



Natural Hazards Risk and Resilience Report

Barcaldine Region Planning Scheme

Prepared for
Barcaldine Regional Council

24 March 2022~~23 March 2022~~

Contents

1	Introduction	2
2	Regional Context	3
3	Flood Hazards	4
3.1	<i>Outcome 1 – Identifying Natural Hazard Areas</i>	4
3.1.1	Barcaldine	4
3.1.2	Aramac	4
3.1.3	Muttaburra	4
3.1.4	Alpha	5
3.1.5	Jericho	6
3.2	<i>Outcome 2 – Achieving an Acceptable or Tolerable Level of Risk</i>	6
3.2.1	Barcaldine	7
3.2.2	Aramac	98
3.2.3	Muttaburra	109
3.2.4	Alpha	1140
3.2.5	Jericho	1411
3.3	<i>Outcome 3 – Development Requirement Provisions</i>	1512
4	Bushfire Hazards	1815
4.1	<i>Outcome 1 – Identifying Natural Hazard Areas</i>	1815
4.2	<i>Outcome 2 – Achieving an Acceptable or Tolerable Level of Risk</i>	1916
4.2.1	Barcaldine	1916
4.2.2	Aramac	2017
4.2.3	Muttaburra	2118
4.2.4	Alpha	2219
4.2.5	Jericho	2320
4.2.6	Rural areas generally	2320
4.3	<i>Outcome 3 – Development Requirement Provisions</i>	2421
5	Landslide Hazard	2623
5.1	<i>Outcome 1 – Identifying Natural Hazard Areas</i>	2623
6	Conclusion	2724

Information About this Report

This report was originally drafted in 2019 by the (then) Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) on behalf of Barcaldine Regional Council, as part of the preparation of the proposed planning scheme as a template planning scheme. The preparation of the proposed planning scheme was subsequently transferred to Council, who engaged Reel Planning to assist with this process. A range of changes have been made to the proposed planning scheme since 2019. This report is based on the original version of the report prepared by DSDMIP. Changes to this report have been made insofar as those changes are required to reflect changes made to the proposed planning scheme by Council, however the overarching principles, structure and approach of the report have not been amended, to ensure consistency and efficiency, acknowledging the significant work already undertaken by DSDMIP. At the request of the Department of State Development, Infrastructure, Local Government in Planning in the course of the state interest review process, the report has been further revised to incorporate advice commissioned by Council from ACS Engineers in 2021.

1 Introduction

This Natural Hazards, Risk and Resilience Report has been prepared in support of the draft Barcaldine Region Planning Scheme (‘the proposed planning scheme’). The report details how the proposed planning scheme responds to the State Planning Policy 2017 (‘the SPP’), specifically the State Interest for Natural Hazards, Risk and Resilience. Each natural hazard is addressed in separate sections of the report.

This report demonstrates a fit for purpose risk assessment has been applied to natural hazards in the Barcaldine Region local government area. This risk assessment includes consideration of the following natural hazards:

- Flood hazards
- Bushfire hazards
- Landslide hazards

Based upon each of the hazards detailed above, this fit for purpose risk assessment outlines:

- how the hazards areas have been identified;
- the level of risk associated with the hazard areas; and
- what measures have been included in the proposed planning scheme to address the level of risk.

The SPP state interest guidance *“Natural Hazards, Risk and Resilience Technical Manual – Evaluation report”* documents are provided for bushfire, flood and landslide hazards. A response has been provided to each outcome and each requirement taken from the relevant state interest guidance documents. A summary of how the proposed planning scheme addresses and responds to each relevant hazard has been developed based on the outcomes and requirements in the other guidance documents.



2 Regional Context

This report applies to the local government area of Barcaldine Regional Council. The Barcaldine Regional local government area is approximately 54,000km². It has current population of 2,852 people (2018) which is expected to decrease by 1.0% over the next 25 years.

The Barcaldine Region local government area is serviced by the townships of Barcaldine, Alpha, Aramac, Jericho and Muttaborra. Barcaldine has a population size of 1,422 persons, Alpha 335 people, Aramac 299 people, Jericho 115 people and Muttaborra 88 people (2016 census).

Barcaldine Regional Council has a local disaster management plan (reviewed 2018) and localised flood mitigation studies for Alpha and Jericho which provide responses to natural hazards such as flooding and bushfires for its local community. Both documents have been considered in this assessment.

3 Flood Hazards

This chapter discusses how the proposed planning scheme reflects and responds to the SPP state interest guidance document *Natural Hazards, Risk and Resilience Technical Manual – Evaluation Report: Flood Hazards* (Flood Hazards Technical Manual).

The towns within the region are prone to both inundation and isolation during flood events due to their location near or adjacent to watercourses. Barcaldine is located to the east of Lagoon Creek, Muttaborra is located to the west of the Thomson River, Alpha is located to the west of Alpha Creek, Jericho is located to the west of Jordan Creek and Aramac is located to the north-east of Aramac Creek.

To ensure that opportunities for investment and economic growth across the region are not diminished by known risks to property and livelihoods from recurrent flood events, development within the towns in the region is to be reasonably regulated to achieve an acceptable level of resilience to these flood events, where appropriate. Development outcomes on flood-affected land, including development siting, layout, design, access and evacuation options, will be carefully managed so that risk to personal safety, property and the environment during future flood events is minimised.

3.1 Outcome 1 – Identifying Natural Hazard Areas

3.1.1 Barcaldine

The township of Barcaldine is bound to the north by Lagoon Creek and to the south by the Alice River. The report prepared by DHI for the Queensland Reconstruction Authority (QRA) titled “*Flood Hazard Mapping – Barcaldine – Bundle 1.*” dated January 2013 mapped the following flood events:

- April 1990 flood event (8.96 metres at BoM Gauge 36157)
- 2% AEP design event (8.95 metres at BoM Gauge 36157)
- 1% AEP design event (9.58 metres at BoM Gauge 36157)
- 0.2% AEP design event (11.49 metres at BoM Gauge 36157)

For the township of Barcaldine, the 1% AEP design event has been used as the basis to identify the flood hazard area. This will provide greater flood immunity than the April 1990 flood event.

3.1.2 Aramac

The township of Aramac is bound to the south by Aramac Creek. The report prepared by DHI for the Queensland Reconstruction Authority (QRA) titled “*Flood Hazard Mapping – Aramac – Bundle 1.*” dated January 2013 mapped the following flood events:

- April 1990 flood event (5.49 metres at BoM Gauge 36162)
- 2% AEP design event (6.08 metres at BoM Gauge 36162)
- 1% AEP design event (6.77 metres at BoM Gauge 36162)
- 0.2% AEP design event (8.22 metres at BoM Gauge 36162)

For the township of Aramac, the 1% AEP design event has been used as the basis to identify the flood hazard area. This will provide greater flood immunity than the April 1990 flood event.

3.1.3 Muttaborra

The township of Muttaborra is bound to the east by the Thomson River. The report prepared by DHI for the Queensland Reconstruction Authority (QRA) titled “*Flood Hazard Mapping – Muttaborra – Bundle 1.*” dated January 2013 mapped the following flood events:

- 1955 flood event (8.48 metres at BoM Gauge 36037)
- 5% AEP design event (7.62 metres at BoM Gauge 36037)
- 1% AEP design event (8.97 metres at BoM Gauge 36037)

- 0.2% AEP design event (10.48m at BoM Gauge 36037)

For the township of Muttaborra, the 1% AEP design event has been used as the basis to identify the flood hazard area. This will provide greater flood immunity than the 1955 flood event.

3.1.4 Alpha

The township of Alpha is bound at the east by Alpha Creek which forms part of the upper catchment of the Burdekin River system. A levee was constructed in 1983 on the western bank between the old hospital and the Capricorn Highway. During the 1990 flood event the levee was breached and has never been reinstated.

The report prepared by Connell Wagner for Barcaldine Regional Council titled “*Alpha Town Flood Mitigation Study*” dated 2 July 2008 investigated flood mitigation works. The scope of the study included the development of a two-dimensional hydraulic model of Alpha Creek and its floodplain to the confluence with Native Companion Creek. The model was calibrated against the following flood events:

- April 1990 flood event (10.26 metres [351.86 metres AHD] at BoM Gauge 35229)
- February 1997 flood event (7.45 metres [349.05 metres AHD] at BoM Gauge 35229)
- February 2003 flood event (7.5 metres [349.10 metres AHD] at BoM Gauge 35229)

It is acknowledged in the supporting flood study that both the 1997 and 2003 flood events did not indicate flood waters entering the township of Alpha. In the 1990 flood event when the levee was breached the maximum depth of flood waters recorded in the township of Alpha was approximately 2.5 metres.

Limited available data (i.e. rainfall and stream gauge records) provided a challenge in modelling the design flood events. The flood study determined that the historical 1990 flood event was equivalent to a 100 year ARI design event and that the 1997 and 2003 flood event were equivalent to smaller than a 50 year ARI design event.

A hazard review of the 1990 flood event is represented in a preliminary flood hazard map for the town area of Alpha, which shows the majority of the town centre within the extreme flood hazard. The velocities were in the order of 0.4 – 0.8 m/s (medium to high hazard) however the flood depths at approximately 2.5 metres triggered high to extreme flood hazard.

The flood study made recommendations on acceptable planning and development control measures that could be implemented, such as:

- prevent new development in areas subject to flooding (the study noted this may not be practical);
- limit the filling of lots as this could have an adverse effect on surrounding properties if flood waters are redirected; and
- freeboard above the highest known flood level would facilitate the passage of floodwaters without inundation to habitable floor levels.

On 11 May 2011, Council adopted the following planning control measures for future development in Alpha:

"The minimum building floor height (distance from the ground to the bottom of the floor bearer) of any new structure constructed in the Alpha Town Area must be 300mm above the levels determined by the 1990 historic event as described in the Alpha Town Flood Mitigation Report compiled by Connell Wagner in clauses 10.2.3 and 10.2.4 as equivalent to the 1990 information available and any structure, including any associated works, must not in any way redirect flood waters."

It is best practice for local governments to declare flood hazard areas and adopt defined flood levels (DFL) in accordance with Section 13 of the *Building Regulation 2006*. The resolution refers to Section 10.2.3 and 10.2.4 of the Alpha Town Flood Mitigation Report which provide limited details on the 1990 flood event, and for the purposes of interpreting the planning control the 1990 flood event is the defined flood event. The defined flood event for the April 1990 flood event is measured 10.26 metres (351.86 metres AHD) at BoM Gauge 35229.

Council's adopted planning control measures require:

- Review of a flood map of the 1990 flood event to determine if the property is in the defined floodplain;

- Determination of the flood level for the property based on the recorded 1990 flood event (a detailed site survey would be required to accurately determine this);
- Application of a freeboard of 600mm to the 1990 flood level in order to calculate the minimum habitable floor level to which the new building must be constructed;
- Buildings to be designed and constructed to withstand flood impacts, including the design of footings and foundations to take into account static and dynamic loads (including debris loads and any reduced bearing capacity owing to submerged soils) (Flood Resilient Building Guidance for Queensland Homes, 2019)
- Preparation of a Flood Risk Assessment to determine whether the development is acceptable;
- All development, including planning and building approvals within the flood zone to trigger at a minimum an assessable development (Code for low and medium hazard areas and Impact for high and extreme hazard areas) application.

The increased minimum freeboard (from 300mm to 600mm) should accommodate the potential impacts from climate change factors on flood depths.

3.1.5 Jericho

The township of Jericho is located in the floodplain of Jordan Creek which flows in a northerly direction along the eastern edge of town, joins the Alice River and then flows to the west to join the Barcoo River. The majority of the town area of Jericho was inundated by flood waters during the 1990 flood event. The former Jericho Shire constructed a ring levee to the south and east of the town. Ongoing monitoring and maintenance of the levee is undertaken by Council.

The report prepared by Connell Wagner for the former Jericho Shire Council titled “*Jericho Town Flood Mitigation Study*” dated 25 November 2002 investigated flood mitigation works. The scope of the study included the development of a two-dimensional hydraulic model of Jordan Creek and its floodplain. The model was calibrated against the following flood events:

- April 1990 flood event (350.3 metres AHD adjacent to the Creek near the Weir, no official flood gauge at Jericho as a result post flood surveys were undertaken) with a maximum flood depth in the town area of up to one (1) metre occurring in the north west corner of the town.
- February 1997 flood event (7.45 metres [349.05 metres AHD] at BoM Gauge 35229)

It is understood that the levee was upgraded in 2012 after the February 2012 flood event where the freeboard was breached by flood waters in the north western corner and at the junction with the rail line. The upgrade works have been undertaken by Council to ensure that the levee is designed with a freeboard of 300mm above a 50 year ARI flood event.


On 11 May 2011, Council adopted the following planning control measures for future development in Jericho, in addition to the flood mitigation works, as follows:

"The minimum building floor height (distance from the ground to the bottom of the floor bearer) of any new structure constructed in the Jericho Town Area must be 300mm above the highest levels determined by the 2002 Jericho Town Flood Mitigation Study by Connell Wagner and any structure, including any associated works, must not in any way redirect flood waters."

The same methodology from Alpha is applied to the town area of Jericho for determining the minimum floor heights for any new buildings. The flood study noted that insufficient data was available for the 1990 flood event and that no defined flood level is provided in the control measure.

3.2 Outcome 2 – Achieving an Acceptable or Tolerable Level of Risk

The Barcaldine Region has a history of being impacted by flood events. The impacts from the flood events have varied and depend upon the severity of the event. These events have historically caused localised disruptions and property damage.



For the townships of Barcaldine, Aramac and Muttaborra, the 1% AEP design event for flooding has been used as the basis for identifying the flood hazard areas. This design event is a commonly used design event for flood hazards and is considered acceptable to the level of risk that flooding represents in these towns.

For the townships of Alpha and Jericho, the SPP Interactive Mapping System Flood Hazard Area – Level 1 – Queensland Floodplain Assessment Overlay has been used. For Jericho, this layer has been used as this represents the best information available. For Alpha, the Queensland Floodplain Assessment Overlay has been used, however is supplemented by a report and mapping prepared by Connell Wagner for Barcaldine Regional Council titled “Alpha Town Flood Mitigation Study” and dated 2 July 2008.

The scope of the study included the development of a two-dimensional hydraulic model of Alpha Creek and its floodplain to the confluence with Native Companion Creek. A hazard review of a 1990 Flood Event is represented in a preliminary flood hazard map for the town area of Alpha, which shows the majority of the town centre within the extreme flood hazard area. This data has informed the development of the Alpha High and Extreme Flood Hazard Area category on the Flood Hazard Overlay Map.

The proposed planning scheme includes categories of development and assessment that regulate development in the Natural Hazards Overlay. Outside the Alpha high and extreme flood hazard overlay area, development is generally categorised as Assessable Development that is subject to Code Assessment. In the Alpha high and extreme flood hazard overlay area development is generally categorised as Assessable Development that is subject to Impact Assessment

3.2.1 Barcaldine

For the township of Barcaldine, flood mapping shows that the 1% AEP event inundates those parts of the town which front Lagoon Creek (refer to **Figure 1**).

The areas impacted by flooding include land located in the following planning scheme zones:

- Community Facilities Zone, including land in the:
 - Operational and Utility Precinct
 - Community Services Precinct
- Recreation and Open Space Zone;
- Rural Zone;
- Rural Residential Zone;
- Township Zone, including:
 - approximately 66 properties which are completely or substantially inundated;
 - 20 lots which are partially inundated;
 - 1 lot in the Industrial Precinct which is partially inundated.

Note: Substantially inundated means inundation to such an extent that it would be difficult to locate development consistent with the zone outside of the flood affected area.

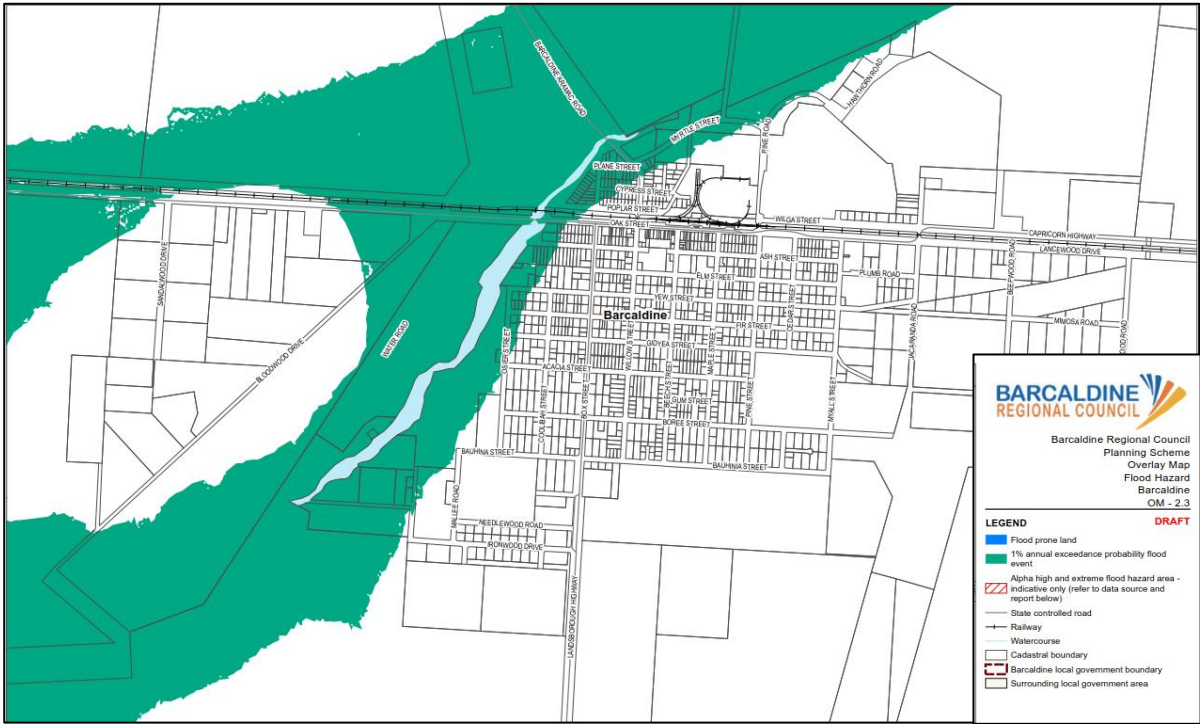


Figure 1 Extract of Flood Mapping for Barcaldine

3.2.2 Aramac

For the township of Aramac, flood mapping shows that the 1% AEP event inundates parts of the town (refer to **Figure 2**). The deeper areas of inundation occur over those properties which are located in the western and southern parts of the town.

The areas impacted by flooding include land located in the following planning scheme zones:

- Community Facilities Zone, including land in the:
 - Education Precinct
 - Emergency Services Precinct
 - Operational and Utility Precinct
 - Cemetery Precinct
 - Community Services Precinct
 - Cultural Precinct;
- Recreation Zone and Open Space Zone;
- Rural Zone;
- Township Zone, including:
 - approximately 69 properties which are completely or substantially inundated;
 - 9 lots which are partially inundated;
 - 1 lot within the Industrial Precinct which is partially inundated.

Note: Substantially inundated means inundation to such an extent that it would be difficult to locate development consistent with the zone outside of the flood affected area.

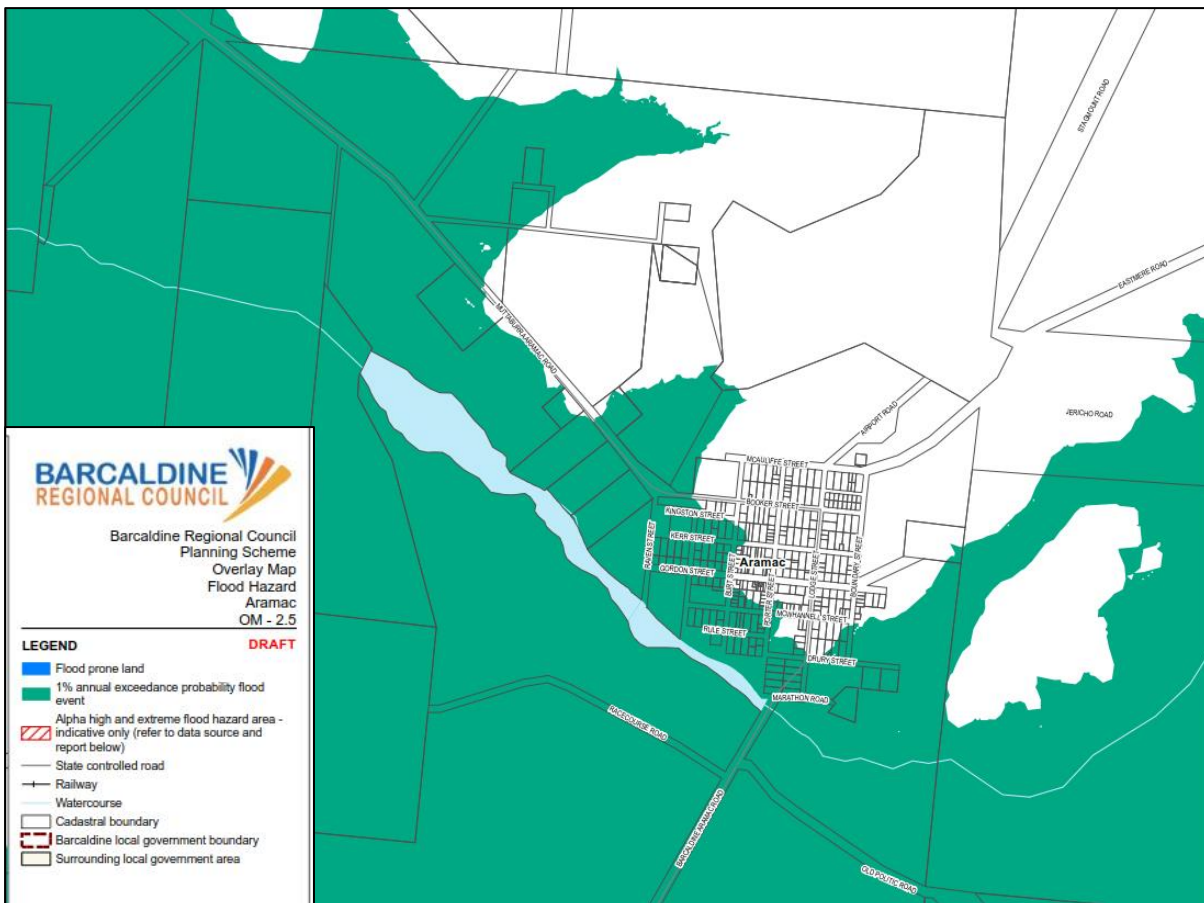


Figure 2 Extract of Flood Mapping for Aramac

3.2.3 Muttaborra

For the township of Muttaborra, flood mapping shows that the 1% AEP event inundates parts of the town (refer to **Figure 3**). The deeper areas of inundation occur over those properties which are located in the northern and eastern parts of the town.

The areas impacted by flooding include land located in the following planning scheme zones:

- Community Facilities Zone, including land in the:
 - Operational and Utility Precinct
 - Emergency Services Precinct
- Recreation and Open Space Zone;
- Rural Zone;
- Township Zone, including:
 - approximately 63 properties which are completely or substantially inundated;
 - 10 lots which are partially inundated.

Note: Substantially inundated means inundation to such an extent that it would be difficult to locate development consistent with the zone outside of the flood affected area.

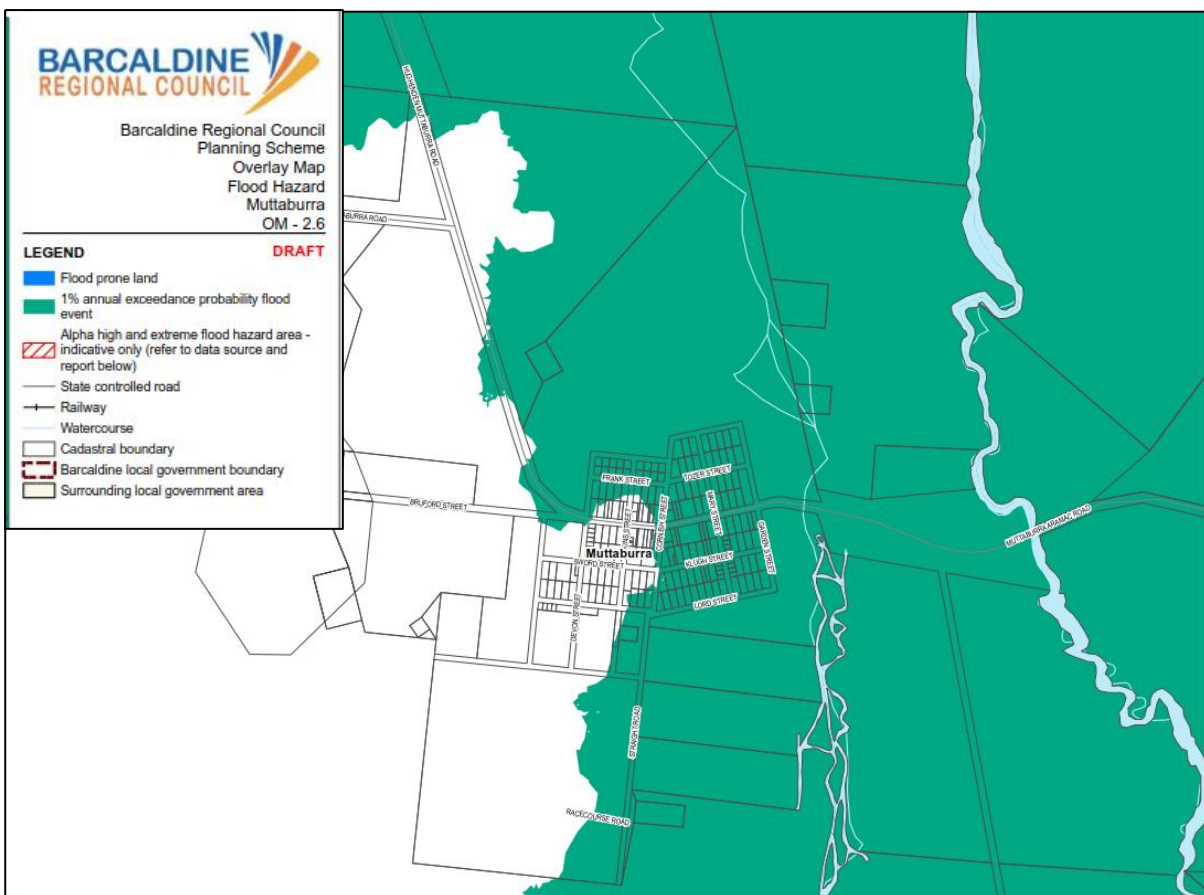


Figure 3 Extract of Flood Mapping for Muttaborra

3.2.4 Alpha


For the township of Alpha, flooding of the Alpha Creek impacts on the populated areas of the town. The previously cited report prepared by Connell Wagner titled “*Alpha Town Flood Mitigation Study*” dated 2 July 2008 included the development of a two-dimensional hydraulic model of Alpha Creek and its floodplain to the confluence with Native Companion Creek. This model has been used in conjunction with the Queensland Floodplain Overlay Assessment to map the Flood Prone Land and the Alpha High and Extreme Flood Hazard Area shown on the overlay map.

The areas impacted by flooding include land located in the following planning scheme zones:

- Community Facilities Zone, including land within the:
 - Education Precinct
 - Health Care Precinct
 - Emergency Services Precinct
 - Operational and Utility Precinct
 - Government and Administration Precinct
 - Community Services Precinct
 - Cultural Precinct
- Recreation and Open Space Zone;
- Rural Zone;
- Township Zone, including:
 - 312 lots which are completely or substantially inundated;
 - 4 lots which are partially inundated;
 - 2 lots in the Industrial Precinct which are partially inundated.

The lots impacted by the flood mapping of Alpha in terms of developed, undeveloped and land use include:

- **Impacted (completely or substantially inundated) lots:**
 - Developed – total 259 lots:
 - Community Facilities Zone – 14 lots
 - Rural Zone – 25 lots
 - Township Zone (residential and commercial properties) – 220 lots
 - Undeveloped – total 119 lots:
 - Community Facilities Zone – 1 lot
 - Rural Zone – 29 lots
 - Township Zone (residential and commercial properties) – 86 lots
 - Recreation and Open Space Zone – 3 lots
- **Partially impacted lots (flooding on lot but not impacting existing infrastructure/dwellings or adequate flood free land available for future infrastructure/dwellings):**
 - Developed – total 5 lots:
 - Community Facilities Zone – 2 lots
 - Township Zone (residential and commercial properties) – 2 lots
 - Undeveloped – total 9 lots:
 - Community Facilities Zone – 2 lots
 - Rural Zone – 3 lots
 - Township Zone (residential and commercial properties) – 4 lots



In Alpha, the residential housing is typically highset therefore providing some flood hazard protection. According to Barcaldine Region Planning Scheme, the largest flood in the recorded history of Alpha occurred in 1990 with a height of 10.26 m and approximately 75% of houses flooded. Flooding in the lowest areas of town experienced flood depths of up to 3 m across the properties.

The town of Alpha utilises an early flood warning system and a Disaster Management Plan (Information and Warnings Sub Plan and Evacuation Sub Plan) as the adopted flood mitigation measures. There are currently no physical flood mitigation measures in place for the township.

Prior to a potential and during an actual flooding event, data and bulletins from the following sources need to be taken into consideration:

- Bureau of Meteorology (BOM) rainfall and river height predictions, warnings and bulletins
- River height and rainfall station data specifically from Alpha and sites upstream including Zeta and Rivington (to the south)

The Barcaldine Regional Council (BRC), the Local Disaster Management Group (LDMG) and the Local Disaster Coordinator (LDC) jointly, will contribute to the updating of the Barcaldine Regional Council Disaster Management Plan and sub plan to provide clear detail on triggers for the township or specific regions within the township to be evacuated. In the event of a flood emergency evacuation orders will be communicated to residents via emergency services and the LDMG. All emergency services are located outside the flood zone therefore will not need to be evacuated and will be accessible in case of emergencies.

During a flooding event, Alpha Golf Club (1 km from the town centre) and Alpha Racecourse (3km from town centre) are the nominated sites for evacuation centres. The Alpha Town Hall is not a suitable evacuation centre as it is located within the flood zone. The nominated evacuation sites are situated to the west of Alpha Creek and adjacent to the Capricorn Highway. Both locations will allow for set up of an evacuation centre for the population of Alpha of approximately 335 people (Census, 2016). These venues are equipped with large open areas and large clubhouses/undercover areas. Commercial kitchens and power are also available if extended evacuation is necessary.

During a flooding event, access to the north, south and east is most likely to be cut due to flooding. Alpha Creek Bridge has a high flood immunity although most land surrounding the bridge becomes inundated therefore it is not recommended to be used as an evacuation route during a flood event. The railway line will also likely be shut down. Therefore, evacuating to locations outside of Alpha is not recommended due to the flooding that may occur along the Capricorn Highway. The town within closest proximity to the west is Jericho which also has an extreme risk of flooding.

The Alpha flood and rainfall gauging station utilises manual recordings. To improve the quality and timeliness of flood warning information the gauging station should be upgraded to an automatic recording and remote data transmission capability.

The township of Alpha has been frequently impacted by floods for the past 70 years therefore the residents have a high awareness and reasonable tolerability of flooding events. The frequent flooding occurs due to the proximity to Alpha Creek and the relatively flat terrain throughout the town.

According to the 2016 Census, Alpha has a small population of 335 people with a medium age of 43 years old. The population is made up of approximately 17.5% aged 0 – 14 years and 19.0% aged 65 years and over. There is an average of 2.2 motor vehicles per dwelling. The majority of dwellings are high-set detached timber houses.

While the township of Alpha is vulnerable to flooding the community itself is considered to have a reasonably low vulnerability due to the relative age of the population, the ability to self evacuate, the awareness of flood potential and the ease with which the at risk population can be notified of imminent flood risk.

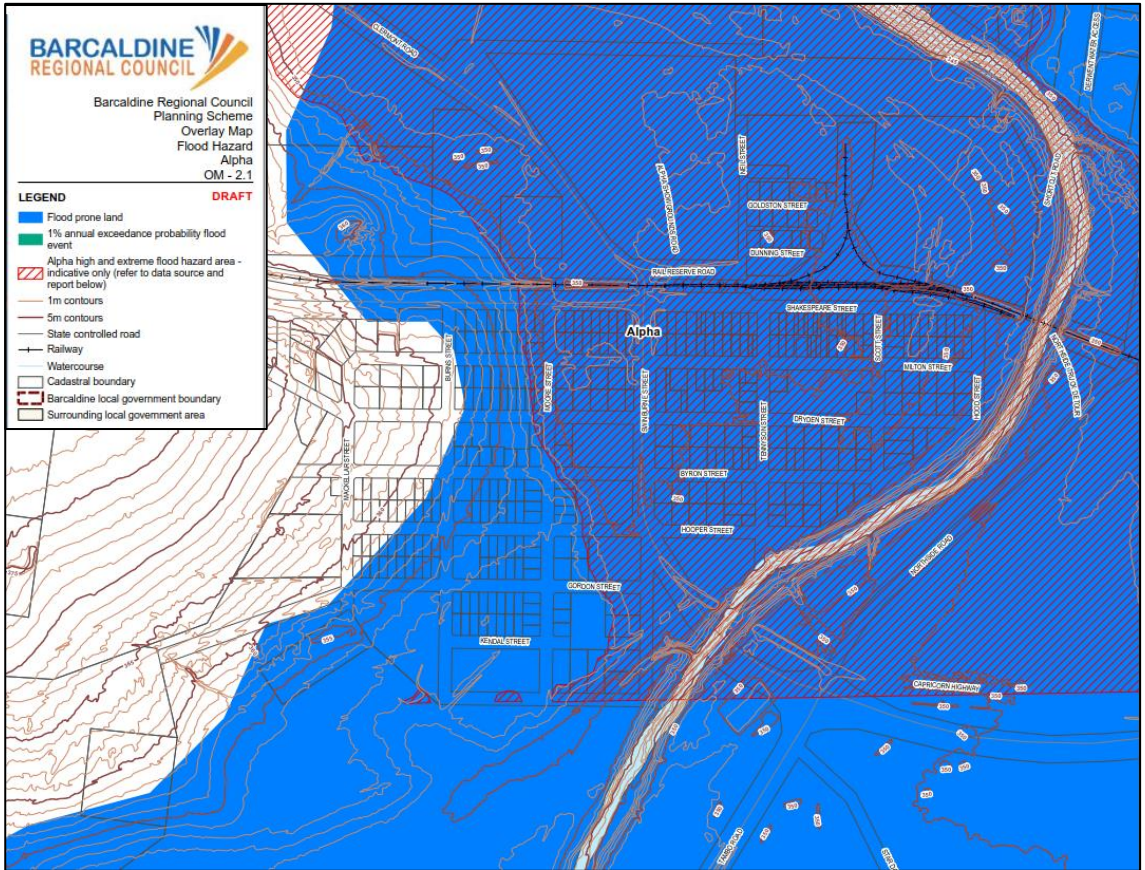


Figure 4 Extract of Flood Mapping for Alpha

3.3 Outcome 3 – Development Requirement Provisions

As all the townships within the Barcaldine Region are impacted by flooding to varying degrees. Although no changes in zoning are proposed based upon this assessment, planning provisions are proposed based upon an avoid and mitigate approach, in accordance with the SPP 2017.

Accordingly, future development should be located outside of flood affected areas, however where this is not possible, development needs to be designed so as to not expose people or property to unacceptable risks.

The planning provisions have been developed in accordance with the *State Planning Policy – State Interest Guidance Material: Natural Hazards, Risks and Resilience – Flood* to ensure the planning provisions were developed in a manner consistent with the relevant standards.

Flood risk mapping has been provided for the entirety of the region, as shown in Section 3.2 of this report.

Table 1 Flood Risk and Planning Response Assessment

Planning Response	Planning Strategy	Planning Scheme Provisions								
Limit certain land uses that are not appropriate for the hazard	Adjust current zonings to reflect appropriate land use	Current zoning extents have not been adjusted, however, provisions in the proposed planning scheme have strengthened flood resilience. No new areas are proposed to be zoned for development.								
Categories of development and assessment appropriate for the hazard	Uses which increase people residing in flood prone areas require assessment	<p>The categorisation table for overlays categories development as follows:</p> <table border="1"> <thead> <tr> <th colspan="2">Assessable Development – Code Assessment</th> </tr> </thead> <tbody> <tr> <td>Any: (a) Material Change of Use (where categorised as Assessable development in the relevant zone); (b) Reconfiguring a Lot; or (c) Carrying out operational work where for filling, excavation or drainage work,</td> <td>If within an area identified as ‘flood prone land’ or ‘1% annual exceedance probability flood event’ overlay area on Maps OM-2.0 to OM-2.6.</td> </tr> <tr> <th colspan="2">Assessable Development – Impact Assessment</th> </tr> <tr> <td>Any: (a) Material Change of Use; (b) Reconfiguring a Lot; or (c) Carrying out operational work where for filling, excavation or drainage work,</td> <td>If within an area identified as an ‘Alpha high and extreme flood hazard’ overlay area on Maps OM2.0-OM2.6.</td> </tr> </tbody> </table>	Assessable Development – Code Assessment		Any: (a) Material Change of Use (where categorised as Assessable development in the relevant zone); (b) Reconfiguring a Lot; or (c) Carrying out operational work where for filling, excavation or drainage work,	If within an area identified as ‘flood prone land’ or ‘1% annual exceedance probability flood event’ overlay area on Maps OM-2.0 to OM-2.6.	Assessable Development – Impact Assessment		Any: (a) Material Change of Use; (b) Reconfiguring a Lot; or (c) Carrying out operational work where for filling, excavation or drainage work,	If within an area identified as an ‘Alpha high and extreme flood hazard’ overlay area on Maps OM2.0-OM2.6.
Assessable Development – Code Assessment										
Any: (a) Material Change of Use (where categorised as Assessable development in the relevant zone); (b) Reconfiguring a Lot; or (c) Carrying out operational work where for filling, excavation or drainage work,	If within an area identified as ‘flood prone land’ or ‘1% annual exceedance probability flood event’ overlay area on Maps OM-2.0 to OM-2.6.									
Assessable Development – Impact Assessment										
Any: (a) Material Change of Use; (b) Reconfiguring a Lot; or (c) Carrying out operational work where for filling, excavation or drainage work,	If within an area identified as an ‘Alpha high and extreme flood hazard’ overlay area on Maps OM2.0-OM2.6.									
New development to avoid flood prone areas or mitigates the risk	Include planning code provisions to address the risk	The Natural Hazards Overlay Code includes provisions to ensure new development avoids flood prone areas or alternatively a flood management plan is prepared.								
Support built form change over time	Make future development resilient to the hazard	<p>The Natural Hazards Overlay Code includes provisions for:</p> <ul style="list-style-type: none"> Development on Flood Prone Land (except for land within the Alpha high and extreme flood hazard area) to ensure the finished floor level of any replacement or alteration to an existing non-residential building, or of a habitable room, is to be 600mm above the defined flood level. 								

Planning Response	Planning Strategy	Planning Scheme Provisions
		<ul style="list-style-type: none"> Development within a Flood Hazard Area (for land within the Alpha high and extreme flood hazard area) to ensure development does not involve new buildings and structures.
Flooding is not made worse	Filling and excavation in floodplain areas is minimised	<p>Filling, excavation and drainage work is:</p> <ul style="list-style-type: none"> Assessable Development – Code Assessment if within an area identified as ‘flood prone land’ or ‘1% annual exceedance probability flood event’ overlay area on Maps OM-2.0 to OM-2.6; and Assessable Development – Impact Assessment, if within an area identified as an ‘Alpha high and extreme flood hazard’ overlay area on Maps OM2.0-OM2.6. <p>AO11 of the Natural Hazards Overlay Code limits net filling to 10m³.</p>
Community resilience to flooding is improved	Include planning code requirements to enable development to address the risk	<p>Community Services and facilities that constitute a Material Change of Use are categorised as:</p> <ul style="list-style-type: none"> Assessable Development – Code Assessment, if within an area identified as ‘flood prone land’ or ‘1% annual exceedance probability flood event’ overlay area on Maps OM-2.0 to OM-2.6; and Assessable Development – Impact Assessment, if within an area identified as an ‘Alpha high and extreme flood hazard’ overlay area on Maps OM2.0-OM2.6. <p>The Natural Hazards Overlay Code sets out the Flood immunity requirements for community services and facilities at Table 7.2.2.3b.</p>
Future lots ensure any future development is not adversely impacted by flood hazard	Design of new lots to address the risk	<p>The Natural Hazards Overlay Code includes provisions that, where not in the Alpha high and extreme flood hazard area:</p> <ul style="list-style-type: none"> New lots are not created in mapped Flood Hazard Areas where land is subject to an unacceptable flood hazard risk; are located outside of the hazard area or maintain the necessary flood immunity; safe evacuation routes are established. <p>Where in the Alpha high and extreme flood hazard area, new lots are not created.</p>

A summary of the proposed planning scheme provisions relating to flood hazard is provided in **Table 2**.

Table 2 Proposed Planning Scheme Provisions - Flood Hazard

Part	Section	Provision
Part 3 Strategic Outcomes	3.2, 3.3, 3.4, 3.5 Strategic outcomes	3.2.1 Regional Outcomes
		3.2.2 Land Use Outcomes (The Barcaldine Region)
		3.4.1 Town Outcomes (The Town of Alpha)
		3.4.2 Land Use Outcomes (The Town of Alpha)
		3.5.2 Land Use Outcomes (The Towns of Jericho, Aramac and Muttaborra)
Part 5 Categories of Development and Assessment	5.8 Overlays	Table 5.8.1 - Overlays
Part 6 Zones	6.2.2 Emerging Community Zone Code	6.2.2.1 Purpose
	6.2.5 Rural Zone	6.2.5.1 Purpose
	6.2.7 Township zone code	6.2.7.2 Specific benchmarks for assessment Performance Outcome PO31
Part 7 Overlay Codes	7.2.3 Natural Hazards Overlay Code	Whole code
Part 8 Use Codes	8.3.3 Reconfiguring a Lot Code	8.3.3.3 Specific benchmarks for assessment
Schedule 2 – Mapping	Overlay Maps	OM2.0 -2.6 Overlay Map -Flood Hazard

4 Bushfire Hazards

This chapter discusses how the proposed planning scheme reflects and responds to the SPP state interest guidance document Natural Hazards, Risk and Resilience Technical Manual – Evaluation report: Bushfire hazards (Bushfire Hazards Technical Manual).

State bushfire mapping has been used to determine the extent of bushfire hazard in the Barcaldine Region local government area. The extent of the region subject to bushfire hazard is shown on the SPP mapping through the Bushfire Prone Areas. This mapping is not duplicated within the proposed planning scheme itself (such as through dedicated Bushfire Hazard Overlay maps). As such, State mapping is intended to be relied upon for the life of the proposed planning scheme.

The mapping applies to the whole of the region.

4.1 Outcome 1 – Identifying Natural Hazard Areas

The extent of potential bushfire hazard with varying levels of risk has been identified and mapped using State mapping resources. The region is prone to bushfire events and these areas are shown on SPP mapping – Safety and Resilience to Hazards (Natural Hazards Risk and Resilience – Bushfire Prone Area).

The bushfire prone mapping includes the following hazard areas:

- Very High Potential Bushfire Intensity
- High Potential Bushfire Intensity
- Medium Potential Bushfire Intensity
- Potential Impact Buffer

The towns in the Barcaldine region are affected only by the Medium Potential Bushfire Intensity and Potential Impact Buffer.

4.2 Outcome 2 – Achieving an Acceptable or Tolerable Level of Risk

4.2.1 Barcaldine

For the township of Barcaldine, the bushfire prone area affects the eastern and southern parts of the town. Land within the Township Zone - Industrial Precinct on the south side of town is affected and eastern parts of the same zone which are situated to the east of the town. Land within the Community Facilities Zone (Air Services Precinct) which is located to the east of the town is also affected. The extent of the bushfire prone area is shown in **Figure 6**.

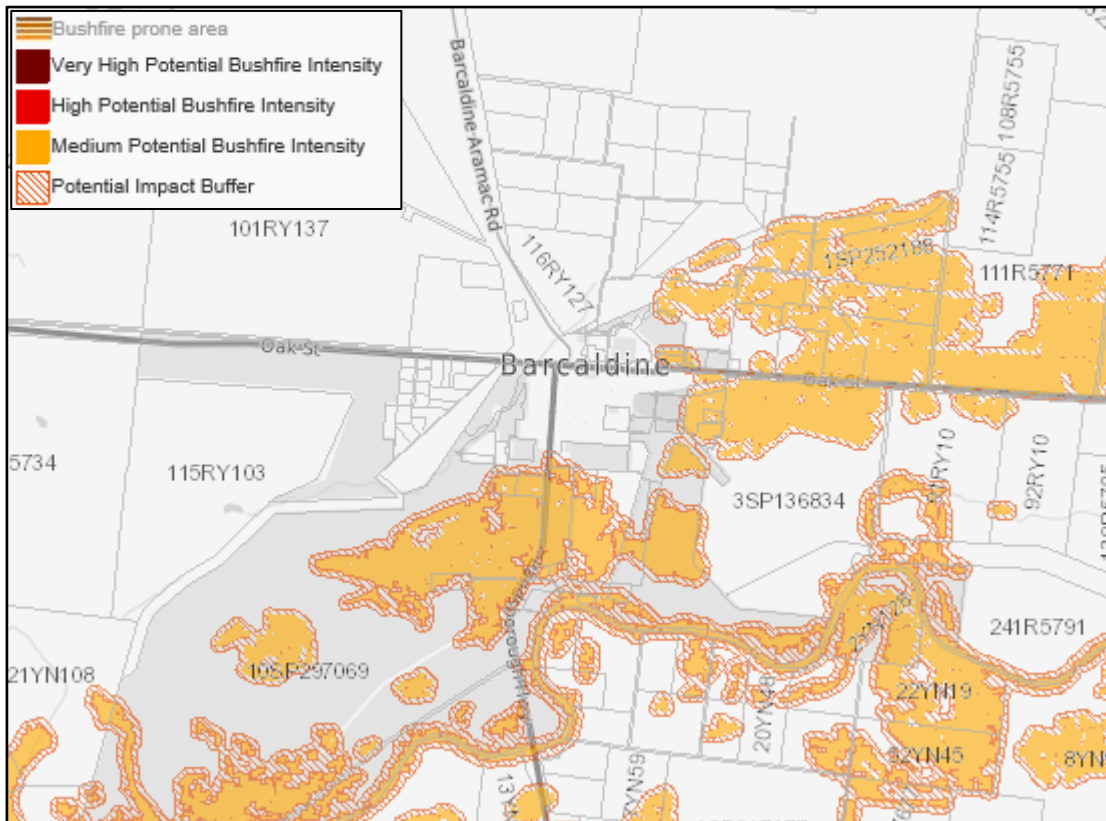


Figure 6 Extract of Bushfire Mapping for Barcaldine

4.2.2 Aramac

For the township of Aramac, the bushfire prone area does not impact on the Township Zone and is restricted to land within the Rural Zone to the east of the township. The extent of the bushfire prone area is shown in **Figure 7**.



Figure 7 Extract of Bushfire Mapping for Aramac

4.2.3 Muttaborra

For the township of Muttaborra, the bushfire prone area closely follows the Thomson River and its tributaries. Two properties in the north eastern part of the town are partially affected by the Potential Impact Buffer area. The land which is affected by the bushfire prone area is largely within the Rural Zone. The extent of the bushfire prone area is shown in **Figure 8**.

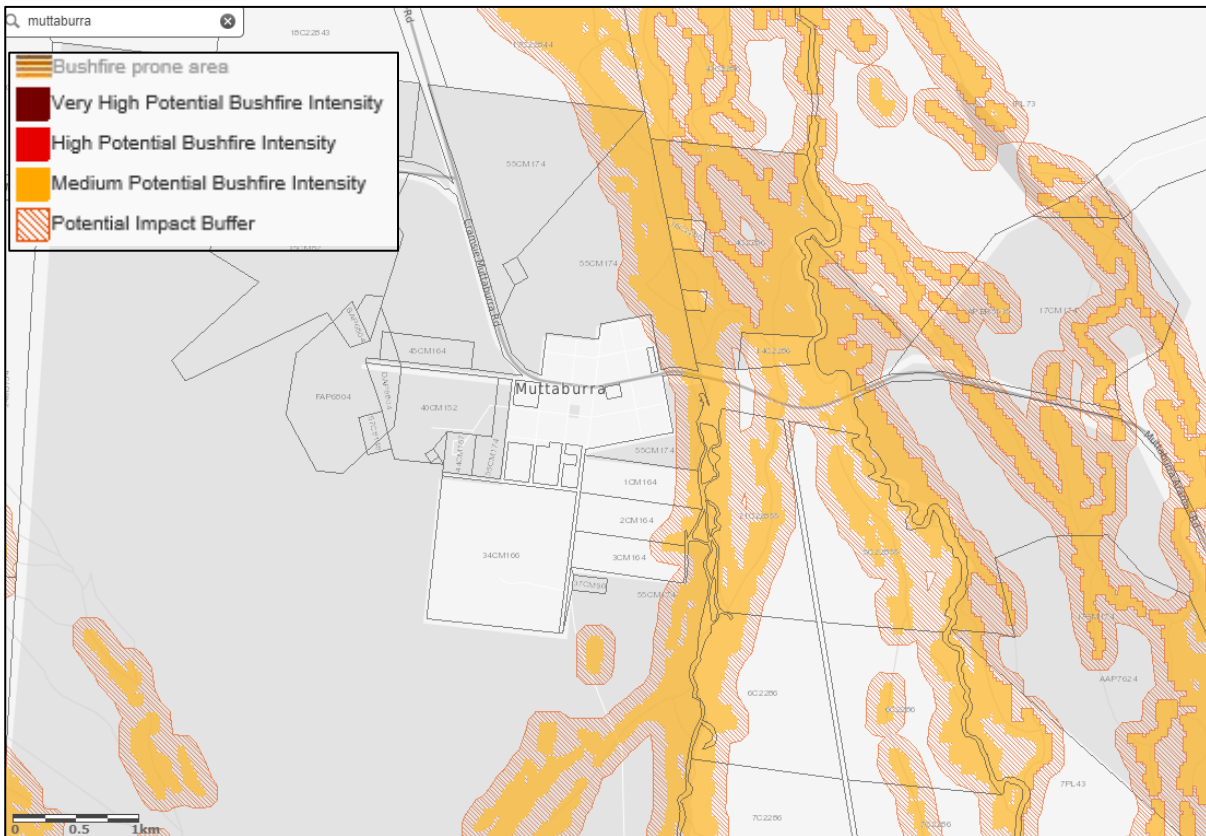


Figure 8 Extract of Bushfire Mapping for Muttaborra

4.2.4 Alpha

For the township of Alpha, the bushfire prone area impacts on those properties in the Township Zone which are primarily located close to the vegetated banks of Alpha Creek, as well as the Industrial Precinct at the north-western edge of the town.

The majority of these properties are mainly impacted by the Potential Impact Buffer area and partially by the area mapped as Medium Potential Bushfire Intensity. Parts of the Recreation and Open Space Zone are also affected by the bushfire prone area.

The extent of the bushfire prone area is shown in **Figure 9**.



Figure 9 Extract of Bushfire Mapping for Alpha

4.2.5 Jericho

As the township of Jericho is surrounded by vegetation, the bushfire prone area impacts different parts of the town. The south western part of the town is the area most affected as a number of properties (nine) are either completely or partially in the Medium Potential Bushfire Intensity Area. Other areas of the town are affected by the Potential Impact Buffer.

The extent of the bushfire prone area is shown in **Figure 10**.

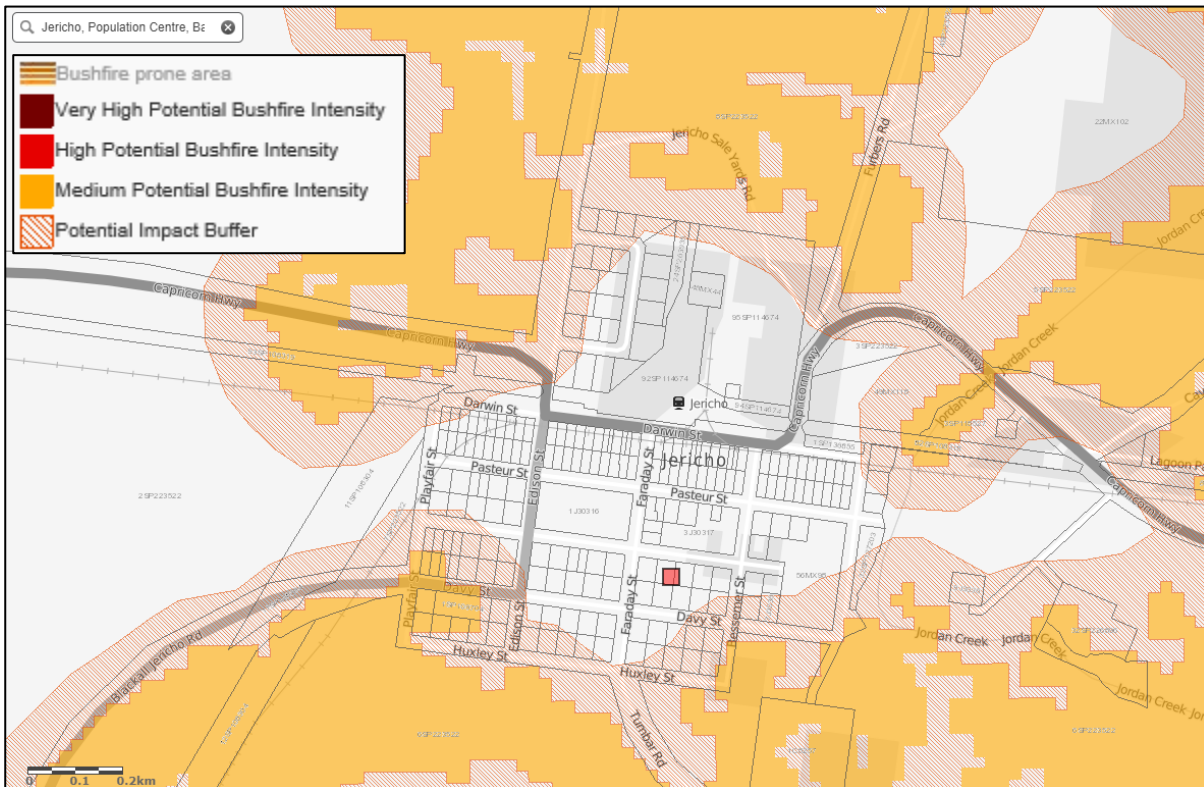


Figure 10 Extract of Bushfire Mapping for Jericho

4.2.6 Rural areas generally

Parts of rural areas of the Barcaldine region are impacted by the full range of bushfire prone areas (Very High, High and Medium Intensity Bushfire Areas and the Potential Impact Buffer). The High Bushfire Intensity Areas are generally located in remote heavily vegetated areas. Rural fires which may affect property and grazing areas are most common in the dry season following good rainfall.

4.3 Outcome 3 – Development Requirement Provisions

Given bushfire mapping impacts on the region, planning provisions have been included through the Natural Hazards Overlay to manage this natural hazard with an avoid and mitigate approach. This means new development should avoid areas known to be bushfire prone but, where unavoidable, must be built, designed and located to be resilient to bushfire hazards. Details of bushfire risk and planning provisions proposed are detailed below in **Table 3**.

Table 3 Bushfire Risk and Planning Response Assessment

Planning response	Planning strategy	Planning scheme provisions
Make no changes to existing land uses as risk is minimal	No up or down zoning in bushfire prone areas	Maintain proposed planning scheme zoning.
Categories of development and assessment appropriate for the hazard	Uses which increase people residing in bushfire prone areas require assessment	The categorisation table for overlays does not change the category of development and assessment for Material Change of Use or Reconfiguring a Lot, if within an area identified as a bushfire prone area of SPP mapping – Hazards and Safety, Natural Hazards, Bushfire.
New development to avoid bushfire prone areas or mitigates the risk	Include planning code provisions to address the risk	The Natural Hazards Overlay Code includes provisions to ensure new development avoids bushfire prone areas or mitigates the risk by providing: <ul style="list-style-type: none"> defendable buffer space safe evacuation route suitable water supply, The code also includes provisions to require development to not create additional risk through revegetation or landscaping.
Bushfire risk not made worse	Include planning code provisions to address the risk	The Natural Hazards Overlay Code includes provisions to ensure storage of hazardous materials does not occur in the bushfire prone area or is designed to prevent exposure of the hazardous materials in the event of a fire.
Community resilience to bushfire is improved	Include planning code requirements to enable development to address the risk	The Natural Hazards Overlay Code includes provisions to ensure emergency services and community infrastructure are not located in the bushfire prone area.
Future lots ensure any future development is not adversely impacted by bushfire risk	Design of new lots to address the risk	The Natural Hazards Overlay Code includes provisions requiring that: <ul style="list-style-type: none"> No new lots are created in the bushfire prone area; or any new lots created: <ul style="list-style-type: none"> maintain a separation distance from hazardous vegetation maintain an effective buffer suitable for fire fighting vehicles safe evacuation routes are established critical infrastructure continues to operate (undergrounded)

A summary of the proposed planning scheme provisions relating to flood hazard is provided in **Table 4**.

Table 1 Proposed Planning Scheme Provisions Summary for Bushfire Risks and Hazards

Part	Section	Provision
Part 3 Strategic Outcomes	3.2, 3.3, 3.4, 3.5 Strategic Outcomes	3.2.1 Regional Outcomes (The Barcaldine Region)
		3.2.2 Land Use Outcomes (The Barcaldine Region)
		3.4.1 Town Outcomes (The Town of Alpha)
		3.4.2 Land Use Outcomes (The Town of Alpha)
		3.5.2 Land Use Outcomes (The Towns of Jericho, Aramac and Muttaborra)
Part 5 Categories of Development and Assessment	5.8 Overlays	Table 5.8.1 - Overlays
Part 6 Zones	6.2.2 Emerging Community Zone Code	6.2.2.1 Purpose
	6.2.5 Rural Zone	6.2.5.1 Purpose
	6.2.7 Township Zone Code	6.2.7.2 Specific benchmarks for assessment Performance Outcome PO31
Part 7 Overlay Codes	7.2.3 Natural Hazards Overlay Code	Whole code
Part 8 Use Codes	8.3.3 Reconfiguring a Lot Code	8.3.3.3 Specific benchmarks for assessment

5 Landslide Hazard

This chapter discusses how the proposed planning scheme reflects and responds to the SPP state interest guidance document *Natural Hazards, Risk and Resilience Technical Manual – Evaluation Report: Landslide hazards* (Landslide Hazards Technical Manual).

5.1 Outcome 1 – Identifying Natural Hazard Areas

The township areas within the Barcaldine Region do not include areas of steep land. Rural areas may contain areas of steep land. Rural areas are primarily comprised of large rural grazing properties and there is considered minimal risk that future development will be located on steep land given the opportunities to construct buildings in other areas.

There is no mapping which identifies landslide hazard area in the proposed planning scheme, however the Development Works Code includes Performance Outcome 24 which requires that development avoids areas subject to landslide hazard or mitigates the risks to people and property to a tolerable level. The inclusion of this Performance Outcome is considered sufficient to address the likely risk posed by landslide hazards in the local government area.

The Barcaldine Regional Disaster Management Plan (2018) does not include landslide as a potential hazard for the local government area.

Reasons for not specifically mapping a landslide hazard area in the proposed planning scheme are:

- the resources required to undertake a landslide hazard assessment across the expansive nature of the local government area makes the exercise unviable due to cost; and
- there is no development pressure in these areas to warrant a fit for purpose risk assessment.

No risk assessment or specific planning scheme response is therefore relevant for this natural hazard.



6 Conclusion

As demonstrated in this report, the proposed planning scheme addresses and responds to the risks associated with natural hazards within the Barcaldine Region local government area.

Throughout the proposed planning scheme, provisions are included to address the risk of bushfire and flood. There is no landslide hazard identified by the mapping however a planning response to landslide hazard is addressed in the Development Works Code.

The proposed planning scheme contains various provisions which integrate the consideration of the applicable hazards, through the use of overlays which identify the extent of hazard areas which then triggers specific categories of development and assessment and assessment against the relevant assessment benchmarks for the hazard category.

The provisions of the proposed planning scheme are intended to ensure that development is resilient to these natural hazards and that future development will be required to consider and respond to the relevant natural hazards and the level of risk presented.

No business continuity plans have been developed for any of the applicable hazards.