

Rockhampton Regional Council

Flood Management Strategy





1918 Flood - Depot Hill

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Rockhampton Regional Council

Mayor's Message



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Like many parts of Australia, Rockhampton and surrounding areas are vulnerable to natural disasters, particularly flooding.

The Fitzroy River is a key feature and important resource for our Region. Our local area also features a number of significant creek catchments, many of which provide an attractive natural backdrop for urban areas. While we enjoy the benefits of our rivers, creeks and catchments, they are also subject to periodic flooding. The result can have devastating impacts on people, property and the local economy.

Council and the community have a central role in planning and responding to flood events. The objective for Council is to continue to improve and expand our community's resilience to natural disasters.

Improving flood risk management takes considerable time, cooperation and financial resources. Council is committed to working through these essential processes both in the short and long term. Our flood planning and responses will evolve and improve over time and progressively lead to a more flood resilient community.

This Flood Management strategy details how Rockhampton Regional Council intends to plan and keep improving flood management into the future.



2011 Flood - Depot Hill

Our Mission

The Rockhampton Region has been affected by regular floods across recorded history. Climate change may make future flood events even more frequent and severe. Flood preparation, response and recovery is determined by our ability to understand flood behaviour, associated risks, and our capacity to develop and implement appropriate plans to mitigate their impact.

Council's role in flood management involves:

- **Development Control:** Ensuring development is appropriately located and is resilient to flood hazards;
- **Resilient Infrastructure:** Developing and maintaining flood mitigation infrastructure and infrastructure resilient to flooding;
- **Building Community Awareness:** Ensuring that flood impacts are understood and flood information is available; and
- **Disaster Planning and Management:** Achieving a balance of prevention, preparedness, response and recovery.

The impacts of the 2010-2011 floods throughout Queensland and the subsequent outcomes from the Queensland Flood Commission of Inquiry highlighted that individual responses to flooding, such as land use planning will not work effectively in isolation. The need for an integrated and holistic approach to flood risk management is a lesson well learnt.

This Flood Management Strategy outlines how Rockhampton Regional Council intends to work toward improving community resilience and better respond to flooding in the future. We must employ a combination of measures including land use planning, building controls, flood management infrastructure, early warning systems, community awareness and fine tuned emergency management protocols.

Our Mission: Continually improve flood resilience through an informed, planned, integrated, and risk based approach to flood management.



Our Strategy

This Flood Management Strategy provides an overarching framework for Council's current and future floodplain risk management activities and plans.

The objectives of Council's Flood Management Strategy are to better understand flooding and implement plans to avoid and mitigate its impacts on the community. The Strategy will progressively result in a number of catchment based Flood Risk Management Plans targeted at specific areas of flood risk. Not all flood risks will be eliminated and residual risk will always need to be managed effectively.

Effective flood risk management takes considerable time, cooperation and financial resources. As a result, Council's

Flood Risk Management Plans will address the areas of highest priority first.

The Flood Risk Management Plans will apply a range of non-structural and structural measures to mitigate and manage existing, future and continuing risk. These measures include land use planning and development controls, flood mitigation infrastructure, flood awareness and flood emergency management responses.

Council's Strategy and associated plans are based on current Australian floodplain management best practices. The practices and processes to develop Flood Risk Management Plans include flood investigations, risk assessments and formulation and implementation of responses to those risks.

Council will prioritise actions to reduce and manage flood risks in the following order:

- 1. Life and public safety;**
- 2. Critical infrastructure;**
- 3. Public and private property; and**
- 4. The Region's economy.**

Flood Investigations

Develop a sound understanding of flood behaviour through data collection, flood modelling, studies and investigations.

Risk Assessment

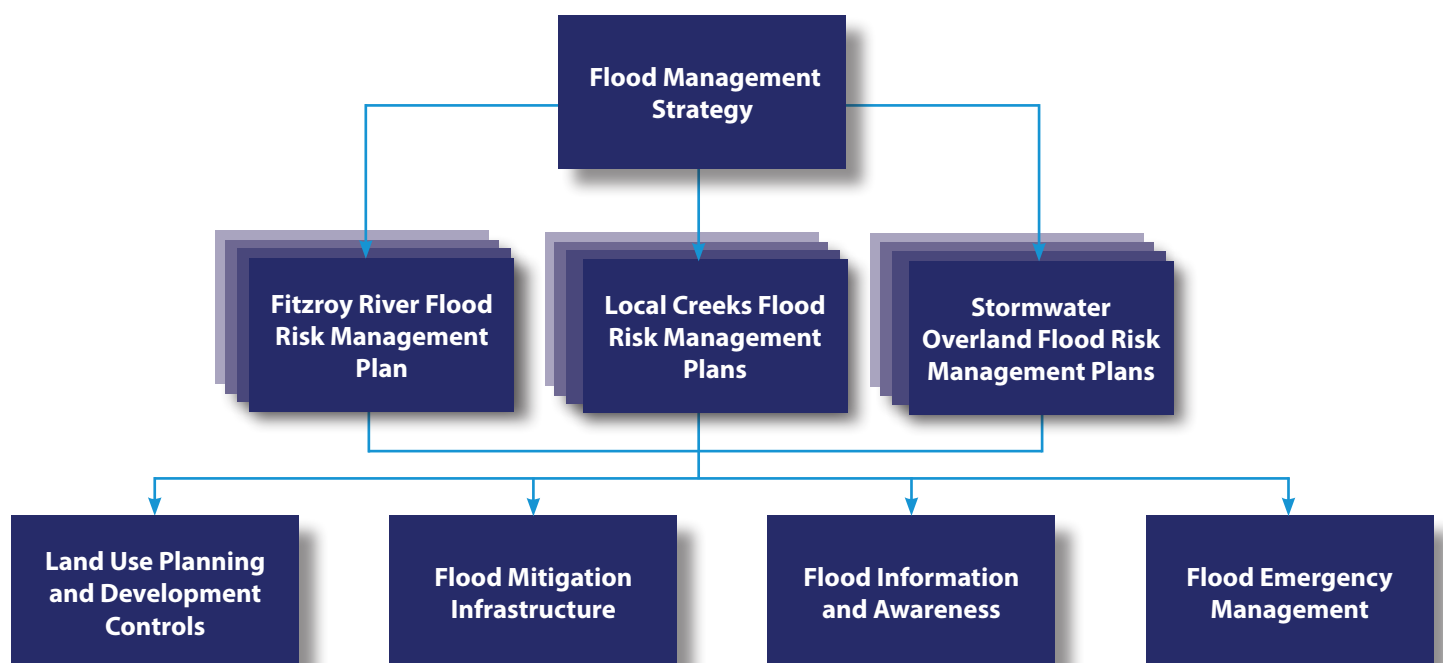
Understand the likelihood and consequences of flooding and develop and assess a range of options to manage flood risk.

Risk Management Plan

Integrated plan to manage existing, future and continuing risk, including a prioritised list of actions.



The Flood Management Strategy will progressively result in a number of catchment based Flood Risk Management Plans targeted at specific areas of flood risk.





Understanding Flood Types



River Flooding

River Flooding is caused by widespread, prolonged rainfall over the catchment area of the Fitzroy River. As the river reaches capacity, excess water overflows its banks onto the floodplain. The community generally receives many days notice of significant river flooding and is able to prepare for impacts in urban areas. The impact can be felt for many weeks through inundation, isolation and recovery efforts. The Region experienced major Fitzroy River floods in 1918, 1954, 1991, 2008, 2011 and 2013.



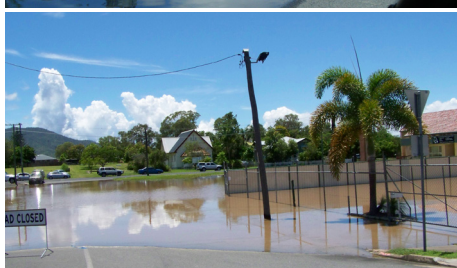
Creek Flooding

Creek flooding is caused by significant rainfall events in local creek catchments. Creeks can rise quickly, become fast flowing and recede very quickly, with little warning. Due to the limited warning, this type of flooding can present a greater risk to life than river flooding. Creek catchments in North Rockhampton, Bajool, Stanwell and Kabra received significant creek flooding in January 2013 due to ex Tropical Cyclone Oswald.



Stormwater Overland Flow Flooding

Stormwater and overland flow flooding is caused by significant rainfall events when water flows across the ground or rises naturally from underground. During and after heavy rain, water may also cause stormwater infrastructure to overflow, resulting in overland flow flooding. The impact of overland flooding is usually of short duration with water generally draining, either directly or via a natural watercourse, to the Fitzroy River.



Storm Tide Flooding

Storm tide flooding is caused when a storm surge, generally related to cyclonic activity, creates higher than normal sea levels. Flooding can also occur from king tides which are predictable events occurring twice a year; once in summer and once in winter. In an extreme event associated with cyclonic activity, the impact may be felt in the Fitzroy River as far upstream as Rockhampton.



Photo from the Capricornia CQ Collection, CQUniversity Library

Flood Planning Process

Flood Investigations

Fitzroy River

Flood modelling was undertaken in 1992, 1999 and 2011 and is being updated as part of South Rockhampton Flood Levee Investigations.

Risk Assessment

Fitzroy River

Rockhampton Flood Management Study 1992 contains risk assessments which were reviewed and confirmed in the Fitzroy River Flood Study 2011.

Risk Management Plan

Fitzroy River

Recommended actions identified in the Flood Studies. Planning Scheme development controls and Disaster Management recommendations have been implemented. Investigations into South Rockhampton Flood Levee are ongoing.

Flood Investigations

Local Creek Catchments

Flood investigations in creek catchments in urban areas have been prioritised. Investigations into rural creek catchments will proceed in the future.

Risk Assessment

Local Creek Catchments

Detailed risk assessments to be completed based on the Local Creek Catchment Flood Studies. Hazard levels, draft responses and development controls prepared for development and disaster planning purposes.

Risk Management Plan

Local Creek Catchments

To be developed following risk assessments. Existing development controls based on general design standards. New codes will be updated based on new modelling.

Flood Investigations

Stormwater Overland Flow

Flood investigations are carried out on a needs basis using State and National standards and guidelines.

Risk Assessment

Stormwater Overland Flow

Risk assessments currently carried out in localised areas on a needs basis.

Risk Management Plan

Stormwater Overland Flow

Stormwater infrastructure upgrades identified in annual Capital and Operational Works Programs. Existing development controls are based on design standards.

Flood Investigations

Storm Tide

State Government provides Coastal Hazard Mapping. Further local investigations not planned at this stage.

Risk Assessment

Storm Tide

Risk mitigated to acceptable level through outcomes contained within the Planning Scheme's coastal protection overlay code.

Risk Management Plan

Storm Tide

Monitor and respond appropriately to relevant State Government Planning Instruments. Development of Storm Tide Management Plan not planned at this stage.



Flood Investigations

The first step in the flood risk management process is a flood investigation which involves flood modelling and associated flood studies.

WHAT IS FLOOD MODELLING?

Flood modelling uses sophisticated computer software to estimate how rainfall of various intensities and duration produce stormwater flows along creek and river catchments.

Flood modelling is used to estimate:

- The inundation extents of the areas that may be flooded;
- The peak depths of flood waters; and
- The hazard related to the depth of water or how quickly the water flows (velocity).

Flood modelling estimates a range of design floods based on a statistical analysis of rainfall information provided by the Bureau of Meteorology. This information is used to establish the likelihood of a rainfall or flood event which is referred to as the Average Recurrence Interval (ARI). Catchments are usually modelled to show a range of design events from a 2 year ARI through to a 100 year ARI.

RIVER CATCHMENTS

Flood modelling of the Fitzroy River has been progressively refined over a long period of time. The flood modelling to date has addressed riverine impacts on Rockhampton and surrounding areas, including Alton Downs, Pink Lily, Nine Mile, Fairy Bower, Midgee and Port Curtis.

The most recent assessments undertaken in 1992, 1999 and 2011 are now being updated to inform the investigation of the proposed South Rockhampton Flood Levee.

The 1992 study included flood modelling, assessment of flood risk and flood mitigation options. A number of the recommended options have been or are being implemented. Council's planning schemes have incorporated land use and development controls for floodplain development; as recommended in the 1992 and 1999 studies. Infrastructure recommendations including the upgrading of the Bruce Highway across the Yeppen floodplain, the Yeppen North Project, and the Yeppen South project are completed or underway.

The recommended flood levee options were remodelled in 2011 to assess their impact on an ARI 100 event. The 2011 modelling was successfully used to assist

with counter disaster operations during the 2010-2011 floods.

The South Rockhampton Flood Levee, previously known as the Port Curtis – Depot Hill – Lower CBD option was recommended in the 1992 study as the next priority following upgrade of the Bruce Highway into Rockhampton. A levee has potential to protect 1000 dwellings, 350 commercial properties and 150 rural properties.

Council's commercial business unit, Fitzroy River Water, is responsible for the safe operation of the No. 7 Dam in Mount Morgan. Fitzroy River Water has in place an Emergency Action Plan (EAP) to manage the safety of the No. 7 Dam which outlines how Fitzroy River Water will respond in the event of an emergency at the No. 7 Dam, such as a major flood in the Dee River.

LOCAL CREEK CATCHMENTS

Council is modelling the risk posed by flash flooding in creek catchments. Unlike the Fitzroy River, this is the first time creek catchments have been comprehensively modelled. There are no stream flow records for creek catchments and limited records of historical flood events to assist in validating the flood models.



While there may be less information available to compare with past events, the modelling uses best practice methods to provide the assessment of flooding in creek catchments. Modelling will be refined over time as better information is collected and modelling capabilities develop.

Creek catchments impacting on the urban centres in North Rockhampton and Gracemere have been prioritised because of the level of risk involved. Rural catchments will be studied when the tasks and skills are established in Council.

Council and the SES are also working with communities to develop emergency management responses in All Hazard Disaster Plans in communities such as Mount Morgan, Stanwell and Bajool.

As Council's understanding of creek catchment impacts grows, appropriate planning, infrastructure and emergency response measures will be put in place.

STORMWATER DRAINAGE PATHS AND OVERLAND FLOW

Isolated assessments of overland flooding are undertaken by Council on a needs basis. In the longer term, Council will work toward a more systematic approach to flood modelling and prioritised assessment of these areas.

In the interim, Council will assist residents to understand the local impacts of flooding and assist residents maintain these areas to reduce the potential impacts of flooding.

WHAT IS A DEFINED FLOOD EVENT?

A Defined Flood Event (DFE) is a flood event chosen by Council that forms the basis for flood mapping and controls contained within Council's Planning Scheme. A DFE usually represents at least a one in 100 year flood probability event which may also be referred to as:

- Q100;
- ARI 100 event; or
- 1% AEP event (Annual Exceedance Probability).

An average person living to approximately 80 years old, statistically has:

- Just over a 50% chance of experiencing a one in 100 year flood event in their lifetime; and
- A 20% chance of experiencing two, one in 100 year flood events in their lifetime.

The mapped flood extent of the DFE is used in the planning scheme to regulate different types of land uses in a flood affected area, dependent on the level of flood risk, or hazard. The DFE is used by

Council planners to minimise the risk of flooding to new developments by setting controls such as minimum floor levels for houses.

For example: The building floor height must be 500mm above the DFE level in areas triggered by a Flood Overlay map.



Flood Risk Assessment

Flood risk management involves assessing and managing flood risks to reduce the impacts on people and property.

Different catchments and types of flooding result in different consequences and associated risks. As a result, they require individual assessments of risks and targeted responses to mitigate each risk.

Flood modelling is used to conduct individual risk assessments. Determined flood risks for impacted locations are then used to form tailored and targeted responses. These are then described in the Flood Risk Management Plans.

A risk based approach to flood management involves:

- Understanding the behaviour and consequences of flooding across a range of potential flood events;
- Effective networking of agencies at a local level;
- Consistent and effective policy from all levels of government; and
- Adequate funding for flood mitigation measures.

UNDERSTANDING FLOOD RISK

Flood risk is the combination of both the likelihood and the consequences of flooding.

Likelihood is the probability of a specific flood event (e.g. a one in 100 year event), or range of events occurring. This can range from unlikely to very likely.

Consequence is an evaluation of the possible impacts of the event(s). This can be rated from low to severe.

Risk = Consequence x Likelihood

E.g. Land located beside a creek may experience frequent fast flowing flooding. A park located alongside the creek would be a better land use choice than a nursing home as the likelihood of flooding is the same however the potential consequences are very different.

EVOLUTION OF FLOOD RISK MANAGEMENT IN AUSTRALIA

Up to 1970's

The focus of flood management was on flood mitigation infrastructure (dams, levees, channel modifications). Following numerous floods in the 1970's, land use planning was used to significantly limit development in flood impacted areas.

1990's

The focus was on improving flood emergency management and more effective community responses. Flood modelling also improved significantly.

Post 2011 floods

The focus was on providing improved and more comprehensive flood information and creating a high level of community awareness.

The future

Best practice flood risk management requires a coordinated integration of all of the flood management measures. Governments will continue to plan for viable methods of protecting areas at high risk of flood inundation.



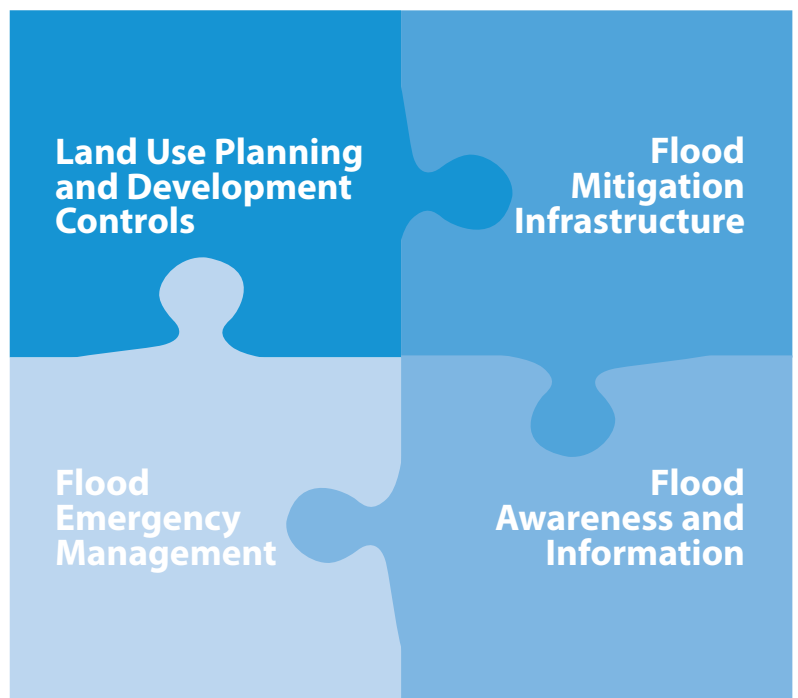
Flood Risk Management

A range of non-structural and structural measures to mitigate and manage existing, future and continuing risk will be identified in customised, but integrated Flood Risk Management Plans.

The Flood Risk Management Plans will outline short term and long term implementation actions. Plans will generally carry across multiple future Council budgets.

Plans will incorporate land use planning and development controls, flood mitigation infrastructure, flood awareness and information and flood emergency management responses.

Integrated Strategy





Integrated Flood Management

Land Use Planning and Development Controls

Smart planning and building

Ensure that new development and redevelopment becomes increasingly resilient to flood risk and does not increase impacts on existing or planned development. This can be achieved by:

- Locating the right land use in the right place and consider how development can be designed and sited to better tolerate flood hazards;
- Locating new urban growth in flood free areas or where the effects of flooding can be properly managed;
- Ensuring buildings are constructed to the latest flood resilient standards set by building codes such as the Queensland Development Code;
- Planning now for the possible impact of changing weather patterns such as rising sea levels, more intense cyclones, more intense rainfall events and bigger storm tides; and
- Maximising the efficiency of the disaster response capability and efficiency by planning for the safe movement of emergency workers, evacuees and supplies during floods.

Timely and effective response and recovery

Further develop our capacity to respond to and recover from flood events by continuously reviewing and implementing best practice disaster management across the four phases: prevention, preparedness, response and recovery. This can be achieved by:

- Public notification and early warning via the Bureau of Meteorology;
- Providing easy to use guidelines on how to develop emergency plans, emergency kits and what to do in an emergency;
- Activating the Local Disaster Management Group (LDMG) to coordinate local counter disaster operations during flood events;
- Utilising online and social media to update the community leading up to and during flood events; and
- Annually reviewing and updating the Local Disaster Management Plan.

Flood Emergency Management



Effective and maintained flood mitigation infrastructure

Maintain and improve flood immunity for critical infrastructure and invest in flood mitigation infrastructure to continuously protect the community and support the Region's economic growth. This can be achieved by:

- Supporting completion of the Yeppen North and Yeppen South Bruce Highway upgrade projects to improve flood immunity and to maintain access to Rockhampton;
- Providing appropriate flood mitigation infrastructure associated with riverine, local creek and overland flooding, particularly in urban areas; and
- Maintaining existing stormwater and flood mitigation infrastructure between flood events to ensure it functions effectively when required.

**Flood
Mitigation
Infrastructure**

Educated and resilient community

Ensure the community has an understanding of flood behaviour and risk, promote the steps community members can take to prepare for floods and minimise impacts on homes and businesses. This can be achieved by:

- Assisting residents and businesses to be more resilient and prepared for flooding by providing simple, accessible and fit for purpose flood information;
- Providing residents in flood prone areas with up to date information on the flood hazard to their property and how they can respond and plan for it;
- Publishing most recent flood studies and flood maps for flood affected areas on Council's website; and
- Promoting awareness of expected changes to long term weather patterns and the local impacts we can expect living in Central Queensland.

**Flood
Awareness and
Information**

Flood Information and Resources

Rockhampton Regional Council

www.rockhamptonregion.qld.gov.au

Queensland Flood Commission

www.floodcommission.qld.gov.au

Department of State Development, Infrastructure and Planning

www.dsdip.qld.gov.au

Queensland Reconstruction Authority

www.qldreconstruction.org.au



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