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GREATER TAREE CITY COUNCIL

PITT STREET WATERFRONT PRECINCT, CHATHAM

"FIGTREES ON THE MANNING"

Flood Impact Assessment

Issue C

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Water Resources

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GREATER TAREE CITY COUNCIL
PITT STREET WATERFRONT PRECINCT, CHATHAM
Flood Impact Assessment

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Project: PITT STREET WATERFRONT PRECINCT, CHATHAM
Flood Impact Assessment

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A	Issued for Review	WJH	CRT		12/12/08		
B	Final Draft	WJH	CRT		2/4/09		
C	Final Report	WJH	CRT	Chris Thomas	15/5/09		

CONTENTS

1. INTRODUCTION

The Pitt Street Waterfront Precinct is located along the northern foreshore of the Manning River approximately two kilometres downstream from the central business district of Taree (*refer* **Figure 1**). Representatives from Greater Taree City Council (*GTCC*) and the owners of the land have formed a Rezoning Consultation Group (*RCG*) that will oversee and facilitate the process of rezoning the precinct to incorporate additional residential and commercial development. The rezoning application is known as "Figtrees on the Manning", and incorporates existing properties between Nelson Street and Manning River Drive (*refer* **Figure 2**).

Flood behaviour within the lower Manning River has previously been investigated and documented in the Manning River Flood Study which was published in 1991. The Flood Study was based on the results of flood modeling that was undertaken using the ESTRY software package.

Patterson Britton & Partners (*now a part of WorleyParsons*) recently prepared detailed flood extent mapping for the lower Manning River floodplain which was based on the results of the ESTRY modelling and Airborne Laser Scanning (*ALS*) survey data for the floodplain that was acquired in 2005. This work was undertaken using WorleyParsons' in-house waterRIDE^{TM} software.

The flood extent mapping for Taree and the surrounding area shows that a significant portion the Pitt Street Waterfront Precinct is susceptible to inundation during major flooding of the Manning River. It also shows that local catchment runoff could lead to flooding of low lying areas of the Precinct. Accordingly, any rezoning of the land needs to be based on consideration of the range of constraints to development, including the potential for sections of the Precinct to be inundated.

Future redevelopment of the Precinct is likely to involve earthworks and filling to allow the construction of buildings, dwellings and a marina. The filling and associated infrastructure have the potential to impact on existing flood characteristics in the vicinity of the Precinct.

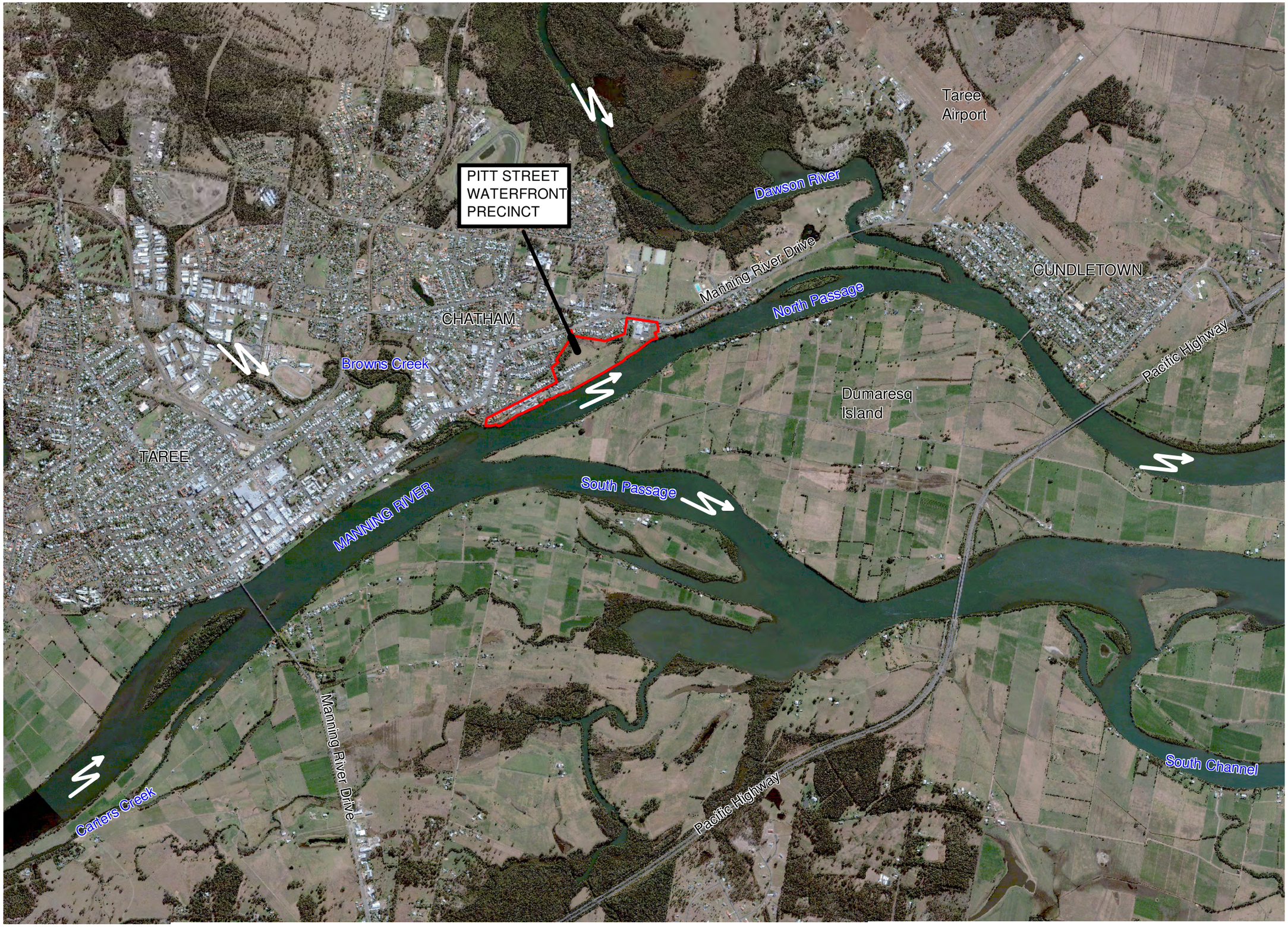
Accordingly, the RCG engaged WorleyParsons to construct a detailed 2D flood model to investigate and quantify the impacts that future development at the Pitt Street Waterfront Precinct may have on existing flood characteristics.

This report documents the process followed to develop the flood model, including the information used to construct and calibrate it. It also documents the procedures employed to verify that the model reliably represents design flood behaviour in the vicinity of the Precinct.

The results of flood modelling for existing conditions and for post-development conditions are also presented. These results have been used to determine the potential impact of the proposed redevelopment on local flood characteristics.

The report also includes the results of investigations to assess the potential for climate change to impact on the proposed development. An appropriate Flood Evacuation Plan has been prepared to show how evacuation of the precinct can be undertaken at the onset of flooding.

FIGURE 1



LEGEND

Pitt Street
Waterfront Precinct

N

0 0.5 1.0

kilometres

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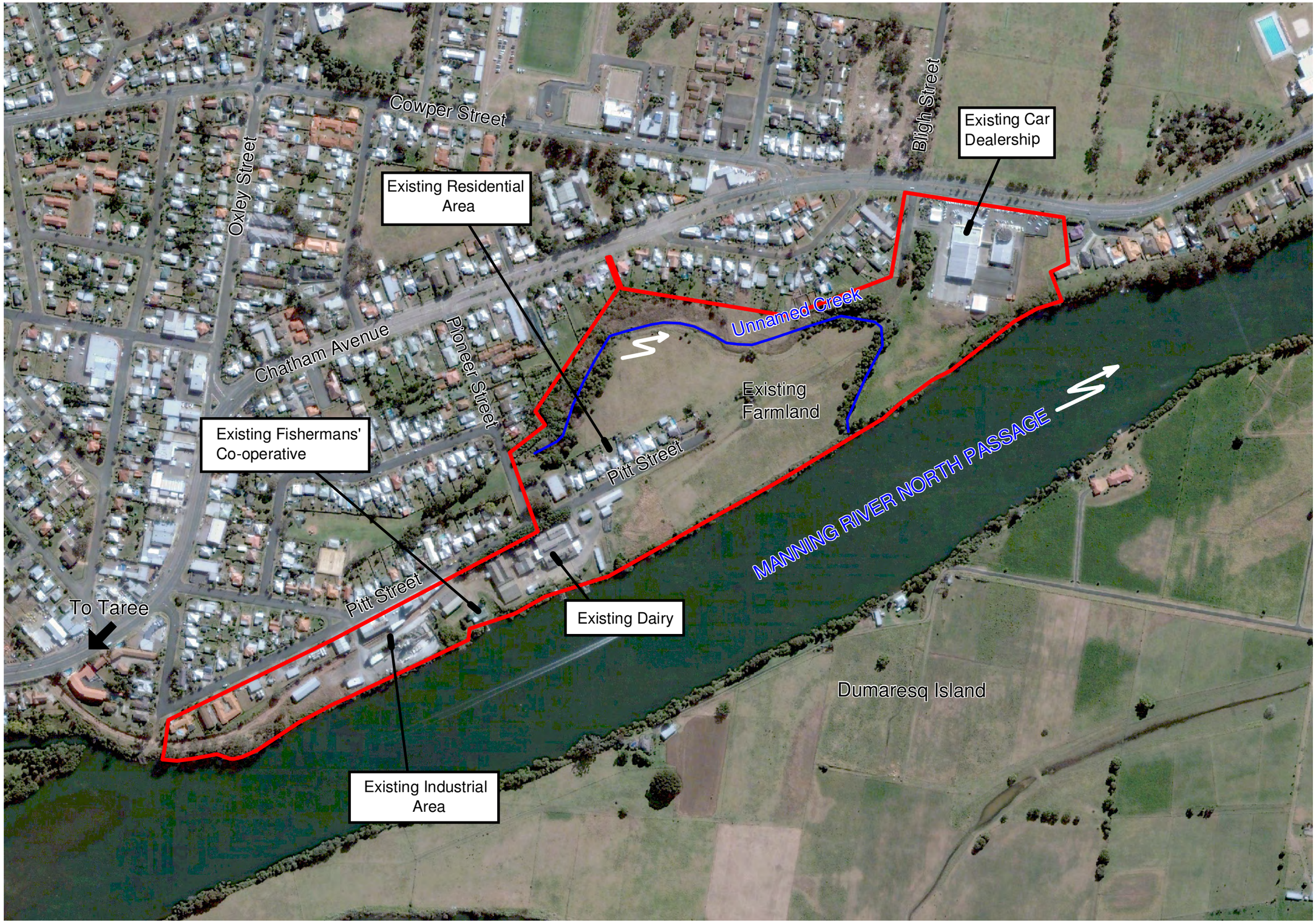
rp7485 Pitt Street Waterfront Precinct FIA
Figure 1 - Location.wor

LOCATION OF PITT STREET WATERFRONT PRECINCT

FIGURE 2



LEGEND

- Unnamed creek
- Pitt Street Waterfront Precinct

N

0 100 200

Meters

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Figure 2 - Site plan.wor

PITT STREET WATERFRONT PRECINCT

2. ASSESSMENT OF EXISTING FLOOD BEHAVIOUR AT THE DEVELOPMENT SITE

2.1 BACKGROUND

The Pitt Street Waterfront Precinct is located on the northern shore of the Manning River to the east of Taree (*refer* **Figure 1**).

As shown in **Figure 1**, Browns Creek discharges to the Manning River immediately upstream from the western-most boundary of the Precinct. The Dawson River discharges to the Manning River approximately 2 kilometres downstream from the Precinct (*refer* **Figure 1**).

A small unnamed drainage channel passes through the site and discharges to the Manning River about 300 metres from the eastern boundary of the Precinct (*refer* **Figure 2**). This channel is fed by the existing stormwater drainage system which drains the area to the west of Pioneer Street and follows the approximate alignment of the northern boundary of the Precinct until it turns to the south and toward the northern bank of the Manning River.

Existing flood extent mapping for the Manning River indicates that a significant portion of the Precinct is subject to inundation during major flooding of the Manning River. Current estimates of peak design flood levels at the Precinct are listed in **Table 1**. These flood levels are predicted to occur at the western boundary of the Precinct (*i.e., at the upstream limit of the site*).

Table 1 PEAK DESIGN FLOOD LEVELS AT PITT STREET WATERFRONT PRECINCT

AVERAGE RECURRENCE INTERVAL (*Years*)	PEAK FLOOD LEVEL (*m AHD*)
20	4.2
50	4.9
100	5.2
200	5.7
Probable Maximum Flood	9.1

Source: Greater Taree City Council

2.2 PREVIOUS INVESTIGATIONS

2.2.1 Manning River Flood Study (*1991*)

Flood characteristics for the lower Manning River have previously been determined and documented in the Manning River Flood Study, which was prepared in 1991.

Preparation of the Flood Study involved the development of hydrologic and hydraulic flood models for the Manning River catchment and floodplain. RORB and WBNM hydrologic models were developed and were used to determine discharge hydrographs for catchment runoff.

A 1-Dimensional ESTRY flood model was developed to determine existing design flood levels along the lower Manning River and its tributaries. Flood behaviour was modelled for the 20, 50, 100 and 200 year recurrence floods and an extreme flood. The flood levels listed in **Table 1** were extracted from the results of the 1991 ESTRY flood modelling.

2.2.2 Manning River Floodplain Management Study (*in draft, 1996*)

Preparation of the draft Manning River Floodplain Management Study involved the assessment of various structural and non-structural floodplain management measures. It is understood that the existing ESTRY flood model was modified as required to investigate the potential hydraulic benefit or flood damage reduction that would be afforded by each measure.

A list of preferred management strategies is presented in the report.

2.2.3 Preparation of Detailed Flood Extent Mapping for the Manning River (*2007*)

Patterson Britton & Partners (*now a part of WorleyParsons*) was engaged by Greater Taree City Council to prepare detailed flood extent and flood level contour mapping for design flood events that were previously modelled as part of work for the 1991 Flood Study. The flood extent and flood level contour mapping was incorporated into Council's GIS and is currently used to support planning and development advice.

This work involved processing the 1-Dimensional ESTRY model results into a 2D compatible format and then mapping the resultant flood surface map to detailed terrain information obtained by Airborne Laser Scanning (ALS) survey.

2.3 TWO-DIMENSIONAL MODELLING APPROACH

Investigation of flood hydraulics along the Manning River to-date has involved the simulation of flood characteristics based on a 1D modelling approach using the ESTRY software. This approach is considered appropriate for the broad scale characterisation of flood behaviour as part of floodplain management investigations.

However, the level of spatial analysis of flood behaviour is somewhat limited in the application of 1D modelling techniques. Furthermore, the inherent lack of spatial data incorporated into a 1D model, such as detailed terrain mapping, can limit the capacity of the model to provide a reliable representation of flooding.

Advances in computer technology since the preparation of the original ESTRY model in 1991 have allowed the development of sophisticated 2D modelling techniques. A 2D modelling approach allows for an increased level of modelling accuracy and improved interpretation of modelling results. As an example, 2D modelling results can be interrogated to determine flood levels and section averaged flow velocities for any point across the floodplain. This is important for the assessment of flood hazard, particularly where development is proposed.

It is therefore considered that a 2-Dimensional modelling approach is more suitable for the assessment of flood impacts that could arise as a consequence of filling and development that is proposed as part of the "Figtrees on the Manning" development proposal.

2.4 AVAILABLE DATA FOR USE IN FLOOD MODELLING

A range of data has been gathered and used to develop a 2-Dimensional hydrodynamic model for the Manning River. This data includes:

- Airborne Laser Scanning (*ALS*) survey data to define the existing topography of the Manning River floodplain in the vicinity of the precinct;
- detailed hydrographic survey for the Manning River in the vicinity of the precinct;
- previous hydrographic survey collected for the Manning River between Wingham and the ocean;
- aerial photography covering the precinct and surrounding areas;
- a DRAINS hydraulic model of the stormwater system that discharges to the unnamed drainage channel that passes through the precinct; and,
- a copy of the original ESTRY flood model for the Manning River.

Further details of this data are outlined in the following. The extent of available topographic and hydrographic survey information is shown in **Figure 3**.

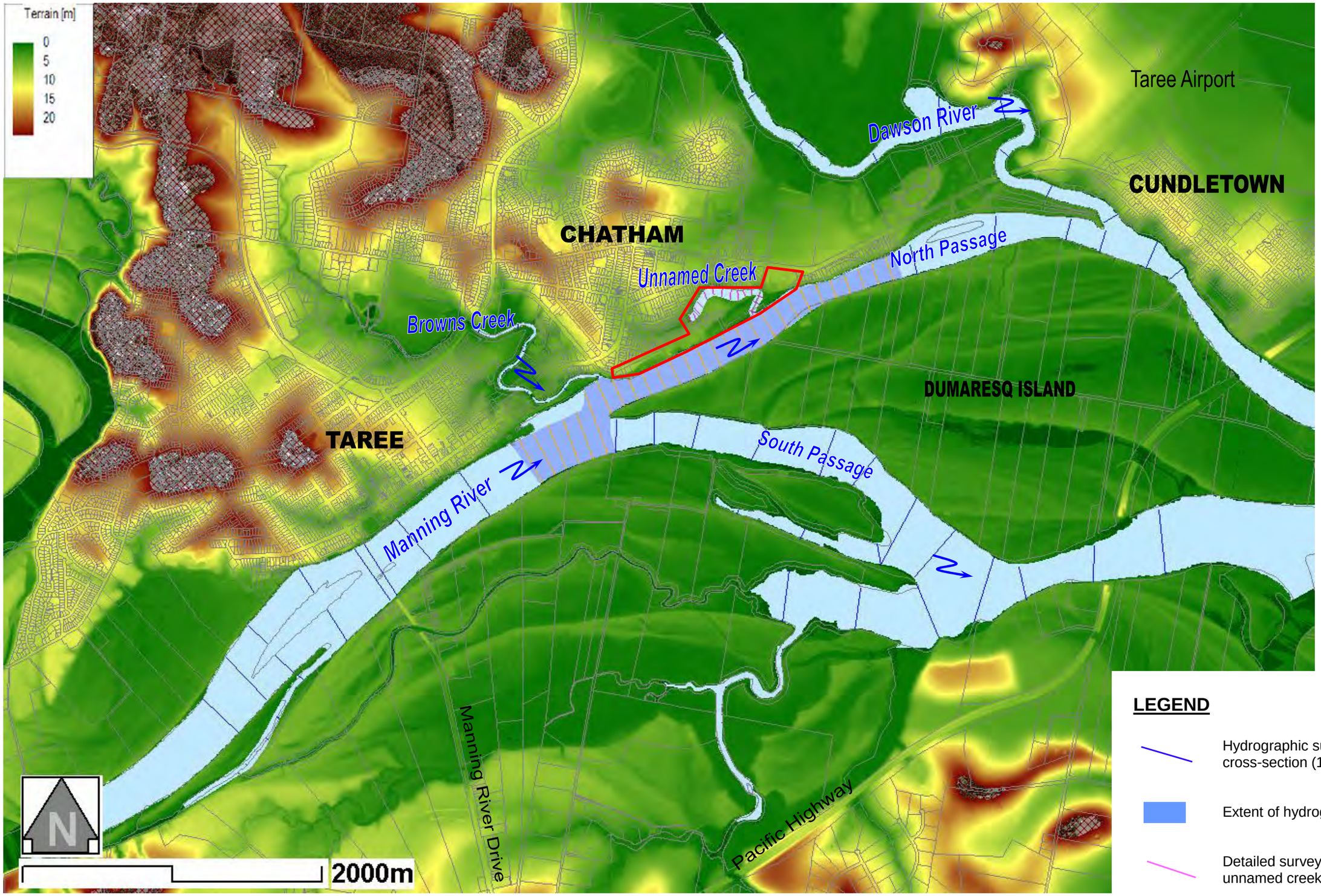
2.4.1 Topographic Data

ALS survey data was collected by AAM Hatch Pty Ltd for Greater Taree City Council in October 2005. The vertical accuracy of the ALS data is reported to be 0.2 metres. A Digital Terrain Model (*DTM*) was developed for the study area using several tiles of ALS data.

The DTM has been mapped thematically and is presented in **Figure 3**. It has been used to define surface levels for the 2D flood model network.

An increased level of detail for the topography across the Pitt Street Precinct is presented in **Figure 4**.

FIGURE 3



LEGEND

- Hydrographic survey cross-section (1999)
- Extent of hydrographic survey (2007)
- Detailed survey cross-section for unnamed creek (2008)
- Pitt Street Waterfront Precinct

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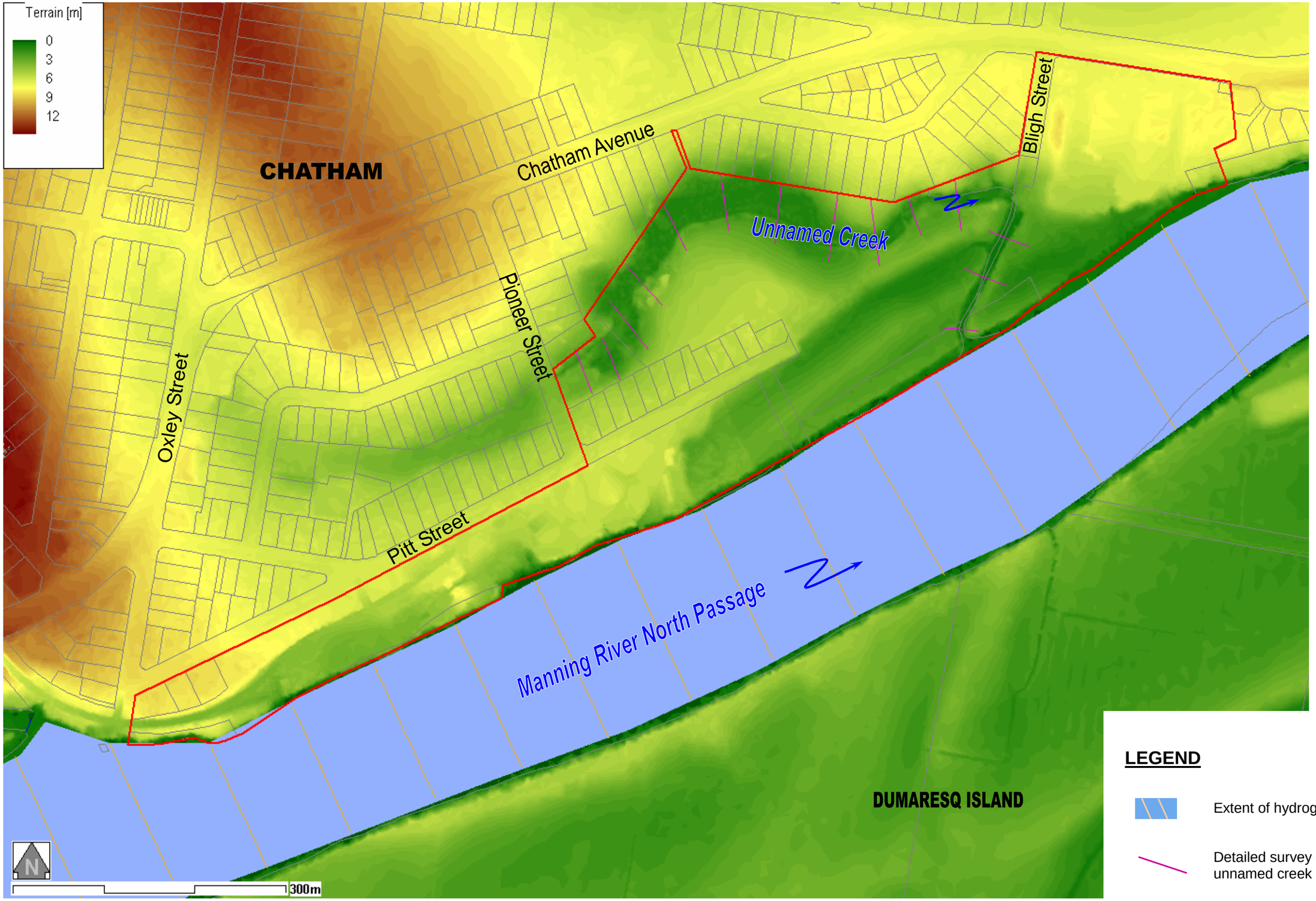
Figure 3 – Available Data.doc

AVAILABLE TOPOGRAPHIC AND HYDROGRAPHIC SURVEY DATA

FIGURE 4



LEGEND

- Extent of hydrographic survey (*2007*)
- Detailed survey cross-section for unnamed creek (*2008*)
- Pitt Street Waterfront Precinct

TOPOGRAPHY AT THE PITT STREET WATERFRONT PRECINCT

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2.4.2 Hydrographic Data

Detailed hydrographic survey of the Manning River adjacent to the Precinct was undertaken in 2007 by Hydrographic Surveys Pty Ltd. The extent of the hydrographic survey is shown in **Figure 3**. It extends approximately 800 metres upstream from the Precinct and 700 metres downstream.

A more general hydrographic survey of the Manning River and its tributaries was also undertaken in 1999 by the Department of Public Works as part of the Estuary Management Program. This survey includes up to 60 channel cross-sections within the study area for this investigations (*refer* **Appendix A**). The location and extent of these cross-sections is shown in **Figure 3**.

2.4.3 Aerial Photography

Aerial photographs provided by the RCG, in conjunction with notes from site inspections, have been used to determine the density of floodplain vegetation within the study area for the purpose of assigning floodplain roughness parameters within the 2D flood model.

The airphotos have also been used to identify buildings within the floodplain so that they could be incorporated into the 2D model.

The aerial photography is shown in **Figures 1** and **2**.

2.4.4 DRAINS Hydraulic Modelling

Greater Taree City Council is currently investigating the stormwater system that drains to the unnamed creek that passes through the Precinct (*refer* **Figure 2**). As part of these investigations, a DRAINS hydraulic model has been developed to simulate flows carried by the stormwater pit and pipe system.

Outflow hydrographs from the downstream limit of the DRAINS model have been used as inputs for the 2D flood model that has been developed as part of this project.

2.4.5 ESTRY Flood Model Data

As discussed, an ESTRY flood model was developed as part of the *'Manning River Flood Study'* (*1991*). Results were extracted from this model and were used as the boundary conditions for the 2D flood model that has been developed as part of this study. The layout of the ESTRY model is shown on a figure included in **Appendix B**.

Discharge hydrographs were extracted from the results generated by the ESTRY model to define the upstream boundary conditions along the Manning River, Browns Creek and the Dawson River.

Downstream boundary conditions were extracted from the ESTRY model for the Manning River in the form of stage hydrographs to model tailwater levels.

2.5 DESCRIPTION OF THE PITT STREET PRECINCT

The Pitt Street Waterfront Precinct covers an area of approximately 22 hectares. The precinct is currently zoned as a mixture of residential, industrial, special uses, rural agriculture and open space.

Interrogation of the Digital Terrain Model created from the ALS survey data shows that the existing topography of the precinct ranges from about 0.5 mAHD to 8.8 mAHD (*refer* **Figure 4**). The lowest areas of the site are naturally along the alignment of the unnamed drainage channel. The central section of the site that fronts the Manning River is also low; typically less than 3.0 mAHD. This area is about 3.5 hectares in size. The remainder of the precinct has an elevation greater than 5.0 mAHD (*refer* **Figure 4**).

Existing buildings within the precinct include residential dwellings along Pitt Street, the former Manning Valley Dairy Co-operative, the Fisherman's co-operative, a fuel depot and a car dealership (*refer* **Figure 2**).

The Rezoning Consultation Group (*RCG*) is in the process of preparing a Masterplan for the precinct which will involve rezoning the precinct to mixed uses, including residential, business and tourist areas.

2.6 FLOOD MODEL DEVELOPMENT

A 2-Dimensional hydrodynamic model was developed to define flood behaviour in the vicinity of the Pitt Street Waterfront Precinct. The model was created using TUFLOW software.

TUFLOW is a 2D finite difference software package that employs a regular grid network to represent the study area. The model solves the depth averaged 2D shallow water equations of fluid motion, which are used for modelling long waves such as floods, ocean tides and storm surges. 1D hydrodynamic modelling is embedded within the 2D model grid along defined river channels and creeks.

A schematic representation of the TUFLOW model developed for the Pitt Street Waterfront Precinct and surrounding areas of the Manning River floodplain is presented in **Figure 5**. The figure shows the extents of the model, which can be summarised as follows:

- Downstream limits:
  - ⇒ Manning River North Passage – 1.3 kilometres downstream from junction with Dawson River, near the Pacific Highway crossing.
  - ⇒ Manning River South Passage – 3.9 kilometres downstream from junction with Manning River North Passage, near the Pacific Highway crossing.