad-leaved banksia
Dicotyledons	Proteaceae	*Hakea actites*	
Dicotyledons	Proteaceae	*Persoonia virgata*	Small-leaved geebung
Dicotyledons	Thymelaeaceae	*Pimelea linifolia*	
Dicotyledons	Verbenaceae	*Lantana camara**	Lantana

* Introduced Species