

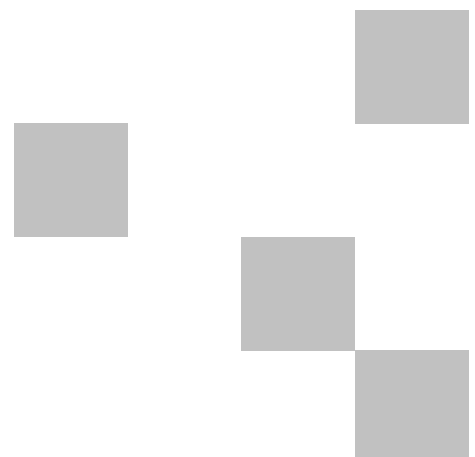


Transport
Roads & Maritime
Services

APPENDIX B8

Construction Flood Management Plan Additional Crossing of the Clarence River at Grafton Project




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Document control

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Glossary / Abbreviations

BOM	Bureau of Meteorology
ARI	Average Recurrence Interval
CEMP	Construction Environmental Management Plan
CoA	Condition of Approval
CVC	Clarence Valley Council
DP&E	Department of Planning & Environment
DPI Water	Department of Primary Industries Water (formerly NSW Office of Water)
EIS	Environmental Impact Statement
EEC	Endangered Ecological Community
EPA	Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EWMS	Environmental Work Method Statements
CFMP	Flood Management Plan
LEP	Local Environmental Plan
OEH	Office of Environment and Heritage
PMF	Probable Maximum Flood
Project, the	Additional Crossing of the Clarence River at Grafton Project
RMS	Roads and Maritime Services
SES	State Emergency Service
SSI	The state significant infrastructure as generally described in Schedule 1 (SSI-6103) of the Infrastructure Approval.

1 Introduction

1.1 Context

This Construction Flood Management Plan (CFMP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for the Additional Crossing of the Clarence River at Grafton Project (the Project).

This CFMP has been prepared to address the requirements of:

- the Infrastructure Approval;
- the environmental management measures listed in the *Additional Crossing of the Clarence River at Grafton Environmental Impact Statement (EIS) (ARUP, 2014)* and the *Additional Crossing of the Clarence River at Grafton Submissions Report*; and
- all applicable legislation.

1.2 Background

The *Additional Crossing of the Clarence River at Grafton EIS (ARUP, 2014)* assessed the impacts of construction and operation of the Project on flooding and hydrology.

As part of the EIS development, a detailed flood and hydrology assessment was prepared to address the Director-General's Requirements for the Project, issued by the Department of Planning and Environment. The flood and hydrology assessments were included in the EIS as Appendix E – *Technical Paper: Flooding and Hydrology Assessment*.

1.3 Environmental management document system overview

The overall Environmental Management document system for the Project is described in the Construction Environmental Management Plan (CEMP).

The CFMP is part of the Fulton Hogan's environmental management framework for the Project, as described in Section 4.1 of the CEMP. In accordance with CoA D46(f), this CFMP has been developed in consultation with a qualified and experienced hydrologist, EPA, the State Emergency Service (SES) and Clarence Valley Council. Details of the consultation carried out as part of the preparation of this CFMP are provided in Section 4.

Mitigation and management measures identified in this CFMP will be incorporated into site- or activity-specific Environmental Work Method Statements (EWMS).

EWMSs will be developed and signed off by environment and management representatives prior to associated works, and construction personnel will be required to undertake works in accordance with the identified mitigation and management measures.

Used together, the CEMP, strategies, procedures and EWMS form management guides that clearly identify the required environmental management actions for reference by Fulton Hogan personnel and contractors.

The review and document control processes for this CFMP are described in Section 1.6 and Chapter 10 of the CEMP.

1.4 Terminology

Specific flooding and hydrology terms used in this CFMP are defined in Table 1-1.

Table 1-1 Glossary of terms relevant to flooding and hydrology

Term	Definition
100-year flood event	A 100-year flood is the flood that will occur or be exceeded on average once every 100 years. It has 1% probability of occurring in any given year. The same principle applies to other flooding events, such as 10-year, 20-year and 50-year flood events.
Australian height datum (AHD)	This is the standard datum that most flood levels are measured from. Its value is equivalent to mean sea level.
Average recurrence interval (ARI)	The long-term average number of years between the occurrence of a flood larger than the selected event.
Landside Project Works	Means those parts of the Project Work that are not within the River Works
Probable maximum flood (PMF)	The largest flood that could conceivably occur (a worst-case flood event). It is typically estimated from probable maximum precipitation coupled with the worst flood-producing catchment conditions. The PMF extent defines the floodplain and incorporates all flood-prone land. The PMF is a very rare and improbable flood.
River Works	Means those parts of the Contractor's Work: <ul style="list-style-type: none"> (a) that are performed or to be performed between the banks and below the waterline of the Clarence River; or (b) that may affect river levels or afflux, and in respect of which any preconditions under the deed are required to be satisfied before the commencement of those works, including: <ul style="list-style-type: none"> (c) the granting of any Approval; (d) satisfaction of any conditions under an Approval; or (e) the completion of any other parts of the Contractor's Work, and to avoid doubt: <ul style="list-style-type: none"> (f) includes mobilisation within the waterway of the Clarence River of any floating plant intended for use in the course of the Contractor's Work; (g) excludes Property Works and those works described or specified in the section of the Scope of Works and Technical Criteria identified in Item 29(ss) of Schedule 1.

2 Purpose and objectives

2.1 Purpose

The purpose of this CFMP is to describe how construction impacts on hydrology and flooding from works on the flood levee and within the Clarence River and its floodplain will be minimised and managed so that any significant adverse impacts to people and property are avoided.

2.2 Objectives

The key objective of the CFMP is to ensure that construction impacts relating to flooding and hydrology are minimised. To achieve this objective, the following will be undertaken:

- ensure controls and procedures are implemented during construction activities to avoid, minimise or manage potential adverse impacts to construction works in the event of a flood within or adjacent to the Project corridor;
- ensure measures are implemented to address the relevant CoA outlined in Table 3-1, and the management measures detailed in the EIS; and
- ensure measures are implemented to comply with all relevant legislation and other requirements as described in Section 3.1 of this Plan.

2.3 Targets

The following targets have been established for the management of flooding and hydrology impacts during construction of the Project:

- ensure full compliance with the relevant legislative requirements and the Infrastructure Approval requirements addressed in this Plan;
- minimise and manage construction impacts on hydrology and flooding from works on the flood levee and within the Clarence River and its floodplain; and
- avoid any significant adverse impacts to people and property.

3 Environmental requirements

3.1 Relevant legislation and guidelines

3.1.1 Legislation

Legislation relevant to flooding and hydrology management includes:

- Environmental Planning and Assessment Act 1979 (EP&A Act);
- Clarence Valley Local Environmental Plan (LEP), 2011;
- Protection of the Environment Operations Act 1997 (POEO Act);
- State Emergency and Rescue Management Act 1989 (SERM Act);
- State Emergency Service Act 1989;
- Water Management Act 2000 (WM Act); and
- Water Act 1912 (Water Act).

Relevant provisions of the above legislation are explained in the register of legal and other requirements included in Appendix A1 of the CEMP.

3.1.2 Additional approvals, licences, permits and requirements

Refer to Appendix A1 of the CEMP.

3.1.3 Guidelines

The main guidelines, specifications and policy documents relevant to this Plan include:

- Floodplain Development Manual (OEH);
- Floodplain Risk Management Guideline (OEH);
- Australian Rainfall and Runoff (Institution of Engineers, Australia);
- Grafton and Lower Clarence Floodplain Risk Management Plan (CVC, 2007);
- Lower Clarence River Flood Study (PWD, 1986);
- Clarence Valley Local Flood Plan (SES, 2012);
- RMS Specification D&C G36 – Environmental Protection (Management System) (G36);
- New South Wales State Emergency Management Plan (EMPLAN, December 2012);
- New South Wales State Flood Plan (a sub-plan of EMPLAN) (March 2015);
- New South Wales State Emergency Management Plan – Evacuation Management Guidelines (March 2014); and
- New South Wales Flood Prone Land Policy (May 2005).

3.2 Minister's Conditions of Approval

The CoA's relevant to this CFMP are listed in Table 3-1 below. A cross reference is also included to indicate where the condition is addressed in this CFMP or other Project management documents.

Table 3-1 Conditions of Approval relevant to the CFMP

CoA No.	Condition Requirements	Where addressed
B6.	Scour protection measures shall be implemented prior to and during construction on the banks of the Clarence River in the vicinity of the bridge works to protect the riverbank from erosion and instability during construction and operation.	Detailed design CSWQMP
D26.	The proposed Grafton and South Grafton levee flood mitigation measures shall be implemented prior to construction commencing in the Clarence River, including pier/pile construction and the installation of temporary in-river rock platforms, unless otherwise agreed by the Secretary.	Section 6.1
D46(f)	As part of the Construction Environment Management Plan for the SSI, the Proponent shall prepare and implement a Construction Flood Management Plan to detail how construction impacts on hydrology and flooding from works on the flood levee and within the Clarence River and its floodplain will be minimised and managed and that any significant adverse impacts to people and property are avoided. The Plan shall be prepared in consultation with a suitably qualified and experienced hydrologist, OEH, SES and Council, and shall include, but not necessarily be limited to:	This Plan Section 6 Section 4
	(i) an assessment of the probabilities and consequences of flood damages and personnel safety over the likely construction period including for possible extensions to this period;	Section 7.1 Annexure B
	(ii) details of works and activities, including structures within the Clarence River, which may be impacted by a flood during construction and associated risks;	Section 6.1
	(iii) details of measures to ensure work sites and plant and equipment are secure during flooding events and do not become flood debris or impact on property and the environment;	Section 7.3
	(iv) management measures and procedures that would be implemented prior to a flooding event, including timeframes for securing work sites and moving plant and equipment,	Section 7.2
	(v) consideration of the flood management objectives described in condition D23(b) (i.e. flood level (height), duration, velocity and direction, and flood evacuation at affected properties);	Section 7 Annexure A
	(vi) monitoring of the work sites during flood events; and	Section 8.1 Section 8.3
	(vii) mechanisms for the monitoring, review and amendment of this plan.	Section 9

4 Consultation

4.1 Consultation Requirements under the Infrastructure Approval

CoA D46(f): The Flood Management Plan shall be prepared in consultation with a suitably qualified and experienced hydrologist, EPA , SES and Council.

A summary of consultation undertaken during the preparation of this CFMP is provided in Appendix A2 of the CEMP.

4.2 Consultation Requirements under the EIS

FH1: Flood monitoring and response measures will include notification and consultation with relevant stakeholders.

FH2: Impacts of the Project on flood evacuation routes NSW State Emergency Services will be notified of any partial or total road closures during construction.

FH3: Affected landowners will be consulted during construction regarding flooding impacts on properties, residences and other structures.

FH5: Property-specific flood risk will be assessed for each property identified as being affected by residual impact from the project, based on the results of the floor level survey. Flood mitigation options will be developed and implemented in consultation with property owners and Clarence Valley Council.

5 Existing environment

This chapter describes the existing flood regime within the Project area, based on the information contained in Section 8 and Appendix E of the EIS.

5.1 Existing flood regime

The Clarence River is a major coastal river with lower floodplain areas subject to frequent and extensive flood inundation. The river catchment covers about 20,000 km² upstream of Grafton. During times of major flooding, a floodplain of about 500 km² downstream of Grafton may also become inundated.

The flooding behaviour of the lower Clarence River is dominated by runoff generated in the large catchment area upstream of Grafton. The upstream catchment typically contributes 80 to 90% of the total volume of floodwater that enters the lower floodplains during main river flood events. Clarence River floods typically occur from low rainfall intensity events that last several days, or even weeks.

Minor tributaries within the lower floodplain of the Clarence River also have the potential to cause flooding issues.

5.2 Flood levels in Grafton and South Grafton

Grafton and South Grafton have a long history of flooding. The towns are protected by a ring levee system as shown in Figure 5-1. The existing levee system provides flood immunity for around a 20-year average recurrence interval (ARI) event, that is, there is around 5% chance that the levee may be overtopped in any given year. Overtopping begins when flood levels are at, or close to, 8 m on the Prince Street gauge in Grafton and 8.1 m in South Grafton (refer Figure 5-1). After the levee overtops, large areas of Grafton and South Grafton are inundated by floodwater.

Peak flood levels and depths for the Clarence River at Grafton are presented in Table 5-1 and Table 5-2 respectively. The tables show that significant overtopping of the levee system occurs during floods above the 20-year ARI.

Flood protection is also provided by natural high ground and the embankments for the railway and Pacific Highway.

Table 5-1 Existing peak flood levels

Flood Event ARI	Peak Flood Levels (m AHD)			
	Prince Street gauge	Existing Grafton bridge	Grafton: Intersection of Pound Street and Prince Street	South Grafton: Intersection of Abbott Street and Vere Street
20-year	7.95	7.69	No flooding	3.87
50-year	8.32	8.02	5.92	4.56
100-year	8.41	8.10	6.90	5.65
Probable Maximum Flood (PMF)	9.78	9.41	9.25	9.98

Table 5-2 Existing peak flood depths

Flood Event ARI	Peak Flood Depths (m AHD)	
	Grafton: Intersection of Pound Street and Prince Street	South Grafton: Intersection of Abbott Street and Vere Street
20-year	No flooding	0.6
50-year	0.52	1.29
100-year	1.5	2.38
Probable Maximum Flood (PMF)	3.85	6.71

5.3 Flood extents

The extents of inundation for the 20, 50 and 100-year ARI flood events and the probable maximum floods (PMF) in Grafton and South Grafton are shown in Figure 5-2.

The figure indicates that flooding is a significant issue as:

- during a 100-year ARI flood, most of the land inside the levee system would be inundated; and
- during the PMF (the worst-case scenario), the entire township of Grafton would be inundated.

Due to these factors, flooding poses a significant risk to the residents in Grafton and lower lying areas in South Grafton. Inundation of individual properties may result in damage to buildings and belongings. Local businesses would also be impacted due to a loss of trade and income, and damage to property and goods.

5.4 Emergency response and evacuation

The NSW State Emergency Services (SES) has developed the Grafton Sector Response Strategy for the Grafton area of the Clarence Valley, and documents this in the *Clarence Valley Council Local Flood Plan* (SES, 2012). Broadly, the Grafton Sector Response Strategy (refer Annexure C) describes the following information (but is not limited to):

- Sector controller;
- Key flood warning gauge: Prince Street;
- evacuation sectors;
- evacuation trigger levels, defining sector-specific evacuation actions relating to a range of flood levels at Prince Street gauge;
- vulnerable community groups requiring special consideration or help during an evacuation;
- evacuation routes; and
- evacuation centres;

The Grafton Sector Response Strategy identifies the main evacuation routes out of Grafton (refer

Figure 5-15). Three evacuation routes from the north of Grafton converge on the junction of Clarence Street and Craig Street in Grafton CBD before crossing the existing Grafton bridge to South Grafton and an identified Assembly Area at South Grafton High School.

The efficiency of flood evacuation in Grafton is largely constrained by traffic movement across the existing bridge, therefore keeping the existing bridge free of obstructions is crucial for the efficient evacuation of Grafton.

5.5 Floodplain risk management plan

The *Grafton and Lower Clarence Floodplain Risk Management Plan* (CVC, 2007) recognises the flood risk to Grafton and South Grafton and identifies mitigation work that focuses on the maintenance and augmentation of the levee system. The plan notes that any work to increase the levee height has the potential to increase inundation to areas not protected by the levees.

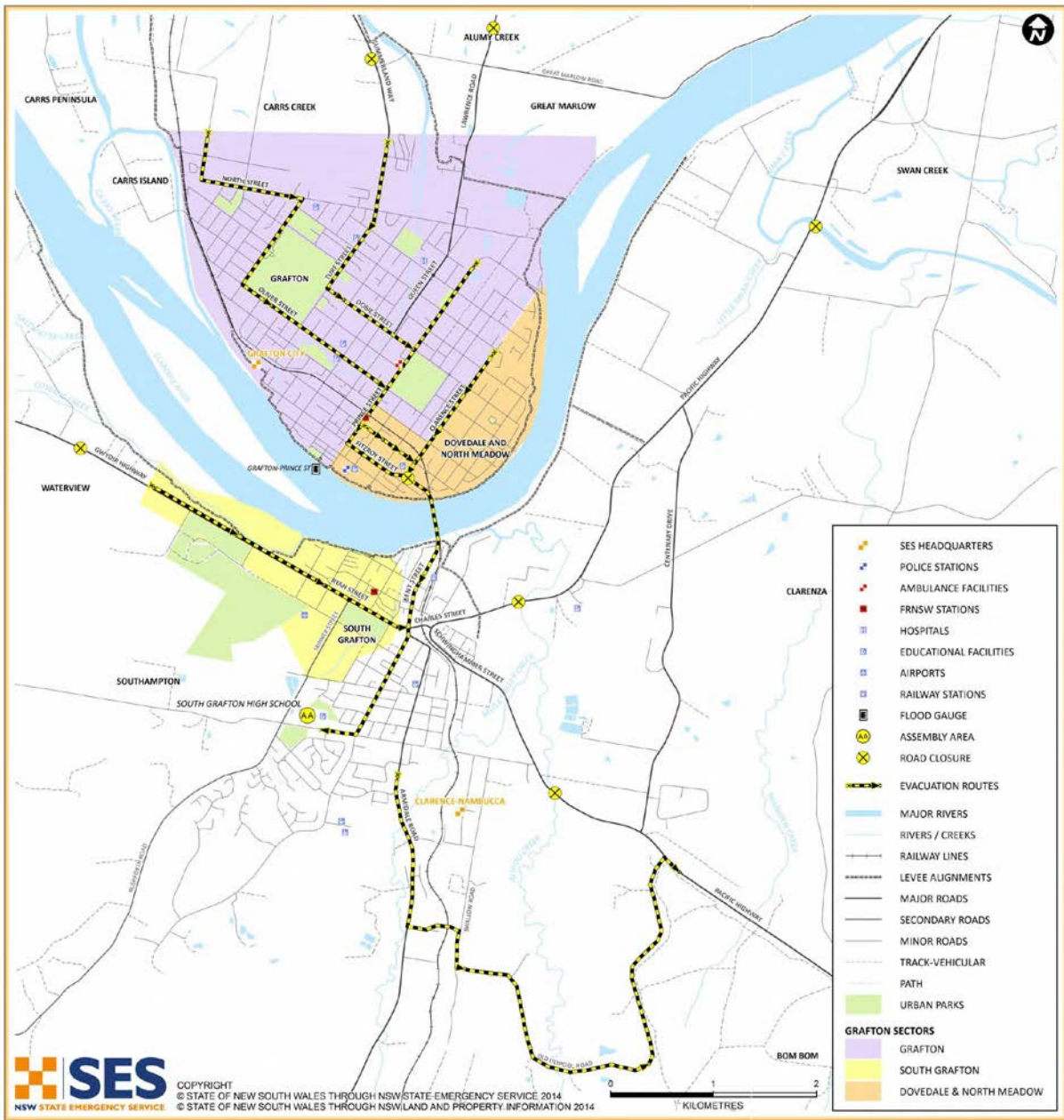


Figure 5-1 Existing levee system and flood evacuation routes

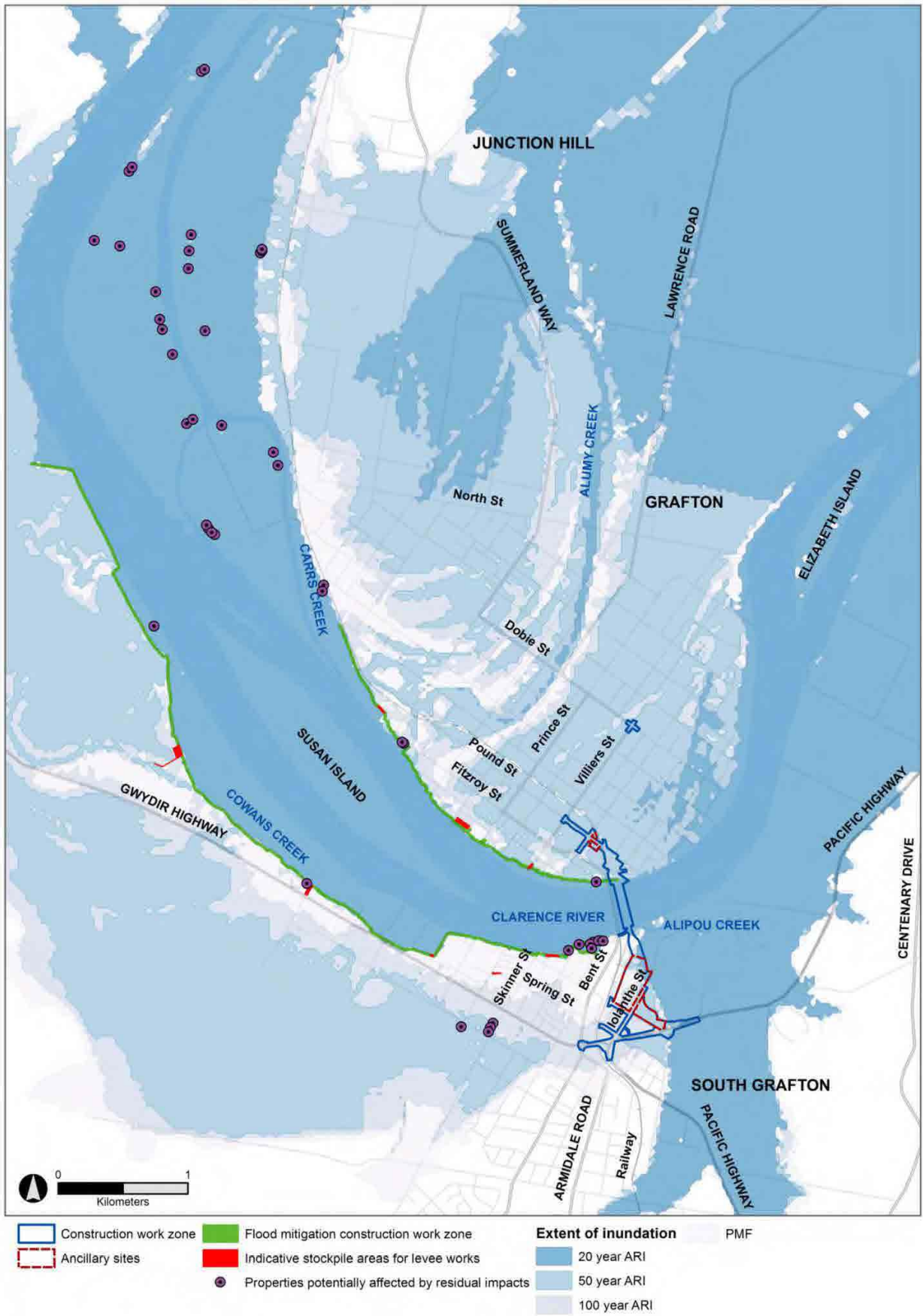


Figure 5-2 Approximate extents of inundation without the Project

6 Environmental aspects and impacts

6.1 Construction activities

Flood mitigation works as identified in the *Hydrological Mitigation Report* (KBR, June 2016) will be implemented prior to any in-river works to ensure no worsening of the existing flood regimes during construction. Key aspects of the Project that could result in flooding and hydrology impacts include:

- levee works;
- bulk earthworks and stockpiling of materials;
- placement of construction ancillary facilities within the 20 year ARI flood plain;
- bridge construction, including construction of embankments, bridge piers and temporary structures, such as barges;

The key construction activities and the associated potential impacts to flooding and hydrology were identified through a risk management approach. The results of this risk assessment are captured in the Environmental Aspects and Impacts Register included in Appendix A3 of the CEMP.

6.2 Project flooding and hydrology impacts

6.2.1 Potential impacts of flooding on the Project

Flood events above the 20-year ARI flood event have the potential to impact construction ancillary sites and construction work zones and to disrupt construction activities. Flooding may also increase the risk of soil erosion and sedimentation.

With the exception of a small portion of the South Grafton ancillary site and construction work zone, all ancillary sites and construction work zones for the bridge and approaches would be protected by the existing levee system in a 20-year flood event.

In Grafton, there is potential for the construction work zone near the Pound Street rail viaduct and the Pacific Highway end of Iolanthe Street to flood when there is a high intensity rainfall event in Grafton while the Clarence River is in flood. There are existing low points in these areas, which normally drain to the river during a local rainfall event. When the Clarence River is in flood, the raised river level prevents local storm water from draining to the river and localized water ponding occurs.

6.2.2 Potential impacts of construction on the flood regime

The construction of additional structures on the floodplain and in the river, such as bridge piers, embankments and temporary construction structures, would have a progressive and gradual impact on the existing flood regime upstream of the Project. This is due to the extensive length of the Grafton and South Grafton levees, where even slight changes in flood level within the Clarence River have the potential to alter the volume of water overtopping the levee. Therefore, flood mitigation works are to be completed prior to River Works which may impact the flood regime. Extensive flood modelling of the Project indicates that there are no downstream flood impacts from the Project.

6.2.3 Changes to emergency response and evacuation

Key factors that influence how the proposed bridge would impact evacuation operations include:

- **Evacuation route contingency:** As shown in Figure 5-1, evacuation routes currently converge on the junction of Clarence Street and Craig Street before crossing the existing Grafton bridge to South Grafton and an identified Assembly Area at South Grafton High School.
- **Evacuation route flood immunity:** An evacuation route is compromised if it is inundated by flood water. Grafton is affected by flooding in flood events greater than the 20-year ARI event. Due to this local flood behaviour, where possible, the elevation of flood evacuation routes should be greater than surrounding land and avoid traversing drainage depressions which many prematurely compromise the evacuation route.
- **Provision of services:** Flooding within the Lower Clarence Valley can last for prolonged periods (several days to weeks). Due to this flood behaviour, it is important that evacuated residents have access to services and shelter following evacuation from Grafton. South Grafton represents the primary place large enough to provide for these needs.
- **Vulnerable community groups:** SES resourcing needs to accommodate for vulnerable community groups that may require special consideration and/or assistance during an evacuation.

Construction activities would not have a significant impact on existing evacuation routes. The SES would be notified in advance of any partial or total road closures during construction.

7 Environmental management measures

A range of environmental requirements and control measures are identified in the various environmental documents, including the EIS, Conditions of Approval and other RMS documents. Mitigation and management measures will be implemented to avoid, minimise or manage impacts to hydrology and to minimise impacts to construction in the event of a flood. Measures and requirements to address impacts on hydrology and minimise flooding impacts are outlined in Table 7-1 and Table 7-2.

Table 7-1 Environmental management measures for flooding and hydrology impacts

ID	Measure / Requirement	Reference	When to implement	Responsibility	Where addressed
CONSULTATION					
CO1	Roads and Maritime will consult with Clarence Valley Council on the design and potential staging of flood mitigation works.	EIS Section 8	Pre-construction	Contractor and RMS	<i>Hydrological Mitigation Report (CoA D23) (by RMS)</i>
SOILS, SEDIMENTS, WATER AND CONTAMINATED LAND					
Stockpile site management					
SW16	Where practicable, stockpiles will be located away from areas subject to concentrated overland flow. Stockpiles located on a floodplain will be managed so as to minimise loss of material in flood or rainfall events.	EIS Section 8	Construction	Contractor	<i>Stockpile Management Protocol</i> included in Annexure E of the CSWQMP
FLOODING AND HYDROLOGY					
Impacts of flooding on the project construction					
FH1	<p>Flood monitoring and response measures will be included as part of the CEMP. These measures will include protocols to monitor the forecast of large rainfall and flood events in the project area and protocols to minimise the risk of damage to infrastructure and equipment during a large flood or rainfall event and will include but not limited to:</p> <ul style="list-style-type: none"> • Methods of monitoring rising water and where possible notification from upstream • A register of all materials stored in work areas within the banks of the Clarence River and within the levee system • Methods and responsibilities for removal of all materials safely from work areas during a flood event • Notification and consultation with relevant stakeholders. 	EIS Section 8	Pre-construction	Contractor	<p>Section 4 Section 7.1 Section 7.2 Section 7.4 Section 7.5 Section 7.5 Table 7-2 mitigation measure ID CFMM1-CFMM5 Section 8.1 <i>Community Communication Strategy (CoA C1)</i> to be provided separately to the CEMP</p>
Impacts of the project on flood evacuation routes					
FH2	NSW State Emergency Services will be notified of any partial or total road closures during construction	EIS Section 8	Construction	Contractor and RMS	<i>Community Communication Strategy (CoA C1)</i> to be provided separately to the CEMP

ID	Measure / Requirement	Reference	When to implement	Responsibility	Where addressed
					Section 6.2.3 Section 7.5
Consultation					
FH3	Roads and Maritime will consult with affected landowners during detailed design and construction regarding flooding impacts on properties, residences and other structures.	EIS Section 8	Pre-construction, Construction	Contractor	<i>Hydrological Mitigation Report (CoA D23) (by RMS)</i> <i>Community Communication Strategy (CoA C1) to be provided separately to the CEMP Section 4.2</i>
Flood modelling					
FH4	Detailed flood modelling will be carried out to further refine the levee raising mitigation measures proposed for the project and to further consider the need to raise any houses not protected by the existing levee which would be affected by increased flood levels within the river. As part of this modelling, floor level surveys will be carried out on properties identified as potentially affected by residual impact from the project.	EIS Section 8	Pre-construction of bridge	RMS	<i>Hydrological Mitigation Report (CoA D23) (by RMS)</i>
Residual impacts on properties and infrastructure					
FH5	Property-specific flood risk will be assessed for each property identified as being affected by residual impact from the project, based on the results of the floor level survey. Flood mitigation options will be developed and implemented in consultation with property owners and Clarence Valley Council.	EIS Section 8	Pre-construction of bridge	RMS	<i>Hydrological Mitigation Report (CoA D23) (by RMS)</i>
Impacts of project construction on existing flood regimes					
FH6	Flood mitigation works will be staged to ensure no worsening of the existing flood regimes during construction.	EIS Section 8	Pre-construction	Contractor	Section 6.1

Table 7-2 Additional mitigation measures for flooding and hydrology impacts

ID	Environmental Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
CFMM1.	Ensure all site personnel, including sub-contractors and visitors, attend the Project induction and familiarise themselves with emergency response procedures.		✓	Foreman Project / Site Engineer
CFMM2.	Monitor the Bureau of Meteorology (BoM) online Flood Warning Service and latest river heights for Clarence River at the Prince Street Gauge daily to determine whether rainfall in the catchment is predicted to cause elevated river levels at construction work zones or ancillary facilities. (http://www.bom.gov.au/fwo/IDN60231/IDN60231.058178.plt.shtml). Additionally, monitor online the River Heights for Prince Street Gauge Camera associated with the BoM water level recorder (http://www.clarence.nsw.gov.au/cp_themes/metro/page.asp?p=DOC-BTR-18-83-64).		✓	Foreman Project / Site Engineer
CFMM3.	Maintain a register of all hazardous materials stored on the Project, including those stored in work areas within the banks of the Clarence River and within the levee system, in accordance with the Fulton Hogan <i>Project Work Health Safety Management Plan</i> .		✓	Safety Manager
CFMM4.	In the event of an impending flood event, convene the Project's Emergency Planning Committee (EPC, refer Table 7-3) and commence implementing the recommended actions stipulated in Section 7.2 and Section 7.5 of this CFMP.		✓	Project Director
CFMM5.	A site evacuation notice may be issued by the EPC following the receipt of sufficient and reliable information from the Flood Warning Services, emergency services or on-site rainfall intensity monitoring. In the event of an evacuation, follow the process described in Section 7.3.2.		✓	EPC
CFMM6.	The barge operator will prepare a Severe Weather Event Evacuation Procedure prior to commencement of the barge works. The Procedure will form part of the Environmental Work Method Statement for the barge works, which is expected to undergo agency review and consultation in February 2017. Implementation of the Severe Weather Event Evacuation Procedure is to be considered in preparation of the site in the event of a "Flood Warning" being issued.		✓	Barge Operator/ Environmental Manager

7.1 Probabilities and consequences of flood damages and personnel safety

The EIS undertook an assessment of the potential impacts of the project relating to flooding and hydrology. The EIS included a flooding and hydrology assessment technical report prepared by BMT WBM consultants (refer to EIS Appendix E, Technical Paper: Flooding and Hydrology Assessment).

The EIS states that flood events above the 20-year ARI flood event have the potential to impact construction ancillary sites and construction work zones and to disrupt construction activities (ARUP 2014, p162). However, the use of the term "ARI" can lead to confusion as it implies that the associated magnitude of the flood event is only exceeded at regular intervals. Therefore, in order to understand the probability of a particular flood event it is preferable to express the probability of an event in terms of its Annual Exceedance Probability (AEP). AEP is defined on the BoM website as, "The probability that a given rainfall total accumulated over a given duration will be exceeded in any one year." (BoM 2016).

Taking into consideration that the EIS identifies flood events greater than the 20-yr ARI as being the critical event, the corresponding probability of this critical event being exceeded in any given year is approximately 5%. It is the probability of this critical event which subsequently informed the likelihood of flood damages and personnel safety over the likely construction period as detailed in **Error! Reference source not found.**

7.2 Measures to be implemented prior to a flooding event

7.2.1 Monitor flood warning services

The BoM Flood Warning Service Program, whose primary function is the provision of an effective flood forecasting and warning service, will be consulted daily to ascertain if any flood warnings have been issued. This service is provided in co-operation with other government agencies such as State emergency management agencies, water authorities and local Councils, coordinated through Flood Warning Consultative Committees and established cooperative working arrangements in each State/Territory.

In each State, Flood Warnings, Watches and River Height Bulletins are available via some or all of the following:

- Local Response Organisations: these include the Council, Police, and State Emergency Service in the local area
- Bureau of Meteorology: Flood Warnings, Flood Watches and general information are available directly from the Bureau of Meteorology, including:
 - On the web at: www.bom.gov.au/australia/warnings;
 - Through the Telephone weather warnings service. Flood Warnings and Flood Watches in most States are available on the Bureau of Meteorology's recorded message service, 1300 659 218 (charges apply), and
- Radio: Radio stations, particularly local ABC and local commercial stations broadcast flood warning information as part of their new bulletins, or whenever practicable.

A "Flood Watch" is issued when flooding is possible. A "Flood Warning" is issued when a flood is likely. SES advises that a "Flood Watch" for the Clarence River is typically issued several days before the event is anticipated. SES clarified by example that there could be 3-4 days of rain in the upper catchment before this runoff actually impacts (increasing river height and velocity) is experienced in vicinity of the site.

In addition to information provided by Local Response Organisation and radio/television broadcast stations, Fulton Hogan will monitor the BoM Flood Warning Service and latest river heights for Clarence River at the Prince Street Gauge daily to determine whether rainfall in the catchment is predicted to cause elevated river levels at construction work zones or ancillary facilities.

For Fulton Hogan to achieve this daily monitoring, the following real-time data from automated telemetry systems will be consulted:

- BoM Latest River Heights for the NSW Northern Rivers, Prince Street Gauge, Gauge Number 058178: <http://www.bom.gov.au/fwo/IDN60231/IDN60231.058178.plt.shtml>.
- Public Works, Manly Hydraulics Laboratory, Prince Street Gauge Camera: http://www.clarence.nsw.gov.au/cp_themes/metro/page.asp?p=DOC-BTR-18-83-64

7.2.2 Preparation of the site

Ancillary facilities will be situated predominantly outside the 20-year ARI flood extent as indicated in Figure 5-2. To prepare the site for a flood emergency upon the issuing of a “Flood Watch” the following will be considered, as a minimum:

- Inform all site staff well in advance of a predicted flood event and confirm flood emergency procedures;
- Ensure no materials are stockpiled in areas of concentrated overland flow;
- All dangerous and hazardous goods will be stored at the main compound, outside the extent of a 20-yr ARI flood event, in a dangerous goods (shipping) container which is purpose built and compliant with the Australian Standard for the storage and handling of flammable and combustible liquids (AS 1940:2004). In the event a flood greater than the 20-yr ARI is predicted, the dangerous goods (shipping) container is to be removed/relocated from site to a safe and secure location outside the extent of the predicted flood event.;
- All plant and equipment, including earthworks plant and cranes, is to be moved and parked in areas outside the 20-year ARI flood extent (as shown in Figure 5-2), or higher depending on information from the Flood Warning Service, and encircled with a wall of sandbags;
- Silt curtains or other in-river environmental controls are to be removed to a location outside the 20-yr ARI;
- If feasible, in-river work platforms, such as jetty platforms, are to be removed from the river and stored outside the 20-year ARI; alternatively, in-river work platforms must be secured to avoid causing damage to property;
- Barges are to be secured by setting an additional anchor upstream of the barge and paying out more anchor wire on the upstream side so that the barge is further away from its anchor location. This ensures the load put into the anchors is applied more or less along the riverbed, reducing the potential to cause damage to property and the riverine environment;
- Back-up all computer files and network information off-site;
- Store sandbags on site to place at site office doors and equipment shed doors to impede the ingress of floodwaters into the buildings, when a flood is predicted to exceed the 20-year ARI;
- Store geofabric (or similar) to place around material stockpiles that cannot be located outside of the 20-year ARI flood extent, to prevent erosion and loss of material; and
- In the event of a pending flood, any open sections of levee will be reinstated (e.g. sandbags) and erosion control measures put in place to prevent the open section of the levee being eroded away.

It should be noted that a “Flood Watch” can be issued for the Clarence River without an actual flood occurring. Therefore, consideration of the actions listed above and the timeframe for securing the work site and moving plant and equipment will be decided by the EPC on a case-by-case basis depending on the most current information available and advice received from SES. Refer to Section 7.2.3 below.

It is anticipated that there will be permanent staff as well as sub-contractors and visitors on site during construction. All site personnel (permanent staff, sub-contractors and visitors) will be briefed on emergency procedures in their project induction and periodically during toolbox talks to ensure they are prepared for a flood event. Should evacuation of the site be ordered, it is essential site personnel on site are familiar with the evacuation procedure and routes described in this CFMP.

7.2.3 Mobilisation of Emergency Planning Committee

Apart from flash floods, most other floods allow some warning and preparation time. Being prepared for a flood emergency will help manage the risk and reduce potential loss of life and damage to construction works, equipment, property and the environment. Preventing panic during the emergency can be mitigated through proper education, notification and communication of information to enable well informed decisions to be made and executed during the emergency.

Upon the issuing of a “Flood Watch”, the Project’s Emergency Planning Committee (EPC) will be mobilised to co-ordinate the preparation of the site, communicate and notify site personnel and emergency services (e.g. SES) and potentially evacuate the site if deemed necessary. The personnel comprising the EPC are identified in Table 7-3.

Table 7-3 Emergency Planning Committee Members

EPC Member	EPC	Discipline: Focus Area
Project Director	Lead Member	All disciplines: Entire site
Construction Manager	Alternate Lead Member	Construction: Entire Site
Superintendent	Alternate Lead Member	Plant, equipment & materials: Entire site
Safety Representative		Site personnel: Entire site
Environmental Officer		Environment: Entire site

7.3 Measures to be implemented during a flooding event

The SES is the designated Agency for dealing with floods and is responsible for coordinating the evacuation and welfare of affected communities (SES Act 1989; EMPLAN, 2012). In response to a flood event, SES will operate a 24 hours a day, 7 days a week “Operations Centre” to manage the Emergency Assistance telephone number (132 500) and co-ordinate their activities.

Upon the issuing of a “Flood Warning”, Fulton Hogan will continuously monitor BoM Flood Warning Service and maintain open communications with the SES.

7.3.1 Protect and Secure

Upon the issuing of a “Flood Warning” the following actions are advised if they were unable to be carried out/completed prior to a predicted flood event:

- Secure all items in ancillary facilities that may become hazardous and cause damage if moved by flood water;
- Ensure all utilities (e.g. gas, electricity water) connected to the site office have been put to the OFF position and main valves closed;
- Should barges be in-river, consider implementation of a Severe Weather Event Evacuation Procedure (refer to Table 7-2 mitigation measure ID CFMM6);
- Relocate chemicals that react with water to give off heat or form explosive or toxic gases and poisons to the highest level. Include any substances that could contaminate flood waters; and
- Tie down timber, drums and other loose, buoyant items to prevent them from being carried away by flood water or battered against other items or structures.

7.3.2 Evacuate

When the river height at the Prince Street Gauge is predicted to reach or exceed 7.9 m AHD, the SES is likely to order an evacuation of Grafton and South Grafton (SES, 2012). Following receipt of

an evacuation order from emergency services or on-site monitoring which prompts the decision to evacuate, the process outlined in Figure 7-1 is to be followed.

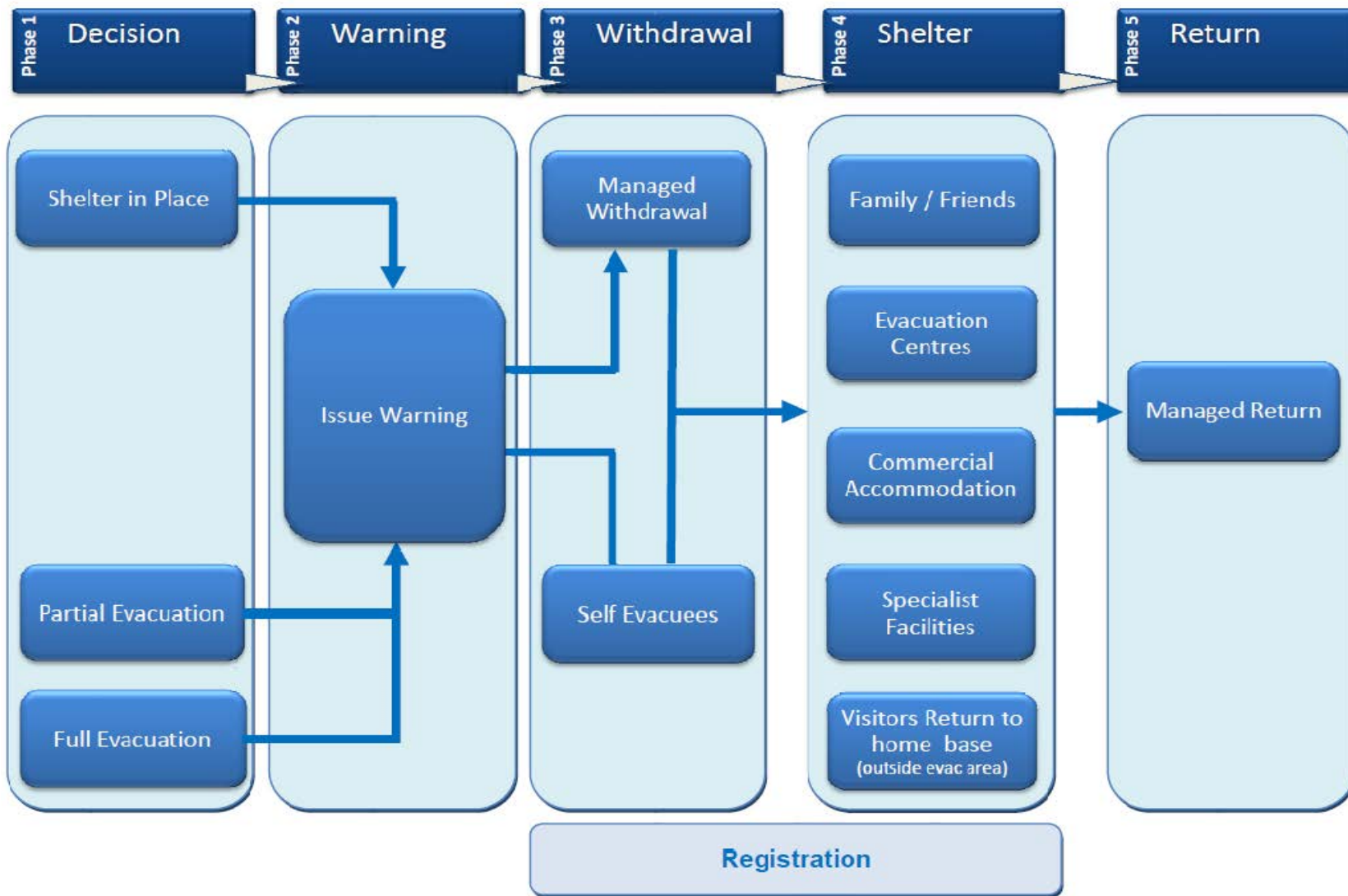


Figure 7-1 The evacuation process

(Source: NSW State Emergency Management Plan - Evacuation Management Guidelines, March 2014)

7.3.2.1 The Decision

The decision by the EPC to advise or direct people to evacuate should be considered whenever there is a potential need to move people to a safer place. The decision process of the EPC should take into consideration where an evacuation has already been instigated, whether by an emergency service (e.g. SES), members of the public or site personnel self-evacuating. During a flood event, the site office will serve as an emergency assembly area where workers will gather before an evacuation order is issued. The site office is protected by the levee.

If insufficient time is available for a full evacuation, secondary strategies may need to be considered such as a partial evacuation (safety of personnel is paramount), refuge in South Grafton above the 100-year ARI flooding extent, or refuge in a place of safety as advised by the emergency services.

7.3.2.2 Warning

Once a decision to evacuate is made, site personnel will be immediately notified of the decision and provided advice on the withdrawal process, including any actions or evacuation routes to follow.

7.3.2.3 Withdrawal

Withdrawal is to be an orderly, potentially phased, removal from the project site via the site access points. The movements of all site personnel are to be recorded in a register. Site personnel will be encouraged to use their own method of transport to evacuate the site. Evacuation routes identified in Figure 5-1 should be followed. In the event that the evacuation routes identified in Figure 5-1 are compromised and not accessible, alternative evacuation routes will be developed in consultation with the emergency services, taking into consideration the hazard threat and available timeframes.

Emergency services should be consulted when identifying the preferred evacuation route. The following should be taken into consideration:

- Potential number and types of vehicles utilising the routes
- Direct evacuees away from the potential or actual hazard(s) to places of safety
- Route capacity considered in relation to available timeframe
- Management strategies identified for traffic congestion, route blockage or breakdowns including vehicle removal
- Restrictions on heavy vehicles
- Identification of contra-flow options and associated safety measures, and

Movement of emergency service and other responder vehicles in relation to evacuation route(s).

7.4 Flood recovery

A flood event during the construction phase could cause considerable damage to property and the environment. If the site is properly prepared for the flood event, then damage could be minimised. The following list of actions should be considered when returning to site:

- Wait until authorities have declared the area safe before entering;
- Access roads to site may have been damaged during the flood event so drive carefully and approach the site safely;
- Check power boxes and electrical equipment on site. These may have been inundated and require a qualified electrician to check for damage;

- Do not turn power back on until all electrical equipment on site has been checked and certified by a qualified electrician;
- Check the structural integrity of all buildings on site by a suitably qualified professional. Buildings on site will be of a temporary nature so may not be designed to withstand extreme flood flows and depths. Even if floodwaters have not entered the buildings check foundations for erosion;
- Check to see if any equipment has been moved by flood waters and relocate equipment back to a safe position/location;
- Check material stockpiles for erosion and losses;
- Check water and waste water systems on site. Water systems may need to be flushed or repaired following the flood event. Clean up any ponded water around site to prevent the spread of waterborne disease;
- Prepare an incident report on the flood event. Include information on how the site was evacuated and document the resulting flood depths and damage to the site; and
- EPC to re-open site only when it is deemed safe to continue work.

Only once the flood has receded and the site has been re-opened should in-river environmental controls, equipment or platforms be re-established.

7.5 Communication and notification

Timely and accurate warning information is vital during emergencies and is integral to minimising panic and ensuring suitable actions can be taken to minimise risk to life and property.

When heavy rainfall is being experienced and throughout the implementation of this CFMP, communication and consultation with the organisations stipulated in Table 7-4 must be undertaken continuously.

Table 7-4 Relevant contacts in relation to flood emergency

Organisation Contact	Number	Website
State Emergency Services (SES)	132 500	www.ses.nsw.gov.au
Bureau of Meteorology (BOM)	1300 659 218	www.bom.gov.au/nsw/warnings
Clarence Valley Council	(02) 6643 0200	www.clarence.nsw.gov.au
NSW Police (Grafton)	(02) 6642 0222	www.police.nsw.gov.au
NSW Fire and Rescue (Grafton)	(02) 6643 3491	www.fire.nsw.gov.au
Fulton Hogan Project Director: (Name)		
Fulton Hogan Construction Manager: (Name)		
Fulton Hogan Superintendent: (Name)		

Communication and the distribution of information to site personnel leading up to, and throughout a flood event, must be implemented. Following any decision to evacuate, site personnel and emergencies services will be notified of the following:

- The decision to evacuate;
- Type of evacuation (full, partial or shelter in place);
- The stages of withdrawal (if applicable);
- Evacuation routes and any heavy or oversized equipment to be removed from site; and
- Location of any potential hazardous materials and how these have been secured or protected.

8 Compliance management

8.1 Roles and responsibilities

The Project Team's organisational structure and overall roles and responsibilities are outlined in Section 4.2 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Chapter 7 of this Plan.

8.2 Training

All employees, contractors and utility staff working on site will undergo site induction training relating to flooding and hydrology management issues. The induction training will address elements related to flood management including:

- the requirements of this CFMP;
- relevant legislation;
- roles and responsibilities associated with this CFMP;
- flood management measures, before and during a flood event;
- flood monitoring requirements, and
- specific responsibilities for the protection of construction works during flooding.

Further details regarding staff induction and training are outlined in Chapter 5 of the CEMP.

8.3 Monitoring and inspections

General requirements and responsibilities in relation to monitoring and inspections are documented in Section 8.2 of the CEMP.

Monitoring and inspections specific to flood management are identified below:

- Monitoring flood warning services and river heights daily, as described in Section 7.2.1;
- Following the preparation of the site for a flood emergency, inspect the entire site to ensure the site is secure and does not pose a risk to life or property; and
- Once a flood emergency has receded, inspect the site and consider the actions described in Section 7.4 before re-opening the site.

8.4 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this sub plan, Infrastructure Approval and other relevant approvals, licenses and guidelines.

Audit requirements are detailed in Section 8.3 of the CEMP.

8.5 Reporting

Reporting requirements and responsibilities are documented in Section 8.3 and Section 8.5 of the CEMP.

9 Review and improvement

9.1 Continuous improvement

Continuous improvement of this plan will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process will be designed to:

- identify areas of opportunity for improvement of environmental management and performance;
- determine the cause or causes of non-conformances and deficiencies;
- develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies;
- verify the effectiveness of the corrective and preventative actions;
- document any changes in procedures resulting from process improvement; and
- make comparisons with objectives and targets.

9.2 CFMP update and amendment

The processes described in Chapter 8 and Chapter 9 of the CEMP may result in the need to update or revise this CFMP. This will occur as needed.

Any revisions to the CFMP will be in accordance with the process outlined in Section 1.6 of the CEMP and as required, be provided to RMS, ER and other relevant stakeholders for review and comment and forwarded to the Secretary of the DP&E for approval.

A copy of the updated CFMP and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure – refer to Section 10.2 of the CEMP.

Annexure A Flood Management Objectives and Mitigation Measures for Affected Properties

Mitigation measures based on documented flood management objectives in the Hydrological Mitigation Report (CoA D23) for affected properties. The flood management objectives shall cover flood level (height), duration, velocity and direction, and flood evacuation and be developed in consultation with Council and the SES

Where the project results in an increased flood impact, landowners are consulted and some works on individual properties are proposed in keeping with the project's flood management objectives.

Flood management objectives have been set to be consistent with other Roads and Maritime Services projects. These flood management objectives are identified in Table 1 and Table 2 below, as sourced from *Hydrological Mitigation Report* (KBR, June 2016).

The overall flood management objective is to maintain the existing level of flood protection as committed to in the EIS. This is to be achieved by adhering to the following flood management objectives in Table 1 and 2 that have been determined in consultation with Clarence Valley Council, Office of Environment and Heritage, NSW State Emergency Service and approved by the Secretary of the Department of Planning and Environment 6 July 2016.

Table 2 Flood Management Objectives (Increase in water level and duration)

Location	Flood Management Objectives
Residences	To limit increase in water level to less than or equal to 30 mm.
Major Outbuildings	To limit increase in water level to less than or equal to 30 mm.
Minor Outbuildings	To limit increase in water level to less than or equal to 50 mm.
Commercial/Not-for-Profit	To limit increase in water level to less than or equal to 30 mm.
Agricultural Land/Stock	To limit increase in water level to less than or equal to 40 mm.
Urban Land	To limit increase in duration to less than or equal to 5%.
Agricultural Land	To limit increase in duration to less than or equal to 10%.

The flood management objectives regarding increase in water level apply to inundation of floor areas, in the 20 year ARI, 50 year ARI and 100 year ARI events.

Table 3 Flood Management Objectives (Velocity, direction and flood immunity)

Attribute	Flood Management Objectives
Velocity	To limit increase in velocity to less than or equal to 0.6 m/s; and To limit increase in velocity such that at no location a velocity less than 2 m/s is increased to a velocity greater than 2 m/s.
Direction	To prevent any significant changes in direction of flood water.
Flood immunity	To provide flood immunity for the approaches to the proposed Grafton Bridge in a 20 year ARI event.

Details regarding the specific mitigation measure to be applied to private residences have not been included due to confidentiality and privacy reasons, however these details are included in the *Hydrological Mitigation Report* (KBR, June 2016).

Annexure B Probabilities and consequences of flood damages and personnel safety

CFMP Annexure B
Probabilities and consequences of flood damages and personnel safety

ACTIVITY/ASPECT	HAZARD/SOURCE OF IMPACT	IMPACT	PROBABILITY	CONSEQUENCE	RISK RATING
Flood Damages & Personnel Safety					
Construction work zones and ancillary construction facilities	Flood event above 20 year ARI. Failure of flood levee system. Stormwater / surface runoff inflow.	Loss of reusable material, such as top soil and backfill material	Unlikely	Major	Medium 14
		Disruption to construction activities and program	Unlikely	Major	Medium 14
		Increased surface water runoff or inflow contributing to soil erosion and sedimentation, and introduction of construction debris to downstream receiving environment	Possible	Significant	Medium 13
		Reduced water quality in local stormwater network and waterways associated with increased sedimentation and/or construction debris	Possible	Significant	Medium 13
		Flood damage to construction plant and equipment, installed project infrastructure, haul roads or ancillary facilities	Unlikely	Major	Medium 14
Construction personnel safety	Flood event above 20 year ARI. Failure of flood levee system.	Compromise of worker or public protection/safety and potential catastrophic incident or fatality	Rare	Catastrophic	Medium 15
Impacts of construction on flood regime	Obstruction of flood plain and existing hydrology associated with construction activities, infrastructure or ancillary facilities. Alteration to localised flooding patterns or drainage pathways.	Construction activities or infrastructure restricting or obstructing drainage pathways resulting in localised flooding events or ponding.	Unlikely	Major	Medium 14
		Alteration to flood levels impacting sensitive receivers and property downstream	Unlikely	Major	Medium 14
Impact of construction on emergency response and evacuation	Temporary changes to existing SES evacuation routes.	Temporary or partial road closures impacting SES evacuation routes	Rare	Catastrophic	Medium 15
		Obstruction of SES personnel or emergency response efforts contributing to property damage, compromise of public protection/safety or potential catastrophic incident or fatality	Rare	Catastrophic	Medium 15

HSQE Operational Risk Matrix

To be used during any required risk assessments for all Fulton Hogan activities including: SWMS, CAMs Cases, Aspects & Impacts Assessments, Workplace Risk Assessments, etc.

Step 1 - Assess the potential consequence of the unwanted event (or what **could** have occurred for an incident):

		Potential Consequence				
		Insignificant	Minor	Significant	Major	Catastrophic
Risk Type	Health and Safety	No treatment required	First Aid Treatment Injury	Medical Treatment Injury (MTI) OR Restricted Work Injury OR Lost Time Injury (LTI) 3 days or less	Lost Time Injury (LTI) 4 days or more OR Hospitalisation	Fatality OR Permanent disability
	Environment	No impact on or off site	On-site impact requiring routine internal remediation	Off-site impact requiring internal remediation OR on-site impact requiring substantial internal remediation	Impact on- or off-site requiring specialist external remediation	Impact on- or off-site with long term effect OR requiring immediate external response
	Quality	Accept as is OR Audit Recommendation	Minor Audit Finding (NCR)	Major Audit Finding (NCR)	Critical Audit Finding (NCR) OR Accreditation warning	Loss of accreditation
	Cost (Remedials, Plant or Property)	Less than \$1000	\$1,000 to \$10,000	\$10,000 to \$25,000	\$25,000 to \$100,000	Greater than \$100,000
	Community & Reputation	No community complaints	Isolated community complaint	Repeat community complaints OR negative local media	Frequent community complaints OR negative regional media OR Negative Social Media	Organized community opposition OR negative national media OR Viral Negative Social Media
	Regulatory	Notified / no response or Verbal directive	Verbal Warning / No Response Required	Written Warning / Cost Recovery / Response Required / Improvement Notice	Abatement Notice / Infringement Notice / Prohibition Notice	Prosecution / Enforcement Order
	Business Interruption	No interruption to work	Work interrupted	Temporary site closure (less than a day)	Temporary site closure (more than a day)	Permanent site closure or eviction

Step 2- Using the Potential Consequence, decide on the likelihood of occurrence to categorise the incident or hazard risk rating.

		Potential Consequence Level				
		Insignificant	Minor	Significant	Major	Catastrophic
Potential Likelihood Level	Almost Certain <i>The potential consequence is expected to occur in most circumstances</i>	Med 11	High 16	High 20	Ext 23	Ext 25
	Likely <i>The potential consequence will probably occur in most circumstances</i>	Med 7	Med 12	High 17	High 21	Ext 24
	Possible <i>The potential consequence is expected to occur at some time</i>	Low 4	Med 8	Med 13	High 18	High 22
	Unlikely <i>The potential consequence could occur at some time</i>	Low 2	Low 5	Med 9	Med 14	High 19
	Rare <i>The potential consequence may occur in exceptional circumstances</i>	Low 1	Low 3	Low 6	Med 10	Med 15

RISK LEVELS	SCORES	PARAMETERS
EXTREME	23 – 25	If the post-control risk is EXTREME the activity MUST NOT proceed. Elimination, substitution, isolation and/or engineering controls must be put in place to reduce the risk rating to LOW or MEDIUM
HIGH	16 – 22	If the post-control risk is High the activity MUST NOT proceed. Alternate controls must be put in place to reduce the risk rating to LOW or MEDIUM
MEDIUM	7 – 15	The activity can proceed so long as the highest level and most appropriate risk control measures have been identified and implemented
LOW	1 – 6	Activity may proceed with normal supervision after implementing control measures

Annexure C Grafton Sector Response Strategy

ANNEX K - CLARENCE VALLEY SECTOR/COMMUNITY RESPONSE ANNEX

This annex provides further detail of the planned response strategies within Clarence Valley Community.

N.B Some of the following information in this Annex is based on the 2010 Grafton Maclean Overtopping Study, of which the levee survey height was determined to be incorrect. The levee has been re-surveyed and is being incorporated into the revised levee overtopping study (due 2012). On completion of this study, this Annex will be revised accordingly.

K1. GRAFTON SECTOR RESPONSE

This annex provides further detail of the planned response strategies within Grafton Sector. The associated maps for each sector evacuation plan are provided in Annex L.

Grafton Sector See Map Attached			
Sector Description	This sector covers Alamy Creek, Carrs Creek, Carrs Island, Carrs Peninsula, Eatonsville, Great Marlow, North Grafton, Seelands, South Grafton, Southampton, Waterview and Waterview Heights. Areas of this sector are protected by a system of levees which will over top at different heights.		
Hazard	Clarence River Riverine Flooding		
Flood Affect Classification	North Grafton is a low flood island during extreme floods. South Grafton is classified as Rising Road Access to South Grafton Hill.		
At risk properties	North Grafton 3748 South Grafton 921	Total number of properties	North Grafton 4089 South Grafton 2529
Population	North Grafton 9954 (2006 Census)*	South Grafton 2017(2006 Census)	
Sector Control	The Grafton Unit Controller will control evacuations in this sector. The SES will conduct evacuations in this sector with assistance from NSW Police, Fire and Rescue NSW, and RFS volunteers.		
Key Warning Gauge Name: Prince Street	Minor: 2.10m	Moderate: 3.60m	Major: 5.40m
General Strategy	<ul style="list-style-type: none"> • Evacuation of at risk population. • Self-evacuation to friends/family outside of the impact area. • Establishment of an Assembly Area at South Grafton High School auditorium (Tyson Street), where evacuees are able to gather while flood situation is monitored. • Where a major levee overtopping and/or failure occurs, evacuees will either remain at the South Grafton High School or be transported to Coffs Harbour. 		

Key Risks / Consequences	<ul style="list-style-type: none"> • Overtopping and/or failure of Grafton and/or South Grafton levees resulting in inundation behind the levees. • Potential loss of life from rapid and potentially high velocity inundation in levee overtopping/failure scenario. • Potential isolation of thousands of people estimated to be for a number of days.
Information and Warnings	<ul style="list-style-type: none"> • Flood Watch • Flood Bulletins • Evacuation Warning • Evacuation Order • Sequenced door knocking of evacuation sectors • Media announcements • Emergency Alert SEWS (SMS, Landlines)
Property Protection	<p>Specific property protection measures:</p> <ul style="list-style-type: none"> • Monitoring rising flood waters. • Relocation of livestock. • Relocation of farm machinery and valuable goods • Control of surface water through sandbagging measures. • Assist in the lifting of furniture to residents in need. • Monitoring integrity of dwellings surrounded by flood waters. • Monitoring integrity of existing levee system. • Control of surface water inside levee. <p>Protection of essential infrastructure:</p> <ul style="list-style-type: none"> • No identified essential infrastructure requiring protection below 1% flood height of 8.36m on the Prince St Gauge. • Grafton’s potable water supply reservoir is located on high ground 5km south of Grafton above the PMF. • Country Energy substation on the western end of North Street is also flood free below the 1% flood height. (Prince St Gauge 8.36 metres). • Selected sewer pump stations will be switched off upon levee overtopping • The Telstra exchange for Grafton is located on Pound Street, between Prince and Queen Streets. This exchange is powered by mains electricity. If electricity was lost during a flood then the generator (located above PMF height) will automatically start. The generator will last between 24-48 hours before refuelling is required.
Evacuation and/or Isolation Triggers	<p>The key evacuation triggers based on Bureau of Meteorology flood height predictions at the Grafton Prince St gauge:</p> <ol style="list-style-type: none"> 1. Prediction to reach and/or exceed 4.4m Carrs Island Bridge closes isolating residents on island. (Approximately 5 properties). 2. Prediction to reach and/or exceed 5.4m Flood waters enter Alipou Creek area starting to pond around

	<p>rural properties (Approximately 5 properties). Pacific Highway closes at Alipou Creek alternate route high level bypass Via Centenary Drive and Lilypool Road.</p> <p>3. Prediction to reach and/or exceed 5.7m Lawrence Road and Great Marlow Road cut near Butterfactory Lane isolating properties in the Alummy Creek and surrounding areas (approximately 30 properties). Water enters low lying areas of Glenwood Tourist Park.</p> <p>4. Prediction to reach and/or exceed 7.8 Targeted Evacuation Warning issued for Grafton Sector A including owners of livestock to relocate livestock outside of the impact area.</p> <p>5. Prediction of between 7.9m to 8.0m Based on monitoring and assessment of levee condition, a Targeted Evacuation Order will be issued for Sector A Dovedale and Northmeadow (area bordered by Clarence Street, Bacon Street, Prince Street and the Clarence River) and other low lying areas.</p> <p>Another 70 houses and some other buildings in the Back Lane, Carr street, Summerland Way and Lawrence Road areas could be isolated, along with the Gateway Caravan Park.</p> <p>Targeted Evacuation Warning issued for Grafton Sectors B,C,D</p> <p>6. Prediction to reach and/or exceed 8.2m Targeted Evacuation Order issued for Sectors B, C, D and all low lying areas in North and South Grafton.</p>
<p>Sequencing of evacuation</p>	<p>For Prediction 5, the areas of Dovedale and Northmeadow in Sector A will be systematically evacuated.</p> <p>For Prediction 6, North Grafton will be divided into Sectors B and C, while South Grafton becomes Sector D. Evacuation will commence with Sector B. Sectors C and D will follow.</p> <p>Grafton: Order for Sectors is A, B, then C.</p> <ul style="list-style-type: none"> • Sector A: Clarence Street, Bacon Street, Prince St including Dovedale, North meadow, • Sector B: west of Clarence Street, Bacon Street, Prince Street to Turf St. • Sector C: west of Turf St, including Westlawn, and Back Lane, Carr St, Marlow St, and Summerland Way to Junction Hill. <p>South Grafton:</p> <ul style="list-style-type: none"> • Sector D: Low-lying areas of South Grafton including Bent,

	<p>Ryan, Cowan, Abbott, Spring, Through, Skinner, Wharf, Armidale, Beetson, Bligh, Edward, James, Kelly, Kennedy, New, Orr, and Vere Sts).</p> <p>Evacuation of vulnerable facilities (Eg: Aged care facilities, schools, child care facilities) will require higher priority.</p>
<p>Evacuation Routes</p>	<p>Sector A: Clarence St, Bent St and Tyson St.</p> <p>Sector B: Route 1 Dobie St, Prince St, Pound St, Clarence St, Bent St, and Tyson St. Route 2 Oliver St, Prince St, Fitzroy St, Craig St, Bent St and Tyson St.</p> <p>Sector C: Route 1 Marlow St, North St, Cranworth St, Oliver St, Prince St, Pound St, Clarence St, Bent St, and Tyson St.</p> <p>Route 2 Turf St, Dobie St, Prince St, Fitzroy St, Craig St, Bent St, and Tyson St.</p> <p>Sector D: Bent St, Tyson St.</p> <p>See attached map.</p> <p>It is likely that the Pacific Highway south to Coffs Harbour will remain open to all vehicles, via Lilypool Road but this could be limited if flooding is widespread.</p>
<p>Evacuation Route Closures</p>	<p>Road closures affecting the sequenced evacuation of sectors A,B,C,D:</p> <ul style="list-style-type: none"> • There is uncertainty when local roads inside the Grafton levee will close, the closure will be dependent on local rainfall conditions. • Craig Street approach to the Grafton Bridge closes (8.25m Prince Street Gauge) • The Cross Roads South Grafton remain open beyond the 1% flood height of (8.36m at the Prince St Gauge). • The Railway line is immune to a possible maximum flood height (PMF). <p>Other known road closures include:</p> <ul style="list-style-type: none"> • Pacific Highway Closes (5.4m Prince Street gauge) at Alipou Creek, Alternate route high level bypass Centenary Drive. • Lawrence Road Closes (5.7m Prince Street gauge). Alternate route Summerland Way. • Orara Way Closes at Bluff Bridge at (5.8m on the Glenreagh Gauge). Alternate route Pacific Hwy. <p>Other roads where closure is dependent on local rainfall and events (e.g. landslips) include :</p> <ul style="list-style-type: none"> • Summerland Way closes on Grafton levee overtopping at

	<p>(8.34m on the Prince Street gauge).</p> <ul style="list-style-type: none"> • Gwydir Highway (road susceptible to land slippage) • Armidale Road
Method of Evacuation	<ul style="list-style-type: none"> • Primarily self-evacuation by private transport before road closures. • Public transport to the Assembly Area on South Grafton Hill will be available to members of the community without private vehicles. An estimate of 10% of evacuees will not have private transport. (20 Buses are estimated for transport.) Agreements to be in place with private bus operators. • Buses could also operate around South Hill picking people up from their parked cars to take them to assembly area or evacuation centre. Car parking capability unlimited. • Grafton Bridge will be closed by Police to North bound traffic ensuring maximum expedience of traffic flow over the bridge and access for emergency vehicles. • If the Cross Roads South Grafton are cut, railway transport becomes the main method of evacuation. Evacuation access to the railway is via the Grafton Railway Yard platform and the South Grafton Railway Station. A temporary platform can be erected at the corner of Federation and Ryan Street, (the Tin Bridge) South Grafton for an evacuation route up George Street to Bent Street and onto South Grafton High School.
Evacuation Centre/Assembly Point	<ul style="list-style-type: none"> • People should be encouraged to stay with friends/relatives in high areas such as South Hill, Clarenza, Junction Hill or Waterview Heights. Note some of these areas may become isolated with further river rises. • Where this is not possible the nominated assembly area is the South Grafton High School Auditorium, Tyson Street. This can be used as an assembly point in the short term, but could also double as an evacuation centre should the need arise. • There are a number of other schools located in flood free areas in South Grafton and Clarenza which are available for use as Evacuation Centres. These schools will be nominated by Family and Community Services as the need arises.
Large scale evacuations	<p>In the event that evacuee numbers exceed the South Grafton evacuation centre capacity, evacuees will either be transported to alternative evacuation centres or transported by bus, rail or private transport to Coffs Harbour, dependent on road closures and local flooding.</p>
Rescue	<p>The Grafton and Copmanhurst SES Units will undertake all Flood Rescue Operations as per the Flood Rescue Operations Policy.</p>
Resupply	<ul style="list-style-type: none"> • Resupply will be provided by the SES through the 132500 call out system. • The Grafton Base Hospital and Grafton Correctional Centre will be resupplied if required. The hospital floor begins to be

	inundated when flood waters exceed 8.36m on Prince Street Gauge.
Aircraft Management	<p>Helicopter Landing Zones</p> <ul style="list-style-type: none"> • Grafton Airport (S29° 45' 30.56", E153° 1' 45.45") • EOC Junction Hill (S29° 38' 37.43", E 152° 55' 12.73") • SES Region Headquarters (S29° 43' 24.53", E 152° 56' 37.78") • Grafton Base Hospital (S29° 40' 31.89", E 152° 56' 27.66")
Other	<p>Special considerations relating to the evacuation:</p> <ul style="list-style-type: none"> • Closure of Schools - coordinated through the Department of Education and Training, District Office, Grafton. • Closure of Licensed Premises. All hotels and licensed clubs will be closed. • Evacuation of residential institutions, nursing homes and age care facilities will occur where these are threatened by predicted flood waters. • The Grafton Base Hospital will only be evacuated in extenuating circumstances. • Rail Transport. Suspension of normal transport Operations through Grafton would be required, in anticipation of the deployment of rail operations to assist with evacuees. • Security. Police patrols to be established to maintain law and order after evacuation has occurred. • The SES will use flood boats and helicopters to monitor safety of individuals. • Grafton has three peak seasons with potential for a 10% population increase: <ul style="list-style-type: none"> • (1) July Race Carnival – early July • (2) Jacaranda Festival – late Oct. / early Nov. • (3) Bridge to Bridge Ski Race – Oct long weekend. <p>These arrangements will stay in place until the ALL CLEAR is provided by the SES to residents to return to their premises.</p>

*2006 census data will need to be updated with 2011 census data.