

ECOTOURISM DEVELOPMENT

FLOOD ASSESSMENT REPORT ISSUE 2

**LOT 490 DP1095234, PART OF LOT 489 DP47021
& PART OF LOT 500 DP1095235
CASUARINA WAY, KINGSCLIFF**

**LEIGHTON'S PROPERTIES PTY LTD
LEVEL 11, WATERFRONT PLACE
1 EAGLE STREET
BRISBANE QLD 4000**

OCTOBER 2009

QC003655

Airlie Beach Mackay Gladstone Emerald Bundaberg Hervey Bay Sunshine Coast Brisbane Gold Coast

Document Control Sheet

Ecotourism Development

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Synopsis:	This report presents the Flood Assessment for the proposed Ecotourism Development to be located on Casuarina Way, Kingscliff. This investigation establishes the flood levels and extent across the site and reviews the impact of the development on upstream and downstream flood levels.

Revision History:

Issue	Date	Author	Reviewer	Approved
2	16-10-2009	Steven Chamberlain  Senior Water Engineer	Emma Jarrold  Manager, Water Services	Emma Jarrold  Manager, Water Services RPEQ 8614

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1. Introduction

VDM Consulting Belleng was commissioned by Leighton Properties Pty Ltd to prepare a Flood Assessment Report for the proposed mixed use development on Lot 490 DP1095234 and ancillary development on part of Lot 489 DP47021 and part of Lot 500 DP1095235, Casuarina Way, Kingscliff (the subject site). This report will accompany the planning application that seeks a Development Permit within the subject site and has been amended in August 2009 following comments from the Department of Planning regarding the adequacy of the report.

1.1. Scope

The general approach and methodology employed to achieve the study objectives involved:

- Compilation and review of available information;
- Site inspection;
- Collection of additional topographic data;
- Review Councils relevant flood policy;
- Establishes the Defined Flood Level (Q_{100});
- Establish Habitable Flood Level for all residential development;
- Flood Planning Level for all non residential development;
- Define the Emergency evacuation routes;
- Address requirements of Councils Flood Risk Management Policy and Development on Flood Liable Land policy;

As part of the preliminary flood assessment a number of sources were used as follows:

- The Tweed Shire Council (TSC) Flood Risk Management Policy 2007;
- The TSC DCP Section A3 – Development of Flood Liable Land;
- The TSC Draft Coastal Creeks Flood Study;
- The NSW Floodplain Development Manual (2005);
- Personal Communication with Tweed Shire Council (TSC) Infrastructure Planning Unit; and
- Maritime Safety Queensland.

1.2. Description of Subject Site

1.2.1. Location

The subject site is bounded to the south by land identified in local zoning maps as tourist regions and to the northwest by Tweed Coast Way, Cudgen Creek, rural residential and agricultural properties.

The subject site slopes from the southeast to the northwest at a grade of approximately 2%. Levels across the site range from a maximum of 8m AHD to a minimum of 1m AHD. Stormwater flows north through the centre of the site into an existing wetland and through culverts located under Tweed Coast Way to discharge into Cudgen Creek and finally discharge into the Pacific Ocean. Refer to Figure 1 for the approximate location of the site.

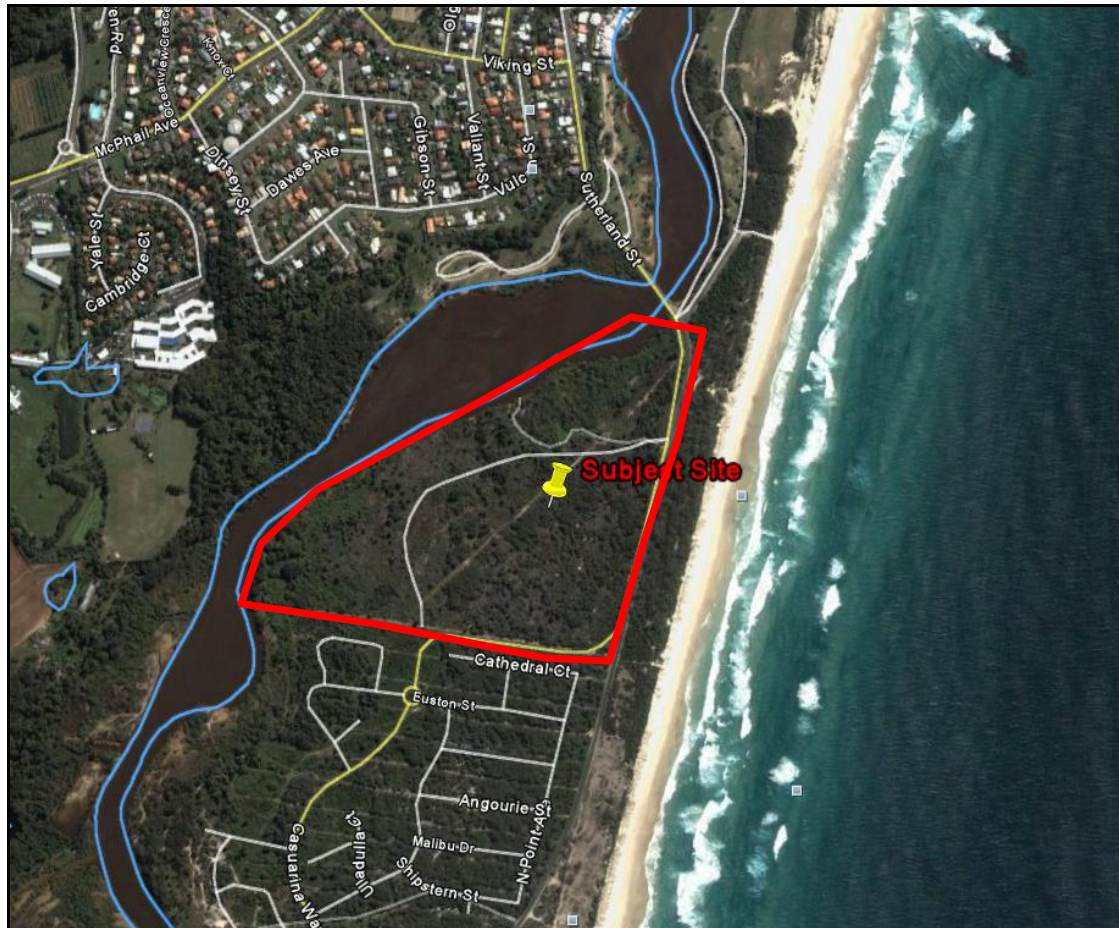


Figure 1. Site Location

1.3. Description of Development

The proposed development will include the following:

- Dwellings;
- Reception;
- Conference Centre;
- Communal Amenities;
- Car Parks;
- An Internal Road Network;
- Pontoon;
- Recreational Facility, and
- Footpath.

2. Review of Flood Related Policy

The following sections address Tweed Shire Councils Flood related policies, namely:

- Tweed Shire Councils Development Control Plan, Section A3 – Development of Flood Liable Land;
- Tweed Shire Councils Flood Risk Management Policy; and
- Flood Related Requirements of the Director General.

2.1. Tweed Shire Council's Development Control Plan, Section A3 - Development of Flood Liability Land

The following is to be read in conjunction with TSC Development Control Plan Section A3 – Development of Flood Liable Land (Section A3.6 Coastal Villages). The following flood planning items are the same requirements as those applied to other villages in the areas such as Casuarina Beach and Salt, and have been confirmed with Council. Table 2.1 below outlines the proposed controls for development on flood liable land.

Table 2.1 Development Control Plan for Flood Liable Land

Development Item	Control Item	Control Plan
Flood Levels	Defined Flood Level (Q ₁₀₀)	The Design Flood Level (DFL) for development is 2.60m AHD corresponding to Table 7.1 of the TSC DCP A3 which specifies a minimum DFL of 2.60m AHD. The 1 in 100 year flood level for the site, as detailed in the TSC <i>Draft Coastal Creek Flood Study</i> (provided by Danny Rose of TSC) is 2.50m AHD. Please refer to Appendix A for a plot of the DFL.
Development Generally on Flood Liable Land	Development	Appendix A shows that only a small portion of the proposed development is located within the Defined Flood Level of 2.60m AHD. The portion of the proposed development to be located within the Defined Flood Level will be of pier and beam construction with any habitable areas to be located above the defined flood level. This construction technique minimises the need for filling within the flood plain and any potential loss of flood storage, and further minimises any obstructions to regional flood conveyance.
	Filling	Filling below the defined flood level is confined to internal roads, to provide emergency access/egress routes, and minor incursions associated with the conference facility.
	Building Materials	All building materials below Councils adopted designated flood level will not be susceptible to water damage.
	Electrical Supply	All electrical wiring, power outlets, switches etc, will to the maximum extent possible be located above the defined flood level. All electrical wiring installed below the defined flood level will be suitably treated to withstand continuous submergence in water.
	Car Parking	No basement car parking is proposed for this development.

Residential Development on Flood Liable Land	Subdivision	Filling is required for the purposes of providing safe emergency evacuation from the development site.
	Filling	As discussed above all development within the defined flood area will be of pier and beam construction, thus reducing the need for fill and alleviating any potential issues with loss of floodplain storage or conveyance. A minor amount of filling to 2.60m AHD is proposed to achieve an emergency evacuation route for affected accommodation types, in accordance with the NSW Floodplain Development Manual (2005). This high level evacuation route will grade up to land above the Probable Maximum Flood (PMF). As per the TSC <i>Draft Coastal Creek Flood Study</i>, the PMF level for the site is defined as 5.20m AHD. All accommodation types will have direct access to the high level road via a series of high level (2.60m AHD) walkways.
	Development	Table 7.1 of the TSC DCP A3 specifies a minimum habitable floor level of the DFL + 0.5m. Therefore, for the proposed development, the minimum floor level will be 2.60m + 0.50m = 3.10m AHD.
Commercial Development on Flood Liable Land	Development	There is no minimum floor level required for non-residential development. As per Councils requirements adequate flood free storage areas will be provided for stock and equipment susceptible to water damage.

2.2. Probable Maximum Flood (PMF)

The PMF level is 5.20m AHD, as defined in the TSC *Draft Coastal Creeks Flood Study*. In accordance with TSC *Flood Risk Management Policy 2007* Section 1.4.2, all new residential development of this nature is to have a permanent high level road evacuation route(s) to land above probable Maximum Flood (PMF) level.

2.2.1 Emergency Access and Egress

All residential accommodation below the defined flood level will have access to the permanent high level access road via elevated walkways. These access roads and walkways will be set at a minimum level of 2.60m AHD and remain trafficable and safe for pedestrian movement for events in excess of the Q_{100} (assuming vehicular traffic and pedestrians can move safely through floodwater up to approximately 200mm depth). As illustrated in Appendix A, these roads lead to the higher portions on the east of the site where roads are located well above the PMF level of 5.20m AHD.

Portions of the internal roadways are located below the PMF level but above the DFL of 2.60m AHD. It is considered during a large scale flood event, when the water level is approaching the DFL, any guests at the site would have begun to make preparations to move to higher ground. Therefore, there will be adequate time for guests to reach the higher portions of the site located above the PMF level. Therefore, although not all roads are flood free during a PMF, the facilities to be located above the DFL and the warning times are sufficient to allow guests to move to safe areas.

In the event of a PMF, roads in the eastern and southern extents of the development remain flood free and could provide emergency access/egress to the site. The intersection at Casuarina Way appears to be inundated by depths less than 200mm. This depth of flooding is minor and the roadway would remain trafficable to vehicles wishing to access the site. Furthermore, there are opportunities for pedestrian traffic to move to higher ground to the south via the proposed walkways and the existing coastal bikeway. Emergency access and egress paths are illustrated in Appendix A.

2.3. Climate Change Impacts

The TSC *Draft Coastal Creeks Flood Study* includes modelling of Cudgen Creek and has simulated a range of climate change scenarios. The “High Level” climate change scenario results in a peak water level of 2.90m AHD. This includes the Q_{100} level for the site (i.e. 2.50m AHD) plus an additional 0.40m rise that accounts for sea level rise and a 30% increase in rainfall intensity. Therefore, the 3.10m AHD minimum floor level provides additional clearance to the high level impacts of climate change, including potential for sea level rise, increased storm severity and changes to the rainfall patterns.

2.4. Director General’s Environmental Requirements

The Director General Environmental Requirements (DGR) application Number 07_0089 has identified two items (Item 6.7 and 6.8) to be addressed, as discussed below.

2.4.1 Flood Risk Assessment (Item 6.7)

The Director General requires that a risk assessment is provided in accordance with the NSW Floodplain Development Manual (2005) and to include the potential effects of sea level rise and increase in rainfall intensity.

As discussed in Section 2.3, the proposed minimum flood level exceeds the Q_{100} water level plus high level climate change variations. Therefore, Item 6.7 of the DGR is adequately addressed.

2.4.2 Filling within the Floodplain (Item 6.8)

As identified previously, minimal filling within the floodplain is proposed for the purposes of constructing a permanent high level evacuation route for residential accommodation built with the defined flood area. All residential accommodation proposed for the site is to be of pier and beam construction, thus limiting the need for fill within the subject site, and reducing any potential obstruction to regional flood conveyance.

The flood storage volume lost due to the proposed filling is to be confirmed. Cudgen Creek is within the vicinity of the subject site and is tidally influenced. Therefore the minor amount of filling required will not cause adverse impacts on surrounding properties. Thus no floodplain compensation on site has been proposed. Discussions have occurred with TSC, and they have confirmed that floodplain compensation is not required due to the tidal influences and the close proximity to the ocean. This is in line with accepted hydraulic practice within industry.

2.5. Department of Planning Issues

A number of other issues have been raised by the Department of Planning (DOP) in relation to flooding of the site. These issues are discussed in the following paragraphs.

As discussed in Section 2.3, the TSC *Draft Coastal Creeks Flood Study* has undertaken hydraulic modelling of Cudgen Creek and has simulated a range of climate change scenarios. The “High Level” climate change scenario results in a peak water level of 2.90m AHD. This includes the Q_{100} level for the site (i.e. 2.50m AHD) plus an additional 0.40m rise that accounts for sea level rise and a 30% increase in rainfall intensity. Therefore, the 500mm freeboard requirement specified by the TSC exceeds the increased water levels that could be expected for even the worst climate change scenarios. Therefore, the development takes into consideration the sea level rise predictions outlined in the 2007 IPCC report.

The *Draft Coastal Creeks Flood Study* has simulated a full range of design storm events, up to and including the PMF event, for Cudgen Creek. The Q_{100} and PMF levels are the focus of this assessment as these events are the most likely to result in material damage and potentially injury or loss of life for visitors to the report. As discussed above, the “High Level” climate change scenario accounts for a combination of catchment based flooding and sea level rise.

In setting the floor levels of the cabins at 3.20m AHD, the development effectively addresses the potential impacts of sea level rise. The *Draft Coastal Creeks Flood Study* quantifies the Q_{100} flood level and “High Level” climate change scenario which accounts for a combination of catchment based flooding and sea level rise. The *Practical Consideration of Climate Change – Floodplain Risk Management Guideline* (DECC, October 2007) is more generic in nature and discusses variations in rainfall intensities and potential management. These issues have already been considered by the TSC in the modelling undertaken as part of the *Draft Coastal Creeks Flood Study*. It is therefore considered that the information provided by the *Draft Coastal Creeks Flood Study* adequately addresses the potential impacts of sea level rise and addresses all concerns highlighted in the *Practical Consideration of Climate Change – Floodplain Risk Management Guideline* (DECC, October 2007).

The PMF event and emergency access/egress is discussed in Section 2.2. Results of the *Draft Coastal Creeks Flood Study* indicate a PMF level of 5.20m AHD, while Figure 3 illustrates appropriate access/egress opportunities within the proposed development layout.

3. Summary

The following dot points summarise the above discussion:

- The proposed development is to be located primarily above the defined flood level of 2.60m AHD;
- All residential development will have a minimum habitable floor level of 3.10m AHD (incorporating 500mm freeboard);
- Residential development located within the defined flood areas will have high level access (walkways) to a permanent high level evacuation road to land above the Probable Maximum Flood (PMF), defined as 5.20m AHD;
- A large portion of the site is located above the PMF level and the proposed internal road network provides emergency access and egress opportunities for vehicular traffic during a PMF event;
- The proposed walkways and the existing coastal bikeway provide additional access and egress opportunities for pedestrian traffic during the PMF event;
- The minor filling proposed will not significantly reduce floodplain storage and will not impact upon surrounding peak water levels due to the proximity to the Pacific Ocean;
- Commercial development does not have a minimum flood planning level;
- Commercial development requires adequate flood free storage areas to be provided for stock and equipment susceptible to water damage; and
- Building materials used below the defined flood level must not be susceptible to flood damage.

Appendix A

Floodlines and Emergency Access Routes

