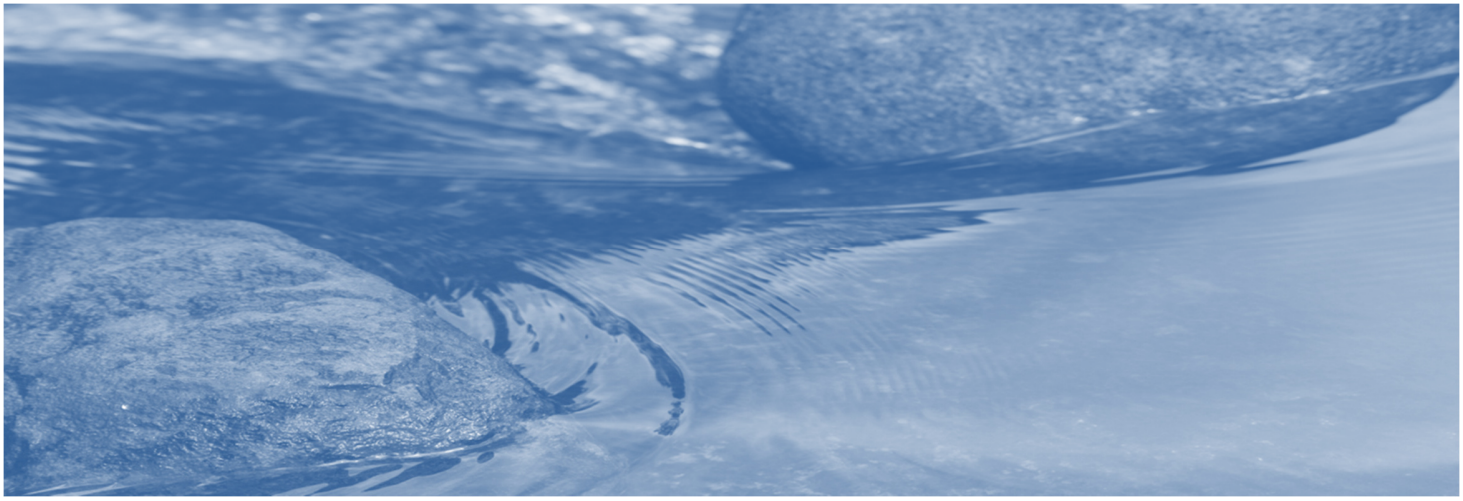


KEMPSEY SHIRE COUNCIL

KEMPSEY CDB FLOODPLAIN RISK MANAGEMENT PLAN

DRAFT FOR PUBLIC EXHIBITION



JULY 2016

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KEMPSEY FLOODPLAIN RISK MANAGEMENT PLAN

DRAFT FOR PUBLIC EXHIBITION

JULY 2016

Project Kempsey Floodplain Risk Management Plan	**Project Number** 29046
Client Kempsey Shire Council	**Client's Representative** Tony Castle
Authors Ella Harrison Monique Retallick Mark Babister	**Prepared by** TO BE SIGNED FOR FINAL REPORT
Date 12 July 2016	**Verified by** TO BE SIGNED FOR FINAL REPORT

Revision	Description	Date
4	Revised Draft for Public Exhibition	July 2016
3	Draft for Public Exhibition	April 2016
2	Draft Plan for discussion v2	Sep 2015
1	Draft Plan	June 2015

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KEMPSEY FLOODPLAIN RISK MANAGEMENT PLAN

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FOREWORD

The NSW State Government's Flood Policy provides a framework to ensure the sustainable use of floodplain environments. The Policy is implemented through the NSW Government's Floodplain Development Manual, 2005, which provides guidance to local Councils on the execution of the policy. It is specifically structured to provide solutions to existing flooding problems in rural and urban areas. In addition, the Policy provides a means of ensuring that any new development is compatible with the flood hazard and does not create additional flooding problems in other areas.

Under the Policy, the management of flood liable land remains the responsibility of local government. State government assists local council by providing financial support by means of grants though the Floodplain Management Program. To be eligible for funding Councils have to demonstrate that they can follow the floodplain risk management process as outlined in the Floodplain Development Manual. State Government also provides specialist technical and policy related advice, administered by the Office of Environment and Heritage (OEH), to assist Councils in the discharge of their floodplain management responsibilities.

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

1. Collection of Data

- Compiling existing historical and new information.

2. Flood Study

- Determine the nature and extent of the flood problem.

3. Floodplain Risk Management Study (FRMS)

- Evaluates management options for the floodplain in respect of both existing and proposed development having regard for social, ecological, economic factors which relate to flood risk.

4. Floodplain Risk Management Plan (FRMP)

- Includes public exhibition of the Plan – a chance for the community who live and work on the floodplain to provide comments, following which a revision of the draft plan may be required.
- Formal adoption by Council of a Plan of management for the floodplain.

5. Implementation of the Plan

- Construction of flood mitigation works to protect existing development, use of Local Environmental Plans to ensure new development is compatible with the flood hazard.

6. Review of the Implemented Plan

- To account for changes in the issues originally addressed and consider any emergent issues since the plan was first implemented. This is an ongoing process which should be undertaken on a regular basis such as every 5 years and when significant changes occur which could affect the plan as well as when further information becomes available such as after significant flood events.

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The Draft Kempsey Floodplain Risk Management Plan constitutes the fourth stage of the management process. This study has been prepared by WMAwater for Kempsey Shire Council (KSC) and provides the basis for the future management of flood prone lands in the Kempsey area. Funding for this study was provided by Kempsey Shire Council and the Office of Environment and Heritage.

This document does not necessarily represent the opinions of the NSW Government or the Office of Environment and Heritage.

This document should be reviewed in 5 to 10 years or following a major flood event.

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1. FLOODPLAIN RISK MANAGEMENT MEASURES

The objective of this draft Floodplain Risk Management Plan is to present the prioritised and costed floodplain risk management measures which are recommended for implementation within the Kempsey Study Area. The draft Plan draws extensively on the work undertaken in the preparation of the Kempsey Floodplain Risk Management Study (WMAwater, 2015b), which should be referred to for more detailed information regarding the development and assessment of the measures presented herein.

The recommended measures for the Kempsey catchment from the Kempsey Floodplain Risk Management Study are summarised in Table 1 and discussed in the following sections. The priority ranking is based on a matrix of measures which includes consideration of economic, environmental, social, funding, maintenance on other implications. There is no particular order within each priority categorisation. This document should be reviewed in 5 to 10 years or following a major flood event.

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Table 1: Kempsey Floodplain Risk Management Plan

Option	Description	Benefits	Maintenance	Costs & Funding	Implementation Actions and Responsibility
High Priority					
Repair Levees to Design Height including upgrading the temporary flood barriers (Section 1.1.1)	Council survey found that the three main levees (Eden St, First Ln and RSL Levees) that project Kempsey are up to 200mm lower than their design height.	Minimal in terms of reduced damages, however will provide existing level of protection for longer in face of future climate change.	The necessary repair works should be added to Council's maintenance works schedule when possible.	Minimal additional cost to existing maintenance. Funded from Council	Council to program levee repairs into maintenance schedule.
Modifications to Wide Street Levee (Section 1.1.2)	Upgrading boarded sections of levee and consideration of raising	No change to flood levels for upgrade works although they would reduce some Council burden during a flood as removes the need for boarding. Raising would provide some reduction in risk to the properties protected by the levee.	No additional maintenance burden anticipated.	Minimal cost Would be eligible for funding from the NSW Floodplain Management Program.	Council to schedule into maintenance works program.
Flood Warning (Section 1.1.3)	• Conversion of all gauges in catchment to AHD, • Clarification on whether the Frederickton and Third Lane Gauges are still active and incorporate into the ENVIRONMON system • Install additional gauges in the middle of the catchment • Correlate Kempsey and Smithtown gauges	Provide more robust and improved flood warning network	Maintenance requirements and responsibilities would be more clearly defined	$50,000	Relevant gauge owners/operators
Evacuation Planning (Section 1.1.4)	• Local Flood Plan to be reviewed no later than July 2017 • Investigate ticketing system for CBD during flood	Improve evacuation planning for future flood events	Nil	$50,000	State Emergency Services
Flood Awareness and Preparedness (Section 1.1.5)	• Develop a flood awareness program which also addresses the different levee overtopping scenarios	Improve community awareness of all risks, including from rare events and levee overtopping	For program to be effective it would need to be repeated at regular intervals	Minimal Cost Council funded	Council to prepare material for program schedule events with SES.
Flood Planning Levels and Flood Planning Area (Section 1.1.6)	• Revise FPL and FPA as per outcomes of this Study	Latest information would be utilised. Would build some climate change resilience into planning system	Nil	Negligible costs Council funded	Council staff to implement
Revise LEP (land-use zoning) and DCPs (Section 1.1.7)	• Review of floodway definition based on hydraulic modelling • Define a Flood Planning Area based on 1% AEP flood levels plus 0.5m freeboard • Council to consider minor changes to LEP and DCP	Latest information would be utilised.	Nil	Council funded	Council staff to review and implement as required.
Voluntary House Purchase (Section 1.4.1)	Continuation and acceleration of current VP scheme	Significant reduction in risk to life and other intangible benefits.	Nil	$6 Million. Would be eligible for funding from the NSW Floodplain Management Program.	Council should continue this program.
House Raising (Section 1.4.2)	Contact those on the list for VP and review the list periodically	Reduce flood damages during an event. BCR (<5% AEP) = 1.42	Nil	$70,000 per dwelling/grant.	Subject to landowner taking up this option.
S149 Certificates (Section 1.1.8)	• Reissue s149 certificates to all affected by the revised FPA. • Issue 149(5) at same time as 149(2) at no additional cost in order to promote flood awareness	Improve flood awareness and education amongst existing and new residents. May help to accelerate voluntary house purchase / house raising schemes	Nil	Council funded	Council to investigate and implement action as required.

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Option	Description	Benefits	Maintenance	Costs & Funding	Implementation Actions and Responsibility
Medium Priority					
Levee at South Kempsey or similar (Section 1.2.1)	An open drain runs through South Kempsey and joins the Macleay River just downstream of the railway line. A small earthen embankment currently runs along the river bank. This could be increase to 8.6m AHD to prevent backwater flooding in events up to the 5% AEP	In the 10% and 5% AEP events 25 and 30 residential properties respectively are no longer subject to yard inundation. In the 5% AEP event 8 houses are no longer flooded above floor level. AAD reduced by $67,553. BCR: 2.89	Levees require regular, ongoing maintenance by Council which would already be undertaken on the earthen embankment. Some additional burden might arise from the upgrade but this is considered to be negligible and easily absorbed into Council's existing maintenance schedule.	$500,000 Would be eligible for funding from the NSW Floodplain Management Program.	Council should look to progress design and undertake necessary site investigations to confirm feasibility. Alternate flood mitigation measure possible for same benefit.
Floodgate at Gladstone Street (Section 1.2.2)	1. Placement of a floodgate on the railway underpass on Gladstone Street to prevent backwatering into West Kempsey. 2. Use of existing Kemp Street playing fields to establish protective measures (earth levee) for the more frequent flood events less than 5% AEP.	Flooding in the area west of Gladstone Street underpass would be reduced by approximately 1m in a 5% AEP event. No reduction in larger events. AAD reduced by $108,555, with up to 26 properties experiencing reduced flooding. 11 properties no longer flooded above floor in the 10% AEP event. BCR: 8	There would be an ongoing maintenance requirement to ensure the long-term performance of the floodgate.	$200,000 Would be eligible for funding from the NSW Floodplain Management Program.	Council should look to progress design and undertake necessary site investigations to confirm technical and operational feasibility.
Low Priority					
Clearance of Floodways (Section 1.4.3)	Accelerate plan to remove buildings, particularly houses, in areas designated as floodway.	Significant reduction in risk to life and other intangible benefits. Limited benefit in terms of reduction in flood levels. BCR: 0.4	Nil	$12 Million Eligible for Floodplain Management Program funding	Ongoing program.
Flood Refuge Mounds (Section 1.4.4)	Areas of artificially elevated ground to be used as temporary evacuation for communities / stock / assets. Suitable for locations in the floodplain up- and down-stream of Kempsey clear of floodways and major flow paths.	Used as a temporary refuge in minor frequent flood events.	Some maintenance required by individual property owners to ensure long-term stability of mounds but no burden to Council	Minimal – cost of fill material only, however unlikely to be eligible for funding under NSW Floodplain Management Program, usually funded by the individual proponent	Landowner to apply to Council to establish flood refuge mounds. Council to investigate creation of policy and procedure for flood refuge mounds.
Flood Proofing (Section 1.3.1)	• Retrofitting flood proofing for commercial properties in the CBD • Flood proofing requirements for all new development	No change to flood levels, will reduce individual damages.	No additional maintenance burden.	Costs borne by individuals. Most economic when undertaken at time of construction/renovation	Council should undertake an awareness program to promote flood proofing to existing commercial properties and ensure development controls stipulate the requirement for future commercial development located in flood prone areas.
Flood Access (Section 1.3.2)	Raise Belgrave Street and South West Rocks Road	Provide improved access to affected residents during a flood, reducing risk to life. BCR <1	No additional maintenance burden.	Grant and Council funded if available. Belgrave approximately $740,000 and South West Rocks Road $500,000.	Prepare Feasibility Study in first instance.

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1.1. High Priority

1.1.1. Repair Levees to Design Height / Upgrade Temporary Flood Barriers

Council survey undertaken in 2011 found that the three main levees (Eden Street, First Lane and RSL Levees) that protect Kempsey are up to 200mm lower than their design height. The largest impact from repairing the levees to their design events will occur in events when they are about to overtop, however even then the impacts on flood levels are minimal. Table 2 shows the current and repaired levee overtopping events.

Table 2: Repaired levee overtopping height

Levee	Design Height (mAHD)	First Overtopping Event	
		Existing Levee Height	Improved to Design Height
Eden Street levee	7.50	< 10% AEP	< 10% AEP
First Lane levee	5.90	< 5 year ARI	< 5 year ARI
RSL levee wall	7.26	< 10% AEP	< 5% AEP

During flood events sandbags are deployed at a number of locations in Kempsey to raise low points in the levees and block flows from particular roads. Council's *Procedure for a Flood Event* (Kempsey Shire Council, 2013) requires that sand and sandbags are deployed at Smith Street (Macleay Valley Way) as it passes through First Lane levee and the low point on Eden Street Levee across the road when flooding approaches a moderate flood (5.7m AHD at Kempsey Traffic Bridge). Temporary barriers are also used at the Wide Street/Cooks Lane levee across Cooks Lane when a major flood is predicted at Kempsey Traffic Bridge (greater than 6.5m AHD). Sandbagging of private property and commercial businesses in Kempsey is also undertaken by residents.

Council should consider raising ground levels when upgrading levees or roads that tie in with levees to reduce the requirement for sandbagging during an event. This work could be incorporated into future maintenance / upgrade works and would have minimal additional cost. Although there would be no reduction in flood levels, it would remove the need for SES staff to install the temporary barriers, allowing them to focus on other activities. It would also strengthen the levee system overall as these areas are currently the weak points, which are most likely to fail during a flood event.

1.1.2. Modification to Wide Street Levee

The Wide Street / Cooks Lane levee protects a small number of houses in West Kempsey to approximately a 1% AEP event. In Cooks Lane the pavement has been raising but during flood events boards are required to be fitted across the road to complete the levee system. The boards are approximately 300mm high. It is recommended that Council consider raising the road as part of future road upgrades and therefore removing the need to place the boards during an event.

Further, raising the levee to its design height at the identified low points would across a span of approximately 60m would ensure the levee was not overtopped during a 1% AEP event.

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1.1.3. Flood Warning

Flood warning and the implementation of evacuation procedures by the SES are widely used throughout NSW to reduce flood damages and protect lives. Adequate warning gives residents time to move goods and cars above the reach of floodwaters and to evacuate from the immediate area to high ground.

The warning time for levee overtopping is generally 12 to 24hrs depending on the event. Flood predictions are supplied for Kemspey and now Smithtown. A number of issues have occurred in the past with gauge failure and confusion over the Kempsey Traffic Bridge level.

It is recommended that all warnings and flood intelligence cards be transitioned to mAHD. An education program will be required to familiarise residents, Council and emergency services with the new levels. A peak level correlation between Kempsey and Smithtown has been partially developed (WMAwater, 2013) which should be further developed in future events.

Currently there are in excess of 100 telemetry stations operating within the Macleay catchment. Of these there are 30 stations fundamental to the flood alert system operating for the Macleay. Gauges in the catchment are owned and maintained by several agencies, BoM, KSC, OEH and MHL. It is important that these gauges are regularly maintenance to improve performance in an event. The agency responsible for maintenance of each gauge should be clarified and a strategic plan for future operation developed. The possibility of upgrading from a gas pressure system to a new compressor which will not run out of gas should be considered. This will reduce the need for NSW SES personnel to undertake manual readings during an event. Manual readings during a flood event have an impact on SES resourcing and potentially put the SES personnel at risk.

Several new rainfall and water level gauges have been installed in the last 20 years, thus providing a more accurate assessment of flooding. This program should be continued and some of the gauges should be linked to the BOM system so that some real time rainfall recording is available. RMS installed water level gauges at Frederickton and Third Lane as part of the Kempsey Bypass. These gauges would have in the order of 5 years of record including several flood events. These gauges should be continued and incorporated into Council's ENVIROMON system. Additional gauges are recommended in the middle of the Macleay River catchment to enhance flood warning.

The costs associated with these recommendations are minimal, and the benefits are hard to quantify, however it is considered likely that the cost benefit ratio would exceed 1.

1.1.4. Evacuation Planning

A number of residents will be required to be evacuated in a flood event. The SES has the skills and experience to undertake the necessary evacuations. The NSW SES Local Flood Plan was updated in December 2012 and should be updated no later than 2017.

The 2011 Flood Intelligence Collection Study (WMAwater, 2013), found that evacuation was not a popular response to flooding amongst the community. Any flood awareness programs should

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target why evacuation is necessary during a major flood event.

There have been issues during past flood events of curious residents entering the CBD to observe the flooding. This could cause a major issue if an evacuation of the CBD is required. The use of a ticketing system to control the number of people in the CBD, particularly if the levees are expected to be overtopped, should be investigated.

Access to properties can be cut for some time and residents will try to drive through floodwaters to return home or undertake regular tasks. The NSW SES advice is never to drive through floodwaters but recent past events in Queensland, NSW and Victoria in 2011 demonstrated that many people do not adhere to this advice. Cars can float in as little as 0.3 m depth of water and consequently a number of lives have been lost and the lives of rescuers put at risk in rescuing stranded motorists. Warning signs such as depth markers could be placed on every inundated road. This is a cost effective measure that would at a minimum advise motorists of the flood depth. In addition warning signs advising motorists of the risk of driving through floodwaters could be provided.

The warning times and stream gauges upstream of Kempsey are crucial as the majority of the downstream areas rely on this information being accurate and available. The Local Flood Plan and Flood Intelligence Cards indicate flow times between the four flood gauges in the upstream area along with Kempsey and Smithtown. The exact source of these travel times is unknown. These travel times for flood waters should be further investigated and be understood that each flood is different and times may not be accurate. A hydraulic model should be used to confirm flow times.

1.1.5. Flood Awareness and Preparedness

A community with high flood awareness will suffer less damage and disruption during and after a flood because people are aware of the risks, and how best to react. Kempsey residents generally have a high level of flood awareness and often relate flooding relative to the levels at the Kempsey Traffic Bridge gauge and/or levee crest heights. However, this awareness is usually of the smaller more frequent events in the order of 10% AEP (recent events e.g. 2001, 2009 and 2013). Residents would be less aware of the implication of larger events such as the 1% AEP event.

The level of flood awareness for residents and businesses in the area protected by the levee is lower than the rest of the community. This is due to the sense of security that landholders in this area feel due to the presence of the levee. The impacts if the levee fails or a levee overtopping event occurs should be communicated to residents in this area.

For risk management to be effective it must become the responsibility of the whole community. It is difficult to accurately assess the benefits of an awareness program but it is generally considered that the benefits far outweigh the costs. The perceived value of the information and level of awareness, diminishes as the time since the last flood increases.

A major hurdle is often convincing residents that major floods (similar to the 1949) will occur in the

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future. Many residents hold the false view that once they have experienced a large flood then another will not occur for a long time thereafter. This viewpoint is incorrect as a 1% AEP event (or sometimes termed a 100 year ARI) has the same chance of occurring next year, regardless of the magnitude of the event that may have recently occurred.

Regular awareness campaigns are recommended to ensure that the level of flood awareness in Kempsey stays high. It is important to also educate residents on the different mechanisms of flooding. For example the different Kempsey Levee overtopping scenarios. A pamphlet with information could be used in a flood awareness campaign.

Table 3 provides examples of various flood awareness methods that can be used.

Table 3: Flood Awareness Methods

Method	Comment
Letter/Pamphlet from Council	These may be sent (annually or bi-annually) with the rate notice or separately. A Council database of flood liable properties/addresses makes this a relatively inexpensive and effective measure. The pamphlet can inform residents of subsidies, changes to flood planning levels or any other relevant information. These should also be handed out as part of rental property information. Information should also be provided on levee overtopping.
School Project or Local Historical Society	This provides an excellent means of informing the younger generation about flooding. It may involve talks from various authorities and can be combined with water quality, estuary management, etc.
Displays at Council Offices, Library, Schools, Local Fairs	This is an inexpensive way of informing the community and may be combined with related displays. Include photographs, newspaper articles and information on development controls and standards, flood evacuation and readiness procedures.
Historical Flood Markers or Depth Indicators on Roads	Signs or marks can be prominently displayed in parks, on telegraph poles or such like to indicate the level reached in previous floods. Depth indicators on roads advise drivers of the potential hazards. Particularly appropriate near local waterways and low points which become flow paths during large events. Kempsey Council have already put these measures in place such as the plaque on Clyde Street Mall commemorating the six people who died in the 1949 flood and a pole with the historical flood levels.
Articles in Local Newspapers	Ongoing articles in the newspapers will ensure that the problem is not forgotten. Historical features and remembrance of the anniversary of past events make good copy.
Collection of Data from Floods	Collection of data from floods that occur in the future will assist in reinforcing to the residents that Council is aware of the problem and ensures that the design flood levels are as accurate as possible.
Notification of Section 149 Planning Certificate Details	Floodplain property owners were indirectly informed that they were potentially flood affected as part of the public consultation program and floor level survey. Future residential property owners are advised during the property searches at the time of purchase by details provided on the Section 149 certificate. This notification is also extended to the rural zoned properties outside of the villages on townships on the Lower Macleay.
Web-based tools	Online presentations, activities, gauge data.
Updates on Council website	Council already provide regular updates on the current flood situation on the home page of their website. The website also provides information on

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	flood preparedness, response and recovery.
NSW SES flood awareness programs	The NSW SES are undertaking a flood awareness program in Kempsey including, leaflets and flyers, and stalls at local events, This should also include information on levee overtopping.

1.1.6. Flood Planning Levels and Flood Planning Area

The FPL is a useful mitigation measure for future flood risk and is derived from a combination of flood level results from a flood event of specific probability, usually the 1% AEP, and freeboard of usually 0.5m. FPLs do not apply to existing development, but through development controls are enforced on generally all new development.

Kempsey Council currently sets the FPL as the 1% AEP flood level plus a 0.5 m freeboard. The current DCP requires that all habitable floors of residential development are above this level and for commercial buildings that at least one fifth of the floor area is above this level.

The 1% AEP flood level varies across the Kempsey and FPLs specific to different areas of the floodplain are defined in Council's Flood Risk Management Procedure 1.1.11. This work undertaken as part of the FRMS amended the 1% AEP event flood level. Therefore it is recommended that the DCP be updated to reflect this. Table 4 summarises the change in 1% AEP flood levels between different models of the study area. The change in flood level is minimal.

Table 4: Comparison of Hydraulic Models 1% AEP levels

Location	River/ Floodplain	Peak Level (mAHD)				
		Rubicon	RMA-2	SOBEK	TUFLOW	
					Kempsey Bypass model	New TUFLOW model
Railway Bridge	River	10.2		10.15	10.15	10.02
Traffic Bridge	River	8.7		8.7	8.57	8.51
Pola Creek	River	8.2	8.1	8.11	8.07	8.03
Glenrock Drain	River	7.7	7.7	7.86	7.79	7.77
Upstream Frederickton	River	7.1	7.1	6.96	6.96	6.98
Frederickton	River	6.7	6.8	6.64	6.62	6.62
Downstream Frederickton	River	6.5	6.5	6.32	6.38	6.37
East Kempsey Wetland	Floodplain	n/a	6.7	6.64	6.76	6.65
Old Station Road	Floodplain	6.6	6.6	6.60	6.72	6.60
Frogmore	Floodplain	5.9	5.9	5.93	6.11	6.05
South West Rocks Road	Floodplain	5.9	5.9	5.87	6.02	5.96
Upstream Bridge Right Bank	Floodplain	5.9	5.9	5.88	6.02	5.96

Council may also want to consider using the FPL to set flood proofing requirements for non-residential dwellings. Although the only area where depths are shallow enough to all this is the current CBD.

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1.1.7. Revise LEP and DCPs

Updated and relevant planning controls are important in flood risk management. Planning instruments can be used as tools to guide new development away from high flood risk locations, ensure that new development does not increase flood risk elsewhere or ensure development in flood prone areas would be suitably designed, for example raised floor levels. They can also be used to develop appropriate evacuation and disaster management plans to better reduce flood risks to the existing population.

The outcomes of the Kempsey FRMS should feed into an updated DCP in respect to flood related development controls or, alternatively, the existing documents can simply refer to the study and plan.

Council haven chosen to modify the recommended model local clause 7.3 in the LEP to suit their circumstances, given the nature of flooding in Kempsey, the criteria in this clause are supported. The LEP classifies the current 1(e) floodway land use as E2 Environmental Protection. Some of the areas previously classified as 1(e) floodway in the LEP 1987 are no longer considered to be floodway, based on revised hydraulic modelling undertaken as part of the FRMS. Where these have been directly reclassified as E2 under the LEP Council may seek to rezone these areas with a more appropriate land uses (refer to FRMS for further detail).

The LEP has classified the area north of Eden Street and south of Belgrave Street, as well as two areas between Belgrave and Forth Streets, as RE1 Public Recreation. Under the RE1 land use zone a number of uses are permitted with consent that would not be permitted under the criteria for Kempsey Local Floodway No. 1 in the DCP. Council may wish to either rezone these areas to E2 in keeping with the rest of Local Floodway No. 1. However, this may prevent some development which is actually intended in these areas allowed under RE1 but not E2. If the land is not rezoned then the DCP will need to be used to control development in these areas as it currently does. Strict development controls should be applied to floodways defined in the DCP (including this area) to further limit development from that allowed under the LEP land use classification to only that appropriate in a floodway.

As the new LEP standard format does not have specific land zones relating the floodways, it is recommended that the current method of identifying a number of floodways in the DCP is maintained. However, it is recommended that only those areas defined as hydraulic floodway be referred to as floodways. Other areas currently referred to as floodways in Council's DCP should be renamed as flood precincts or similar.

It is recommended that the DCP is reworded to refer to the "latest available flood modelling for the area" or similar rather than stipulating specific levels in the DCP document itself. This will then ensure that Council will be contacted to provide the latest flood levels relevant to a site, and would allow more than one hydraulic model to inform flood levels for an area; for example the modelling undertaken for the FRMS will be used to inform the FPLs for the majority of the hydraulic model extent and the previous modelling undertaken for the wider Macleay catchment will be used for areas outside this area.

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The DCP does not currently account for future increases in flooding due to climate change. Therefore it is recommended that the DCP defines a Flood Planning Area (FPA). This should be defined as the 1% AEP flood level plus 0.5 m, and therefore will encompass a wider area than the current 1% AEP flood extent.

The DCP currently allows extensions to existing properties in the floodway, however it is recommended that this clause is removed. By preventing extensions in the floodway, not only will this prevent further obstructions to the floodway but in the long run may encourage people to leave the floodway area as they will need to move to acquire larger property.

1.1.8. Section 149 Certificates

Section 149 Planning Certificates provide information on the planning policies and controls that apply to a particular parcel of land. Councils issue planning certificates to potential purchasers under Section 149 of the Environmental Planning and Assessment Act of 1979 (EP&A Act). Identification of potential flood affectation and therefore flood related development controls on a Section 149 Planning Certificate is mandatory for residential developments located below the residential FPL.

The S149 certificate is divided into two parts s149(2) and s149(5) relating to the relevant clauses of the EP&A Act 1979. Under Part 2 Council is required to advise if it is aware of the flood risk and any other known risk (bush fire, land slip etc.). A certificate issued under Section 149(2) provides information about the zoning of the property, the relevant state, regional and local planning controls and other property affectations such as land contamination, road widening and flooding. Part 5 is not compulsory but provides additional information on other relevant matters affecting the land such as advice from other authorities, subdivision history and easements where Council has information available. This can include flood levels relevant to the site or in some cases Council choose to mention where properties may be affected by flooding in due to climate change. Planning certificates are an important source of information for prospective purchasers on whether there are flood related development controls on the land. They need to rely upon the information under both Section 149(2) and 149(5) in order to make an informed decision about the property.

Data from the hydraulic modelling undertaken for the FRMS should be incorporated into Council's Section 149 planning controls. Wording or description included on the certificate should be clear in describing the flooding implications and/or planning/building restrictions at the property based on the outcomes from the study process. This information may include minimum floor levels for properties within the area affected by the FPL, or, for areas above the FPL, information relating to rarer flood events based on historical information. Details of flood level information should be continually updated as more accurate survey and flood level information becomes available.

The s149 certificate can be used to assist in clearing of the Kempsey Local Floodway No. 1, clarifying to property owners in the floodway that land clearance will be necessary.

It is recommended that update S149 certificates are issued to all affected by the revised FPA. In addition, we recommend 149(5) certificates are issued at the same time as S149(2) at no

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additional cost in order to promote flood awareness.

This measure would result in some additional costs to Council in terms of administration (revisions and reissuing), but the benefits associated with a more informed and aware community is considered to outweigh these.

1.2. Medium Priority

1.2.1. South Kempsey Levee

An open drain runs through South Kempsey and joins with the Macleay River just downstream of the railway line. The area is subject to Macleay River flooding in small events which mainly affects yards. The majority of properties in South Kempsey are not flooded above floor level until a 1% AEP event. A small earthen embankment currently runs along the river bank.

The height of the embankment should be increased to 8.6m AHD (0.1m above the 5% AEP) to prevent backwater flooding in events up to a 5% AEP event. The levee would need to be fitted with a one way flap gate to drain water from the area after the peak of the Macleay River flooding has passed. It is unlikely that the local catchment and Macleay River would peak at the same time. Increases in flood levels as a result of blocking off the backwater area were assessed as being minor (<0.1m) and contained within the Macleay River (WMAwater, 2014).

Table 5 summarises the number of properties no longer flooded and those that experience reduced flooding. In the 10% and 5% AEP events 25 and 30 residential properties respectively are no longer subject to yard inundation. In a 5% AEP event 8 houses are no longer flooded above floor level. Average annual damages to residential properties are reduced by $67,553. The levee would cost in the order of $500,000 to build giving it a benefit cost ratio of 2.

Table 5: Number of affected properties – South Kempsey Levee

Event	Reduction in Number of Properties affected below floor level	Reduction in Number of Properties Flooded above floor level
5% AEP	30	8
10% AEP	25	4
5 Year ARI	6	1

1.2.2. Flood Gate – Gladstone Street

Placement of a floodgate on the railway underpass on Gladstone Street would prevent backwatering into West Kempsey. Currently the area is inundated in events rarer than a 5 year ARI.

The area west of the Gladstone Street underpass is flood free in a 10% AEP event. Flooding in the area would be reduced in a 5% AEP event in the order of 1m. In larger events there is no reduction in flood levels. There may still be local drainage issues with local rainfall in the area although this is likely to be relatively minor compared to the flooding from backwater.

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The floodgate would need to be specially manufactured of steel and secured to the wingwall of the existing underpass. The flood gate would be closed by Council in events when the Eden Street or First Lane levees are expected to be overtopped (moderate level (5.7mAHD) at the Kempsey Traffic Bridge gauge). Consideration would need to be given to how the floodgate would be operated post event when it may have some local floodwaters stored behind it and without erosion of Gladstone Street.

Average Annual Flood damages to residential properties are reduced by $108,555. Up to 26 residential properties experience reduced flooding (Table 6). The number of residential properties no longer flooded above floor level in a 10% AEP event is 11. It is anticipated the flood gate would cost $200,000 including construction and refinement of the operating strategy. A cost benefit ratio of 8 is achieved by this project.

Table 6: Number of Impacted Properties – Flood Gate Gladstone Street

Event	Reduction in properties affected below floor level	Reduction in properties flooded above floor level
5% AEP	20	10
10% AEP	26	11
5 Year ARI	0	0

Possible alternatives to a flood gate would be to increase storage in the catchment in the form of retarding basins near the Council deport or house raising or applying another levee at Wide Street between the Showground and Catholic Public School and within the existing Thompson Street playing fields.

1.3. Low Priority

1.3.1. Flood Proofing

Flood proofing is divided into two categories; wet proofing and dry proofing. Wet proofing assumes that water will enter a building but techniques are used to reduce damages while dry proofing aims to totally exclude flood waters from entering a building.

In Kempsey, dry proofing would only be suitable for commercial properties due to the limitations resulting from flood depths and velocities. Temporary dry proofing measures, such as fitting flood gates over entrance points, could be effective given the warning time for the onset of flooding in Kempsey.

Wet flood proofing assumes water will enter the building however the property is designed to minimise damages and/or reduce recovery times (e.g. electrical outlets are raised above flood levels). It is usually only cost effective at time of construction / renovation, or during repairs after a flood.

Grant funding is usually not available for flood proofing. Although Council cannot be responsible for flood proofing existing properties, they can enforce flood proofing for any new development

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within flood prone areas through planning controls. Furthermore, Council can, through a flood awareness campaign targeted at both commercial and residential property owners, make available information on flood proofing existing buildings such as temporary flood barriers. These activities would require minimal cost.

It is recommended that flood proofing for commercial properties in the Kempsey CBD is promoted by Council, and that flood proofing for all new commercial development located in flood prone areas is set as a requirement in Council's planning documents.

1.3.2. Flood Access

One of the main ways of improving evacuation is to ensure that there are adequate evacuation routes available and appropriate warnings as to when the routes will become impassable. The raising of both Belgrave Street and South West Rocks road would improve evacuation and recovery times.

1.3.2.1. Belgrave Street

Belgrave Street is the main east west route connecting Kempsey and West Kempsey. When the road is cut residents are unable to attend work or access services. The low point in the road is approximately 4.3m AHD. The road is flooded in events more frequent than a 10 % AEP event. Raising Belgrave Street between Holman and Stuart Street for a distance of 250m to a level of between 4.92 and 5m AHD (tying into existing levels) would reduce the frequency of inundation and reduce the post flood recovery time. As part of the works, the culverts downstream at Forth Street would also be doubled (0.9m diameter).

The impact on peak flood levels in the 10% AEP event is in the order of a few millimetres because the event significantly overtops Belgrave Street, however, it would provide an additional hour till overtopping.

The costs for this option would be in the order of $738,500

This option would increase evacuation times, reduce the cost to business during a flood as workers could return to work earlier, customers could access businesses sooner post flood, residents could re-enter the area earlier post flood, and emergency services could travel through town for longer during an event. It is difficult to assign a monetary value to these benefits. The cost benefit for this option is likely to be greater than 1.

1.3.2.2. South West Rocks Road

South West Rocks Road is inundated in a 2 year ARI event. Raising South West Rocks Road between Red Hill Lane and the bend in South West Rocks Road at the corner of Astral Eden Outer Road would increase access during minor flood events and improve evacuation. Culvert upgrades were not considered as part of the option but may reduce impacts.

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Overtopping of the road will occur approximately 1 hour later than the current situation in a 5 year ARI event. In a 5 year ARI event flood levels at three high velocity locations (at the base of Red Hill, Ferry Lane and halfway between the two) are increased by up to 0.2m. However, no houses are impacted. The areas are in some cases slightly lower or the surrounding topography is funnelling the water in that direction. Any road raising option should consider maintaining these at a lower level. In events that overtop the road the impact is minimal and contained to the low point near Red Hill lane (0.038m in a 5% AEP and 0.02m in a 1% AEP event).

The costs for this option would be in the order of $500,000. It is difficult to assign a monetary value to the benefits of this option, however it is likely that the cost benefit ratio is would exceed 1.

Implementing this option should be considered whenever pavement works are required for South West Rocks Road.

1.4. Existing Measures to be continued

A number of existing floodplain risk management measures are employed in the Kempsey study area. The following sections discusses those which should be continued, and in some cases accelerated.

1.4.1. Voluntary House Purchase (High Priority)

Approximately 40 residential properties are located in the current Kempsey Voluntary Purchase Zone, including a respite centre. Voluntary purchase is the most cost effective means of reducing the flood risk for properties located in the floodway who are flooded frequently and subject to high hazard. The flood risk to the voluntary purchase zone will increase with climate change, with the area flooded more frequently. While progress has been made in removing houses, at the current rate clearing of the voluntary purchase zone would take another 20 years to clear.

The removal of all buildings in the floodway would reduce flood levels and improve conveyance, as well as allow the consideration of other mitigation measures. It is estimated to cost up to $6 Million to clear all properties, and therefore, whilst this measure it strongly supported, it is recognised as a long-term measure, however, if possible the scheme should be accelerated to ideally be completed in the next 10 years.

1.4.2. House Raising (High Priority)

House raising has been widely used throughout NSW to eliminate inundation from habitable floors. This approach provides more flexibility in planning, funding and implementation than voluntary purchase. However its application is limited as it is not suitable for all building types and only becomes economically viable when above floor inundation occurs frequently (say in a 10% AEP event or less).

House raising is suitable for most non-brick single storey buildings on piers and is particularly relevant to those situated in low hazard areas on the floodplain. The benefit of house raising is

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that it eliminates inundation to the height of the floor and consequently reduces the flood damages. However it does not reduce the external hazard, evacuation issues or yard/garage damages.

The grants for funding of this measure generally only cover the basic costs of raising the structure. The subsidy is usually offered on a relative basis depending on the severity of the problem and potential damages. Residents will most likely have to contribute their own funds to make up any difference and to facilitate the associated works or modifications.

Most houses within the study area which are subject to frequent flooding have been raised in the past. However some may have only been raised to avoid nuisance flooding. Survey identified the average residential floor level as being approximately 1.8 m above ground level. Up to 25 houses, including some of the most flood prone in the area, downstream of Kempsey were raised to the 1% AEP plus 0.5m by the Kempsey Bypass. A number of houses in the floodway are suitable for raising. For houses in the floodway voluntary purchase is considered a more appropriate option as house raising does not reduce hazard.

The cost of house raising is typically in the order of $70,000 per house. For the floodplain downstream of Kempsey, Council has determined a list of the 100 most flood prone rural properties that are suitable for house raising. These properties are on a list for a voluntary house raising scheme, subject to funding, where the owner and Government both contribute to the cost of house raising. Council regularly contacts and reviews this list, and should continue to do so

The cost of raising the 40 most flood prone houses (to the 1% AEP plus 0.5m) which are flooded in events less than a 5% AEP is approximately $2,800,000. This reduces AAD by $1,832,098 resulting in a benefit cost ratio of 1.42. The cost of raising 136 houses that are flooded in up to a 1% AEP level has a benefit cost ratio of 0.58.

An indication of the property's eligibility for house raising could be recorded on part 5 of the s149 Certificate (there is now allowance under the Act for this to be included in Part 2) to ensure future potential purchasers are made aware of their options.

1.4.3. Clearing of Floodways (Low Priority)

Council has a number of defined floodways in their DCP and the study area contains a number of natural floodways including through the CBD. A significant risk to life and buildings in the floodway occurs events as small as a 10% AEP event. Removal of these buildings particularly residential buildings is the only way to significantly reduce their risk. Council has a policy of voluntary purchase for houses in the CBD floodway, however few voluntary purchases have occurred and it would take a long time at the current pace to remove all buildings.

The peak flood levels were shown to decrease reduced by between 0.5 to 0.7m upstream of Belgrave Street due to the removal of the existing car yard on Belgrave Street, which is currently assumed to act as a significant barrier to flow. Conveyance of floodwaters is improved with the buildings removed. Flood levels were decreased by greater than 0.3m in a 1% AEP event. An increase in flood levels, away from existing houses, of up to 0.3m occurs downstream where the

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houses are removed from the floodway. This option has most benefit in large floods when the floodway is in full operation. At a cost of approximately $12 million this option would have a total benefit cost ratio of 0.4. However the intangible benefits are significant and hard to quantify. The commercial properties on Belgrave Street were shown to have the greater benefit when removed however if demolished first would have adverse impact on those residential properties downstream.

Removing buildings particularly houses in the floodway would significantly reduce the risk to life. The removal of buildings from the floodway has limited benefit in terms of flood levels. Any plan to clear the floodway is long term and should be undertaken in conjunction with other measures. Where possible this plan should be accelerated.

Council should continue with the long term plan to remove properties from the floodway, and wherever possible, this should be accelerated.

Table 7: Number of Affected Properties – Integrated Option

Event	Residential		Commercial	
	Reduction in number of properties affected below floor level	Reduction in number of properties affected above floor level	Reduction in number of properties affected below floor level	Reduction in number of properties affected above floor level
5 year ARI	2	0	2	0
10% AEP	77	26	78	50
5% AEP	86	34	30	15
1% AEP	42	44	12	16

1.4.4. Flood Refuge Mounds (Low Priority)

Flood refuge mounds are used as an effective means of reducing losses during a flood and are useful as a last resort evacuation for communities during a flood.

Flood refuge mounds should only be considered where there access to high ground can be cut early or is far away. Flood refuge mounds can cause localised flow diversions or increases in flood levels. Flood refuge mounds should therefore be located as much as possible in line with the flow path and utilise existing high ground. For large rural properties it is unlikely these impacts would extend far enough to affect neighbouring properties. However in accordance with Council policy this should be confirmed for all proposed flood mounds.

The cost to construct the mounds depends entirely upon the availability of fill material. Funding under the NSW Floodplain Management Program is unlikely to be available for these works and they are usually funded by the individual proponent.

Flood refuge mounds are suitable mitigation options for the floodplain upstream and downstream of Kempsey. In accordance with Council policy the impact of flood mounds on neighbouring properties should be confirmed for all proposed flood mounds.

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2. REFERENCES

1. WMAwater
Draft Kempsey Floodplain Risk Management Study
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2. Kempsey Shire Council
Procedure for Flood Event for Flood Controller
July 2013

3. WMAwater (Webb, McKeown & Associates Pty Ltd)
Lower Macleay River June 2011 Flood: Post Flood Event Data Collection and Intelligence Review
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LIST OF FIGURES

No table of figures entries found.

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