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Our Ref: 9339/OCK/AMB/L72091
Your Ref: TNS/003277 and
EcoTrack Applic. 471359 Proj. 279643
Council Ref: 8/13/1625
Date: 14 May 2013

Attn: Mr Michael Trenerry
Department of Environment and Heritage Protection
5b Sheridan Street
PO Box 937
Cairns, QLD 4870

Via: Courier / E-mail

Dear Madam

**RE: INFORMATION REQUEST RESPONSE PURSUANT TO SECTION 278 OF THE
SUSTAINABLE PLANNING ACT 2009**

**APPLICATION FOR RECONFIGURATION OF A LOT (1 LOT INTO 99 LOTS) ON LAND
LOCATED AT VIXIES ROAD, WONGA, LAND DESCRIBED AS LOT 51 SP155078**

We act on behalf of Wonga Beach Aquaculture Resort Pty Ltd, regarding the abovementioned Development Application.

On 14 September 2011 an Information Request was received from the former Department of Environment and Resource Management (DERM), in relation to its concurrence jurisdiction in respect of wetland protection matters.

Subsequent to the issue of DERM's request for further information, the time period in which the Applicant has been required to respond to the request has been extended until 1 June 2013. The Applicant has also been advised by correspondence, dated 14 September 2012, that the concurrence agency and advice agency jurisdictions relating to wetland protection have transferred to the Department of Environment and Heritage Protection (DEHP) and that the DEHP contact is the addressee of this response (refer above).

Pursuant to Section 278 of the Sustainable Planning Act 2009, we provide our response to the request for further information relating to wetland protection matters.

Information Request Item 1 (Development Positioning)

Two (2) HES wetlands occur adjacent to Lot 51 on SP155078.

Please provide a map showing the HES wetlands and proposed buffers with an overlay of the subdivision and proposed lots to demonstrate that the development is located outside the mapped boundary of the identified HES wetlands. This map should clearly show the location of all proposed high impact earthworks.

Response

The plan provided for reference in **Attachment A**, RPS Drawing No 9339-37, shows the HES wetlands and proposed buffers with the proposed subdivision overlayed. It is evident from the Concept Filling and Drainage Overlay Plan, that the proposed fill and drainage works and the location of lot boundaries and roads are located outside of the mapped boundary of the HES wetland and as required in response to the Wetlands Assessment provided for reference in **Attachment B**, works associated with the development are located outside the recommended buffer.

Information Request Item 2 (Buffer)

While Council has granted a Preliminary Approval over the land for Material Change of use, for the purposes of this assessment DERM considers that the site is not an urban area. AN urban area is defined in the Sustainable Planning Regulation 2009 as:

- a) An area identified in a gazette notice is by the chief executive under the Vegetation Management Act as an urban area; or*
- b) If no gazette notice has been published- an area identified as an area intended as an area intended specially for urban purposes, including future urban purposes (but not rural residential or future rural residential purposes) on a map in a planning scheme that-*
 - i. Identifies the areas using cadastral boundaries; and*
 - ii. Is used exclusively or primarily to assess development applications.*

As the development is located outside an urban area a minimum buffer width of 200 meters should be provide to satisfy the TSPP, unless an alternative buffer is approved by DERM.

Acceptable Outcomes 2.2 and 2.3 of the TSPP allows for an alternative buffer to be provided and maintained, the width of which must be supported by an evaluation of the values, functioning and threats to the wetland. This evaluation requires a detailed site-specific investigation to assess the values present in the wetland, and the nature of the work and threats posed by development.

The Wetlands Assessment: Vixies Road, Wonga Beach (prepared by RPS, July 2011), included in the development application, recommends a minimum 15 metre buffer from the top-of-bank. This report does not provide sufficient information to support the claim that a 15 metre buffer is a suitable alternative to a 200 metre buffer. In reference to Acceptable Outcome 2.2 and 2.3 of the TSPP, please provide details on the provision, maintenance and protection of an adequate buffer between the development and HES wetland. A link to the Queensland Wetland Buffer Planning Guideline (2011) is attached for your information:

Refer to Original Correspondence for Web Address

Furthermore, it is noted that a pathway may be constructed within the proposed wetland buffer area. Please provide details of any earthworks or structures that are proposed within the buffer area, and demonstrate how these will avoid any impacts to the function of the buffer.

Response

With regard to the above matter, please find a revised Wetlands Assessment which has been prepared in response to the request for further information.

After further review, the Wetland Assessment has concluded that the buffer from the HES wetland should be 20 metres from the top of bank of the sandy swale located along/adjacent to the site's western boundary and 20 metres from the mapped edge of the HES wetland located in the site's north-eastern corner. The HES wetland buffer and development design considerations recommended in the Wetland Assessment is reflected in the Concept Filling and Drainage Overlay Plan, RPS Drawing No 9339-37, provided for reference in **Attachment A** and the amended Reconfiguration Proposal Plan, RPS Drawing No 9339-20 Issue G provided for reference in the Wetland Assessment.

Information Request Item 3 (Hydrology)

The development application state that 'the final stormwater management measures are subject to further detailed engineering design', and that the 'design intent' includes partial management of stormwater flows through the provision of rubble drainable pit on each lot, draining to open grass swale draining located within the road reserves.

Please provide details of proposed stormwater management measures across the site, as well as any other earthworks or structures that may divert water to or from the HES wetland, and demonstrate how they will avoid or minimise impacts to the surface water hydrological regime of these wetlands.

Response

In response to this matter, please refer to the Wonga Beach Integrated Stormwater Management Plan, prepared by BMT WBM and provided for reference in **Attachment C** and the Engineering Assessment prepared by PDR Engineers and provided for reference in **Attachment D**.

The Wonga Beach Integrated Stormwater Management Plan provides an assessment of the wetland hydrology and concludes that through the implementation of water sensitive urban design, the design objectives related to the maintenance of critical wetland hydrology characteristics can be met. The Engineering Assessment provides a Conceptual Filling and Drainage Plan which has been prepared to meet the principles, recommendations and requirements of the Wonga Beach Integrated Stormwater Management Plan in relation to both stormwater management and water quality.

Information Request Item 4 (Groundwater)

Please demonstrate that the water table and hydrostatic pressure within the wetland protection areas will not be lowered or raised outside the bounds of natural variability under existing conditions by the development.

OR

Please provide details as to how the development will return the water table and hydrostatic pressure of the wetland to its natural state and will not result in the ingress of saline water into any freshwater aquifers.

Response

In response to this matter, please refer to the Wonga Beach Integrated Stormwater Management Plan, prepared by BMT WBM and provided for reference in **Attachment C** and the Engineering Assessment prepared by PDR Engineers and provided for reference in **Attachment D**.

The Wonga Beach Integrated Stormwater Management Plan addresses wetland hydrology (recharge and discharge) and how the proposed development will affect these processes. The Management Plan concludes that through the implementation of water sensitive urban design, the design objectives related to the maintenance of critical wetland hydrology characteristics can be met and it is noted that the Conceptual Filling and Drainage Plan detailed in the Engineering Assessment has been prepared to meet the principles, recommendations and requirements of the Wonga Beach Integrated Stormwater Management Plan in relation to both stormwater management and water quality.

Information Request Item 5 (Water Quality- Stormwater)

The development application states that 'a management plan will be implemented prior to construction works being undertaken on site which will be able to address the specific outcomes'.

Please provide details as to how the buffer and water quality values of the HES wetlands will be protected from stormwater impacts. Utilising the HES wetlands for stormwater treatment will not satisfy the requirements of the TSPP.

Development, including increased runoff from impervious surfaces, should not result in any measureable change to the quality and quantity of stormwater entering the HES wetland during construction or operation.

It is recommended that an erosion and sediment control strategy also be prepared by a suitably qualified person. This strategy should consider the impacts on water quality during the construction and operation of the development, including how sediment and erosion will be controlled in both dry and wet seasons.

Response

In response to this matter, please refer to the Wonga Beach Integrated Stormwater Management Plan, prepared by BMT WBM and provided for reference in **Attachment C** and the Engineering Assessment prepared by PDR Engineers and provided for reference in **Attachment D**.

The Wonga Beach Integrated Stormwater Management Plan provides an assessment of the wetland hydrology and concludes that through the implementation of water sensitive urban design, the design objectives related to the maintenance of critical wetland hydrology characteristics can be met. The Engineering Assessment provides a Conceptual Filling and Drainage Plan which has been prepared to meet the principles, recommendations and requirements of the Wonga Beach Integrated Stormwater Management Plan in relation to both stormwater management and water quality.

The Operational Works Stage is the timeframe at which detailed engineering works design will be undertaken and the Operational Works Stage is the appropriate timeframe to be addressing the requirement to provide an erosion and sediment control strategy.

Information Request Item 6 (Ecological Values- Vegetation)

The application states that no clearing is proposed within the HES wetland or buffer area, however it is noted that a walking trail is proposed within the buffer area. Please demonstrate that vegetation clearing will not occur within the HES wetlands and associated buffer areas.

Response

This matter is addressed in the Wetland Assessment provided for reference in **Attachment B**, which states;

“The site at Vixies Road is already completely cleared and has been used for livestock grazing for many years. Clearing is not proposed, or indicated by any recommendations with respect to wetland buffers, within the HES wetlands or the wetland buffer areas.”

No clearing of vegetation and no walking trail was proposed in the HES wetland or the original recommended buffer and in accordance with the recommendations of the revised Wetland Assessment provided for reference in **Attachment B**, no clearing of vegetation and no walking trail is proposed in the HES wetland or the recommended buffer as is evident in the Concept Filling and Drainage Overlay Plan, RPS Drawing No 9339-37, provided for reference in **Attachment A** and the amended Reconfiguration Proposal Plan, RPS Drawing No 9339-20 Issue G provided for reference in the Wetland Assessment in **Attachment B**.

Information Request Item 7 permanent

No request for further info has been made in respect of Item 7.

Information Request Item 8 (Ecological Values- Pest and Invasive Species)

It is noted that revegetation with endemic species is proposed within the central watercourse (a mapped wetland management area). Please indicate if other areas, including the HES wetlands and their associated buffers, are to be revegetated. In any revegetation efforts, species of local provenance are preferred to reduce the risk of exotic flora invading and establishing in an adjacent to HES wetlands.

It is also noted that the application state that ‘development of the site represents an opportunity to reduce or eliminate weed infestation in wetland and vegetation areas’. Please provide information on how weeds will be removed (i.e. mechanical or chemical techniques) and disposed of, the areas that will be subject to weed removal efforts, and potential impacts to HES wetlands as a result of this strategy.

Please provide details on how the development will avoid or minimise the threat of introduction of non-native or pest species that pose a risk to the ecological values and processes of the HES wetlands.

Response

This matter is addressed in the Wetland Assessment provided for reference in **Attachment B**, which states;

“No response required. There were no proposals to manage the HES wetlands on the eastern or western sides of the Vixies Road site that included rehabilitation or weed/pest removal. The HES wetlands have been assessed and appropriate buffers recommended that will protect the values of the wetland ecosystems.”

No response required. There were no proposals to manage the HES wetlands on the eastern or western sides of the Vixies Road site that included rehabilitation or weed/pest removal. The HES wetlands have been assessed and appropriate buffers recommended that will protect the values of the wetland ecosystems.

Information Request Item 9 (Noise, Light and Visual Disturbance)

During construction and operation the development has the potential to impact on wetland fauna, particularly wetland bird species, as a result of noise, light and visual disturbances. Please provide details of how lighting, noise and visual disturbances will be controlled and managed, both during construction and operation, to avoid or minimise impacts on wetland fauna values.

Response

Construction works would be expected to be completed during daylight hours and provided construction activities respect the HES wetland buffer area and leave the buffer area undisturbed, it is considered that the wetland fauna values will be adequately managed during construction and future residential activity.

Information Request Item 10

It is noted that the development application states that ‘it is expected that the requirements for an operational management plan would be necessarily required by Council prior to undertaking Operational Works on the site’.

Please provide details of ongoing management, maintenance and monitoring that will be undertaken to ensure adverse effects on hydrology, water quality and ecological processes of a HES wetland are avoided or minimised during the construction and operation of the development

Response

As indicated in the original development application, details such as an operational management plan which, in part, is intended to adequately manage potential adverse impacts on hydrology, water quality and ecological processes of a HES wetland during the construction, will be provided prior to undertaking Operational Works on the land once the detailed design considerations have been determined.

On-going management intended to adequately address potential adverse impacts on hydrology, water quality and ecological processes of the HES wetland areas during the operation of the development is achieved, in part, through the provision of the recommended HES wetland buffer (refer to **Attachments A and B**) and through the design of the development (refer to the above responses to the request for further information).

In accordance with Section 278(1)(a) of the *Sustainable Planning Act 2009* this letter and attachments constitute a response to all of the information requested. We ask that the Department proceed with assessment of this development application.

We trust this information is sufficient for your purposes, however should you require any further details or clarification, please do not hesitate to contact the undersigned in the Cairns office.

Yours sincerely

RPS



Owen Caddick-King
Principal – Planning

cc: Attn: Mr James Goode
Wonga Beach Aquaculture Resort Pty Ltd
PO Box 2214
DANGAR NSW 2309

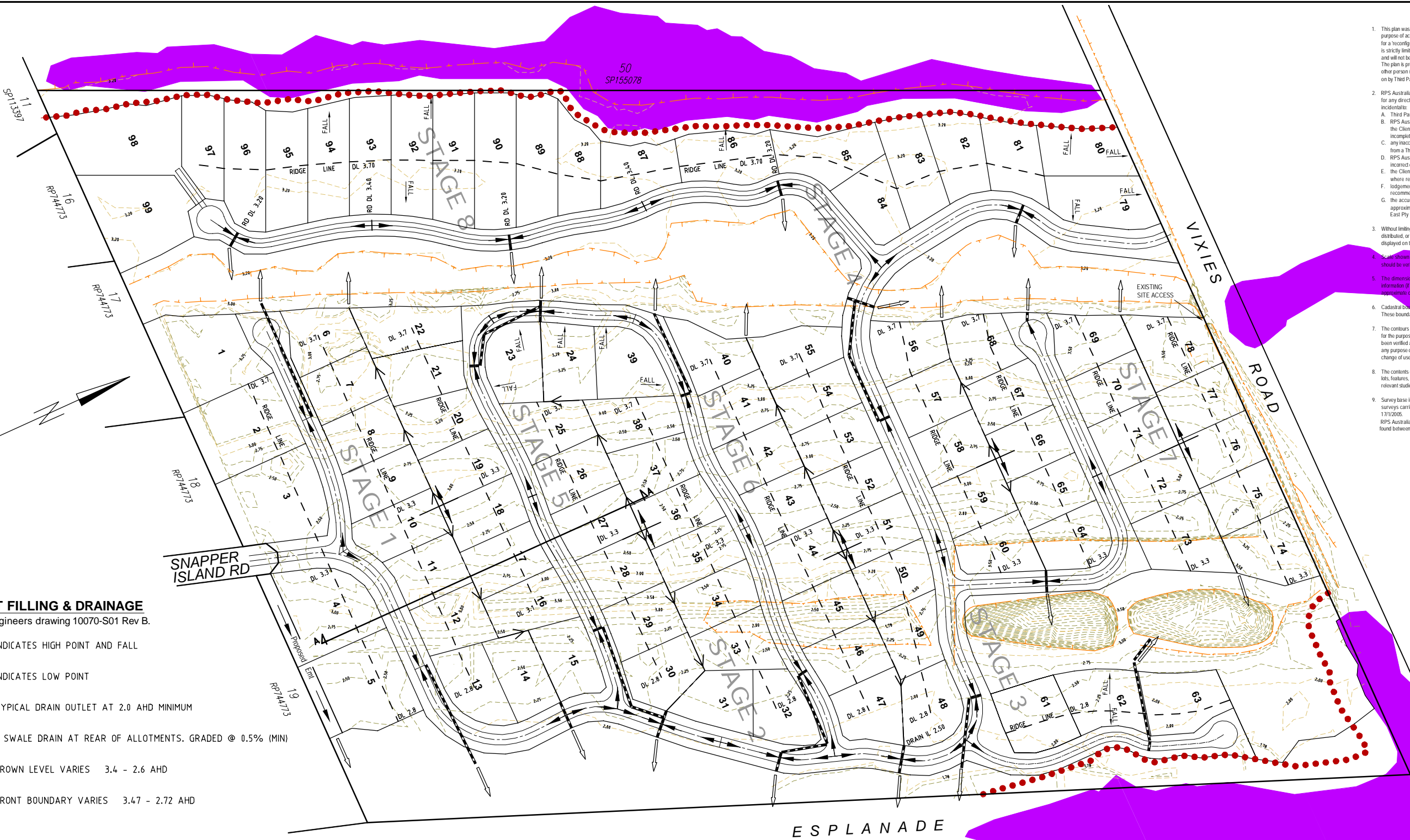
Attn: Mr Neil Beck
Chief Executive Officer
Cairns Regional Council
PO Box 359
CAIRNS QLD 4870

enc: **Attachment A:** RPS Drawing No.9339-37
Attachment B: Wetland Assessment
Attachment C: Stormwater Management Plan
Attachment D: Engineering Assessment



Attachment A

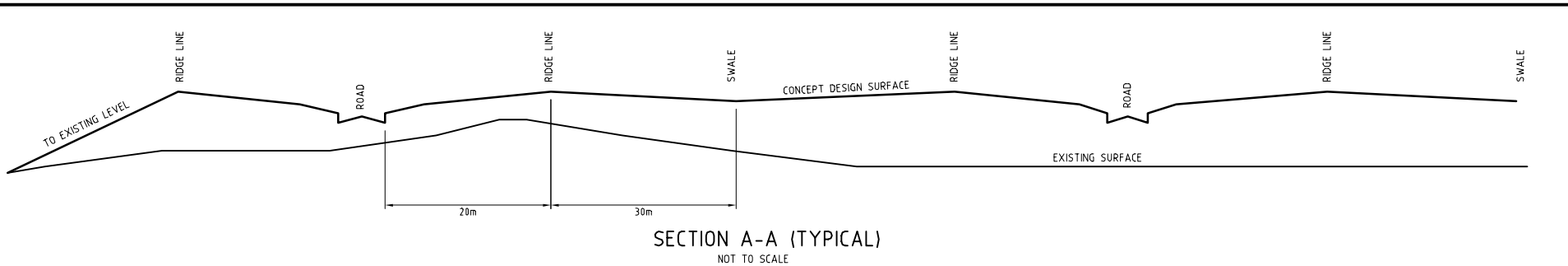
RPS Drawing No.9339-37



- IMPORTANT NOTE**
- This plan was prepared for the sole purposes of the client for the specific purpose of accompanying an application to the Cairns Regional Council for a reconfiguration of lot of the land described on this plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other application, purpose, use or matter. The plan is presented without the assumption of a duty of care to any other person (other than the Client ("Third Party") and may not be relied on by Third Party.
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 - The dimensions, area, size and location of improvements, flood information (if shown) and number of lots shown on this plan are approximate only and may vary.
 - Cadastral boundaries are obtained by this dimensions and DCDB. These boundaries have not been verified and are approximate only.
 - The contours shown on this plan were by field survey and are suitable only for the purposes of this application. The integrity of the contours has not been verified and no reliance should be placed upon such contours for any purpose other than for the purpose of this application for a material change of use of land.
 - The contents of this plan are conceptual only, for approval purposes. All lots, features, areas and dimensions are approximate only. Subject to relevant studies, Survey, Engineering and Government approvals.
 - Survey base information has been compiled from the merger of detail surveys carried out over the site at various times from 1960/2000 to 17/12/2005. RPS Australia East Pty Ltd takes no responsibility for any differences found between original data and current values.

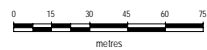
CONCEPT FILLING & DRAINAGE
from PDR Engineers drawing 10070-S01 Rev B.

- INDICATES HIGH POINT AND FALL
- INDICATES LOW POINT
- TYPICAL DRAIN OUTLET AT 2.0 AHD MINIMUM
- SWALE DRAIN AT REAR OF ALLOTMENTS. GRADED @ 0.5% (MIN)
- CROWN LEVEL VARIES 3.4 - 2.6 AHD
- FRONT BOUNDARY VARIES 3.47 - 2.72 AHD




LEGEND

- MAPPED WETLAND AREAS OF HIGH ECOLOGICAL SIGNIFICANCE
© The State of Queensland 2013
- SETBACK FROM HES WETLAND (20m from mapped HES Wetland - Eastern Bdy)
(20m from surveyed top of bank - Western Bdy)
- SURVEYED TOP OF BANK
- CONTOURS



SCALE 1:1500 IS APPLICABLE ONLY
TO THE ORIGINAL SHEET SIZE. (A1)
(1:3000 @ A3)

AMENDMENTS		PROJECT MANAGER		WONGA BEACH AQACULTURE RESORT		 <div>RPS Australia East Pty Ltd ACN 140 292 762 135 Abbott St PO Box 1949 CAIRNS QLD 4870 T +61 7 4031 1336 F +61 7 4031 2942 W rpsgroup.com.au</div>	
		O. CADDICK-KING					
		SURVEYED					
		COMPILED		WETLAND AREAS OF HIGH ECOLOGICAL SIGNIFICANCE - CONCEPT FILLING AND DRAINAGE OVERLAY			
		RMW				T F W	
CAD REF 9339-37.DWG							
		SHEET 1 OF SHEETS 1		SHEET SIZE A1		SCALE 1:750	
						DATE 07/05/2013	
						DRAWING NO 9339-37	
						ISSUE	



Attachment B

Wetland Assessment



Wetlands Assessment: Vixies Road, Wonga Beach

Response to Information Requests

Prepared by: Dr Paul Clayton

Prepared for:

RPS AUSTRALIA EAST PTY LTD

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Report Number: 9339/
Version / Date: April 2013

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Document Status

Version	Purpose of Document	Orig	Review	Review Date
1	Internal advice for RPS Cairns to complete response to client			
2	Response to Request for Further Information			

Approval for Issue

Name	Date
Paul Clayton	10 April 2013

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Appendices

Annexure 1	DERM – Information Request
Annexure 2	Cairns Regional Council – Information Request
Attachment 1	Reconfiguration Proposal Plan

1.0 Introduction

In late 2011, information requests were received from the Cairns Regional Council and, separately, from the Queensland Government with respect to the proposed development on Vixies Road, Wonga Beach. This short document provides responses to those parts of the information requests that refer to wetland issues on the development site.

The relevant Information Requests are:

1. Department of Environment and Resource Management, Information Request – reference number 279643 (IC0911CNS0006), September 2011 (Refer to **Annexure 1**).
2. Cairns Regional Council, Information Request – reference number 8/13/1625 (3307055), September 2011 (Refer to **Annexure 2**).

1.1 Background

More than a year has passed since the issue of these information requests. In that time, some changes to wetlands management policy/procedure have occurred for Queensland which may have bearing on the responses provided here. In part, the change of government in Queensland precipitated some legislative and planning changes that need to be mentioned. The following is provided for context.

With regard to wetland management in FNQ coastal areas, the following is noted:

1. “Wetland Management Areas” (WMA) no longer exist. This is a consequence of the Sustainable Planning Amendment Regulation (No.5) 2012 which removed all reference to them about mid-year 2012. As a result DEHP (formerly DERM) are aligning by removing (or already have removed) their references to and use of WMAs. For the Vixies Road site, therefore, there are no WMAs and the latest ‘Map of Referable Wetlands’ from DEHP shows this. Further, there are no Wetlands of General Ecological Significance relating to the site (refer to the Areas of Ecological Significance Mapping provided for reference in the Wetland Assessment lodged in support of the development application). WMAs will no longer be defined/delineated anywhere so their inclusion by any local government through the DA process will be by virtue of historic mapping and historic considerations only. Despite this legislative change, there are environmental values in the site associated with the central channel (which was previously mapped as WMA) and these should not be ignored because they still have relevance to the nearby HES wetlands – indeed, directly upstream of the HES wetland to the north of the site.
2. “Wetland Protection Areas” (WPA) do exist for GBR catchments and are mapped for the Vixies Road site. WPAs include the HES wetland itself plus its ‘trigger area’, so the entire site is a WPA in this case. DEHP are concurrence agency according to the Sustainable Planning Regulation 2009 Schedule 7 Item 43A. That means the provisions and performance outcomes of the State Planning Policy 4/11 apply.
3. The FNQ Regional Plan State Planning Regulatory Provisions (SPRP) were repealed by the State Government on 26 October 2012 and the effect of Part 1.2 of the Far North Regional Plan, which relates to Coastal Management, was surrendered for a period of 12 months at the same time. However, Part 7.1 of the Far North Regional Plan, which relates to Protection of waterways, wetlands and water quality, still has effect in relation to the HES Wetlands which are located along the western boundary and adjacent to the north-eastern portion of the site. It is further noted that Part 7.1 of the Far North Regional Plan refers to HES Wetlands and Wetlands of General Ecological Significance and that there are no Wetlands of General Ecological Significance relating to the site (refer to the Areas of Ecological Significance Mapping provided for reference in the Wetland Assessment lodged in support of the development application).

4. The Queensland Coastal Plan is in effect from 3 February 2012. It replaces the State Coastal Management Plan (2001) and associated regional coastal management plans. The Queensland Coastal Plan has been prepared under the Coastal Protection and Management Act 1995. It includes a state planning policy under the Sustainable Planning Act 2009. However, the Deputy Premier and Minister for State Development, Infrastructure and Planning made the Draft Coastal Protection State Planning Regulatory Provision (the Draft SPRP). This provision took effect on 8 October 2012 and suspends the operation of the State Planning Policy 3/11: Coastal Protection (Coastal SPP). Also, in this process, Regional Coastal Management plans were repealed by Queensland Government on 8th October 2012. In the end, there are no significant wetland provisions in the draft SPRP, beyond general environmental stewardship, which would not be accommodated by addressing item 2 above.

Proposal of wetland buffers that are different to the default buffer sizes in the State Planning Policy 4/11 must be assessed by a wetland specialist, and must be in accordance with the Qld Wetland Buffer Guideline 2011. The wetland buffer provided for in the assessment and report dated July 2011, which supported the original development application, already adequately addressed this requirement and, this is also completely in line with the FNQ Regional Plan concerning wetland management.

2.0 DEHP Information Request response

2.1 Wetland Buffer (DEHP Item 2)

In item 2 of the DEHP (formerly DERM) request for further information, the issue of providing an adequate wetland buffer size to protect the values of the mapped HES wetlands is raised. Reference is made to State Planning Policy 4/11 and the Qld Wetland Buffer Guideline 2011. In particular, the DEHP information request seeks further detail to support the claim in the earlier RPS wetlands report that the wetlands buffer can be reduced from the default 200m.

This section provides additional detail and draws, where relevant, on text already prepared and included in the earlier wetlands report.

An effectively managed wetland buffer helps to maintain and protect the wetland itself, but it also serves to maintain and protect the inherent wetland values which can be as obvious as a significant species or as subtle as an ecological function/process. A wetland buffer is the area between the wetland ecosystem and human activities or developments that threaten the wetland's values. Importantly, a wetland buffer is not necessarily a development or activity free area but must only provide for activities that do not threaten the wetland or its inherent values. For these reasons, prescriptive wetland buffer sizes applied generically is a simplistic approach that takes little or no account of varied wetland ecosystem process or condition, and takes little or no account of variability in development proposals.

A number of methods for determining appropriate wetland buffer sizes have been proposed but, most recently, methods for determining buffers using site specific information have become popular and are favoured by many wetland ecologists, including the author. Indeed, a wetland buffer guideline incorporating these principles is available from DERM and provides for a wetland buffer that is made up of a "wetland support area" and a "wetland separation area":

- A Wetland Support Area is the area adjacent and connected to a wetland that provides essential requirements to support the wetland and any identified values.
- A Wetland Separation Area is the area adjacent to the wetland support area that protects the wetland from negative impacts providing an appropriate distance between the wetland and any external pressures.

The wetland buffer is the combination of the support and separation areas, and it may not be symmetrical around the wetland or similar from one wetland to another. Practically, however, sufficient information to determine site-specific wetland buffers is rarely available without detailed ecological investigation so default generic buffer sizes are still necessary for application in some circumstances.

In the case of the wetlands at the Vixies Road development site, the site assessment conducted by RPS has provided information about the wetland's condition, ecosystem fragmentation and the wetland values such that an appropriate buffer size can be proposed.

This buffer determination in this case, and the foundation assessment of wetland values, was conducted in detail and directly in line with DEHP wetland buffer guidelines and in line with AquaBAMM principles, the current state method for assessment of aquatic conservation values (Clayton *et al*, 2006).

2.1.1 Buffer Design Method

In line with the DEHP wetland buffer guidelines, determination of appropriate wetland buffers should rely broadly upon a process with six steps:

1. Identify and prioritise Wetland Environmental Values (WEVs)
2. Determine wetland support area requirements based on WEVs
3. Define wetland support area
4. Identify and prioritise direct pressures
5. Determine wetland separation area requirements based on pressures
6. Define wetland separation area

Wetland environmental values may relate to species, habitat, ecological processes and/or environmental condition. **Table 1** provides a list of the most commonly considered WEVs but is not exhaustive, and expert wetland knowledge is usually required to consider specific wetland circumstances case by case. A number of commonly considered WEVs compete and must be assessed accordingly, and many WEVs are not quantifiable without detailed or long-term research investigation. For all of these reasons, a balance must be struck through the wetland buffer assessment that provides for the protection and maintenance of critical WEVs in the context of the specific wetland case, within limited timeframes, and in the context of the proposed development.

Table 1 Commonly considered WEVs in buffer determination investigations

Category	Characteristics
Wetland Processes	Hydrological processes Food webs Physical habitat Nutrient cycling Sediment trapping and stabilisation
Conservation Significance	Diversity Naturalness Special Features Uniqueness Representativeness Threatened Species/Habitats/Communities Ecological Connectivity
Material Benefits of Wetland Ecosystems	Mitigation of climate impacts Coastal shoreline stabilisation Local climate regulation/function Biological control of pests Contaminant trapping Flood control Primary production Genetic resources
Activities	Recreation Tourism Education
Cultural Resources	

Identification of wetland pressures (stressors and impacts) is also landscape context driven, both with respect to geographic/catchment characteristics as well as anthropomorphic influences (rural land-use, urbanisation, recreational uses, etc). Importantly, potential ecosystem pressures must be considered given that wetland buffer assessment is normally being undertaken with a proposed development or wetland use in

mind. Most commonly, the following list of major wetland stressors are considered when assessment current and potential ecosystem pressures for wetland separation area determination:

- Aquatic sediments
- Bacteria/pathogens
- Biota removal/disturbance
- Conductivity
- Connectivity
- Habitat removal
- Hydrology
- Litter (rubbish)
- Nutrients
- Organic matter
- Pest species (animal and plant)
- pH
- Toxicants

To the extent that client/regulator timeframes would allow, these have been considerations in the wetlands assessment at Vixies Road, Wonga Beach.

2.1.1.2 Wetland Support Area

With respect to identification of a wetland support area, the primary WEVs that were considered for the Vixies Road site, Wonga Beach, are shown in the following table.

Table 2 WEV consideration for HES wetlands at the Vixies Road site

WEV Category	WEC Characteristic	Description/Comment	WEV Rating	Support area requirements
Conservation Significance	All Characteristics (refer Table 1)	Wetlands adjacent to the Vixies Road site have been subject to an approved Aquatic Conservation Assessment (AquaBAMM) and have been shown to meet requirements for HES classification through that process. However, typical for most remotely sensed assessment techniques, the ACA rarely benefits from locally specific (and field truthed) data for some characteristics. In the case of the wetlands assessed at the Vixies Road site, local impacts with respect to water quality, weed intrusion, livestock movement, and adjacent clearing do affect "naturalness" values and would have affected ultimate 'Aquascore' results through an ACA with specific local data.	High-Medium (however, support area requirements moderated due to local impacts to "naturalness")	Most reliable literature (refer Qld Government Wetland Buffer Guidelines) specify buffers varying between 15m and 100m depending upon circumstance. Some authors have required as little as 5m. In the Vixies Road site case, clearing for grazing purposes has been complete to 'top of bank' in all areas and exhausted values to within a few meters of normal waterlines and/or to beyond property boundaries. 15m is adequate for support area set-back in this case. Even at this size, the support area is cleared (historically) and without remnant wetland values.

WEV Category	WEC Characteristic	Description/Comment	WEV Rating	Support area requirements
Wetland Processes	Physical habitat; Hydrological process; Sediment trapping	<p>Historic land-use (clearing, fencing, livestock access to the wetlands, etc) has resulted in the active wetland process area confined within the high banks (for the western wetland area) or outside of the property boundary (for the eastern wetland area).</p> <p>Maintenance of process in a longitudinal context (to maintain connectivity and function with HES wetlands to the north) is more critical than the latitudinal context given the extent of historic disturbance. Longitudinal process is less influenced by the proposed development.</p>	Medium	<p>Maintain current remnant wetland extent. Limited value in extending significant distance away from the wetland given current land-use.</p> <p>5m is adequate for support area set-back in this case</p>
Other Categories		Considered broadly, particularly in other project components (e.g. separate hydrological study), but not significantly influence wetland support area decision given the detail above and given field observations/expert opinion at the site.		

In the case of the Vixies Road development site, the transition area between cleared agricultural land and the wetland for most locations inspected corresponds to top-of-bank (TOB) for the wetland/watercourse features or the wetland vegetation boundary where TOB is irrelevant or topographically indistinct. By virtue of this geography, the remaining primary wetland support functions are likely to still be supported within the areas defined by TOB or within the current wetland vegetation boundary where TOB is irrelevant or topographically indistinct. This is not to say that greater wetland support areas would not have occurred prior to agricultural development; however, the extent of clearing and the current land use beyond TOB or beyond edge of remnant vegetation means that definition of wider wetland support areas is very unlikely to increase wetland support function. Previous WEVs for these outer areas, if any, have been exhausted through current and historic land-use.

Given the assessment provided in **Table 2**, and taking the most conservative set-back recommendation, the wetland support area boundary for the Vixies Road site should be taken as **15m from the wetland boundary**, which in most cases on site can be considered as the outer edge of vegetation in all areas due to historic clearing – for practical purposes, this will coincide with the “wetland” remnant vegetation boundary/edge or TOB in the case of the site’s western boundary.

2.1.1.3 Wetland Separation Area

In assessing the wetland separation area for wetlands at the Vixies Road site, Wonga Beach, the following were primary considerations and relate to current or proposed wetland stressors and impacts:

- Wetland pressures as discussed in Section 2.1.1 above.
- The property boundaries (and proposed development extent) with respect to mapped HES wetland

- Wetland context (e.g. upstream stressor/pressures that relate to water quality, sediment and stormwater management; neighbouring land-use with respect to weed/pest invasion; current levels of clearing; Vixies Road disturbance to connectivity and habitat alteration effects)
- Technical detail provided in other reports, particularly the Wonga Beach Integrated Stormwater Management Plan (BMT WBM 2012) with respect to hydrological context and potential hydrological effects of the proposed development.

The HES wetlands at and adjacent to the Vixies Road site are subject to a number of pressures already. For the western wetland, which occurs along a watercourse, the greatest pressures are:

- a. Effects of upstream livestock activity influencing water quality – livestock were observed to be permanently paddocked/grazing through the wetland with consequent effects with respect to nutrients, sediment, and weed invasions.
- b. Effects of upstream stormwater management from the suburban area – water quality and quantity entering the HES wetland is affected, and exacerbates the issues raised in (a).
- c. Western bank landholders and land-use – houses and some small crops (including a vineyard) occur on the western side of the mapped wetland with cleared areas, infrastructure, and exotic plants occupying land to within a few metres of the wetland. Pressures include domestic animal influence, stormwater runoff, agricultural chemical use, recreation, and some livestock.
- d. The downstream end of the wetland (with respect to the subject Vixies Road property) is disconnected from the larger wetland areas to the north by Vixies Road and the constructed crossing/culvert - Pressures include removal/reduction of ecological connectivity, habitat alteration (e.g. greater light ingress), weed invasion, litter.

For the eastern wetland, which occurs along the coastal foreshore and dune area, the greatest pressures are:

- a. Vixies Road provides recreational access to the foreshore wetland areas.
- b. The northern end of the wetland (with respect to the subject Vixies Road property) is partly disconnected from the larger wetland areas to the north by Vixies Road - Pressures include removal/reduction of ecological connectivity, habitat alteration (e.g. greater light ingress), weed invasion, litter.

Of course, grazing and operational activity within the Vixies Road site does provide some pressure to the wetlands from lateral, adjacent areas. However, given the local topography, these pressures are expected to be less significant than those described above.

In the case of the Vixies Road development site, the wetland separation area will not contain natural vegetation (remnant or otherwise). The area is completely cleared and has been grazed/modified for many years. We recommend that the wetland separation area **should be 5m**, measured from the outside edge of the wetland support area described in Section 2.1.1.2.

2.1.2 Final Wetland Buffer

Given that the remaining functional portion of wetland support area is largely contained within the identified wetland boundaries (outer edge of remnant vegetation), a lesser additional area is required to ensure all wetland support values are protected. This additional area is already completely cleared and unlikely to be providing wetland support function but is recommended here in a precautionary context given the wetlands conservation value assessment in a regional sense. The recommendation is for a 15m wetland support area (refer Section 2.1.1.2).

In the Vixies Road site case, the wetland separation area need not extend much beyond the support area for the reasons described in Section 2.1.1.3 and because the most significant potential pressures from the proposed development can be controlled through the design phase (road/path location; stormwater management, etc). It is important that the design principles discussed elsewhere (and in other reports) are followed in this case to ensure pressure on the wetland areas is avoided and so that the wetland separation area size recommendation can be narrow. The recommendation is for a 5m wetland separation area (refer Section 2.1.1.2) provided that:

- a. Stormwater management on the site should be designed to flow away from the mapped wetlands (toward the centre of the development site in most cases and in other alternate cases, with no stormwater outlets having an outlet flowing directly into the mapped HES Wetland and nominated buffer area).
- b. Stormwater management at any controlled discharge points must be managed through appropriate treatment 'trains' to ensure appropriate (and locally relevant) water quality, water velocity and water volume.
- c. Primary stormwater treatment train elements, where required, must be constructed and located outside of the wetland buffer.

The wetland buffer is the combination of the wetland support area and the wetland separation area. Therefore, our recommendation is that a **minimum 20 metre buffer** be applied to wetland areas in the development site, which may be effectively measured from the TOB along the site's western boundary or outer edge of mapped remnant wetland vegetation for the north-eastern portion of the site. The preliminary planning and intent accommodated this buffer requirement in most areas..

This recommendation is for a larger wetland buffer than proposed in the earlier wetland assessment report and follows repeat analysis of field data and further consideration of upstream (off-site) wetland pressures. Where required, the Reconfiguration Proposal Plan (Refer to Drawing 9339-20 Issue G in **Attachment 1**) has been amended to accommodate the wider recommended 20 metre buffer.

2.1.2.1 Buffer Elements

It is important to note that wetland buffers can include natural or artificial features that help to protect wetlands from direct pressures. This is a common concept applied in wetland management, and is referred to in detail by the DEHP Wetland Buffer Guidelines (including their Appendix G). Features such as pathways, walking platforms, fencing, etc, have been used in a number of circumstances to assist in minimising wetland pressures by restricting access, controlling uses/recreational activity, etc. These management actions allow for the specification of narrower buffers but are useful to ensure minimisation of wetland pressures, particularly when HES wetlands are involved.

In addition to the recommendations above, the following are also made to further support intent for the protection of wetland values and to ensure the success of buffer application:

- a. A low impact pathway may be located within the wetland separation area; however, drainage must be engineered in line with earlier stormwater management recommendations, and the pathway footprint should be as narrow as practical and located at the outer side of the wetland separation area (at least within the outer 50% of the wetland separation area). This could be combined with low fencing/bollards on the wetland side to control use/recreation within the buffer areas.

2.1.3 Authorship

The initial wetlands assessment and buffer determination at Vixies Road, Wonga Beach (RPS 2011) was undertaken by Dr Paul Clayton. This response to information requests has been prepared by Dr Paul Clayton.

With respect to DEHP concerns that the wetland values were not considered in line with State Planning Policy 4/11 and/or that wetland buffer determination was not undertaken in line with the wetland buffer guidelines, the following is provided by way of assurance. Dr Paul Clayton, prior to joining RPS, was a member of the DEHP (formerly DERM and formerly EPA) wetlands program team and was responsible for the following:

- a. Architect and primary author in the development and implementation of AquaBAMM, the state's current method for aquatic/wetland values assessment (Clayton *et al* 2006). The results of Aquatic Conservation Assessments (ACA) using AquaBAMM are the foundation for identification of HES wetlands. That is, the DEHP referable wetlands mapping, including HES wetlands, relies upon ACA results that identify 'high' and 'very high' value wetlands.
- b. Joint author and technical contributor in the Queensland Wetlands Classification and Mapping Method, including initial development of the primary wetlands classification key.
- c. Joint author and technical contributor of the Queensland Wetland Buffer Guidelines.

With this technical background, Dr Paul Clayton has an intimate understanding of Queensland's wetland mapping, the identification and values for HES wetlands, and the requirements for determination of appropriate wetland buffers. RPS can assure DEHP that this knowledge and experience was brought to bear in assessing the Vixies Road development site.

2.2 Ecological Values - Vegetation (DEHP Item 6)

The site at Vixies Road is already completely cleared and has been used for livestock grazing for many years. Clearing is not proposed, or indicated by any recommendations with respect to wetland buffers, within the HES wetlands or the wetland buffer areas.

2.3 Ecological Values – Pest and Invasive Species (DEHP Item 8)

No response required. There were no proposals to manage the HES wetlands on the eastern or western sides of the Vixies Road site that included rehabilitation or weed/pest removal. The HES wetlands have been assessed and appropriate buffers recommended that will protect the values of the wetland ecosystems.

3.0 Cairns Regional Council Information Request Response

3.1 Setback Distances And Wetland Impacts (Council Item 5)

In Item 5 of the Cairns Regional Council request for further information, the issue of providing an adequate wetland buffer size (setback distances) to protect the values of the mapped HES wetlands is raised. Reference is made to State Planning Policy 4/11 and the Qld Wetland Buffer Guideline 2011. This section provides additional detail to respond to Council concerns and draws, where relevant, on text already prepared and included in the earlier wetlands report.

The wetland buffer determination and discussion provided above in **Section 2.1** is relevant and is provided to Council in response to their request for further information.

3.1.1 Re FNQ Regional Plan

As discussed in Section 1.1, Part 7.1 of the Far North Queensland Regional Plan, which relates to the Protection of waterways, wetlands and water quality, still has effect in relation to the HES Wetlands which are located along the western boundary and adjacent to the north-eastern portion of the site. It is further noted that Part 7.1 of the Far North Queensland Regional Plan refers to HES Wetlands and Wetlands of General Ecological Significance and that there are no Wetlands of General Ecological Significance relating to the site (refer to the Areas of Ecological Significance Mapping provided for reference in the Wetland Assessment lodged in support of the development application). Hence, the Regional Plan's provisions relating to HES Wetlands are relevant to the site and it is confirmed that the wetland assessment and buffer determination adequately addresses the Regional Plan's wetland protection provisions. The Regional Plan refers to the state's process for managing HES wetlands and to the state's Wetland Buffer Guideline. These policies and procedures were considered directly in the Vixies Road assessment and recommendations.

3.1.2 Re Vegetation

As indicated in Section 3.1.1 above, the Far North Queensland Regional Plan's provisions relating to HES Wetlands are relevant to the site and it is confirmed that the wetland assessment and buffer determination adequately addresses the Regional Plan's wetland protection provisions. The Regional Plan refers to the state's process for managing HES wetlands and to the state's Wetland Buffer Guideline. These policies and procedures were considered directly in the Vixies Road assessment and recommendations (refer to Section 2 of this assessment for detail) and a further detailed vegetation assessment was not necessitated to adequately address the Regional Plan's wetland protection provisions.

3.1.3 Re Hydrology

Refer to the investigation and report prepared by BMT WBM, the Wonga Beach Integrated Stormwater Management Plan (BMT WBM 2012), with respect to the hydrological detail sought by Council.

3.1.4 Authorship/Assurance

The initial wetlands assessment and buffer determination at Vixies Road, Wonga Beach (RPS 2011) was undertaken by Dr Paul Clayton. This response to information requests has been prepared by Dr Paul Clayton.

With respect to DEHP concerns that the wetland values were not considered in line with State Planning Policy 4/11 and/or that wetland buffer determination was not undertaken in line with the wetland buffer guidelines, the following is provided by way of assurance. Dr Paul Clayton, prior to joining RPS, was a

member of the DEHP (formerly DERM and formerly EPA) wetlands program team and was responsible for the following:

- a. Architect and primary author in the development and implementation of AquaBAMM, the state's current method for aquatic/wetland values assessment (Clayton *et al* 2006). The results of Aquatic Conservation Assessments (ACA) using AquaBAMM are the foundation for identification of HES wetlands. That is, the DEHP referable wetlands mapping, including HES wetlands, relies upon ACA results that identify 'high' and 'very high' value wetlands.
- b. Joint author and technical contributor in the Queensland Wetlands Classification and Mapping Method, including initial development of the primary wetlands classification key.
- c. Joint author and technical contributor of the Queensland Wetland Buffer Guidelines.

With this technical background, Dr Paul Clayton has an intimate understanding of Queensland's wetland mapping, the identification and values for HES wetlands, and the requirements for determination of appropriate wetland buffers. RPS can assure DEHP that this knowledge and experience was brought to bear in assessing the Vixies Road development site.

4.0 References

Clayton, P.D., Fielder, D.P., Howell, S. and Hill, C.J. (2006). Aquatic Biodiversity Assessment and Mapping Method (AquaBAMM): a conservation values assessment tool for wetlands with trial application in the Burnett River.

Annexure I

DERM – Information Request

Information request

This notice is issued by the Department of Environment and Resource Management pursuant to section 276 of the Sustainable Planning Act 2009 ("the Act").

Wonga Beach Aquaculture Resort Pty Ltd
C/- RPS Australia East Pty Ltd
PO Box 1949
CAIRNS QLD 4870

Attn: Owen Caddick-King

cc. Chief Executive Officer
Cairns Regional Council
PO Box 359
CAIRNS QLD 4870

Attn: Neil Beck
Assessment manager reference:
8/13/1625 (3255378)

Our reference: 279643 (IC0911CNS0006)

Re: Application for development approval

1. The Chief Executive, Department of Environment and Resource Management (DERM) as a concurrence agency requests the applicant to give further information needed to assess the application. That further information is stated in the attached information request.

2. Application Details

Date application made or referred to DERM: 1 September 2011

Development approval applied for: Development Permit

Aspect(s) of development:

Reconfiguring a lot - Land in a Great Barrier Reef wetland protection area	<i>Sustainable Planning Regulation 2009</i> - Schedule 7, table 2, item 43A	DERM Ref No – 279643 DERM Permit No - SPCC02679411
Reconfiguring a lot - Land in or near a wetland	<i>Sustainable Planning Regulation 2009</i> - Schedule 7, table 2, item 43	DERM Ref No – 279643 DERM Permit No - SPAR02679211
Various aspects of development - Acid sulfate soils	<i>Sustainable Planning Regulation 2009</i> - Schedule 7, table 3, item 3	DERM Ref No – 279643 DERM Permit No - SPAR02679311

Development description: Reconfiguring a lot (1 lot into 99 lots).

Property/Location description: Lot 51 on SP155078, described as Vixies Road,
Wonga Beach QLD 4873

3. The application will lapse unless the applicant gives the assessment manager or concurrence agency a response to the information request under section 278 of the Act which requires such response to include a written notice to the requesting authority stating:
 - (a) all of the information requested is provided; or
 - (b) part of the information requested is provided, and to proceed with assessment of the application; or
 - (c) the applicant does not intend to supply any of the information requested, and to proceed with assessment of the application.
4. A response to the information request must be given to Cristina Cochenec, the Project Manager, at the address stated below.



Delegate

Cristina Cochenec
Natural Resource Officer
Department of Environment and Resource Management
14 September 2011

Enquiries:

Cristina Cochenec
Department of Environment and Resource Management
5b Sheridan Street, Cairns QLD 4870
PO Box 937, Cairns QLD 4870
Phone: 07 4222 5446
Fax: 07 4222 5493
Email: cristina.cochennec@derm.qld.gov.au

Attachment – Information Request

Information Request

DERM Ref. No: 279643
DERM Permit No: SPCC02679411

The Department of Environment and Resource Management (DERM) assesses development applications involving high impact earthworks in or adjacent to wetlands of high ecological significance (HES wetlands) in Great Barrier Reef catchments to prevent the loss or degradation of the hydrological and ecological values of the wetland. As part of the assessment requirements, your application will be assessed against the Specific Outcomes of the *Temporary State Planning Policy 1/11 – Protecting Wetlands of High Ecological Significance in Great Barrier Reef Catchments* (the TSPP).

A copy of the Policy, Guideline and associated information can be obtained from the DERM website on: <http://www.derm.qld.gov.au/wildlife-ecosystems/ecosystems/wetlands-spp.html>

An initial review of your application has determined that additional information addressing the TSPP is required. Details of the specific information required are set out below:

1. Development Positioning

Two (2) HES wetlands occur on or adjacent to Lot 51 on SP155078.

Please provide a map showing the HES wetlands and proposed buffers with an overlay of the subdivision and proposed lots to demonstrate that the development is located outside the mapped boundary of the identified HES wetlands. This map should clearly show the location of all proposed high impact earthworks.

2. Buffer

While Council has granted a Preliminary Approval over the land for a Material Change of Use, for the purposes of this assessment DERM considers that the site is not an urban area. An urban area is defined in the *Sustainable Planning Regulation 2009* as:

- (a) an area identified in a gazette notice by the chief executive under the Vegetation Management Act as an urban area; or
- (b) if no gazette notice has been published – an area identified as an area intended specifically for urban purposes, including future urban purposes (but not rural residential or future rural residential purposes) on a map in a planning scheme that –
 - (i) identifies the areas using cadastral boundaries; and
 - (j) is used exclusively or primarily to assess development applications.

As the development is located outside an urban area a minimum buffer width of 200 metres should be provided to satisfy the TSPP, unless an alternative buffer is approved by DERM.

Acceptable Outcomes 2.2 and 2.3 of the TSPP allows for an alternative buffer to be provided and maintained, the width of which must be supported by an evaluation of the values, functioning and threats to the wetland. This evaluation requires a detailed site-specific investigation to assess the values present in the wetland, and the nature of the works and threats posed by development.

The *Wetlands Assessment: Vixies Road, Wonga Beach* (prepared by RPS, July 2011), included in the development application, recommends a minimum 15 metre buffer from the top-of-bank. This report does not

provide sufficient information to support the claim that a 15 metre buffer is a suitable alternative to a 200 metre buffer. In reference to Acceptable Outcome 2.2 and 2.3 of the TSPP, please provide details on the provision, maintenance and protection of an adequate buffer between the development and HES wetland. A link to the *Queensland Wetland Buffer Planning Guideline* (2011) is attached for your information:
<http://www.epa.qld.gov.au/wetlandinfo/site/ManagementTools/Guidelines/bufferguidelines.html>

Furthermore, it is noted that a pathway may be constructed within the proposed wetland buffer area. Please provide details of any earthworks or structures that are proposed within the buffer area, and demonstrate how these will avoid any impacts to the function of the buffer.

3. Hydrology

The development application states that '*final stormwater management measures are subject to further detailed engineering design*', and that the 'design intent' includes partial management of stormwater flows through the provision of a rubble drainage pit on each lot, draining to open grass swale drains located within the road reserves.

Please provide details of proposed stormwater management measures across the site, as well as any other earthworks or structures that may divert water to or from the HES wetlands, and demonstrate how they will avoid or minimise impacts to the surface water hydrological regime of these wetlands.

4. Groundwater

Please demonstrate that the water table and hydrostatic pressure within the wetland protection areas will not be lowered or raised outside the bounds of natural variability under existing conditions by the development.

OR

Please provide details as to how the development will return the water table and hydrostatic pressure of the wetland to its natural state and will not result in the ingress of saline water into any freshwater aquifers.

5. Water Quality – Stormwater

The development application states that '*a management plan will be implemented prior to construction works being undertaken on site which will be able to address the specific outcomes*'.

Please provide details as to how the buffer and water quality values of the HES wetlands will be protected from stormwater impacts. Utilising the HES wetlands for stormwater treatment will not satisfy the requirements of the TSPP.

Development, including increased runoff from impervious surfaces, should not result in any measurable change to the quality and quantity of stormwater entering the HES wetland during construction or operation.

It is recommended that an erosion and sediment control strategy also be prepared by a suitably qualified person. This strategy should consider the impacts on water quality during the construction and operation of the development, including how sediment and erosion will be controlled in both dry and wet seasons.

6. Ecological Values – Vegetation

The application states that no clearing is proposed within the HES wetland or buffer area, however it is noted that a walking trail is proposed within the buffer area. Please demonstrate that vegetation clearing will not occur within the HES wetlands and associated buffer areas.

8. Ecological Values – Pest and Invasive Species

It is noted that revegetation with endemic species is proposed within the central watercourse (a mapped wetland management area). Please indicate if other areas, including the HES wetlands and their associated

buffers, are to be revegetated. In any revegetation efforts, species of local provenance are preferred to reduce the risk of exotic flora invading and establishing in and adjacent to HES wetlands.

It is also noted that the application states that '*development of the site represents an opportunity to reduce or eliminate weed infestation in wetland and vegetation areas*'. Please provide information on how weeds will be removed (i.e mechanical or chemical techniques) and disposed of, the areas that will be subject to weed removal efforts, and potential impacts to HES wetlands as a result of this strategy.

Please provide details on how the development will avoid or minimise the threat of introduction of non-native or pest species that pose a risk to the ecological values and processes of the HES wetlands.

9. Noise, Light and Visual Disturbance


During construction and operation the development has the potential to impact on wetland fauna, particularly wetland bird species, as a result of noise, light and visual disturbances. Please provide details of how lighting, noise and visual disturbances will be controlled and managed, both during construction and operation, to avoid or minimise impacts on wetland fauna values.

10. Operational Management, Maintenance and Monitoring

It is noted that the development application states that '*it is expected that the requirement for an operational management plan would be necessarily required by Council prior to undertaking Operational Works on the site*'.

Please provide details of ongoing management, maintenance and monitoring that will be undertaken to ensure adverse effects on hydrology, water quality and ecological processes of a HES wetland are avoided or minimised during the construction and operation of the development.

Delegate


Cristina Cochennec
Natural Resource Officer
Department of Environment and Resource Management
14 September 2011

Enquiries:

Rochelle Basham
Department of Environment and Resource Management
187-209 Stanley Street, Townsville QLD 4810
PO Box 5318, Townsville QLD 4810
Phone: 07 4799 7750
Fax: 07 4760 7436
Email: rochelle.basham@derm.qld.gov.au

Annexure 2

Cairns Regional Council – Information Request



8 September 2011

ENQUIRIES: Neil Beck
PHONE: (07) 4044 3548
FAX: (07) 4044 3836
YOUR REF: 9339/OCK/KK/L69705
OUR REF: 8/13/1625 (3307055)

RECEIVED
12 SEP 2011

BY:

Wonga Beach Aquaculture Resort Pty Ltd
C/- RPS Australia East Pty Ltd
PO Box 1949
CAIRNS QLD 4870

Attention: Owen Caddick-King

Dear Sir,

**INFORMATION REQUEST - RECONFIGURING A LOT (1 LOT INTO 99
LOTS) VIXIES ROAD, WONGA**

Reference is made to the above matter. After a preliminary examination of the above application, it is apparent that the proposed reconfiguration plan has given little regard to the conditions of the Preliminary Approval with specific reference to setbacks, drainage and flooding constraints, road reserve widths (public transport) and the ability to service the development with particular reference to effluent disposal.

A comprehensive response to each condition of the Preliminary Approval is requested. In addition, the following information is required in conjunction with addressing conditions of the Preliminary Approval.

1. Acknowledging that the DHI International flood study was originally undertaken for Council, the input parameters adopted at that time have since been superseded and does not suitably address or represent best practice for the development of coastal areas. It is considered that the study has very limited applicability for determining levels in new developments.

An updated study must be undertaken. The updated study is to adopt a tail water level of 2.73m AHD at the ocean outlet and is to model the full extent of the drainage path(s) between the development and the outlet.

In addition, the updated local drainage study of the site must determine the drainage impacts on properties / areas external to the site.

In particular, the study must address the following:

- a. The contributing catchment boundaries;
- b. The extent of the 100 year ARI flood event in relation to the site both pre and post development;
- c. Primary and secondary flow paths for the 2, 5, 10 and 100 year ARI flood events, (Reference is made to Section 6.3.1 of the DHI International flood study advising on a "network of overland flow paths" throughout the catchment area);
- d. Identify any requirement for drainage easements;
- e. Identify the need and tenure for flood detention areas to ensure a no worsening impact on downstream properties for the entire development. Particular regard is to be given to the impact of development on the high storage and extensive groundwater infiltration that is currently occurring within the site;
- f. Information on the proposed works and any impacts proposed at the drainage outlet from the proposed development;
- g. The stability and integrity of the principle drainage line (north-south alignment) in the western portion of the site to determine suitable setbacks.

Amend the layout plan accordingly.

2. Provide further information addressing the policy intent of the Queensland Coastal Plan and the State Planning Policy with respect to how the development responds to the adverse impacts of storm tide inundation and sea level rise. In particular, a risk assessment of sea level rise (0.8 metres by 2100) and a storm tide event greater than 1 metre must be undertaken along with an adaptation strategy demonstrating that the development can be mitigated against such impacts through location, design construction and operating standards.
3. Provide a detailed contour plan clearly identifying the contours within the various drainage swales within the site and the drainage line adjacent the western boundary in order to determine / clarify the top of bank and provide substantiation for the nominated location. Some areas within the survey do not appear to support the nomination of this line as representing the top of bank with grouping of contours indicating steeply sloping banks outside the nominated alignment of top of bank.

The detailed contour plan must nominate the boundary of Lot 51 and the existing line of vegetation adjacent both the eastern and western boundary and for vegetation contained within the site. The plan must also identify the area which is mapped as remnant vegetation for comparison purposes.

4. The layout of the development does not reflect the drainage regime of the site and the notion of filling 50% of the residential lots is not supported. All residential lots must be filled to achieve Q100 flood immunity to a level as determined by the drainage study.

The revised lot layout will require significant filling to achieve grading and drainage of the site in accordance with the outcomes of the drainage study. Information in the form of a Site Works Plan identifying existing surface contours and proposed finished surface contours is to be provided. The Site Works Plan is to identify the height of fill batters and be represented as coloured contour plans i.e contour the fill height depths. All lot must drain to road frontages and avoid rear allotment drainage.

5. In determining the development footprint, please note that the supporting ecologist's report does not contain sufficient detail in accordance with Policy 7.1 of the FNQ Regional Plan to support the setback distances being proposed from the declared wetlands. Given the lack of detail, concern is raised with respect to other environmental factors and hydrological characteristics of the wetlands, and the likely impact that the development will have on the declared wetlands. It is requested that the layout plan be amended to comply with the generic setbacks from the wetlands or provide an updated report which adequately addresses the following:

Vegetation

- a. Quality of vegetation with species identified including rare and threatened species, width of riparian vegetation, how the current vegetation can maintain bank stability and prevent erosion, rehabilitation of riparian vegetation where necessary, fauna and habitat values.

The report must also investigate and provide comment on the existing vegetation located adjacent the northern boundary and central to the site. Opportunities to retain this vegetation is to be explored as part of the development.

Hydrology

- b. Provide additional information addressing wetland hydrology (recharge and discharge) and how proposed development will effect these processes, effect on wetlands from run-off and measures to ensure urban development does not negatively affect water quality (WSUD), downstream effects over time.

In addition, provide information concerning the management of wetland fauna including crocodiles (proposed stormwater detention areas) and monitoring of the impact of the development on wetland quality.

6. Undertake a review of the development footprint. The layout appears to encroach within the buffer zones and appears to be inconsistent with the representations in other parts of the submission. This includes the representations in the wetland report.

Please note that all wetland buffer areas are to be clear of development including residential lots, road reserves, fill batters, drainage or other associated infrastructure.

7. Provide revised Master Plans reflecting the current lot layout or amended lot layout as a consequence of the information request. The Master Plans lodged in support of the application show an earlier road and lot layout that is quite different from the current proposed layout.

The Master Plans are to be reviewed to ensure consistency between the representations that have been made in the various reports and conditions of the Preliminary Approval. For example the Wetlands report recommends that stormwater be directed away from the mapped wetlands towards the centre of the site (section 2.3.3 of the Wetlands assessment). The Wetlands assessment also nominates minimum buffers that the Master Plans will need to respect unless otherwise determined by Information Request Item 4.

8. Provide a staging plan in accordance with Condition 9 of the Preliminary Approval.
9. Rationalise the layout for Lots 96 – 99 to provide appropriate road frontage and dimensions consistent with the Preliminary Approval.
10. A traffic impact assessment to be submitted in accordance with Austroads guide to Traffic Management Part 12 "Traffic Impacts of Development" prepared by a suitably qualified and experienced Traffic Engineer which includes but is not limited to the following:
 - a. The prediction of road traffic generated by the proposed development;
 - b. Traffic distribution and travel patterns;
 - c. Analysis of the impact of the increased development related traffic on Council roads (cross sections) and intersections between the development and the highway and identification of any mitigation works required to mitigate these impacts;
 - d. Analysis of expected traffic volumes on Snapper Island Drive and suitability of the existing road and nearby intersections to carry this level of traffic;
 - e. Details of the proposed layout and an analysis of intersections at the entrance and exit points of the development that connect on to the existing Council roads, particularly at Vixie Road/Connector Road as the proposed plan has only one access onto Vixie Road.
 - f. Amend the road reserve width of the Minor Collector to have a minimum road reserve width of 20 metres;
 - g. How the connector road is to cross the creek (connection from lot 56 to 84);
 - h. Detail pedestrian and cyclist movements to and from the development;
 - i. Analysis of internal traffic circulation and accommodation of pedestrian and cycle facilities; and
 - j. Any staging of the development and road construction to be outlined along with expected traffic distributions during each stage of the development.
11. Water and Waste is of the opinion that the site should be connected to town services for water and sewerage. On-site treatment and disposal is

considered problematic on this site for a number of reasons including flooding, cumulative impacts, design and management. Consequently the following further information is on the basis of connecting the site to town services.

- a. Provide a sewerage design report outlining how sewage generated from the site will be conveyed to and serviced by Council's existing sewerage infrastructure, and identify any pump stations, rising mains, trunk mains and treatment facilities (Mossman Treatment Plant) are required to be constructed or upgraded to cater for the development.
- b. Provide a water design report outlining how Council's existing water supply infrastructure can cater for the increased demand generated by the development and identify any upgrades that are required to be undertaken by the Developer.

12. Should on-site treatment be pursued, the following information is required

- a. An on-site treatment and disposal evaluation report prepared by a recognised expert in the field such as Simmons and Bristow and Gilbert Sutherland.
- b. The report being comprehensive and as a minimum includes the following:-
 - (i) A detailed evaluation of lot based on-site effluent disposal system and community based effluent disposal systems;
 - (ii) MEDLI modelling to assess the suitability of both the lot and community based on-site effluent disposal system;
 - (iii) Analysis of site constraints in terms of land area, setback distances, groundwater table, groundwater quality, wet weather storage requirements and soil types;
 - (iv) Solutions to enable effluent disposal to land to be incorporated in the development;
 - (vi) Design of effluent disposal area; and
 - (vii) Management and ownership strategies and control measures to ensure performance of the system design.
- c. A flood study that will confirm flood constraints on the site consistent with proposed on-site system.

Should you require any further information or assistance, please contact Mr. Neil Beck of Council's Development Assessment Team on telephone number (07) 4044 3548.

Yours faithfully

A handwritten signature in black ink, appearing to be 'KR', with a horizontal line and a diagonal stroke.

Kelly Reaston

Manager Development Assessment

Attachment I

Reconfiguration Proposal Plan

Site boundary

Toe of frontal dune
Approximated from edge of Remnant Vegetation

Erosion prone area boundary
10m from toe of frontal dune or HAT, whichever provides the greater erosion prone area

Eastern edge of developable area
Limited to Highest Astronomical Tide RL 1.78 AHD or edge of DERMs Referrak Agency Response Plan

Top of bank
From field survey

Setback from HES Wetland. (20m from M...)
(20m from T...)

DERM Referral Agency Response (Vegetation) Plan
Final RARP 2009/006473

Dominant Remnant of Concern
Regional Ecosystem 2003 RE Mapping
Approximate location

6m Setback from Road Frontage

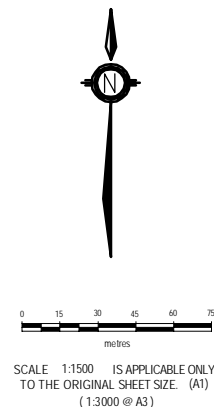
10m Setback from Mapped Remnant V...
No new lot boundaries or roads are permitted wit...

20m Setback from Mapped Remnant V...
No building development is permitted within 20 m...

15m x 20m Minimum Building Envelope

50m x 50m Rural Settlement Minimum

Total Site Area	38.93 ha
Total No. of Allotments	99
4000m ² +	average 140m ²
2000m ² +	92
2000m ² +	average 216m ²
Total Open Space	10.4 ha
Active Open Space	2.25 ha
Passive Open Space	5.86 ha
DERM Vegetation Plan	2.29 ha
Total Length of New Road	3145 m
15.5m Wide Road	1951 m
20m Wide Road	1194 m
Area of New Road Reserve	5.71 ha



1. This plan was prepared for the sole purposes of the client for the specific purpose of accompanying an application to the Cairns Regional Council for a reconfiguration of all of the land described on this plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will be used for any other application, purpose, use or matter. The plan is presented without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
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 - F. lodgement of this plan with any local authority against the recommendation of RPS Australia East Pty Ltd;
 - G. the accuracy, reliability, suitability or completeness of any approximations or estimates made or selected to by RPS Australia East Pty Ltd in this plan.
3. Without limiting paragraph 1 or 2 above, this plan may not be copied, distributed or used for any purpose, process this plan may not be relied upon for the plan.
4. Scale shown is correct for the original plan and any copies of the plan should be verified by checking against the bar scale.
5. The dimensions, area, size and location of improvements, flood information (if shown) and number of lots shown on this plan are approximate only and may vary.
6. Cadastral boundaries are obtained by file dimensions and DCDB. These boundaries have not been verified and are approximate only.
7. The contours shown on this plan are by field survey and are suitable or for the purposes of this application. The accuracy of the contours has not been verified and no reliance should be placed upon such contours for any purpose other than for the purpose of this application for a material change of use of land.
8. The contents of this plan are conceptual only, for approval purposes. All lots, features, areas and dimensions are approximate only. Subject to relevant studies, Survey, Engineering and Government approvals.
9. Survey base information has been compiled from the merger of detail surveys carried out over the site at various times from 1864/2000 to 17/1/2006.
10. RPS Australia East Pty Ltd takes no responsibility for any differences found between original data and current values.

<u>Stage</u>	<u>No Lots</u>
1	14
2	11
3	13
4	12
5	12
6	10
7	15
8	12
<u>Total</u>	<u>99</u>

AMENDMENTS
A: Amend lots and statistics
B: Amend lots and statistics
C: AMK: Amend lots and statistics per mapped vegetation setbacks
D: RMW: Add Stage Nos
E: AMK: Revise lots 95-99
F: AMK: Revise HES setback - lots 61-63 & 80,82,83,85,89,92,96-98.
F: AMK: Revise connector road width.

PROJECT MANAGER O. DALTON		SURVEYED
COMPILED JLS		CAD REF 9339-20g.DWG 6174106a.amk.dtm2.CC)
SHEET SIZE A1	SHEET 1 OF SHEETS 1	

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WONGA BEACH AQACULTURE
RESORT PTY LTD

RECONFIGURATION
PROPOSAL PLAN
LOT 51 ON SP155078
WONGA BEACH

SCALE	DATE	DRAWING NO.	ISS
1:1500	14/3/2013	9339-20	0



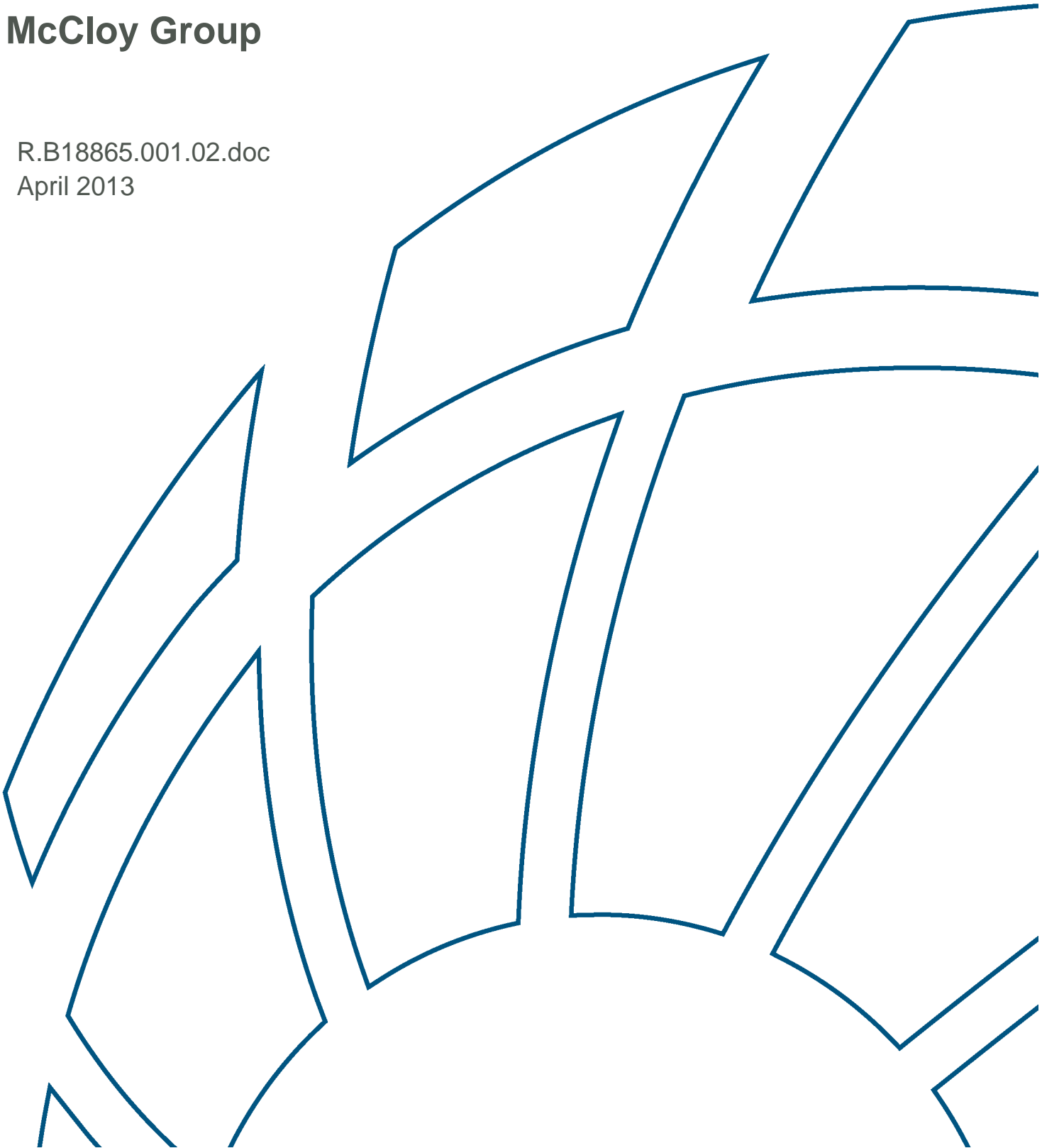
Attachment C

Stormwater Management Plan

Wonga Beach Integrated Stormwater Management Plan

**prepared for
McCloy Group**

R.B18865.001.02.doc
April 2013



Wonga Beach Integrated Stormwater Management Plan

Prepared For: McCloy Group

Prepared By: BMT WBM Pty Ltd (Member of the BMT group of companies)

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Ian Clark

Project Manager :

Client : McCloy Group

Client Contact: James Goode



Client Reference

Title : Wonga Beach Integrated Stormwater Management Plan

Authors: Ian Clark, Anthony Charlesworth, Paul Dubowski, Brad Dalrymple and Lucy Peljo

Synopsis : This report presents the stormwater management strategy for the proposed Wonga Beach development located on Lot 51 on SP155078, Vixies Road, Wonga. It has been prepared in response to conditions of the Preliminary Approval for the development as well as to respond to Council's Information Request.

REVISION/CHECKING HISTORY

REVISION NUMBER	DATE OF ISSUE	CHECKED BY	ISSUED BY
1	22/04/2013	LP 	IC 

DISTRIBUTION

DESTINATION	REVISION			
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McCloy Group	PDF	PDF	PDF	
BMT WBM File	PDF	PDF	PDF	
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SUMMARY

Wonga Beach Aquaculture Resort Pty Ltd (the Applicant), is proposing a rural residential development, at Wonga Beach which is located approximately 38 kilometres (by road) north of Port Douglas, Queensland. A Preliminary Approval for the development was issued by Cairns Regional Council and subsequent to this approval, a development application for a Reconfiguration of a Lot was lodged. An Information Request was then issued by Council which included requests from both Council and referral agencies regarding (*inter alia*), stormwater management for the site.

The *Wonga Beach Integrated Stormwater Management Plan (ISMP)* has been prepared in response to the conditions of the Preliminary Approval for the development as well as to respond to Council's Information Request. The report addresses 4 components of stormwater management including:

1. **Flood Impact Assessment** – this component includes a flood impact assessment of the site and adjacent drainage paths to the Coral Sea, including construction of a 1D/2D flood model, testing existing and developed site arrangements to investigate stormwater detention requirements.

Results and recommendations:

The flooding investigation for the site demonstrates that the site can be developed in such a way as to have no adverse flooding impacts on adjacent properties. Peak ARI flood levels and inundation extents for the ARI 100 year design flood event have been established. These levels will allow the determination of building envelopes in suitable locations and the setting of floor levels for residential dwellings. Consideration of storm tide and climate change has been considered within this assessment.

2. **Stormwater Quality Management Plan (SQMP)** – this component includes a stormwater impact assessment of the site including modeling of :
 - a. pre and post development stormwater quality
 - b. pre and post development wetland hydrology.

Results and recommendations:

Total pollutant load results were predicted with the use of the MUSIC modeling software to provide a representation of how the site will perform under different development and stormwater management scenarios.

To minimise the impact from the development, a water sensitive urban design (WSUD) treatment approach was taken. The mitigation measures proposed include **streetscape bioretention systems with filter areas sized at 1.8% of the urban catchment area and 5 kL domestic rainwater tanks on each lot.**

The modeling results show that with the integration of the proposed stormwater management strategy, the pollutant removal targets can be achieved. Specifically, the modeling results estimate that the treatment will achieve the following reductions when compared to the

developed case without treatment: 85% total suspended solids, 66% total phosphorus, 52% total nitrogen and 100% gross pollutants. Furthermore, the proposed development (and associated stormwater management strategy) is predicted to result in a decrease in total suspended solids, total phosphorus and total nitrogen pollutant load compared to the pre development case.

A detailed Erosion and Sediment Control Plan will be provided at the operational works stage of the development. This plan should address the objectives adopted by this report as a minimum standard.

With respect to the wetland hydrology, the assessment demonstrates that the design objectives will also be achieved. That is, the hydrologic impacts as a result of the development are expected to be suitably mitigated to avoid significant adverse impacts on the wetland ecology. However, a detailed ecological assessment of the wetland (and its sensitivity to changed hydrologic conditions) could be undertaken to further assess the potential for impact on wetland processes

3. **WSUD Principles Assessment** – this component includes a brief description of how the proposed development responds to the WSUD principles adopted for the site. A qualitative assessment of the design solutions against the principles was also undertaken to ensure that the principles had been suitably accounted for during the design process.

Results and recommendations:

The assessment of the proposed stormwater treatment solutions against the WSUD principles adopted for the site demonstrates that the solutions reflect all of the adopted WSUD principles.

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1 INTRODUCTION

1.1 Background

This Integrated Stormwater Management Plan (ISMP) has been prepared by BMT WBM on behalf of Wonga Beach Aquaculture Pty Ltd (the Applicant), in support of a rural residential development situated at Vixies Road and Snapper Island Drive, Wonga Beach (Lot 51 on SP155078), (hereafter referred to as 'the site').

A Preliminary Approval for a Material Change of Use of the land was issued by Cairns Regional Council (by way of a Negotiated Decision Notice dated 13 April 2011), and subsequent to this approval, a development application for a Reconfiguration of a Lot (dated 28 July 2011), had also been lodged. An Information Request (dated 8 September 2011), was then issued by Council which included requests from both Council and referral agencies regarding (*inter alia*), stormwater management for the site.

The *Wonga Beach Integrated Stormwater Management Plan (ISMP)* has been prepared in response to the conditions of the Preliminary Approval for the development as well as to respond to Council's Information Request. The specific information request items to which this plan responds includes items 1, 2, 4 (in part) and 5b.

Prior to drafting this report, two of the report authors (Ian Clark and Paul Dubowski) inspected the site, upstream and downstream catchments and surrounding developments.

1.2 Scope of Report

This report provides a preliminary assessment of stormwater-related requirements, opportunities and constraints for the proposed development. The report addresses 4 components of stormwater management including:

1. **Section 4: Flood Impact Assessment** – this component includes a flood impact assessment of the site and adjacent drainage paths to the Coral Sea, including construction of a 1D/2D flood model, testing existing and developed site arrangements to investigate stormwater detention requirements.
2. **Section 5: Stormwater Quality Management Plan (SQMP)** – this component includes a stormwater quality assessment which considers:
 - a. pre and post development stormwater quality
 - b. pre and post development receiving water hydrology (waterway stability and frequent flow management)
 - c. pre and post development wetland hydrology.
3. **Section 6: WSUD Principles Assessment** – this component includes a brief description of how the proposed development responds to the WSUD principles adopted for the site.

2 SITE DESCRIPTION

2.1 Location

The site is located at Vixies Road and Snapper Island Drive, Wonga Beach (Lot 51 on SP155078) and has total area of 38.88 Ha. The site boundary and its location (approximately 39 kilometres by road north of Port Douglas, Queensland), is shown on Figure 2-1.

2.2 Land Use

Existing Case

The site is predominantly cleared and currently used for residential purposes including the development of cabins in accordance the resort development approved for the site. The site is also used for cattle grazing. An aerial photo of the existing site is provided in Figure 2-2.

Developed Case

The Development Application seeks a Development Permit for the Reconfiguration of a Lot of the land into rural residential, intended for residential use. A portion of the site is to remain undeveloped and be retained as 'active open space', 'passive open space' and 'Dominant Remnant of Concern Regional Ecosystem'.

A layout plan showing an indicative, conceptual layout is provided in Figure 2-3.

2.3 Site Topography & Drainage

Existing Case

The site is characterised by low sandy plains marked with gently undulating grassy beach swales running south-north on lower ground. Site elevation ranges between approximately 2.0 - 4.0 m Australian Height Datum (AHD) (see Figure 2-4), with a gentle slope from west to east. A vegetated sandy watercourse runs from south to north across the western portion of the site towards and existing culvert on Vixies Road. A wetland of conservation significance is located within this swale.

Two more vegetated sandy swales are located along the eastern and western boundaries of the site and another wetland of conservation significance is located within each of these swales (external to the site). A detailed description of the wetland vegetation is provided in the Wetland Assessment (RPS, 2011). There are also four artificially constructed lakes on site which are groundwater fed.

Developed Case

The proposed development will primarily consist of rural residential lots and access roads throughout the site. Areas of open space are proposed along with Open Space/Drainage areas incorporating DERM's RARP area. Appropriate buffers are also proposed adjacent to wetlands and areas of mapped remnant vegetation.

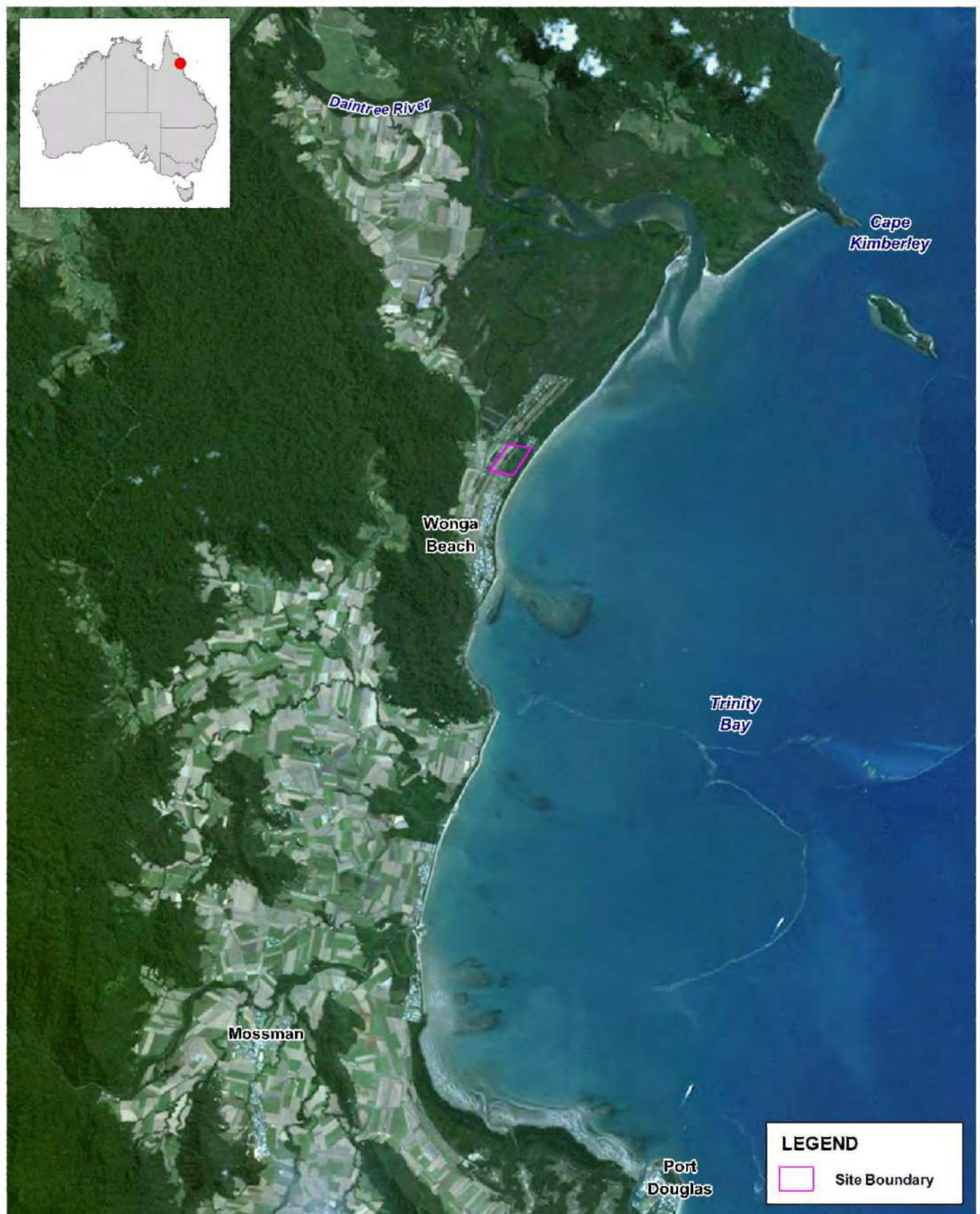
In areas of potential flood inundation, it is proposed to provide a filled building envelope area to a level that will provide immunity against flooding and or storm tide inundation for residential dwellings.

The two artificial lakes in the south west of the site are proposed to be filled while the two lakes in the north east of the site and the wetland (with buffer), are proposed to be retained.

2.4 Soils and Groundwater

Geotechnical investigations undertaken by Natural Solutions (2008) indicate that topsoil is a silty sand, fine to coarse grained and of medium density. The underlying strata is sand with a fine to coarse/gravel grain structure of medium density. The predominant soil type based on grain analysis was sand. The Natural Solutions report states that “gravelly sand lithology permits high infiltration rates to groundwater and significantly aid site drainage.”

Groundwater was frequently encountered by Natural Solutions across the across the low sandy plains of the site. Levels varied slightly ranging between 0.55 meters to 1.8 meters below ground level (Natural Solutions, 2008). These levels would be expected to fluctuate between seasons.



LEGEND

Site Boundary

Title:
Location of Site

Figure:
2-1

Rev:
A

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.



0 2.5 5km
Approx. Scale



Filepath: J:\B18865_I_GML_WongaBeach\DRG\ESG_001_120913 Locality Map.wor



Title:
Aerial Photo of Existing Site

Figure:
2-2

Rev:
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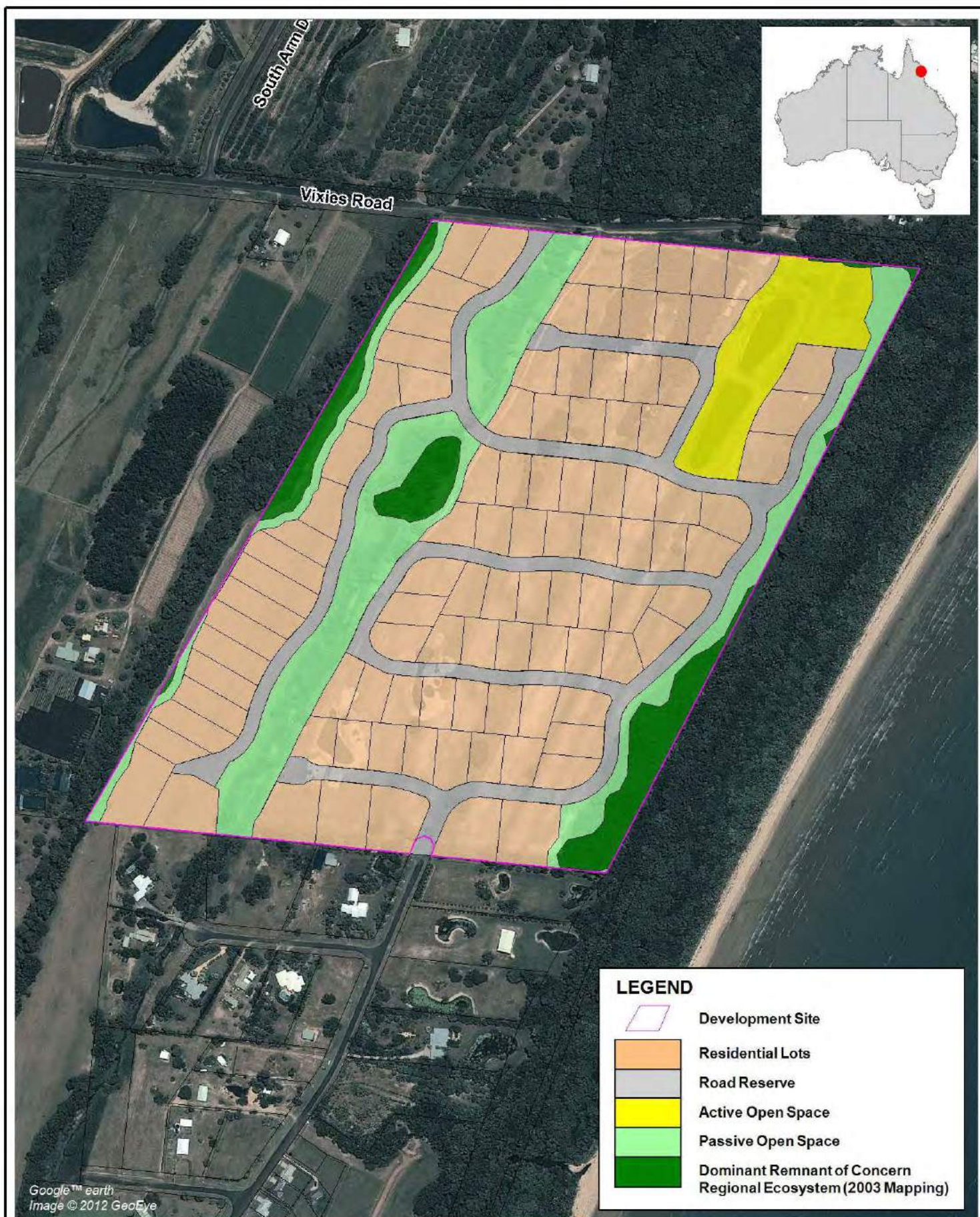
BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.



0 100 200m
Approx. Scale



Filepath : J:\B18865_I_GML_WongaBeach\DRG\ESG_006_121005 Aerial Photo of Site.wor



Title:
**Preliminary Conceptual Development Layout
- Subject to Change**

Figure:
2-3

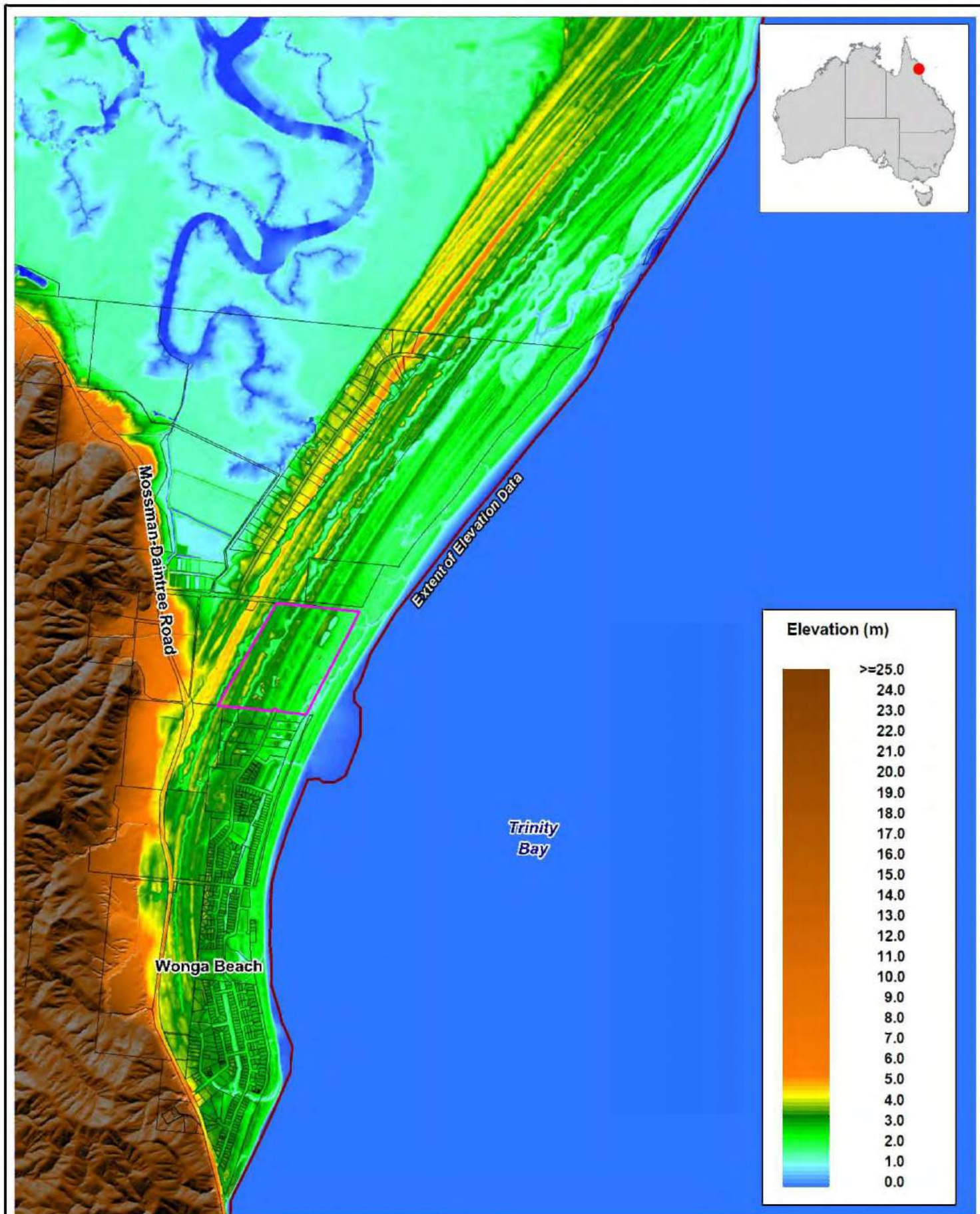
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0 100 200m
Approx. Scale





Title:
Digital Elevation Model of Existing Site

Figure:
2-4

Rev:
A

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0 0.5 1km
Approx. Scale



Filepath : J:\B18865_I_GML_WongaBeach\DRG\ESG_002_120913 Existing Topography Map.wor

2.5 Climate

Wonga is located within the wet-tropics climate zone. Table 2-1 provides a summary of climate statistics from the Bureau of Meteorology (BOM) station Cairns Aero (Station 031011). This rainfall station is located approximately 70 km south of the site. Although there are other stations located closer to the site, the Cairns Aero station has the least amount of missing data and accumulated data and is therefore the more reliable. Further, given the proximity to the coast, similar topography and relatively close proximity of this rainfall station to the site, the climate data is expected to be representative of climate at the site.

Table 2-1 Summary of Climate Statistics from the Cairns AERO

Parameter	Month												Annual Average
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	
Mean maximum temperature (°C)	31	31	31	29	28	26	26	27	28	30	31	31	29
Mean minimum temperature (°C)	24	24	23	22	20	18	17	17	19	21	22	23	21
Mean 3pm relative humidity (%)	66	69	67	65	64	61	58	56	55	57	60	62	62
Mean rainfall (mm)	396	455	428	197	90	46	29	27	34	47	95	181	2027
Mean number of days of rain >1mm	16	16	16	15	10	7	5	5	5	6	8	11	119

(Source: BoM, 2012)

As can be seen from the table, the region experiences hot and humid summers and milder dryer winters. Rainfall is exceptionally high during the wet season (January to March), when the majority of rainfall occurs and there is a distinct dry season from July through to August.

The monsoon trough is close to Wonga from December to March bringing with it warm to hot, humid conditions and the possibility of thunderstorms and tropical cyclones. The cyclone season is normally confined to between December and April but exceptions do occur (BOM, 2012).

3 OPPORTUNITIES & CONSTRAINTS FOR STORMWATER MANAGEMENT

3.1 Site Opportunities

There are a number of opportunities presented for the application of stormwater quality and quantity controls, as described below:

- **Layout – A layout, similar to the conceptual** layout shown in Figure 2-3, offers a number of open space areas where stormwater management systems could feasibly be integrated (if topography was suitable). The extensive road frontage for these open space areas also assists in facilitating end of pipe treatment systems.

The proposed allotments are also larger than 'typical' low density residential lots with wider frontages. This allows for the consideration of linear treatment systems in the road reserved. Allotments of this size generally result in low levels of pervious surfaces which results in higher infiltration and a reduction in the size of stormwater treatment systems.

The proposed east-west alignment of most of the proposed roads is commensurate with the existing drainage. This layout is generally suitable for linear streetscape systems. The north-south roads are all adjoining open space so drainage of these roads to treatment systems in these open space areas is feasible.

Topography and drainage – The flat topography would appear to favour the application of streetscape treatment systems (either linear or pod-type systems). These types of systems include a range of benefits apart from stormwater quality treatment including for example reduced development costs, improved streetscape amenity, reduced urban heat island (through the retention of water in the landscape) and multiple use of space.

The sandy soils discussed in Section 2.4 assist in draining surface waters which can reduce the size of treatment systems if retained as the surface layer.

- **On Site Water Demand** – A proportion of the irrigation demand for the large allotments and open space areas could be serviced by harvested stormwater. Similarly, several other non-potable household uses (e.g. laundry and toilet flushing), could also be serviced with harvested stormwater. Opportunities therefore exist for the use of alternate water supply sources such as rainwater and stormwater to:
 - reduce stormwater runoff volumes and pollutant loads generated from the site
 - meet a part of the non-potable demands; and
 - assist in conserving potable water supplies.

Building resilience against the potential impacts of climate change on centralised water supplies further strengthens the case for rainwater/stormwater harvesting.

Sewer mining or greywater reuse may provide viable alternative options for satisfying a proportion of non-potable demands (due to consistent supply throughout the year). These options have not been investigated as part of this study as they would not improve the quality of stormwater discharged from site.

3.1.1 Site Constraints

The major constraints identified for the site with respect to the application of stormwater quality controls were as follows:

- **Layout** – As noted in the opportunities above, the proposed allotments are larger than ‘typical’ low density residential lots with wider frontages. There are numerous design and operational issues with driveway crossovers (e.g. potential reduction in conveyance, postal access difficulties, safety issues etc.), which may limit the adoption of linear treatment systems. The careful selection of appropriate locations for stormwater quality treatment systems is therefore required.

In selecting these locations, due consideration should be given to the location of road sags and high points and contributing subcatchments to ensure that stormwater is adequately treated and Queensland Urban Drainage Manual (QUDM) safety requirements are maintained.

- **Topography and drainage** – The flat nature of the site potentially limits the application of end-of-pipe systems as there is typically insufficient fall to discharge piped stormwater to surface treatment systems. Similarly, linear treatment systems (e.g. streetscape swales), could be limited particularly where there is insufficient fall to ensure these systems are free-draining. In areas where topography is too flat, additional fill could be used to provide adequate fall however this is often a cost prohibitive option.

The low lying nature of the site means that fill will be required to maintain flood immunity on the proposed allotments. As the composition of the fill material is unknown it can only be assumed that the fill not share the same pervious characteristics of insitu soils. Any benefit from insitu soils on stormwater management (and size of treatment systems) would therefore be lost.

- **On Site Water Demand** – As noted in Section 2.5, Wonga is located in the wet tropics with good rainfall all year. External demands for irrigation are therefore lower compared to other Queensland climate zones. Other non-potable demands (laundry, toilet flushing, car/boat washing etc.) however, are not influenced by high rainfall and therefore harvesting may still be viable. This is especially the case for the drier months (July-September) and in periods of drought although these are also periods where harvesting yields would be at their lowest.

4 FLOOD IMPACT ASSESSMENT

4.1 Preamble

This section of the report has been prepared to provide a summary of an assessment into the flooding and flood impacts of a proposed rural residential development located at Vixies Road, Wonga Beach, known as Lot 51 on SP155078 (the subject site). The site boundary and its location (approximately 39 kilometres by road north of Port Douglas, Queensland), is shown on Figure 2-1.

This report details complex, full two dimensional dynamic flood modelling of the subject site and surrounding area, both for its existing state and as well as assessing the extent of developable area possible without causing adverse flooding impacts. This report refines previous flood assessments undertaken by DHI Australia (2000), which has previously been relied upon for determining flood levels for the site.

4.2 Approach

Due to the complex nature of the Wonga Beach catchment, detailed hydrologic and hydraulic models were developed to investigate both catchment runoff and flooding respectively. In order to carry these assessments, BMTWBM adopted the following approach:

- Obtain detailed LIDAR survey of the entire Wonga Beach catchment;
- Obtain site specific survey
- From the survey, determine the overall Wonga Beach catchment extent
- Construct a detailed WBNM hydrologic model to determine catchment runoff
- Construct a detailed one/two-dimensional TUFLOW flood model extending upstream and downstream of the site
- Utilise the flows from the WBNM hydrologic model as boundary conditions for the TUFLOW flood model.
- Run the flood model for the ARI 100 year design flood event to determine existing flood levels for the site and surrounds
- Input the proposed development area into the flood model
- Run the proposed model case for the ARI 100 year design
- Report on potential flood impacts resulting from the development.

4.3 Hydrology

As mentioned above, a detailed hydrologic (catchment runoff) model was established to determine the estimated catchment runoff from the Wonga Beach catchment. The runoff results from this model were used as boundary condition inputs to the flood model.

Catchment, sub-catchment extents and associated areas along with stream paths were determined from the LIDAR survey by using the 'Catchsim' program. Pervious and impervious areas were also

determined based on land use maps and aerial photography. These inputs were used to establish WBNM hydrologic model.

Figure 4-1 shows the WBNM model catchment layout and extent.

The main flow into the site is via a drainage channel which flows from south to north and is situated just off centre, on the western portion of the site. Another significant drainage path is situated adjacent to the western boundary of the site. The very eastern boundary of the site also has a drainage path, running behind a frontal dune system with an outlet situated off the north-east corner of the site. The majority of this flow path is situated outside the site boundary. The site contains some local drainage paths, generally located within north/south swale arrangements. These tend to drain in a southerly direction before flowing to the eastern flow path along the southern and eastern site boundaries.

Results from the above analysis indicate that the main channel within the site experiences $49\text{m}^3/\text{s}$ peak flow during the ARI 100 year design storm event. The western channel adjacent to the western site boundary receives $23\text{m}^3/\text{s}$.

4.4 Flooding

To determine the flooding experienced by the site and surrounds, a detailed 1D/2D fully hydrodynamic flood model was established using the TUFLOW modelling system. The model is made up of a 3m topographic grid, representing the ground surface levels and 1 dimensional elements representing culverts, bridges and small drainage channels.

Figure 4-2 shows the TUFLOW model extent and the topography for the existing situation.

Roughness values were determined using current land use maps and aerial photography.

To represent the ARI 100 year design storm, flow hydrographs were obtained from the WBNM hydrologic model and used as boundary conditions for the flood model. Ocean tailwater levels were based on the storm surge level of 2.73m AHD as requested by council in there information request. The model was run to determine existing flood levels and depths.

Figure 4-3 and Figure 4-4 show the exiting condition flood levels and depths respectively. A summary of peak water levels at selected reporting points are presented in Table 4-1. Figure 4-3 shows the locations of these points.

Table 4-1 Existing Case ARI 100 Year Peak Water Levels

Reporting Point	A	B	C	D	E	F	G	H	I	J	K	L
Level (mAHD)	3.756	3.481	2.971	2.461	3.560	3.466	2.979	2.407	3.456	3.412	2.980	2.307

Due to the majority of the flood flows being contained with channels and swale areas, peak 100 year floods vary across the site. In the adjacent western channel, peak ARI 100 year flood levels range from RL 3.80 to 3.45m AHD. In the permanent channel within the site, peak levels range from RL 3.48 to 3.41m AHD. Further to the east local ponding within the swale areas is approximately RL

2.98m AHD whilst the eastern boundary of the site is dominated by the storm tide level of RL 2.73m AHD.

To determine maximum developable area for the site, the potential area was assumed to be blocked from flood flows. This is a conservative approach as due to the large lot sizes, only roads and house pad areas are proposed to be filled in the final design. This does however provide an indication of the maximum flood impact likely to be experienced.

Figure 4-5 shows the impacts predicted from the maximum development scenario.

The main area where impacts of less than 80mm are predicted is in the channel adjacent to the western boundary. These impacts are contained within the channel and do not increase the actual flooding extent over the existing case. It is therefore considered that the impacts do not adversely impact on adjacent properties.

4.5 Discussion

From the analysis described above, the results indicate that the development can be accommodated within the proposed extent without adverse flooding impacts on adjacent properties. Due to the large lot sizes, filling is only proposed for roads, house pad areas and possibly for local drainage. As a result the predicted impacts from flooding are predicted to be less than those presented in this analysis following more detail design and analysis.

It is recommended that as many lots as possible be configured to maximise the location of building envelopes on the flood free areas. Where lots are potentially flood affected, building envelopes should be nominated at a level to provide appropriate flood immunity. It is anticipated that filling will be the main method of providing immunity in building envelopes however high set dwelling or a combination of filling and high set dwellings could be considered. Some additional filling may also be required to provide free draining of lots and prevent nuisance ponding.




Minimum floor levels are to be at least 300mm above the predicted ARI 100 year design storm event and/or predicted storm tide level, whichever is the highest. For the area in the western portion of the site (represented by reporting points B, E, f, I and J, Figure 4-3), a **minimum** floor level of RL 3.8m AHD is recommended. Similarly for the central to eastern area of the site (represented by reporting points C, G and K, Figure 4-3), **minimum** floor levels of RL 3.3m AHD are also recommended. For the eastern area of the site (represented by reporting points D, H and L, Figure 4-3), **minimum** floor levels of RL 2.7m to 2.8m AHD are required. These minimum floor levels are based on peak ARI 100 year design flood levels combined with a predicted ARI 100 year storm surge level of 2.23m AHD (representing the storm tide level of 2.23m AHD including 300mm mean sea level rise).

Flood levels presented within this report are based on conceptual development areas and assumptions, levels may change and be subject to further refinement following more detailed design.



Google™ earth
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LEGEND

-  Development Site
-  Subcatchments
-  Watercourse

Title:
WBNM model layout and Catchment Extents

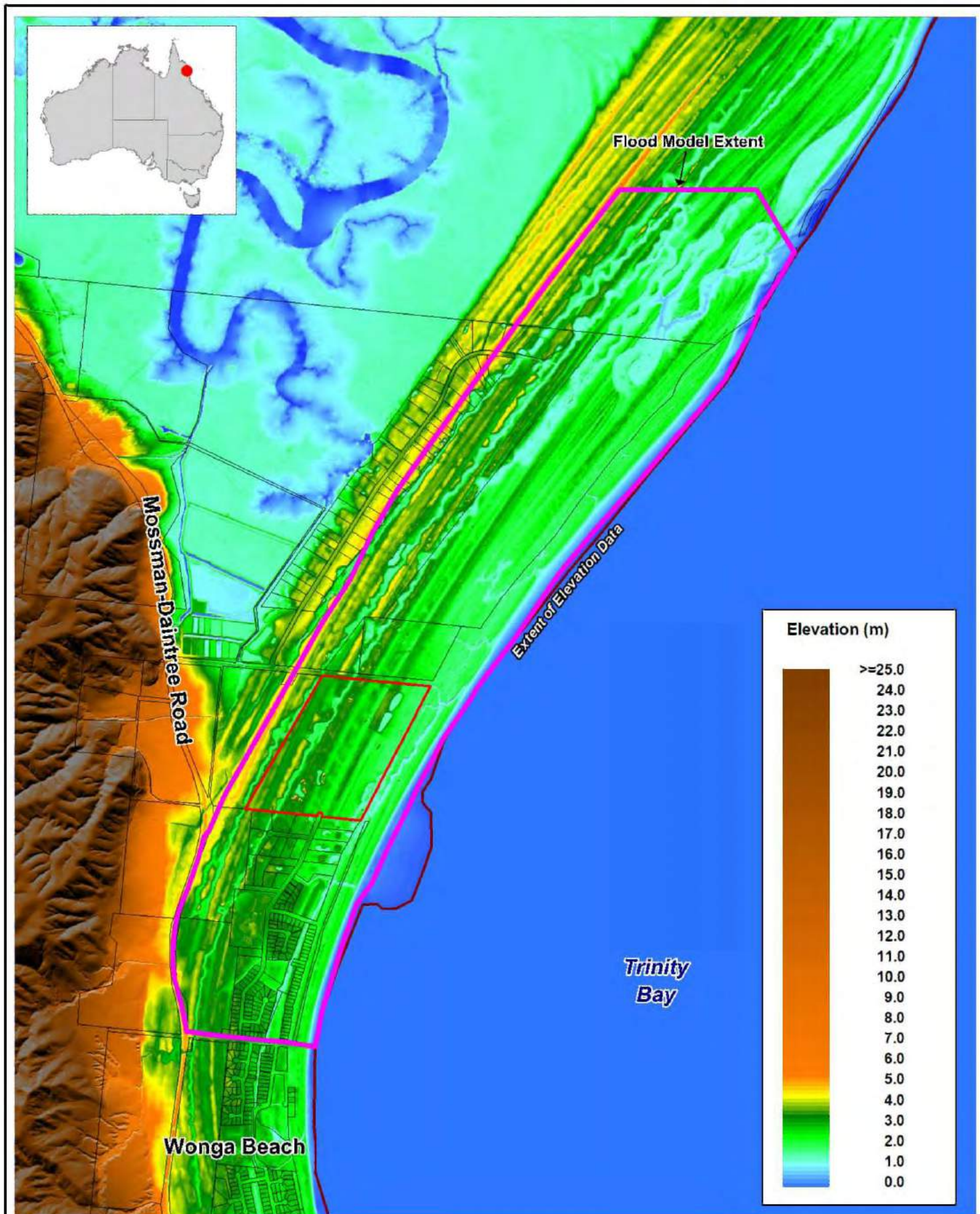
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Title:
TUFLOW Flood Model Extent

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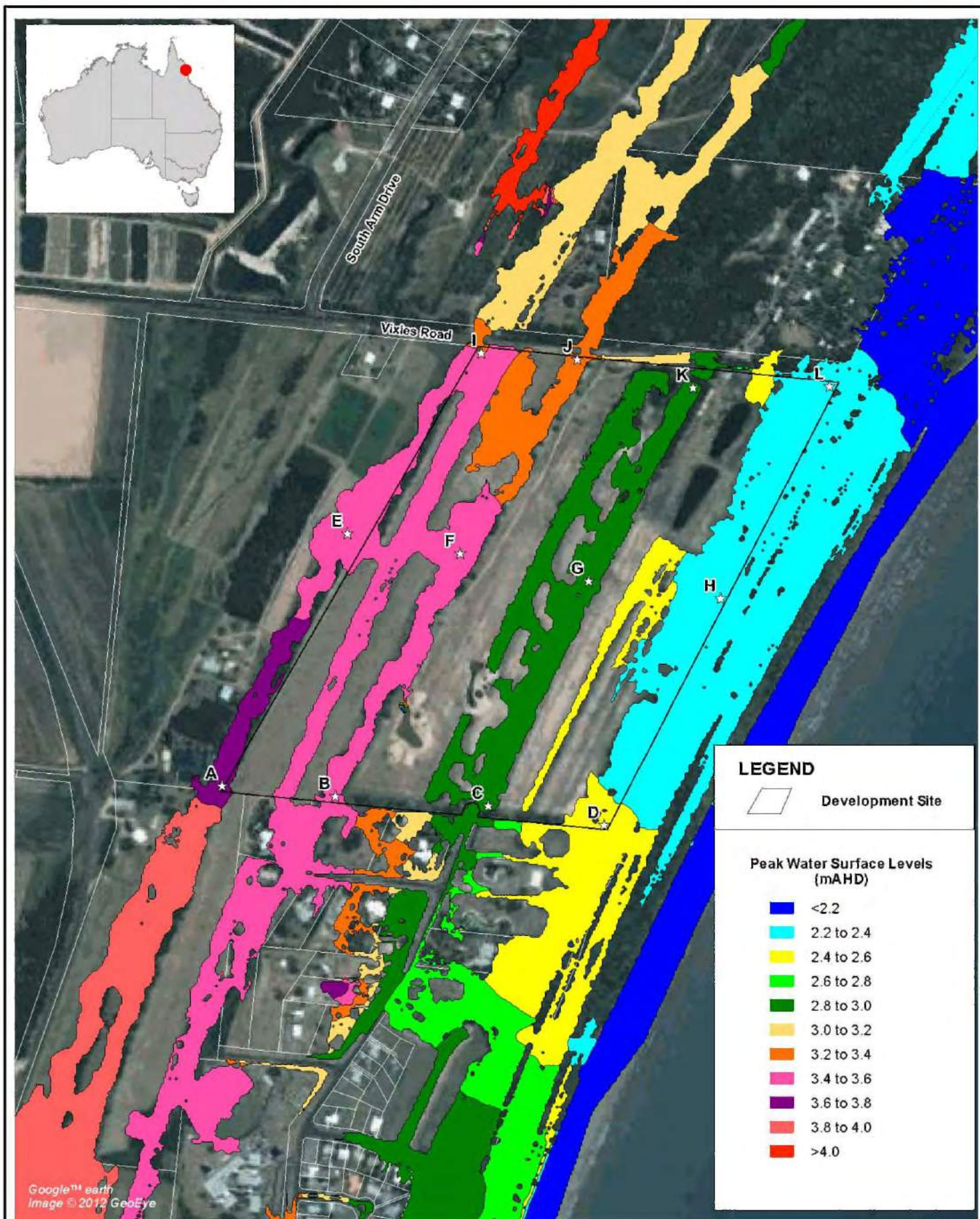
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Approx. Scale



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Title:
**ARI 100 Year Peak Flood Levels
Existing Case**

Figure:
4-3

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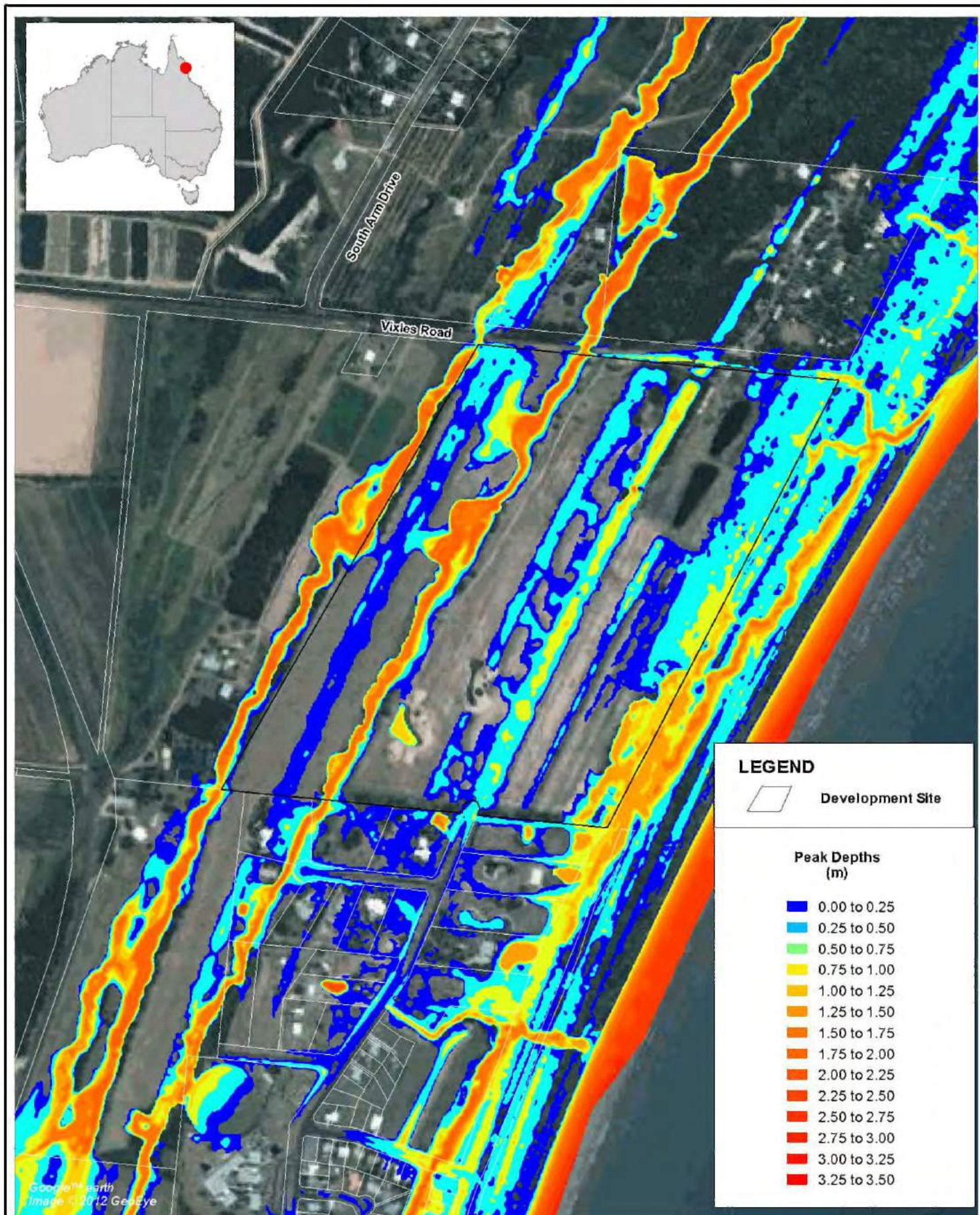
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Title:
**ARI 100 Year Peak Flood Depths
Existing Case**

Figure:

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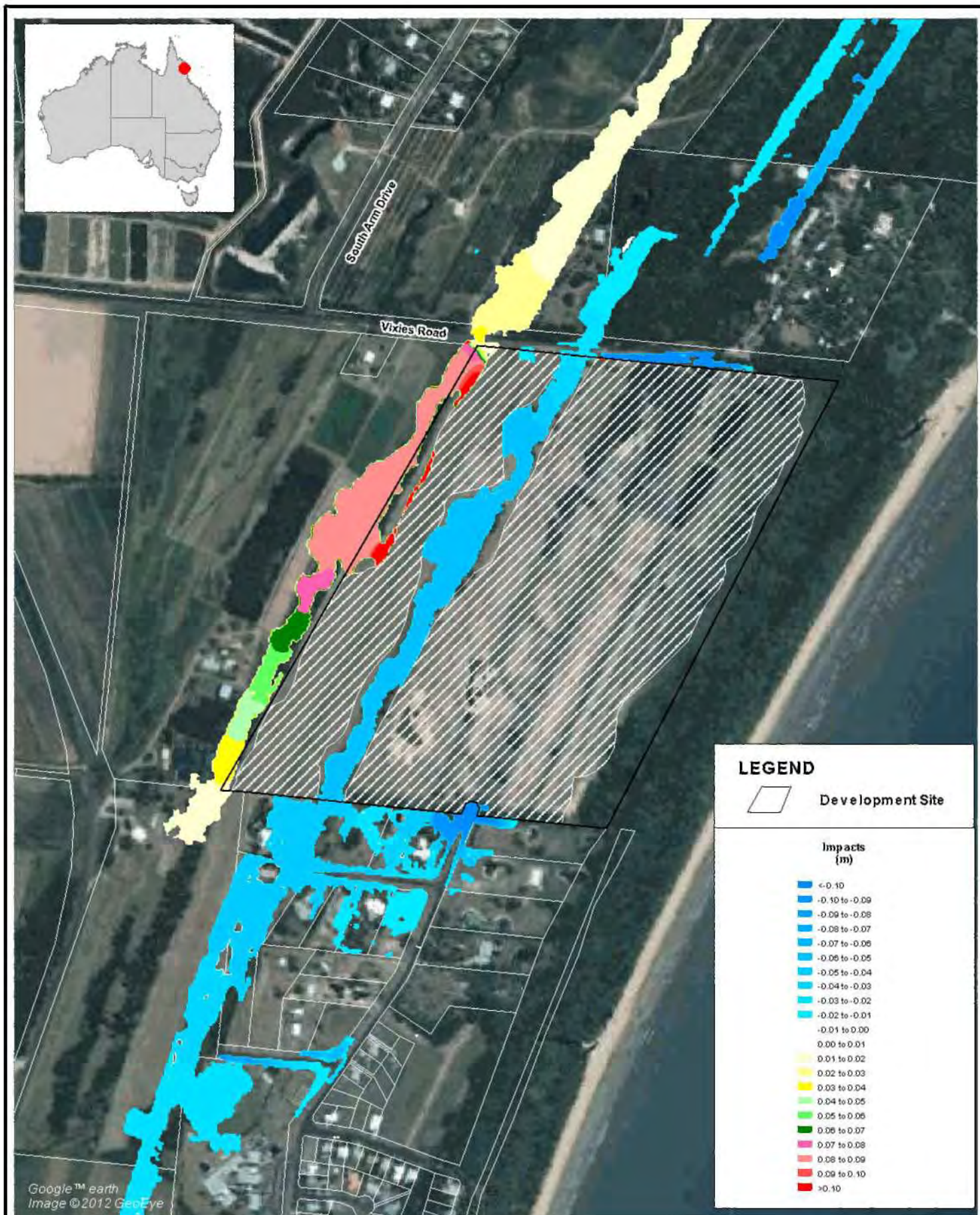
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Title:
**ARI 100 Year Peak Flood Impacts
 Maximum Extent of Developable Area**

Figure:
4-5

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5 STORMWATER MANAGEMENT PLAN

5.1 Preamble

This section addresses the important issue of stormwater management at the site and considers the following key issues:

- stormwater quality management
- receiving water hydrology, and
- wetland hydrology

This conceptual plan explains how the proposed development will meet the given stormwater management objectives through the implementation of water sensitive urban design (WSUD).

As discussed previously the following assessment is based on a preliminary conceptual layout and is subject to change once the development layout has been finalised.

5.2 Stormwater Quality Management

This section provides an assessment of stormwater quality for the proposed development describing the following:

- design objectives
- methodology and proposed treatment
- results and discussion

5.2.1 Design Objectives

5.2.1.1 Design Objectives - Construction Phase

Performance Outcome PO3 of the State Planning Policy (SPP) for Healthy Waters (DERM, 2010) Develop Assessment Code requires that “construction activities for the development avoid or minimise adverse impacts on stormwater quality.” The acceptable outcome for PO3 includes the provision of an erosion and sediment control plan (ESCP) that demonstrates compliance with design objectives outlined in the Urban Stormwater Quality Planning Guidelines (DERM, 2010) (hereafter referred to as the “SPP Planning Guidelines”). These performance criteria are provided in Table 5-1 and Table 5-2.

Table 5-1 Construction Phase Issue Performance Criteria

Issue	Stormwater Design Objective
Drainage control	Design life and design storm of temporary drainage works: <ol style="list-style-type: none"> 1. Disturbed area open for <12 months—1 in 2 ARI 2. Disturbed area open for 12-24 months—1 in 5 ARI 3. Disturbed area open for > 24 months—1 in 10 ARI
Erosion control	<ol style="list-style-type: none"> 1. Minimise exposure of disturbed soils at any time 2. Avoid or minimise large construction activities in the wet season 3. Divert water run-off from undisturbed areas around disturbed areas 4. Use erosion risk ratings to determine appropriate erosion control measures
Sediment control	Use soil loss rates to determine appropriate sediment control measures. Design storm for sediment control basins should be based on retaining the maximum sediment quantity for the maximum volume of water run-off. Site discharge during sediment basin dewatering should not exceed 50 mg/L TSS and pH between 6.5–8.5.
Stormwater drainage/ flow management	Take all reasonable and practicable measures to minimise changes to the natural waterway hydraulics and hydrology from:- <ul style="list-style-type: none"> • peak flow for the 1–year and 100–year ARI event (respectively for aquatic habitat and flood protection) • run-off frequency and volumes entering receiving waters • uncontrolled release of contaminated stormwater

Table 5-2 Construction Phase Stormwater Quality Performance Criteria

Pollutant	Stormwater Quality Design Objective
Coarse sediment	Retain coarse sediment on site
Fine sediment (Total Suspended Solids)	Take all reasonable and practicable measures to collect all run-off from disturbed areas and drain to a sediment basin – up to the design storm event.
Turbidity	Site discharge during sediment basin dewatering complies with a TSS concentration less than 50 mg/L up to the design event — flocculation as required. In storms greater than the design event take all other reasonable and practicable measures to minimise erosion and sediment export. Released waters from the approved discharge point(s) have turbidity (NTU) less than 10% above receiving waters turbidity – measured immediately upstream of the site.
Nutrients (N and P)	Manage through sediment control.
pH	Prevent litter/waste entering the site or the stormwater system or internal watercourses that discharge from the site – minimise on-site production, contain on-site and regularly clear bins.
Litter or other waste	Prevent litter/waste entering the site, the stormwater system or watercourses that discharge from the site. Also minimise or sufficiently contain on-site litter and waste production and regularly clear waste bins.
Hydrocarbons and other contaminants	Prevent from entering the stormwater system or internal watercourses that discharge from the site – control storage, limit application and contain contaminants at source.
Wash down water	Waste containing contaminants must be disposed of at authorised facilities.
Cations and anions	Prevent from entering the stormwater system or internal watercourses that discharge from the site. As required under an approved Acid Sulfate Soil Management Plan, including aluminium, iron and sulfate.

The objectives provided in Table 5-1 and Table 5-2 are directly relevant to this development and have therefore been adopted for the site. A detailed ESCP will be provided at the operational works stage of the development. This plan should address the objectives adopted by this report as a minimum standard.

5.2.1.2 Design Objectives - Operational Phase

Stormwater Runoff Objectives

Performance Outcome PO1 and PO2 of the SPP for Healthy Waters Development Assessment Code requires that, “the development is compatible with the land use constraints of the site for achieving stormwater design objectives” and that “the entry of contaminants into, and transport of contaminants, in stormwater is avoided or minimised.” The acceptable outcomes include the provision of a report that demonstrates compliance with design objectives outlined in the SPP Planning Guidelines.

These performance criteria specific for the Wet Tropics region are provided in Table 5-3.

Table 5-3 Operational Phase Performance Criteria

Pollutant	Objectives
Total Suspended Sediment (TSS)	80%
Total Phosphorus (TP)	65%
Total Nitrogen (TN)	40%
Gross Pollutants (GP)	90%

The objectives provided in Table 5-3 are directly relevant to this development and have therefore been adopted for the site. Compliance with these objectives is demonstrated in this report.

Wetland Objectives

Council's information request requires that the "effect on wetlands from run-off" be addressed including the adoption of measures "to ensure urban development does not negatively affect water quality". However, locally specific water quality objectives for the wetland are not available. This is not unusual with few, if any, authorities in Queensland publishing such objectives.

The Hunter & Central Coast Regional Environmental Management Strategy (HCCREMS), have however published guidelines which describe stormwater management (water quality and hydrology) objectives for urban development in catchments above coastal wetlands in NSW. These guidelines are intended to help protect wetland ecological health. Although these guidelines were developed in NSW, the methodology outlined in the guidelines for determining appropriate objectives and developing treatment solutions take into account local conditions. As a result, these guidelines are directly transferrable to coastal wetlands in Queensland and in the absence of more locally specific guidelines, have been adopted for determining appropriate wetland protection measures.

Consequently, water quality management objectives for the existing wetland were derived from *Water Sensitive Urban Design Solutions for Catchments above Wetlands* (HCCREMS, 2007). This guideline suggests a pragmatic approach to setting catchment stormwater quality objectives i.e. the guideline recommends that "all stormwater discharged (following hydrologic control to meet hydrologic management objectives) is treated to "best practice" standards".

Best practices standards for the proposed development are presented in Table 5-3. The same objectives adopted from stormwater quality runoff are therefore also adopted for runoff to the wetland.

5.2.2 Modelling Methodology

Water quality modelling for the project was undertaken using the eWater MUSIC software (Version 5) in accordance with Water by Design's (2010b) "*MUSIC Modelling Guidelines*". The water quality modelling demonstrates that adequate measures are included in the development to meet the operational phase design objectives. The following three scenarios were considered as part of the modelling exercise:-

- *Existing Site:* The base case is an assessment of the undeveloped site in its current state represented by 'rural residential' parameters.
- *Developed Site Without Treatment:* The developed case without mitigation is essentially an assessment of what would occur if the site were developed without any integration of stormwater treatment devices or pollution control measures. For consistency, the unmitigated site has been modelled using identical source node parameters as that of the scenario for modelling the developed site incorporating WSUD features.
- *Developed Site with Treatment (bioretention systems):* This scenario includes 5kL rainwater tanks on each lot and streetscape bioretention for treatment.

5.2.3 Model Results and Discussion

Total annual flow and pollutant loads from the site for each scenario are presented in Table 5-4. The "developed site with treatment" results are based on **streetscape bioretention filter areas sized at 1.8% of the contributing urban catchment and a 5 kL rainwater tank on each lot.**

Table 5-4 Predicted Annual Pollutant Loads and Flows for 'Existing Site' & 'Developed Site without any Treatment

Parameter	Existing Site	Developed Site Without Treatment	Developed Site With Treatment	% Removal	% Pollutant Removal Target	% Decrease from Existing Site
Flow (ML/yr)	258	321	302			
TSS (kg/yr)	99,900	63,600	9,740	85	80	90
TP (kg/yr)	84	131	45	66	65	47
TN (kg/yr)	681	633	303	52	40	56
Gross Pollutants (kg/yr)	0	3,260	0	100	90	-

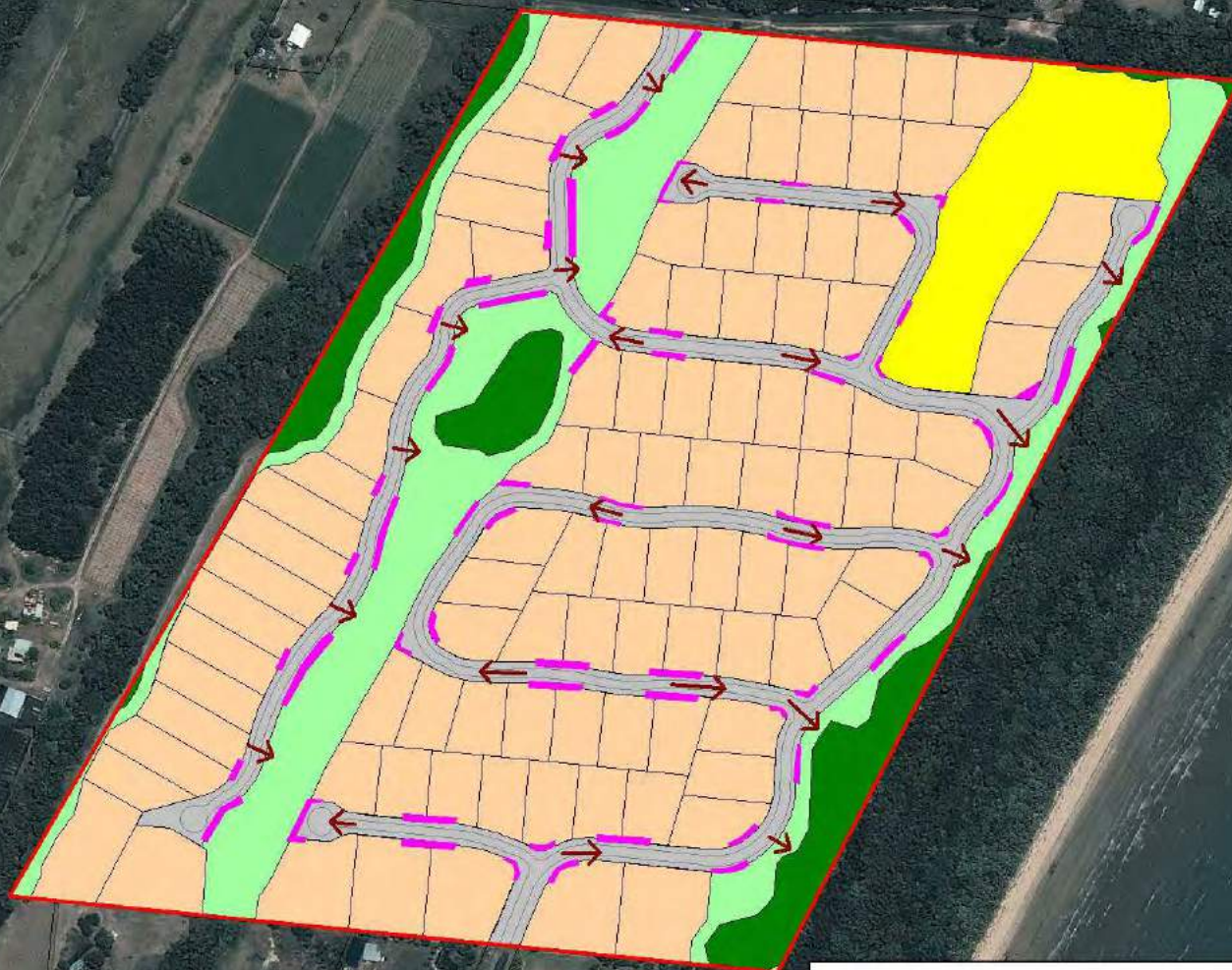
As shown by the results presented above, with the integration of the proposed stormwater management strategy, the stormwater pollutant removal targets can be achieved. Furthermore, the proposed development (and associated stormwater management strategy) is predicted to result in a decrease in total suspended solids, total phosphorus and total nitrogen pollutant loads from the existing site.

Figure 5-1 also provides an indicative layout plan showing the potential location / distribution of streetscape bioretention within the proposed development.



South Arm Drive

Vixies Road



LEGEND

Site Boundary

Land Use

- Residential Lots
- Road reserve
- Active open space
- Passive open space
- Dominant Remnant of Concern Regional Ecosystem (2003 Mapping)
- Indicative location of streetscape bioretention System
- Indicative flow direction

Google™ earth
Image © 2012 GeoEye

Title: Indicative Layout of Proposed Streetscape Bioretention System - Based on Preliminary Conceptual Development Layout

Figure:

5-1

Rev:

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Approx. Scale



5.3 Receiving Water Hydrology

This section provides an assessment of receiving water hydrology for the proposed development describing the following:

- design objectives
- proposed treatment

5.3.1 Design Objectives

Performance Outcome PO4 of the SPP for Healthy Waters development assessment code requires that, “construction and operation activities for the development avoid or minimise changes to waterway hydrology from adverse impacts of altered stormwater quality and flow.” The SPP Planning Guidelines also identify hydrologic management objectives for frequent flow and waterways stability management as summarised in Table 5-5.

Table 5-5 Hydrologic Management Design Objectives

Criterion	Intent	Design Objective
Waterway stability management	To reduce the impacts of urban development on channel-bed and bank erosion by limiting changes in flow rate and flow duration within the receiving waters.	Limit the post-development peak one-year average recurrence interval (ARI) event discharge within the receiving waters to the pre-development peak.
Frequent flow management	To reduce the frequency of disturbance to aquatic ecosystems from urban development by managing the volume and frequency of surface runoff during small rainfall events.	<p>From the proposed development, capture and manage:-</p> <ul style="list-style-type: none"> • The first 10mm of runoff from impervious surfaces where the total impervious surface is 0% to 40% • The first 15mm of runoff from impervious surfaces where the total impervious surface is greater than 40% <p>Note: The capacity to capture runoff must be restored within 24 hours of the runoff event.</p>

The SPP Planning Guideline states that the objectives provided in the above table are relevant to runoff that drains to unlined channels, or non-tidal waterways or wetlands. The guideline also states that, “where a receiving waterway is degraded, the local or regional authority may choose not to require compliance with this objective on the basis that the receiving waterway and its associated catchment/s have been identified by the authority as having limited potential for future rehabilitation and/or WSUD retrofitting.”

The proposed development drains towards unlined channels including artificial, degraded channels in Vixies Road. These channels, however, drain to natural and relatively undisturbed ephemeral waterways and therefore compliance with the objectives should be required by Council. The hydrologic management objectives listed above have therefore been adopted for the site.

5.3.2 Proposed Treatment

Through the provision of streetscape bioretention systems sized at 1.8% of the contributing catchment and a 5 kL rainwater tank on each lot it is predicted that both the waterway stability and the frequent flow management objectives will be met.

5.4 Wetland Hydrology

This section provides an assessment of wetland hydrology for the proposed development describing the following:

- design objectives
- methodology
- results
- impact on wetland processes

5.4.1 Design Objectives

Council's information request requires that additional information be provided "addressing wetland hydrology (recharge and discharge) and how the proposed development will affect these processes". Locally specific objectives for wetland hydrology are not available, however, as discussed in Section 5.2.1.2, *Water Sensitive Urban Design Solutions for Catchments above Wetlands* (HCCREMS, 2007) has been adopted to define wetland objectives.

The hierarchical scheme proposed by this guideline to classify wetlands is based on *dominant vegetation, dominant substratum, water chemistry and typical life forms*. The guideline suggests that a site inspection is required to assess these wetland characteristics. The site inspection was carried out by Paul Dubowski, Senior Environmental Scientist, on 14 September 2012. Based on the site inspection it was determined that the wetland can be classified as a "wet forest swamp".

The hydrologic management objectives for a "wet forest swamp" are to ensure that the post-development hydrologic indices are similar to the pre-development hydrologic indices, in particular, when comparing the critical drying hydrology.

5.4.2 Methodology

Based on the wetland classification as a "wet forest swamp", the guidelines recommend undertaking an assessment of drying hydrology including dry season flow duration frequency analysis and low flow spells frequency analysis with a 60-day reference duration.

Hydrological modelling was undertaken to ensure that adequate measures are included in the development to ensure the wetland is not adversely affected by the proposed development. This modelling was undertaken using the MUSIC model described in 5.2.2. The entire catchment draining to the wetland was included in the assessment, including the 162 ha catchment external to the site of the proposed development (with land usage classifications and catchment extents based on available aerial photography and topographic data).

Achieving compliance of the hydrologic management objectives should be demonstrated by the post-development flow duration curves and low flow spell frequency curves attaining similar shapes and slopes.

Four separate hydrology analyses were undertaken (in accordance with HCCREMS, 2007):

- Critical drying period identification
- Minimum annual 60-day average flow exceedance probability assessment
- Mean annual 60-day average flow exceedance probability assessment
- Low flow spell frequency analysis

These analyses were undertaken for three scenarios:

- Pre-development
- Post-development with no WSUD
- Post-development with WSUD (in accordance with the proposed WSUD strategy, including bioretention filter areas sized at **1.8%** of the contributing urban catchment and a 5 kL rainwater tank on each lot).

5.4.3 Results

The critical drying period was identified as June to November as this was the period with the highest difference between rainfall and potential evapotranspiration (PET).

The minimum 60-day low flow duration frequency curves and the mean 60-day low flow duration frequency curves for the three scenarios are shown in Figure 5-2 and Figure 5-3, respectively.

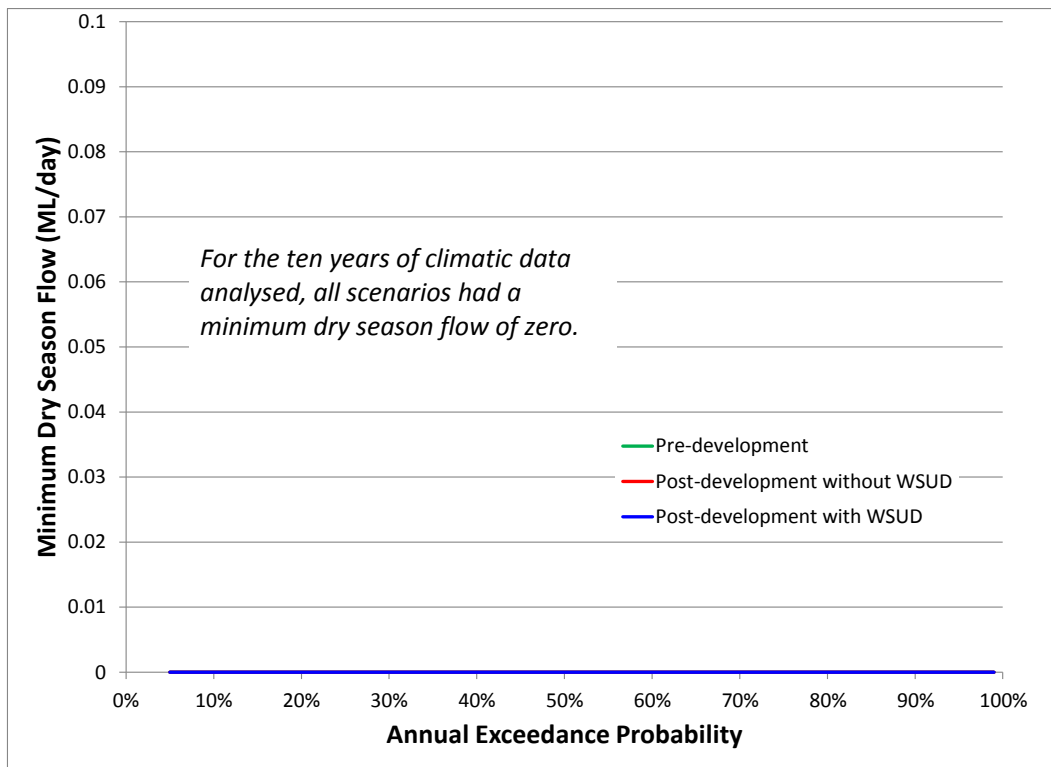


Figure 5-2 Minimum 60-day low flow duration frequency curve (i) pre-development; (ii) post-development without WSUD; (iii) post-development with WSUD

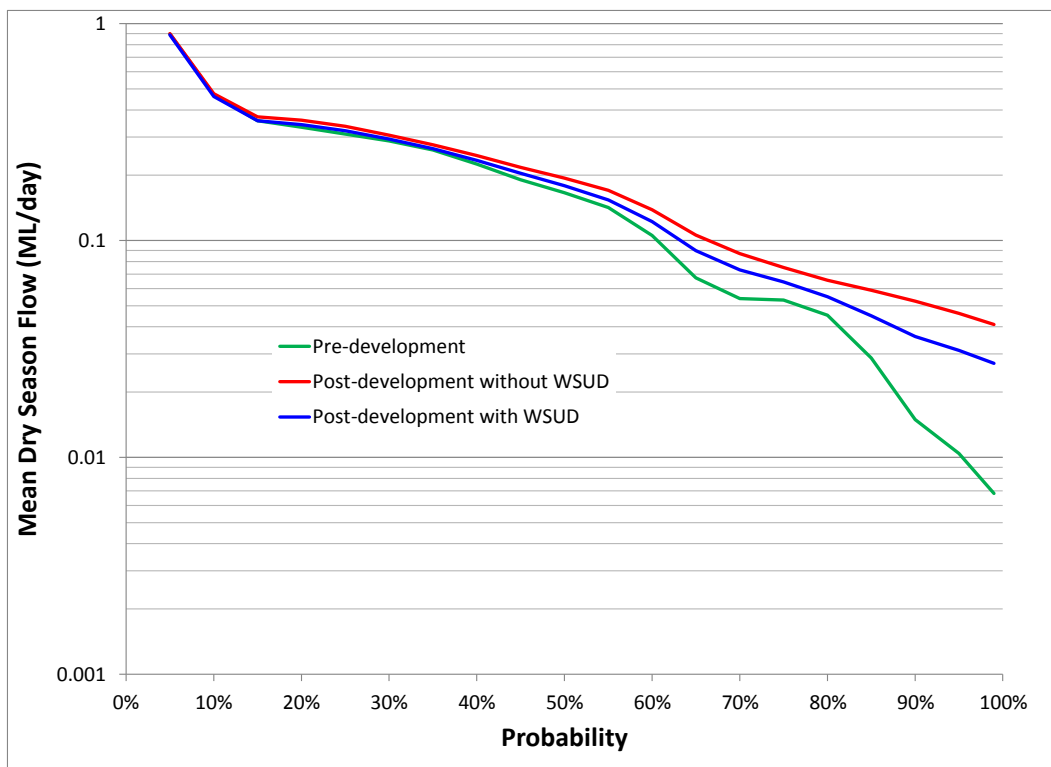


Figure 5-3 Mean 60-day low flow duration frequency curve (i) pre-development; (ii) post-development without WSUD; (iii) post-development with WSUD

Figure 5-2 shows that, for the ten years of data included in our assessment, all scenarios had a minimum 60-day low flow of zero. Therefore, the proposed development or WSUD strategy has no demonstrated impact on minimum 60-day low flow rates entering the wetland.

Figure 5-3 illustrates that the proposed development (if no WSUD was incorporated into the site) would impact on the mean dry season flows, with higher rates of flows entering the wetland for small, frequent flow events. This is anticipated given that the proposed development (without WSUD) would discharge higher volumes of flow (and discharge flows more frequently) given the increased imperviousness and hydraulic efficiency. These changed hydrologic conditions are, however, mitigated by the proposed WSUD strategy (with the 'post development with WSUD' scenario having a more similar mean 60-day low flow duration frequency curve to the 'pre-development' scenario).

Based on the results illustrated in Figure 5-3, the low flow threshold was determined to be 0.17 ML/day. This low flow threshold was subsequently used to for the low flow spell frequency analysis. The results of this analysis are illustrated in Figure 5-4.

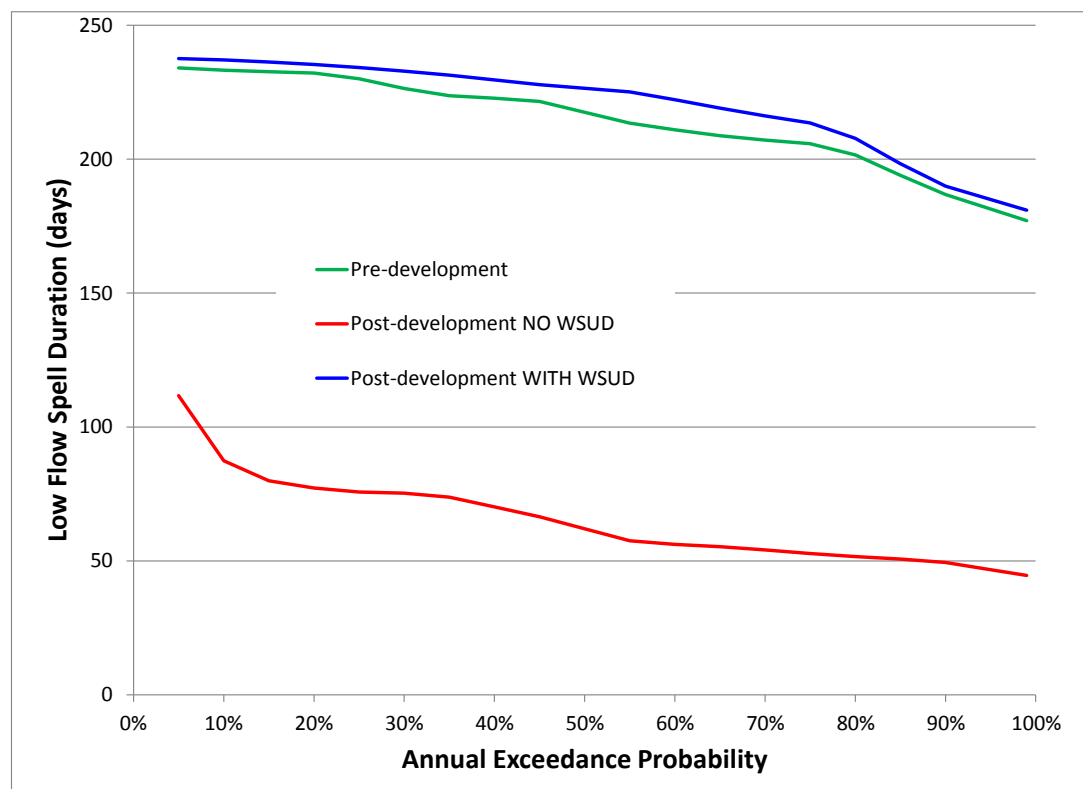


Figure 5-4 Low Flow Spell Frequency Curve (i) pre-development; (ii) post-development without WSUD; (iii) post-development with WSUD – 60 days low flow duration

The low flow spell frequency analyses illustrated above indicate that, if no WSUD was incorporated into the proposed development, the duration of 'low flow spells' (periods when flow was less than the aforementioned low flow threshold) would significantly decrease. As a result, the proposed development (without WSUD) would be predicted to cause the wetland to be essentially 'wetter' (due to the increased frequency and volume of flows entering the wetland). The figure above also illustrates, however, that the proposed WSUD strategy significantly mitigates these potential hydrologic changes – and the 'proposed development with WSUD' scenario has a very similar low flow spell frequency curve to the 'pre-development' scenario.

5.4.4 Impact on Wetland Processes

Based on the results given in the previous section, if WSUD was not incorporated into the proposed development, the drying hydrology of the wetland would be predicted to change by a significant amount – with higher rates, volumes, and frequencies of flows entering the wetland. The results, however, also indicate that the proposed WSUD strategy significantly mitigates these potential changes with results indicating that drying hydrology analysis curves (in accordance with HCCREMS, 2007) of the proposed development with WSUD would be very similar to pre-development conditions.

Therefore, the analyses (as recommended by HCCREMS, 2007) indicate that the critical drying hydrology of the wetland with the proposed development (with WSUD) would be very similar to the pre-development scenario. Based on these analyses, we would subsequently anticipate that the proposed development (with WSUD) would satisfy the HCCREMS (2007) hydrologic management objectives and be unlikely to have any significant negative impact on wetland processes (associated with hydrology). Nevertheless, a detailed ecological assessment of the wetland (and its sensitivity to changed hydrologic conditions) could be undertaken to further assess the potential for impact on wetland processes.

5.5 Conclusion

In summary, the results demonstrate that through the implementation of water sensitive urban design (WSUD) all design objectives are met. The WSUD strategy has been determined based on preliminary conceptual drawings and include a 5 kL rainwater tank on each lot and streetscape bioretention with the filter area size totaling 1.8% of the developable catchment area.

An indication of the conceptual location of streetscape bioretention systems was provided based on a preliminary conceptual site layout. These will be further refined at subsequent planning stages ensuring minimal disturbance to existing vegetation. A key design philosophy of integration with the landscape will be adopted during the detailed design phase. Further detailed design stormwater quality modelling will need to be undertaken to inform this process.

6 WSUD PRINCIPLES ASSESSMENT

In developing solutions and influencing layout design, a number of water sensitive urban design principles were adopted for the site. The principles were derived from the WSUD principles presented by the National Water Commission (NWC, 2012) and include:

- minimise impact on existing natural features and ecological processes
- minimise impact on natural hydrologic behaviour of catchments
- protect water quality of surface and ground waters
- minimise demand on the reticulated water supply system
- improve the quality of and minimise polluted water discharges to the natural environment
- incorporate collection treatment and/or reuse of runoff, including roofwater and other stormwater
- reduce run-off and peak flows from urban development
- increase social amenity in urban areas through multi-purpose greenspace, landscaping and integrating water into the landscape to enhance visual, social, cultural and ecological values
- add value while minimising development costs (e.g. drainage infrastructure costs)
- account for the nexus between water use and wider social and resource issues.

These principles were considered throughout the design process to ensure suitably responsive stormwater treatment solutions. A qualitative assessment of the proposed design solutions against the principles was also undertaken to ensure that the principles had been suitably accounted for during the design process. This gives Council the confidence that the design team considered the principles during the design process. This qualitative assessment is provided in Table 6-1.

Table 6-1 WSUD Principles Assessment

Principle	Site specific relevance
Minimise impact on existing natural features and ecological processes	The key existing natural features which support ecological processes include the wetland located on site and the vegetated swale. These features are proposed to be retained and stormwater management solutions proposed which will minimise impacts on wetland hydrology and water quality.
Minimise impact on natural hydrologic behaviour of catchments	Hydrologic management objectives were adopted for both the wetland and the downstream receiving waterways. Compliance with these objectives is demonstrated in this report.
Protect water quality of surface and ground waters	Stormwater quality objectives were adopted to minimise impacts on surface and groundwater quality. Compliance with these objectives is demonstrated in this report.
Minimise demand on the reticulated water supply system	Rainwater tanks were adopted as one of the treatment strategies to minimise demand on the reticulated water supply minimise stormwater pollutant discharge.
Improve the quality of and minimise polluted water discharges to the natural environment	The proposed stormwater quality treatment strategy includes bioretention systems and rainwater tanks to minimise pollutant discharges.
Incorporate collection treatment and/or reuse of runoff, including roofwater and other stormwater	Rainwater tanks were adopted as one of the treatment strategies to harvest stormwater for domestic use.
Reduce run-off and peak flows from urban development	The flood modelling demonstrates that due to the low level of impervious areas, sufficiently low runoff will be generated so that peak flows do not need to be managed through a detention basin or similar treatment system.
Increase social amenity in urban areas through multi-purpose greenspace, landscaping and integrating water into the landscape to enhance visual, social, cultural and ecological values	The proposed treatment strategy includes streetscape bioretention systems that have multi-functional roles including: stormwater quality treatment; increasing landscaping and the amenity of the streetscape; and reducing urban heat island effect by maximizing greenspace and retaining water in the landscape. Ecological benefits are expected by minimising impacts from pollutant loads entering

receiving waterways and minimising impacts on the hydrology of the wetland and receiving waters.

Add value while minimising development costs (e.g. drainage infrastructure costs)

The values of the proposed WSUD treatment strategy include minimising the effects of urban development on the natural ecological and hydrological cycles. By adopting streetscape systems, drainage infrastructure costs are minimised by reducing the length of pipe required to convey stormwater. It is further proposed to avoid the use of drainage pipes in the base of the bioretention systems to minimise drainage infrastructure costs (approvals, construction, materials, and maintenance). For small treatment systems such as the ones proposed, drainage pipes are not necessary and adequate stormwater conveyance can be achieved through the gravel drainage media. This will require a screen in the base of the drainage pipes to prevent the gravel drainage media being washed into the overflow pit. This design response also increases the volume of groundwater recharge and assists in replicating pre-development hydrology.

Account for the nexus between water use and wider social and resource issues

Water use is supplemented by the proposed domestic rainwater tanks thereby minimising impacts on the reticulated water supply.

The assessment of the proposed stormwater treatment solutions against the WSUD principles adopted for the site demonstrates that the solutions reflect all of the adopted WSUD principles.

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Attachment D

Engineering Assessment

WONGA BEACH AQACULTURE RESORT PTY LTD

**RECONFIGURING A LOT INTO 99 LOTS
AT
VIXIES ROAD WONGA**

**Engineering response to
Cairns Regional Council's
Information request (8th September 2011)**

pdr engineers

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This report was prepared by PDR Engineers for Wonga Beach Aquaculture Resort Pty Ltd.

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Document Status				
Project:			PDR Project No.:	
Revision No.	Date	Purpose of issue	Prepared By	Approved for Issue By
A	6 th May 2013		A McP	PDR

INTRODUCTION:

Wonga Beach Aquaculture Resort Pty Ltd have lodged an application with Cairns Regional Council proposing a low density 99 lot residential subdivision located adjacent to Vixies Rd and Snapper Island Drive, Wonga Beach in Far North Queensland. Council issued an information request, dated 8th September 2011, seeking further information on a number of matters including engineering issues.

This report addresses items 4, 10 and 11b of the RFI.

ITEM 4 – SITEWORKS AND DRAINAGE:

Council's comments advising that filling of 50% of each allotment is not supported and that lots should be filled to the Q100 level and sloped to drain to the front of each allotment were noted and taken into consideration. In response to Council's comments, and following the receipt of the "Wonga Beach Integrated Stormwater management Plan" prepared by BMT WBM Pty Ltd (BMT), we prepared a concept filling and drainage plan for the site. Our plan 10070-S01 Rev B is attached at the end of this report.

This plan is subject to final design, however, it shows the proposed fill levels of the allotments, proposed parameters on road levels and drainage paths for both overland and underground stormwater. It has been prepared to meet the principles, recommendations and requirements of the BMT report in relation to both stormwater management and water quality. Examination of this plan will show that it is intended to fill and grade the allotments so that they fall to both the front and rear of each lot. The typical section through the allotments shows the proposed profile. The drawing also indicates the proposed lot levels, road crown levels and ridge levels on the lots.

The recommended design solution has been adopted for the following reasons:

- The proposed "ridge" levels provide ample area to ensure that any residence can be built above the specified Q100 levels plus 300mm freeboard for habitable buildings. The Q100 levels. In accordance with the BMT report these levels vary from 3.8 AHD in the western areas of the site to 3.5 near the centre and 2.8 AHD along the eastern area.
- Sloping the lots from the ridge to the rear allows grassed swales to be formed along the rear boundaries. These swales provide drainage outlets and sufficient area to improve water quality for the runoff water. It is envisaged that these swales will be covered by an easement.
- The provision of these grassed swales provides ample treatment area for the removal of TSS, TN and TP and improves water quality as recommended in section 5.23 of the BMT report and satisfies WSUD principles. The swales will provide a much higher area of treatment than streetscape alternatives.
- We recommend the use of these swales instead of providing bio retention systems in the streetscape and within the road reserves. Bio retention areas do not provide long term satisfactory results in tropical rainfall climates and add to the maintenance load of Council.
- The swales will discharge to the adjacent creeks and wetland areas as indicated on the drawing. In most cases this will be via a culvert under the road that is also collecting discharge from the road reserve. Provided the conceptual drainage network does not require additional treatment trains or flow retention, the swales will discharge directly to the adjacent creeks and wetlands.

- The use of the swales will reduce the volume of stormwater within the road reserves and the need for the roads to be the primary Q100 overland flowpaths. This has the benefit of improving accessibility for residents in times of high rainfall events.
- Drawing 10070 – S01 shows the existing contours, proposed allotment and road levels, the location and flow direction of the swales, proposed location of underground drainage and discharge points. It provides a typical cross section to demonstrate the relationship of the lots to the roads and drainage swales.
- The road levels are designed to cater for Q100 overland flows and during the Q100 event the maximum depth of water over the crown is 250mm. This ensures safe passage of emergency vehicles.

We recommend the proposed solution as it provides a good drainage solution, satisfies the requirements of the BMT report and WSUD principles and provides for the protection of water quality of the stormwater discharging to the adjacent creeks and wetland areas.

ITEM 10 – TRAFFIC IMPACT STATEMENT:

In addressing the traffic issues associated with this development the requirements of part 12 of the Austroads document “guide to traffic management – Traffic impacts of development” have been considered and taken into account. It is noted that this development, due to its size, does not require a traffic impact assessment. In accordance with section 4.1.2 of the guide a traffic impact statement has been prepared.

The development is accessed by Snapper Island Drive at its southern end and Vixies road at the northern end. The main through road is a minor collector road (less than 3000 vpd) and connects Snapper Island Drive to Vixies Road. The road reserve is 20 metres wide and complies with table D1.1 of FNQROC for low density residential land. The pavement width will be 7.0 metres and will generally have kerb and channel both sides. There is scope to have alternative edge options adjacent to wetlands, swales and the foreshore section. A number of internal cul-de-sacs and a loop road connect to the minor collector road to serve the internal allotments.

The attached drawing, 10070-T01 shows the location of the subdivision, its relationship with local and through roads and includes all roads and intersections that are impacted by this development. The drawing also shows the additional generated traffic figures for Snapper Island Drive, the total vpd and, where applicable, the peak hour movements for intersections serving the development.

Traffic movements (vpd) for each residence were generated on the following basis:

Local shopping.....	1.0
Other facilities.....	0.5
Sporting/Community.....	1.5
Primary school.....	<u>2.0</u>
Sub total – Internal.....	5.0
External School (secondary).....	1.5
Higher order shopping.....	0.5
Employment.....	<u>2.0</u>
Sub total – External.....	4.0
Total Movements.....	<u>9.0</u>

Following this analysis, consideration of local traffic movements and the rate of progress of the planned development (noting that the increase in traffic flow detailed below is likely to be over a 10+ year period) our conclusions and relevant points for consideration are set out below:

- Snapper Island Drive will provide the only access to the subdivision until the construction of stage 4. At that time the through connection to Vixies Road will be made.
- The maximum increase in daily traffic movements in Snapper Island Drive, up to the stage when stage 4 is completed, will be 315 vpd.
- Generated figures were based on 70% of the ultimate traffic using Snapper Island Drive and 30% using Vixies Road.
- The ultimate increase in traffic using Snapper Island Drive will be 764 vpd increasing the overall movements to 1700 vpd. This is a minor to moderate flow and requires minor access standard of a 7.5 metre pavement. The existing pavement is of this standard and as a result the impact from this development does not require the upgrading of Snapper Island Drive.
- Whilst there is a significant increase in movements through the Snapper Island Drive/Wonga Beach Road intersection it is not large in terms of low density or urban development. Total movements through this intersection are between 2500 and 3000 vpd and no special intersection upgrading is required. It would be advantageous, subject to Council agreement, to install give way signs on Snapper Island Drive as a safety control.
- Traffic through the intersection of Wonga Beach Road and the Mossman Daintree Road increases the total flow on the Mossman Daintree Road by up to 10%. Examination of the existing intersection indicates that the current layout will cater for this increase. Some minor upgrading may be required subject to DTMR conditions.
- Traffic through the Vixies Road/Mossman Daintree Road intersection increases flow on the Mossman Daintree Road by 4.5%. Some minor upgrading will be required subject to DTMR conditions.

Our investigation reveals that this development will only have minor impact on the local road network and that the existing Snapper Island Drive will not require upgrading. There may be some upgrading required to Vixies Road along the frontage of the site following the completion of stage 4. Internal local intersections do not require upgrading subject to the installation of recommended signage. The two intersections with the Mossman Daintree Road are adequate, with minor upgrading, to cater for the traffic increase generated by this development. This is subject to review by DTMR.

ITEM 11b – WATER RETICULATION:

Discussions have been held with Council Officers regarding the provision of town water at adequate volume and pressure to this development. It is understood that council have carried out an analysis for Wonga Beach and, as a result, it is considered unnecessary to duplicate such work. Council have indicated that the results of this analysis will be made available so that a suitable design can be finalised.

At this stage the analysis has not been provided, however, our investigations indicate that the current supply in Snapper Island Drive is insufficient to provide water to this development and meet fire fighting requirements. The current main is 100 mm and is connected to the primary main in Wonga Beach Road.

Water supply to this project can be improved by either upgrading the Snapper Island Drive water main back to Wonga Beach road or providing an option via Vixies Road. It is our view that the latter option is the better long term solution. We have prepared a concept primary water reticulation layout with provisional main sizes indicated. These details are shown on our drawing 10070 – W01 attached at the end of this report. Sizes shown are subject to checking when Council's analysis is available and to further consultation with Council officers.

Our solution involves the provision of a new 225 mm headworks main from the intersection of the Mossman Daintree Road with Wonga Beach Road north to the Vixies Road intersection. A branch main of 150 mm would be extended down Vixies Road to the western boundary of the applicant's property. This main would be considered as a headworks main as it can be used to improve supply to existing properties in Vixies Road, South Arm Drive and the land to the north of Vixies Road which is located in the Rural Settlement Planning Area and in which Council's Planning Scheme requires reticulated water to be provided to any residential development on the land. At the western end of the property our intention would be to connect to the 150 mm main and extend it down Vixies Road to the development entry. It would then be progressively extended through the development to connect to the existing 100 mm main in Snapper Island Drive.

This solution has the benefit of (a) ensuring that the new development is provided with an adequate water supply and (b) improving volume and pressure to Snapper Island Drive back to Wonga Beach Road by providing a connecting loop main.

It is envisaged that the 225 mm main and 150 mm main to the boundary would be headworks infrastructure. If correct then the applicant could construct these mains and credit the cost against future water headworks contributions.

The final solution and main sizes are subject to consultation with Council officers to determine if this satisfies future requirements and checking flows against the current Wonga water analysis. Subject to these checks we consider that this proposal will provide water to the development at adequate volume and pressure and not have an impact on existing service levels.

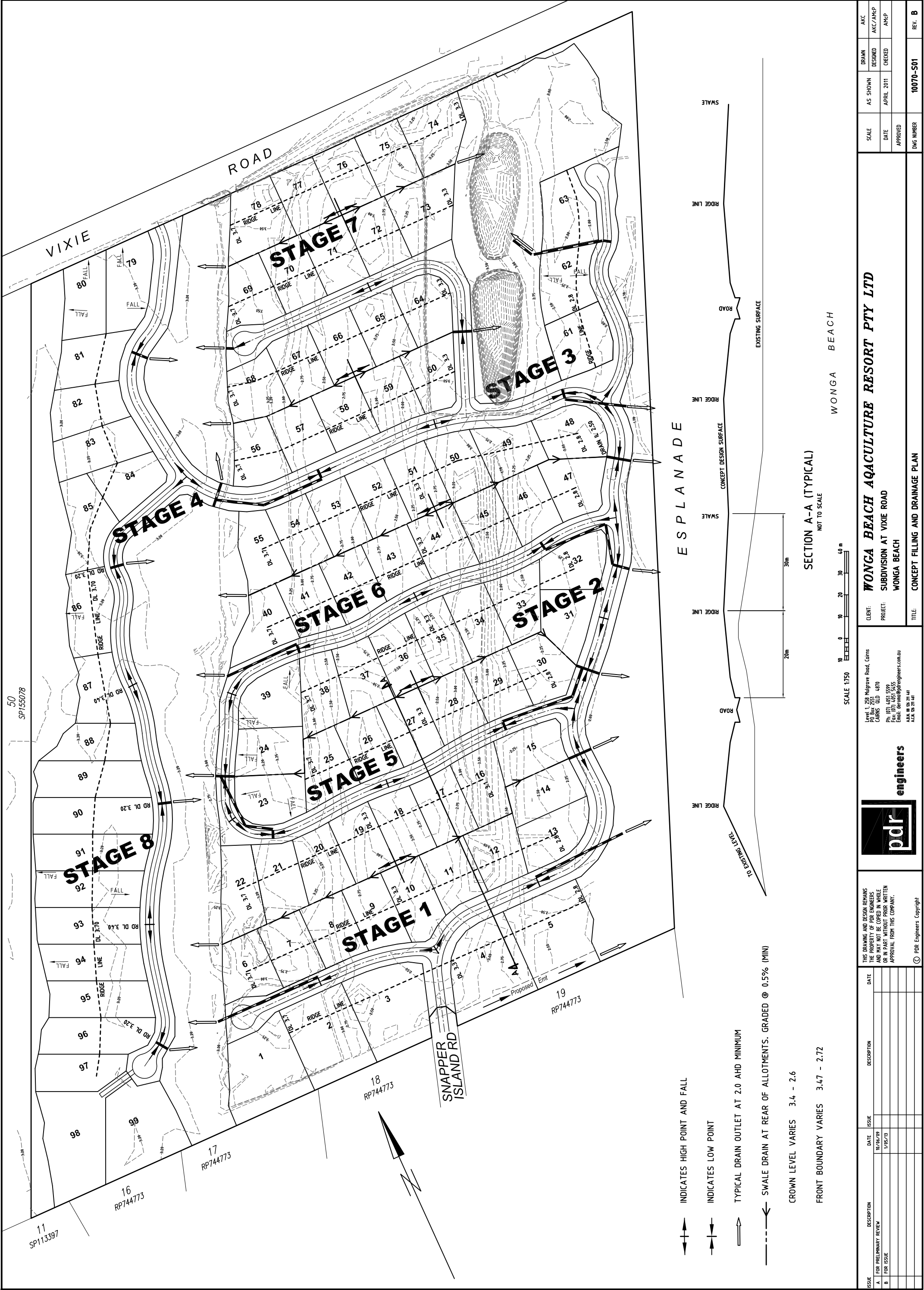
SUMMARY:

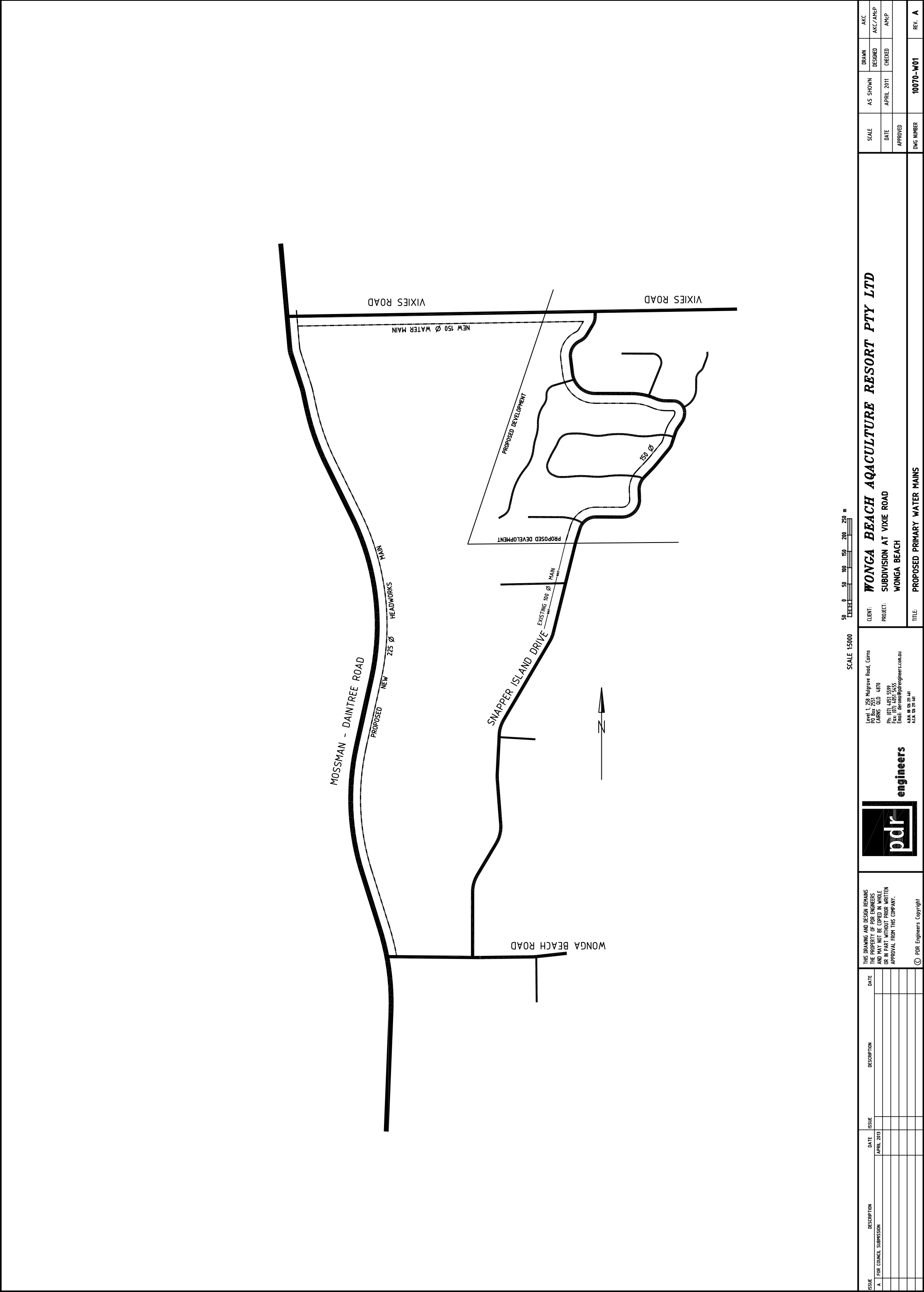
This report provides responses to Council's RFI of the 8th September 2011 in relation to items 4 (filling and drainage), 10 (traffic impacts) and item 11b relating to water reticulation. We consider that the solutions and comments put forward address Council's concerns and recommend acceptance of this report.

A handwritten signature in black ink, appearing to read 'Alan C McPherson', with a long horizontal line extending to the right.

Alan C McPherson
RPEQ 809

For PDR Engineers





ISSUE	DESCRIPTION	DATE	ISSUE	DESCRIPTION	DATE	SCALE	AS SHOWN	DRAWN	AKC
A	FOR COUNCIL SUBMISSION	APRIL 2013						DESIGNED	AKC/ANP
								CHECKED	ANP

CLIENT:	WONGA BEACH AQUACULTURE RESORT PTY LTD
PROJECT:	SUBDIVISION AT VIXIE ROAD WONGA BEACH
TITLE:	PROPOSED PRIMARY WATER MAINS

SCALE	1:5000
DATE	APRIL 2011
APPROVED	
DWG NUMBER	10070-W01
REV.	A

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