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Part E Planning for natural hazards

Chapter 11 Flood liable land

11.1 How to use this Chapter

The southern Narrandera Township and some rural areas of the Shire are affected by flooding from the Murrumbidgee River. The Council has modelled, through consultants, the extent of flooding during the 1 in 100 year event, and has placed development controls on the further development of flood liable land in those areas of the Shire.

To assess the flood related controls for various development types and locations the following steps should be undertaken.

- Determine the location of the development using Figure 1 (overall floodplain area map);
- Determine the flood hydraulic category shown upon the map (note that Gillenbah is located in both the floodway and flood storage hydraulic category and Nallabooma is located in the flood storage category);
- Identify the category of development outlined in Table 1, section 11.4 to this plan;
- Refer to section 11.5 and Figure 2 for Gillenbah development controls, section 11.6 and Figure 3 for Nallabooma Estate development controls, and section 11.7 for development controls for all other areas;
- Consider the criteria used to determine development applications in section 11.3. The Council encourages pre-lodgement meetings and will meet the applicant on site if needed to discuss the particulars of the development.

Attachment 1 to this Chapter contains supplementary material related to the flood liable land controls, including definitions and abbreviations used in the plan, information required to be lodged with a development application, historic flooding in the plan area, a description of flood hydraulic and hazard categories, a description of the area impacted by flooding, a discussion on the flood protection measures in this plan, a list of building components and flood compatible materials and methods of flood proofing buildings.

The supplementary material also includes the design flood levels in cross-sections of the floodplain. The Council will use the Design Flood Levels to estimate the required floor height plus freeboard for buildings within the floodplain.

11.2 Flood risk management zone map

Figure 1 Flood risk location and hydraulic category map

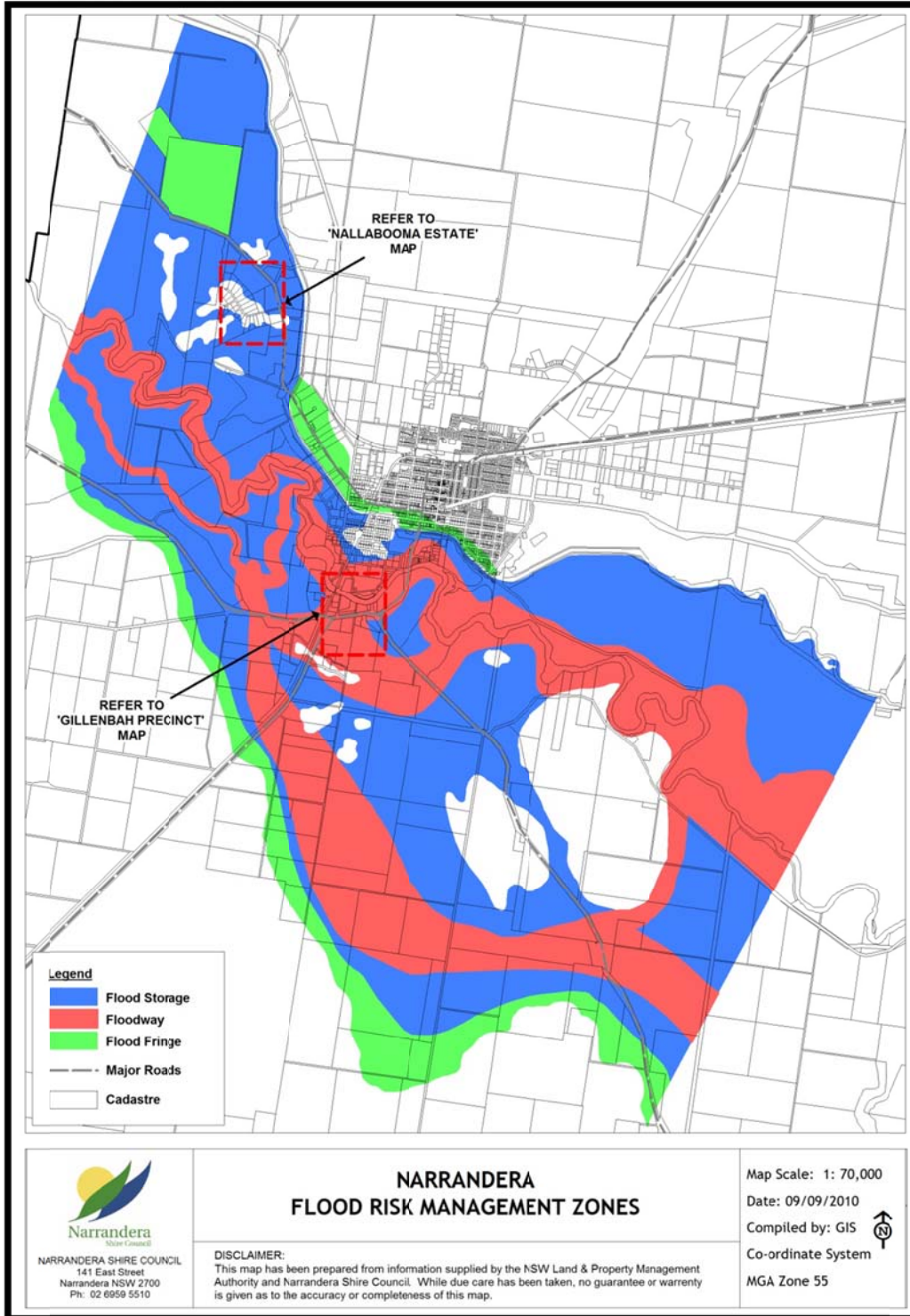


Table 1 Hydraulic categories of flood prone land**Hydraulic categories of flood prone land**

The Floodplain Development Manual¹ defines three hydraulic categories for flood prone land, being floodway, flood storage and flood fringe.

Together with the Manual, consultants Sinclair Knight Merz have defined the hydraulic categories in Narrandera's context as set out below.

Floodway

Floodways are areas where a significant volume of water flows during flood and are often aligned with obvious natural channels. They are areas which, if only partially blocked would cause a significant increase in flood levels and/or a significant redistribution of flood flow.

- Floodways use the minimum bank full level for all creeks and waterways;
- Floodways use the 20 year ARI flood outline as a starting point, and
- Floodways are very sensitive to obstruction and blocking.

Flood storage

Flood storage comprises those areas of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood.

- Flood storage is the area between the floodway and the 100 year ARI event.

Flood fringe

The flood fringe is the remaining area of land affected by flooding, after the floodway and flood storage have been derived.

- Flood fringe is the remaining area beyond the flood storage within the extent of the extreme flood event.

The hydraulic categories are relevant to the type of building proposed for construction. For example different controls can be required for commercial buildings and residential buildings within the same hydraulic category. The building controls are based on the risk to the building and its occupants.

The effect of hydraulic categories is summarised in the flood development control matrix at Appendix 1.

¹ New South Wales Government (2005) *Floodplain Development Manual*

11.3 What are the criteria for determining development applications?

When a development application is lodged the Council will utilise the prescriptive and performance controls within sections 11.5 to 11.7 of this Chapter. This information is also provided in summary form (a flood control matrix) in the supplementary material at Attachment 1.

The prescriptive controls include:

- The setting of habitable and non-habitable floor levels, and
- The use of flood compatible building components and construction methods.

The performance controls include, in defined circumstances:

- An engineer's report on the structural adequacy of the building with regard to flood waters, debris impact and buoyancy;
- An engineer's report certifying that the development will not increase the flood effects elsewhere on the floodplain;
- Evidence of reliable evacuation access during flood events;
- Evidence that the land use will not cause pollution during flood events;
- Evidence that the building has been designed to minimise impact on flood flow, and
- Evidence that the storage of materials within the building or development can be carried out above a specified flood planning level.

Where an applicant wishes to vary the requirements of this plan, the variation will be assessed on its merits according to the intent of the relevant development controls and the provisions of the NSW Floodplain Development Manual 2005.

11.4 Land use categories in this plan

Within this plan the land use category that a building or structure falls into has an important bearing on the development controls and performance criteria to be met. The principal land use categories are tabled within sections 11.5 to 11.7 of this Chapter. The *land use type within each category* is outlined in the Table 11.1.

Table 2 Principal land use categories and individual land uses

Category	Land uses
Critical uses and facilities	Community facilities which play a vital role during floods or where evacuation is difficult, or infrastructure that must not be disrupted, which include: Hospitals, Nursing and dependent care homes, Police, Fire and Ambulance stations, SES headquarters, Rescue Squad headquarters, Council depot and administration office, sewage and water treatment plant and pump stations, major roads.
Sensitive uses and facilities	Community and other facilities and infrastructure which are not critical uses but which are essential to evacuation during flood or which if affected would unreasonably affect the ability of the community to return to normal activities after flood events, which include: Communication facilities, Housing for aged or disabled persons, Institutions, Educational establishments, Waste disposal facilities, Utility installations and generating works, Public halls, Liquid fuel depot, Hazardous or offensive or potentially hazardous or offensive industry or storage establishment, similar land uses to those in this category.
Residential	Residential subdivision, Dwellings, Alterations and additions to all types of dwellings, Bed and breakfasts, Dual occupancy and Multi dwelling housing, Residential flats, Boarding houses, Group homes, all Child care facilities, Health consulting rooms, Caravan Parks and camping grounds (long-term sites) ² , similar land uses to those in this category.
Commercial	Business premises, Retail premises, Highway Service Centre, Hotel and Motel, Place of Worship, Motor showroom, Bulky goods premises, Recreation facility, Restaurant, Road or rail transport terminal, similar land uses to those in this category, similar land uses to those in this category.
Industrial	General and light industry including for the purposes of this plan intensive livestock or intensive plant keeping.
Recreation & agriculture & non-urban	Caravan Park and camping ground (short-term sites only), Recreation areas and ancillary structures such as toilets and kiosk, Agriculture, Extractive industry, Forestry, Retail plant nursery.
Other	Flood fringe only, matters not included in other categories.

² Defined by the Local Government (Caravan Park and Camping Grounds) Transitional Regulation 1993

11.5 Flood controls in the Gillenbah precinct

The Gillenbah precinct is located in both the floodway and flood storage hydraulic categories. Figure 2 shows the extent of the Gillenbah precinct. Table 2 on the following page provides the prescriptive and performance based development controls for Gillenbah.

Figure 2 Gillenbah precinct floodplain area

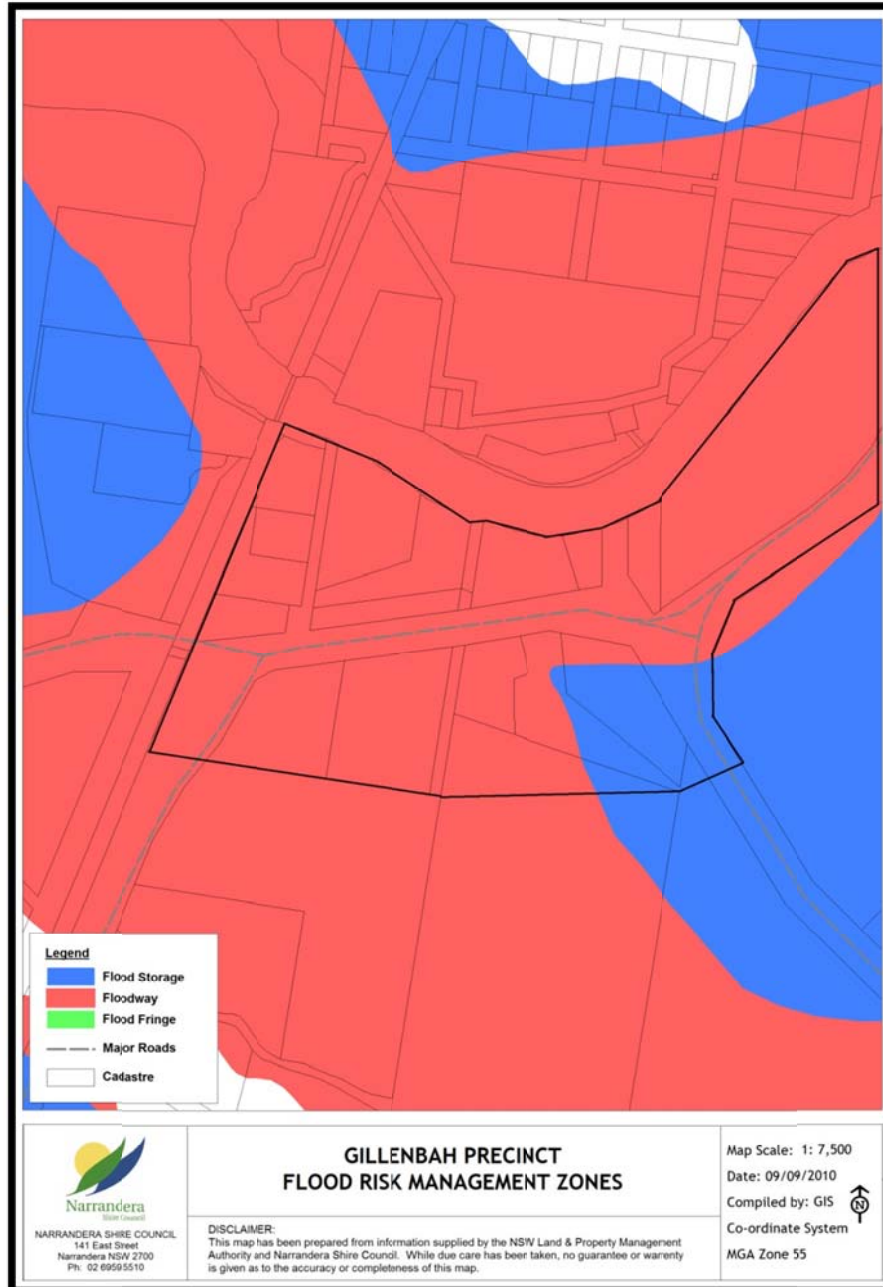


Table 3 Flood controls in the Gillenbah Precinct

Land Use	Hydraulic Category	Criteria to be met
Critical uses	Floodway	Not suitable for critical land uses
	Flood storage	Not suitable for critical land uses
Sensitive uses	Floodway	Not suitable for sensitive land uses
	Flood storage	Not suitable for sensitive land uses
Residential <i>New residential development (apart from minor extensions and replacement dwellings) is not suitable in the floodway or flood storage hydraulic categories</i>	Floodway	<p>Floor level</p> <ul style="list-style-type: none"> • Extensions to existing houses only, up to 20% of existing floor area, at existing dwelling height; • For dwelling extensions over 20% of existing floor area and replacement of existing dwelling the entire habitable floor level must not be lower than the 100 year ARI level plus freeboard of 500mm; • Replacement of a dwelling will only be permitted if its location on site will be the same or improved with respect to floor level and flood affectation controls, and evacuation. <p>Building components</p> <ul style="list-style-type: none"> • All new structures to have flood compatible building components below the 100 year ARI level. <p>Structural soundness</p> <ul style="list-style-type: none"> • Engineers report to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year ARI level plus freeboard of 500mm. <p>Flood effect</p> <ul style="list-style-type: none"> • Extensions to existing houses only, up to 20% existing floor area, at existing dwelling height – no requirement. • Extensions over 20% floor area and replacement dwellings, engineers report required to certify that the development will not increase flood effects elsewhere, having regard to (i) loss of flood storage, (ii) changes in flood levels and velocities caused by alterations to the flood conveyance, and (iii) the cumulative impact of multiple developments in the floodplain. <p>Evacuation</p> <ul style="list-style-type: none"> • Reliable access for pedestrians or vehicles is required from the building to an area of refuge above the PMF level: the access commencing and continuing at a level no lower than the lowest level of the building. • The development is to be consistent with the evacuation plans specified in the SES Local Flood Plan adopted by the Council. <p>Management and design</p> <ul style="list-style-type: none"> • No storage of materials below the 100 year ARI level which may cause pollution or be hazardous during a flood.

Land Use	Hydraulic Category	Criteria to be met
	<p>Flood storage</p>	<ul style="list-style-type: none"> • Applicant to demonstrate that any proposed fencing is of an open nature and collapsible during floods. <p>Floor level</p> <ul style="list-style-type: none"> • Extensions to existing houses only, up to 20% of existing floor area at existing dwelling height; • For dwelling extensions over 20% of existing floor area and replacement of existing dwellings the entire habitable floor level must not be lower than the 100 year ARI event plus freeboard of 500mm. • Non-habitable floor levels to be no lower than the 20 year ARI level unless justified by a site specific assessment. <p>Building components</p> <ul style="list-style-type: none"> • All new structures to have flood compatible building components below the 100 year ARI level. <p>Structural soundness</p> <ul style="list-style-type: none"> • Engineers report to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year ARI level plus freeboard of 500mm. <p>Flood effect</p> <ul style="list-style-type: none"> • Extensions to existing houses only, up to 20% existing floor area, at existing dwelling height – no requirement. • Extensions over 20% floor area and replacement dwellings, engineers report required to certify that the development will not increase flood effects elsewhere, having regard to (i) loss of flood storage, (ii) changes in flood levels and velocities caused by alterations to the flood conveyance, and (iii) the cumulative impact of multiple developments in the floodplain. <p>Evacuation</p> <ul style="list-style-type: none"> • Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the PMF level. • The development is to be consistent with the evacuation plans specified in the SES Local Flood Plan adopted by the Council. <p>Management and design</p> <ul style="list-style-type: none"> • No storage of materials below the 100 year ARI level which may cause pollution or be hazardous during a flood. • Applicant to demonstrate that any proposed fencing is of an open nature and collapsible during flood.
<p>Commercial</p>	<p>Floodway and Flood storage</p>	<p>Floor level</p> <ul style="list-style-type: none"> • Habitable floor levels to be no lower than the 20 year ARI level unless justified by a site specific assessment. <p>Building components</p> <ul style="list-style-type: none"> • All new structures to have flood compatible building components below

Land Use	Hydraulic Category	Criteria to be met
		<p>the 100 year ARI level.</p> <p>Structural soundness</p> <ul style="list-style-type: none"> Engineers report to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year ARI plus freeboard of 500mm. <p>Flood effect</p> <ul style="list-style-type: none"> The flood impact to be considered to ensure that the development will not increase flood effects elsewhere, having regard to (i) loss of flood storage, (ii) changes in flood levels and velocities caused by alterations to the flood conveyance, and (iii) the cumulative impact of multiple developments in the floodplain. The development should be generally in accordance with the Floodplain Risk Management Study provisions for Gillenbah, otherwise an engineer’s report should be provided. <p>Evacuation</p> <ul style="list-style-type: none"> Reliable access for pedestrians or vehicles is required from the building to an area of refuge above the PMF level: the access commencing and continuing at a level no lower than the lowest level of the building. The development is to be consistent with the evacuation plans specified in the SES Local Flood Plan adopted by the Council. <p>Management and design</p> <ul style="list-style-type: none"> The applicant is to demonstrate that area is available to store goods above the 100 year ARI level. No storage of materials below the 100 year ARI level which may cause pollution or be hazardous during a flood. Applicant to demonstrate that any proposed fencing is of an open nature and collapsible during floods. Applicant to demonstrate that the proposed development is aligned with the direction of flood flow and where possible of an open nature (that is the building should be aligned/oriented in the direction of the flood flow and should be preferably broken up to avoid one long building mass which may redirect flows).
Industrial	N/A	All industrial development is unsuitable in the Gillenbah precinct
Recreation & agriculture	Floodway and Flood storage	<p>Floor level</p> <ul style="list-style-type: none"> All floor levels to be no lower than the 20 year ARI level unless justified by a site specific assessment. <p>Building components</p> <ul style="list-style-type: none"> All new structures to have flood compatible building components below the 100 year ARI level. <p>Structural soundness</p> <ul style="list-style-type: none"> Engineers report to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100

Land Use	Hydraulic Category	Criteria to be met
		<p>year ARI level plus freeboard of 500mm.</p> <p>Flood effect</p> <ul style="list-style-type: none"> The flood impact to be considered to ensure that the development will not increase flood effects elsewhere, having regard to (i) loss of flood storage, (ii) changes in flood levels and velocities caused by alterations to the flood conveyance, and (iii) the cumulative impact of multiple developments in the floodplain. The development should be generally in accordance with the Floodplain Risk Management Study provisions for Gillenbah, otherwise an engineer’s report should be provided. <p>Evacuation</p> <ul style="list-style-type: none"> Reliable access for pedestrians or vehicles is required from the building to an area of refuge above the PMF level: the access commencing and continuing at a level no lower than the lowest level of the building. The development is to be consistent with the evacuation plans specified in the SES Local Flood Plan adopted by the Council. <p>Management and design</p> <ul style="list-style-type: none"> The applicant is to demonstrate that area is available to store goods above the 100 year ARI level. No storage of materials below the 100 year ARI level which may cause pollution or be hazardous during a flood. Applicant to demonstrate that any proposed fencing is of an open nature and collapsible during floods. Applicant to demonstrate that the proposed development is aligned with the direction of flood flow and where possible of an open nature (that is the building should be aligned/oriented in the direction of the flood flow and should be preferably broken up to avoid one long building mass which may redirect flows).
<p>Other development</p>	<p>Floodway and flood storage</p>	<p>Other development is not suitable in the Gillenbah precinct</p>

11.6 Flood controls in the Nallabooma Estate

The Nallabooma estate is located the flood storage hydraulic category. Figure 3 shows the extent of the Nallabooma estate. Table 4 on the following page provides the prescriptive and performance based development controls for Nallabooma.

Figure 3 Nallabooma Estate floodplain area

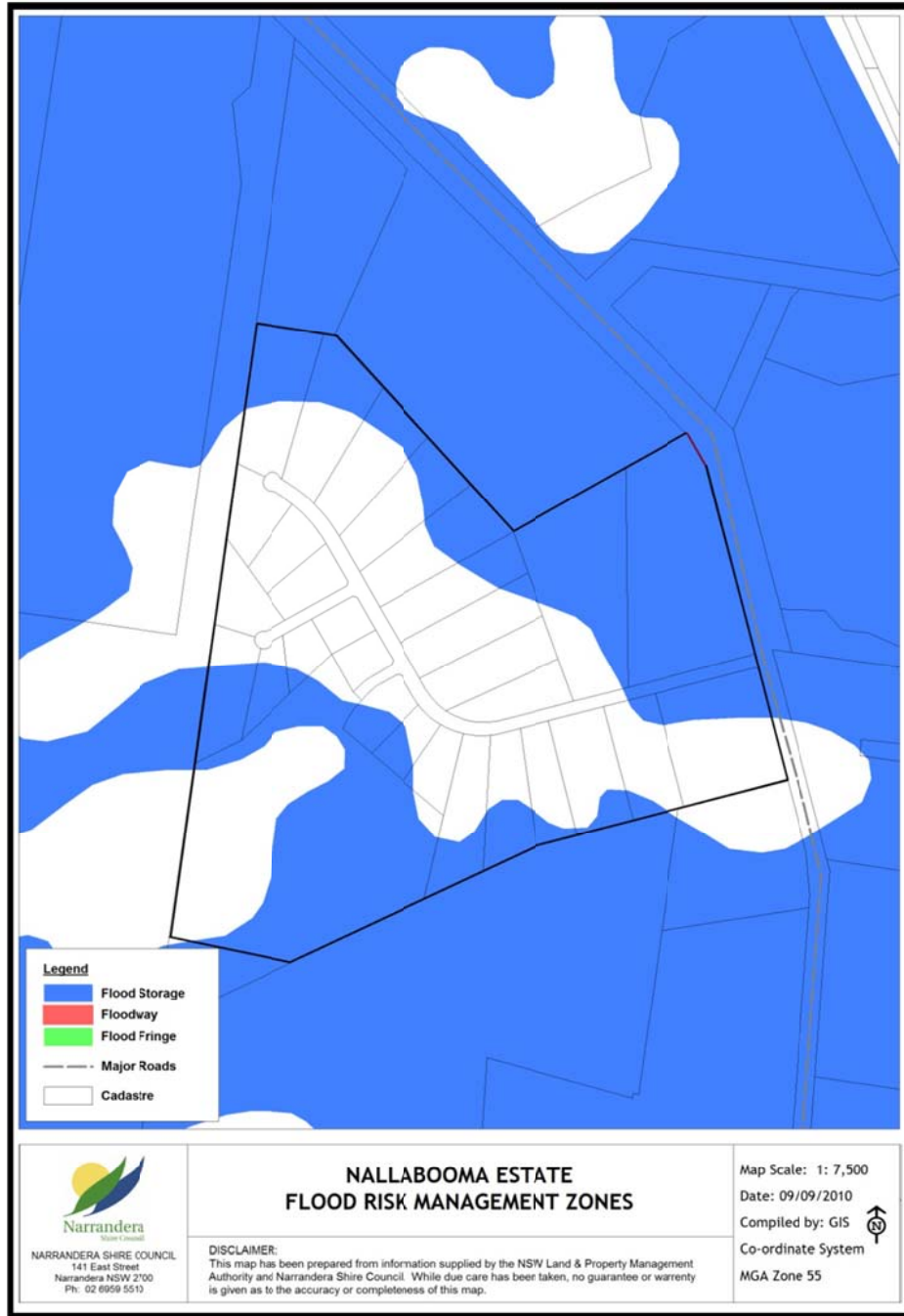


Table 4 Flood controls in the Nallabooma Estate

Land Use	Hydraulic Category	Criteria to be met
Critical use	Flood storage	Not suitable for critical land uses
Sensitive use	Flood storage	Not suitable for sensitive land uses
Residential	Flood storage	<p>Floor level</p> <ul style="list-style-type: none"> • Extensions to existing houses only, up to 20% of existing floor area at existing dwelling height; • For dwelling extensions over 20% of existing floor area and replacement of existing dwellings the entire habitable floor level must not be lower than the 100 year ARI level plus freeboard of 500mm. • Non-habitable floor levels to be no lower than the 20 year ARI level unless justified by a site specific assessment. <p>Building components</p> <ul style="list-style-type: none"> • All new structures to have flood compatible building components below the 100 year ARI level. <p>Structural soundness</p> <ul style="list-style-type: none"> • Engineers report to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year ARI level plus freeboard of 500mm. <p>Flood effect</p> <ul style="list-style-type: none"> • Extensions to existing houses only, up to 20% existing floor area, at existing dwelling height – no requirement. • Extensions over 20% floor area and replacement dwellings, engineers report required to certify that the development will not increase flood effects elsewhere, having regard to (i) loss of flood storage, (ii) changes in flood levels and velocities caused by alterations to the flood conveyance, and (iii) the cumulative impact of multiple developments in the floodplain. <p>Evacuation</p> <ul style="list-style-type: none"> • Reliable access for pedestrians or vehicles is required from the building to an area of refuge above the PMF level: the access commencing and continuing at a level no lower than the lowest level of the building. • The development is to be consistent with the evacuation plans specified in the SES Local Flood Plan adopted by the Council. <p>Management and design</p> <ul style="list-style-type: none"> • No storage of materials below the 100 year ARI level which may cause pollution or be hazardous during a flood. • Applicant to demonstrate that any proposed fencing is of an open nature and collapsible during floods.

Land Use	Hydraulic Category	Criteria to be met
Commercial	Flood storage	Commercial land uses are not suitable within the Nallabooma Estate having regard to its zoning under the Narrandera LEP 1991.
Industrial	Flood storage	Industrial land uses are not suitable within the Nallabooma Estate having regard to its zoning under the Narrandera LEP 1991.
Recreation & agriculture	Flood storage	<p>Recreation, and broad scale or intensive agricultural land uses (involving construction of buildings or structures) are not suitable within the Nallabooma Estate having regard to its zoning under the Narrandera LEP 1991.</p> <p>Buildings or structures which are ancillary to the use of a dwelling will be considered through the residential category above.</p>
Other	Flood storage	Other development is not suitable in the Nallabooma Estate unless it is ancillary to the use of a dwelling. This development will be dealt with through the residential category above.

11.7 Flood controls in all other areas

The remainder of the floodplain has land within each hydraulic category – floodway, flood storage and flood fringe. Figure 1 at the beginning of this plan shows the floodplain area, with separate maps for Gillenbah and Nallabooma. Table 5 below provides the prescriptive and performance based development controls for the remainder of the floodplain.

Table 5 Flood controls in the remainder of the floodplain

Land Use	Hydraulic Category	Criteria to be met
Critical use	Floodway	Not suitable for critical land uses
	Flood storage	Not suitable for critical land uses
	Flood fringe	Not suitable for critical land uses
Sensitive use	Floodway	Not suitable for sensitive land uses
	Flood storage	Not suitable for sensitive land uses
	Flood fringe	<p>Floor level</p> <ul style="list-style-type: none"> Habitable floor levels to be no lower than the PMF level. Non-habitable floor levels to be no lower than the PMF level, unless justified by a site specific assessment. <p>Building components</p> <ul style="list-style-type: none"> All new structures to have flood compatible building components below the PMF level. <p>Structural soundness</p> <ul style="list-style-type: none"> Applicant to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year ARI level. An engineer’s report may be required at the discretion of the Council. <p>Flood affectation</p> <ul style="list-style-type: none"> The flood impact of the development must be considered to ensure that the development will not increase flood effects elsewhere, having regard to (i) loss of flood storage, (ii) changes in flood levels and velocities caused by alterations to the flood conveyance, and (iii) the cumulative impact of multiple developments in the floodplain. An engineer’s report may be required at the discretion of the Council. <p>Evacuation</p> <ul style="list-style-type: none"> Reliable access for pedestrians or vehicles is required from the building to an area of refuge above the PMF level: the access commencing and continuing at a level no lower than the lowest level of the building. The development is to be consistent with the evacuation plans specified in the SES Local Flood Plan adopted by the Council.

Land Use	Hydraulic Category	Criteria to be met
		<p>Management and design</p> <ul style="list-style-type: none"> The applicant is to demonstrate that area is available to store goods above the 100 year ARI level. No storage of materials below the 100 year ARI level which may cause pollution or be hazardous during a flood.
<p>Residential</p> <p><i>All new residential development apart from minor extensions and replacement dwellings is not suitable in the floodway hydraulic category</i></p> <p><i>All new dwelling entitlements created by rural subdivision and existing holdings must meet the new dwelling controls in this plan</i></p>	<p>Floodway</p>	<p>Floor level</p> <ul style="list-style-type: none"> Extensions to existing houses only, up to 20% of existing habitable floor area, at existing dwelling height; For dwelling extensions over 20% of existing habitable floor area and replacement of existing dwelling the entire habitable floor level must not be lower than the 100 year ARI level plus freeboard of 500mm. Replacement of a dwelling will only be permitted if its location on site will be the same or improved with respect to floor level and flood affectation controls, and evacuation. <p>Building components</p> <ul style="list-style-type: none"> All new structures to have flood compatible building components below the 100 year ARI level. <p>Structural soundness</p> <ul style="list-style-type: none"> Engineers report to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year ARI level plus freeboard of 500mm. <p>Flood effect</p> <ul style="list-style-type: none"> Extensions to existing houses only, up to 20% existing habitable floor area, at existing dwelling height – no requirement. Extensions over 20% of existing habitable floor area and replacement dwellings, engineers report required to certify that the development will not increase flood effects elsewhere, having regard to (i) loss of flood storage, (ii) changes in flood levels and velocities caused by alterations to the flood conveyance, and (iii) the cumulative impact of multiple developments in the floodplain. <p>Evacuation</p> <ul style="list-style-type: none"> Reliable access for pedestrians or vehicles is required from the building to an area of refuge above the PMF level: the access commencing and continuing at a level no lower than the lowest level of the building. The development is to be consistent with the evacuation plans specified in the SES Local Flood Plan adopted by the Council. <p>Management and design</p> <ul style="list-style-type: none"> No storage of materials below the 100 year ARI level which may cause pollution or be hazardous during a flood. Applicant to demonstrate that any proposed fencing is of an open nature and collapsible during floods.

Land Use	Hydraulic Category	Criteria to be met
	Flood storage	<p>Floor level</p> <ul style="list-style-type: none"> • Extensions to existing houses only, up to 20% of existing habitable floor area at existing dwelling height; • For dwelling extensions over 20% of existing habitable floor area and replacement of existing dwellings the entire habitable floor level must not be lower than the 100 year ARI level plus freeboard of 500mm. • Non-habitable floor levels to be no lower than the 20 year ARI level unless justified by a site specific assessment. <p>Building components</p> <ul style="list-style-type: none"> • All new structures to have flood compatible building components below the 100 year ARI level. <p>Structural soundness</p> <ul style="list-style-type: none"> • Engineers report to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year ARI level plus freeboard of 500mm. <p>Flood effect</p> <ul style="list-style-type: none"> • Extensions to existing houses only, up to 20% existing habitable floor area, at existing dwelling height – no requirement. • Extensions over 20% of existing habitable floor area and replacement dwellings, engineers report required to certify that the development will not increase flood effects elsewhere, having regard to (i) loss of flood storage, (ii) changes in flood levels and velocities caused by alterations to the flood conveyance, and (iii) the cumulative impact of multiple developments in the floodplain. <p>Evacuation</p> <ul style="list-style-type: none"> • Reliable access for pedestrians or vehicles is required from the building to an area of refuge above the PMF level: the access commencing and continuing at a level no lower than the lowest level of the building. • The development is to be consistent with the evacuation plans specified in the SES Local Flood Plan adopted by the Council. <p>Management and design</p> <ul style="list-style-type: none"> • No storage of materials below the 100 year ARI level which may cause pollution or be hazardous during a flood. • Applicant to demonstrate that any proposed fencing is of an open nature and collapsible during floods.
	Flood fringe	<p>Floor level</p> <ul style="list-style-type: none"> • Extensions to existing houses only, up to 20% of existing habitable floor area at existing dwelling height; • For dwelling extensions over 20% of existing habitable floor area and replacement of existing dwellings the entire habitable floor level must not be lower than the 100 year ARI level plus freeboard of 500mm. • Non-habitable floor levels to be no lower than the 20 year ARI level unless justified by a site specific assessment.

Land Use	Hydraulic Category	Criteria to be met
		<p>Building components</p> <ul style="list-style-type: none"> All new structures to have flood compatible building components below the 100 year ARI level. <p>Structural soundness</p> <ul style="list-style-type: none"> Engineers report to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year ARI level . <p>Flood effect</p> <ul style="list-style-type: none"> Extensions to existing houses only, up to 20% existing habitable floor area, at existing dwelling height – no requirement. Extensions over 20% of existing habitable floor area and replacement dwellings, engineers report required to certify that the development will not increase flood effects elsewhere, having regard to (i) loss of flood storage, (ii) changes in flood levels and velocities caused by alterations to the flood conveyance, and (iii) the cumulative impact of multiple developments in the floodplain. <p>Evacuation</p> <ul style="list-style-type: none"> Reliable access for pedestrians or vehicles is required from the building to an area of refuge above the PMF level: the access commencing and continuing at a level no lower than the lowest level of the building. The development is to be consistent with the evacuation plans specified in the SES Local Flood Plan adopted by the Council. <p>Management and design</p> <ul style="list-style-type: none"> No storage of materials below the 100 year ARI level which may cause pollution or be hazardous during a flood.
Commercial	N/A	<i>Commercial development is generally not suitable in the rural areas of the Shire. Commercial land uses are located in the Narrandera town centre</i>
Industrial <i>Industrial development is generally unsuitable in the rural areas of the Shire. There are designated industrial areas in the Narrandera township. However rural industrial</i>	Floodway Flood storage	<p>Not suitable for industrial land uses or rural industrial land uses</p> <p>Floor level</p> <ul style="list-style-type: none"> Habitable floor levels to be no lower than the 20 year ARI level unless justified by a site specific assessment. <p>Building components</p> <ul style="list-style-type: none"> All new structures to have flood compatible building components below the 100 year ARI level. <p>Structural soundness</p> <ul style="list-style-type: none"> Engineers report to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year ARI level plus freeboard of 500mm. <p>Flood affect</p>

Land Use	Hydraulic Category	Criteria to be met
<i>development will be considered</i>		<ul style="list-style-type: none"> • The flood impact of the development must be considered to ensure that the development will not increase flood effects elsewhere, having regard to (i) loss of flood storage, (ii) changes in flood levels and velocities caused by alterations to the flood conveyance, and (iii) the cumulative impact of multiple developments in the floodplain. An engineer’s report may be required at the discretion of the Council. <p>Evacuation</p> <ul style="list-style-type: none"> • Reliable access for pedestrians or vehicles is required from the building to an area of refuge above the PMF level: the access commencing and continuing at a level no lower than the lowest level of the building. • The development is to be consistent with the evacuation plans specified in the Local Flood Plan adopted by the Council. <p>Management and design</p> <ul style="list-style-type: none"> • The applicant is to demonstrate that area is available to store goods above the 100 year ARI level. • No storage of materials below the 100 year ARI level which may cause pollution or be hazardous during a flood. • Applicant to demonstrate that any proposed fencing is of an open nature and collapsible during floods. <p>Flood fringe</p> <p>Floor level</p> <ul style="list-style-type: none"> • Habitable floor levels to be no lower than the 20 year ARI level unless justified by a site specific assessment. <p>Building components</p> <ul style="list-style-type: none"> • All new structures to have flood compatible building components below the 100 year ARI level. <p>Structural soundness</p> <ul style="list-style-type: none"> • Engineers report to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year ARI level. <p>Flood affect</p> <ul style="list-style-type: none"> • The flood impact of the development must be considered to ensure that the development will not increase flood effects elsewhere, having regard to (i) loss of flood storage, (ii) changes in flood levels and velocities caused by alterations to the flood conveyance, and (iii) the cumulative impact of multiple developments in the floodplain. An engineer’s report may be required at the discretion of the Council. <p>Evacuation</p> <ul style="list-style-type: none"> • Reliable access for pedestrians or vehicles is required from the building to an area of refuge above the PMF level: the access commencing and continuing at a level no lower than the lowest level of the building. • The development is to be consistent with the evacuation plans specified in the SES Local Flood Plan adopted by the Council.

Land Use	Hydraulic Category	Criteria to be met
		<p>Management and design</p> <ul style="list-style-type: none"> The applicant is to demonstrate that area is available to store goods above the 100 year ARI level. No storage of materials below the 100 year ARI level which may cause pollution or be hazardous during a flood. Applicant to demonstrate that any proposed fencing is of an open nature and collapsible during floods.
<p>Recreation & agriculture</p>	<p>Floodway and Flood storage</p> <p>Flood fringe</p>	<p>Floor level</p> <ul style="list-style-type: none"> All floor levels to be no lower than the 20 year ARI level unless justified by a site specific assessment. <p>Building components</p> <ul style="list-style-type: none"> All new structures to have flood compatible building components below the 100 year ARI level. <p>Structural soundness</p> <ul style="list-style-type: none"> Engineers report to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year ARI level plus freeboard of 500mm. <p>Flood effect</p> <ul style="list-style-type: none"> The flood impact to be considered to ensure that the development will not increase flood effects elsewhere, having regard to (i) loss of flood storage, (ii) changes in flood levels and velocities caused by alterations to the flood conveyance, and (iii) the cumulative impact of multiple developments in the floodplain. An engineer's report may be required at the discretion of the Council. <p>Evacuation</p> <ul style="list-style-type: none"> Reliable access for pedestrians or vehicles is required from the building to an area of refuge above the PMF level: the access commencing and continuing at a level no lower than the lowest level of the building. The development is to be consistent with the evacuation plans specified in the SES Local Flood Plan adopted by the Council. <p>Management and design</p> <ul style="list-style-type: none"> The applicant is to demonstrate that area is available to store goods above the 100 year ARI level. No storage of materials below the 100 year ARI level which may cause pollution or be hazardous during a flood. Applicant to demonstrate that any proposed fencing is of an open nature and collapsible during floods. Applicant to demonstrate that the proposed development is aligned with the direction of flood flow and where possible of an open nature. <p>Floor level</p> <ul style="list-style-type: none"> All floor levels to be no lower than the 20 year ARI level unless justified

Land Use	Hydraulic Category	Criteria to be met
		<p>by a site specific assessment.</p> <p>Building components</p> <ul style="list-style-type: none"> All new structures to have flood compatible building components below the 100 year ARI level. <p>Structural soundness</p> <ul style="list-style-type: none"> Engineers report to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year ARI level. <p>Flood effect</p> <ul style="list-style-type: none"> The flood impact to be considered to ensure that the development will not increase flood effects elsewhere, having regard to (i) loss of flood storage, (ii) changes in flood levels and velocities caused by alterations to the flood conveyance, and (iii) the cumulative impact of multiple developments in the floodplain. An engineer’s report may be required at the discretion of the Council. <p>Evacuation</p> <ul style="list-style-type: none"> Reliable access for pedestrians or vehicles is required from the building to an area of refuge above the PMF level: the access commencing and continuing at a level no lower than the lowest level of the building. The development is to be consistent with the evacuation plans specified in the SES Local Flood Plan adopted by the Council. <p>Management and design</p> <ul style="list-style-type: none"> The applicant is to demonstrate that area is available to store goods above the 100 year ARI level. No storage of materials below the 100 year ARI level which may cause pollution or be hazardous during a flood.
<p>Other development</p>	<p>Floodway</p> <p>Flood storage</p>	<p>Other development is not suitable in the floodway</p> <p>Floor level</p> <ul style="list-style-type: none"> All floor levels to be no lower than the 20 year ARI level unless justified by a site specific assessment. <p>Building components</p> <ul style="list-style-type: none"> All new structures to have flood compatible building components below the 100 year ARI level. <p>Structural soundness</p> <ul style="list-style-type: none"> Engineers report to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year ARI level.

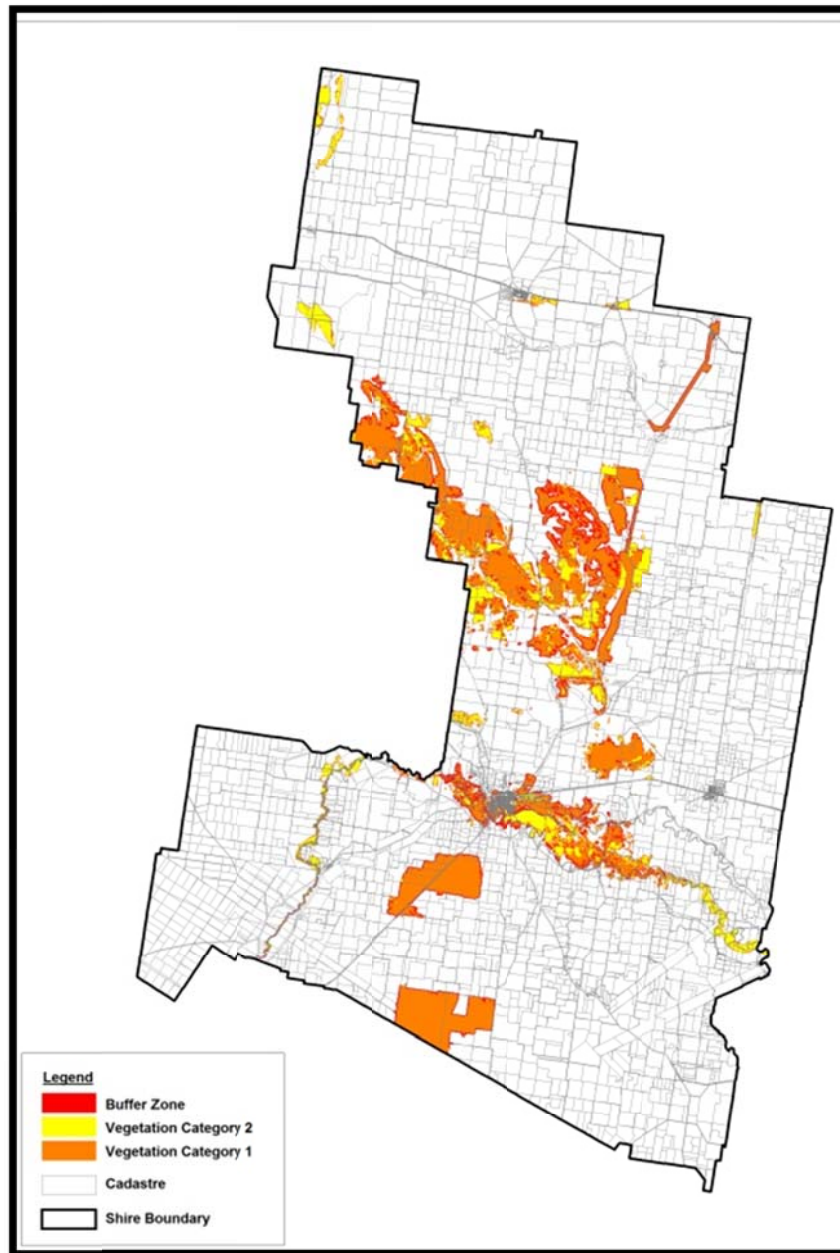
Land Use	Hydraulic Category	Criteria to be met
	<p style="color: green; text-align: center;">Flood fringe</p>	<p>Flood effect</p> <ul style="list-style-type: none"> The flood impact to be considered to ensure that the development will not increase flood effects elsewhere, having regard to (i) loss of flood storage, (ii) changes in flood levels and velocities caused by alterations to the flood conveyance, and (iii) the cumulative impact of multiple developments in the floodplain. An engineer’s report may be required at the discretion of the Council. <p>Evacuation</p> <ul style="list-style-type: none"> Reliable access for pedestrians or vehicles is required from the building to an area of refuge above the PMF level: the access commencing and continuing at a level no lower than the lowest level of the building. The development is to be consistent with the evacuation plans specified in the SES Local Flood Plan adopted by the Council. <p>Management and design</p> <ul style="list-style-type: none"> The applicant is to demonstrate that area is available to store goods above the 100 year ARI level. No storage of materials below the 100 year ARI level which may cause pollution or be hazardous during a flood. Applicant to demonstrate that any proposed fencing is of an open nature and collapsible during floods. <p>Floor level</p> <ul style="list-style-type: none"> All floor levels to be no lower than the 20 year ARI level unless justified by a site specific assessment. <p>Building components</p> <ul style="list-style-type: none"> All new structures to have flood compatible building components below the 100 year ARI level. <p>Structural soundness</p> <ul style="list-style-type: none"> Engineers report to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year ARI level. <p>Flood effect</p> <ul style="list-style-type: none"> The flood impact to be considered to ensure that the development will not increase flood effects elsewhere, having regard to (i) loss of flood storage, (ii) changes in flood levels and velocities caused by alterations to the flood conveyance, and (iii) the cumulative impact of multiple developments in the floodplain. An engineer’s report may be required at the discretion of the Council.

Land Use	Hydraulic Category	Criteria to be met
		<p>Evacuation</p> <ul style="list-style-type: none"> • Reliable access for pedestrians or vehicles is required from the building to an area of refuge above the PMF level: the access commencing and continuing at a level no lower than the lowest level of the building. • The development is to be consistent with the evacuation plans specified in the SES Local Flood Plan adopted by the Council. <p>Management and design</p> <ul style="list-style-type: none"> • The applicant is to demonstrate that area is available to store goods above the 100 year ARI level. • No storage of materials below the 100 year ARI level which may cause pollution or be hazardous during a flood.

Chapter 12 Bushfire prone land

The Narrandera Shire is fortunate to be home to significant areas of native vegetation, including riparian area based River Red Gum, and Cypress Pine and Box Gum woodland. This vegetation, particularly when located in denser patches or on slopes, hillsides and escarpments, can be bushfire prone. The NSW Rural Fire Service has mapped bushfire prone land in the Shire.

Figure 4 Bushfire prone land in Narrandera Shire

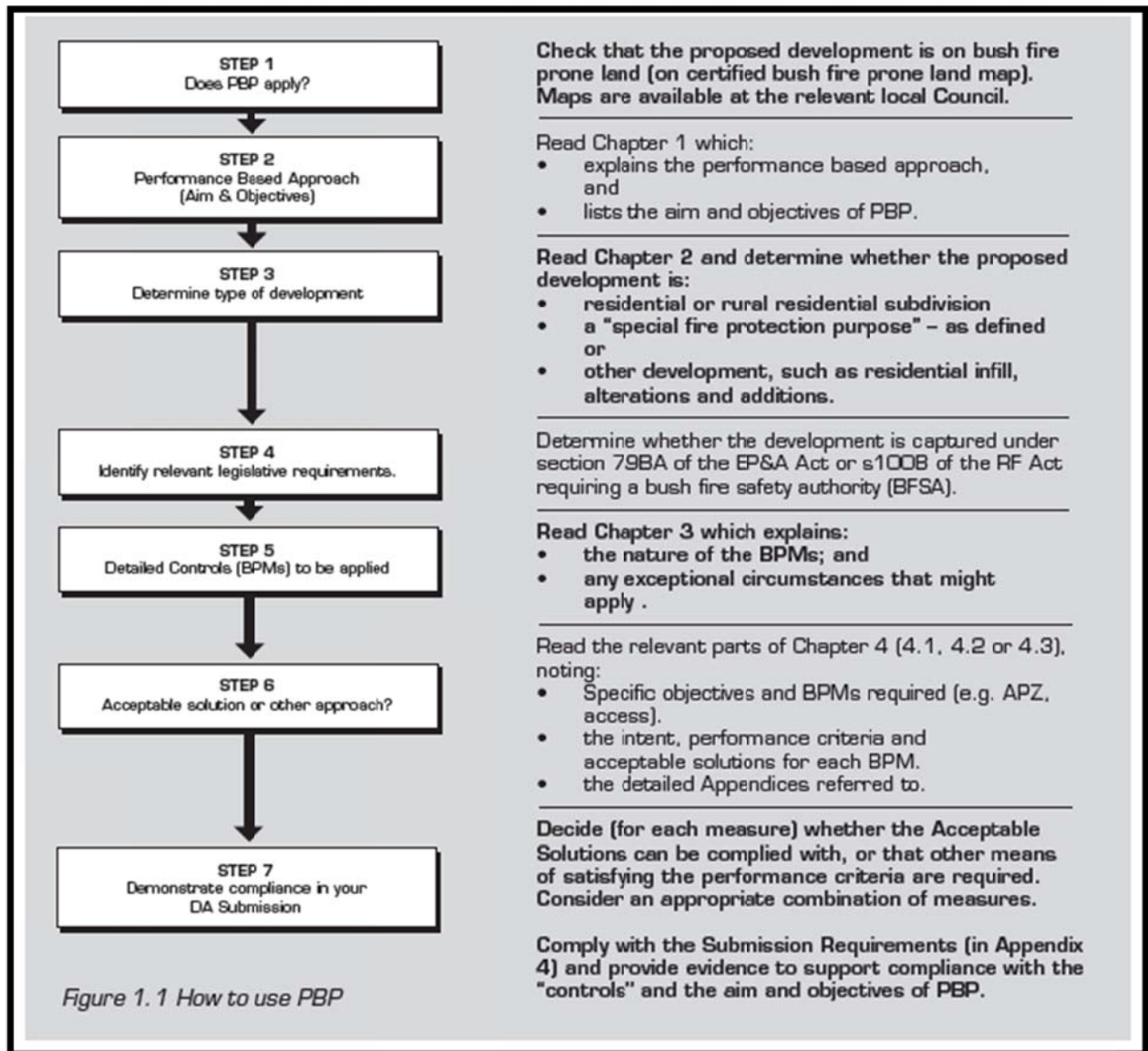


In the above figure, the Murrumbidgee River, State Forests and elevated hillsides feature prominently.

Appendix 2 contains more detailed maps of bushfire prone land for the Narrandera Township and Villages of Barellan and Grong Grong.

The NSW Government, through the Rural Fire Service, has prepared a publication titled *Planning for Bushfire Protection* – go to <http://www.rfs.nsw.gov.au/>. *Planning for Bushfire Protection* (PBP) contains a set of guidelines for determining the type of development proposed, vegetation category, legislative requirements, bushfire protection measures - including asset protection zones (distance and clearing buffers) and method of building construction. An excerpt of Figure 1.1 from PBP is provided below.

Figure 5 Excerpt of Planning for Bushfire Protection



If your proposed development site is identified on any of the bushfire maps, or is identified as bushfire prone land on a Planning Certificate, please contact the Council for assistance with your application.

Appendix 1 Flood liable land additional information

- A. Information required with a development application;
- B. Definitions relevant to flood liable land;
- C. Historic river flooding in the Narrandera Township locality;
- D. Local areas impacted by flooding;
- E. Flood protection measures;
- F. Flood development control matrix;
- G. Design flood levels and river cross-sections.

A. Information required with a development application

All applicants proposing development in the floodplain are to submit a Statement of Environmental Effects (SEE) which addresses the matters within this sub-chapter of the DCP.

Apart from the SEE, the following supporting information is to be provided.

- A survey plan showing:
 - The position of existing buildings and/or proposed buildings;
 - The existing ground levels and contours of the site to Australian Height Datum (AHD), and
 - The existing or proposed floor levels to AHD;
- Applications for earthworks, filling of land or subdivision are to be accompanied by a survey plan with contours to 0.25 metres showing levels to AHD;
- Where the controls in this plan require an assessment of structural soundness during potential floods, an engineer's report must be submitted addressing the impacts on the foundations and the building of:
 - Hydrostatic and hydrodynamic pressure;
 - Impact of debris, and
 - Buoyancy forces.

B. Definitions used in this sub-chapter

Term	Explanation
Australian height datum	A common national surface level datum approximately corresponding to mean sea level.
Average recurrence interval	The long term average number of years between the occurrences of a flood as big as or larger than the selected event. For example, floods with a discharge as great as or greater than the 20 year ARI flood will occur on average once every 20 years.
Flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse.

Term	Explanation
Flood fringe areas	The remaining areas of flood prone land after floodway and flood fringe areas have been defined.
Flood liable land	Also known as flood prone land. Any land susceptible to flooding by the Probable Maximum Flood (PMF).
Floodplain	Area of land which is subject to inundation by floods up to and including the PMF.
Flood planning levels	The combination of flood levels (derived from significant historical events or floods of specific Average Exceedence Probability) and freeboard levels selected for floodplain risk management purposes.
Flood proofing	A combination of measures incorporated in the design, construction and alteration of individual buildings and structures subject to flooding. Flood proofing aims to reduce or eliminate flood damages.
Flood storage areas	Those parts of a floodplain that are important for the temporary storage of floodwaters during passage of a flood. See floodway below.
Freeboard	Is a safety factor expressed as a height of a design flood level. The typical freeboard is 0.5 metres.
Floodway	Areas where a significant volume of water flows during flood and are often aligned with obvious natural channels.
Habitable floor level	In a residential situation means a living or working area, such as a bedroom, lounge room or kitchen. In a commercial situation means an area used for offices and to store valuable possessions or equipment susceptible to flood water damage.
PMF (Probable Maximum Flood) & Extreme Flood	The largest flood that could conceivably occur at a particular location.
Risk	In the context of a flood, is the chance of the flood happening, measured in terms of the consequences and likelihood.

C. Historic river flooding in the Narrandera Township locality

Floods passing through the Narrandera reach of the Murrumbidgee River, flow essentially westward over a 15km wide floodplain. The predominant flow paths over the floodplain are the Murrumbidgee River and its overbank sections, Sandy Creek/Poison Waterholes Creek, and Gillenbah Creek.

The main obstacles impeding flood flow are the Narrandera River Bridge on the Newell Highway, the Narrandera-Tocumwal Railway viaduct and the banks of the Main Canal.

Downstream of the railway viaduct the flood extends northwards to an area in the vicinity of the Narrandera Aerodrome and Cudgill Sandhills. This area is considered predominantly a flood storage area.

Serious flooding has been reported in the region since settlement began over 150 years ago. Flood events in the Murrumbidgee Valley described from 'serious' to 'disastrous' were recorded in 1824, 1832, 1852, 1867, 1875 and 1878 (*Sinclair Knight and Partners, 1977*).

The flood of June 1852 is considered the most severe prior to the commencement of gauging in 1887, mainly because of the 89 lives lost in Gundagai. However, the 1853 flood exceeded this flood in terms of level. Since regular recording of levels in the Murrumbidgee Valley, the most significant floods were identified as having occurred in 1891, 1900, 1925, 1931, 1950, 1952, 1956, 1974 and 1989.

The 1974 flood is the highest recorded at Narrandera. It reached a level of 146.36m AHD at the Narrandera gauge (GSN 410005) and had an estimated discharge of 266,000 ML/d. This flood was initially recorded as a 100 year Average Recurrence Interval (ARI) event; however the 2007 review³ determined that the 1974 flood was approximately a 65 year ARI event.

D. Local areas impacted by flooding

Newell Highway

The Newell Highway, south of the Gillenbah Commercial area is cut by flood waters including and exceeding the 5 year ARI event. The Highway has areas categorised as both floodway and flood storage, with flood fringe at the southern extremity of the flood plain.

Sturt Highway

The Sturt Highway, west of the Gillenbah Commercial area is cut by flood waters including and exceeding the 5 year ARI event. The Highway also has areas categorised as both floodway and flood storage, however east of the Gillenbah area the category is mostly flood storage.

Gillenbah Commercial Area (see section 11.5)

The Gillenbah Commercial Area will suffer inundation for floods including and exceeding the 10 year ARI event. The hydraulic category is mostly floodway. Anecdotal advice indicates that at the height of the 1974

³ Sinclair Knight Merz (2007) *Narrandera Flood Study Review*

flood there was about one metre of water flowing through the commercial area, at the then Mobil service station building (now Caltex).⁴

Narrandera-Tocumwal Railway

The base of the railway formation is inundated in the 100 year ARI event. The flood waters will pass through the formation; however the structure represents a significant obstruction to floodplain flow. The likelihood of the formation being removed to relieve the obstruction is very small. The rail line formation transects the flood plain and therefore is affected by all three categories.

Main Canal

The southern bank of the Main Canal provides an effective flood defence for the town, and is likely to provide protection up to and including the 100 year ARI event. The Canal however has a freeboard of between 300mm and 1.4m above the 100 year event.

The Canal will be overtopped during an extreme event, and it is assumed that such overtopping will result in flood waters ponding north of the Canal bank and flooding some lower lying properties within the township. The main hydraulic category adjacent to the Canal is flood storage.

Nallabooma Estate (Rural Small Holdings – see section 11.6)

The Nallabooma Estate is located south west of the town and is partly inundated by the 100 year ARI event. Houses in the estate have been required to be constructed at the 1974 flood level (now known to be a 65 year ARI event) plus a freeboard of 500mm.

New houses in this estate will be required to meet the 100 year ARI event plus 500mm freeboard based on the 2007 Sinclair Knight Merz Flood Study Review. The hydraulic category in this locality is flood storage.

Narrandera Aerodrome

The aerodrome is protected by a ring levee which would be overtopped at some points by a 100 year ARI event. During the 1974 flood parts of the levee required sandbagging to prevent overtopping. During an extreme event the aerodrome will be completely inundated. The hydraulic category is flood fringe.

Town and rural development

If the Main Canal is overtopped there is a risk that some properties within the township will be affected by flooding, depending on the size of the flood event above the 100 year ARI event.

There are existing rural properties in the flood plain, some of which are located upon earthen mounds or have small ring levees, which may provide protection to the 5 or 10 year ARI event. Those rural dwellings in close proximity to the River, Bundidgerry Creek, Gillenbah Creek and Sandy Creek/Poison Waterholes Creek are likely to be in the floodway category, and otherwise in the flood storage category.

⁴ Pers com (31/08/2010) Mr Wal Lingen Narrandera SES Controller describing the 1974 Flood

E. Flood protection measures

The two main flood protection measures proposed in this sub-chapter are *development controls*, including provision of *minimum height floor levels* to Australian Height Datum and *flood proofing*. Other flood protection measures are also considered below.

The risks of house raising as a flood protection measure

The Council does not recommend or encourage raising existing or new houses in the floodplain, to meet the 100 year ARI event plus freeboard, particularly within the floodway hydraulic category areas, for the following reasons.

- The likely expense of raising an existing house;
- The perception that the occupant is 'safe' from the flood;
- The high likelihood of isolation for a period ranging from a few days to a number of weeks, and the strong possibility of disruption to utility services such as telephone, electricity, potable tank water and on site effluent disposal, and
- The increased risk to emergency services once evacuation routes have been cut by flood waters. *It is noted that the local flood plan requires evacuation from isolated dwellings to be completed before evacuation routes are closed.*

In limited circumstances it may be appropriate to consider raising a house to avoid more frequent floods, say 10 or 20 year ARI events. However the merits of these cases will be considered with regard to the above points and sections 11.5-11.7 of this plan.

Filling in the floodplain

The Council does not support significant filling of the land within the floodway hydraulic category, whether that filling constitutes a levee or raised mound to elevate a dwelling.

The Council will consider, with development consent, minor filling of up to 100m² of land to a maximum fill depth of 300mm within the floodway area.

The Council may consider filling of land to elevate a dwelling within the flood storage hydraulic category, where there is an offset to the filling on the same land. Such a proposal must be supported by an Engineers report justifying the filling on the basis that the change in flood flow will not detrimentally affect other buildings or structures or places in the vicinity of the work.

Development controls

Through this plan, in sections 11.5-11.7, development controls have been put in place to govern the location and type of development permitted within the Gillenbah Commercial precinct, the Nallabooma rural residential estate and other general rural areas.

The development controls do not provide for outright prohibition of development (unless that development is prohibited in the particular zone by the Narrandera LEP 2012). Instead the controls are based on prescriptive and performance controls which will dictate whether a given development type is acceptable, on flood risk grounds in a given location.

Minimum floor levels (flood planning level)

The flood planning level is derived from the adopted flood level plus freeboard (safety margin). The incorporation of the freeboard allows for uncertainties in the estimation of flood levels, wave action, localised hydraulic behaviour and embankment or levee settlement. The freeboard acts as a factor of safety and should not be relied upon to protect against a flood larger than that adopted as the basis for defining the flood planning level for a given area.

Flood planning levels in this plan are based on the Narrandera Floodplain Risk Management Study and Plan 2009, prepared by Sinclair Knight Merz.

This plan adopts a flood planning level for **new residential development** equivalent to the 100 year ARI event plus a freeboard of 500mm. This is in accordance with the NSW Floodplain Development Manual 2005. This plan adopts a flood planning level for **new commercial/industrial development** equivalent to the 20 year ARI event, as these developments are typically not exposed to the same socio-economic risks.

Appendix 1 to this plan contains the flood development control matrix. The matrix attempts to provide for a 'low risk' outcome if the controls are followed. The matrix considers the following factors in pursuit of this outcome.

- Appropriate development category;
- Floor level of building;
- Building components;
- Structural soundness of building;
- Flood effects of the building;
- Evacuation potential for pedestrians and vehicles, and
- Management and design of the building, (that is the building should be aligned/oriented in the direction of the flood flow and should be preferably broken up to avoid one long building mass which may redirect flows), internal goods storage, outdoor storage and pollution impact.

Flood proofing

Flood proofing involves construction or retrofitting of buildings with flood compatible and/or water resistant materials and methods. The aim of flood proofing is to minimise structural damage to the building and to ideally minimise damage to the contents of the building if inundated. Tables of flood compatible materials and building flood proofing methods follow. The Table contents are not exhaustive and other materials or methods may be appropriate, if professionally justified.

Flood proofing guidelines are as follows.

- Flood proofing is only appropriate in the case of commercial buildings, where the social costs and consequences are anticipated to be less than for residential buildings. However flood proofing is a property protection measure and will not reduce the economic disruption of a flood. Flood proofing a building should not be expected to be 100% effective, even in new buildings.
- Flood proofing is not a panacea for avoiding flood related problems and will not be used in isolation. The Council will not permit new development in a given area on the basis of flood proofing alone.
- Flood proofing, where permitted, will be used in conjunction with other flood protection measures such as flood planning levels.

Building component	Flood compatible material
Flooring and sub floor structure	<ul style="list-style-type: none"> • Concrete slab on ground monolith construction (Note: clay filling not permitted beneath slab on ground construction which could be inundated); • Pier and beam construction, or • Suspended reinforced concrete slab
Floor covering	<ul style="list-style-type: none"> • Clay or concrete tiles; • Concrete, pre cast or in situ; • Epoxy formed in place; • Mastic flooring, formed in place; • Rubber sheets or tiles, vinyl sheets or tiles, with chemical set adhesive; • Ceramic tiles fixed with mortar or chemical set adhesive; • Asphalt tiles, fixed with water resistant adhesive, or • Removable rubber backed carpet
Wall structure	<ul style="list-style-type: none"> • Solid brickwork, block work, reinforced concrete or mass concrete
Windows	<ul style="list-style-type: none"> • Aluminium frame with stainless steel or brass rollers
Doors	<ul style="list-style-type: none"> • Solid panel with water proof adhesives; • Flush door with marine ply filled with closed cell foam; • Painted material construction; • Aluminium or galvanised steel frame
Wall and ceiling lining	<ul style="list-style-type: none"> • Brick, face or glazed; • Clay tile glazed in waterproof mortar; • Concrete or concrete block; • Steel with waterproof applications; • Stone, natural solid or veneer, waterproof grout; • Glass, or plastic sheeting or wall with waterproof adhesive
Insulation	<ul style="list-style-type: none"> • Foam or closed cell types
Nails, bolts, hinges or fittings	<ul style="list-style-type: none"> • Galvanised, • Removable pin hinges

Building component	Flood proofing methods and treatments
External walls	Ventilation openings (for example, weep holes) to be re-routed
Doors and windows	To be sealed through construction methods and design
Main power supply	Subject to the approval of the relevant authority the incoming power line and meter should be located above the flood planning level. The power supply must be able to be easily cut from the building
Wiring	All wiring, power outlets, switches to the maximum extent possible should be located above the flood planning level. All wiring 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 splicers should be used below the flood planning level. All conduits located below the flood level should be installed so that they are self-draining
Equipment	All equipment installed below or partially below the flood planning level should be capable of disconnection by a single plug and socket assembly
Heating and air conditioning systems	Where viable, heating and air conditioning systems should be installed in areas and spaces above the flood planning level. If this is not possible, fuel supply lines should have a manual cut off valve, heating equipment and tanks should be installed on secure footings to withstand impact and buoyancy and to prevent movement which could damage the fuel lines, tanks should be vented to above the flood planning level, ductwork should be provided with openings for drainage and cleaning (self-draining if possible) and a closure assembly operated from above the flood level should be installed where ductwork must pass through a watertight wall or floor
Sewer	All sewer connections to properties are to be fitted with reflux valves
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

Planning Consideration	F. Flood development control matrix																				
	Flood fringe							Flood storage						Floodway							
	Critical uses and facilities	Sensitive uses and facilities	Residential	Commercial	Industrial	Recreation and Agriculture	Other development	Critical uses and facilities	Sensitive uses and facilities	Residential	Commercial	Industrial	Recreation and Agriculture	Other development	Critical uses and facilities	Sensitive uses and facilities	Residential	Commercial	Industrial	Recreation and Agriculture	Other development
Floor Level		3	2,4	5	5	5	1			2,4	5	5	1	1			6	5		1	
Building Components		2	1	1	1	1	1			1	1	1	1	1			1	1		1	
Structural Soundness		3	2	2	2	2	2			1	1	1	1	2			1	1		1	
Flood Affection		2	2	2	2	2	2			1	2	2	2	2			1	1		2	
Evacuation		2,3	2,3	1 or 2,3	1 or 2,3	2,3	2,3			2,3	2,3	2,3	2,3	2,3			2,3	2,3		2,3	
Management and Design		2,3	3	1,3	1,3	1,3	1,3			3,4	1,3,4,5	1,3	1,3	1,3,4			3,4	1,3,4,5		1,3,4,5	

KEY:



Unsuitable Land Use

General Notes:

a	Freeboard equals an additional height of 500mm.
b	The Narrandera Local Environmental Plan 1991 identifies development permissible in various zones of the LGA. Notwithstanding, constraints specific to individual sites may preclude Council granting consent to certain forms of development on all or part of a site. This matrix along with Section 6, 7 and 8 identifies where flood risks are likely to determine where certain development types will be considered 'unsuitable' due to flood related risks.
c	The Gillenbah precinct covers both floodway and flood storage areas. Refer to Section 6 for specific development controls.

Floor Level:

1	All floor levels to be no lower than the 20 year flood level unless justified by site specific assessment.
2	Habitable floor levels to be no lower than the 100 year flood level plus freeboard.
3	Habitable floor levels to be no lower than the Extreme flood level. Non-habitable floor levels to be no lower than the Extreme flood level unless justified by site specific assessment.
4	Non-habitable floor levels to be no lower than the 20 year flood level unless justified by site specific assessment.
5	Habitable floor levels to be no lower than the 20 year flood level unless justified by site specific assessment.
6	Minor extensions to existing dwellings only. Habitable floor levels to be no lower than the 100 year flood level plus freeboard.

Building Components and Method:

1	All structures to be flood compatible building components below the 100 year flood level.
2	All structures to be flood compatible building components below the Extreme flood level.

Structural Soundness:

1	Engineer's report to certify that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year flood level plus freeboard.
2	Applicant to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year flood level.
3	Applicant to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including the 100 year flood level; Engineer's report may be required at the discretion of Council.

Flood Effects:

1	Engineer's report required to certify that the development will not increase flood effects elsewhere, having regards to (i) loss of flood storage, (ii) changes in flood levels and velocities caused by the alterations to the flood conveyance, and (iii) the cumulative impact of multiple potential developments in the floodplain.
2	The flood impact of the development to be considered to ensure that the development will not increase flood effects elsewhere, having regards to (i) loss of flood storage, (ii) changes in flood levels and velocities caused by the alterations to the flood conveyance, and (iii) the cumulative impact of multiple potential developments in the floodplain; an Engineer's report may be required.

Evacuation:

1	Reliable access for pedestrians and vehicles required during the 100 year flood.
2	Reliable access for pedestrians and vehicles is required from the building, commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the Extreme flood level
3	The development is to be consistent with the evacuation plans specified in the Local Flood Plan adopted by Council, if the development will have multiple occupancy (ie. of a commercial nature) a development specific evacuation plan is required.

Management and Design:

1	Applicant to demonstrate that area is available to store goods above the 100 year flood level
2	Applicant to demonstrate that area is available to store goods above the Extreme flood level
3	No storage of materials below the 100 year ARI flood level which may cause pollution or be hazardous during any flood.
4	Application to demonstrate that any proposed fencing is of an open nature and collapsible during floods.
5	Applicant to demonstrate that the proposed development is aligned with direction of flow and where possible is of an open nature.

G. Design flood levels and river cross-sections

The Narrandera Floodplain Risk Management Plan provides Design Flood Levels in cross -sections of the floodplain. These levels are used by the Council to estimate the required floor height of buildings within the floodplain.

The cross-section diagram is provided over along with cross-section river level tables.

Maximum Flood Levels for Flood Planning Purposes							
Model Cross Section	Maximum Flood Levels (mAHD)					Extreme Flood Event	
	5 year ARI	10 year ARI	20 year ARI	50 year ARI	100 year ARI		
POISON 2000	147.647	147.988	148.146	148.343	148.895	151.069	
POISON 4000	147.241	147.564	147.706	148.065	148.337	150.385	
POISON 6000	146.239	146.409	146.502	146.732	147.109	149.641	
POISON 6000	146.239	146.409	146.502	146.732	147.109	149.641	
POISON 8150	145.56	145.819	145.971	146.333	146.795	149.426	
POISON 9050	145.254	145.55	145.722	146.164	146.616	149.199	
POISON 9550	145.075	145.383	145.555	145.991	146.417	148.819	
POISON 10000	144.933	145.221	145.39	145.841	146.244	148.473	
POISON 10050	144.889	145.211	145.382	145.834	146.236	148.414	
POISON 10060	144.88	145.193	145.358	145.795	146.168	148.089	
POISON 10070	144.872	145.184	145.348	145.732	146.12	148.446	
POISON 10070	144.872	145.184	145.348	145.732	146.12	148.446	
POISON 11400	144.701	144.996	145.184	145.554	145.779	147.923	
POISON 11400	144.701	144.996	145.184	145.554	145.779	147.923	
POISON 12400	144.672	144.872	144.902	144.974	145.36	147.629	
POISON 12400	144.672	144.872	144.902	144.974	145.36	147.629	
POISON 13900	142.772	143.355	143.553	143.761	144.53	146.709	
POISON 13900	142.772	143.355	143.553	143.761	144.53	146.709	
POISON 15300	142.626	143.333	143.531	143.68	144.065	145.218	
POISON 15400	142.626	143.333	143.531	143.68	144.063	145.217	
GILLEN 0	145.357	145.715	145.963	146.55	147.09	149.639	
GILLEN 900	144.846	145.25	145.576	146.292	146.894	149.526	
GILLEN 1025	144.838	145.243	145.569	146.283	146.884	149.508	
GILLEN 1025	144.838	145.243	145.569	146.283	146.884	149.508	
GILLEN 1400	144.816	145.215	145.539	146.247	146.842	149.422	
GILLEN 1650	144.798	145.183	145.498	146.192	146.775	149.305	
GILLEN 1650	144.786	145.159	145.466	146.146	146.716	149.206	
GILLEN 1900	144.72	145.135	145.447	146.132	146.705	149.158	
GILLEN 1910	144.712	145.113	145.409	146.05	146.576	148.755	
GILLEN 1920	144.713	145.119	145.424	146.095	146.66	149.138	
GILLEN 2450	144.567	144.895	145.149	145.741	146.256	148.621	
GILLEN 2450	144.567	144.895	145.149	145.741	146.256	148.621	
GILLEN 2500	144.352	144.851	145.138	145.733	146.248	148.587	
GILLEN 2600	144.215	144.765	145.057	145.65	146.159	148.462	
GILLEN 3500	143.573	144.385	144.635	145.16	145.637	147.853	
GILLEN 3500	143.573	144.385	144.635	145.16	145.637	147.853	
GILLEN 3600	143.568	144.379	144.628	145.152	145.628	147.731	
MURRUM 0	147.647	147.988	148.146	148.343	148.895	151.069	
MURRUM 2000	147.359	147.681	147.832	148.249	148.636	150.884	
MURRUM 2000	147.359	147.681	147.832	148.249	148.636	150.884	
MURRUM 4000	146.586	146.863	146.995	147.343	147.799	150.491	
MURRUM 4000	146.586	146.863	146.995	147.343	147.799	150.491	
MURRUM 6000	145.816	146.051	146.197	146.738	147.281	149.885	
MURRUM 6000	145.816	146.051	146.197	146.738	147.281	149.885	
MURRUM 8150	145.357	145.715	145.963	146.55	147.09	149.639	
MURRUM 8150	145.357	145.715	145.963	146.55	147.09	149.639	
MURRUM 9050	145.098	145.525	145.779	146.361	146.901	149.32	
MURRUM 9050	145.098	145.525	145.779	146.361	146.901	149.32	
MURRUM 9230	145.036	145.479	145.732	146.315	146.854	149.266	
MURRUM 9230	145.036	145.479	145.732	146.315	146.854	149.266	
MURRUM 9250	144.983	145.43	145.68	146.253	146.782	149.126	
MURRUM 9270	144.959	145.418	145.67	146.25	146.785	149.168	
MURRUM 9550	144.544	145.118	145.376	145.954	146.485	148.814	
MURRUM 9550	144.544	145.118	145.376	145.954	146.485	148.814	
MURRUM 10050	144.28	144.894	145.129	145.635	146.1	148.181	
MURRUM 10050	144.28	144.894	145.129	145.635	146.1	148.181	
MURRUM 10055	144.277	144.891	145.126	145.633	146.099	148.18	
MURRUM 10060	144.372	144.984	145.208	145.681	146.144	148.208	
MURRUM 10065	144.277	144.89	145.125	145.632	146.098	148.179	
MURRUM 10750	144.061	144.704	144.975	145.564	146.045	148.171	
MURRUM 10750	144.061	144.704	144.975	145.564	146.045	148.171	
MURRUM 11750	143.568	144.379	144.628	145.152	145.628	147.731	
MURRUM 11750	143.568	144.379	144.628	145.152	145.628	147.731	
MURRUM 13050	142.383	143.366	143.788	144.362	144.746	146.552	

Maximum Flood Levels for Flood Planning Purposes

Model Cross Section	Maximum Flood Levels (mAHD)					Extreme Flood Event
	5 year ARI	10 year ARI	20 year ARI	50 year ARI	100 year ARI	
POISON 2000	147.647	147.988	148.146	148.343	148.895	151.069
POISON 4000	147.241	147.564	147.706	148.065	148.337	150.385
POISON 6000	146.239	146.409	146.502	146.732	147.109	149.641
POISON 6000	146.239	146.409	146.502	146.732	147.109	149.641
POISON 8150	145.56	145.819	145.971	146.333	146.795	149.426
POISON 9050	145.254	145.55	145.722	146.164	146.616	149.199
POISON 9550	145.075	145.383	145.555	145.991	146.417	148.819
POISON 10000	144.933	145.221	145.39	145.841	146.244	148.473
POISON 10050	144.889	145.211	145.382	145.834	146.236	148.414
POISON 10060	144.88	145.193	145.358	145.795	146.168	148.089
POISON 10070	144.872	145.184	145.348	145.732	146.12	148.446
POISON 10070	144.872	145.184	145.348	145.732	146.12	148.446
POISON 11400	144.701	144.996	145.184	145.554	145.779	147.923
POISON 11400	144.701	144.996	145.184	145.554	145.779	147.923
POISON 12400	144.672	144.872	144.902	144.974	145.36	147.629
POISON 12400	144.672	144.872	144.902	144.974	145.36	147.629
POISON 13900	142.772	143.355	143.553	143.761	144.53	146.709
POISON 13900	142.772	143.355	143.553	143.761	144.53	146.709
POISON 13900	142.626	143.333	143.531	143.68	144.065	145.218
POISON 13900	142.626	143.333	143.531	143.68	144.065	145.218
POISON 15400	142.626	143.333	143.531	143.68	144.063	145.217
GILLEN 0	145.357	145.715	145.963	146.55	147.09	149.639
GILLEN 900	144.846	145.25	145.576	146.292	146.894	149.526
GILLEN 1025	144.838	145.243	145.569	146.283	146.884	149.508
GILLEN 1025	144.838	145.243	145.569	146.283	146.884	149.508
GILLEN 1400	144.816	145.215	145.539	146.247	146.842	149.422
GILLEN 1650	144.798	145.183	145.498	146.192	146.775	149.305
GILLEN 1850	144.786	145.159	145.466	146.146	146.716	149.208
GILLEN 1900	144.72	145.135	145.447	146.132	146.705	149.158
GILLEN 1910	144.712	145.113	145.409	146.05	146.576	148.755
GILLEN 1920	144.713	145.119	145.424	146.095	146.66	149.138
GILLEN 2450	144.567	144.895	145.149	145.741	146.256	148.621
GILLEN 2450	144.567	144.895	145.149	145.741	146.256	148.621
GILLEN 2500	144.352	144.851	145.138	145.733	146.248	148.587
GILLEN 2600	144.215	144.765	145.057	145.65	146.159	148.462
GILLEN 3500	143.573	144.385	144.635	145.16	145.637	147.853
GILLEN 3500	143.573	144.385	144.635	145.16	145.637	147.853
GILLEN 3600	143.568	144.379	144.628	145.152	145.628	147.731
MURRUM 0	147.647	147.988	148.146	148.343	148.895	151.069
MURRUM 2000	147.359	147.681	147.832	148.249	148.636	150.884
MURRUM 2000	147.359	147.681	147.832	148.249	148.636	150.884
MURRUM 4000	146.586	146.863	146.995	147.343	147.799	150.491
MURRUM 4000	146.586	146.863	146.995	147.343	147.799	150.491
MURRUM 6000	145.816	146.051	146.197	146.738	147.281	149.885
MURRUM 6000	145.816	146.051	146.197	146.738	147.281	149.885
MURRUM 8150	145.357	145.715	145.963	146.55	147.09	149.639
MURRUM 8150	145.357	145.715	145.963	146.55	147.09	149.639
MURRUM 9050	145.098	145.525	145.779	146.361	146.901	149.32
MURRUM 9050	145.098	145.525	145.779	146.361	146.901	149.32
MURRUM 9230	145.036	145.479	145.732	146.315	146.854	149.266
MURRUM 9230	145.036	145.479	145.732	146.315	146.854	149.266
MURRUM 9250	144.983	145.43	145.68	146.253	146.782	149.126
MURRUM 9270	144.959	145.418	145.67	146.25	146.785	149.168
MURRUM 9550	144.544	145.118	145.376	145.954	146.485	148.814
MURRUM 9550	144.544	145.118	145.376	145.954	146.485	148.814
MURRUM 10050	144.28	144.894	145.129	145.635	146.1	148.181
MURRUM 10050	144.28	144.894	145.129	145.635	146.1	148.181
MURRUM 10055	144.277	144.891	145.126	145.633	146.099	148.18
MURRUM 10060	144.372	144.984	145.208	145.681	146.144	148.208
MURRUM 10065	144.277	144.89	145.125	145.632	146.098	148.179
MURRUM 10750	144.061	144.704	144.975	145.564	146.045	148.171
MURRUM 10750	144.061	144.704	144.975	145.564	146.045	148.171
MURRUM 11750	143.568	144.379	144.628	145.152	145.628	147.731
MURRUM 11750	143.568	144.379	144.628	145.152	145.628	147.731
MURRUM 13050	142.383	143.366	143.788	144.362	144.746	146.552

Model Cross Section	Maximum Flood Levels (mAHD)					Extreme Flood Event
	5 year ARI	10 year ARI	20 year ARI	50 year ARI	100 year ARI	
MURRUM-OBS2 0	145.357	145.715	145.963	146.55	147.09	149.639
MURRUM-OBS2 100	145.073	145.597	145.877	146.481	147.025	149.378
MURRUM-OBS2 900	145.039	145.515	145.771	146.354	146.894	149.311
MURRUM-OBS2 900	145.039	145.515	145.771	146.354	146.894	149.311
MURRUM-OBS2 1080	145.034	145.488	145.74	146.322	146.861	149.271
MURRUM-OBS2 1080	145.034	145.488	145.74	146.322	146.861	149.271
MURRUM-OBS2 1100	145.034	145.486	145.738	146.319	146.859	149.268
MURRUM-OBS2 1120	144.852	145.209	145.468	146.083	146.656	149.055
MURRUM-OBS2 1400	144.81	145.16	145.415	145.982	146.528	148.845
MURRUM-OBS2 1400	144.81	145.16	145.415	145.982	146.528	148.845
MURRUM-OBS2 1900	143.918	144.742	145.022	145.633	146.105	148.197
MURRUM-OBS2 1900	143.918	144.742	145.022	145.633	146.105	148.197
MURRUM-OBS2 1905	143.915	144.742	145.021	145.632	146.104	148.196
MURRUM-OBS2 1910	143.91	144.74	145.019	145.629	146.102	148.195
MURRUM-OBS2 2200	143.752	144.694	144.965	145.555	146.035	148.16
MURRUM-OBS2 2200	143.752	144.694	144.965	145.555	146.035	148.16
MURRUM-OBS2 2500	143.568	144.379	144.628	145.152	145.628	147.731
MURRUM-OBS3 0	143.568	144.379	144.628	145.152	145.628	147.731
MURRUM-OBS3 100	143.563	144.372	144.621	145.145	145.621	147.721
MURRUM-OBS3 2600	142.484	142.779	142.921	143.509	143.857	145.428
MURRUM-OBS3 2600	142.484	142.779	142.921	143.509	143.857	145.428
MURRUM-OBS3 2800	140.225	141.212	141.771	142.185	142.497	143.933
POISON_RB 0	144.872	145.184	145.348	145.732	146.12	148.446
POISON_RB 1850	144.498	144.834	145.032	145.432	145.775	147.933
POISON_RB 1850	144.498	144.834	145.032	145.432	145.775	147.933
POISON_RB 1900	144.041	144.343	144.618	145.284	145.735	147.936
POISON_RB 2900	143.603	143.963	144.27	144.992	145.459	147.634
POISON_RB 2900	143.603	143.963	144.27	144.992	145.459	147.634
POISON_RB 4400	142.675	143.162	143.507	144.036	144.55	146.712
POISON_RB 4400	142.675	143.162	143.507	144.036	144.55	146.712
POISON_RB 5800	140.594	141.693	142.29	142.961	143.613	145.191
POISON_RB 5800	140.594	141.693	142.29	142.961	143.613	145.191
POISON_RB 5900	140.225	141.212	141.771	142.185	142.497	143.933
POISON_15400 0	142.626	143.333	143.531	143.68	144.063	145.217
POISON_15400 50	140.594	141.693	142.29	142.961	143.613	145.191
POISON_13900 0	142.772	143.355	143.553	143.761	144.53	146.709
POISON_13900 50	142.675	143.162	143.507	144.036	144.55	146.712
POISON_12400 0	144.672	144.872	144.902	144.974	145.36	147.629
POISON_12400 50	143.603	143.963	144.27	144.992	145.459	147.634

Appendix 2 Bushfire prone land maps for Narrandera, Barellan and Grong Grong

[insert pdf maps – located at K:\LEP 2010\DCP - Comprehensive\Bushfire]



0 0.5 1 1.5

Kilometres

Scale: 1:23,000



Narrandera
Shire Council

NARRANDERA SHIRE COUNCIL
141 East Street
Narrandera NSW 2700
Ph: 02 6959 5510

DCP 2012

NARRANDERA TOWNSHIP

Date: 28/11/2011

Compiled by:
GIS Narrandera

Co-ordinate System:
MGA 94 Zone 55

Ref: 2011-161

This map is a representation of the information currently held by Narrandera Shire Council. While every effort has been made to ensure the accuracy of the product, Council accepts no responsibility for any errors or omissions.

LEGEND

 Property Boundaries

 Road Corridor

 Water Courses

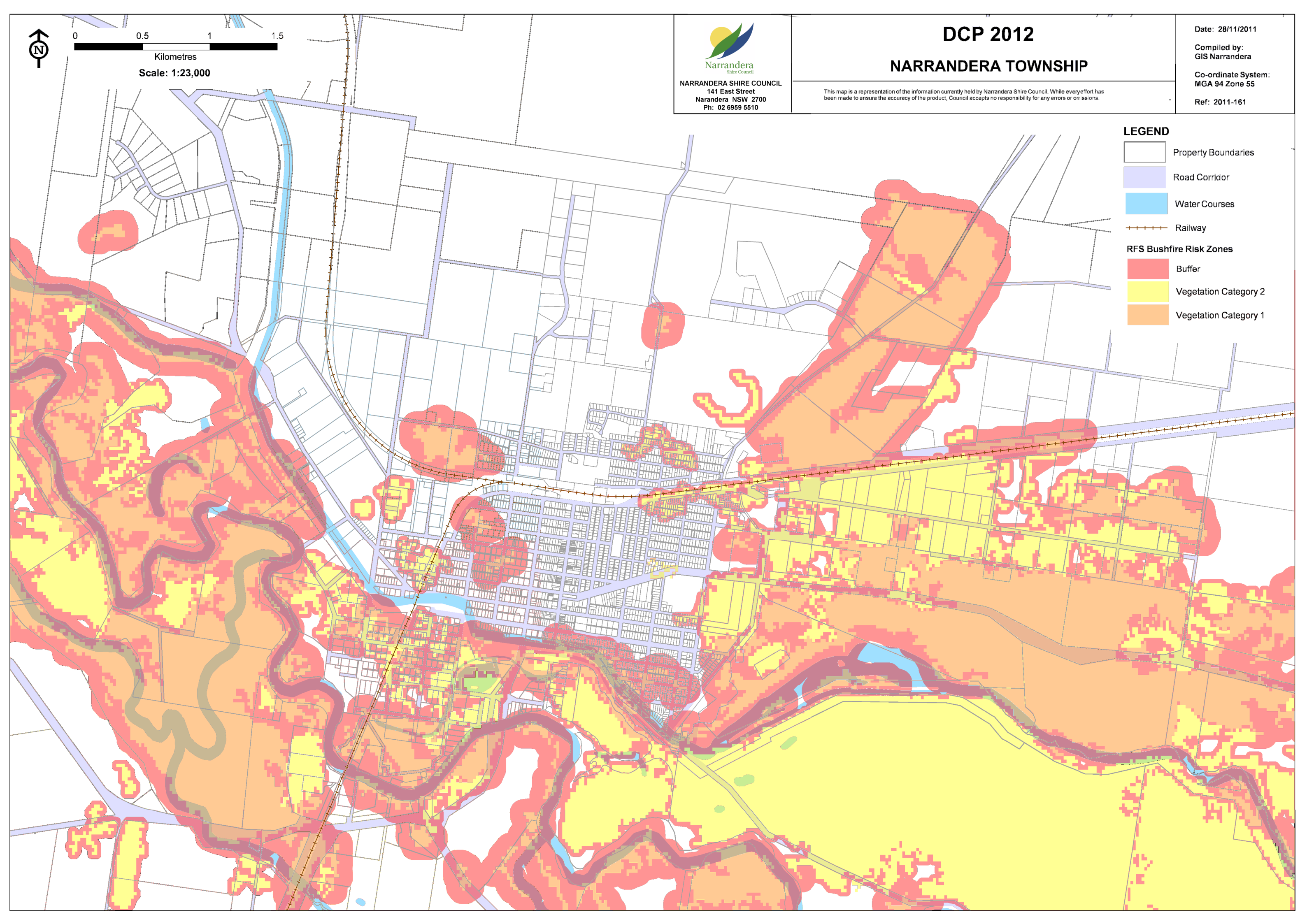
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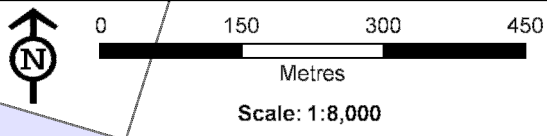
RFS Bushfire Risk Zones

 Buffer

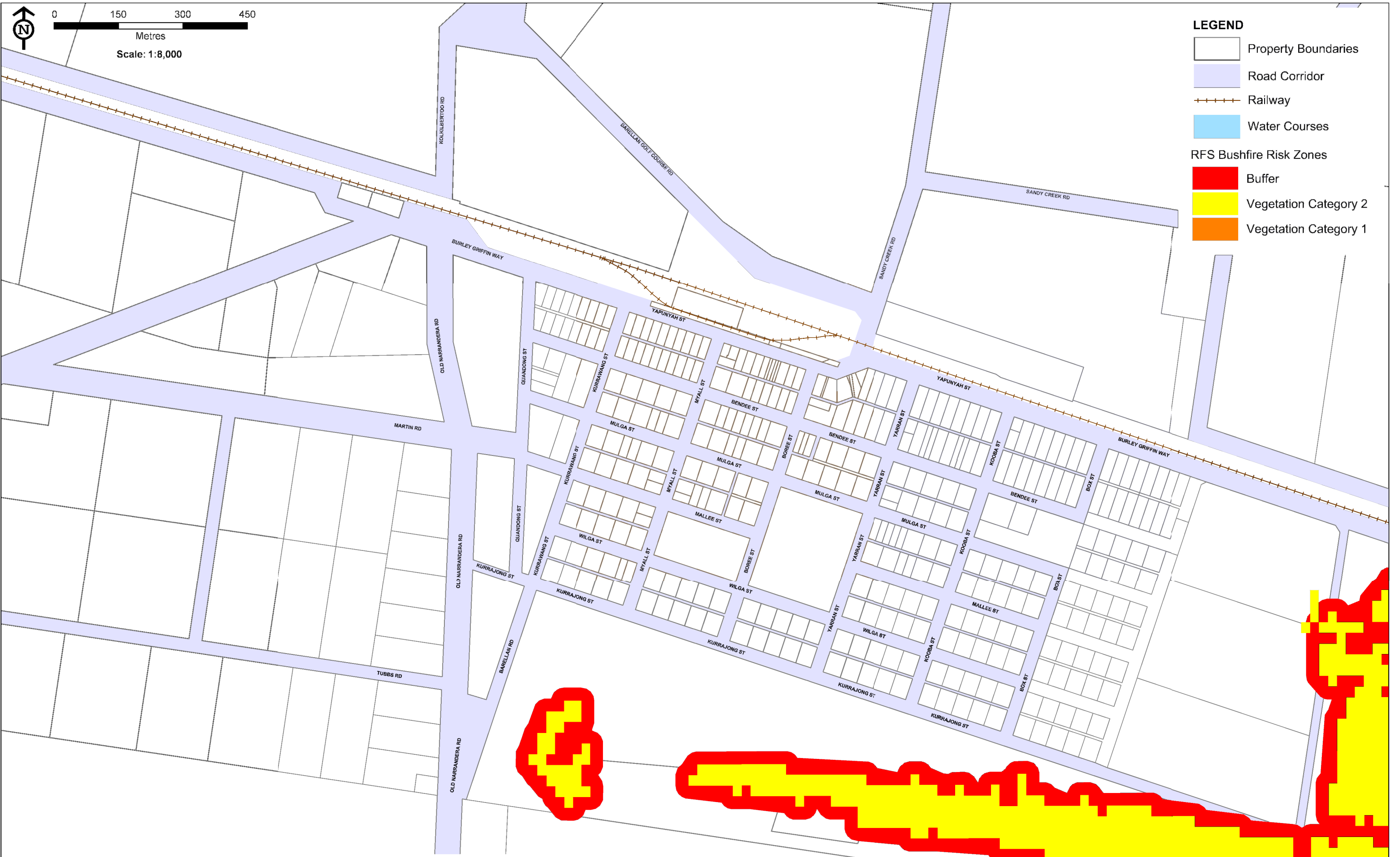
 Vegetation Category 2

 Vegetation Category 1





- LEGEND**
-  Property Boundaries
 -  Road Corridor
 -  Railway
 -  Water Courses
- RFS Bushfire Risk Zones**
-  Buffer
 -  Vegetation Category 2
 -  Vegetation Category 1





0 150 300 450

Metres

Scale: 1:8,000

LEGEND

-  Property Boundaries
-  Road Corridor
-  Railway
-  Water Courses
- RFS Bushfire Risk Zones**
-  Buffer
-  Vegetation Category 2
-  Vegetation Category 1




Narrandera
 NARRANDERA SHIRE COUNCIL
 141 East Street
 Narrandera NSW 2700
 Ph: 02 6959 5510

DCP 2012
GRONG GRONG VILLAGE

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Date: 28/11/2011
 Compiled by:
 GIS Narrandera
 Co-ordinate System:
 MGA 94 Zone 55
 Ref: 2011-181