JERALGAMBETH CREEK AT ILLABO

FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

FINAL REPORT

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FOREWORD

The State Government's Flood Policy is directed at providing solutions to existing flooding problems in developed areas and to 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 remains the responsibility of local government. The State subsidises flood mitigation works to alleviate existing problems and provides specialist technical advice to assist councils in the discharge of their floodplain management responsibilities.

The Policy provides for technical and financial support by the Government through the following four sequential stages:

1.	Flood Study	Determines the nature and extent of flooding.
2.	Floodplain Risk Management Study	Evaluates management options for the floodplain in respect of both existing and proposed development.
3.	Floodplain Risk Management Plan	Involves formal adoption by Council of a plan of management for the floodplain.
4.	Implementation of the Plan	Construction of flood mitigation works to protect existing development. Use of Local Environmental Plans to ensure new development is compatible with the flood hazard.

ACKNOWLEDGEMENT

This *Floodplain Risk Management Study and Plan* has been prepared for Junee Shire Council with funding from the joint State and Commonwealth *Natural Disaster Resilience Program* and with the technical assistance of the Office of Environment and Heritage. The report builds on the results of the companion report *Jeralgambeth Creek at Ilabo Flood Study, 2011* which assessed the pattern of flooding in the creek system under present day conditions.

SUMMARY

S1 Floodplain Risk Management Study Objectives

Junee Shire Council commissioned the preparation of the *Floodplain Risk Management Study (FRMS)* and *draft Plan* for Jeralgambeth Creek at Illabo. The *FRMS* and *draft Plan* are set out in this report. The study area is located on the southern side of the Olympic Highway and Main Southern Railway in the floodplain of Jeralgambeth Creek. The area is zoned 1(a) General Rural and is presently undeveloped apart from two residential properties located within the extent of inundation of the 100 year ARI flood. Following the recommendations of the *Illabo Village Strategy, 2009,* which considered a number of options for encouraging development in the Illabo area, Council prepared a planning proposal for consideration by Department of Planning and Infrastructure which would permit a dwelling entitlement on various lots, whilst retaining the existing rural-small holdings characteristics of the area. **Figure 2.1** shows details of the existing zoning of Illabo, as well as the area subject to the planning proposal.

This report builds on the results of the *Jeralgambeth Creek at Illabo Flood Study, 2011*. That study assessed the pattern of flooding at Illabo arising from flooding in Jeralgambeth Creek. The objectives of the *FRMS* were to assess the impacts of flooding, review existing Council policies as they relate to development of land in flood liable areas of Illabo, consider options for management of flood affected land and to develop a *draft Floodplain Risk Management Plan* (*FRMP*) which:

i) Sets out the recommended program of works and measures aimed at reducing over time, the social, environmental and economic impacts of flooding on existing development and ensuring that impacts on future development are minimised.

ii) Proposes *Flood Planning Levels* (*FPL*'s) and conditions for future development for the various potential land uses in the floodplain.

iii) Prepares a draft Flood Policy which could be used by Council to ensure that future development of flood affected land is undertaken so as to be compatible with the flood hazard and risk.

The *FRMS* deals with main stream flooding in Jeralgambeth Creek only. Problems resulting from overflows of the local stormwater drainage system in areas bordering the creek, which may occur during localised heavy rainfall, are not covered in this investigation.

S2 Study Activities

The activities undertaken in this *FRMS* included:

- Review of flooding patterns on Jeralgambeth Creek and its tributary Un-Named Creek for flood events up to the PMF (**Chapter 2**).
- Review of current flood related planning controls for Illabo and their compatibility with flooding conditions (**Chapter 2**).
- Consideration of flood related development controls to be applied over the study area, including the lands subject to the planning proposal, as well as the preparation of a draft Flood Policy to guide future development in flood prone areas (**Appendix A**).
- Assessment of potential floodplain management works and measures which could be included in the *FRMP.* Options considered included structural works such as channel

improvements or levees, as well as non-structural measures such as land use planning or improvements to flood emergency management procedures. (**Chapter 3**).

- Preparation of a *draft FRMP.* Measures recommended for inclusion in the *FRMP* are presented in **Table S.1**.

S3 Summary of Main Stream Flood Impacts in Illabo

The combined catchment area of Jeralgambeth Creek and Un-Named Creek at Illabo amounts to 73 km^2. **Figure 2.2** shows the catchment area. There is considerable warning time available of the arrival of floodwaters at Illabo, as floodwaters take six to nine hours to reach peak level after the commencement of heavy rainfall. **Figure 2.3** shows the indicative extent of inundation for the 100 year ARI flood, as well as the extent of the proposed ***Flood Planning Area*** (land inundated by the 100 year ARI flood plus 500 mm freeboard). **Figure 2.4** shows the times of rise of floodwaters at the Eurongilly Road crossing and at several locations within the catchment. Brabins Road may be impassible for several hours and overtopping of Eurongilly Road could last for up to a day. **Figure 2.5** shows the relationship between flood frequency, height of the flood peak on the gauge at Eurongilly Road and depth of flow over the road. At the 100 year ARI, the depth of floodwaters over the low point in the road would be about 850 mm and it may remain overtopped for up to a day.

There are currently two residential properties located on the floodplain, although only one (on Eurongilly Road – see **Figure 2.1**) is currently occupied. Inundation of these allotments would commence at about the 20 year ARI level of flooding. The floor levels of both properties are above the design 100 year ARI flood level, with freeboards of 560 mm for the residence on Eurongilly Road and 330 mm for the residence on the right bank of the creek adjacent to Morgan Street.

S4 Flood Hazards

For the purposes of administering the Flood Policy of **Appendix A**, the floodplain has been divided into hazard zones for areas inundated up to the ***Flood Planning Level - FPL*** (100 year ARI flood level plus an allowance of 500 mm for freeboard), as shown on **Figure A1.1** of **Appendix A**. Hazard is related to the depths and velocities of flow, as well as other factors such as the rate of rise of floodwaters and ease of evacuation from the floodplain in the event of a flood emergency.

S5 Assessment of Flood Management Measures

Details of floodplain management measures which should be incorporated in the *FRMP* are summarised in **Table S.1**. Engineering works such as protective levees or channel improvements to Jeralgambeth Creek are not recommended on both technical and economic grounds and would also have adverse environmental effects, as described in **Chapter 3** of the report. Recommended measures having a high priority comprise planning measures and improvements to flood awareness and SES emergency management procedures. They involve:

- The application of a graded set of planning controls that recognises both the type of development and the flood risk of the area, to be applied through a *Flood Policy* for Illabo. A draft Flood Policy which could be modified and adopted by Council as a DCP is presented in **Appendix A**.

- Improved emergency management plans for Illabo, including incorporation by SES of flood information collected in this present study and the companion *Flood Study* in the next edition of the *Junee Shire Local Flood Plan*. The flood data at the Eurongilly Road gauge presented in **Figure 2.5** will be of assistance in this regard. The data could be used by SES as the basis of a future Flood Intelligence Card relating flood magnitude to consequences (e.g. in terms of inundation of properties, loss of access). As SES base these consequences on gauge height, it will be important to establish the ownership of the gauge and to document any future adjustments in gauge location or gauge zero.
- As part of the improved awareness of flooding, Council should ensure that the flood mapping is available for the information of residents and prospective purchasers of property.

S6 Funding

The measures included in the draft *FRMP* involve Council and SES Staff costs only, and do not require Government funding for implementation.

S7 Implementation Program

The steps in progressing the floodplain management process from this point onwards are:

- Floodplain Management Committee to adopt the recommendations of this study.
- Exhibit the *draft FRMS* and *FRMP* and seek community comment.
- Consider public comment, modify the document if and as required, and submit to Council.
- Council adopts the *FRMP.*
- Implement the measures in accordance with the established priorities.

The *FRMP* should be regarded as a dynamic instrument requiring review and modification over time. The catalysts for change could include new flood events and experiences, legislative change, future re-zoning and resulting development, reviews of Council's planning strategies. In any event, a thorough review every five years is warranted to ensure the ongoing relevance of the *FRMP.*

TABLE S.1
RECOMMENDED MEASURES FOR INCLUSION IN ILLABO FLOODPLAIN RISK MANAGEMENT PLAN

Measure	Features of the Measure	Comments and Funding Source
Implement development controls based on Flood Policy	▪ Control development in floodplain via Flood Policy, a draft of which is attached to this report as **Appendix A**. ▪ The draft Flood Policy incorporates a graded set of flood controls based on the type of development and their locations within the floodplain. ▪ The floodplain has been divided into Flood Risk Zones based on the relative degree of Flood Hazard. No new development is recommended in the High Hazard/Floodway/ zone. ▪ Minimum floor levels for any future residential or commercial/industrial development to be equal to the 100 year ARI flood plus 500 mm freeboard. ▪ Minimum floor levels for Essential Community Facilities and Critical Utilities, aged persons homes and other flood-vulnerable development to be a 100 year ARI flood plus 500 mm freeboard, but to be capable of operation in the event of a Probable Maximum Flood. ▪ Aged persons homes and other flood-vulnerable development to have minimum floor levels 100 year ARI plus 500 mm and to have storage areas at a higher level for the storage of equipment required for their continuing operation.	This measure has a recommended high priority for inclusion in the *FRMP*. It does not require Government funding.
Ensure flood data in *the Floodplain Risk Management Study and Plan* is available to SES for refining flood emergency response procedures.	▪ SES should incorporate the flood information for Illabo presented in this *FRMS* and the companion flood study report in the next edition of the *Junee Shire Local Flood Plan.* Indicative flood extents, times of rise of floodwaters and depths of inundation are identified. Information on the travel time of floodwaters in the creek will assist SES in refining emergency management procedures. ▪ The flood data at the Eurongilly Road gauge presented in **Figure 2.5** will also be of assistance. The data could be used by SES as the basis of a future Flood Intelligence Card relating flood magnitude to consequences (e.g. in terms of inundation of properties, loss of access). As SES base these consequences on gauge height, it will be important to establish the ownership of the gauge and to document any future adjustments in gauge location or gauge zero.	This measure will improve emergency management procedures and has a high priority. It does not require Government funding.
Implement flood awareness and education program for residents and owners of commercial property.	▪ Council and SES should prepare a Flood Information Brochure to advise residents of the flood risk, based on the information presented in this report and ensure that copies of the flood extent diagrams are available to the public.	This measure will inform prospective residents of the extent of flooding and the flood risk and has a high priority. It does not require Government funding.

1 INTRODUCTION

1.1 Study Background

Junee Shire Council, through the Illabo Floodplain Management Committee commissioned the preparation of the *Floodplain Risk Management Study and Plan* for the village in accordance with the New South Wales Government's flood prone lands policy and using procedures set out in the *Floodplain Development Manual, 2005*. The floodplain is currently zoned 1(a) General Rural and there are currently only two residential properties on the floodplain. However, Council has submitted a planning proposal to the Department of Planning and Infrastructure to allow a dwelling entitlement for various blocks to the south-east of the railway line, which would allow future development, whilst maintaining the existing rural-small holdings nature of the area. This option for encouraging development was recommended in the *Illabo Village Strategy, 2009.*

The recently completed *Jeralgambeth Creek at Illabo Flood Study, 2011* reviewed present day flooding conditions. This *Floodplain Risk Management Study (FRMS)* assessed the feasibility of potential measures aimed at reducing the impact of flooding on both existing and future development and includes a draft policy to guide future development in flood prone areas. These investigations allowed the formulation of the *draft Floodplain Risk Management Plan (FRMP)* for Illabo which is summarised in **Table S.1**.

1.2 Background Information

The following documents were used in the preparation of this report.

- Jeralgambeth Creek at Illabo Flood Study, 2011.
- Junee Shire Local Flood Plan, 2010.
- Junee LEP, 1992.
- Illabo Village Strategy, 2009.

1.3 Overview of Report

This report sets out the findings of the *FRMS* and presents the *draft FRMP*. The contents of each Chapter of the report are briefly described below:

- **Chapter 2**, **Baseline Flooding Conditions**. This Chapter includes a description of the Jeralgambeth Creek drainage system and a review of existing flood behaviour in Illabo. The Chapter assesses the impacts of flooding, reviews Council's existing planning controls and proposals for development of the study area and SES's flood emergency management practices.
- **Chapter 3**, **Potential Floodplain Management Measures**. This Chapter reviews the feasibility of floodplain management options for their possible inclusion in the *draft FRMP.*
- **Chapter 4** contains a list of References.

Appendix A - **Illabo Draft Flood Policy** presents a policy aimed at guiding future development in flood prone areas bordering Jeralgambeth Creek.

1.4 Community Consultation and Flood Experience

Following the inception meeting of the Floodplain Management Committee which included Council, OEH, SES and Community representatives, a Community Newsletter was prepared by the Consultants and distributed to residents by Council. The Newsletter contained a Questionnaire seeking details from the community of flood experience. Because of the absence of recent major floods in Illabo at the time of issuing the Questionnaire, none of the responses provided quantitative information on historic flood levels and flow patterns.

Council surveyors carried out a survey of the floodplain which was used to prepare a hydraulic model of the study area. A hydrologic model of the Jeralgambeth Creek catchment was developed to estimate design flood flows and used in conjunction with the hydraulic model to assess flooding patterns at Illabo. Initial results of the modelling were presented to the second meeting of the Committee in July 2011. During the course of the study a severe storm had occurred in February 2011 which resulted in a significant flood at Illabo. Following the second meeting, data were collected for that flood which as described in the flood study allowed testing of the catchment and floodplain models developed for the flood study and confirmed the initial results.

Potential flood management measures were reviewed and the draft Flood Policy prepared (ref. **Appendix A**). The draft Study Report and draft Plan (this document) were then reviewed and amended by the Committee at a third meeting in early December 2011, prior to public exhibition of the document. Public exhibition took place over the period 12 January to 10 February 2012. No submissions were received.

1.5 Flood Frequency and Terminology

In this report, the frequency of floods is generally referred to in terms of their Average Recurrence Interval (ARI). The frequency of floods may also be referred to in terms of their Annual Exceedance Probability (AEP). The approximate correspondence between these two systems is:

Annual Exceedance Probability (AEP)%	Average Recurrence Interval (ARI) – years
1	100
5	20
20	5

The AEP of a flood represents the percentage chance of its being equalled or exceeded in any one year. Thus a 100 year ARI flood has a 1% chance of being equalled or exceeded in any one year and would be experienced, on the average, once in 100 years; a 20 year ARI flood has a 5% chance of exceedance, and so on.

The 100 year ARI flood (plus freeboard) is usually adopted to define the ***Flood Planning Level*** (***FPL***) and ***Flood Planning Area*** (***FPA***) when setting flood related controls over residential development. While a 100 year ARI flood is a major flood event, it does not define the upper limit of possible flooding. Over the course of a human lifetime of, say 70 years, there is a 50% chance that a flood at least as big as a 100 year ARI will be experienced. The assessment of flooding patterns in the event of larger flood events i.e.

the “Probable Maximum Flood” was also required to assist SES develop emergency management procedures.

2 BASELINE FLOODING CONDITIONS

2.1 Physical Setting and Community Profile

Illabo is a township of about 70 population located on the south-west slopes of NSW about 16 km north-east of Junee the administrative centre of the shire. Of the villages located within the Junee Shire, Illabo has the largest number of businesses, public facilities and services. The village also supports several cultural and sporting events which include an annual agricultural show, country music festival, primary school sporting events and a biennial theatrical performance. Each of these events attracts large numbers of people from within the local area, the region and interstate.

The residents of both the village and surrounding rural community are extremely strong in their support of the existing services and amenities within the village and are eager to see these retained and enhanced where possible (ref*. Illabo Village Strategy, 2009* which also provides details of existing land uses within the village area, including businesses, industry, community and educational, as well as recreation and open space categories). The Grain Corp Silo complex located on the southern side of the railway is the most visually significant landmark for travelers and promotes the importance of the agricultural sector to the village (**Figure 2.1**).

Under Junee Local Environmental Plan, 1992 the village of Illabo is zoned 2(v) Village or Urban. The 2(v) zone defining the main village area is located above flood level on the northern side of the railway line and is encircled by land zoned 1(a) General Rural, which includes the Jeralgambeth Creek floodplain. **Figure 2.1** shows the current zoning. The road layout and cadastre follow the traditional grid pattern and remain almost identical to the original village plan adopted at the time the village was proclaimed in 1898. The original plan defined a road layout for land to the south of the railway line and to date this land, which forms part of the floodplain of Jeralgambeth Creek, has remained largely undeveloped.

There are currently two residential properties on the Jeralgambeth Creek floodplain, one of which is occupied and situated on Eurongilly Road. The other residence is located on the right bank of the creek adjacent to Morgan Street and is unoccupied. The floor levels of both residences are above design 100 year ARI flood levels, with freeboards of 560 mm for the residence on Eurongilly Road and 330 mm for the residence on the right bank of the creek.

As part of the State Government's requirement for the development of a Community Strategic Plan for each NSW LGA, a meeting was held in Illabo in 2009 at which the communities of Illabo and Bethungra were invited. The aim of the meeting was to gain community feedback on strategies for future development. The main themes emerging for a development strategy for Illabo of relevance to this present investigation were:

- The requirement to identify and address flooding issues. The results of the flood study to assess flooding patterns in the Jeralgambeth Creek floodplain to the south of the Olympic Highway are presented in the companion report (*Jeralgambeth Creek at Illabo Flood Study, 2011*).

- The requirement for zoning changes to encourage population growth. This *FRMS* provides flood related data (flood levels and hazard) to assist Council in its deliberations, so that future use of the land is compatible with the flood risk (refer **Section 2.8**). A draft *Flood Policy* to guide future development in the Jeralgambeth Creek floodplain is set out in **Appendix A** of this study.

2.2 The Drainage System

Jeralgambeth Creek has its headwaters in the foothills to the south of Illabo and flows in a generally north-easterly direction through farming lands before discharging to Billabong Creek, which then drains southwards to the Murrumbidgee River. **Figure 2.2** shows the extent of the catchment which has an area of 73 km^2 at Illabo. The recent investigation of flooding in the catchment involved field survey of the creek system and computer modelling to assess flow patterns and indicative extents of inundation for a range of floods from 5 year ARI up to the Probable Maximum Flood.

There are two main arms of the creek, denoted Jeralgambeth Creek (Northern Tributary) and Jeralgambeth Creek (Southern Tributary), which join about 5 km upstream of Illabo. A minor tributary stream, Un-named Creek, flows through the undeveloped portion of the village on the southern side of the Olympic Highway and joins the main arm downstream of Eurongilly Road. The channels of the drainage system are indistinct and of low hydraulic capacity. Most of the flow during major flood events is conveyed on the floodplain, which has a gradient of about 0.3 to 0.5 per cent.

Figure 2.3 shows the extents of inundation for the 100 year ARI flood and the PMF. The extent of the *Flood Planning Area* (*FPA*) is also shown (i.e. land inundated by the 100 year ARI flood plus an allowance of 500 mm for freeboard and discussed in **Section 3.5**). These extents were defined from a digital elevation model of the study area which was prepared from surveyed cross sections of the floodplain. The extents shown are indicative. Site survey would be required to confirm the degree of flood affectation or otherwise of individual allotments.

Under design flood conditions water levels at Illabo rise to their peaks between six and nine hours after the commencement of heavy rainfall. **Figure 2.4** shows the rise of floodwaters for design storms of 100 year ARI. The critical storm is the storm which maximises flood levels at the location on the drainage system under consideration and is of nine hours duration. As shown on **Figure 2.4**, shorter 100 year ARI storms (e.g. the three hours storm) may result in lesser flood peaks than for the critical storm, but may reach their peak earlier.

2.3 Flood Hazard Zones and Floodway Areas

2.3.1 Flood Hazard

Provisional flood hazard categories were assigned to flood affected areas in the *Flood Study*, in accordance with the procedures outlined in the *Floodplain Development Manual, 2005*. Flood prone areas may be provisionally categorised into *Low Hazard* and *High Hazard* areas depending on the depth of inundation and flow velocity.

Flood depths as high as 1 m in the absence of any significant flow velocity represent *Low Hazard* conditions. Similarly, areas of flow velocities up to 2.0 m/s but with minimal flood depth also represent *Low Hazard* conditions. Interpolation may be used to assess hazards for intermediate values of depth and velocity. Flood hazards categorised on the basis of depth and velocity only are *provisional*. They do not reflect the effects of other factors that influence hazard. These other factors include:

- Size of flood – major floods though rare can cause extensive damage and disruption.
- Effective warning time – flood hazard and flood damage can be reduced by evacuation if adequate warning time is available.
- Flood awareness of the population – flood awareness greatly influences the time taken by flood affected residents to respond effectively to flood warnings. The formulation and implementation of response plans for the evacuation of people and possessions promote flood awareness.
- Rate of rise of floodwaters – situations where floodwaters rise rapidly are potentially more dangerous and cause more damage than situations in which flood levels increase slowly.
- Duration of flooding – the duration of flooding (or length of time a community is cut off) can have a significant impact on costs associated with flooding. The duration is shorter in smaller, steeper catchments.
- Evacuation problems and access routes – the availability of effective access routes from flood prone areas directly influences flood hazard and potential damage reduction measures.

Provisional hazard categories may be reduced or increased after consideration of the above factors.

A qualitative assessment of the influence of the above factors on the provisional flood hazard (i.e. the hazard based on velocity and depth considerations only) is presented in **Table 2.1**. Factors which would increase the flood hazard in **Table 2.1** are more than balanced by considerations reducing the hazard. Consequently, there would be no reason to adjust the provisional flood hazard and it is considered that the final determination of hazard in the floodplains could be based on depth and velocity alone.

Figure 5.9 of the companion *Flood Study* report shows zones of high and low hazard for the 100 year ARI flood. The high hazard areas are restricted to narrow zones located in the channels of Jeralgambeth and Un-named Creeks and their immediate vicinity.

TABLE 2.1
INFLUENCE OF FLOOD RELATED PARAMETERS ON PROVISIONAL FLOOD HAZARD ON JERALGAMBETH CREEK AT ILLABO

Parameter	Influence on Provisional Hazard	Flood Characteristics
Size of flood	-1	Flooding is comparatively shallow, with no sudden increases in depth of flow or alternative flow paths developing with increasing severity of flooding for floods up to PMF.
Effective warning time	-1	A reasonable warning time of at least six to nine hours is available at Illabo, which would tend to reduce the provisional flood hazard.
Flood awareness	0	As the last occurrence of major flooding occurred in February 2011, flood awareness would currently be high. However, it needs to be appreciated that flood awareness needs to be maintained to remain effective, by incorporating information on flooding behaviour in the planning of development (e.g. by defining floodways and the *FPA*). Consequently, this category on balance has been given a neutral rating.
Rate of rise and velocity of floodwaters	0	The rate of rise at Illabo is comparatively slow for the critical duration design storm, with the stream rising to a peak about nine hours after the commencement of heavy rainfall. Shorter duration storms, although not resulting in as high flood levels, may rise more quickly at Illabo. This category on balance has also been given a neutral rating.
Duration of flooding	1	The duration of the flood peak is relatively prolonged at the local access roads, in particularly Eurongilly Road which may be impassable for up to a day. This prolongation of flooding may increase the flood hazard.
Evacuation problems	– 1	Flooding is comparatively shallow and there is easy egress from flooded areas to higher ground.

Legend 0 = neutral impact on provisional hazard
1 = tendency to increase provisional hazard
– 1 = tendency to reduce provisional hazard

2.3.2 Floodways

According to the *Floodplain Development Manual, 2005*, the floodplain may be subdivided into the following zones:

- Floodways;
- Flood storage; and
- Flood fringe

Floodways are those areas where a significant volume of water flows during floods and are often aligned with obvious natural channels. They are areas that, even if partially blocked, would cause a significant increase in flood level and/or a significant redistribution

of flow, which may in turn adversely affect other areas. They are often, but not necessarily, areas with deeper flow or areas where higher velocities occur.

Flood storage areas are those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood. If the capacity of a flood storage area is substantially reduced by, for example, the construction of levees or by landfill, flood levels in nearby areas may rise and the peak discharge downstream may be increased. Substantial reduction of the capacity of a flood storage area can also cause a significant redistribution of flood flows.

Flood fringe is the remaining area of land affected by flooding, after floodway and flood storage areas have been defined. Development in flood fringe areas would not have any significant effect on the pattern of flood flows and/or flood levels.

In determining appropriate hydraulic categories, it is important that the *cumulative* impact of progressive development be evaluated, particularly with respect to floodway and flood storage areas. Whilst the impact of individual developments may be small, the *cumulative* effect of the ultimate development of the area can be significant and may result in unacceptable increases in flood levels and flood velocities elsewhere in the floodplain. Most of the flow is conveyed in the channels and their immediate overbanks. The 100 year ARI extent of flooding on Jeralgambeth Creek at Illabo is limited to a strip 70 to 100 m wide. Because of the relatively narrow floodplain, flood storage effects are not significant and may be omitted from the hydraulic categorisation, which could be restricted to defining the floodway and flood fringe areas (ref. **Figure 5.10** of the *Flood Study).*

The hazard diagram of **Figure 5.9** of the *Flood Study* report was integrated with the hydraulic categorisation diagram of **Figure 5.10** to prepare the flood zoning diagram **Figure A1.1** which accompanies the draft Flood Policy of **Appendix A**. The floodway area was sub-divided into "*High Hazard Floodway"* and *"Low Hazard Overland Flowpath"* zonings. Use of these categories in the proposed Flood Policy for guiding future development in flood prone areas bordering the creek system is outlined in **Section 3.5.**

2.4 Impacts of Climate Change

The potential impacts of future climate change were assessed in the *Flood Study* using procedures recommended by DECCW (now OEH). The impact of climate change on *flooding patterns* in the Jeralgambeth Creek floodplain were summarised as:

- A gradual widening of the extent of inundation.
- A small increase in flood levels and flow velocities within the inundated area, but no sudden increase in the flood hazard due to increased flood depths and flow velocities.
- No islands or new flow paths would be created. Flow would continue to follow its existing course along the main arms.
- There may be a small reduction in the time of rise of the floodwaters. On-going community education by Council and SES is required to limit risks to people and property. Measures for improving community education are discussed in **Section 3.7**.

2.5 Economic Impacts of Flooding

Flood damages on the Jeralgambeth Creek floodplain are not significant under present day conditions. There are presently two residences on the floodplain, one of which is occupied. The floor levels of both residences are above the 100 year ARI flood level, with freeboards of 560 mm (occupied house on Eurongilly Road) and 330 mm (unoccupied house on the right bank of the creek downstream of Eurongilly Road).

2.6 Flood Warning and Flood Preparedness

2.6.1 Junee Shire Local Flood Plan

The State Emergency Service is nominated as the principal combat and response agency for flood emergencies in NSW. The SES is responsible for the issuing of relevant warnings (in collaboration with the Bureau of Meteorology), as well as ensuring that the community is aware of the flood threat and how to mitigate its impact. The *Junee Shire Local Flood Plan, 2010*, published by SES covers preparedness measures, the conduct of response operations and the coordination of immediate recovery measures for all levels of flooding within the Junee area, including the village of Illabo.

The *Junee Shire Local Flood Plan* is administered by Junee SES Local Controller. The area is located within the Murrumbidgee SES Region and for emergency management purposes is part of the Murrumbidgee Emergency Management District.

The *Local Flood Plan* is set out under the following headings:

- **Responsibilities** of SES and supporting services including Junee Shire Council, NSW Police Service, RTA, SRA, Bureau of Meteorology, NSW Fire Brigades and Rural Fire Service, Country Energy, Telstra, DOCs and other Government organisations.
- **Preparedness** of the Plan for flood emergencies including: participation in Floodplain Management activities organised by Junee Council, development of Flood Intelligence describing flood behaviour and its effects on the community, development of Flood Warning System for flood affected areas, public education and dissemination of flood brochures and displays in flood liable areas.
- **Response** to flooding including coordination of other agencies and organisations for flood management tasks.
- **Recovery** including de-briefing arrangements after the flood emergency has abated.

2.6.2 Operational Management of Local Flood Plan

The Junee SES maintains an Operations Centre at Bolton Street, Junee.

2.6.3 Activation of Flood Plan

The plan will be activated by the Junee SES Local Controller.

a. On receipt of a Bureau of Meteorology Flood Watch for the Murrumbidgee River Basin.

b. On receipt of a Bureau of Meteorology Flood warning.

c. When other evidence leads to an expectation of flooding within the Council area.

2.6.4 Flood Intelligence During Flood Emergencies

Sources of flood intelligence during times of flooding are:

a. **Bureau of Meteorology**. The Bureau provides:

- *Flood Watches*, which give an early appreciation of developing meteorological situations that could lead to flooding. These are normally provided on a whole-of-catchment basis for the Murrumbidgee River Basin.
- *Flood Warnings*, which include river height readings and height-time predictions.
- *Weather Forecasts* warning of potential storm activity.

b. **Murrumbidgee SES Region Headquarters**. The Region Headquarters relays warnings received from BOM to Junee SES.

c. **Junee Council**. Information on road closures within Council areas.

The flood gauges relevant to Junee Shire for which predictions are provided are Gundagai and Wagga Wagga on the Murrumbidgee River. No flood gauges are monitored on Jeralgambeth Creek. The Olympic Highway is flooded in the Jeralgambeth Creek catchment between Junee and Illabo for several hours during major flooding. Council distributes information relating to road closures received from staff and other sources to SES.

2.6.5 Flood Intelligence Information of Benefit to SES Incorporated in the *FRMS*

One of the objectives of the *FRMS* was the provision of the latest Flood Intelligence to SES. This will allow quantitative information on flooding at Illabo to be incorporated in future editions of the *Junee Shire Local Flood Plan,* specifically at **Annex A –The Flood Threat** and **Annex B – Effects of Flooding on the Community**. The results of the *FRMS* and companion flood study report provided the following information:

(1) Presented indicative extents of inundation for various flood frequencies (e.g. **Figure 2.3** for the 100 year ARI and PMF events).

(2) Described flooding patterns within the catchment, including presentation in the flood study report of a detailed photographic record of the recent February 2011 flood.

(3) Determined times of rise of flood waters and durations of flooding at representative locations within the creek system (**Figure 2.4**).

(4) Presented a diagram showing the relationship between flood frequency, height on the gauge and the depth of water over the Eurongilly Road crossing (**Figure 2.5**). The data could be used by SES as the basis of a future Flood Intelligence Card relating flood magnitude to consequences (e.g. in terms of inundation of properties, loss of access). As SES base these consequences on

gauge height, it will be important to establish the ownership of the gauge and to document any future adjustments in gauge location or gauge zero.

2.7 Existing Planning Instruments and Policies

2.7.1 Land Use Zoning

As mentioned, land use planning within the Junee Council area is regulated by way of the *Junee Local Environmental Plan 1992*. This section of the report outlines flood related controls in the existing document and suggests amendments which could be incorporated in the updated LEP to conform with the NSW Government's policy for the development of floodprone lands (*FDM, 2005*). Suggested wording for S149 (2) certificates is also presented and the proposed draft Flood Policy for the study area introduced.

Section 2.8 provides a context for Council's planning proposal, which was originally recommended as "Proposal 3" of the *Illabo Village Strategy, 2009* and specifically deals with lots to the south-east of the railway line, as shown on **Figure 2.1**.

2.7.2 Flood Provisions of the Junee LEP

The Junee LEP, 1992 contains little flood related information on controls over development in flood prone areas in the shire. In Section 6 of the LEP under definitions, "flood liable land" is defined by land shown hatched on the LEP Map.

The only other mention of flooding is in Clause 24 where the LEP states that a person shall not erect a building or carry out a work for any purpose on flood liable land except with the consent of the Council. There are no conditions mentioned in the LEP which Council may apply to development in flood prone areas. There are no technical definitions of "floodway" or "flood liable land" in the LEP, 1992 and it is therefore inconsistent with the requirements of the FDM, 2005 and Clause 733 of the Local Government Act in that it does not account for variations in flood hazard.

2.7.3 Suggested Amendments to LEP

Junee Shire Council is currently in the process of updating its LEP in common with other Councils in NSW. DOP and DECCW (now OEH) have carried out extensive negotiations regarding the generic wording of flood related clauses to be included in new versions of LEP's in NSW.

The *provisionally* agreed (and subject to change) generic wording for new LEP's is shown below:

" 7.3 Flood planning [local d07]

(1) The objectives of this clause are as follows:

(a) to minimise the flood risk to life and property associated with the use of land;

(b) to allow development compatible with the land's flood hazard, taking into account projected sea level rise;

(c) to avoid significant adverse impacts on flood behaviour and the environment.

(2) This clause applies to:

(a) land that is shown as "Flood Planning Area" on the Flood Planning Map, and

(b) other land at or below the flood planning level.

Drafting direction
Councils know of some areas that flood and those areas are mapped as "flood planning area", but there are other areas where accurate mapping is not possible. Consequently, the wording of this sub-clause captures the land that can be accurately mapped and the land that cannot. Such unmapped land includes the "flood planning area" (as defined in the Floodplain Development Manual) up to the "flood planning level".

(3) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that the development:

(a) is compatible with the flood hazard of the land; and

(b) will not significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties, and

(c) incorporates appropriate measures to manage risk to life from flood, and

(d) will not significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses, and

(e) will not be likely to result in unsustainable social and economic costs to the community as a consequence of flooding.

(4) A word or expression used in this clause has the same meaning as it has in the NSW Government's Floodplain Development Manual published in 2005, unless it is otherwise defined in this clause.

(5) In this clause:

***flood planning level** means the level of a 1:100 ARI (average recurrent interval) flood event plus [insert number 0.xx] metres freeboard.*

Flood Planning Map means the [Name] Local Environmental Plan 2010 Flood Planning Map. "

The ***flood planning level*** referred to above is the 100 year ARI flood plus an allowance for freeboard, which is usually set at 500 mm. It is the minimum level set for future residential development. The area encompassed by the ***FPL*** is known as the ***Flood Planning Area*** and denotes the area subject to flood related development controls. It is now standard practice for the residential ***FPL*** to be based on the 100 year ARI flood plus freeboard unless exceptional circumstances apply (see **Section 3.5.2** for further discussion)

This wording takes into account recent amendments to government policy that for residential land use, the area to be subject to flood-related development controls will be limited to land inundated by the 100 year ARI flood plus an allowance for freeboard. Under the arrangements agreed to by DOP and OEH, flood related development controls for other categories of development for which a higher level of protection may be required (e.g. hospitals, aged persons accommodation, critical utilities, etc), may be covered by Flood Policy DCP's.

2.7.4 Existing Flood Policy and Section 149 Certificates

As per the Lower Butlers Creek Flood Study adopted in 2009, Junee Council could use the *Jeralgambeth Creek at Illabo Flood Study, 2011* results in setting minimum floor levels for residential property in the floodplain at Illabo, based on the 100 year ARI flood level plus 500 mm freeboard.

After the Illabo area is re-zoned, Council could provide flood related development information in S149 (2) certificates at Clause 7A therein, using the following wording:

"Flood related development controls information

(a) Whether or not development on that land or part of the land for the purposes of dwelling houses, dual occupancies, multi dwelling housing or residential flat buildings (not including development for the purposes of group homes or seniors housing) is subject to flood related development controls.
Yes/No

(b) Whether or not development on land or part of the land for any other purpose is subject to flood related development controls.
Yes/No

(c) Whether the land is shown as flood liable land under the *Jeralgambeth Creek at Illabo Flood Study, 2011*.
Yes/No"

2.7.5 Draft Flood Policy

The draft *Flood Policy* of **Appendix A** conforms with the requirements of the Circular issued by the Department of Planning on 31 January 2007 which contained a package of information clarifying flood related controls on land located above the 100 year ARI flood level (i.e. land which is infrequently flooded). The Flood Policy would be consistent with the suggested amendments to the LEP above. The Policy is supported by the results of the *Flood Study, 2011*, which defined flood levels, flood extents and the hydraulic and hazard categorisation of the floodplain (as amended in this present study).

In keeping with modern flood policy, the draft Flood Policy structures the criteria to be adopted for assessing proposals which are potentially affected by flooding in recognition that different controls are applicable to different land uses and levels of potential flood inundation and hazard.

The types of controls identified in the draft Flood Policy have been graded relative to the severity and frequency of potential floods, having regard to the location within the floodplain. As discussed in **Section 3.5.4** it is proposed to divide the floodplain into zones, extending from the zone of highest hazard within and bordering the creek channels (denoted the "*High Hazard Floodway*") to the outside limits of the flooded area (denoted the "*Outer Floodplain*").

2.8 Planning Proposal for Land to the South-East of the Railway

2.8.1 Illabo Village Strategy, 2009

According to the Village Strategy, Council's aim of facilitating future growth of Illabo places a focus on the land immediately south of the railway line. Between the railway and Eurongilly Road in the area identified in **Figure 2.1**, there exists a number of fragmented lots zoned 1(a) General Rural which are up to 4 ha in area. The Village Strategy noted that the fragmented cadastre and ownership patterns reduce the capacity for this land to be utilised for the viable agricultural development typical of the Illabo area. It recommended that the land be utilised for small holdings development with a dwelling entitlement to encourage population growth whilst retaining its current land use pattern.

The Village Strategy Study identified several factors which required consideration:

- **Surrounding Agricultural Uses**. The approval of any development for a dwelling must ensure that there was no impediment to the existing broad-scale agricultural uses on adjoining land. This will entail the introduction of specific building envelopes and buffer distances.

- **Drainage Issues**. The extent of flooding in the small lots to the south of the Graincorp Silo needed to be considered when assessing any application for residential development.

- **Vegetation**. Native vegetation exists which will require retention where possible as part of any development proposal.

The Village Strategy Study recommended that Council introduce a specific provision to permit a dwelling to be erected on each existing lot in the labelled area and that Council assess the flood behaviour of the area to determine appropriate floor levels.

2.8.2 Recent Evaluation by Council

After consideration of the above recommendation, Council noted that under the LEP, 1992, only those lots in the 1(a) General Rural zone that are a vacant "existing holding" (as defined in the LEP) would have a dwelling entitlement. Most of the lots identified in **Figure 2.1** are vacant "existing holdings" and therefore would have a dwelling entitlement. However, as an "existing holding" could consist of a number of lots owned by the same person, then only the whole of the existing holding would have a single dwelling entitlement, not each individual lot.

For example, seven of the nine existing lots to the east of Morgan Street are owned by one person. Therefore, as per the definition of "existing holding" in the LEP, the owner could only build one dwelling on the land and not one dwelling on each of the lots. As the owner already has a dwelling on one of his lots that make up the "existing holding", therefore as it stands now, he has no further potential to build another dwelling, nor does he have enough land for sub-division.

Council considered that each of the lots could easily accommodate a dwelling and associated effluent disposal area and a reserve area for future effluent disposal, as each lot is around 4 ha in area. The other lots to the west of Morgan Street are smaller, around 2,000 m^2 in area, but are able to accommodate a dwelling. Portions of four of the lots lie within the *High Hazard Floodway,* as defined in the *Flood Study, 2011,* which should be kept clear of future development. However, there would be room on these four lots for a dwelling outside that zone.

Council concluded that any future application for a dwelling on these lots would need to conform with the requirements of the draft Flood Policy of **Appendix A**; specifically in regard to the dwelling being located outside the extent of the *High Hazard Floodway,* having a minimum floor level equal to the *FPL* and being accompanied by a site survey. The design of the dwelling would also include flood compatible materials below the *FPL*, along with structural requirements nominated by the policy.

2.8.3 Conformance of Planning Proposal with S117 Directions

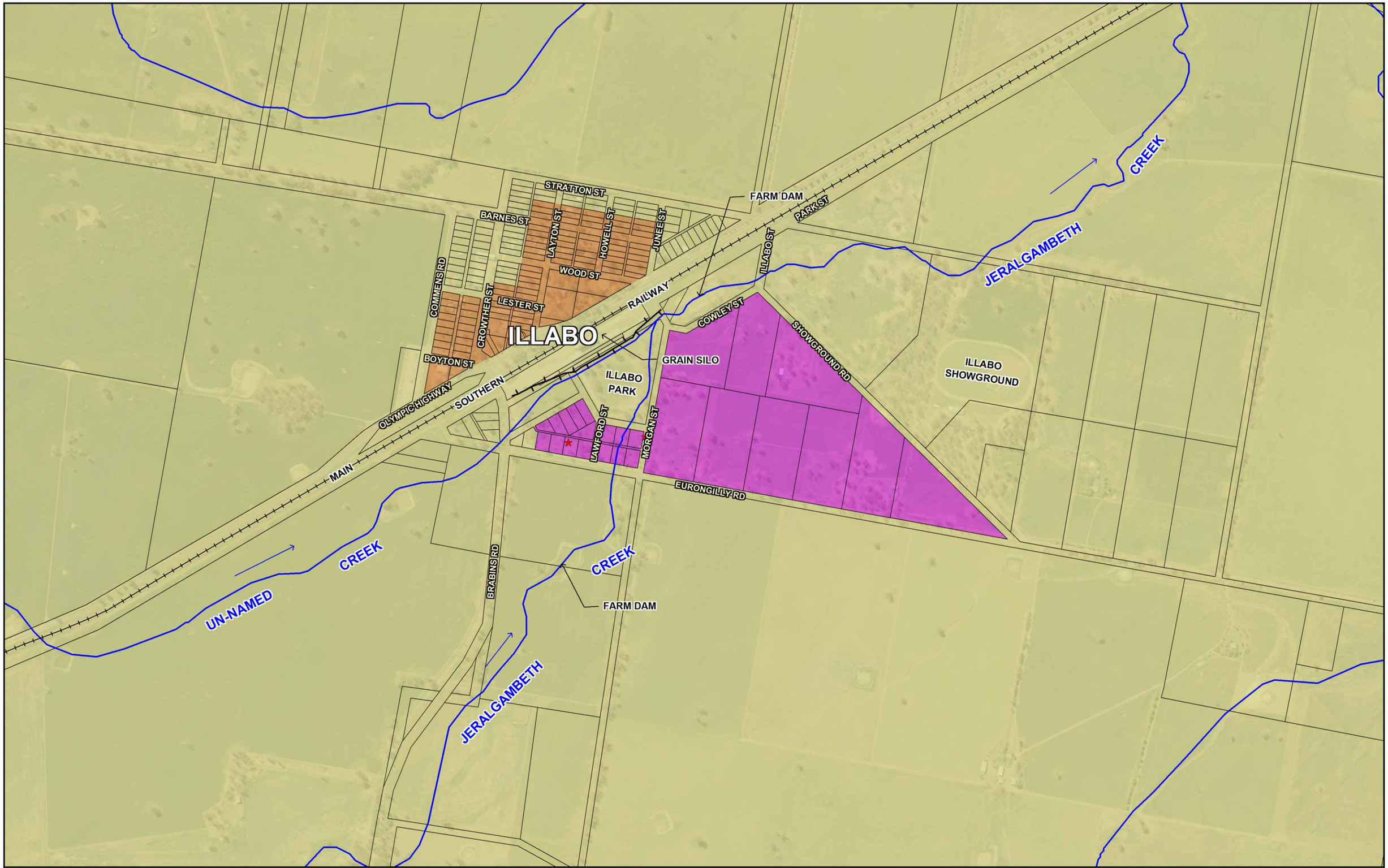
According to S117 of the Environmental Planning and Assessment Act (ref. Section 4.3 Flood Prone Land), a planning proposal must not re-zone land within the *FPA* from a rural zone to a residential zone. A planning proposal may be inconsistent with this direction only if the relevant planning authority can satisfy the Director General that:

(a) The planning proposal is in accordance with a floodplain risk management plan prepared in accordance with the principles and guidelines of the *Floodplain Development Manual, 2005*, or

(b) The provisions of the planning proposal that are inconsistent are of minor significance.

In the present case Council's proposal involves a rezoning of lands from the formerly proposed RU1 Primary Production to the proposed R5 Large Lot Residential zone under the new LEP 2012. Council has submitted a Planning Proposal to amend the proposed LEP 2012 to reflect this rezoning. It is proposed to amend Schedule 1 of the draft Junee LEP 2012 to permit the construction of a dwelling house on each vacant lot the subject of the rezoning, but no further subdivision of such lots will be permitted. The proposal applies to the various lots to the south-east of the railway as identified in Proposal 3 of the *Illabo Village Strategy, 2009* and shown on **Figure 2.1**.

Provided that there are no new dwellings allowed within the *High Hazard Floodway* area of **Figure 2.6,** and any application for development conforms with the requirements of the draft Flood Policy, the provisions of S117 would be satisfied.



N

100 0 100 200 300 m

Scale: 1:10,000

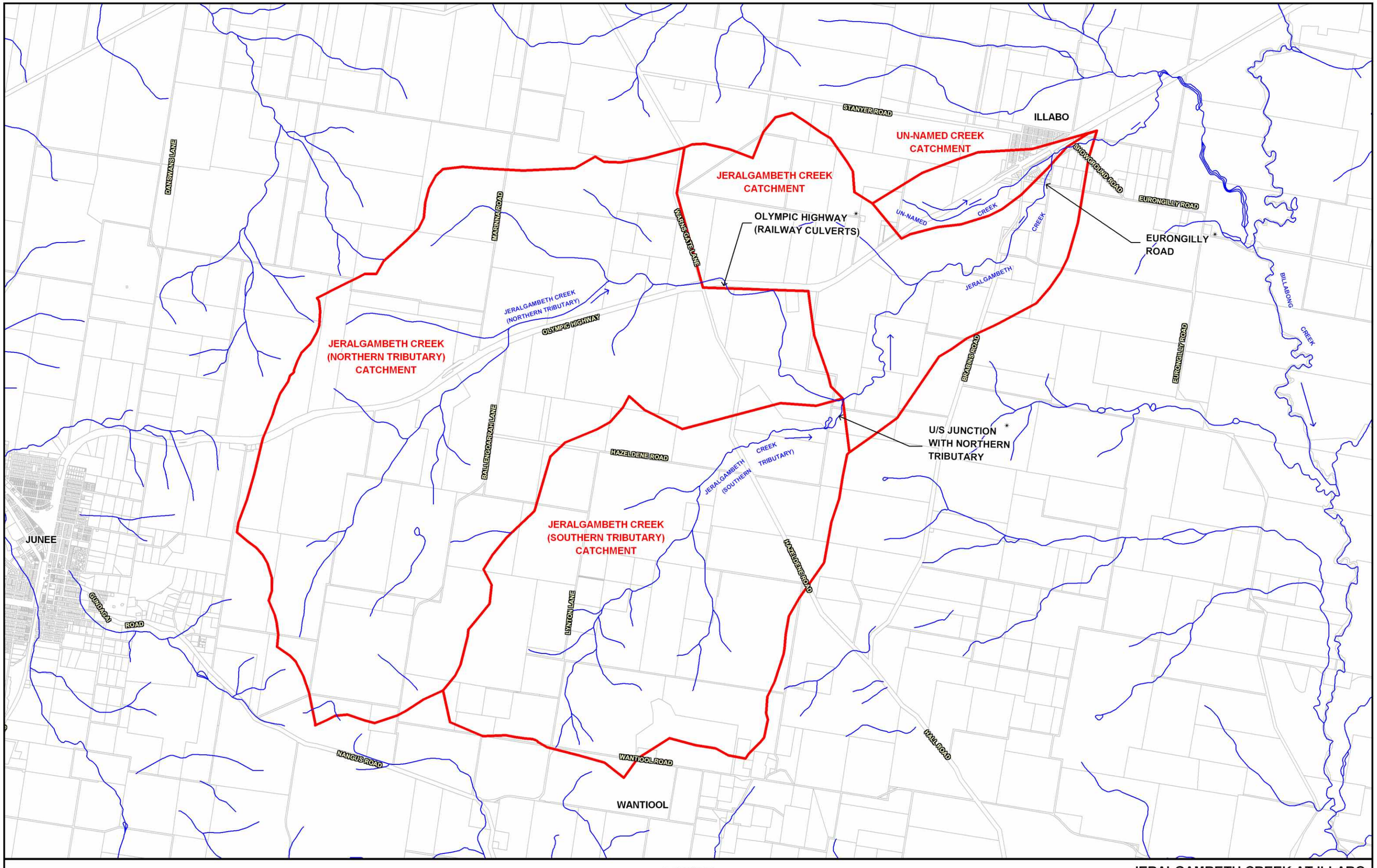
LEGEND

- Zone 2V - Village
- Zone 1A - General Rural
- Levee
- ★ Existing Residence
- Area subject to Council's Planning Proposal for a Dwelling Entitlement (Proposed R5 Large Lot Zone)

JERALGAMBETH CREEK AT ILLABO
FLOODPLAIN RISK MANAGEMENT STUDY

Figure 2.1

LOCATION PLAN



JERALGAMBETH CREEK AT ILLABO
FLOODPLAIN RISK MANAGEMENT STUDY

Figure 2.2

CATCHMENT AND DRAINAGE SYSTEM

Indicative Depth of Inundation (m)

- < 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.40
- 0.40 to 0.50
- 0.50 to 0.60
- 0.60 to 0.70
- 0.70 to 0.80
- 0.80 to 0.90
- 0.90 to 1.00
- > 1.00

STRATTON ST
BARNES ST
LAYTON ST
HOWELL ST
JUNEE ST
PARK ST
WOOD ST
COMMENS RD
CROWTHER ST
LESTER ST
RAILWAY
ILLABO
ILLABO ST
COWLEY ST
SHOWGROUND RD
ILLABO SHOWGROUND
BOYTON ST
ILLABO PARK
OLYMPIC HIGHWAY
SOUTHERN
LAWFORD ST
MORGAN ST
MAIN
100 YEAR ARI EXTENT
EURONGILLY RD
BRABINS RD

262 262.5 263 263.5 264 264.5 265 265.5 266 266.5 267 267.5 268 268.5 269 269.5 270 270.5 271

N

80 0 80 160 240 m

Scale: 1:8,000

NOTE:

THE EXTENTS OF INUNDATION SHOWN WERE DETERMINED FROM SURVEYED CROSS SECTIONS OF THE CREEK AND FLOODPLAIN AND AVAILABLE DATA AND ARE APPROXIMATE ONLY. THE EXTENT OF INUNDATION OF INDIVIDUAL ALLOTMENTS NEAR THE FLOOD FRINGE SHOULD BE CONFIRMED BY SITE SPECIFIC SURVEY.

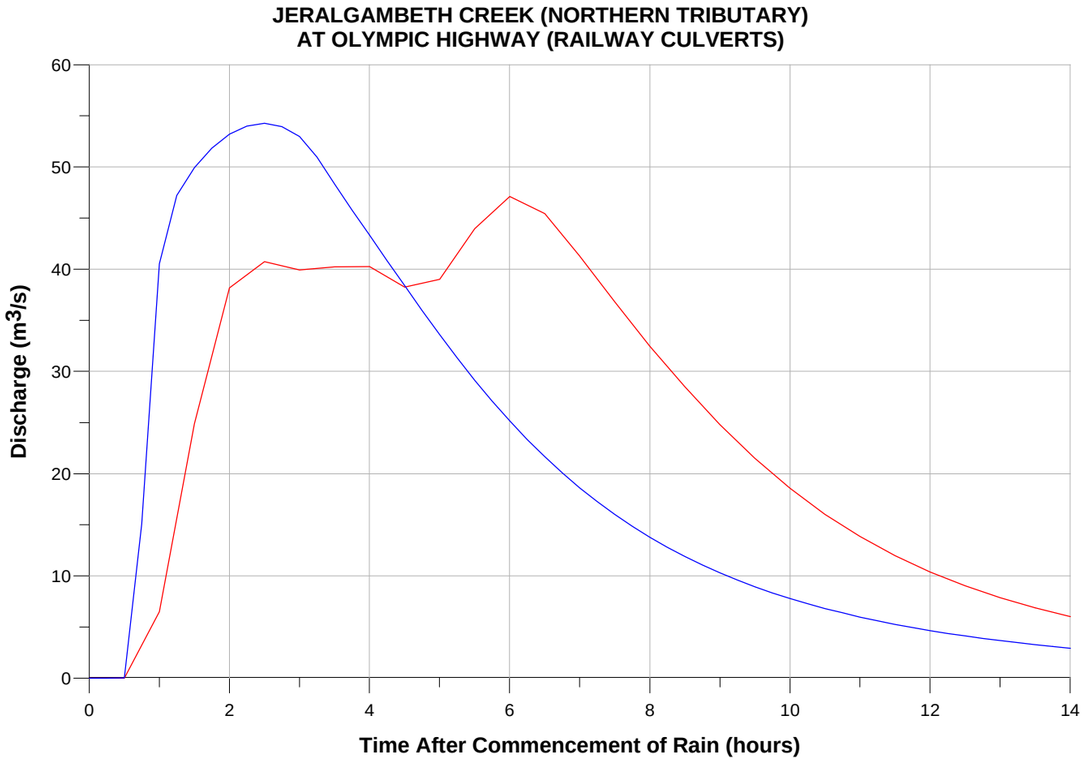
LEGEND

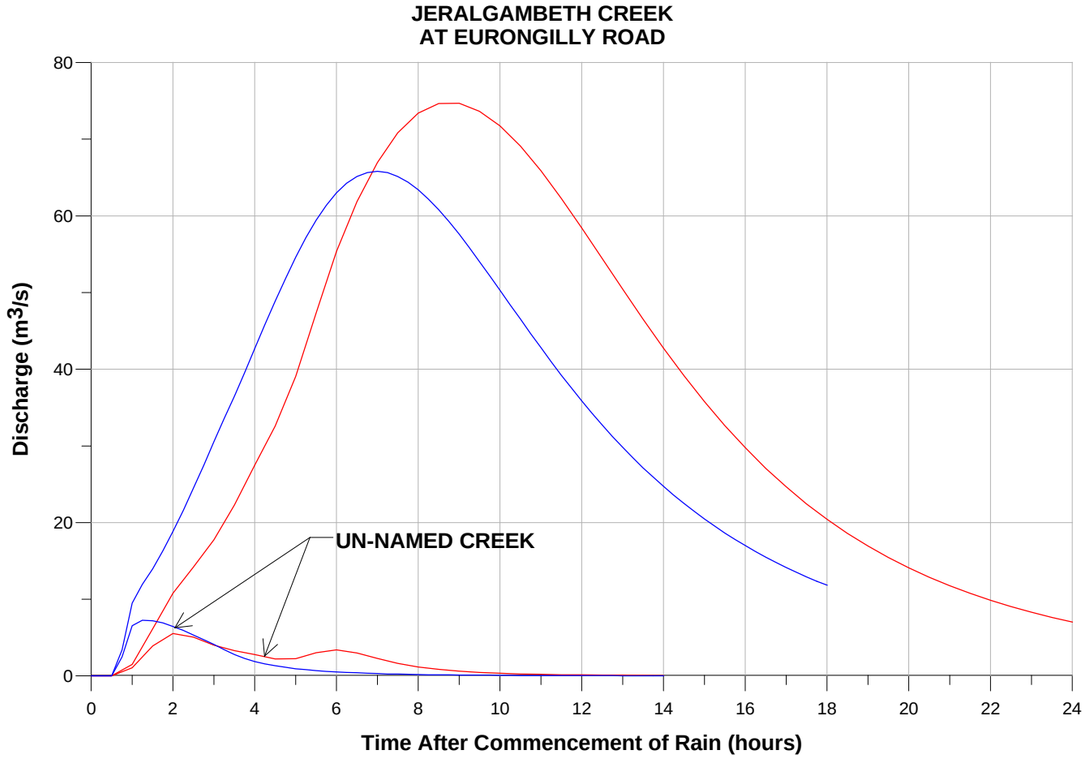
- Two Dimensional Model Boundary Peak Water Surface Elevation
- 269.5 Contour (m AHD) - 100 Year ARI
- Boundary of Area Subject to Council's Planning Proposal for a Dwelling Entitlement (Proposed R5 Large Lot Zone)
- Extent of Flood Planning Area (100 Year ARI + 500 mm)
- Extent of PMF
- Levee

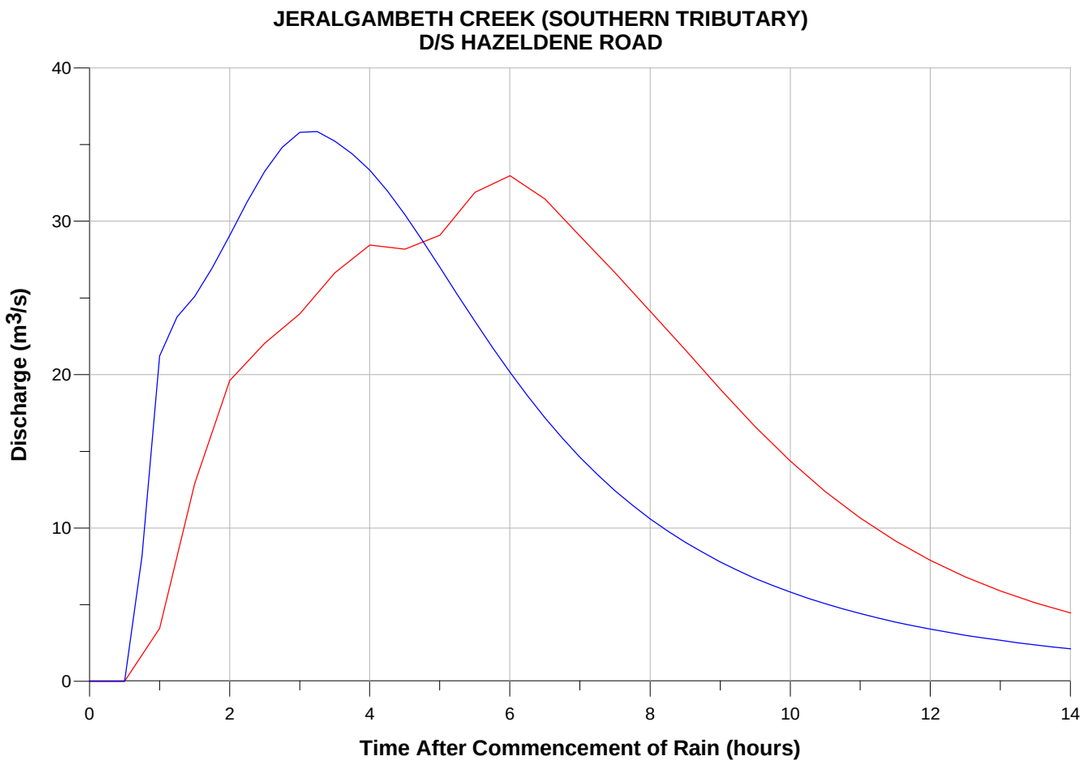
JERALGAMBETH CREEK AT ILLABO
FLOODPLAIN RISK MANAGEMENT STUDY

Figure 2.3

INDICATIVE EXTENTS OF INUNDATION







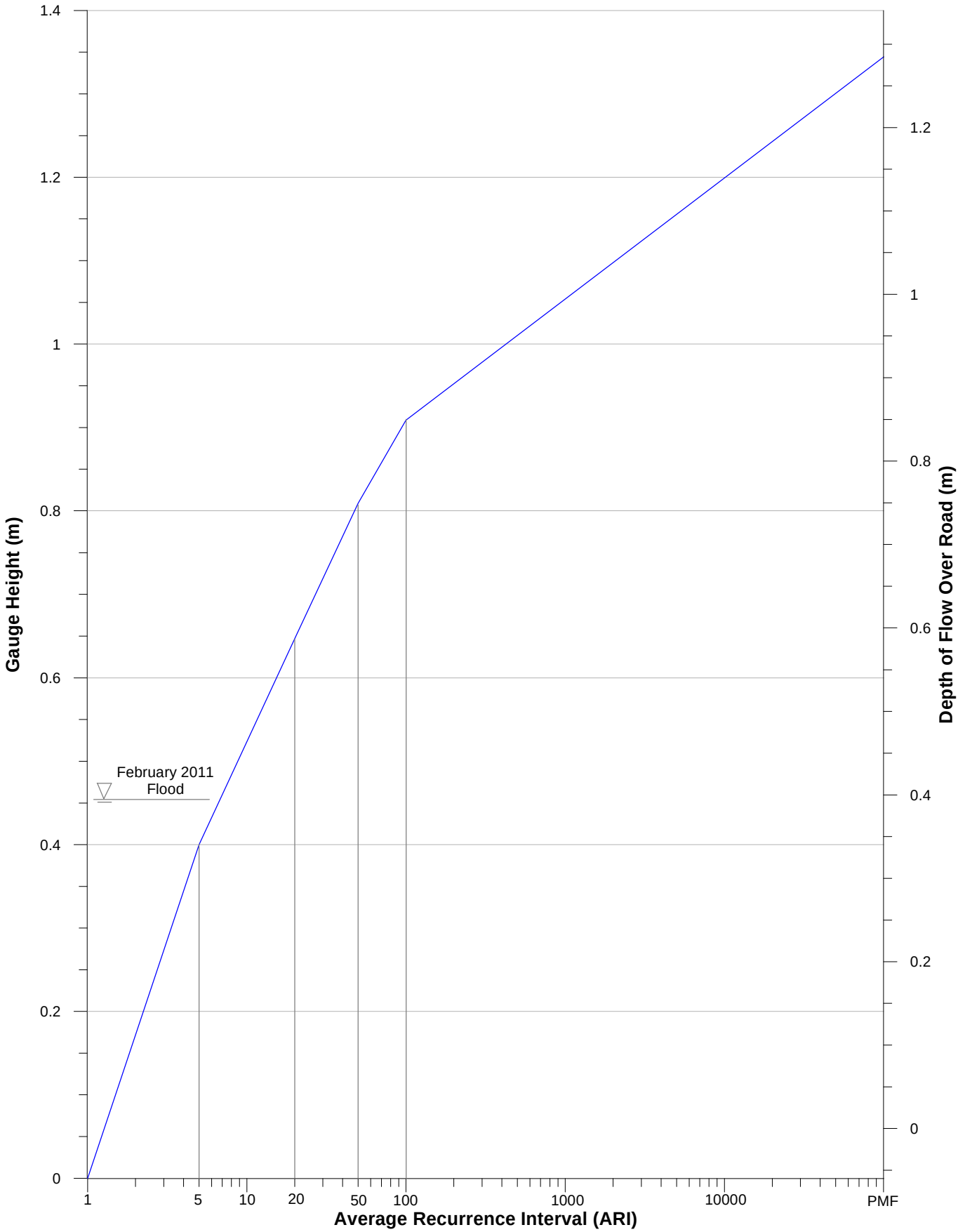
LEGEND
3 Hour Storm
9 Hour Storm

NOTE:
SEE FIGURE 2.3 FOR LOCATIONS

JERALGAMBETH CREEK AT ILLABO
FLOODPLAIN RISK MANAGEMENT STUDY

Figure 2.4

TIME OF RISE OF FLOODWATERS
100 YEAR ARI



NOTE:

Gauge Zero = 265.69 m AHD
Low Point of Eurongilly Road = 265.75 m AHD

JERALGAMBETH CREEK AT ILLABO
FLOODPLAIN RISK MANAGEMENT STUDY

Figure 2.5

FLOOD DATA AT EURONGILLY ROAD

ILLABO

STRATTON ST
BARNES ST
LAYTON ST
HOWELL ST
JUNEE ST
WOOD ST
COMMENS RD
CROWTHER ST
LESTER ST
BOYTON ST
RAILWAY
SOUTHERN
OLYMPIC HIGHWAY
MAIN
PARK ST
ILLABO ST
COWLEY ST
SHOWGROUND RD
ILLABO PARK
ILLABO SHOWGROUND
LAWFORD ST
MORGAN ST
EURONGILLY RD
BRABINS RD

262.5
262
263
263.5
264
264.5
265
265.5
266
266.5
267
267.5
268
268.5
269
269.5
270
270.5
271

NOTE:

THE EXTENTS OF INUNDATION SHOWN WERE DETERMINED FROM SURVEYED CROSS SECTIONS OF THE CREEK AND FLOODPLAIN AND AVAILABLE DATA AND ARE APPROXIMATE ONLY. THE EXTENT OF INUNDATION OF INDIVIDUAL ALLOTMENTS NEAR THE FLOOD FRINGE SHOULD BE CONFIRMED BY SITE SPECIFIC SURVEY.

N

80 0 80 160 240 m

Scale: 1:8,000

LEGEND

- High Hazard Floodway
- Low Hazard Overland Flowpath
- Intermediate Floodplain
- Outer Floodplain
- Extent of Hydraulic Modelling
- Extent of 100 Year ARI
- Extent of Flood Planning Area (100 Year ARI + 500 mm)
- Levee
- Extent of PMF
- Peak Water Surface Elevation Contour (m AHD)
- Existing Residence
- Boundary of Area Subject to Council's Planning Proposal for a Dwelling Entitlement (Proposed R5 Large Lot Zone)

JERALGAMBETH CREEK AT ILLABO
FLOODPLAIN RISK MANAGEMENT STUDY

Figure 2.6

FLOODWAY - FLOOD PLANNING AREA

3 POTENTIAL FLOODPLAIN MANAGEMENT MEASURES

3.1 Range of Available Measures

A variety of floodplain management measures can be implemented to reduce the impacts of flooding.

Flood modification measures change the behaviour of floods in regard to discharges and water surface levels to reduce flood risk. This can be done by the construction of levees, channel improvements or detention basins. Such measures are also known as "structural" options as they involve the construction of engineering works.

Property modification measures reduce risk to properties through appropriate land use zoning, specifying minimum floor levels for new developments, voluntary purchase of residential property in high hazard areas, or raising existing residences in the less hazardous areas. Such options are largely planning measures, as they are aimed at ensuring that the use of floodplains and the design of buildings are consistent with flood risk. Property modification measures could comprise a mix of structural and non-structural methods of damage minimisation.

Response modification measures change the response of flood affected communities to the flood risk by increasing flood awareness, by the installation of flood warning systems and the development of emergency management plans for property evacuation. These options are wholly non-structural.

The cost of flood modification measures is clearly not presently justified due to the sparse development on the floodplain. The purpose of the following review is to assess their feasibility as a strategy for mitigating flooding in future urban development following any re-zoning of the area by Council. The assessment is necessarily of a very preliminary nature.

3.2 Channel Improvements

3.2.1 Current Practice

The hydraulic capacity of a stream may be increased by widening, deepening or straightening the channel and by clearing the banks of obstructions. The scope of such improvements can vary from minor works such as de-snagging and bank clearing, which do not increase the waterway area but reduce hydraulic roughness, to major channel excavations. Careful attention to design is required to ensure stability of the channel is maintained and scour or sediment build-up is minimised. The potential for channel improvements to increase downstream flood peaks also needs to be considered. In general, channel improvements need to be carried out over a substantial stream length to have any significant effect on flood levels. Proposals also need to conform with Government Policies in regard to retention of native vegetation, maintenance of fish habitat and other environmental considerations.

Over the last 20 years there has been a move away from achieving channel improvements by relatively straight, engineered grassed floodways, to designs more in keeping with the appearance and morphology of natural streams. The Department of

Water and Energy (DWE), now Office of Water as administrator of the Water Management Act, 2000, noted in *Guidelines for Controlled Activities Riparian Corridors, 2008* that construction in the bed of streams or within 40 m of the banks is regulated by the act and that approval for works is required. A grassed floodway may not be supported by Office of Water, or the Catchment Management Authority for environmental reasons.

Modern practice is to consider creeks as functioning as riparian corridors and recognise that they form a transitional zone between terrestrial and aquatic environments, performing a range of important environmental functions, in addition to conveying flood flows.

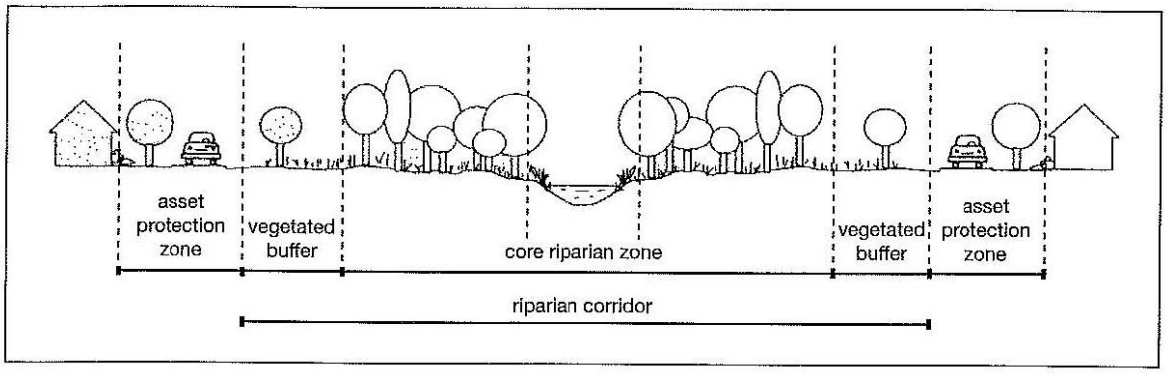
As noted in *DWE's Guidelines for Controlled Activities Riparian Corridors, 2008* the functions are:

- Provide bed and bank stability and reduce channel and bank erosion.
- Protect water quality by trapping sediment nutrients and other contaminants.
- Provide a diversity of habitat for terrestrial riparian and aquatic flora and fauna species.
- Allow for the conveyance of flood flows and control their direction.
- Provide an interface between developments and waterways.

As shown on the schematic cross section Figure 1, extracted from DWE, 2008 a riparian corridor would typically comprises three zones:

- The core riparian zone (CRZ) contained within and adjacent to the channel.
- A vegetated buffer protecting the CRZ from weed invasion.
- An asset protection zone protecting houses from bushfire damage.

Figure 1. Riparian corridor zones.



3.2.2 Potential for Riparian Corridor/Improved Channel on Blackjack Creek

Jeralgambeth Creek is a typical ephemeral stream with long dry periods and intermittent surface runoff events and occasional major flood flows such as occurred in February 2011. In view of the need to protect (future) development, mitigation of flooding would probably be a more important objective of the development of the riparian corridor than on

other streams which do not have urban flooding problems. In order to achieve a flood mitigation objective, the overall hydraulic capacity of the waterway would need to be substantially increased, compared with the relatively small channel cross section shown on Figure 1.

As the vegetated zones on the floodplain associated with a riparian corridor on Jeralgambeth Creek may result in an increase in hydraulic roughness compared with the existing grass cover on the floodplain, there would need to be a large increase in the area of the channel to contain floodwaters. Consideration would need to be given to limiting the density of planting in the area bordering the channel to ensure that flood levels for the very large events which surcharge the channel are not increased, compared with present day conditions. It would be desirable to vary the bed gradient and also provide a sinuous channel (in plan) in keeping with natural streams.

3.2.3 Preliminary Analysis of Riparian Corridor/Improved Channel

Hydraulic modelling was carried out of a flood management measure involving the above features. The objective was to contain the extent of flooding up to the 100 year ARI event to the confines of the channel. The channel would follow the route shown on **Figure 3.1**. For the purposes of modelling the improved channel section was assumed to extend from Eurongilly Road to the prolongation of Stratton Street. Banking along the southern side of the road would be required to direct flows into the improved sections of channel. Eurongilly Road would also have to be lowered at the entrance to the improved sections of channel by up to 500 mm.

To provide a modified version of the concept shown on Figure 1 above, an overall width of about 80 to 100 m would be required for the channel and vegetated buffer on the main arm of Jeralgambeth Creek, with a lesser width required for Un-Named Creek. Typical modelled cross sections are shown in **Figure 3.2**. A trapezoidal channel of about 60 to 70 m bed width and 1 vertical to 4 horizontal side slopes was modelled for Jeralgambeth Creek, with an invert about 1 m below present day levels.

In practice the side slopes would be varied along the length of the channel to mimic natural streams. The invert and batters would be vegetated with local grass and plant species, selected and planted at a density which ensures that hydraulic capacity is not reduced over time. On-going maintenance would be required to control growth. Several rock structures could be located in the invert to control scour and allow the formation of ponds during dry periods. The overbanks could be planted with stands of trees to simulate natural creek conditions.

The riparian corridor/ improved channel concept would control floodwaters up to the 100 year ARI magnitude and as shown on **Figure 3.1**, would render a considerable proportion of the floodplain flood free at that level of flooding. However, it would have an adverse impact on the serviceability of the local road system during flood events and would not be economically justified or financially viable for Council. It would also not be in keeping with the objectives of the *Illabo Village Strategy, 2009* because of the requirement to clear extensive areas of native vegetation for the channel improvements. After consideration, the Committee considered that a non-structural approach involving the application of flood related development controls to accommodate future development would be a more appropriate management measure for inclusion in the *draft FRMP*.

3.3 Levees

3.3.1 General

Levees are an effective means of protecting flood affected properties up to the chosen design flood level. In designing a levee it is necessary to take account of three important factors: potential re-distribution of flood flows, the requirements for the collection and disposal of internal drainage from the protected area and the consequences of overtopping the levee in floods greater than the design event. A freeboard between the design flood level and the crest level of between 0.5 and 1 m would be required, based on an assessment of site specific flooding conditions.

A major issue to consider when evaluating levee proposals, is that unless the levee is built to exclude the PMF, there will be a residual chance of its being overtopped over its life. Adoption of the PMF as the design flood is usually not feasible due to its considerable increase in peak flood level compared with the lesser floods. When a flood smaller than the PMF is adopted for design, provision will need to be made for controlled overtopping of the crest. It is usual practice to have the downstream end of the levee set lower than the average flood gradient along its extent, so that overtopping commences at its downstream end and continues progressively upstream as river levels rise. This allows the overtopping to take place into a pool of water on the protected side of the levee and minimises the risk of erosion of its face.

Stormwater generated from the local catchment on the “protected” side of the levee must also be catered for over the duration of the flood. During that time any runoff generated locally must either be stored behind the levee for later drainage to the river as flood levels recede, disposed of by pumping over the levee, or conveyed downstream to a location where it can be discharged by gravity to the river.

3.3.2 Feasibility of Levees on Jeralgambeth Creek at Illabo

Figure 3.3 shows a concept for a levee aimed at providing a 100 year ARI level of flood protection. The scheme involves the retention of the existing farm water storages. For the purposes of illustration, both arms (Un-Named Creek and Jeralgambeth Creek) were leveed, commencing upstream of Eurongilly Road and continuing to the prolongation of Stratton Street. A shorter length of levee may be achieved by location diversion banking on the upstream side of Eurongilly Road to train the flows into both arms (as for the channel improvement of **Figure 3.1**). The works would also include upgrading the existing levee protecting the Grain Silo.

Hydraulic modelling of the levee concept showed that 100 year ARI flood levels in the main arm would locally be increased by up to 300 mm due to its constricting effects on flood flows. The average increase in peak flood levels would be around 100 mm (the increase in flood levels compared with present day conditions is shown in the colour coded “afflux” table on **Figure 3.3**. The figure also shows the height of levee required assuming a freeboard of 500 mm on 100 year ARI flood levels under post-levee conditions. The freeboard is a factor of safety which allows for wave action, uncertainties in the assessment of 100 year ARI flood levels, construction tolerances and potential settlement of the levee.

The height of the levee would range between 900 mm and 1.3 m, reaching its maximum at Eurongilly Road. To maintain continuity service, the road would need to grade over the levee on both banks of the main arm, as well as at the Un-Named Creek crossing.

The provision of facilities for the temporary detention and release of runoff from the protected areas whilst creek levels are maintained would be an important issue in planning for the levee. During major floods, elevated water levels will be maintained in the creek for a period of up to 20 hours. Stormwater would either have to be stored, pending drainage to the creek as floodwaters recede or alternatively directed downstream along channels on the protected side of the levee. There are no obvious storage sites available.

The levee concept would control floodwaters up to the 100 year ARI magnitude and as shown on **Figure 3.3**, would render a considerable proportion of the floodplain flood free at that level of flooding. However, it would not be justified on grounds similar to the riparian corridor/channel improvement scheme and also because of the technical difficulties associated with the disposal of local runoff generated behind the levee. The Committee considered that a non-structural approach involving the application of flood related development controls would be a more appropriate management measure for inclusion in the *draft FRMP*.

3.3.3 Upgrading Existing Levee at the Grain Silo

As shown in **Figures 5.7** and **5.8** of the *Flood Study*, the levee would be surcharged at several low points, including near its upstream end at Lawford Road. To achieve a 100 year ARI level of protection (i.e. with 500 mm of freeboard) the existing levee crest would need to be raised by up to 0.5 m. It may be possible to incorporate the existing levee in the new works. However, this would be subject to geotechnical testing at the design stage, as the engineering properties and compaction of the fill material are presently unknown.

3.4 Construction of Detention Basins

Detention basins provide a temporary storage of floodwaters additional to that contained in the natural floodplain, which can reduce the flood peak in downstream reaches of the creek. “Offline” basins, remote from the streams, with intake and outlet channels to and from the stream, are preferred over embankments constructed across the channel to maintain the continuity of the creek system.

The basin should also be located in the middle or lower reaches of the catchment, sufficiently close to the area intended to be protected, that its attenuating effects over flood peaks is not negated by downstream tributary inflows. Typically the basin should command in excess of 60 to 70 per cent of the total catchment at the urban centre to be protected.

Another requirement is that the basin be of sufficient size to store a significant percentage of runoff from the design storm. Basins attenuate the flood peak (i.e. reduce the downstream peak rate of runoff) by temporarily storing the incoming discharge hydrograph and releasing it at a controlled rate. To be effective, basins storage volumes at least 30 to 40 per cent of the volume of runoff of the incoming flood event are required.

Flows up to the 100 year ARI are usually controlled by low level pipes. Larger flows are conveyed by a combination of flow through the low level outlets together with flow over an emergency spillway, which is usually constructed by excavating a channel and broad crested weir in one of the abutments. For the more important basins, the spillway crest is armoured with reno-mattress or equivalent to prevent scour.

For optimum performance in reducing downstream flows the design flood should be conveyed through the basin via the low level outlets without the spillway operating. Achieving this objective often requires a large basin storage. Small basins are quickly overwhelmed by the incoming flood waters, with the result that the level of stored water quickly rises to the level of the emergency spillway. Because the spillway is able to pass a large rate of flow, with little rise in level, the rate of outflow rapidly rises to the rate of inflow, negating the purpose of the basin.

For a basin on the Jeralgambeth Creek system, the objective would be to reduce flows to no greater than the pre-basin 5 year ARI peak, which may be conveyed within the channel at most locations without significant surcharging. The required volume of storage would be about 2 Million cubic metres equivalent to a storage area of 1 km^2 and 2 m deep. Clearly, detention basins are not a practicable flood mitigation measure.

3.5 Flood Policy for Future Development

3.5.1 Considerations for Setting Flood Planning Level

Selection of the **Flood Planning Level** (***FPL***) for an area is an important and fundamental decision as the standard is the reference point for the preparation of floodplain management plans. It is based on adoption of the peak level reached by a particular flood plus an appropriate allowance for freeboard. It involves balancing social, economic and ecological considerations against the consequences of flooding, with a view to minimising the potential for property damage and the risk to life and limb. If the adopted ***FPL*** is too low, new development in areas above the ***FPL*** (particularly where the difference in level is not great) may be inundated relatively frequently and damage to associated public services will be greater. Alternatively, adoption of an excessively high flood planning level will subject land that is rarely flooded to unwarranted controls.

Councils are responsible for determining the appropriate ***FPL***'s within their local government area. Whilst the flood used to determine the residential ***FPL*** is a decision of the Council, the FPM, 2005 highlights that ***FPL***'s for typical residential development would generally be based around the 100 year ARI flood, plus an appropriate freeboard (typically 500 mm).

3.5.2 Current Government Policy

The circular issued by the Department of Planning on 31 January 2007 contained a package of changes clarifying flood related development controls to be applied on land in low flood risk areas (land above the 1 in 100 year flood). The package included an amendment to the Environmental Planning and Assessment Regulation 2000 in relation to the questions about flooding to be answered in Section 149 planning certificates, a revised ministerial direction (Direction 15) regarding flood prone land (issued under

Section 117 of the EP&A Act, 1979) and a new Guideline concerning flood-related development controls in low flood risk areas.

The Circular advised that Councils will need to follow both the *Floodplain Development Manual, 2005* as well as the Guideline to gain the legal protection given by Section 733 of the Local Government Act.

The Department of Planning Guideline confirmed that **unless exceptional circumstances applied, councils should adopt the 100 year ARI flood (1 in 100 year flood) with appropriate freeboard as the *FPL* for residential development**. In proposing a case for exceptional circumstances, a Council would need to demonstrate that a different ***FPL*** was required for the management of residential development due to local flood behaviour, flood history, associated flood hazards or a particular historic flood. Unless there were exceptional circumstances, Council should not impose flood-related development controls on residential development on land with a low probability of flooding, that is land above the residential ***FPL***.

Nevertheless, the safety of people and associated emergency response management needs to be considered in low flood risk areas, which may result in:

- Restrictions on types of development which are particularly vulnerable to flood emergencies, for example, developments for aged care.
- Restrictions on critical emergency response and recovery facilities and infrastructure. These aim to ensure that these facilities and the infrastructure can fulfil their emergency response and recovery functions during and after a flood event. Examples include evacuation centres, hospitals and major utility facilities.

3.5.3 Proposed Flood Planning Levels

Consideration of the data supports retaining the 100 year ARI flood plus a freeboard allowance of 500 mm for floor levels of residential development, along with a graded set of controls depending on the location of the development within the area flooded by that event.

3.5.4 Division of the Floodplain into Flood Hazard Zones

The flood prone land (as defined by the PMF) is divided into areas of varying flood risk using the hydraulic and hazard categorisation data derived in the companion *Flood Study* and reviewed herein. In the proposed *Flood Policy* previewed in **Chapter 2** and presented in **Appendix A**, the flood prone land would be divided into four planning zones. (The diagram showing the proposed flood hazard zones is reproduced as **Figure 2.6**):

- **"*High Hazard Floodway*"** this is the most flood affected land and the area where the highest flow velocities would be expected at the 100 year ARI flood. This zone should be kept clear of future development.
- ***"Low Hazard Overland Flowpath"*** this is flood affected land where lesser but still significant flow velocities may be experienced. Developments in this area would need to be capable of withstanding hydraulic forces and would also need to be sited to minimise adverse re-directions of flow to adjacent

properties. The local impacts on flooding of any proposals for filling would need to be assessed.

- **"*Intermediate Floodplain*"** is the remaining land lying within the ***Flood Planning Area*** (land inundated by the 100 year ARI flood levels plus 500 mm). Within this area, there would only be the requirement for minimum residential floor levels to be set at 100 year ARI flood levels plus 500 mm. All land uses would be permitted in this zone. However, Essential Community Facilities, Critical Utilities and Flood Vulnerable development such as housing for aged and disabled persons would be subject to additional controls.
- ***"Outer Floodplain***" is the remainder of the floodplain between the ***Flood Planning Area*** and the extent of the PMF (that is, the extent of the floodplain). In this area, no controls would apply for residential development. However, because the flood hazard zones have been mapped using available contour mapping (1 m intervals), Council would check proposed floor levels of developments to ensure that they are no lower than the ***FPL***.

3.6 Flood Response Modification Measures

3.6.1 Existing Flood Warning System

As noted in **Section 2.7**, Bureau of Meteorology warning services for the area are restricted to more general Severe Weather Warnings, Severe Thunderstorm Warnings and Flood Watches for the Murrumbidgee Valley.

Flood forecasting and warning can be an effective flood management measure if there is sufficient warning time for the community to react to the warning. An effective flood warning system has three key components, i.e. a flood forecasting system, a flood warning broadcast system and an evacuation plan. Flood response to rainfall on the catchments is expected to be between around six to nine hours (i.e. from the commencement of heavy rainfall to the occurrence of the flood peak; ref **Figure 2.4**).

3.6.2 Improvements to Flood Warning System

After discussion, the Floodplain Management Committee considered that the magnitude of the flooding problem at Illabo did not warrant implementation of a formal flood warning system. The Committee noted that during major floods, velocity flooding is mainly confined to the immediate vicinity of the creek channels and roads, with little impact on existing (sparse) development. There are only two residences located in the floodplain, neither of which would be subject to above-floor inundation at the 100 year ARI level, although their allotments would be inundated. However, evacuation would not be a problem as there is easy egress to high ground. The Committee supported the inclusion of the flood data at the Eurongilly Road gauge (**Figure 2.5**) as it would provide useful flood intelligence to SES.

The Committee considered that current services provided by BOM for severe weather and thunderstorms were adequate. However, the information on flooding and its consequences contained in this report could be used to improve the flood awareness of the Illabo community, particularly the awareness of residents in flood affected areas. Measures which could be implemented are discussed in the following section.

3.7 Flood Awareness Programs

3.7.1 General Comments

Community awareness and appreciation of the existing flood hazards in the floodplain would promote proper land use and development in flood affected areas. A well informed community would be more receptive to requirements for flood proofing of buildings and general building and development controls imposed by Council. One aspect of a community's preparedness for flooding is the "flood awareness" of individuals. This includes awareness of the flood threat in their area and how to protect themselves against it. It is fair to assume that the level of awareness drops as individuals' memories of previous experience dim with time. **Figures 2.3** and **2.6** provide data on flood behaviour which will be of assistance in land use planning, as well as maintaining the flood awareness of future residents of the study area.

3.7.2 Practical Measures for Increasing Flood Awareness

Means by which community awareness of flood risks can be maintained or may be increased include:

- Sending out regular information with rates notices. The information contained in this present study could be edited and used by Council and SES to prepare a *Flood Information Brochure*.
- Displays at Council offices using the information contained in the present study and photographs of historic flooding in the area e.g. the recent February 2011 flood – ref. companion *Flood Study* report.
- Talks by SES officers with participation by Council and longstanding residents with experience of flooding in the area.

3.8 Summary

This chapter has reviewed a number of potential floodplain management measures. From this review, the following measures are considered the most promising for incorporation in the *Floodplain Risk Management Plan*

- Development Controls as nominated in the Flood Policy of **Appendix A,** with complementary clauses as agreed by DOP and OEH and presented in **Section 2.7.3** to be included in any updating of the LEP.
- Ensure flood data in *the Floodplain Risk Management Study and Plan* are available to SES for refining flood emergency response procedures. A summary of data is given in **Section 2.6.5**.
- Implement flood awareness and education programs for residents via targeted interviews by Council officers of affected residents and the preparation of appropriate documentation setting out the nature of the flood risk.
- Structural measures (channel improvements, levees, detention basins) are not technically or economically feasible and would have adverse environmental consequences.

Indicative Depth of Inundation (m)

- < 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.40
- 0.40 to 0.50
- 0.50 to 0.60
- 0.60 to 0.70
- 0.70 to 0.80
- 0.80 to 0.90
- 0.90 to 1.00
- > 1.00

STRATTON ST
BARNES ST
LAYTON ST
HOWELL ST
JUNEE ST
PARK ST
WOOD ST
COMMENS RD
CROWTHER ST
LESTER ST
RAILWAY
ILLABO
ILLABO ST
COWLEY ST
XS 5
XS 6
SHOWGROUND RD
ILLABO SHOWGROUND
BOYTON ST
OLYMPIC HIGHWAY
SOUTHERN
MAIN
ILLABO PARK
LAWFORD ST
XS 4
XS 2
XS 3
XS 1
PRESENT DAY 100 YEAR ARI EXTENT
EURONGILLY RD
BRABINS RD
MORGAN ST
261.5
262
262.5
263
263.5
264
264.5
265
265.5
266
266.5
267
267.5
268
268.5
269
269.5
270
270.5
271

PRELIMINARY CONCEPT ONLY
AND NOT FOR CONSTRUCTION

N

80 0 80 160 240 m

Scale: 1:8,000

NOTE:
THE EXTENTS OF INUNDATION SHOWN WERE DETERMINED FROM SURVEYED CROSS SECTIONS OF THE CREEK AND FLOODPLAIN AND AVAILABLE DATA AND ARE APPROXIMATE ONLY. THE EXTENT OF INUNDATION OF INDIVIDUAL ALLOTMENTS NEAR THE FLOOD FRINGE SHOULD BE CONFIRMED BY SITE SPECIFIC SURVEY.

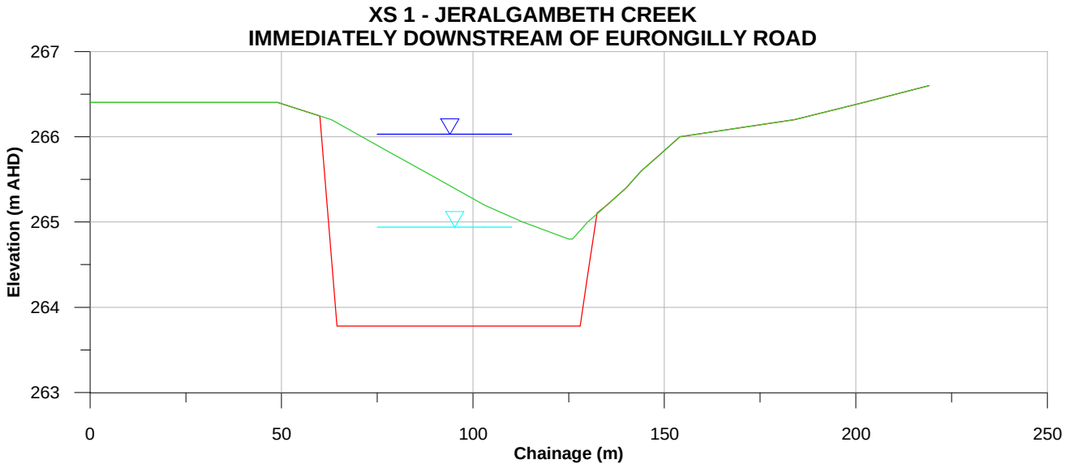
LEGEND

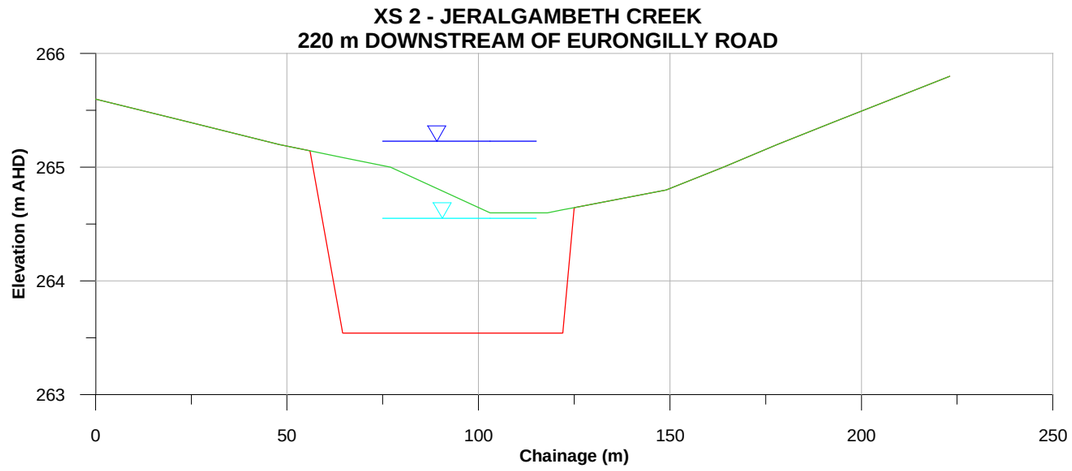
- Two Dimensional Model Boundary
- Proposed Levee
- Improved Channel/ Riparian Corridor
- Road to be Lowered by up to 500 mm
- Land Rendered Flood Free By Improved Channel
- 266.5 Peak Water Surface Elevation Contour (m AHD)
- XS 3 Riparian Corridor Cross Sections (See Figure 3.2 for Details)

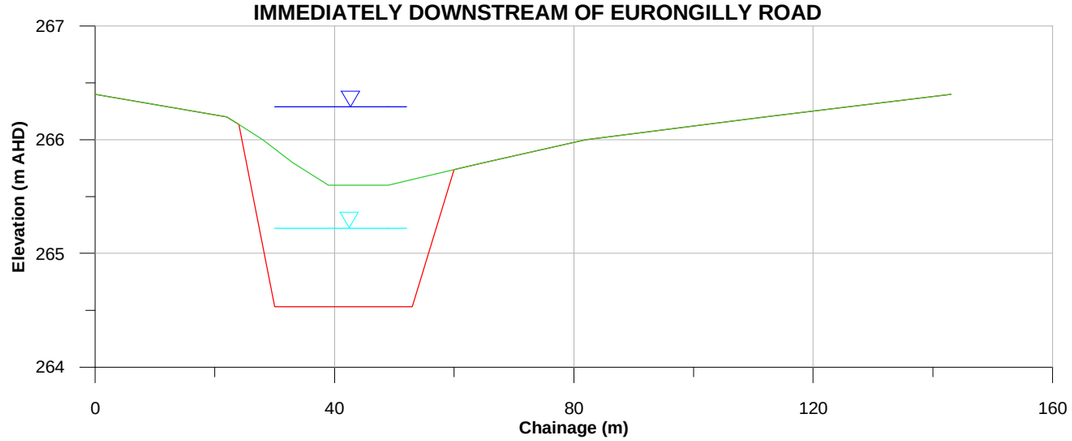
JERALGAMBETH CREEK AT ILLABO
FLOODPLAIN RISK MANAGEMENT STUDY

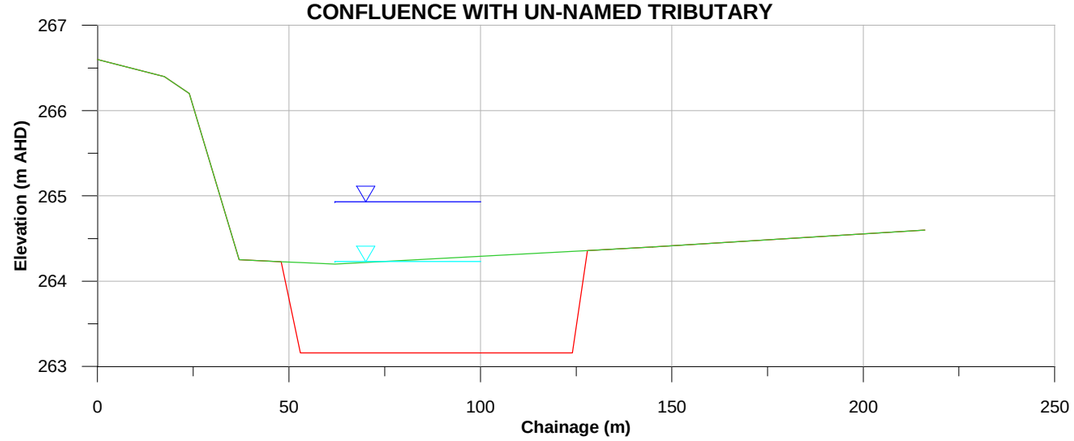
Figure 3.1

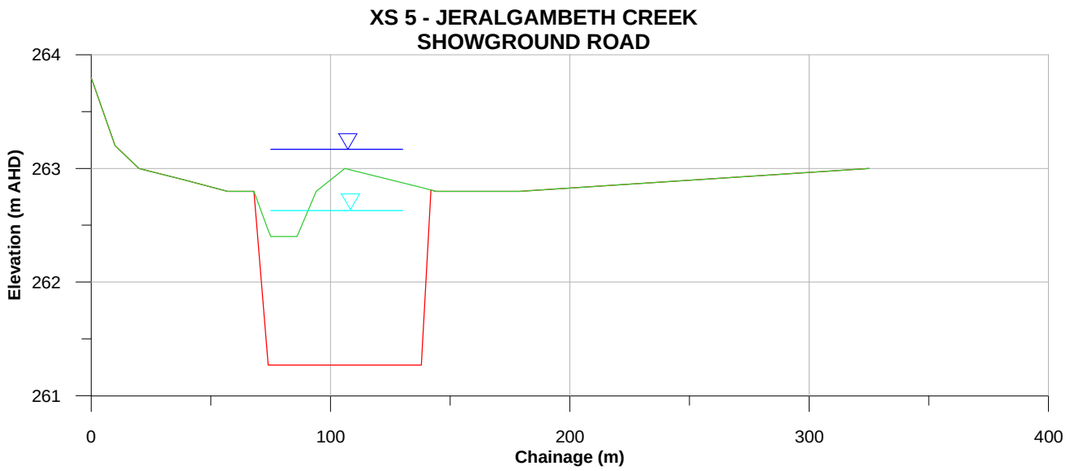
RIPARIAN CORRIDOR/ IMPROVED CHANNEL
FLOOD CONTOURS AND DEPTHS - 100 YEAR ARI

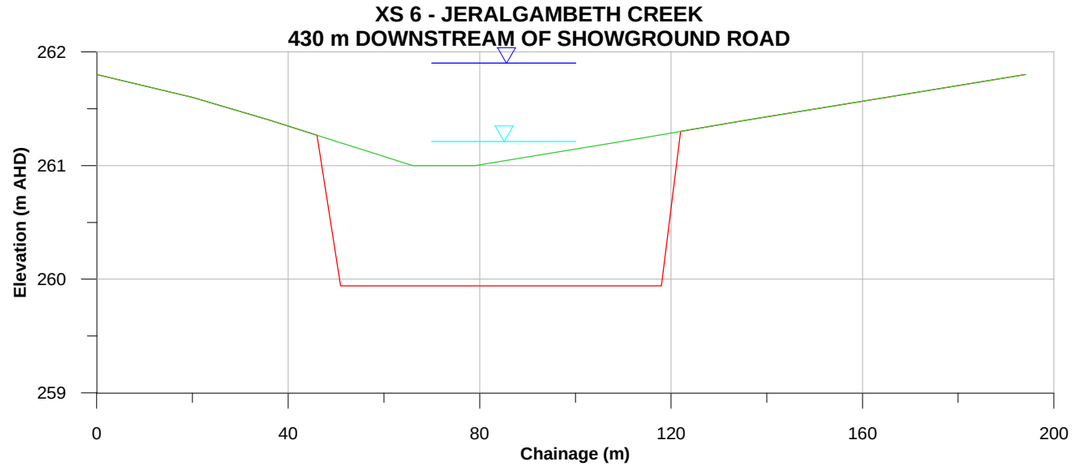












NOTE:

FOR LOCATION OF CROSS SECTIONS SEE FIGURE 3.1

PRELIMINARY CONCEPT ONLY AND NOT FOR CONSTRUCTION

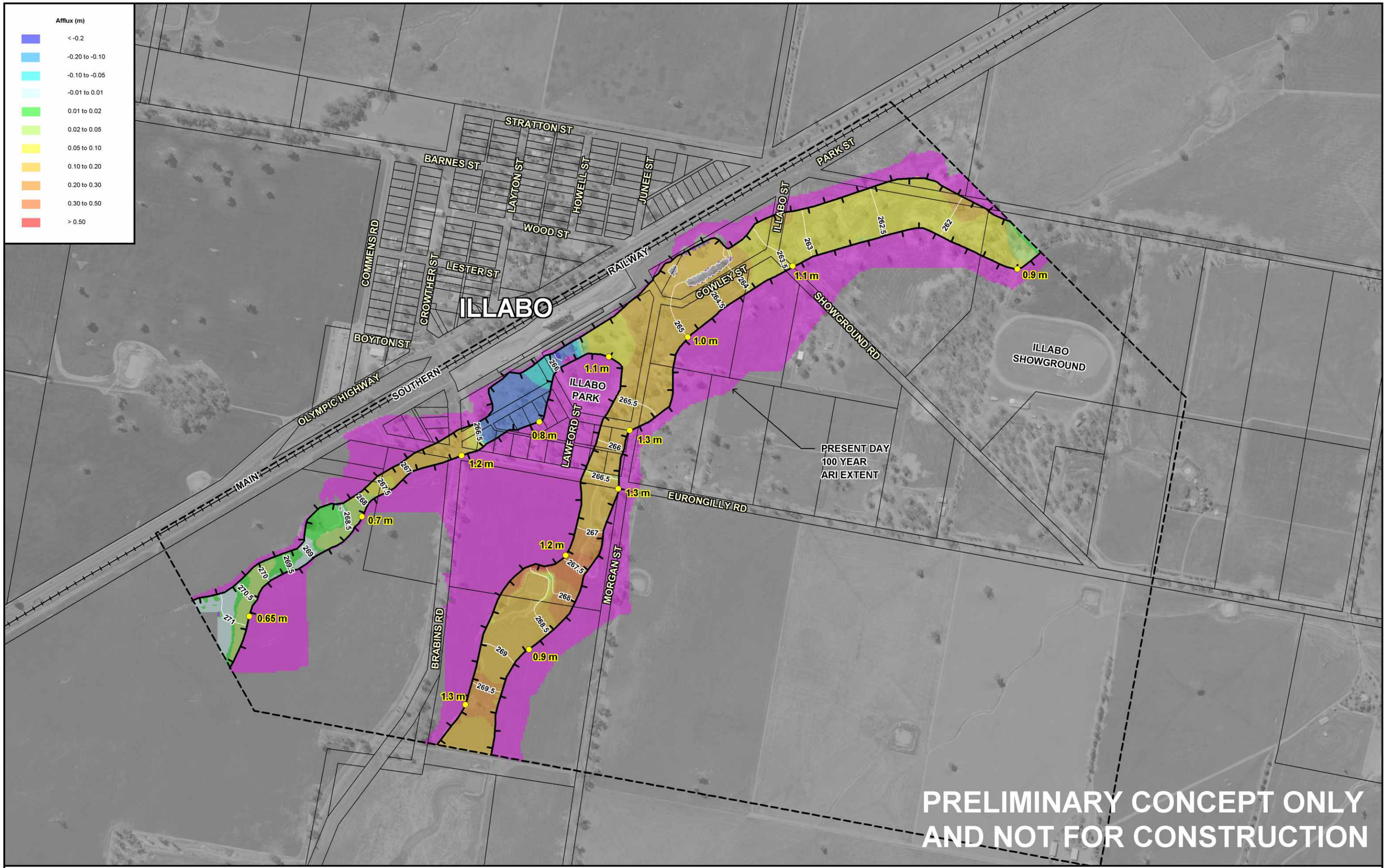
LEGEND

- Natural Surface
- Improved Channel
- WS - Present Day - 100 Year ARI
- WS - Improved Channel - 100 Year ARI

JERALGAMBETH CREEK AT ILLABO
FLOODPLAIN RISK MANAGEMENT STUDY

Figure 3.2

RIPARIAN CORRIDOR/ IMPROVED CHANNEL CROSS SECTIONS



N

80 0 80 160 240 m

Scale: 1:8,000

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LEGEND

- Two Dimensional Model Boundary
- Proposed Levee
- 1.3 m — Height of Levee (Allowing 500 mm Freeboard)
- Land Rendered Flood Free By Levee
- 267 — Peak Water Surface Elevation Contour (m AHD)

JERALGAMBETH CREEK AT ILLABO
FLOODPLAIN RISK MANAGEMENT STUDY

Figure 3.3

LEVEE ALONG BANKS OF CREEK
FLOOD CONTOURS AND AFFLUX - 100 YEAR ARI

4 REFERENCES

Hennessy et al (2004), *"**Climate Change in NSW, Part 2 Projected Changes in Climate Extremes"***. CSIRO Consultancy report for NSW Greenhouse Office.

Institution of Engineers, Australia (1998). ***"Australian Rainfall and Runoff."***

Lyall and Associates Consulting Water Engineers (2011). ***"Jeralgambeth Creek at Illabo Flood Study."***

Lyall and Associates Consulting Water Engineers (2008). ***"Queanbeyan Floodplain Risk Management Study Study."***

New South Wales Government, (2005), ***"Floodplain Development Manual – The Management of Flood Liable Land."***

State Emergency Service (2010), ***"Junee Shire Local Flood Plan."***

Department of Environment, Climate Change and Water, NSW (2008) ***"Floodplain Risk Management Guideline No 4. Residential Flood Damage Calculation"***.

Department of Environment, Climate Change and Water, NSW (2007) ***"Floodplain Risk Management Guideline. Practical Consideration of Climate Change"***.

JERALGAMBETH CREEK AT ILLABO

FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

APPENDIX A

FLOOD POLICY

MARCH 2012

Note: **Figure A1.1** shows the boundary of the area on the southern side of the Main Southern Railway to which this Flood Policy would apply. Junee Shire Council has prepared a planning proposal for consideration by Department of Planning and Infrastructure which would permit a dwelling entitlement, whilst retaining the existing rural-small holdings characteristics of the area. Consequently, only the provisions of the Flood Policy relating to residential development are relevant.

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FIGURES

ANNEXURES

1 INTRODUCTION

This *Flood Policy* was prepared to provide specific controls to guide development of land in flood prone areas bordering Jeralgambeth Creek at Illabo. The *Flood Policy* incorporates the findings of the *Jeralgambeth Creek at Illabo Floodplain Risk Management Study and Plan, 2012* and the procedures set out in the NSW *Floodplain Development Manual, 2005*.

The *Flood Policy* also takes into account the "*Guideline on Development Controls on Low Flood Risk Areas*" and associated Ministerial Direction No 15 issued by the Department of Planning in January 2007. As a consequence, residential areas above the ***Flood Planning Level*** (100 year ARI flood level plus a 500 mm allowance for freeboard) are not subject to flood related development controls. Within the extent of the ***Flood Planning Area*** *(*land inundated at the ***Flood Planning Level****)*, controls over residential development reflect the nature of the flood risk.

The *Policy* recognises the need for controls over commercial and industrial development to balance the flood risk against the requirement for ensuring the long term viability of this sector of Illabo is maintained.

The *Policy* also recognises that the safety of people and associated emergency response management need to be considered and imposes restrictions on vulnerable development (for example aged care facilities) and critical emergency response and recovery facilities and infrastructure (evacuation centres, hospitals and utilities).

1.1 What does the Policy do?

The *Policy* provides information and guidelines to assist people who want to develop or use land affected by potential flooding in Illabo. Development may include, among other things:

- dwelling construction, including additions to existing dwellings;
- filling land to provide building platforms above flood level;
- commercial and industrial development;
- sub-dividing land.

1.2 Objectives

The objectives of this *Policy* are:

(a) To provide detailed flood related development controls for the assessment of applications on land affected by floods in accordance with the provisions of *Junee LEP 1992* (and as amended in future editions) and the findings of the *Jeralgambeth Creek at Illabo Floodplain Risk Management Study and Plan, 2012*.

(b) To alert the community to the hazard and extent of land affected by floods.

(c) To inform the community of Council's policy in relation to the use and development of land affected by the potential floods in Illabo.

(d) To reduce the risk to human life and damage to property caused by flooding through controlling development on land affected by floods.

(e) To ensure new development is consistent with the flood response strategy set out in the *Junee Shire Local Flood Plan, April 2010* (and as amended in future editions) published by the State Emergency Service (SES) and does not impose additional burdens on, or risk to, SES personnel during flood emergencies.

Definitions of flood related terms used herein are provided in the **Glossary** in **Section 4** of this document

1.3 Will the Plan affect my Property?

The *Policy* applies to all development permissible with the consent of Council on land that lies within the extent of the ***Flood Planning Area*** (***FPA***), as shown in **Figure A1.1**.

1.4 How To Use This Policy

The *Policy* provides criteria which Council will use for the determination of development applications in areas within the extent of the ***FPA*** in Illabo. The criteria recognise that different controls apply to different land uses and levels of potential flood inundation or hazard. The procedure Council will apply for determining the specific controls applying to proposed development within the ***FPA*** is set out below. Upon enquiry by a prospective applicant, Council will make an initial assessment of the flood affectation and flood levels at the site using the following procedure:

i) Determine which part of the floodplain the development is located in from **Figure A1.1**.

ii) Identify the category of the development from **Annexure 1: Land Use Category**.

iii) Determine the appropriate ***Flood Planning Level*** and flood related conditions for the category of development from **Figure A1.1** and **Annexure 2: Development Controls Matrix**.

iv) Determine the flood level at the site using information contained in the document entitled *Jeralgambeth Creek at Illabo Flood Study, 2011* and the 100 year ARI flood contour data shown on **Figure A1.1** and confirm that the development conforms with the controls set out in **Annexure 2**.

With the benefit of this initial information from Council, the Applicant will prepare the Documentation to support the development application according to **Annexures 2** and **4**. A survey plan showing natural surface levels over the site will be required as part of the Development Application Documentation. Provision of this plan by the applicant at the initial enquiry stage will assist Council in providing flood related information relevant to the site. Further information on flooding in Illabo and the controls over development imposed by this Flood Policy are available by discussion with and upon written application to Council.

1.5 Other Documents Which May Need to be Read in Conjunction with this Plan

- *Junee Local Environmental Plan 1992*, and as subsequently amended;
- *Jeralgambeth Creek at Illabo Floodplain Risk Management Study and Plan, 2012*;
- *Jeralgambeth Creek at Illabo Flood Study, 2011*;

- NSW Government *Floodplain Development Manual, 2005*; associated *Guideline on Development Controls on Low Flood Risk Areas*; and *Ministerial Direction No. 15, January 2007.*
- Relevant Council policies, development control plans and specifications;

ILLABO

STRATTON ST
BARNES ST
LAYTON ST
HOWELL ST
JUNEE ST
PARK ST
WOOD ST
COMMENS RD
CROWTHER ST
LESTER ST
RAILWAY
ILLABO ST
COWLEY ST
SHOWGROUND RD
BOYTON ST
OLYMPIC HIGHWAY
SOUTHERN
MAIN
ILLABO PARK
ILLABO SHOWGROUND
LAWFORD
MORGAN ST
EURONGILLY RD
BRABINS RD

262.5
262
263
263.5
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264.5
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NOTE:

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N

80 0 80 160 240 m

Scale: 1:8,000

LEGEND

- High Hazard Floodway
- Low Hazard Overland Flowpath
- Intermediate Floodplain
- Outer Floodplain
- Extent of Hydraulic Modelling
- Extent of 100 Year ARI
- Extent of Flood Planning Area (100 Year ARI + 500 mm)
- Levee
- Extent of PMF
- Peak Water Surface Elevation Contour (m AHD)
- Existing Residence
- Boundary of Area Subject to Council's Planning Proposal for a Dwelling Entitlement (Proposed R5 Large Lot Zone)

JERALGAMBETH CREEK AT ILLABO
FLOODPLAIN RISK MANAGEMENT STUDY

Figure A1.1

FLOODWAY - FLOOD PLANNING AREA

2 WHAT ARE THE CRITERIA FOR DETERMINING APPLICATIONS?

2.1 General

Development controls on flood prone land are set out in **Annexure 2** of this *Flood Policy*. The controls recognise that different controls are applicable to different land uses, the location within the floodplain and levels of potential flood inundation and flood hazard.

The controls applicable to proposed development depend upon:

- The type of development.
- The **Flood Hazard** zone where the development is located.
- Peak Flood Levels at the site of the development.

2.2 Land Use Categories and Flood Planning Levels

Eight land use categories have been adopted. The specific land uses, in each category are listed in **Annexure 1**.

The ***Flood Planning Level* (*FPL*)** is the minimum floor level for the land uses:

- For new residential development in Illabo, the ***FPL*** is the peak 100 year ARI flood level at the particular development site, plus an allowance of 500 mm for freeboard.
- For commercial and industrial development the ***FPL*** is the peak 100 year ARI flood level plus an allowance of 500 mm for freeboard. Council may at its discretion allow an amendment to this ***FPL***, subject to local conditions (refer **Section 2.4**).
- Essential Community Facilities and Critical Utilities require a higher degree of flood protection. The ***FPL*** is the 100 year ARI flood plus 500 mm freeboard. In addition, these uses are to be designed to be able to continue to function and suffer minimal damage to structure and valuable contents in the event of a PMF (refer **Section 2.5**).
- For Flood Vulnerable Residential Development (nursing homes, aged care facilities and the like) the ***FPL*** is the peak 100 year ARI flood level plus an allowance of 500 mm for freeboard. Council will also require an area to be provided at a higher level (to be nominated by Council) for the temporary storage of valuable equipment and will in addition require the applicant to demonstrate that there is safe access to the site in the event of a flood emergency (refer **Section 2.6**).

2.3 Division of the Floodplain into Flood Hazard Zones

The types of controls have been graded relative to the severity and frequency of potential floods, having regard to the following Flood Hazard Zones within the floodplain:

- **"*High Hazard Floodway*"** this is the most flood affected land and the area where the highest flow velocities would be expected at the 100 year ARI flood. This zone should be kept clear of future development, although minor additions to existing residences and small outbuildings may be permitted by Council at its discretion and subject to the provision by the applicant of a suitable Flood Risk Report demonstrating that the

development is capable of withstanding hydraulic forces and is sited to minimise adverse re-directions of flow to adjacent properties. Site filling in this zone is to be avoided.

- ***"Low Hazard Overland Flowpath"*** this is flood affected land where lesser but still significant flow velocities may be experienced. Development in this area will need to be capable of withstanding hydraulic forces and sited to minimise adverse re-directions of flow to adjacent properties. The local impacts on flooding of any proposals for filling would need to be considered. Depending on the extent and location of the development, Council may require the applicant to submit a Flood Risk Report (see **Section 2.12** for specific requirements).
- **"*Intermediate Floodplain*"** is the remaining land lying outside the extent of the floodway and within the ***Flood Planning Area*** (land inundated by the 100 year ARI flood levels plus 500 mm). Within this area, there would only be the requirement for minimum residential floor levels to be set at 100 year ARI flood levels plus 500 mm. All land uses would be permitted in this zone. However, Essential Community Facilities, Critical Utilities and Flood Vulnerable development such as housing for aged and disabled persons would be subject to additional controls, which are identified in **Sections 2.5** and **2.6** and in **Annexure 2**.
- ***"Outer Floodplain***" is the remainder of the floodplain between the ***FPA*** and the extent of the PMF (that is, the extent of the floodplain). In this area, no controls would apply for residential development. However, because the flood hazard zones have been mapped using available mapping (based on cross sections of the floodplain), Council would check proposed floor levels of developments outside the extent of the ***FPA*** to ensure that they are no lower than the ***FPL*** (In areas where the PMF is less than 500 mm above the 100 year ARI flood level, this condition does not apply).

2.4 Assessing Commercial and Industrial Development Proposals

The *Flood Policy* nominates the same ***FPL*** as for residential development. However, where it is not practicable to achieve this level, Council may approve a lesser level commensurate with the local streetscape. In this eventuality, the applicant is to provide an area within the development for the temporary storage of goods at a minimum level equal to the ***FPL***. This area should be at least 20% of the gross floor area, or as nominated by Council.

2.5 Critical Utilities and Essential Services

Whilst the *Flood Policy* nominates the same ***FPL*** for these categories of development as for residential development, critical utilities and essential services necessary for emergency management need to be designed to be capable of operating during extreme flood events and constructed of flood resistant materials so as to suffer minimal damages at a higher level of flooding than the ***FPL***. Development proposals are to ensure that valuable equipment necessary for the operation of the facility is located at or above the PMF, either permanently or via relocation to a temporary storage area suitable for this purpose, or otherwise protected from extreme flooding. Council will also require development proposals to provide safe and reliable access to facilities during major flooding.

2.6 Vulnerable Residential Development

The *Flood Policy* nominates the residential ***FPL*** for Flood Vulnerable Residential Development (which includes nursing homes, aged care facilities and the like). However, the applicant is to ensure that valuable equipment necessary for the operation of the facility is located at or above the ***FPL***, either permanently or via relocation to a temporary storage area suitable for this purpose. Council will nominate an appropriate level depending on local flooding conditions and will also require development proposals to provide safe and reliable access to developments during flood events as a minimum to the level of the ***FPL***.

2.7 Minor Additions (Residential)

Council has nominated the floor levels of minor additions to residences to be no lower than the ***FPL***. However, where it can be demonstrated by the applicant that achieving this level is not practicable, Council at its discretion may allow a reduction, provided that the level is at least 500 mm above natural surface level, or as otherwise nominated by Council so as to be above the level of frequent flooding.

2.8 Checking of Completed Finished Floor Height

After the building has been built to the relevant ***FPL***, Council officers will check compliance with this requirement at the relevant inspection stage. The applicant is to provide a benchmark on the site, levelled to Australian Height Datum (AHD).

2.9 Fencing

Any proposed fencing is to be shown on the plans accompanying a development application to allow Council to assess the likely effect of such fencing on flood behaviour.

In the ***Floodway*** and ***Overland Flowpath*** zones***,*** where flow velocities may be significant, fences which minimise obstructions to flow are to be adopted. Where impermeable fences such as Colorbond, galvanised metal, timber or brush are proposed normal to the direction of overland flow (Council will assess the direction of flow), fencing panels should be either:

a) removable so that panels can be laid flat; or

b) horizontally hinged where a portion of at least 1 m high is capable of swinging open to allow floodwater to pass. Trees/landscaping and other structures are not to impede the ability of a hinged fence to open.

2.10 Other Uses and Works

All other development, building or other works within any of the categories that require Council's consent will be considered on their merits. In consideration of such applications, Council must determine that the proposed development is in compliance with the objectives of this Policy.

2.11 Land Filling

No filling or alteration of the land surface is permissible in the ***High Hazard Floodway*** due to the potential for filling or obstructions to flow to adversely re-direct flows. Any minor extensions or repairs permitted by Council should be located on piers to minimise obstructions to the passage of flow, with the underside of any structure supporting the buildings to be above the 100 year ARI flood level. Building pads up to 1 m high may be permitted for residential blocks in the ***Low Hazard Overland Flowpath***. However, the fill and other obstructions must not significantly obstruct flows, Council may require at least part of the development to be located on piers to minimise obstructions to the passage of flow, with the underside of any structure supporting the buildings to be above the 100 year ARI flood level. Sub-surface drainage of building pads is required.

2.12 Flood Related Information to be Submitted to Council

2.12.1 Survey Details – Existing Site

A Survey Plan prepared by a Registered Surveyor is required to be lodged with the Development Application for properties located on flood affected land as shown on **Figure A1.1**. The Survey Plan will enable Council to assess extents and depths of inundation over the site (at existing natural surface levels) and must indicate the following:

- The locations of existing buildings or structures;
- The floor levels and ceiling heights of all existing buildings or structures to be retained;
- Existing and/or proposed drainage easements and watercourses or other means of conveying flood flows that are relevant to the flood characteristics of the site;
- 100 year ARI Flood Level(s) over the site (to be provided by Council); including the extent of the ***FPA***;
- 0.2 metre natural surface contour intervals across the entire property (existing and proposed); or at a contour interval nominated by Council. Note: All levels must be relative to Australian Height Datum (AHD)

Annexure 4 outlines additional requirements for survey data required by Council for the proposed development.

2.12.2 Evaluation of Development Proposals

The Applicant will need to demonstrate, using Council supplied flood information, that:

1. The development conforms with the requirements of this Policy for the particular Flood Hazard zone in which it is located.

2. Depending on the nature and extent of the development and its location within the floodplain, Council may request the Applicant to prepare a Flood Risk Report to demonstrate that its construction does not increase the flood hazard to existing and future occupiers of the floodplain (see Section 2.12.3).

Council will make its evaluation and confirm requirements regarding the proposed site development, based on the Existing Site Survey Plan and accompanying survey data on the proposed development (see Annexure 4) and provision of information set out in the Development Controls Matrix – Annexure 2.

2.12.3 Flood Risk Report – High and Low Hazard Floodways

A. Scope of Work – General

Council will require a **Flood Risk Report** for any (minor) residential development located in the ***High Hazard Floodway***.

Depending on its nature and scale, Council may also require a **Flood Risk Report** for a development situated in the ***Low Hazard Overland Flowpath***, where lesser but still significant flow velocities may be expected. Typically, such a report may be required for a development which Council considers has the potential to adversely re-direct flows. This report is to be prepared by a suitably qualified Consulting Engineer and must address the following:

a) Confirm and nominate the ***FPL*** for the particular category of development through enquiries of Council.

b) Specify proposed floor levels (and existing floor levels where they are to be retained) of habitable and non-habitable structures.

c) Include a site-specific flood assessment that may require flood modelling to demonstrate that there will be no adverse impact on surrounding properties as a result of the development, up to the 100 year ARI flood.

d) Propose measures to minimise risk to personal safety of occupants and the risk of property damage, addressing the flood impacts on the site of the 100 year ARI flood. These measures shall include but are not limited to the following:

- Types of materials to be used, up to the ***FPL*** to ensure the structural integrity for immersion and impact of velocity and debris.
- Waterproofing methods, including but not limited to electrical equipment, wiring, fuel lines or any other service pipes and connections.

e) Confirm the structural adequacy of the development, taking into account the following:

- all piers and all other parts of the structure which are subject to the force of flowing waters or debris have been designed to resist the stresses thereby induced.
- all forces transmitted by supports to the ground can be adequately withstood by the foundations and ground conditions existing on the site.
- the structure will be able to withstand stream flow pressure, force exerted by debris, and buoyancy and sliding forces caused by the full range of flooding up to the 100 year ARI.

f) all electrical connections to be located above the 100 year ARI flood level plus 500 mm. Council will also require all electrical circuit connections to be automatically isolated in the event of flood waters having the potential to gain access to exposed electrical circuits, either internal or external of the building (see also **Annexure 3A**).

g) all materials used in the construction to be flood compatible to a minimum level equivalent to a 100 year ARI flood level plus 500 mm (**Annexure 3B**).

B. <u>Additional Items (Commercial and Industrial Development)</u>

h) For commercial and industrial developments (in the ***Low Hazard Overland Flowpath***), include flood warning signs/depth indicators for areas that may be inundated, such as open car parking areas.

3 DESCRIPTION OF TERMS

Note: For expanded list of definitions, refer to Glossary contained within the NSW Government Floodplain Development Manual, 2005.

TERM	DEFINITION
Annual Exceedance Probability (AEP)	The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. For example, if a peak flood discharge of 500 m^3/s has an AEP of 5%, it means that there is a 5% chance (that is one-in-20 chance) of a peak flood discharge of 500 m^3/s or larger occurring in any one year (see average recurrence interval).
Australian Height Datum (AHD)	A common national surface level datum corresponding approximately to mean sea level.
Flood Affected Properties	Properties that are either encompassed or intersected by the **Flood Planning Level (FPL)**.
Floodplain	Area of land which is subject to inundation by floods up to and including the **Probable Maximum Flood** event, that is, flood prone land.
Flood Planning Level (FPL) (General Definition)	The combinations of flood levels and freeboards selected for planning purposes, as determined in floodplain risk management studies and incorporated in floodplain risk management plans.
Flood Planning Level (for Illabo)	Flood levels selected for planning purposes, as determined in the *Jeralgambeth Creek at Illabo Flood Study, 2011*. For residential development in the floodplain, it is the 100 year ARI flood level at the particular site, plus the addition of a Freeboard of 500 mm. For commercial and industrial development it is the 100 year ARI flood level plus 500 mm Freeboard, unless otherwise allowed by Council and with the requirement for a temporary storage area at the **FPL**. For essential community facilities, essential services and vulnerable residential development it is the 100 year ARI flood level plus 500 mm Freeboard, with additional requirements for storage and safe access/evacuation as nominated in the Policy.
Flood Planning Area (FPA)	Land lying within the area encompassed by the **FPL**.
Flood Prone/Flood Liable Land	Land susceptible to flooding by the PMF. Flood Prone land is synonymous with Flood Liable land.
Floodway	Those areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood levels.

TERM	DEFINITION
Freeboard	A factor of safety typically used in relation to the setting of floor levels, levee crest levels, etc. It is usually expressed as the difference in height between the adopted flood planning level and the flood used to determine the flood planning level. Freeboard provides a factor of safety to compensate for uncertainties in the estimation of flood levels across the floodplain, such as wave action, localised hydraulic behaviour and impacts that are specific event related, such as levee and embankment settlement, and other effects such as "greenhouse" and climate change. Freeboard is included in the Flood Planning Level.
Habitable Room	In a residential situation: a living or working area, such as a lounge room, dining room, kitchen, bedroom or workroom. In an industrial or commercial situation: an area used for offices or to store valuable possessions susceptible to flood damage in the event of a flood.
Intermediate Floodplain **(for Illabo)**	This is defined as the strip of land on each side of the Floodway. It encompasses the zone between the Floodway and the line defining the indicative extent of flooding resulting from the occurrence of the 100 year ARI flood plus 500 mm. In this zone there would still be a significant risk of flood damages, but these damages may be minimised by the application of appropriate development controls.
Outer Floodplain **(for Illabo)**	This is defined as the strip of land between the residential FPL and the extent of the PMF. In this zone there would be no flood related development controls over residential development, but Council will check floor levels to ensure they are no lower than the FPL.
Probable Maximum Flood (PMF)	The largest flood that could conceivably occur at a particular location. Generally, it is not physically or economically possible to provide complete protection against this event. The **PMF** defines the extent of flood prone land, that is, the floodplain.

ANNEXURE 1
LAND USE CATEGORIES

Essential Community Facilities	Critical Utilities and Uses	Flood Vulnerable Residential	Residential	Business & Commercial/Industrial	Non-Urban and Outbuildings	Subdivision and Filling	Minor Additions (Residential)
Building that may provide an important contribution to the notification and evacuation of the community during flood events; Hospitals; Institutions; Educational establishments.	Telecommunication facilities; Public Utility Installation that may cause pollution of waterways during flooding, or if affected during flood events would significantly affect the ability of the community to return to normal activities after the flood events. Hazardous industry; Hazardous storage establishments.	Group home; Housing for aged or disabled persons; and Units for aged persons.	Dwelling; Residential flat building; Home industry; Boarding house; Professional consulting rooms; Public utility undertakings (other than critical utilities); Utility installation (other than critical utilities); Child care centre;	Bulk Store; Bus depot; Bus station; Car repair stations; Club; Commercial premises (other than where referred to elsewhere); General store; Health care professional; Hotel; Intensive livestock keeping; Junkyard; Liquid fuel depot; Motel; Motor showroom; Place of Assembly (other than essential community facilities; Place of public worship; Public building (other than essential community facilities); Recreation facility; Refreshment room; Road transport terminal; Rural industry; Service station; Shop; Tourist facilities; Warehouse.	Retail nursery; Recreation area; Roadside stall; Outbuildings (Sheds, Garages) up to 40 m^2 area.	Subdivision of land involving the creation of new allotments for residential purposes; Earthworks or filling operations covering 100 m^2 or more than 0.3 m deep.	An addition to an existing dwelling of not more than 30 m^2 (habitable floor area)

ANNEXURE 2

DEVELOPMENT CONTROLS MATRIX

	Outer Floodplain							
	Essential Community Facilities	Critical Utilities and Uses	Flood Vulnerable Residential	Residential	Business & Commercial/Industrial	Non-Urban and Outbuildings	Residential Sub-Division	Minor Additions (Residential)
Floor Level	1	1	1	1	1		1	1
Building Components	2	2	1	1	1	1	1	1
Structural Soundness	2	2	1	1	1	1	1	1
Flood Affectation								
Evacuation / Access	2	2	1					
Management and Design	2,3	2,3	5		3,4	3	1	6

	Intermediate Floodplain							
	Essential Community Facilities	Critical Utilities and Uses	Flood Vulnerable Residential	Residential	Business & Commercial/Industrial	Non-Urban and Outbuildings	Residential Sub-Division	Minor Additions (Residential)
Floor Level	1	1	1	1	1		1	1
Building Components	2	2	1	1	1	1	1	1
Structural Soundness	2	2	1	1	1	1	1	1
Flood Affectation								
Evacuation / Access	2	2	1					
Management and Design	2,3	2,3	5		3,4	3	1	6

	Low Hazard Overland Flowpath							
	Essential Community Facilities	Critical Utilities and Uses	Flood Vulnerable Residential	Residential	Business & Commercial/Industrial	Non-Urban and Outbuildings	Residential Sub-Division	Minor Additions (Residential)
Floor Level				1	1			1
Building Components				1	1	1		1
Structural Soundness				1	1	1		1
Flood Affectation				1	1	1		1
Evacuation / Access				1				
Management and Design				7	3,4,7	3,7		6,7

	High Hazard Floodway							
	Essential Community Facilities	Critical Utilities and Uses	Flood Vulnerable Residential	Residential	Business & Commercial/Industrial	Non-Urban and Outbuildings	Residential Sub-Division	Minor Additions (Residential)
Floor Level								1
Building Components						1		1
Structural Soundness						1		1
Flood Affectation						1		1
Evacuation / Access								
Management and Design						3,7		6,7

Not Relevant   Unsuitable Land Use

Floor Level

1. Floor levels to be equal to or greater than the ***FPL*** (100 year ARI food level plus 500 mm freeboard).

Building Components

1. All structures to have flood compatible building components below 100 year ARI flood level plus 500 mm freeboard.
2. All structures to have flood compatible building components below PMF flood level plus 500 mm freeboard.

Structural Soundness

1. Structure to be designed to withstand the forces of floodwater, debris and buoyancy up to 100 year ARI flood plus 500 mm freeboard.
2. Structure to be designed to withstand forces of floodwater, debris and buoyancy up to PMF flood plus 500 mm freeboard.

Flood Affection

1. Applicant is required to demonstrate that the development will not increase flood affectation elsewhere (see Item 7 of Management and Design, below).
   Note: When assessing Flood Affectation the following must be considered:
   i. Loss of conveyance capacity in the floodway or areas where there is significant flow velocity.
   ii. Changes in flood levels and flow velocities caused by the alteration of conveyance of floodwaters.

Evacuation

1. Reliable access for pedestrians or vehicles required in the event of 100 year ARI flood.
2. Reliable access for pedestrians or vehicles required in the event of PMF.

Management and Design

1. Applicant to demonstrate that potential developments as a consequence of a subdivision proposal can be undertaken in accordance with this Policy and the Plan.
2. Applicant to demonstrate that facility is able to continue to function in event of PMF.
3. No external storage of materials which may cause pollution or be potentially hazardous during PMF.
4. Where it is not practicable to provide floor levels to 100 year ARI plus 500 mm freeboard, applicant is to provide an area to store goods at that level – see **Section 2.4**.
5. Applicant is to provide an area to store valuable equipment above 100 year ARI plus 500 mm freeboard – see **Section 2.6**.
6. Where it is not practicable to provide floor levels to 100 year ARI plus 500 mm freeboard, Council may allow a reduction for minor additions to habitable areas – see **Section 2.7.**
7. Flood Risk Report may be required prior to development of this nature in this area – see relevant discussion **Section 2.12.**

NOTE: THIS ANNEXURE IS TO BE READ IN CONJUNCTION WITH REMAINDER OF THE FLOOD POLICY, IN PARTICULAR CHAPTER 2.

ANNEXURE 3A
GENERAL BUILDING MATTERS

Electrical and Mechanical Equipment

For dwellings constructed on land to which this policy applies, the electrical and mechanical materials, equipment and installation should conform to the following requirements.

Main Power Supply

Subject to the approval of the relevant authority the incoming main commercial power service equipment, including all metering equipment, shall be located above the FPL. Means shall be available to easily isolate the dwelling from the main power supply.

Wiring

All wiring, power outlets, switches, etc, should be, to the maximum extent possible, located above the FPL. All electrical wiring installed below this level should be suitable for continuous underwater immersion and should contain no fibrous components. Earth leakage circuit breakers (core balance relays) must be installed. Only submersible type splices should be used below the FPL. All conduits located below the relevant designated flood level should be so installed that they will be self-draining if subjected to flooding.

Equipment

All equipment installed below or partially below the FPL should be capable of disconnection by a single plug and socket assembly.

Reconnection

Should any electrical device and/or part of the wiring be flooded it should be thoroughly cleaned or replaced and checked by an approved electrical contractor before reconnection.

Heating and Air Conditioning Systems

Where viable, heating and air conditioning systems should be installed in areas and spaces of the house above the FPL. When this is not feasible, every precaution should be taken to minimise the damage caused by submersion according to the following guidelines:

i) Fuel

Heating systems using gas or oil as a fuel should have a manually operated valve located in the fuel supply line to enable fuel cut-off.

ii) Installation

The heating equipment and fuel storage tanks should be mounted on and securely anchored to a foundation pad of sufficient mass to overcome buoyancy and prevent movement that could damage the fuel supply line. All storage tanks should be vented to the FPL.

iii) Ducting

All ductwork located below the FPL should be provided with openings for drainage and cleaning. Self-draining may be achieved by constructing the ductwork on a suitable grade. Where ductwork must pass through a watertight wall or floor below the relevant flood level, a closure assembly operated from above the FPL should protect the ductwork.

Sewer

All sewer connections to properties in flood prone areas are to be fitted with reflux valves.

ANNEXURE 3B

FLOOD COMPATIBLE MATERIALS

Building Component	Flood Compatible Material	Building Component	Flood Compatible Material
Flooring and Sub Floor Structure	• Concrete slab-on-ground monolith construction. Note: clay filling is not permitted beneath slabo-on-ground construction which could be inundated. • Pier and beam construction or • Suspended reinforced concrete slab	**Doors**	• Solid panel with waterproof adhesives • Flush door with marine ply filled with closed cell foam • Painted material construction • Aluminium or galvanised steel frame
Floor Covering	• Clay tiles • Concrete, precast or in situ • Concrete tiles • Epoxy formed-in-place • Mastic flooring, formed-in-place • Rubber sheets or tiles with chemical set adhesive • Silicone floors formed-in-place • Vinyl sheets or tiles with chemical-set adhesive • Ceramic tiles, fixed with mortar or chemical set adhesive • Asphalt tiles, fixed with water resistant adhesive • Removable rubber-backed carpet	**Wall and Ceiling Linings**	• Brick, face or glazed • Clay tile glazed in waterproof mortar • Concrete • Concrete block • Steel with waterproof applications • Stone natural solid or veneer, waterproof grout • Glass blocks • Glass • Plastic sheeting or wall with waterproof adhesive
Wall Structure	Solid brickwork, blockwork, reinforced, concrete or mass concrete	**Insulation**	• Foam or closed cell types
Windows	Aluminium frame with stainless steel or brass rollers	**Nails, Bolts, Hinges and Fittings**	• Galvanised • Removable pin hinges

ANNEXURE 4

DEVELOPMENT APPLICATION REQUIREMENTS

Step 1

Check with Council staff to see whether or not the proposal:

- Is located on Flood Prone Land
- Is permissible in the Flood Risk zone and determine the FPL for the particular category of land use.
- Note: an existing site survey (see **Section 2.12.1** of the Policy) is to accompany development proposals to confirm the flood affectation of the allotment and its location within the flood risk zoning system.

Step 2

Plans – A Development Application should include the following plans showing the nature of the proposed development and its extent within the allotment:

- A locality plan identifying the location of the property.
- Plan of the existing site layout including the site dimensions (in metric), site area, contours (0.20 m intervals or as otherwise specified by Council), existing trees, other natural features, existing structures, north point, location of building on adjoining properties (if development involves a building), floor plans located on a site plan, roof plan, elevations and sections of the proposed building, finished levels of floors, paving and landscaped areas, vehicular access and parking.
- Plans should indicate:
  a) The existing ground levels to Australian height datum around the perimeter of the proposed building; and
  b) The existing or proposed floor levels to Australian height datum.
- Minor additions to an existing dwelling must be accompanied by documentation from a registered surveyor confirming existing floor levels.
- In the case of subdivision, four (4) copies of the proposed site layout showing the number of lots to be created (numbered as proposed lot 1, 2, 3 etc), the proposed areas of each lot in square metres, a north point, nearest roads and the like.

Council require plans presented on A3 sheets as a minimum (scale of 1:200 recommended for site plans

Extent of Cut and Fill – All areas subject to cut and fill require the depths of both to be shown as well as the measures proposed to retain both. Applications shall be accompanied by a survey plan (with existing and finished contours at 0.20 m intervals) showing relative levels to Australian height datum.

Vegetation Clearing – Landscaping details including a description of trees to be removed existing and proposed planting, retaining walls, detention basins, fences and paving.

Stormwater Drainage – Any existing and all proposed stormwater drainage to be indicated on the site plan.