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**CLARENCE RIVER  
COUNTY COUNCIL**

**WOOLI RIVER  
FLOODPLAIN MANAGEMENT PLAN**

**Issue No.3  
DECEMBER 1999**

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**Patterson Britton  
& Partners Pty Ltd**  
consulting engineers

# CLARENCE RIVER COUNTY COUNCIL

## WOOLI RIVER FLOODPLAIN MANAGEMENT PLAN

### Issue No.3 DECEMBER 1999

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level 2  
104 Mount Street  
North Sydney 2060

PO Box 515  
North Sydney 2059  
Australia

telephone (02) 9957 1619  
facsimile (02) 9957 1291  
Email: reception@patbrit.com.au  
ACN 003 220 228

**Patterson Britton  
& Partners Pty Ltd**

consulting engineers

# FOREWORD

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The State Government's Flood Policy is directed towards reducing the impacts of flooding and flood liability on individual owners and occupiers, and reducing public and private losses due to flooding. The Policy encourages solutions to existing flood problems in developed areas by ensuring that new development is compatible with the flood hazard and does not create additional flooding problems in other areas.

Under the policy the management of flood liable land is the responsibility of local government. Ulmarra Shire Council has been assisted in this task by the Clarence River County Council and the Woolli Floodplain Community Committee. This committee of Ulmarra Shire Council has a membership comprising a range of technical and community based skills.

The policy provides for technical and financial support by the State Government for a number of activities which include:

1. Preparation of a Flood Study to determine the nature and extent of the flood problem. This study was prepared by Public Works in 1995.
2. Preparation of a Floodplain Management Study to evaluate management options for the floodplain in respect of both existing and proposed development.
3. Preparation of a Floodplain Management Plan which involves formal adoption by Ulmarra Shire Council.
4. Implementation of the Plan.

This Floodplain Management Plan reflects the Committee's preferred strategy of floodplain management for Woolli, comprising non structural options such as evacuation planning, flood recovery planning and flood forecasting. It has been prepared for Ulmarra Shire Council in association with the Woolli Floodplain Community Committee.

## GLOSSARY

<b>aggradation</b>	accretion or siltation of a stream bed
<b>Annual Exceedance Probability (AEP)</b>	refers to the probability or risk of a flood of a given size occurring or being exceeded during a given year
<b>Australian Height Datum (AHD)</b>	a common national plane of level corresponding approximately to mean sea level
<b>catchment</b>	the area draining to a particular site which may include sub-catchments of tributary streams
<b>conveyance capacity</b>	the discharge capability of stream channel
<b>design flood</b>	a flood of known magnitude or probability of exceedance used for engineering design or planning purposes
<b>discharge</b>	the rate of flow of water measured in terms of volume over time
<b>extreme flood</b>	an approximation of the PMF used where meteorological assessments are not available
<b>flood prone land</b>	land that is below the probable maximum flood level
<b>floodplain</b>	the portion of a river valley, adjacent to the river channel that is inundated when the river is in flood
<b>flood storage</b>	those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood
<b>frequent flood</b>	a flood often experienced by communities causing more of a nuisance than threats to property or life, typically floods up to a 5% AEP
<b>hydrograph</b>	a graph which shows how stream discharge or water level varies with time at a specific location
<b>inundation limit</b>	the extent across the floodplain to which a flood of a given probability of occurrence will extend
<b>marginal flood land</b>	land which would be inundated above the standard flood by rarer events up to the extreme or probable maximum flood

**mathematical or computer models**

the representation of the physical processes of rainfall runoff and stream flow through a series of mathematical equations, often processed on a computer

**probable maximum flood (PMF)**

the flood calculated to be the maximum which is likely to occur on the basis of extreme meteorological events

**runoff**

the portion of rainfall that ends up as streamflow

**severe flood**

a flood rarely if ever experienced by most communities and capable of causing damage and severe disruption, typically from a 2% AEP to a 0.2% AEP

**stage**

equivalent to water level, and measured in reference to a particular datum

**velocity**

the speed of water movement measured in terms of distance over time

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# 1 INTRODUCTION

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## 1.1 BACKGROUND

The Wooli River is located on the north coast of New South Wales, approximately 650 kilometres north of Sydney. The river has a catchment area of around 194 square kilometres, encompassing the village of Wooli, low lying swamps and tidal marshes in the lower catchment, and a heavily timbered upper catchment, **Figure 1.1**. The mainstream length of the river is approximately 35 kilometres and the head waters rise to a height of 190 metres above sea level. Tidal influence extends inland approximately 15km along the Wooli River and Bookram Creek.

The village of Wooli has been developed on a narrow sand spit located between the Wooli River and the South Pacific Ocean. The village has a population of around 500 residents, with new residential development to the north of the original Wooli Village. Wooli is an expanding urban centre with significant tourism potential and a fishing industry.

## 1.2 PREVIOUS STUDIES

The Wooli River Flood Study (*Public Works, 1995*) determined design flood levels through the use of hydrologic and hydraulic models. This study defined flood behaviour in the river for the 1% AEP, 2% AEP and 5% AEP events under existing conditions. Design flood levels, flows, and velocities were determined. The study also assessed flood levels for an extreme flood event. The study was the first stage of the floodplain management process for the Wooli River floodplain.

Patterson Britton and Partners completed the Floodplain Management Study for Wooli River in 1997. The study identifies hazard zones, assesses flood damage within the flood plain and identifies practical structural and non-structural floodplain management options for the village of Wooli.

The following Wooli River Floodplain Management Plan completes the floodplain management process for Wooli, identifying the hazard related to the full extent of potential flooding, and through a process of assessment, discussion and review, establishes works and programs that will mitigate the hazard to an acceptable level of risk.

## 1.3 DESIGNATED FLOOD LEVEL

Ulmarra Shire Council's current development consent condition requires that the floor level of any habitable building be a minimum of 500 mm above the 1 in 100 year flood level for the site. For uninhabitable buildings it is a requirement that all electrical components be above the 1 in 100 year flood level.

The floor levels surveyed for the Wooli River Floodplain Management Study (Patterson Britton and Partners, 1997) are reproduced in this report as **Appendix A**.



## 1.4 LANDUSE PLANNING

The current planning policy requires the construction of residential dwellings within flood prone land, to have floor levels at a minimum of 0.5m above the 1% AEP flood level. The bulk of the existing residential community of Wooli Village is situated above the 1% AEP inundation level on the relatively high dune areas. There are however approximately 80 properties that are below this level although they are located in low hazard areas.

The lower Wooli catchment is characterised by low lying swamps and tidal marshes. The area adjacent to the river, north of the existing Wooli Village, contains large areas of undeveloped land all within the 1% AEP flood level.

It is recommended the 1% AEP flood standard remain in place to limit development in the flood effected areas of Wooli. Any future development in the flood effected portion of Wooli will increase the risk of flood damage to property. Construction to meet minimum floor levels can readily be met by pad filling or 2 storey construction.

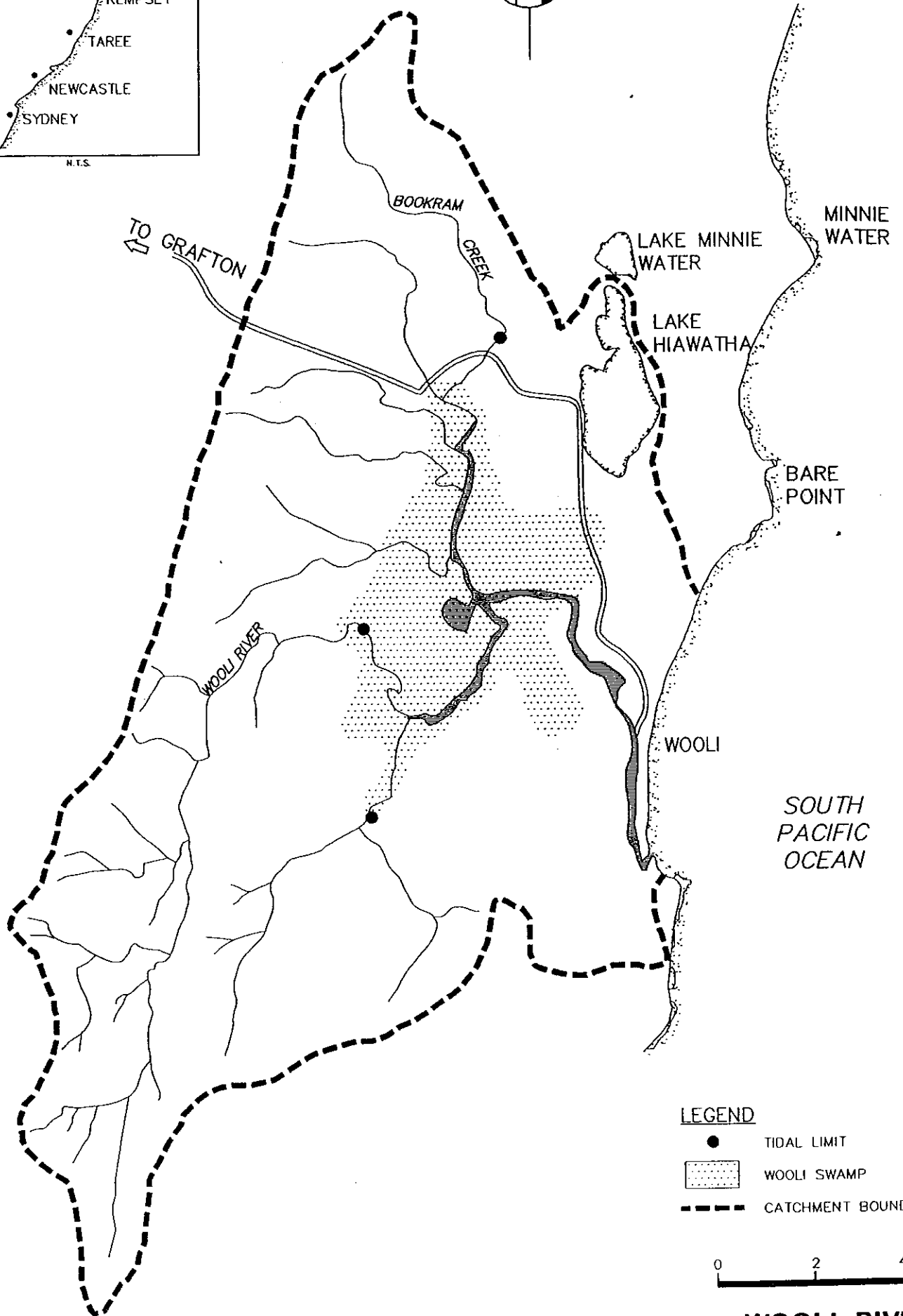
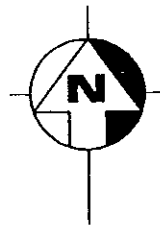
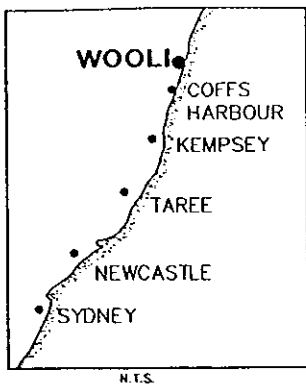
Additions or extensions to habitable rooms of existing dwellings with existing floor levels below the minimum required level (ie, 0.5 m above the 1% AEP flood level) will be restricted to a maximum additional area of 50% of the existing habitable floor area of the building.

The new residential development to the north of the original village and east of Wooli Road is located outside the 1% AEP inundation limits. Further development would not entail additional flood risk however the issue of flood isolation and evacuation needs should be addressed. A severe flood equivalent to the 1% AEP flood or greater will cut Wooli Road isolating the northern development area from the rest of Wooli Village. Planning for any future expansion of residential zoning in this area should consider self evacuation needs and the necessary supporting access infrastructure.

## 1.5 COMMUNITY CONSULTATION

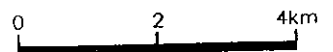
A drop in centre was held at the Wooli Hall on November 27<sup>th</sup> and 28<sup>th</sup>, 1996, to facilitate open discussion with the community on both a one to one and group basis. Twenty five residents visited the centre over the one and a half days it was open, discussions were also held with two residents during the floor level survey, and Mr Lindsay Olen provided a tour of the estuary to point out specific concerns. In addition, discussions were held with the local SES controller and the chairman of the Floodplain Management Committee, who is also a resident of Wooli.

FIGURE 1.1



LEGEND

- TIDAL LIMIT
- ▨ WOOLI SWAMP
- CATCHMENT BOUNDARY



WOOLI RIVER  
CATCHMENT PLAN

## 2 FLOOD BEHAVIOUR

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### 2.1 NATURE OF FLOODING

Wooli has experienced numerous floods throughout the last 50 years. Severe flooding occurred in early 1954, before the construction of the trained entrance, and in March 1974, after the construction of the trained entrance. Flooding in Wooli was previously not considered a serious problem however construction of the trained entrance and the 1974 flood soon after led residents to be concerned the walls may adversely effect flood levels by holding water back inside the river system. The 1974 flood caused disruption throughout the community as road access out of Wooli was cut. The caravan parks and residential dwellings in Carraboi Street and the northern end of Main St were inundated.

The Flood Study, undertaken by Public Works in 1995, defined flood behaviour for the lower Wooli River for the 1%, 2% and 5% AEP (*annual exceedance probability*) floods under existing trained entrance conditions. **Figure 2.1** and **Figure 2.2** show flood contours for the 1% AEP flood and 5% AEP flood. Peak design levels are indicated in the following table:

DESIGN FLOOD	Peak Flood Level (m AHD)	
	Hotel/Motel	Southern Caravan Park
Extreme*	4.50	4.22
1% AEP	2.68	2.52
2% AEP	2.50	2.35
5% AEP	2.21	2.06

\* Note: the extreme level is only an estimate of the probable maximum flood (PMF) and is not based on rigorous assessment of probable maximum precipitation.

#### 2.1.1 Frequent Flooding

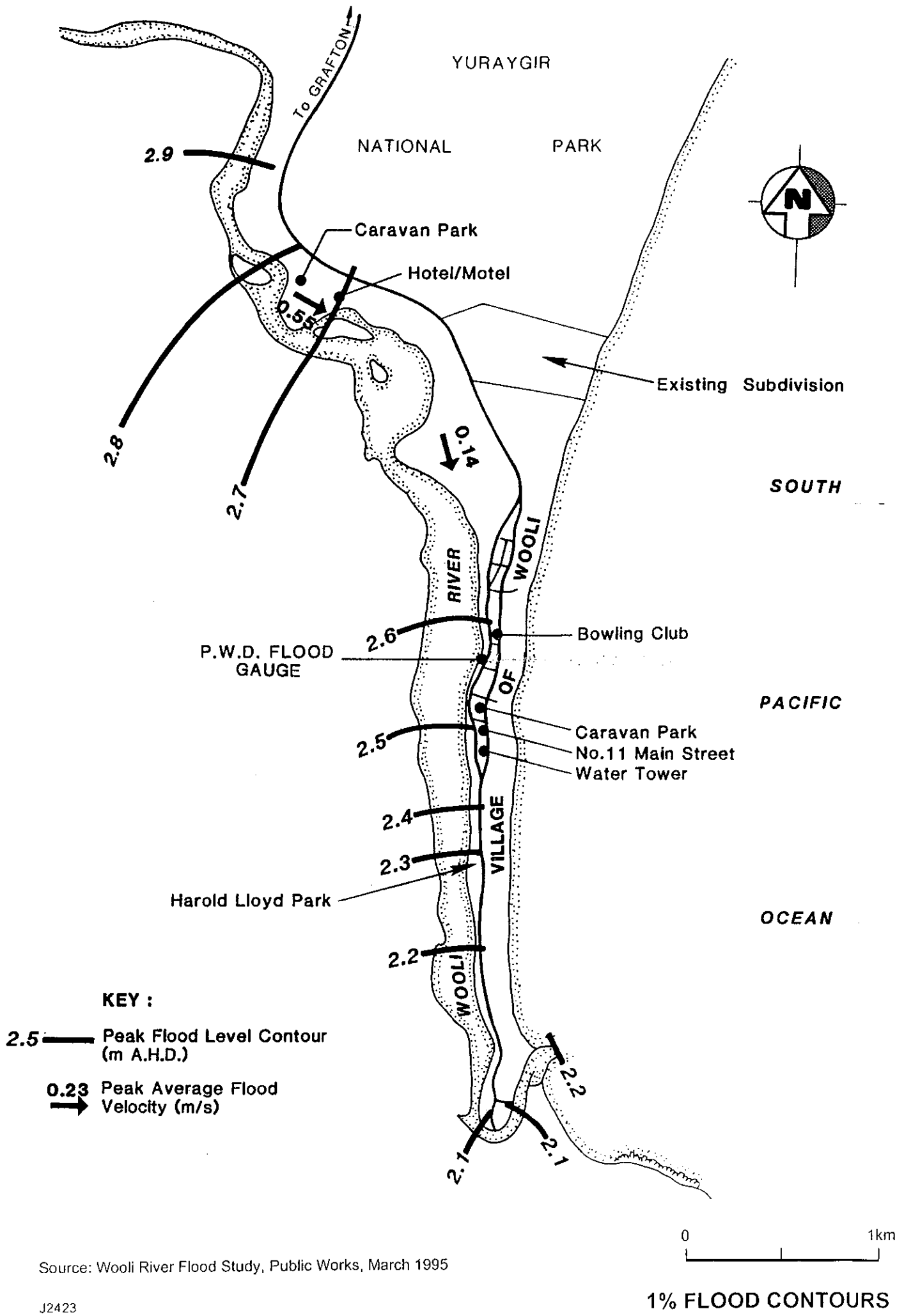
During what may be considered frequent or nuisance flooding, up to about a 1 in 20 year flood, most of the floodwater is confined to the main river channel. Inundation of low lying swamps and tidal marshes provide some flood storage and minor inundation in developed areas occurs in low lying areas such as the northern caravan park, Carraboi Street, Cyril Ellem Place and Olen Close.

#### 2.1.2 Severe Flooding

The more severe flooding associated with a 1% or 2% AEP flood event will cause extensive flooding of tidal marshes and swamp areas. Inundation of residential areas will include the southern caravan park, low lying sections of Riverside Drive and more extensive inundation at Carraboi Street, Cyril Ellem Place, Olen Close, North Street and the northern caravan park.

Inundation levels at the southern caravan park may reach 0.2 m with velocity less than 0.4 m/s. Sections of Riverside Drive may be inundated by depths of 0.6 m in the vicinity of Firth Lane, Durlington Lane, O'Keefe Lane, Braithwaite Lane and Scope Street. Residential premises will be

FIGURE 2.1

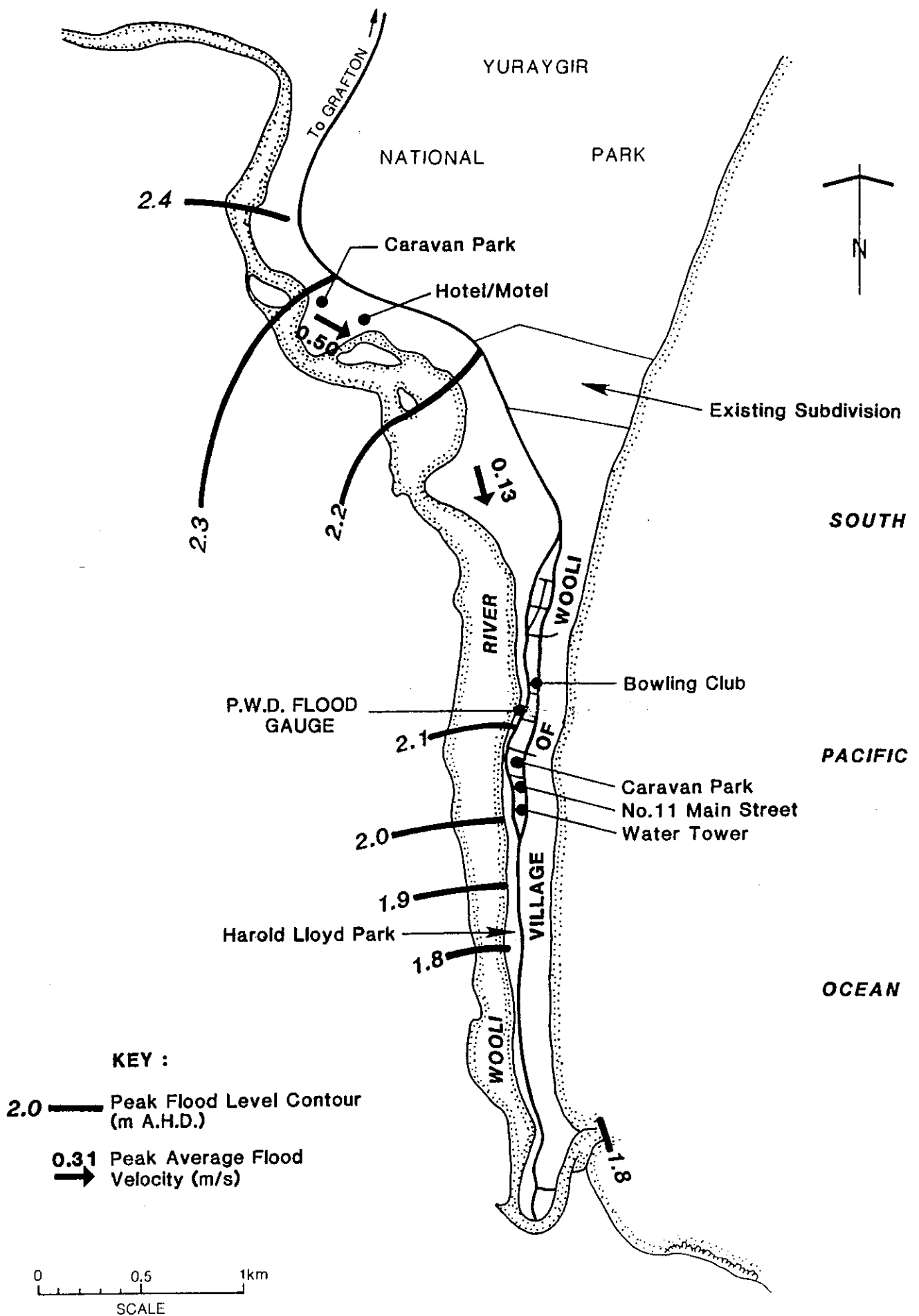


Source: Woolli River Flood Study, Public Works, March 1995

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1% FLOOD CONTOURS

FIGURE 2.2



Source: Woolli River Flood Study, Public Works, March 1995

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5% FLOOD CONTOURS

inundated by up to 0.7 m above floor level in Carraboi Street and Cyril Ellem Place with velocities less than 0.25 m/s.

In the northern residential area inundation extends to North Street where flood depths reach 0.35 m. Inundation of Olen Close also occurs with an average inundation above floor level of 0.5 m and velocities less than 0.3 m/s. The northern caravan park will be inundated by up to 0.8 m with flood velocities around 0.1 m/s.

For severe floods greater than the 1% flood event Wooli Road joining the northern residential area to Wooli Village becomes cut isolating resident in the northern area.

The depth of flooding during a frequent, severe and extreme flood events was determined using the floor level survey undertaken (*refer Appendix A*).

### **2.1.3 Extreme Flooding**

In an extreme flood event 245 premises in Wooli are affected by flooding with 226 of these flooded above floor level. Inundation of residential premises in Wooli begins near the southern caravan park just north of the high ground of the water tower. At the southern caravan park inundation reaches depths of nearly 2 m with the inundation limit extending across Main Street. At O'Keefe Lane flood water extends to Main Street but withdraws around the higher ground of the Bowling Club. North of the Bowling Club inundation reaches the Wooli Hall and remains across Main street until higher ground near Scope Street. The average depth of inundation above floor level in this area is 1.2 m. Flood depths at Cyril Ellem Place reach 2.5 m.

The entire northern residential area is within the flood inundation limit for the extreme event. Flood depths above floor level average 1.5 m. In the lower lying areas of Olen Close the flood depths above floor level may be as high as 2.5 m.

For the extreme event Wooli Road joining the northern residential area to Wooli Village becomes cut isolating resident in the northern area with average flood depths of 2 m.

## 3 FLOOD HAZARDS

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### 3.1 FLOOD HAZARDS

To fully assess the potential impacts of flooding in the Wooli River, flood hazards were determined for 1% AEP, 2% AEP and 5% AEP floods. For the 1% AEP flood all the developed areas within the limits of flood inundation are classified low hazard.

Seventy nine properties are considered floodprone for the 1% AEP flood event. Areas particularly affected are the southern caravan park, Carraboi Street, Cyril Ellem, Olen Close and the northern caravan park.

During the 1% AEP flood event the Main Street connecting the northern residential area to the Wooli village becomes inundated. It is an area of low hazard with flood depths reaching 0.2 m above the road and velocities less than 0.5 m/s. During an extreme flood event the road may become inundated by up to 2m. Isolation of the northern residential area is therefore an issue and appropriate warning would be required to allow evacuation before isolation occurred.

#### 3.1.1 Limits of Flooding

The limit of potential flooding in the Wooli River Valley is based on the extreme event modelled by the Flood Study and is shown in **Figure 3.1**. Crown Land (*Council Managed*) and SEPP 14 land is identified in **Figure 3.2**. Properties and infrastructure within these extents have the potential to be directly affected by flood waters. In addition, some facilities outside these limits may be indirectly affected. The inundation limits adopted in the figure are based on orthophoto and topographic contours only. Minimal ground truthing, except for flood level surveys through the village is available and the extents are therefore not precise.

FIGURE 3.1

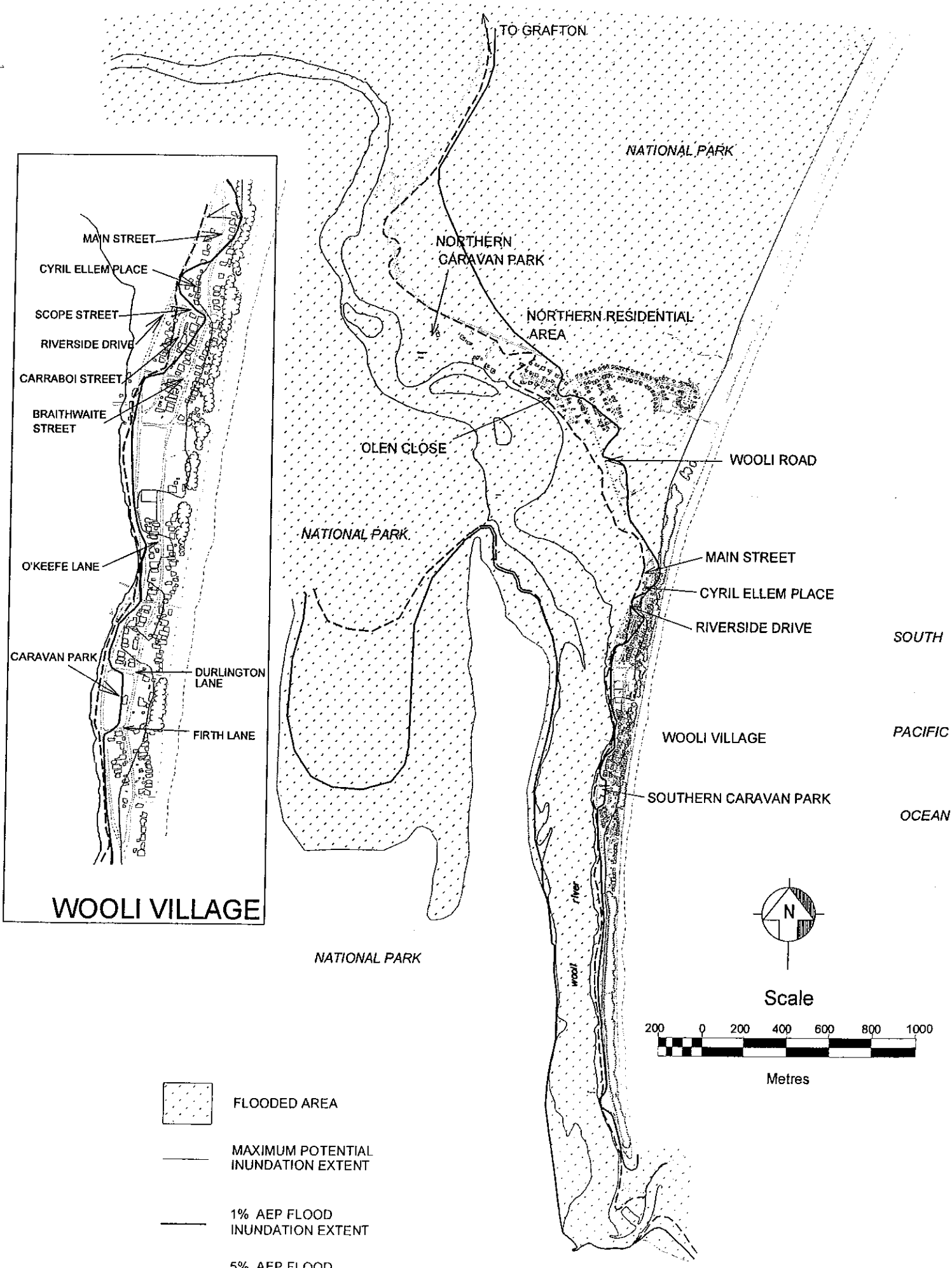
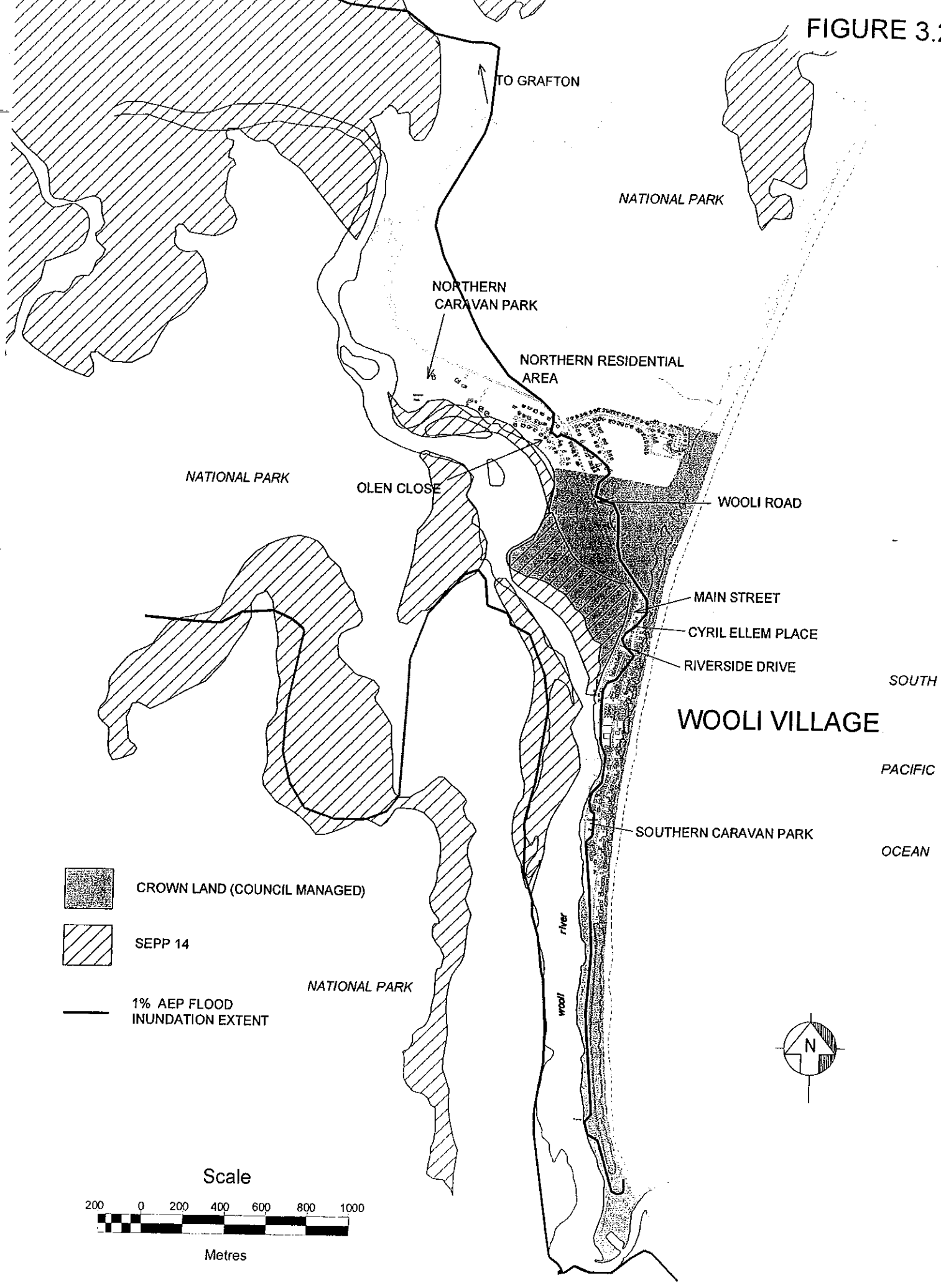




FIGURE 3.2



# 4 MANAGEMENT PLAN

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## 4.1 WOOLI RIVER FLOODPLAIN MANAGEMENT PLAN OVERVIEW

The Wooli River Floodplain Management Study, completed by Patterson Britton & Partners in 1997, identified practical structural and non-structural floodplain management options for the village of Wooli. Options investigated included house raising, levees, road raising, contingency planning and planning and development controls. The options were assessed in term of their effectiveness and performance in achieving management goals from hydraulic, economic, planning, social and environmental perspectives.

The Wooli Floodplain Management Committee allocated the following priorities to floodplain management options identified in the Wooli River Floodplain Management Study:

- Priority One : Contingency Planning, Evacuation Planning and Recovery Planning
- Priority Two : Education Program for Flood Awareness and Preparedness
- Priority Three : Flood Forecasting, Warning and Monitoring System
- Priority Four : Structural Options (*entrance works, dredging, house raising, levee options*)

To identify key aspects of these priority components, discussions were held with the Grafton Local Emergency Management Committee (*GLEMC*), the State Emergency Services (*SES*) and the Bureau of Meteorology (*BOM*).

The Wooli Floodplain Management Plan therefore reflects public sentiment and the Committee's preferred strategy of floodplain management for Wooli. It is recommended the plan should be reviewed every 5 years.

### 4.1.1 CONTINGENCY PLANNING

Effective contingency planning is often the key to a successful floodplain management plan. While formal regional emergency plans are the domain of the State Emergency Service (*SES*), complimentary measures and programs will be implemented by Council to facilitate and augment regional emergency response plans. Appropriate Council initiatives will be developed in the following areas:

- evacuation access and support,
- flood recovery.
- flood awareness and preparedness,
- flood forecasting, warning and monitoring system,

#### 4.1.1.1 Evacuation Planning

Self directed evacuation in conjunction with the necessary flood warnings and preparedness is a feasible program for the entire Wooli community. Informed residents who have adjacent access to high land can manage their own evacuation and make their way to a refuge. Self-directed evacuation,

where feasible, enables SES's field resource personnel to concentrate on those residents who cannot help themselves, and most importantly instils a sense of community spirit in coping with the flood hazard and identifying ownership and control over the problem.

The obvious refuge facility in Wooli would be the Local Hall, unfortunately, although its floor is above the 1% AEP level it is raised off the ground and half a metre below the extreme flood level. The bowling club is, however above the extreme flood level, and with additional residential premises also above the extreme flood level, there is sufficient refuge capacity for the community to look after itself.

The self directed evacuation program will require suitable flood warnings and information being made available, and training and preparedness of the residents concerned. The needs of the infirm and sick will have to be specifically catered for.

It is important to note that the northern residential area becomes isolated from the Wooli Village before inundation of many homes has occurred. The road access to the Wooli village is low lying and in an extreme event will cut access to refuge homes on higher ground in the village. Appropriate warning and SES presence will be required to encourage residents to evacuate from their homes in the northern area before inundation has occurred to avoid possible isolation from refuge facilities.

#### **4.1.1.2 Flood Recovery Planning**

Although flood recovery is generally a reactive exercise, pro-active planning and preparation can lead to improved efficiencies, ensure appropriate resources are available, and in combination with the education program, ensure needs are appropriately prioritised, resources are effectively allocated and conflicts minimised.

Flood recovery encompasses the physical cleanup of private and public facilities, restoration of services and infrastructure and the social support and health recovery of flood victims. A community program will be instituted in concert with Council and the Grafton Local Emergency Management Committee to address the following issues.

- Identify resources available such as equipment, manpower, technical knowledge and professional assistance.
- Establish procedures for physical cleanup of private and public facilities with resources, support and technical information available to assist individuals and groups.
- Establish a structure and procedures for social support and health recovery through counselling. Support will be necessary from the appropriate community organisation, such as churches and Department of Community Services, in Ulmarra or Grafton.

#### **4.1.1.3 Awareness and Preparedness**

Flood awareness is a key element of the Contingency Plan. It refers to the ability of the population to know what to do and how to do it effectively with respect to minimising risk to life and limb and saving goods and possessions in the immediate onset of flooding.

To be aware, the population has to be educated in:

- the nature of the hazard and risk,
- how they will be affected,

- what information will be available and how it can be accessed,
- what support services and facilities are available,
- what can be done in the dry in preparation for a flood, and
- how to prepare in the likely event of a flood.

Apart from longer term residents who may remember the more severe flooding experienced in 1974 and possibly in 1954, the majority of the Wooli community's awareness of flooding is currently limited to the post 1974 period. This period was characterised by numerous 'nuisance' floods. The awareness of severe flooding within the community has also been diluted over the past 20 years as the demographic makeup of the community has changed with many new retirees and residents from cities and large towns settling in the village.

The potential for flooding in an extreme event is 4.2 m AHD at the southern caravan park, nearly 1.5 m higher than the March 1974 event and approximately 2 m above ground level. The impacts on the community of an extreme event are likely beyond comprehension for most residents, as at least 220 residential and commercial premises would be directly affected by flooding.

Through its regular dealings with the community, Council will establish and operate an education/awareness program on flooding developed in concert with SES.

The education/awareness program will include preparation of an information leaflet for public distribution to present relevant aspects of Council's flood management strategy in a clear and concise manner.

An update or refresher leaflet will be prepared every few years, to maintain the awareness and identify any changes or additions to programs and practices.

#### **4.1.1.4 Flood Forecasting and Warning**

BOM regional predictions, Wooli and South Grafton rainfall data, river levels, and local knowledge of the catchment's response will be used to optimise the community's response to any potential flood threat. As there is presently no formal collection, communication, interpretation and dissemination of this flood information, the development of a flood warning program to collate appropriate flood indicators is warranted.

The flood forecasting and warning program will include establishing river level gauging sites along the Wooli River. It will be necessary to establish a flood information centre so local river level data, rainfall data and flood behaviour information can be assimilated to provide flood forecasts and warnings to the community. It will also be useful to establish a database relating all available data collected during a flood with the eventual outcome, as a reference for future predictions.

Management of the flood warning program should be seen to involve the community, Council Staff and the SES, both in the wet and the dry to instil a sense of ownership and community spirit. Awareness of the program and the level of community involvement and control should form part of the community awareness and education program.

## 4.1.2 STRUCTURAL OPTIONS

### 4.1.2.1 Wooli Entrance Works

The flood overflow across Jones Beach has the potential to mitigate flood levels by enlarging the conveyance capacity of the entrance at higher flood levels.

1D modelling of the flood overflow in the Wooli Floodplain Management Study showed insignificant benefits were gained from its construction, however modelling of the Wooli River mouth really requires 2D analysis to gain an accurate assessment of the benefits, as the 1D model ignores the complex hydraulics and is considered misleading. The benefits and potential impacts of this option need to be further investigated by 2D modelling of the entrance.

Other entrance works that should be investigated by 2D modelling include removing the existing low wall and monument area.

### 4.1.2.2 Dredging

The effect of increased siltation within the lower reaches of the Wooli River in causing higher flood levels can be reduced by dredging. Dredging increases the conveyance capacity of the river channel thus reducing flood levels.

In addition to acting as a flood mitigation measure, dredging will restore the river to its pre entrance works hydraulic conditions, improving the recreational amenity of the river. With such a small reported rate of infill, dredging to the extent indicated above will provide long term relief to some properties. The area of inundation will be reduced, however 32 properties will still be affected at the 1% AEP flood.

The Wooli Floodplain Management Study identified some potential benefits of several dredging scenarios. Further studies are now required to prepare a firm dredging proposal identifying the areal extent and depth of dredging.

The environmental impacts of dredging on local fish habitat within the estuary, on intertidal bird roosting and foraging areas, and the impacts on the local oyster industry will also need to be addressed in the dredging plans. The potential for using extracted material from dredging operations to help rectify the current dune erosion problem on Wooli Beach is an option that can be addressed as part of the dredging proposal. It is recommended dredging be considered in the Estuary Management Study for Wooli and/or as a component of an overall rehabilitation program for the Wooli River.

## 4.2 FLOODPLAIN MANAGEMENT PLAN DETAILS

The Wooli Floodplain Management Plan is summarised in the following chart. The components of each floodplain management option are identified and the primary responsibility for each component is indicated.

<b>Management Option</b>	<b>Component</b>	<b>Responsibility</b>	<b>Cost</b>	<b>Funding</b>
<b>Priority 1</b>				
<b>(i) Evacuation Planning</b>	<p>Self directed evacuation program in conjunction with the necessary flood warnings and preparedness with managed support for the aged and infirm.</p> <ul style="list-style-type: none"> <li>• SES personnel establish an evacuation refuge centre at the bowling club</li> <li>• Residents with adjacent access to high ground make their own way to the evacuation refuge centre or to residential premises identified above the extreme flood level</li> <li>• SES assist sick and infirm to evacuation centre</li> <li>• SES presence to encourage residents in the northern area to evacuate before possible isolation from the refuge facility</li> <li>• Provision of emergency food and medical supplies to flood bound people</li> <li>• Disaster Welfare Service provide evacuation support to evacuated residents ie food, clothing, accommodation</li> </ul>	<ul style="list-style-type: none"> <li>• SES</li> <li>• Residents</li> <li>• SES</li> <li>• SES</li> <li>• SES</li> <li>• Department of Community Services</li> </ul>	<ul style="list-style-type: none"> <li>• na</li> </ul>	<ul style="list-style-type: none"> <li>• State Government</li> <li>• State Government</li> <li>• State Government</li> <li>• State Government</li> </ul>
<b>(ii) Recovery Planning</b>	<p>A community program to identify resources and provide technical, social and health assistance for flood victims.</p> <ul style="list-style-type: none"> <li>• Investigate the feasibility of establishing an SES unit at Wooli</li> <li>• Prior to flood event identify resources available such as equipment, manpower, technical knowledge and professional assistance to ensure appropriate resources are available and to improve efficiencies in the recovery stage of a flood event</li> <li>• During flood event SES Local Controller brief chairman of Grafton Local Emergency Management Committee on details of the flood emergency</li> <li>• Establish a Local Recovery Co-ordination Committee (LRCC) chaired by the Grafton Local Emergency Management Committee Chairman with its membership drawn from the GLEMC and other persons as appropriate</li> <li>• LRCC establish procedures and develop a long term plan for the physical cleanup of private and public facilities and the restoration of services and infrastructure</li> <li>• Throughout flood emergency Disaster Welfare Service manage evacuation centres established by the SES and provide welfare support and health recovery through counselling to flood effected residents</li> </ul>	<ul style="list-style-type: none"> <li>• US Council *</li> <li>• US Council</li> <li>• SES</li> <li>• GLEMC</li> <li>• LRCC</li> <li>• Department of Community Services</li> </ul>	<ul style="list-style-type: none"> <li>• na</li> </ul>	<ul style="list-style-type: none"> <li>• US Council</li> <li>• US Council, State/Fed Government</li> <li>• State Government</li> </ul>

\* US Council refers to Ulmarra Shire Council

<b>Management Option</b>	<b>Component</b>	<b>Responsibility</b>	<b>Cost</b>	<b>Funding</b>
<b>Priority 2</b> <b>Flood Education/ Awareness Program</b>	<p>A community program and leaflet outlining relevant aspects of Council's floodplain management strategy.</p> <ul style="list-style-type: none"> <li>• Prepare a clear and concise information leaflet. Topics to be covered in the leaflet would include: <ul style="list-style-type: none"> <li>• The nature and behaviour of the flood hazard and the associated risk in living in the floodplain.</li> <li>• The practices and programs established by Council to manage the hazard in concert with other agencies. eg. SES's emergency response role, the flood warning program, the evacuation access and support program, the flood recovery program.</li> <li>• The resources and infrastructure available for assisting the community.</li> <li>• What can be done by individuals, residents and businesses in the dry, to minimise the risk and potential damage in the event of a flood.</li> <li>• Procedures to follow if flooding is predicted. Individual residents, businesses and groups need to be specifically targeted with details addressing aspects such as self evacuation procedures for residents, how personal effects and valuables can be protected or removed, and special provisions available for the sick and infirm.</li> </ul> </li> <li>• Develop a procedure in concert with the caravan park operators to ensure there is sufficient time and resources to transport caravans in an orderly manner to pre-determined locations.</li> <li>• Prepare an update or refresher leaflet to maintain the awareness and identify any changes or additions to programs and practices. This may be necessary every few years.</li> </ul>	<ul style="list-style-type: none"> <li>• US Council</li> <li>• US Council/ SES</li> <li>• US Council</li> </ul>	<ul style="list-style-type: none"> <li>• \$5k to \$8k</li> </ul>	<ul style="list-style-type: none"> <li>• US Council</li> <li>• US Council</li> </ul>
<b>Priority 3</b> <b>Flood Forecasting, Warning and Monitoring System</b>	<p>A community based system in concert with the SES to predict flood outcomes and provide flood warnings</p> <ul style="list-style-type: none"> <li>• Establish river level gauging sites with sufficient duplication of sites and volunteer readers to cover damage, sickness and vacation etc.</li> <li>• Establish a communication procedure for the volunteer gauge recorders to send their data into a central control, and to receive feedback on flood progress to instil a sense of community spirit and teamwork.</li> <li>• Establish a flood information centre so the local river level data, BOM predictions, and regional rainfall data can be assimilated and interpreted by SES personnel</li> <li>• Dissemination of flood warnings and other flood information to the community by radio, television, phone calls to residences under threat and doorknocks to flood threatened residences by SES and other emergency service personnel</li> <li>• Establish a database relating all available data collected during a flood with the eventual outcome, as a reference for future predictions</li> </ul>	<ul style="list-style-type: none"> <li>• US Council</li> <li>• SES</li> <li>• US Council / SES</li> <li>• SES</li> <li>• SES</li> </ul>	<ul style="list-style-type: none"> <li>• \$100k to \$1Million+</li> </ul>	<ul style="list-style-type: none"> <li>• US Council</li> <li>• US Council/ State Government</li> <li>• State Government</li> </ul>

<b>Management Option</b>	<b>Component</b>	<b>Responsibility</b>	<b>Cost</b>	<b>Funding</b>
<b>Priority 4 Structural Options</b>				
<b>(i) Wooli River Entrance Works</b>	<p>All Wooli River entrance works would require additional 2D modelling to gain an accurate assessment of the benefits. Options to be considered for further investigation and modelling include:</p> <ul style="list-style-type: none"> <li>• Construction of a flood overflow across Jones Beach</li> <li>• Removal of the monument area</li> <li>• Removal of the existing low wall at the entrance</li> <li>• Changing the direction of flow of the mouth</li> </ul>	<ul style="list-style-type: none"> <li>• US Council</li> </ul>	<ul style="list-style-type: none"> <li>• \$20K</li> </ul>	<ul style="list-style-type: none"> <li>• DLWC/ US Council</li> </ul>
<b>(ii) Dredging</b>	<p>The effect of increased siltation within the lower reaches of the Wooli River in causing higher flood levels can be reduced by dredging</p> <ul style="list-style-type: none"> <li>• Dredging Wooli River from the entrance to the Bowling Club increases the conveyance capacity of the river channel and reduces flood levels by 0.25 m</li> <li>• Prepare a Dredging Plan to identify an appropriate extent of dredging, to assess environmental impacts and to investigate the potential to use extracted material for rectification of the current dune erosion on Wooli Beach</li> <li>• Consider dredging in the Wooli Estuary Management Study and as a component of an overall rehabilitation program for the Wooli River</li> </ul>	<ul style="list-style-type: none"> <li>• US Council</li> </ul>	<ul style="list-style-type: none"> <li>• \$5M (lower estuary)</li> <li>• \$3M (half of lower estuary)</li> </ul>	<ul style="list-style-type: none"> <li>• US Council</li> </ul>

\* US Council refers to Ulmarra Shire Council



### 4.3 IMPLEMENTATION PROGRAM

Contingency planning was the preferred strategy for floodplain management in Wooli. Components of the contingency plan to be implemented include:

- Evacuation Planning,
- Recovery Planning,
- Flood Education/Awareness program, and
- Flood Forecasting, Warning and Monitoring System.

These issues are outlined within the Ulmarra Shire local flood plan (Displan).

Appropriate Council initiatives to be implemented are outlined below in order of priority as assigned by the Wooli Floodplain Management Committee.

1. Advise SES of the recommended program of self directed evacuation and where necessary amend the current SES Ulmarra Shire Local Flood Plan.
2. In conjunction with the SES, investigate the feasibility of developing an SES unit at Wooli. The Wooli community currently runs a Volunteer Rescue Association who may serve as a basis for incorporating an SES role.
3. Prior to a flood event, identify resources available such as equipment, manpower, technical knowledge and professional assistance to ensure appropriate resources are available and to improve efficiencies in the recovery stage of a flood event.
4. Establish a Local Recovery Co-ordination Committee (LRCC) chaired by the Grafton Local Emergency Management Committee Chairman with its membership drawn from the GLEMC and other persons as appropriate. The role of the LRCC is to establish procedures and develop a long term plan for the physical cleanup of private and public facilities and the restoration of services and infrastructure.
5. Prepare a clear and concise community information leaflet outlining relevant aspects of Council's floodplain management strategy. An update or refresher leaflet may be necessary every few years. Topics to be covered in the leaflet would include:
  - ◆ The nature and behaviour of the flood hazard and the associated risk in living in the floodplain.
  - ◆ The practices and programs established by Council to manage the hazard in concert with other agencies. eg. SES's emergency response role, the flood warning program, the evacuation access and support program, the flood recovery program.
  - ◆ The resources and infrastructure available for assisting the community.
  - ◆ What can be done by individuals, residents and businesses in the dry, to minimise the risk and potential damage in the event of a flood.
  - ◆ Procedures to follow if flooding is predicted. Individual residents, businesses and groups need to be specifically targeted with details addressing aspects such as self evacuation procedures for residents, how personal effects and valuables can be protected or removed, and special provisions available for the sick and infirm.
6. Develop a procedure in concert with the caravan park operators to ensure there is sufficient time and resources to transport caravans in an orderly manner to pre-determined locations.
7. Establish river level gauging sites with sufficient duplication of sites and volunteer readers to cover damage, sickness and vacation etc.

8. Establish a communication procedure for the volunteer gauge recorders to send their data into a central control, and to receive feedback on flood progress to instil a sense of community spirit and teamwork.
9. Establish a flood information centre so the local river level data, BOM predictions, and regional rainfall data can be assimilated and interpreted by SES personnel
10. Establish a database relating all available data collected during a flood with the eventual outcome, as a reference for future predictions

The Wooli Floodplain Management Committee considered all items listed above in the program of implementation a priority. These aspects of the plan could readily be implemented within the next 1-2 years and it is recommended that the committee remain constituted to steer the program, institute the directives and seek appropriate funding from the NSW Government's Flood Program to prepare the community information leaflet and install the river level gauges.

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## APPENDIX A

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### FLOOR LEVEL SURVEY

**APPENDIX A: SURVEYED FLOOR LEVELS**

HOUSE No.	SURVEYED FLOOR LEVEL m AHD	HOUSE No.	SURVEYED FLOOR LEVEL m AHD	HOUSE No.	SURVEYED FLOOR LEVEL m AHD	HOUSE No.	SURVEYED FLOOR LEVEL m AHD
1	2.57	61	2.3	121	3.41	181	4.19
2	2.92	62	2.57	122	3.63	182	4.07
3	2.67	63	2.03	123	3.63	183	3.73
4	2.47	64	1.95	124	2.83	184	4.65
5	2.92	65	2.35	125	2.87	185	3.71
6	2.97	66	2.27	126	2.53	186	3.8
7	4.93	67	2.33	127	2.53	187	3.64
8	2.67	68	3.65	128	2.53	188	3.53
9	3.28	69	3.44	129	2.38	189	3.85
10	2.62	70	2.75	130	2.38	190	3.97
11	2.87	71	3.32	131	2.77	191	3.72
12	2.63	72	3.17	132	2.7	192	4.12
13	2.35	73	3.02	133	2.94	193	3.77
14	2.83	74	2.75	134	3.01	194	3.42
15	3.68	75	2.65	135	3.53	195	3.29
16	3.73	76	2.64	136	3.36	196	3.27
17	3.64	77	2.52	137	3.28	197	3.12
18	2.73	78	2.6	138	3.46	198	2.31
19	4.36	79	2.33	139	3.49	199	2.33
20	3.64	80	3.97	140	4.13	200	2.87
21	4.43	81	3.32	141	3.75	201	2.29
22	4.64	82	3.32	142	3.7	202	2.34
23	4.28	83	3.54	143	3.7	203	2.29
24	4.06	84	3.36	144	3.72	204	2.58
25	3.31	85	3.62	145	3.57	205	3
26	3.62	86	3.37	146	3.67	206	2.79
27	3.25	87	3.82	147	3.8	207	3.03
28	3.22	88	3.77	148	3.88	208	2.68
29	3.71	89	4.54	149	3.85	209	2.55
30	3.88	90	4.82	150	3.22	210	2.6
31	3.86	91	2.49	151	3.14	211	3.23
32	3.14	92	2.59	152	2.79	212	2.71
33	3.07	93	2.54	153	2.97	213	2.96
34	3.03	94	2.04	154	2.92	214	2.43
35	2.95	95	2.14	155	2.85	215	2.73
36	4.66	96	5.14	156	2.9	216	2.68
37	4.38	97	3.03	157	3.08	217	2.2
38	5.19	98	3.49	158	3.29	218	2.4
39	3.53	99	2.64	159	3.33	219	2.63
40	3.04	100	1.94	160	3.08	220	2.53
41	2.86	101	1.74	161	3.41	221	2.5
42	3.04	102	1.84	162	3.43	222	2.06
43	4.64	103	1.84	163	3.26	223	2.1
44	5.06	104	2.64	164	3.16	224	1.98
45	3.86	105	2.64	165	3.19	225	2.02
46	4.44	106	2.64	166	3.21	226	2.1
47	3.89	107	2.29	167	3.02	227	3.08
48	4.91	108	2.79	168	3.14	228	3.08
49	3.32	109	2.42	169	2.94	229	3.04
50	4.09	110	2.81	170	2.94	230	2.79
51	3.55	111	2.87	171	3.04	231	2.57
52	3.51	112	2.51	172	2.92	232	2.05
53	3.48	113	3.31	173	3.18	233	2.38
54	4.13	114	3.01	174	3.29	234	2.05
55	4.39	115	3.26	175	3.35	235	2.48
56	4.22	116	3.19	176	3.23	236	1.59
57	3.51	117	3.29	177	3.21	237	2.3
58	2.76	118	3.42	178	3.49	238	2.3
59	2.55	119	3.77	179	3.88	239	3.5
60	2.25	120	3.3	180	3.8	240	2.9
						241	2.56
						242	1.92

Northern Caravan Park

To Grafton


Northern Residential Area

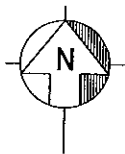
WOOLI RIVER

Wooli Rd

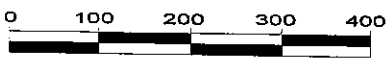
Low lying section of Wooli Rd

### FLOOR LEVEL SURVEY

-  building
- 47 building reference number



Scale



Metres

WOOLI RIVER

Riverside Drive

Scope St

Braithwaite Lane

Bowling Club

O'Keefe Lane

Durlington Lane

Firth Lane

Caravan  
13  
Park

