



Transport
Roads & Maritime
Services

ADDITIONAL CROSSING OF THE CLARENCE RIVER AT GRAFTON

Submissions report

OCTOBER 2014

Executive summary

The project

Roads and Maritime Services (Roads and Maritime) is seeking approval for a new bridge over the Clarence River at Grafton on the NSW Mid North Coast. The project involves:

- Building a road bridge across the Clarence River about 70 metres downstream of the existing road and rail bridge (which is to be retained)
- Upgrading parts of the road network in Grafton and South Grafton to connect the new bridge to the existing road network
- Replacing part of the rail viaduct where it crosses Pound Street in Grafton
- Providing a pedestrian and cycle path and signalised pedestrian crossings.

In operation, the new road bridge and approaches would become part of the Summerland Way. B-doubles and semi-trailers would be required to use the new bridge. Buses, emergency vehicles and smaller heavy vehicles would be able to use either bridge. The existing bridge would be retained with one northbound lane and one southbound lane.

Purpose of this report

This report identifies the issues raised during exhibition of the environmental impact statement (EIS) and provides responses to those issues. It also provides clarification to various matters documented in the EIS and revised environmental management measures for the project.

EIS public exhibition

NSW Department of Planning and Environment made the project's EIS publicly available between 20 August 2014 and 19 September 2014. During this period, the EIS was available at the Department of Planning and Environment website:

http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=6103

Members of the public were also able to read the EIS at selected Roads and Maritime offices and other locations in the Clarence Valley local government area, including:

- Roads and Maritime Services Pacific Highway Office, 21 Prince Street, Grafton
- Roads and Maritime Services Regional Office, 76 Victoria Street, Grafton
- Clarence Valley Council, 2 Prince Street, Grafton
- Clarence Valley Council, Maclean office, 50 River Street, Maclean
- Maclean Library, Stanley Street, Maclean
- Grafton Library, 126-144 Pound Street, Grafton.

Key issues raised in submissions on the EIS

A total of 23 submissions were received in response to the EIS during the exhibition period. Of these, six were from government authorities and 17 were from members of the public. The main issues raised in the submissions related to:

- Project alternatives and justification
- Project staging
- Consultation
- Traffic and transport impacts, including pedestrian and cyclist safety and access
- Flooding impacts

- Noise and vibration impacts
- Aboriginal heritage impacts
- Non-Aboriginal heritage impacts
- Socio-economic impacts
- Property impacts
- Visual amenity and urban design
- Biodiversity impacts
- Soils, sediment and water impacts
- Air quality impacts
- Asset ownership.

Revised environmental management measures

The EIS identified a range of measures to avoid or reduce the environmental impacts of the project. After considering issues raised in the submissions, the environmental management measures for the project have been revised. The revised measures establish the appropriate environmental framework for the project to be undertaken, together with any conditions of approval that are required for the project.

Next steps

The Department of Planning and Environment will assess the project and then submit it to the NSW Minister of Planning for determination. Should the project be approved, Roads and Maritime will continue to consult with community members, government agencies and other stakeholders during the detailed design and construction phases of the project.

Glossary of terms and abbreviations

Term	Meaning
Australian height datum (AHD)	This is the standard datum that most flood levels are measured from. Its value is equivalent to mean sea level.
ARTC	Australian Rail Track Corporation
Average recurrence interval (ARI)	The long-term average number of years between the occurrence of a flood larger than the selected event.
CEMP	Construction environmental management plan
CHMP	Construction heritage management plan
CVC	Clarence Valley Council
DGRs	Director-General's environmental assessment requirements.
DPI	NSW Department of Primary Industries
EEC	Endangered Ecological Communities
EIS	Environmental impact statement
EPA	NSW Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
Heritage Council	Heritage Council of NSW
m	Metre
mg/m ³	milligram per cubic meter
OEH	NSW Office of Environment and Heritage
POEO Act	<i>Protection of the Environment Operations Act 1997 (NSW)</i>
Roads and Maritime / RMS	NSW Roads and Maritime Services
SEPP	A NSW State Environmental Planning Policy
TAFE	North Coast TAFE Grafton Campus
µg/m ³	microgram per cubic meter
VHT	Vehicle hours travelled
VKT	Vehicle kilometres travelled

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1 Introduction and background

1.1 The project

Roads and Maritime Services (Roads and Maritime) is seeking approval for a new road bridge over the Clarence River at Grafton (the project), on the NSW Mid North Coast. The approval is sought under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) given the status of the project as State significant infrastructure.

The project would involve:

- Construction of a new bridge over the Clarence River about 70 metres downstream of the existing road and rail bridge (which is to be retained)
- Upgrades to parts of the road network in Grafton and South Grafton to connect the new bridge to the existing road network, including:
 - Widening Iolanthe Street to four lanes
 - Widening the Gwydir Highway to four lanes between Bent Street and the Pacific Highway
 - Realigning the existing Pacific Highway to join Iolanthe Street near Through Street
 - Providing a new roundabout at the intersection of the Pacific Highway and Gwydir Highway
 - Providing a new roundabout at the intersection of Through Street and Iolanthe Street
 - Limiting Spring Street and the Old Pacific Highway to left in and left out only where they meet Iolanthe Street
 - Realigning Butters Lane
 - Widening Pound Street to four lanes between Villiers Street and the approach to the new bridge
 - Providing traffic signals at the intersection of Pound Street and Clarence Street
 - Closing Kent Street where it is crossed by the bridge approach road
 - Realigning and lowering Greaves Street beneath the new bridge
 - Realigning Bridge Street to join directly to the southern part of Pound Street (east of the new bridge approach). There would be no direct connection between Pound Street south and the new bridge approach
 - Widening Clarence Street to provide formal car park spaces
 - Minor modifications to the existing Dobie Street and Villiers Street roundabout.
- The existing rail viaduct section across Pound Street would be replaced with a new bridge structure to provide sufficient vertical clearance for the upgrade of Pound Street
- Construction of a pedestrian and cycle path and signalised pedestrian crossings for access to and across the new bridge and throughout Grafton and South Grafton
- Flood mitigation works, which includes raising the height of sections of the existing levee upstream of the existing bridge in Grafton and South Grafton

- Ancillary works such as public utility adjustments, construction compounds and stockpile areas and water management measures.

In operation, the new road bridge and approaches would become part of the Summerland Way. B-doubles and semi-trailers would be required to use the new bridge. Buses, emergency vehicles and smaller heavy vehicles would be able to use either bridge. The existing bridge would be retained with one northbound lane and one southbound lane.

The project is needed to address short-term and long-term transport needs within Grafton and South Grafton. The primary drivers of the project are to:

- Relieve current and future traffic congestion across the existing bridge
- Provide greater accessibility (measured in terms of travel time and reliability) for the journey to work, other private travel, freight and commercial activities
- Enhance road safety for all road users over the length of the project.

A more detailed description of the project is found in the *Additional crossing of the Clarence River at Grafton, Environmental Impact Statement* (August 2014) prepared by Roads and Maritime Services.

The location and regional context of the project is shown in Figure 1-1 and key project features are shown in Figure 1-2. The design presented in Figure 1-2 would be subject to further refinement during the detailed design stage.

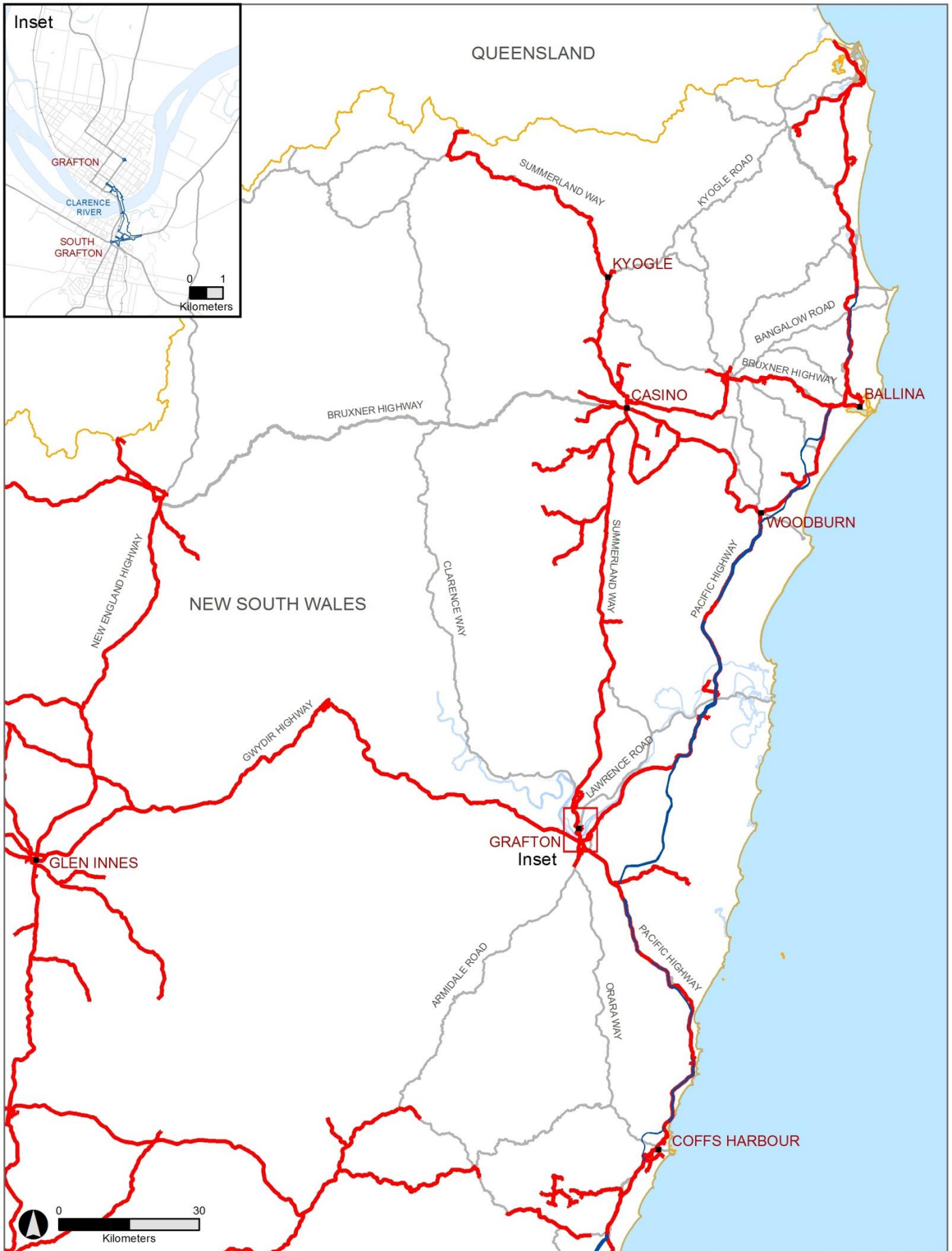
1.2 Statutory context

The project falls within the category of development that is permissible without consent pursuant to clause 94 of the *State Environmental Planning Policy (Infrastructure) 2007* (the Infrastructure SEPP). Clause 94 applies to development for the purpose of a road or road infrastructure facilities and provides that such development, when carried out by or on behalf of a public authority, is permissible without consent. The project is for the purpose of a “road” or “road infrastructure facility” under the Infrastructure SEPP.

Further, the project falls within clause 1 of Schedule 3 of the *State Environmental Planning Policy (State and Regional Development) 2011*. This clause of Schedule 3 identifies as State significant infrastructure, infrastructure or other development that (but for Part 5.1 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act) and within the meaning of Part 5 of the EP&A Act) would be an activity for which the proponent is also the determining authority and would, in the opinion of the proponent, require an EIS to be obtained under Part 5 of the EP&A Act. The project falls within this category of development and as the project is likely to significantly affect the environment, it would require an EIS to be obtained under Part 5 of the EP&A Act.

A State significant infrastructure application report was prepared and submitted to the Department of Planning and Environment in August 2013.

In accordance with the requirements of the EP&A Act, an environmental impact statement was prepared to assess the potential impacts of the project.



- 25/26 m long B-Double routes
- Planned Pacific Highway upgrades

Figure 1-1 Location of the project at Grafton on the NSW Mid North Coast

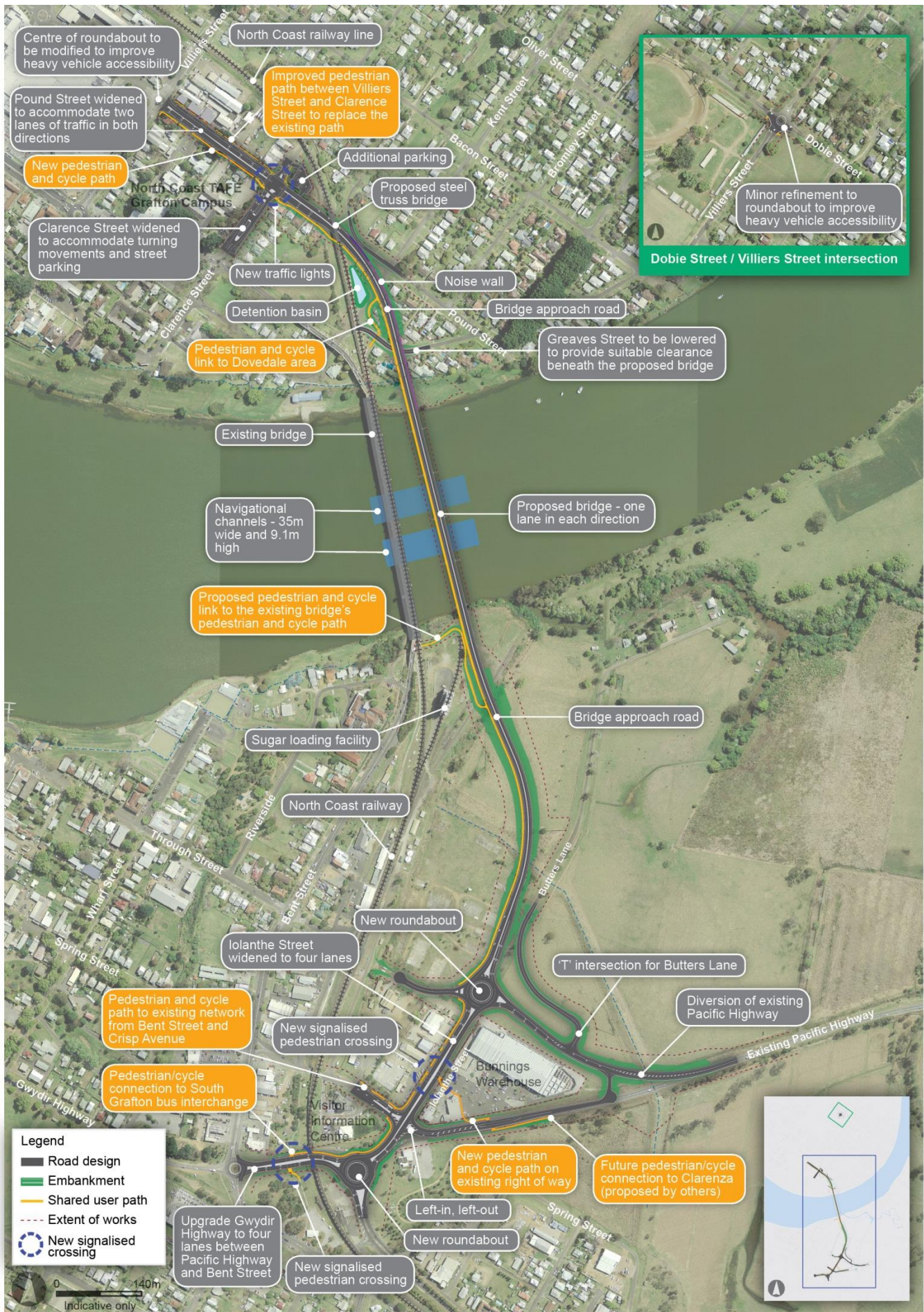


Figure 1-2 Key project features

Note: Design is subject to further refinement during the detailed design stage

1.3 Environmental impact statement exhibition

The environmental impact statement was exhibited by the Department of Planning and Environment for 30 days from 20 August 2014 to 19 September 2014. The closing date for submissions was 19 September 2014 with late submissions accepted up until 26 September 2014.

The exhibition was advertised in the following newspapers:

- The Daily Examiner on 23, 27 and 30 August 2014
- The Grafton Coastal View on 29 August 2014
- The Clarence Valley Review on 27 August 2014 and 3 September 2014.

The environmental impact statement was available on the Department of Planning and Environment website:

http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=6103

Members of the public could also read the EIS at selected Roads and Maritime offices and other locations in the Clarence Valley local government area, including:

- Roads and Maritime Services Pacific Highway Office, 21 Prince Street, Grafton
- Roads and Maritime Services Regional Office, 76 Victoria Street, Grafton
- Clarence Valley Council, 2 Prince Street, Grafton
- Clarence Valley Council, Maclean office, 50 River Street, Maclean
- Maclean Library, Stanley Street, Maclean
- Grafton Library, 126-144 Pound Street, Grafton.

Owners of directly affected properties were notified via a letter that the environmental impact statement had been placed on public display and that their property is impacted by the project for which planning approval is being sought. These property owners were also sent a project update. A directly affected property is where the project is likely to require full or partial acquisition of the property.

Clarence Valley Council also sent a letter on behalf of Roads and Maritime to property owners located along the flood levee nine kilometres upstream of the existing bridge. These letters were to notify property owners about the project and to enable inspections along the levee wall needed as part of the investigations.

Staffed displays were held on Wednesday 3 September 2014 from 4pm to 7pm at the Grafton Community Centre, Duke Street and on Thursday 4 September 2014 from 9am to 12m at the South Grafton Club, Level 1, Wharf Street. Community members were welcome to drop in, view the display material and talk to members of the project team.

Visualisation videos of the concept design were created and available for viewing on the project website and at the staffed displays.

A meeting was held on 16 September 2014 with individual community members who had requested specific project information in matters relating to downstream flooding impacts and the flood model.

1.4 Purpose of the document

A total of 23 submissions were received in response to the EIS during the exhibition period. Of these, six were from government authorities and 17 were from members of the public. The Department of Planning and Environment provided copies of the submissions to Roads and Maritime. In accordance with section 115Z(6) of the EP&A Act, the Secretary required Roads and Maritime to provide a response to the issues raised in these submissions.

This report identifies the issues raised during exhibition of the EIS and provides responses to those issues (Section 2). Clarifications on the EIS are provided in Section 3 and revised environmental management measures for the project are included in Section 4.

No project changes are proposed that would require the preparation of a preferred infrastructure report.

2 Response to issues

This section documents the issues raised in the submissions received during the public display of the EIS and the responses to these issues.

Respondents

A total of 23 submissions were received in response to the EIS during the exhibition period. Of these, six were from government authorities and 17 were from members of the public. Twenty-five per cent of submissions from members of the public objected to the project, six per cent supported the project and 69 per cent neither supported nor objected to the project.

Each submission has been examined individually to understand the issues being raised. The issues raised in each submission have been extracted and collated under the topics listed in Table 2-1.

Corresponding responses to the issues raised have been provided. Where similar issues have been raised in different submissions, only one response has been provided.

Table 2-1 Topics raised in submissions

Topics raised in submissions	Submission No.	Section number where issues are addressed
Project alternatives and justification	1, 2, 4, 5, 9, 11, 14, 16, 17	2.1
Project staging	CVC	2.2
Consultation	4, 10, 17, CVC, EPA, ARTC	2.3
Traffic and transport, including pedestrian and cyclist safety and access	1, 4, 5, 7, 8, 14, 16, 17	2.4
Flooding	2, 3, 10, 15, CVC, OEH	2.5
Noise and vibration	5, 8, 11, EPA	2.6
Aboriginal heritage	OEH	2.7
Non-Aboriginal heritage	Heritage Council	2.8
Socio-economic	12, 13, 14	2.9
Property impacts	6, 8, 11, CVC, ARTC	2.10
Visual amenity and urban design	5, 8, CVC	2.11
Biodiversity	OEH	2.12
Soils, sediment and water	DPI, EPA	2.13
Air quality	11, EPA	2.14
Asset ownership	CVC	2.15

Overview of issues raised by members of the public

As noted in Table 2-1, the most recurrent issues raised by the members of the public in the submissions were related to the following topics:

- Project alternatives and justification
- Flooding
- Traffic and transport.

Overview of issues raised by government authorities

Submissions were received from the following state and local government agencies:

- Department of Primary Industries
- Environmental Protection Authority
- Office of Environment and Heritage
- Heritage Council of NSW
- Clarence Valley Council.

A submission was also received from the Australian Rail Track Corporation (ARTC) and has been included in the table below.

A summary of the main issues raised by each agency is provided below.

Table 2-2 Overview of issues raised by government authorities

Government authority	Overview issues raised
Department of Primary Industries	Issues raised related to groundwater extraction for the purpose of water supply for the development, works undertaken near the Clarence River, stormwater management, erosion and sedimentation control and emergency spills management.
Environmental Protection Authority	Issues raised related to consultation during detailed design, noise and air quality impacts and soil and water management during construction.
Office of Environment and Heritage	Matters noted in the submission included consideration of a flood bypass between Junction Hill and Grafton, flood emergency evacuation plan update, consultation on the archaeological assessment methodology, accuracy of Three-toed snake-tooth skink known records and biodiversity offsets.
Heritage Council of NSW	Issues raised related to demolition of heritage listed items, impacts on heritage significance and on the turntable near the Grafton railway station, impacts from architectural noise treatments on heritage items, and consultation during the preparation of the heritage interpretation plan.
Clarence Valley Council	Matters raised by Clarence Valley Council included consultation during detailed design, flood impacts downstream of the proposed bridge, clarification of flood model, flood assessment matters and the proposed Pound Street drainage strategy, drainage impacts on the Heber Street catchment, access to existing infrastructure, asset ownership and constructability of proposed levee works.

Government authority	Overview issues raised
Australian Rail Track Corporation	Clarification of land needed for the project from the ARTC site in South Grafton, and the need to obtain relevant approvals under ARTC procedures and protocols.

The issues raised and Roads and Maritime response to these issues are documented in sections below.

2.1 Project alternatives and justification

2.1.1 Support for the project or project elements

Submission numbers

4, 11, 16, 17

Summary of issues raised

The following submissions expressed support for the project.

- Support for construction of the new bridge (4) (11)
- Support for the pedestrian and cycle access to the new bridge and its approaches. Supports the link between the old and new bridges on the southern side of the river and the link to Dovedale (16)
- Sees the pedestrian and cycle pathway and circuit as having great potential. (17)

Response

Project support noted.

2.1.2 Objections to the project or project elements

Submission numbers

1, 2, 5, 9, 14

Summary of issues raised

A number of submissions objected to the project or project elements.

- Do not support the project (1) (5) (9) (14)
- Objected to the Cowan Creek levee not being included in the project. (2)

Response

Objections are noted. Specific issues raised in the objections to the project are addressed in the relevant sections of this report. The issues related to the Cowan Creek levee are address in Section 2.5.9 of this report.

2.1.3 Green field or out of town solutions

Submission numbers

1, 5, 9

Summary of issues raised

The following submissions were concerned with the location of the project and believe that a green-field or out of town option should have been selected for the project.

- Respondent does not support the preferred route and believes that the current project is not the best choice of location for a new bridge based on impacts to

amenity, noise, heritage, traffic and safety and believes that a 'green-field' option should have been chosen (1)

- Disagrees with the location of the current project and believes it should be out of town. (5) (9)

Response

Green-field or out of town options were considered and assessed during the route options development stage for the project (Option 14 and Option 15). Refer to the *Additional Crossing of the Clarence River at Grafton Route Options Development Report* (Roads and Maritime, 2012) for more details.

These options were found to provide the least improvement to the efficiency of the road network as they would attract less than a quarter of the traffic from the existing bridge during the morning peak at year of opening. They were among the poorest performing options when assessed against functional, socio-economic and environmental considerations. Green-field or out of town options were also the two most expensive options and provided the least value for money. Hence these options would not meet the project objectives.

The options assessment carried out during the route options development stage determined that the project provides the best balance across social, environmental, functional, engineering and cost factors and best meets the project objectives.

2.1.4 Existing alternate crossing of the Clarence River

Submission numbers

14

Summary of issues raised

The following submission relates to existing alternate crossing of the Clarence River.

- Rogan Bridge is the closest alternative bridge crossing and is located about 16 km upstream of Grafton and remains a satisfactory crossing of the Clarence River. (14)

Response

Roads and Maritime acknowledges that Rogan Bridge is located about 16 kilometres upstream of Grafton. This bridge was not included in the EIS as the nearest feasible alternative for the following reasons:

- The level of the bridge is low in relation to the river and it provides less than 10-year flood immunity
- The bridge is not part of a designated heavy vehicle route.

It should be noted that the trip between South Grafton (Bent Street) and Grafton (Fitzroy Street) via Rogan Bridge is about 55 kilometres. A detour of this magnitude is not a practical alternative for bridge users needing to cross the Clarence River at Grafton.

2.1.5 Demand management

Submission numbers

14

Summary of issues raised

The following submission relates to demand management as an alternative to a new crossing of the Clarence River.

- Alternative options such as demand management and utilising existing infrastructure have not been adequately considered. (14)

Response

Demand management refers to the application of policies and strategies, as opposed to building more infrastructure to manage the demand to travel. This may include measures such as promoting cycling, walking and public transport and varying work and school travel times.

As noted in Section 4.1.3 of the EIS main report, demand management as an alternative to the bridge crossing was considered. It was determined that demand management strategies would not resolve current congestion on the existing Grafton Bridge or improve traffic efficiency in the future. Traffic modelling carried out for the project indicates that the existing bridge is currently operating at capacity during peak periods. Kinks in the horizontal alignment of the existing bridge cause both lanes to slow contributing to congestion and delays.

Demand management measures would be difficult to implement without major social and behavioral change in Grafton. The analysis presented in Table 4-4 of the EIS main report shows that opportunities to implement travel demand management measures in the Grafton area are limited and are likely to have only a marginal effect on managing travel demand during peak periods.

Travel demand management measures would not meet the project objectives, such as meeting the short-term and long-term transport needs within Grafton and South Grafton, improving safety and traffic efficiency between and within Grafton and South Grafton, and supporting regional and local economic development. As such, demand management was not considered a viable project alternative.

2.1.6 Project justification

Submission numbers

14

Summary of issues raised

The following submissions relates to project needs and project benefits.

- Questions the need for the project. Most of the information provided as justification just compares various bridge options rather than justifying the need for a new bridge (14)
- Questions whether the project achieves the project objective 'providing value for money' and the supporting objective 'achieve a good benefit-cost ratio'. (14)

Response

Project need

As noted in Section 3.2 of the EIS main report, the project is consistent with NSW Government planning and transport policies and relevant strategic planning and transport policies and is needed to:

- Provide a practical alternative for road users needing to cross the Clarence River at Grafton. The existing bridge is the only crossing in the Grafton area for people travelling between Grafton and South Grafton
- Relieve current and future traffic congestion on the existing bridge over the Clarence River. The bridge is already operating at capacity during peak periods and traffic growth will worsen congestion problems
- Improve road safety for motorists, pedestrians and cyclists travelling across the river
- Provide a crossing designed for the existing and future levels of traffic use as well as present-day vehicles. The current bridge, built in 1932, constrains traffic

because of the horizontal kinks in the alignment making it difficult for larger vehicles to navigate the bends

- Provide a crossing for large, heavy vehicles. There is a 25/26 metre long B-double truck ban on the current bridge during peak periods, which restricts efficient freight movement over the Clarence River.

Providing value for money

As stated in Table 12-2 of the EIS main report, value for money was a key consideration in the route option development and selection of the preferred option for the project. Of the route options evaluated for an additional crossing of the Clarence River at Grafton, the proposed bridge would provide the greatest improvements to the efficiency of the road network, including during the morning and evening peak periods.

In regards to the supporting objective 'achieve a good benefit-cost ratio', a strategic cost estimate and economic evaluation for the project's preferred option was carried out by Roads and Maritime and documented in the *Recommended Preferred Option Report* (Roads and Maritime, December 2012). Further details were provided in the *Route Options Development Report, Technical Paper: Strategic Cost Estimates* and *Technical Paper: Economic Evaluation* (Roads and Maritime, September 2012). The preferred option's benefit-cost ratio was 1.6 which indicates that the road user benefits would appreciably exceed the capital cost.

During concept design stage, the extent of the project was refined, which has reduced the overall cost of the project while still providing for improved traffic performance in Grafton and South Grafton through to 2039.

2.2 Project staging

Submission reference

CVC

Summary of issues raised

The following submission relates to staging of the local road network upgrades and staging of the levee raising works.

- The EIS has not identified a staging plan. Clarence Valley Council sees potential for staged works to address existing traffic issues as an opportunity (CVC)
- Staging of levee works in relation to other construction activities needs to be clarified. (CVC)

Response

Road network upgrade staging

The potential for staging is noted. Section 5.2 of the EIS main report outlines a description of the main elements of the project including possible initial road network upgrades at year of opening in South Grafton.

Roads and Maritime will consider opportunities to stage delivery of local road network upgrades to address existing traffic issues during the detailed design stage of the project and before construction starts. Roads and Maritime will consult with Clarence Valley Council on any staging of local road network upgrades.

Flood mitigation works staging

As shown in the project indicative construction timeline in Figure 6-1 of the EIS main report, the levee raising works would be completed before the works within the Clarence River start.

Section 8.2.3 of the EIS main report acknowledges the construction contractor may choose to modify the indicative project construction timeline in presented in Figure 6-

1 of the EIS main report, by staging flood mitigation works as the bridge work progresses. Under this alternative construction scenario, the construction contractor would need to carry out additional flood modelling to demonstrate that the proposed levee raising works can be staged without increasing potential flood impacts as a result of the construction of the project. This would need to be done before construction works start within the Clarence River.

As detailed in Section 10 of the EIS main report, environmental management measure FH5, Roads and Maritime has committed to consult Clarence Valley Council on the flood mitigation options.

2.3 Consultation

2.3.1 Consultation with government agencies

Submission numbers

4, CVC, EPA, ARTC

Summary of issues raised

The following submissions relate to consultation with government agencies.

- Queried whether there was any consultation with state rail about the future of the existing bridge (4)
- Clarence Valley Council would welcome the opportunity to be involved in the detailed design stage to specifically address some of the issues raised in its submission and any other issues that may arise (CVC)
- EPA understands that the detailed project design stage will provide an opportunity to provide a more comprehensive review of key impacts and expects that they will be consulted during this phase (EPA)
- ARTC will need an opportunity to review any proposed remedial action plans and final validation reports. (ARTC)

Response

Consultation with Australian Rail Track Corporation (ARTC) has been carried out and is ongoing as detailed in Section 7 of the EIS main report.

Inspections, maintenance, repairs and rehabilitation of the existing bridge are carried out by ARTC and Roads and Maritime on a regular basis via a partnership agreement. The inspection results indicate the bridge is still in a condition suitable for catering for trains, vehicles and pedestrians.

In the future, the existing bridge would continue to operate as per current arrangements although restricted access vehicles including B-double trucks greater than 20 metres in length would be required to use the new bridge.

Roads and Maritime will continue to consult with ARTC about design, construction and ownership transfer of the Pound Street viaduct as well as any remediation needed for the ARTC land on the southern side of the Clarence River.

Roads and Maritime will continue to consult with Clarence Valley Council regarding flood impacts, asset ownership and road issues. Roads and Maritime will also continue to consult with EPA regarding water, noise and air quality impacts during detailed design as relevant and required.

A new environmental mitigation measure (CO1) has been added in Section 4 to reflect these commitments.

2.3.2 Consultation with children

Submission numbers

17

Summary of issues raised

The following submission relates to consultation with children.

- Encouraging councils and planners to listen to children's voices during planning and give their opinion due weight, as they would any other member of the community. (17)

Response

Roads and Maritime is continually looking at ways to engage with various sectors of the community more effectively in both the route selection and the EIS stages of the project.

Ideas provided in submissions from children for improving the amenity for all users of the new bridge will be considered by the project team in the detailed design stage. Further consultation will be undertaken with the Grafton and South Grafton community as elements of the project become more defined and the project progresses.

2.3.3 Consultation with downstream property owners

Submission numbers

10

Summary of issues raised

The following submission relates to the level of consultation with property owners located downstream of the proposed bridge.

- Concerned about the lack of consultation with property owners downstream of the project. (10)

Response

A comprehensive community engagement program was implemented throughout the various project stages including the route development phase and the EIS preparation and exhibition period.

During the EIS preparation and exhibition period and the preparation of the preliminary concept design, members of the Grafton community, including downstream property owners, were provided the opportunity to input and express their views via the following:

- Drop ins at Roads and Maritime Grafton office to talk to the project team
- A dedicated project telephone line (1800 633 332)
- A dedicated project email address (graftonbridge@rms.nsw.gov.au)
- A dedicated project website (www.rms.nsw.gov.au/graftonbridge)
- Staffed and unstaffed community information displays for the EIS at various locations
- 'Community update' newsletter
- Email to community members listed in the project's email database informing them of the EIS display
- Letters from the project manager to owners of directly affected properties
- Online interactive maps and project visualisation videos

- Newspapers advertisement and media release

Further to the above, a meeting was held on 16 September 2014 with individual community members who had requested specific project information on matters relating to downstream flooding impacts and the flood model.

Should the project be approved, Roads and Maritime will continue to consult with community and stakeholders during the detailed design and construction stages. Future consultation on the project will be guided by the Draft Community Consultation Strategy included in Appendix C of the EIS.

2.4 Traffic and transport

2.4.1 Capacity of new bridge

Submission numbers

4, 7

Summary of issues raised

The following submissions relate to the capacity of the proposed bridge.

- Concerned about the provision of only two lanes on the new bridge not four lanes as the project needs to secure a future proof solution for Grafton. Provision of two lanes on the new bridge will cause a bottle neck problem similar to what currently happens on the existing bridge (4)
- The current bridge is over 85 years old and only built to last 100 years. Given its age, the new bridge should provide four lanes, instead of two, to cater for the future. (7)

Response

As noted in Section 3.2.2 of the EIS main report, the existing bridge has pronounced kinks in its horizontal alignment at the both ends. Long, heavy vehicles cannot negotiate the kinks without crossing the centreline, creating a risk of crashes and causing traffic in both directions to slow or stop. This is compounded by narrow lane widths and reduced lateral clearances on the existing bridge.

Because of the stop start traffic conditions at the kinks, traffic queues back past the merging lanes on the approaches at both ends of the bridge. This has a flow on effect causing delays at the merge points. This, in turn, contributes to queuing and delays on the bridge approaches, particularly during peak periods when queuing extends to the Gwydir Highway and Pacific Highway in South Grafton and to Fitzroy Street in Grafton.

There will be no kinks in the new bridge. Traffic modelling carried out for the EIS demonstrates that two lanes (one lane in each direction) on the proposed bridge would be sufficient to manage the predicted traffic growth across the Clarence River in Grafton.

Also, the overall width of the bridge deck is proposed to be around 16 metres which enables additional lanes to be catered for should the need arise in the longer term.

Roads and Maritime understands that there are no plans to replace the existing rail bridge in the foreseeable future.

2.4.2 Pound Street and Villiers Street roundabout design

Submission numbers

4

Summary of issues raised

The following submission relates to the proposed changes to the Pound Street and Villiers Street roundabout.

- Suggests upgrading the Pound Street and Villiers Street roundabout to cater for the changed route of heavy vehicles travelling on the Summerland Way. (4)

Response

The concept design presented in the EIS includes some works to the existing roundabout at the intersection of Pound Street and Villiers Street. These include removing existing vegetation and widening the existing concrete apron to provide an encroachment area for B-double turning movements. This refinement is indicated in Figure 5-1 of the EIS main report.

2.4.3 Pedestrian and cyclist access

Submission numbers

5

Summary of issues raised

The following submission relates to suggestions to improve pedestrian and cyclist access in Grafton.

- A footpath connection should be provided from Bridge Street under the railway viaduct on the eastern side of the approach road to the bridge and connect up with the traffic lights at Clarence Street. The current project significantly increases the walking distance for residents of Bridge Street to the retail/commercial area within Grafton (5)
- A footpath connection should also be provided from Pound Street, across the residual land left over from the project and underneath the viaduct near Greaves Street, to the shared path on the western side of the approach road to the bridge. (5)

Response

Suggested footpath connection from Bridge Street

Suggestion noted. A formalised footpath will be incorporated into the project design to provide a connection between Bridge Street and Clarence Street.

Suggested footpath on Greaves Street underpass

Suggestion noted. This matter will be considered during the project's detailed design stage.

2.4.4 Safety and use of proposed pedestrian and cycle path

Submission numbers

14

Summary of issues raised

The following submission relates to safety of the proposed pedestrian and cycle path.

- Concerned that pedestrians and cyclists will not use the new bridge as it has no safety or distance advantages over the existing route. (14)

Response

The proposed bridge would provide a safer crossing of the Clarence River for pedestrians and cyclists. It would provide clear sight lines from the approach road

and pedestrian and cycle path. Physical barriers separate vehicles from pedestrians and cyclists.

The design of the pedestrian and cycle path has been developed to provide a safe crossing of the Clarence River through the implementation of the *Crime Prevention Through Environmental Design* principles. For example:

- At night, bridge deck lighting would increase casual surveillance opportunities and visibility of pedestrian and cycle paths
- The path location would be at the same level as the new bridge road and approaches which will provide passive surveillance benefits from motorists to pedestrians and cyclists as they will no longer be out of site, beneath the road deck, as occurs with the existing bridge footpaths.

Note the pedestrian and cycle path on the existing bridge will remain available for people to use and will provide shorter journeys for certain trips depending of the origin and destination of a given trip.

The provision of an additional pedestrian and cycle path across the Clarence River at Grafton provides more options for pedestrians and cyclists. In Grafton, the new pedestrian and cycle path would provide increased connectivity to the TAFE, ShoppingWorld, the Dovedale area and the eastern side of Grafton CBD. In South Grafton, the new pedestrian and cycle path would connect to the pathway on the existing bridge linking through to South Grafton CBD, the Iolanthe Street business area, the South Grafton railway station and Clarenza.

The proposed pedestrian and cycle path would integrate with Clarence Valley Council's existing and proposed pedestrian and cycle network and connect to the existing bridge at the southern bank (Refer to Figure 5-1 of the EIS main report).

2.4.5 Effect of proposed pedestrian and cycle path on future planned cycleways

Submission numbers

14, 16

Summary of issues raised

The following submissions relate to the effect of the proposed pedestrian and cycle path on future planned cycleways.

- Concerned that the selection of the new bridge option has resulted in the cessation of work on the cycleway along Crisp Avenue (14)
- The respondent noted that if the existing Pacific Highway section south of Bunnings Warehouse does not carry high traffic volumes, then Clarence Valley Council's proposed Clarenza Cycleway would not need traffic lights or an overbridge or tunnel beneath the Pacific Highway which would result on cost savings. (16)

Response

The Crisp Avenue cycleway is a Clarence Valley Council matter and is not related to this project or the route selection phase. The project would however provide appropriate connections to enable the construction of this cycleway sometime in the future by Clarence Valley Council.

The proposed Clarenza cycleway is a Clarence Valley Council matter. The project would not preclude the construction of this cycleway.

Crossing points on the Pacific Highway have been developed for the project taking into account pedestrian and cyclist safety:

- If Roads and Maritime implements the possible initial road network upgrades in South Grafton described in Section 5.2.3 in the EIS main report, traffic lights would be placed on the Pacific Highway to provide a safe pedestrian and cyclist crossing (Refer to Figure 5-7 in the EIS main report)
- If the Pacific Highway is diverted, a footpath with an appropriate unsignalised at grade crossing would be provided (Refer to Figure 5-2 in the EIS main report).

Note that a Pacific Highway overbridge or tunnel crossing proposed in Clarence Valley Council's Clarenza cycleway would not be required because the Pacific Highway crossing provided as part of the project would provide a safe crossing point.

2.4.6 Suggestions for pedestrian and cycle path connection

Submission numbers

17

Summary of issues raised

The following submission provided suggestions regarding treatments around the pedestrian and cycle link between the existing bridge and the new bridge on the southern bank.

- As part of engaging with children in community projects, suggestions were provided for treatments around the southern bank connection of the two pedestrian and cycle paths across the river including a seat for people to stop and rest, a playground including a slide, a rubbish bin, signs for people coming into Grafton, trees and a pond. (17)

Response

As shown in *Appendix J – Urban Design and Landscape Concept Report* of the EIS, landscaping treatments are proposed as part of the project, including the southern bank where the pedestrian and cycle path connects with the existing bridge. Details of the landscaping plan will be confirmed during detailed design. Suggestions included in the submission will be considered by the project team in finalising treatments around the pedestrian and cycle path, taking into account amenity for pedestrians and cyclists, safety and surveillance, and Aboriginal cultural heritage given the proximity of the Golden Eel site.

2.4.7 Public buses

Submission numbers

8

Summary of issues raised

The following submission relates to the impact of the project on existing bus routes.

- Question about the impact of the project on existing bus routes and the relocation of bus stops. (8)

Response

There is a school bus route that picks up and drops off students on Pound Street near the intersection with Clarence Street that would be impacted. The bus operator would be contacted before construction starts to find an alternative pickup up and drop-off location. This impact is documented in Section 8.1.3 of the EIS main report.

Access to designated bus stops would be maintained during construction or suitable alternatives would be identified in consultation with the bus operators. Mitigation measure TT4 has been updated to reflect this commitment (refer to Section 4).

Consultation was carried out with bus service operators during the design development process, including Busways. Busways expressed a preference to

continue to use the existing bridge following completion of the project. Based on this, it is anticipated the existing bus routes and designated stops managed by Busways would not change as a result of the project. Refer to Section 4.4 in Appendix D of the EIS.

2.4.8 Traffic lights

Submission numbers

8

Summary of issues raised

The following submission relates to the impact of the project on existing bus routes.

- Respondent believes that the traffic lights at the intersection of Pound Street and Clarence Street will encourage unacceptable driving habits. Suggests that some form of enforcement for compliance is considered, for example, a speed camera or red light camera. (8)

Response

The introduction of traffic lights at the intersection of Pound Street and Clarence Street would allow the safe access and circulation of vehicles, pedestrians and cyclists.

The introduction of speed or red light cameras is not currently proposed as part of the project. Roads and Maritime will review the need for such equipment during the operational stage in accordance with relevant Roads and Maritime policies and guidelines.

2.4.9 Future traffic demands

Submission numbers

14

Summary of issues raised

The following submission relates to the forecast traffic demands and the associated congestion relief benefits.

- Table 8.3 on page 141 of the EIS main report and Table 6 page 38 in Appendix D of the EIS are the same table. However, Table 8.3 in the main report is described as peak period traffic forecasts for the modelled network whereas Table 6 in Appendix D appears to be peak traffic forecasts for the existing bridge. Roads and Maritime indicated that the descriptor for Table 8.3 is the correct one. However, the documentation does not make this clear (14)
- The forecast traffic growth rates shown in Table 5 of Appendix D in the EIS are between two and five times greater than the historical growth rates on the existing bridge. Concerned that the traffic forecasts used for the project are higher than the historical population growth rates and that the benefits assumed in terms of congestion relief are too high. (14)

Response

The information presented in Table 8.3 page 141 of the EIS main report and Table 6 page 38 in Appendix D of the EIS correspond to forecasted growth in traffic demand for trips across the existing bridge.

Traffic growth figures have been based on information provided by Clarence Valley Council to ensure forecast traffic growth is consistent with anticipated growth in the local government area. These growth figures have been consistently applied throughout all project development stages. Traffic growth rates for the project are

higher than the historical traffic growth rates presented in Table 5 in Appendix D of the EIS. Traffic growth rates were determined based on the following:

- Forecast growth in key residential growth areas identified in discussions with Clarence Valley Council, such as Junction Hill, Waterview Heights, and Clarenza. Development sequence would occur firstly in Junction Hill, followed by Waterview Heights and finally Clarenza
- Growth in cross-river demand was constrained between 2011 and 2019 due to the capacity of the existing bridge and as such traffic was redistributed within Grafton and South Grafton in order to realistically capture anticipated growth
- All future year modelling has assumed that the Pacific Highway bypass of Grafton would be open by 2019
- The Australian Bureau of Statistics suggests that the persons per household within Grafton and South Grafton are decreasing due to the ageing population and declining household size. It was assumed that infill development would offset the population reductions due to declining household size thereby maintain constant zonal population forecasts for the traditional areas of Grafton and South Grafton.

Please refer to the *Route Options Development Report: Technical Paper - Traffic Assessment* (Roads and Maritime, 2012) for more details on assumptions made in determining future traffic demands for the project.

Notwithstanding the traffic growth rates and as noted in Section 3.2 of the EIS main report, the project is needed to:

- Provide a practical alternative to road users for crossing the Clarence River at Grafton
- Relieve congestion across the river over the existing bridge which currently operates at capacity during peak periods
- Provide an additional crossing that is not constrained by narrow lanes, kinks or travel restrictions for large heavy vehicles.

The main benefits of the project are:

- Increase traffic capacity across the Clarence River, which would relieve congestion during peak periods and meet future traffic demands
- Enhance road safety for road users, including pedestrians and cyclists
- Improve traffic efficiency between and within Grafton and South Grafton and the predicted growth area of Clarenza
- Provide a bridge over the Clarence River that meets contemporary design standards, and meets the needs of present-day vehicles, including large, heavy vehicles
- Improve the level of flood immunity of the surrounding approach roads
- Support regional and local economic development, and provide growth and employment opportunities in the Grafton CBD and the Iolanthe Street precinct.

An economic analysis for the preferred option was carried out during the route selection process. The congestion benefits identified through the economic analysis relate to improvements in vehicle kilometres travelled and vehicle hours travelled. This analysis showed that there would be economic benefits from the project and the analysis was appropriate for selecting a preferred option. That economic analysis is documented in *Route Options Development Report: Technical Paper - Economic Evaluation* (Roads and Maritime, 2012).

2.5 Flooding

2.5.1 Flood modelling

Submission numbers

CVC

Summary of issues raised

The following submission relates to the flood modelling carried out for the EIS.

- The EIS identified ameliorative measures to address impacts from a 1% and 2% AEP event, however it is not known whether there will be different impacts from a range of other events. (CVC)

Response

Flood modelling for the EIS was carried out for the 20-year, 50-year (2 per cent AEP) and 100-year (1 per cent AEP) average recurrence interval flood events and a probable maximum flood event. The existing levee system protects the urban areas of Grafton and South Grafton in a 20-year event. As such, modelling was not carried out for flood events less than a 20-year event.

It should be noted that the flood events modelled for the EIS are consistent with the DGRs issued for the project, which were consistent with the flood events requested by Clarence Valley Council through this process.

2.5.2 Flood model accuracy and peer review

Submission numbers

10, 15

Summary of issues raised

The following submissions relate to the accuracy of the flood model and the peer review.

- Concerned about the accuracy of the flood model and the accuracy of the information provided by Clarence Valley Council (10)
- Questioned why the peer review of the EIS flooding and hydrology technical paper was not made available to the public. (15)

Response

As noted in Section 1.3 of Appendix E of the EIS, the flood assessment uses the lower Clarence River flood model updated in 2013. The updated model has:

- A more detailed model grid to define the existing topography in the flood plain
- More accurate survey data for the flood plain including updated LiDAR1 data and ground survey of the existing levee system
- The latest version of the TUFLOW modelling software.

Roads and Maritime is satisfied that the updated lower Clarence River flood model is appropriate for the assessment undertaken.

The peer review of the EIS flooding and hydrology technical paper is provided in Appendix A of this report. The peer review found that the flood model was adequate for the EIS.

2.5.3 Detailed levee survey information

Submission numbers

15

Summary of issues raised

The following submission relates to the detail provided on the flood levee survey information.

- Questioned why detailed levee survey information showing the existing crest levels of all levees in the Grafton area was not made available to the public. (15)

Response

The levee crest heights incorporated in the flood model include the detailed ground surveys of the existing levee system carried out by Clarence Valley Council. This data was used to prepare the flood model for the assessment of the impacts of the project and to prepare the maps shown in the EIS, which is available to the public.

2.5.4 Verification of flood model

Submission numbers

15

Summary of issues raised

The following submission relates to the proposed drainage system near Pound Street and the proposed pump station.

- Respondent queried why a 2009 rainfall event was used for verification purposes in the local drainage scenario rather than the March 1974 rainfall event which recorded 420 mm rainfall. (15)

Response

Modelling of the historical event was carried out to verify the flood model. The 2009 rainfall event was used because there were sufficient local rainfall records available along with peak level data to adequately verify the model. Such data was not available for the 1974 flood event.

2.5.5 Flooding impacts during construction

Submission numbers

10

Summary of issues raised

The following submission relates to flood impacts during construction.

- Respondent queried the effect on downstream properties due to the presence of structures in the river if there is a significant flood event used during construction of the bridge. (10)

Response

As noted in Section 8.2.3 of the EIS main report, the introduction of additional structures in the river such as bridge piers, embankments and temporary construction structures (such as the proposed jetty for barge launching) would have a progressive and gradual impact on the existing flood regime upstream of the proposed bridge. However, flood modelling shows no impacts are predicted downstream of the proposed bridge as a result of the construction of project.

The construction contractor will develop protocols to monitor forecast rainfall and flood events to minimise the risk of damage to infrastructure and equipment during a large flood or rainfall event. These protocols will include: methods to monitor rising water; methods for removing materials safely from flood affected work areas; and consultation with relevant stakeholders. Refer to mitigation measure FH1 in Chapter 10 of the EIS main report.

2.5.6 Downstream flood impacts

Submission numbers

10, CVC

Summary of issues raised

The following submissions relate to downstream flood impacts as a result of the project.

- Concerned about downstream impacts as a result of the project. Will the construction of the southern approaches cause any more displacement of flood waters onto properties on Butters lane? (10)
- Given the hydraulic height difference upstream and downstream of the existing bridge in the existing model, the flood assessment needs to confirm that the downstream levels will not increase as a result of the second bridge. (CVC)

Response

Flood modelling carried out for the EIS indicates that the proposed bridge would not lead to increased water levels downstream of the new bridge. Afflux associated with bridge piers is an upstream issue only, and is a result of a minor constriction in the river caused by the placement of new piers in the river. This reduces the effective width of the river channel, resulting in a minor increase in flood levels upstream of the new bridge and no increase in flood levels downstream of the new bridge.

The embankment that forms part of the approach road to the new bridge in South Grafton is located in an area that is outside the existing levee. This area is part of the existing flood plain storage area. The flood plain storage area covered by this embankment is very small when compared with the overall flood plain storage area along this part of the river. There would be a negligible change in flood storage as a result of the embankment and this is demonstrated in the flood modelling. This embankment was included in the flood modelling for the project which indicates that there will be no increase in flood levels downstream of the new bridge.

2.5.7 Changes in flood flow velocity and effect of this on riverbed erosion and sedimentation

Submission numbers

10, 15

Summary of issues raised

The following submissions relate to changes in flood flow velocities as a result of the new bridge and the effect this will have on erosion and sedimentation in the river.

- Concerned about potential increase in siltation downstream and a natural damming effect as a result of new bridge structures. Queried whether there will be any rock protection provided on the river banks to eliminate future erosion (10)
- The EIS does not quantify the increased velocity on the Clarence River, nor anything about any resulting increased erosion of the streambed, and subsequent downstream sedimentation, nor where that eroded material will be deposited, nor what effect that siltation downstream will have on flood levels. (15)

Response

The average flood flow velocity through the existing bridge structure is in the order of 3 to 3.5 metres per second for moderate to large flood events. The maximum increase in average flood flow velocity as a result of the project is about 0.2 metres per second which is considered a negligible increase. Localised increases in velocity are expected as the flow contracts through the structure. The velocities re-establish

themselves to baseline conditions within 30 metres as the flow expands downstream of the bridge.

Changes in sedimentation are related to changes in flood flow velocity for a given flood event. As there are no predicted significant changes in flood flow velocity as result of the project, it is unlikely the project would change the existing sedimentation regime on the Clarence River. Local scour would be experienced at the bridge piers but will not be sufficient to lead to any notable increase in downstream sedimentation.

As noted in Section 8.10.4 of the EIS main report, scour protection would be installed around the piers and river banks adjacent to the new bridge infrastructure to protect them from riverbank instability, riverbank erosion and riverbed erosion during flood or high-flow events. The extent of these works will be confirmed during detailed design.

2.5.8 Changes to overtopping locations and depths

Submission numbers

15, CVC

Summary of issues raised

The following submissions relate to changes to overtopping locations and depths as a result of the project.

- Respondent queried whether levee overtopping will occur in the same locations as pre-bridge and to the same depths, as in post-bridge construction or whether the raising of the upstream levees will simply shift the problem downstream (15)
- The flood assessment indicates that for the 50-year flood event, flood levels will increase in some parts of South Grafton (eg Abbott Street and Vere Street) and overtopping volumes will increase by three per cent. Roads and Maritime need to clarify and indicate how these impacts are proposed to be managed. (CVC)

Response

Low points in the existing levee system were identified and were included as overtopping locations in the flood model. The aim of the levee raising works is to maintain existing levels of flood immunity (ie minimal change) rather than improving existing flood immunity.

Levee raising works upstream of the proposed bridge would be designed to offset the increase in flood levels caused by the bridge and prevent additional overtopping of the levee system. It should be noted that both the increase in flood levels and levee raising heights are small compared to the flood depths.

The flood impact assessment carried out for the EIS indicates that there would be a small increase in the overtopping volume, during a 50-year flood event, towards the northern end of the South Grafton rural levee. This would occur along part of the existing levee that would not be raised as part of the project, and the additional water would be stored in the South Grafton common.

It should be noted that the design of the existing levee system was developed to allow flood water to overtop at this location and for that water to be stored in the South Grafton common. It is expected that there would be negligible impacts on dwellings as a result of this small increase in overtopping volume.

Roads and Maritime will consult with Clarence Valley Council during detailed design of the levee raising works as to ensure project impacts on flooding are appropriately mitigated.

2.5.9 Cowan Creek levee

Submission numbers

2, 15

Summary of issues raised

The following submissions relate to flood impacts near the Cowan Creek levee.

- EIS documentation does not specifically mention the Cowan Creek levee. Queried whether the Cowan Creek levee was included in the flood mitigation investigations. Concerned about flooding impacts to rural property if the Cowan Creek levee is not raised (2)
- Respondent noted the Cowan Creek levee was not mentioned in the EIS and queried whether this levee will require raising. (15)

Response

The Cowan Creek levee was not mentioned in the EIS documents but was included in the flood model assessment. This levee does not form part of the South Grafton levee system that protects the town but it does provide a degree of protection to agricultural land.

Land behind the Cowan Creek levee is already subject to flooding in an event less than a 20-year average recurrence interval flood event. Based on the flood model, the Cowan Creek levee would overtop about 10 to 15 minutes earlier during a 20-year average recurrence interval flood event. With the additional bridge in place there would be a flood depth increase of about 0.06 metres at this location.

Roads and Maritime is not proposing to raise the Cowan Creek levee as part of the project because of the minor impacts on the agricultural land that is protected by this levee and because there are no dwellings or other buildings affected in this area.

2.5.10 Riverside Drive levee

Submission numbers

3

Summary of issues raised

The following submission relates to flood impacts to properties along Riverside Drive.

- The EIS does not identify an upgrade of the Riverside Drive levee, which is located immediately upstream of the existing bridge. This levee is on the river side of the houses on Riverside Drive and is about 0.8 metres lower than the current levee for the rest of South Grafton. As a result, the properties on Riverside Drive are impacted more frequently by flooding. This height difference would increase to one metre with the proposal to raise the South Grafton levee an additional 0.2 metres as part of the project. Riverside Drive dwellings should be provided with the same level of flood protection as properties protected by the South Grafton levee. Compulsory acquisition of easements should be used if necessary to construct new levee. (3)

Response

The EIS has considered the Riverside Drive levee as part of the flood assessment, and it is acknowledged that the Riverside Drive levee is lower than the South Grafton levee.

Roads and Maritime is committed to mitigating the flood impacts resulting from the project. The intent of the flood mitigation works is to mitigate flood impacts of the project, not to improve the flood immunity for parts of the Grafton community.

Roads and Maritime will consult with Riverside Drive property owners to develop flood mitigation measures where required for these properties.

2.5.11 Emergency evacuation

Submission numbers

3, 10, 15, OEH

Summary of issues raised

The following submissions relate to emergency evacuation during flood events.

- Concerned about emergency evacuation of nursing home near Riverside Drive during a flood due to road access at the bottom section of Riverside Drive being impeded by water (3)
- Flood access route to private property on Butters Lane will be lost due to the construction of the bridge approaches on the southern side of the river (10)
- The proponent states that more information on “Emergency response and evacuation” in Appendix E of the EIS should have been provided eg no facilities are available in Junction Hill to house and feed people, which section of the town evacuates first, shouldn’t the highest and most accessible buildings be the last evacuated, etc (15)
- Recommended that a new evacuation plan be prepared in conjunction with SES that incorporates explicit reference to the new bridge and associated infrastructure. (OEH)

Response

Flood modelling for the project indicates that the flood immunity of Butters Lane and Riverside Drive flood emergency access routes will be the same as per existing conditions.

During the route selection and EIS stages, Roads and Maritime engaged with NSW State Emergency Services (SES) to discuss flood evacuation planning. SES advised that an additional crossing of the Clarence River at Grafton would be beneficial for the flood evacuation of the Grafton community.

SES is responsible for emergencies and flood evacuation. The project would maintain current evacuation routes and would also improve the overall efficiency of evacuation by providing an alternative route across the Clarence River, particularly during large flood events. Roads and Maritime will provide updated information on the project to enable SES to update existing flood evacuation plans when the additional crossing is open to traffic.

2.5.12 Flood mitigation options

Submission numbers

15, OEH

Summary of issues raised

The following submissions relate to the assessment of the possible flood mitigation options in the EIS.

- Justification of the decision between flood mitigation Option 2 and Option 4 is unclear (15)
- The proposed mitigation options do not holistically consider flood mitigation in the context of Clarence Valley Council’s future flood mitigation actions (OEH)

- Detailed investigation for a flood bypass between Junction Hill and Grafton was excluded from the EIS documentation. OEH consider that investigation of this option is warranted before selecting a preferred flood mitigation option (OEH)
- Recommended that the flooding and hydrology assessment should provide a cost benefit analysis for potential flood mitigation options before selecting a preferred flood mitigation option. (OEH)

Response

The objective of the flooding and hydrology technical paper presented in Appendix E of the EIS was to identify and examine flood mitigation options that would mitigate significant flood impacts due to the project.

As noted in Section 8.2.4 of the EIS main report, Options 2 and 4 were shown to mitigate the majority of the flood impacts resulting from the project. In both options residual impacts remain to properties located outside the zone of protection afforded by the levees.

Option 4 was not selected because it would require raising about 550 metres of the Gwydir Highway by up to two metres, making the Gwydir Highway act as a levee, significantly changing the flooding regime in South Grafton and Waterview Heights.

A flood bypass between Junction Hill and Grafton is mentioned in Section 5.2.1 of Appendix E of the EIS but not assessed using the flood model due to the likely cost of such a measure. The flood bypass option would significantly change flood behaviour around Grafton and as such does not meet the aim of the project flood mitigation works which is to maintain existing flood behaviour. The four mitigation options considered are consistent with the *Grafton and Lower Clarence Floodplain Risk Management Plan* (CVC, 2007).

2.5.13 Design of the levee raising works

Submission numbers

15, CVC, OEH

Summary of issues raised

The following submissions relate to the design of the levee raising works.

- Respondent noted that EIS states that levees are to be raised by “up to 200 mm”. Clarification is sought on what this means. Questions if further studies will be undertaken (15)
- The EIS identified raising the levee by up to 200 mm, but it is not clear whether this is a uniform raising of the whole levee or a maximum raising at identified low points (CVC)
- Recommended that the design of any levee augmentation works be undertaken in consultation with Clarence Valley Council to ensure that the works align with future flood mitigation work being considered by Clarence Valley Council and do not preclude or negatively impact the viability of future Clarence Valley Council food risk mitigation actions (OEH)
- Recommended a steering committee be established to inform the flood impact and mitigation component of the project. Committee should include representatives from OEH, Clarence Valley Council, SES, Roads and Maritime and community members. (OEH)

Response

The levee raising works identified in the EIS are based on the concept design for the project. Flood modelling carried out for the EIS demonstrates that raising the levees by up to 0.2 metres would decrease the overall level of flood risk in Grafton and South Grafton for the majority of flood events. However, there would still be impacts

on properties outside the levee system and during floods greater than the 20-year average recurrence interval event.

Further detailed flood modelling will be carried out during the detailed design stage to refine the design of the levee raising works. This will be carried out when the detailed design of the project has been finalised and may result in a reduction in the height of the levee raising works. The design of the levee raising works will be carried out in consultation with Clarence Valley Council, will be supported by detailed flood modelling and will be developed to mitigate the flood impacts of the project.

Roads and Maritime worked with representatives from NSW State Emergency Services (SES) and Clarence Valley Council during the route option development and selection stages and throughout the concept design and EIS stages.

Roads and Maritime will continue work with Clarence Valley Council to develop suitable solutions for levee raising works. Roads and Maritime will also continue to consult with SES during the detailed design and construction stages of the project.

Roads and Maritime considers that the existing commitments to consult with Clarence Valley Council and SES are appropriate for the project and does not support the creation of a steering committee for the design of the levee raising works.

2.5.14 Design of the South Grafton urban levee

Submission numbers

15

Summary of issues raised

The following submission relates to the design of the South Grafton urban levee.

- Questioned the need to raise the whole of the South Grafton Urban levee. Sections of the levee have greater freeboard than others, and if that freeboard is maintained then raising the levee at this location may not be needed. (15)

Response

It is acknowledged that the South Grafton urban levee has a higher freeboard than parts of the rural levee and much of the South Grafton urban levee is above the 100-year average recurrence interval flood event.

Leaving the South Grafton urban levee at its current level would result in a minor increase in flood risk because the increase in flood level would reduce the available freeboard at the levee. However, if the levee remains above the 100-year average recurrence interval flood levels with an allowance for freeboard then there is scope to leave the South Grafton urban levee at its current level. This matter will be explored further during the detailed design stage.

For the purposes of the EIS the flood assessment documented in Appendix E of the EIS has demonstrated that the levees can be raised and decrease the overall level of flood risk in Grafton and South Grafton for the majority of flood events.

2.5.15 Improving flood immunity for Grafton and South Grafton

Submission numbers

15, OEH

Summary of issues raised

The following submissions relate to improving the flood immunity for Grafton and South Grafton as part of the project.

- Requested that an upgrade of the whole levee system be carefully assessed. Suggested that there is an obligation to provide immunity for a 100-year flood

event, and that there is a risk that Roads and Maritime would be blamed if this is not done and the levee is overtopped after the new bridge is in place. (15)

- Suggested that the opportunity to reduce the flood risk for Grafton and South Grafton should be considered for flood events greater than the 5% AEP. (OEH)

Response

The existing levee system for Grafton and South Grafton provides flood immunity for about a 20-year average recurrence interval flood event.

The project is about providing an additional crossing over the Clarence River at Grafton. The levee upgrades required for the project are needed to maintain the current level of flood immunity for Grafton and South Grafton.

Providing flood immunity for a 100-year average recurrence interval flood is beyond the project scope.

2.5.16 Constructability of levee raising works

Submission numbers

15, CVC

Summary of issues raised

The following submissions relate to the constructability of the levee raising works.

- Requested details on how Roads and Maritime will address weak subgrades, deteriorated sheet-piling and/or cut-off walls, concrete footings etc. issues on the proposed levee raising works, and the disruption to private property (15)
- The EIS has not addressed the practicality or feasibility of raising the levee given that there are a number of logistical constraints such as buildings. Therefore it has not been demonstrated that raising of the levee to ameliorate afflux impacts from the bridge is able to be implemented. (CVC)

Response

Issues highlighted about weak subgrades, deteriorated sheet-piling and/or cut-off walls, concrete footings, etc will be addressed as part of the detailed design of the levee which will be carried out in consultation with Clarence Valley Council and relevant property owners.

As part of the EIS investigations, a team of geotechnical engineers visually inspected the levee and examined levee information provided by Clarence Valley Council on the state and extent of the existing levee system. As a result of these investigations, Roads and Maritime acknowledges the logistical constraints associated with the raising of the levee and will design the levee upgrade taking these constraints into consideration.

2.5.17 Impacts on existing flood management infrastructure

Submission numbers

CVC

Summary of issues raised

The following submission relates to potential impacts on existing flood management infrastructure near the Heber Street levee.

- Concerned about potential impacts on the Clarence Valley Council pump station on the Heber Street levee and the effect of the project on the drainage characteristics in the vicinity of Bunnings Warehouse and the Heber Street levee. This is a small catchment that is sensitive to changes in drainage, and a more

detailed assessment of the impact of the road works on that catchment is considered necessary. (CVC)

Response

Roads and Maritime has consulted with Clarence Valley Council about this levee and the associated pumping station and stormwater drainage system. Information provided by Clarence Valley Council has been incorporated into the EIS investigations and concept design for the project. Integration of the Pacific Highway section of the project in South Grafton with Clarence Valley Council's existing levee, pump and stormwater drainage system will be addressed as part of the project's detailed design in consultation with Clarence Valley Council. Further flood modelling of this area will also be carried out as part of the detailed design phase of the project.

2.5.18 Pound Street drainage

Submission numbers

15, CVC

Summary of issues raised

The following submissions relate to the proposed drainage system near Pound Street and the proposed pump station.

- Respondent considered the information on the impact on local drainage in Grafton to be inadequate and more information is needed before project approval, and not detailed design. More information is needed on: sizing of the detention basin and pumps; pump power supply requirements; maintenance and operation of the pumps; interaction with existing drainage system; noise impacts of the pumps; size of the rising main; and servicing of the pumps (15)
- More information is needed on the sizing of the proposed Pound Street pump station. (CVC)

Response

A strategic flood model was developed for the Grafton drainage network as part of the concept design and EIS stage. This model took into account local rainfall events occurring in Grafton, the existing drainage network and the need to maintain flood immunity for a 20-year flood event for the new bridge approach road.

The strategic flood model was used to determine the size of the culverts under Pound Street, the size of the detention basin and the volume of water that would need to be pumped over the levee to provide flood immunity for a 20-year flood event for the new bridge approach road. From this, the size of the pumps were determined, which included consideration of power supply (including need for back-up power supply and diesel storage for the back-up supply), and the size and location of the rising main. At this stage, the rising main is likely to be about 750 mm in diameter. The exact size, location and outlet will be confirmed during the detailed design stage.

Based on the current concept design, the size of the proposed detention basin is about 1500m³. The detention basin gravity outlet pipes would be located just upstream of the proposed bridge. The pump station outlet pipe would be located just downstream of the proposed bridge. The exact sizing of the detention basin, along with the location of the outlet pipes will be confirmed during detailed design.

Section 8.4.4 of the EIS main report includes an assessment of the potential noise impacts from the operation of the pump station. Given the nature of the pumping station equipment, and the fact that it would usually only run during flooding events or testing, significant noise impacts from its operation are not expected.

Long term ownership and maintenance of assets, including the pump station, will be discussed with Clarence Valley Council during the next project stages.

The proposed drainage strategy in Grafton will result in significant benefits to an area which has existing drainage issues. The proposed detention basin will not hold all the local water during events when the Clarence River level is high. Water will back up through the culverts under Pound Street and within existing low lying upstream areas. However because of the additional basin storage and the pumping, the peak flood levels are predicted to be lower than for the 'without project' case.

Roads and Maritime will consult Clarence Valley Council during detailed design of Pound Street drainage system including pump station sizing.

2.5.19 Clarification of flooding information

Submission numbers

15

Summary of issues raised

The following submission relates to clarifications of flood information provided in the EIS.

- Errors in Tables 5-3 and 5-6 (Appendix E of the EIS) (15)
- Respondent noted some confusion about the Prince Street gauge records. Page A-9 (Appendix E of the EIS) states that the January 2013 flood peaked at "RL 8.09, a 27-year ARI event". Elsewhere in the technical paper is stated that the Grafton Levee provides a protection for a 20-year event (RL 7.95). Respondent questions why there was not major levee overtopping in January 2013 if significant overtopping occurs during events greater than 20-year flood event as stated on page 5 of EIS Appendix E of the EIS (15)
- Respondent noted some confusion with the predictions of existing and future ponding in Appendix E of the EIS as they sometimes related to Prince Street/Pound Street, sometimes Fry Street/Alumy Creek and sometimes North Street/Alumy Creek. Respondent queried whether references to Alumy Creek refer to overtopping of the Grafton levee, the Westlawn Levee or the Pine Street Levee. Respondent suggested predictions should be given for reporting locations on the Eastern Basin because this area is the first to flood and also the deepest. Precise location of the ponding reporting location should be specified. (15)

Response

The error in the tables labeling has been noted. It does not affect the reported results. A clarification is provided in Section 3.2 of this report.

Design events have been modelled for the 20, 50 and 100-year average recurrence interval flood events. A 20-year level at the Prince Street gauge is estimated at 7.95 metres Australian Height Datum (AHD) and a 50-year event at 8.27 metres AHD. Not precluding some minor overtopping, the main levee system protects Grafton and South Grafton in the 20-year flood event but not the 50-year flood event.

The actual event at which the levee overtops therefore lies between a 20 and 50-year flood event.

During the January 2013 event the levees were locally strengthened and raised by placing sand bags along sections of the Grafton levee. This was carried out to prevent overtopping along the Grafton levee during this event.

Minor overtopping of the South Grafton rural levees occurred during the January 2013 event. This led to inundation of parts of the South Grafton common. The January 2013 event is estimated to be a 27-year average recurrence interval flood event and so overtopping was possible as it lies between the 20 and 50-year average recurrence interval flood events.

The reference on Page 5, of Appendix E of the EIS is in reference to the aforementioned modelled design events ie. significant overtopping would occur for modelled design events in excess of the 20-year flood event. This would be the 50-year and 100-year flood events.

Peak flood levels and depths (ponding)

Peak flood levels and depths in Appendix E of the EIS are quoted at the intersection of Pound Street and Prince Street, Grafton. The inclusion of this location in Grafton was to provide supplementary information to assist the reader when trying to interpret the flood maps.

The choice of location was arbitrary as peak levels depths can be extracted for any location from the flood model. The time series plots (change in water elevation over time) were shown for two locations in each of Grafton and South Grafton. Low points in the towns were selected as the time series plots show more clearly the onset of inundation (and therefore any change in this onset).

Alumy Creek (Fry Street) and Pound Street were selected for these low spots in Grafton but again the choice was arbitrary. The locations are within Alumy Creek near Fry Street and low ground adjacent to Pound Street respectively.

Both the Pound Street/Prince Street intersection and the Pound Street locations lie within the Eastern Basin as referred to in the respondent's submission. It should be noted that the plots show a small reduction in levee overtopping volumes and durations into Grafton for all durations and therefore any location selected within Grafton would show no increase in peak flood levels or durations.

2.6 Noise and vibration

2.6.1 Proposed construction hours

Submission numbers

EPA

Summary of issues raised

The following submission relates to construction hours.

- Recommended that standard working hours be limited to: 7am – 6pm Monday to Friday; 8am – 1pm Saturday; and no work on Sundays or public holidays (EPA)
- Recommended that work outside standard hours be considered only after adequate assessment, justification and consultation with community and key agencies is conducted. (EPA)

Response

EPA's recommendations are noted. Section 6.4.1 of the EIS main report details the construction activities that may be required to be carried out outside of standard working hours. These out of hours works will be needed to reduce impacts on adjoining properties and reduce disruptions to the travelling public and rail operations.

2.6.2 Construction noise and vibration impacts

Submission numbers

8, 11, EPA

Summary of issues raised

The following submissions relate to construction noise and vibration impacts.

- Respondent is concerned about noise impacts to private property from construction. Would like acoustic upgrades made to property (8)
- Respondent is concerned about noise and vibration impacts to private property during construction. Request that adequate provisions are made for the prevention of the impacts with adequate fencing and other necessary measures. Request that any repairs needed to buildings as a result of construction are made (11)
- Recommended that a revised noise impact assessment be developed once detailed design of the works are known and decided. Recommended that a Construction Noise and Vibration Management Plan be developed for the project. EPA has provided recommendations for items that should be included in any management plans prepared for the project to address issues from land-based construction and bridge construction works. (EPA)

Response

Noise and vibration impacts during construction would be managed via a Construction Noise and Vibration Management Plan (refer to mitigation measure NV4 in Section 10 of the EIS main report). This plan will further determine construction impacts and mitigation strategies for affected properties including a building condition assessment before and after the construction of the project, where appropriate. It will also outline a community engagement strategy which will complement the overarching Community Consultation Strategy for the project (Appendix C of EIS). Section 8.4.3 of the EIS main report states that construction vibration is predicted to be well below the guidelines and it is not expected to have an impact on property.

Recommendations provided by EPA are noted.

2.6.3 Operational road traffic noise mitigation

Submission numbers

5, 8, EPA

Summary of issues raised

The following submissions relate to mitigation of operational traffic noise impacts.

- The noise wall should be extended down to the railway viaduct to reduce the impact of road traffic noise on residents in Bridge Street (5)
- Concerned about noise impacts to private property from traffic. Would like acoustic upgrades made to property (8)
- Recommended that a revised noise impact assessment be developed once detailed designs of the works are known and decided. (EPA)

Response

The length of the proposed noise wall is indicative at this stage based on modelling carried out for the EIS. Extension of the noise wall to the railway viaduct will be considered during detailed design in accordance with mitigation measure NV3 from the EIS main report.

Properties potentially considered for noise mitigation are shown in Figure 8-16 and 8-17 of the EIS main report. Noise architectural treatments will be developed and implemented in consultation with property owners. Refer to mitigation measure NV19 and NH3 in Section 10 of the EIS main report.

Recommendations provided by EPA are noted. The number and location of properties that require traffic noise mitigation and the extent of the proposed noise

wall will be confirmed during detailed design stage, where a revised noise assessment will be carried out.

2.7 Aboriginal heritage

Submission numbers

OEH

Summary of issues raised

The following submission relates to the Aboriginal heritage assessment.

- Noted that the assessment outlines measures to avoid significant impacts to Aboriginal objects within and adjacent to the development. The Aboriginal heritage assessment documents the avoidance measures negotiated with the registered Aboriginal stakeholders. OEH cannot identify any evidence of the archaeological assessment methodology used to guide the archaeological test excavations being developed in consultation with OEH (OEH)
- Recommended that prior to works commencing, an archaeological assessment methodology used to guide the archaeological test excavations should be prepared to the satisfaction of OEH. (OEH)

Response

Roads and Maritime consulted with OEH on the methodology that has guided the archaeological test excavations carried out as part of the EIS investigations. This consultation is documented in Section 8.6.1 (Archaeological assessment methodology and research design) of the EIS main report.

The assessment determined that no further archaeological test excavations are required. Management measures for unexpected finds are included in Section 10 of the EIS main report.

2.8 Non-Aboriginal heritage

2.8.1 Impacts on heritage items

Submission numbers

Heritage Council

Summary of issues raised

The following submission relates to impacts on heritage items.

- The EIS states that item CZB18 should be demolished to make way for a temporary construction compound. The demolition of a heritage item, even of local significance, for a temporary work is not supported (Heritage Council)
- It is unclear from the EIS documentation exactly how the turntable associated with the Grafton railway station (CZB37) will be impacted. There is insufficient information to demonstrate why demolition is the best option for this site. There should be a heritage impact assessment to evaluate the options, of which retention should be one (Heritage Council)
- The flood levee works need to be clearly described, including how they would impact on heritage items, including one item listed on the State Heritage Register ("Arcola", 150 Victoria Street, Grafton), and any archaeology that may be present (Heritage Council)
- The Heritage Impact Statement recommends that the new rail bridge should have art deco style and archival recording should be done. It is unclear what works are proposed to introduce art deco styling to a single span bridge. (Heritage Council)

Response

Impact to CZB18

The land occupied by CZB18 (31 Pound Street, Grafton, a heritage listed item of local significance) is required for the project, including the widening of Pound Street from two lanes to four lanes, and the replacement of the Pound Street railway viaduct. It is noted during construction, the land occupied by CZB18 will also be used as a temporary construction compound. The temporary construction compound use however, is not the reason for the demolition of CZB18.

Impact to CZB37

The Grafton City Railway Precinct (CZB37) listing does not include the turntable. Note that the turntable is not the original turntable that formed part of the locomotive servicing depot. The existing turntable was used in conjunction with the adjacent sugar loading facility and is currently unused (Refer to Section 4.3.4 in Appendix G of the EIS).

It is likely that the turntable will be removed as part of the project as stated in Table 8-45 of the EIS main report. However, this will be confirmed in the detailed design stage. Roads and Maritime will investigate design refinement opportunities to avoid direct impact on the turntable site. Refer to new mitigation measure (NH11) in Section 4.

Impact of flood mitigation works to heritage items

Impacts from the proposed flood mitigation works are identified in Section 5.2.6 of the EIS main report and Appendix E of the EIS. The extent of area assessed as part of the EIS investigations was conservative.

Arcola (150 Victoria Street, Grafton, FMW24, a heritage listed item of State significance) is located outside but adjacent to the flood mitigation construction work zone (See Figure 8-21 of the EIS main report). Although the levee raising works are unlikely to impact upon the fabric of heritage items (including Arcola), care will be taken during construction of the project to minimise potential impacts on visual amenity regarding views from/to the property. Note environmental management measure NH5 in Section 10 of the EIS main report which states: "Any construction and vegetation clearance within or near the curtilage of heritage items will be sympathetic to minimise removal of, or impact on, associated heritage value".

Pound Street railway bridge

In regards to the new Pound Street railway bridge, Appendix G, Table 29 of the EIS notes the railway bridge design will be investigated further. The design included in the EIS proposes a steel truss bridge, not an art deco style bridge (a clarification on this matter is provided in Section 3.3).

The steel truss bridge will be in a similar character to the existing Gwydir Highway viaduct in South Grafton. Roads and Maritime will investigate options for the design of new piers proposed on either side of the viaduct replacement to incorporate similar design features to the existing abutments.

2.8.2 Non-Aboriginal heritage management measures

Submission numbers

Heritage Council

Summary of issues raised

The following submission relates to measures to manage non-Aboriginal heritage impacts.

- The applicant has recommended an archival recording for Ravensford (CZB10) and Dunvegan (CZB11) properties, specifically in relation to views to and from

the property. The description of impacts outlined above is inconsistent with the conclusion in the Statement of Heritage Impact in Appendix G of the EIS which states that there will be no impact of heritage significance for these properties (Heritage Council)

- Details of the noise treatment and a description of the expected heritage impacts on the site (ie heritage listed properties) should be addressed. Such details are also required for heritage listed properties identified as having direct partial impact. Where architectural noise treatments have been suggested in the EIS, the exact treatment should be specified (Heritage Council)
- The details of a construction heritage management plan (CHMP) should have been included in the EIS (Heritage Council)
- Environmental Mitigation Measures NH1 to NH10 (Summary of Environmental measures, page 398 of the EIS) should be included as conditions of consent for any approval, subject to the following modifications:
 - NH1: The heritage interpretation plan must be developed in consultation with Clarence Valley Council and the local community.
 - MH4: The draft CHMP must be provided to the Heritage Council for comment prior to finalisation (Heritage Council)
- The King George V Plaque (CZB19, Item no. I688), located on the viaduct, is proposed to be salvaged, stored and reinstated on the new viaduct. We consider this to be an acceptable response. (Heritage Council)

Response

Impacts to Ravensford (CZB10) and Dunvegan (CZB11)

These properties have heritage significance based on heritage values. As noted in Appendix G of the EIS, local heritage items "contribute to the individuality and streetscape, townscape, landscape or natural character of an area and are important parts of its environmental heritage. They may have greater value to members of the local community, who regularly engage with these places and/or consider them to be an important part of their day-to-day life and their identity. Collectively, such items reflect the socio-economic and natural history of a local area. Items of local heritage significance form an integral part of the State's environmental heritage".

Impacts on Ravensford (CZB10) consist of an impact on the curtilage of the property with a minor corner truncation of about three square metres. While this is a direct impact on the property, the building itself remains intact. Table 26 of Appendix G of the EIS states that Ravensford is an "attractive two-storey residence has remarkably intact external details and is set within a garden of mature trees on an important corner site. It is significant historically for its association with Captain Greenway (c 1860) and later the Henson family who owned a cordial factory next door. It is representative of the quality two-storey residences built in the period 1890 -1910 and can be compared with Lormont (16 Victoria Street)". Given the residence will remain intact, partly as a result of the project boundary being amended during concept design stage to avoid impacting on the building, the heritage significance of the residence in contributing to "the individuality and streetscape, townscape, landscape or natural character" of the area will remain intact. Roads and Maritime believes there are no inconsistencies with an impact on the property boundary, and the heritage significance of the building remaining unaffected.

The statement of significance for Dunvegan (CZB11) is presented in Table 26 of Appendix G of the EIS and states that Dunvegan (CZB11) is an "imposing two-storey timber clad residence, unusually large in scale and in largely original condition, tells of the local use of this timber. Built for the Powell family in 1905 and extended in 1926 it presents a variety of Victorian and Federation elements including iron lace balustrading and valances and carved barge boards with fretted work at the apex".

The project would require the acquisition of a small portion of land on the corner of the property boundary. This would have an impact on the heritage value of the property but its heritage significance will remain unaffected.

Architectural treatment of heritage properties

The number and nature of noise impacted properties and potential mitigation options documented in the EIS are based on the concept design. The potential heritage impacts of noise mitigation options have been assessed in the EIS. Any architectural noise treatments on heritage items will be applied in a sympathetic manner to minimise impact on the significance of the heritage item (as stated in mitigation measure NH3 in Section 10 of the EIS main report).

Noise mitigation measures will be refined during detailed design, when the noise impact assessment on the final design will be completed. Potential noise mitigation measures include low noise pavement, noise barriers and architectural treatment at the property. Mitigation measures comprising of architectural treatment will need to be negotiated with property owners (as stated in mitigation measure NV19 in Section 10 of the EIS main report).

Construction heritage management plan

The construction heritage management plan (CHMP) will be prepared before construction starts and will form part of the construction environmental management plan (CEMP). Contents of this plan are listed in mitigation measure NH4 in Section 10 of the EIS main report. Note project design will be further refined as part of the detailed design phase. It is more appropriate for the CHMP to be prepared as part of the CEMP.

Environmental management measures NH1 and NH4

Environmental management measures NH1 and NH4 have been amended. See revised measures in Section 4.

Management measures for CZB19

Heritage Council's comment regarding King George V Plaque is noted.

2.9 Socio-economic

2.9.1 Dislocation through acquisition

Submission numbers

14

Summary of issues raised

The following submission relates to dislocation through acquisition.

- Respondent is concerned that adverse social impacts on elderly people directly impacted by the bridge are not fully appreciated or explored. (14)

Response

Appendix I of the EIS acknowledges impacts on the local amenity including visual, noise and vibration, air quality, lighting and traffic impacts affecting the local community, including elderly people.

Roads and Maritime will continue to consult with members of the community impacted by the project in a sensitive manner. Property acquisition will be carried out in accordance with the *Land Acquisition (Just Terms Compensation Act) 1991* as detailed in mitigation measure SE4 in Section 10 of the EIS main report.

2.9.2 Business impacts during construction

Submission numbers

12, 13

Summary of issues raised

The following submissions relate to business impacts during construction.

- Ensure that on-street parking on Pound Street and Clarence Street is kept for businesses during construction and not used for construction workers (12) (13)
- Consider undertaking construction along Pound Street outside of normal business hours to minimise impacts on business. (13)

Response

On-street parking impacts

Some of the on-street parking on the surrounding local road network may be temporarily impacted. The impact would occur during the road network upgrades and the replacement of the Pound Street railway viaduct. These impacts are acknowledged in Section 8.1.3 of the EIS main report. Opportunities to minimise impacts on on-street parking will be implemented as part of the project's CEMP. Refer to mitigation measure TT5 in Section 4.

As part of the Community Consultation Strategy (Appendix C of the EIS) for the construction stage of the project Roads and Maritime will consult with businesses about on-street parking disruptions as a result of the project construction. Suitable access will be maintained during the construction period in consultation with business owners.

Construction outside standard working hours

Comments regarding the opportunity to carry out works outside the standard recommended working hours to minimise business impacts is noted.

Construction work that might be carried out outside the recommended standard hours is listed in Section 6.4.1 of the EIS main report. Upgrading local roads in Grafton and South Grafton to minimise impacts on-road users, local businesses and the TAFE is one of these activities.

2.9.3 Business impacts during operation

Submission numbers

12, 13

Summary of issues raised

The following submissions relate to business impacts during operation.

- Respondents were concerned about the loss of on-street parking for businesses on the corner of Pound Street and Clarence Street. It is requested that the following is considered:
 - Opportunities to provide parallel on-street parking on the southbound side of Pound Street, on the north-western side of the traffic lights at the intersection of Pound Street and Clarence Street should be investigated
 - Centre parking on Clarence Street between Pound Street and the rail viaduct should be considered
 - The project should retain the same number of on-street car parks on Clarence Street between Pound Street and the rail viaduct, preferably on both sides of Clarence Street

- Having both an entry and exit off Clarence Street for the car park on the corner of Clarence Street and Pound Street should be considered. (12) (13)

Response

Roads and Maritime consulted impacted businesses and the TAFE about the proposed parking arrangements along Pound Street and Clarence Street.

In relation to parallel parking on the north-western side of the traffic lights at the intersection of Pound Street and Clarence Street, the current concept design includes one on-street parallel parking space at this location.

Further investigations have identified that as a result of the installation of traffic lights, and the associated legal parking distances from intersections, there would be potential loss of nine on-street car parking spaces on Clarence Street between Pound Street and the railway viaduct. A clarification on this matter is provided in Section 3.1. Roads and Maritime will investigate opportunities to provide a comparable level of parking in this area during detailed design in consultation with business owners. This commitment is reflected in a new mitigation measure (TT15) outlined in Section 4.

As stated in Section 8.1.4 of the EIS main report, the project will formalise and maintain the current level of parking in the Pound Street and Clarence Street area, which services local businesses, TAFE and nearby residences. Suggestions made by the respondents are noted and will be considered during the detailed design stage.

2.10 Property impacts

2.10.1 Property acquisition

Submission numbers

11

Summary of issues raised

The following submission relates to property acquisition impacts.

- Respondent request to purchase some of the residual land once the project construction is complete. (11)

Response

Request has been noted. Any land disposal will be undertaken in accordance with the relevant Roads and Maritime policies and guidelines on management and disposal of real estate assets.

2.10.2 Property access – construction

Submission numbers

11

Summary of issues raised

The following submission relates to access of property during the construction stage of the project.

- Request that private property access is maintained at all times during construction and that Roads and Maritime will be responsible for all costs associated with altering access to private property. (11)

Response

Greaves Street in the vicinity of the northern approach to the new bridge crossing would be closed during construction. Access to Greaves Street properties will be

maintained during construction. Residents to the north would be required to detour via Bacon Street. Those to the south of the closure would be required to detour via Fitzroy Street.

Any necessary alterations to property access required for the project will be carried out at the expense of Roads and Maritime and in consultation with property owners.

2.10.3 Property access – operation

Submission numbers

6, 8, CVC, ARTC

Summary of issues raised

The following submissions relate to property access during operation.

- Concerned about access arrangements for a private property once the project is complete. The existing access off Pound Street will not be available due to safety issues. Respondent's preferred solution is to have access off Clarence Street. Would like this resolved prior to the detailed design being finalised (6)
- Clarification sought on impacts proposed parking in front of property which may hinder access (8)
- Clarence Valley Council access to existing infrastructure needs to be taken into account in detailed road design, eg at the Heber Street levee. (CVC)
- The ARTC seeking clarification on the project needing to acquire land on the southern bridge approach. (ARTC)

Response

Access easement request

Roads and Maritime will provide access to the five parcels of land which currently have frontage to Pound Street and Kent Street. Access location and configuration will be clarified during detailed design.

Access to respondent No 8 property

Respondent No 8's existing property access point has been acknowledged in the project design and will be maintained.

Access to CVC existing infrastructure

Clarence Valley Council comment is noted. Access to existing infrastructure will be taken into consideration during detailed design.

ARTC land acquisition

Details of potential ARTC land needed for the project based on the concept design have been provided to the ARTC through the route selection and EIS process. Consultation with the ARTC will continue through the detailed design and construction phase to identify land needed as part of the project.

2.11 Visual amenity and urban design

Submission numbers

5, 8, CVC

Summary of issues raised

The following submissions relates to property access during operation.

- There needs to be adequate landscaping in the area between the rail viaduct, Bridge Street and the old section of Pound Street to reduce any potential glare

from headlights of cars using the bridge, as well as reduce the overall appearance of the new infrastructure (5)

- Concerned that the security and privacy of the respondent's property will be compromised as a result of removing the existing buildings (8)
- The indicative "visualisations" of aesthetic treatment of the levees where they have been raised include landscape treatments and tree planting on the levee structure. Clarence Valley Council would not favour this approach for reasons of structure integrity and maintenance and to avoid raising erroneous expectations, would prefer these representations to be modified. (CVC)

Response

The potential for headlight glare is noted. This is unlikely to be an issue given that there will be a traffic barrier between properties and the proposed bridge approach road, however, this will be considered in the detailed design stage.

The landscape concept presented in Figure 8-31 of the EIS main report proposes native shrubs and trees along the embankment to mitigate visual impacts of the proposed structures, and to provide screening to properties for privacy.

Roads and Maritime considers that the removal of surrounding buildings will not change the level of security of the respondent's property. Crime Prevention Through Environmental Design principles have been considered during the project design and will continue to be considered during the detailed design stage. Refer to updated environmental management measures V1, V2 and V3 in Section 4.

Clarence Valley Council comment is noted. Roads and Maritime will consult with Clarence Valley Council during the detailed design of the flood mitigation works (refer to new mitigation measure in Section 4) to ensure that any proposed landscape treatment does not compromise the structural integrity of the levee or impose significant additional maintenance requirements to Clarence Valley Council.

2.12 Biodiversity

Submission numbers

OEH

Summary of issues raised

The following submission relates to the EIS biodiversity assessment.

- The Targeted Threatened Species Survey Report for the Three-toed snake-tooth skink in Figure 1 of the Technical Paper shows the known records of the koala instead of the Three-toed snake-tooth skink. This should be corrected (OEH)
- OEH notes the potential impacts to biodiversity that are identified in the EIS documentation. OEH notes that Section 8.9.3 of the EIS discusses consideration of biodiversity offset taking into account the Principles for the use of biodiversity offset in NSW developed by OEH. OEH recommends that an offset proposal should be developed to the satisfaction of OEH to address the proposed biodiversity impacts of the proposal. The OEH offset principles require that all impacts which cannot be avoided or mitigated are to be offset. OEH notes that the offsetting principles referred to are used for proposals other than those for state significant development or State significant infrastructure. It should be noted that a NSW Biodiversity Offset Policy for Major Projects has been developed to deal with proposals for SSD and SSI. This policy sets out the offset principles to be used for Major Projects. OEH acknowledges that the proposed Revegetation Management Sub-Plan and Microbat Management Sub-Plan may be able to address OEH's concerns about lack of offsets however further details are required. OEH willing to liaise with Roads and Maritime Services to ensure that the compensation (offsets) for the direct and indirect impacts of the proposal is

appropriately considered. It is recommended that an offset proposal should be developed to the satisfaction of OEH to address the proposed biodiversity impacts of the proposal. (OEH)

Response

Map of Three-toed snake tooth skink known records

A clarification on this matter is presented in Section 3.4.

Offset of biodiversity impacts

Biodiversity impacts from the project are identified in Section 8.9.3 of the EIS main report and Appendix L of the EIS. The clearing required for the project would be limited to the removal of about 0.41 hectares (total) of two endangered ecological communities (EEC) of poor condition with heavy infestation of exotic species. Two hollow bearing trees and five habitat trees would also be removed.

The biodiversity assessment concluded that the project is unlikely to significantly impact the two EEC recorded due to the relatively minor nature of the impact, and the low viability and condition of the communities from historic and current disturbance. In addition, there would be no significant impacts as a result of removing seven habitat trees.

It should be noted that the area of impact outlined in the EIS for the project, including the flood mitigation works, is based on a 'worse case scenario'. The construction impacts are subject to the construction methodology and activities required to be undertaken on the area of the river bank. It is noted that there would be no operational impacts to EEC as the bridge span is located over the river bank with piers located on the northern bank and in-stream, away from the area of EEC depicted in the EIS.

Roads and Maritime is committed to minimising impacts from the project to biodiversity values. As detailed in environment management measures B1, B2, B4, B8 and B11, as part of the flora and fauna management plan, a revegetation management sub-plan will be developed to provide specific details for the reestablishment of native vegetation on areas disturbed by construction of the project. It will also include details for the regeneration and rehabilitation of areas with a focus on riparian areas within the project area.

The plan will include objectives to incorporate local native species across all revegetation and landscaping efforts along the Clarence River and in the adjoining project area. This will include species consistent with freshwater wetlands on coastal floodplain and subtropical coastal floodplain forest threatened ecological communities species composition, which could potentially provide foraging resources and roosting to threatened fauna species, and increase corridors and connectivity throughout the landscape. In addition, Roads and Maritime is committed to installing nest boxes and bat roost structures as part of the biodiversity management, mitigation and offset measures implemented as part of the project.

Roads and Maritime is committed to working with OEH to ensure that the impacts from the project are appropriately considered. Mitigation measure B2 has been revised to incorporate consultation with OEH during development of the revegetation management sub-plan prepared for the project (refer to Section 4).

2.13 Soils, sediment and water

2.13.1 Groundwater extraction

Submission numbers

DPI

Summary of issues raised

The following submission relates to groundwater extraction.

- Recommended that any groundwater works where water is extracted, or supplementary groundwater collected, for the purpose of water supply for the development should be licensed under the *Water Act 1912*. (DPI)

Response

Groundwater extraction is not proposed or envisaged at this stage. If groundwater extraction or collection for the purpose of water supply occurs as part of the project, a *Water Act 1912* licence will be sought.

2.13.2 Works near water courses and stormwater, erosion and sediment control

Submission numbers

DPI

Summary of issues raised

The following submission relates to works near water courses and stormwater, erosion and sediment control.

- Noted that the project is classed as State significant infrastructure therefore a Controlled Activity Approval under the *Water Management Act 2000* is not required, however the works undertaken within 40 metres of the Clarence River and associated watercourses should be undertaken in accordance with Office of Water's guidelines for Controlled Activities. It is important appropriate stormwater management measures are in place to limit any potential impacts on surface water and groundwater sources in the locality. It is important appropriate measures, including an Erosion and Sedimentation Control Plan are implemented on the site to limit any potential impacts on surface water and groundwater sources. (DPI)

Response

All work near waterways would be carried out in accordance with best practice and appropriate NSW Office of Water guidelines (including *Guidelines for Controlled Activities*) where feasible and reasonable. Refer to updated environmental management measure SW11 in Section 4.

The EIS proposes stormwater management measures during construction and operation to manage impacts on surface and groundwater sources. Measures include the implementation of an erosion and sediment control plan as part of the construction environmental management plan to manage impacts during construction. Refer to Section 10, environmental management measure B13 in the EIS main report.

2.13.3 Management of emergency spills

Submission numbers

DPI

Summary of issues raised

The following submission relates to management of emergency spills.

- Recommended that the approval requires features to manage emergency spills considering the high recreation, commercial and environmental value of the river and that the crossing is a major transport link. The detailed design stage should determine the best design to manage potential spills to protect these environmental and community values. (DPI)

Response

As stated in Section 5.2.8 of the EIS main report, the need to provide measures to manage emergency spills would be evaluated during the detailed design phase. Basins would be considered to capture contaminants in the event of a spill on the bridge.

Other comments provided by DPI (Office of Water and Fisheries) are noted.

2.13.4 Need for a POEO Act licence

Submission numbers

EPA

Summary of issues raised

The following submission relates to the need for a POEO licence.

- It is unclear whether the project would require a licence under the *Protection of the Environment Operations Act 1997* (POEO Act). The proponent will need to make a separate application to EPA to obtain a licence if it is determined to be required, once development project approval is granted. (EPA)

Response

It is envisaged at this stage that the project would not require a licence under the *Protection of the Environment Operations Act 1997* (POEO Act). Should it be required, Roads and Maritime would discuss this further with the EPA.

2.13.5 Risk assessment and soil and water management plan

Submission numbers

EPA

Summary of issues raised

The following submission relates to the need for a risk assessment for impacts on water quality and the development of a soil and water management plan.

- The EIS discusses potential bridge design and construction methodologies. EPA stress the importance of conducting a comprehensive risk assessment of the potential impacts on water quality and hydrological processes posed by proposed bridge construction methods (EPA)
- A Soil and Water Management Plan should be developed which outlines all management and mitigation measures relating to stormwater management, erosion control and water quality management during construction and operational phases. EPA has provided recommendations for items that should be included in any management plans prepared for the project to address issues from land-based construction and bridge construction works. (EPA)

Response

As part of the construction soil and water management plan (part of the CEMP) a risk assessment of the potential impacts on water quality and hydrological processes will be conducted. Please refer to amended environmental management measure SW3 in Section 4.

2.14 Air quality

Submission numbers

11, EPA

Summary of issues raised

The following submissions relate to air quality impacts.

- Concerned about dust impacts to private property during construction (11)
- Recommended that an Air Quality Management Plan be developed to manage construction air quality issues. The plan should detail the mitigation measures that will be implemented to manage dust and other air impurities generated by project plant and equipment. (EPA)

Response

An air quality management plan is proposed as part of the project's construction environmental management plan to manage any increased dust impacts from construction activities, including potential impacts on private property. Refer to measure AQ1 in Section 10 of the EIS main report.

2.15 Asset ownership

Submission numbers

CVC

Summary of issues raised

The following submission relates to long term asset ownership.

- The EIS is silent on the long term ownership of a range of project related infrastructure such as open space and landscaping required to ameliorate visual impacts, drainage infrastructure (in particular the propose Pound Street pump), etc. Clarification of these matters will be required through negotiation ' at detailed design stage, it being noted that it is Clarence Valley Council's view that such matters are integral to the road project and therefore should not impose a maintenance burden on Clarence Valley Council. (CVC)

Response

Long term ownership of assets will be discussed with Clarence Valley Council during the next project stages.

3 Clarifications to the EIS

Roads and Maritime makes the following clarifications to the EIS.

3.1 Traffic and transport

Table 13 in Appendix D of the EIS states there would be a net reduction of two on-street car parking spaces in the area Pound Street and Clarence Street area.

Further investigations have identified that as a result of the installation of traffic lights, and the associated legal parking distances from intersections, there would be potential loss of nine on-street car parking spaces on Clarence Street between Pound Street and the railway viaduct. Roads and Maritime will investigate opportunities to provide a comparable level of parking in this area during detailed design in consultation with business owners. This commitment is reflected in a new mitigation measure (TT15) outlined in Section 4.

3.2 Flooding and hydrology

The column heading 'Grafton: Alamy Creek near North Street' in Table 8-12, Table 8-13, Table 8-14 and Table 8-15 of the EIS main report is mislabeled. The correct column heading is 'Grafton: Intersection of Pound Street and Prince Street'.

Also, the column heading 'Unmitigated' in Table 5-3, Table 5-4, Table 5-6 and Table 5-7 of Appendix E of the EIS is mislabeled. The correct column heading is 'Mitigated'.

3.3 Non-Aboriginal heritage

In regards to the proposed steel railway bridge on Pound Street, Table 29 of Appendix G of the EIS recommends that "the design of the replacement portion of viaduct over Pound Street should incorporate the art deco style of the current viaduct".

The recommendation should read "the design of the replacement portion of viaduct over Pound Street should be sympathetic to the art deco style of the current viaduct".

3.4 Flora and fauna

The map showing the known records of the Three-toed snake tooth skink presented in Figure 1 of the *Targeted Threatened Species Survey – Three-toed snake-tooth skink Coeranoscincus reticulatus* report in Appendix L of the EIS is not accurate. The correct map is presented in Figure 3-1.

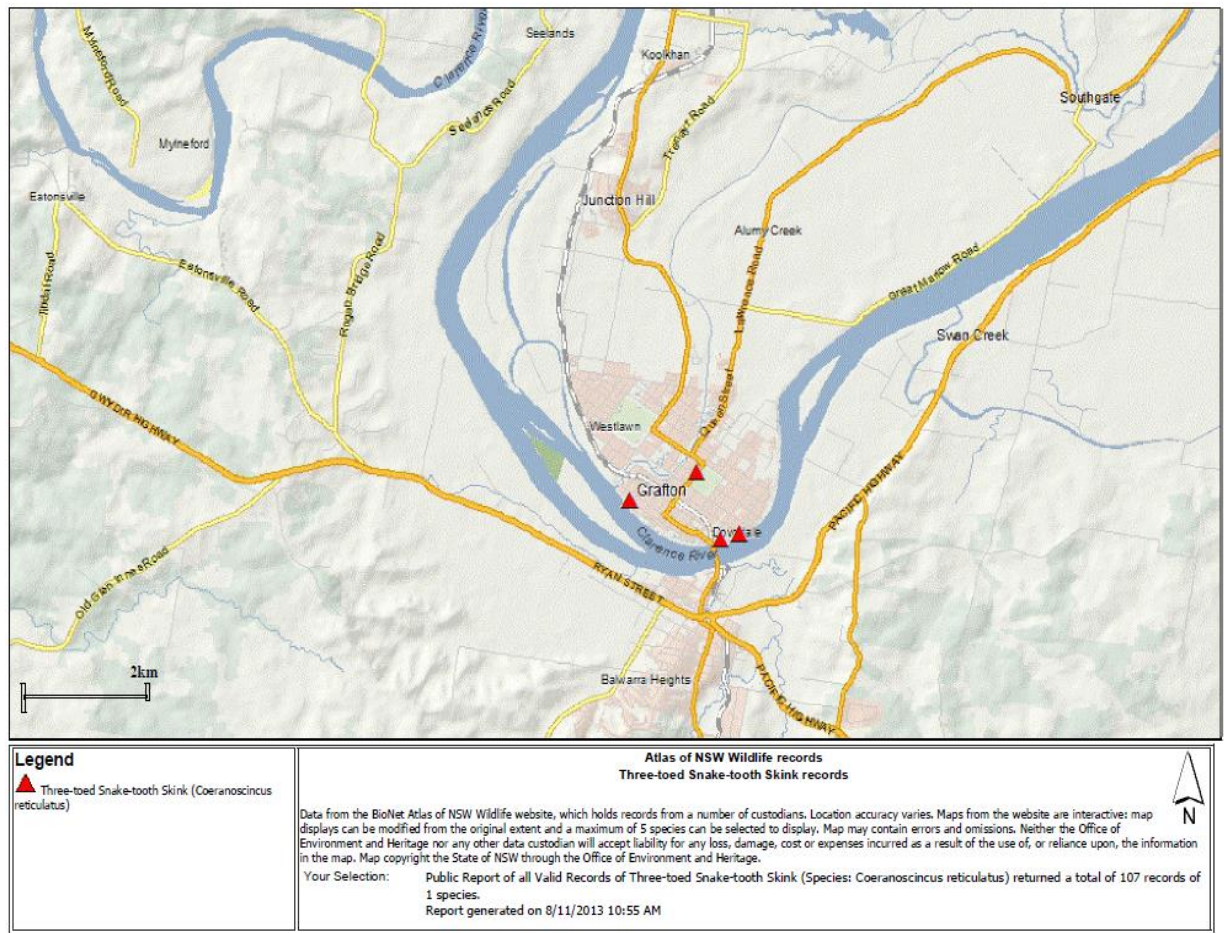


Figure 3-1 Known records of the Three-toed snake tooth skink (Source: NSW OEH Bionet, 2013)

3.5 Air quality

In regards to Table 8-82, Section 8.12 of the EIS main report, the measurement units for carbon monoxide should be mg/m^3 , not $\mu\text{g}/\text{m}^3$. Also, this table does not show the predicted operational air quality results for the Gummaney Aboriginal preschool sensitive receiver (this receiver is shown as RCP7 in Figure 3-2).

The updated table showing results for all receivers assessed as part of the operational air quality assessment is presented in Table 3-1.

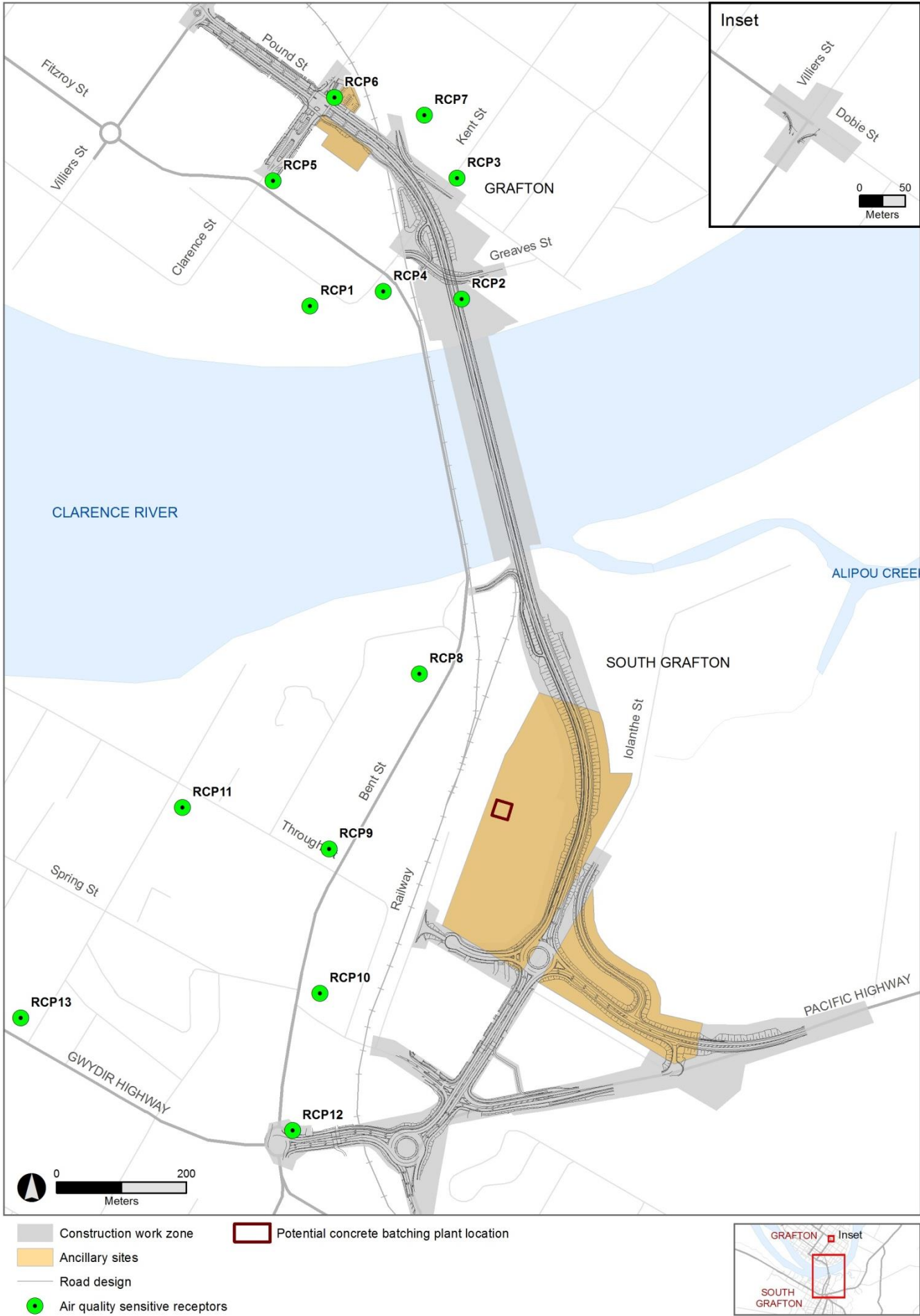


Figure 3-2 Sensitive receivers within the project area for the air quality assessment

Table 3-1 Predicted operational air quality with and without the proposed project

Receptor No.	Without the project									With the project in operation					
	2011			2019			2029			2019			2029		
	NO2 µm/m ³	CO mg/m ³	PM10 µm/m ³	NO2 µm/m ³	CO mg/m ³	PM10 µm/m ³	NO2 µm/m ³	CO mg/m ³	PM10 µm/m ³	NO2 µm/m ³	CO mg/m ³	PM10 µm/m ³	NO2 µm/m ³	CO mg/m ³	PM10 µm/m ³
NEPM Criteria	246 µg/m ³	30 mg/m ³	50 µg/m ³	246 µg/m ³	30 mg/m ³	50 µg/m ³	246 µg/m ³	30 mg/m ³	50 µg/m ³	246 µg/m ³	30 mg/m ³	50 µg/m ³	246 µg/m ³	30 mg/m ³	50 µg/m ³
RCP1	109	1.6	40	114	1.6	40	225	2.2	40	103	1.5	39	109	1.6	40
RCP2	172	2.3	42	187	2.4	43	216	2.7	44	153	2.1	39	175	2.3	39
RCP3	122	1.7	39	128	1.8	39	142	2.0	39	108	1.6	39	116	1.7	39
RCP4	106	1.5	39	109	1.6	39	115	2.3	39	131	1.8	41	144	2.0	41
RCP5	222	2.8	41	244	3.0	41	282	3.5	42	167	2.2	40	188	2.4	40
RCP6	128	1.8	39	138	1.9	39	153	3.1	40	187	2.4	40	215	2.7	41
RCP7	107	1.6	39	111	1.6	39	118	1.8	39	111	1.6	39	120	1.7	39
RCP8	158	2.1	40	169	2.2	40	189	2.4	40	118	1.7	39	115	1.6	39
RCP9	218	2.7	41	244	3.0	41	294	3.6	42	136	1.9	39	121	1.7	39
RCP10	124	1.7	40	132	1.8	40	149	2.0	41	106	1.5	39	100	1.5	39
RCP11	102	1.5	39	106	1.5	39	115	1.6	39	98	1.5	39	100	1.5	38
RCP12	150	2.0	41	162	2.1	42	185	2.4	43	179	2.3	41	180	2.3	40
RCP13	107	1.6	39	115	1.6	39	133	1.8	39	111	1.6	39	117	1.7	39

Note: When the National Environment Protection Measure (NEPM) air quality criteria are exceeded, the number appears in bold font.

4 Revised environmental management measures

The environmental impact statement for the project identified a range of environmental outcomes and management measures that would be required to avoid or reduce environmental impacts.

After consideration of the issues raised in the public submissions, the environmental management measures for the project (refer to Section 10 of the EIS main report) have been revised. Should the project be approved, the environmental management measures in Table 4-1 will guide the subsequent phases of the project development. Additional and/or modified environmental management measures to those presented in the EIS are shown in italics and red colour font and deleted measures, or deletions of parts of measures, are indicated as struck out and in red colour font.

Table 4-1 Summary of revised environmental management measures

Environmental issue	ID	Environmental management measures	Responsibility	Timing
General environmental management				
General environmental management	G1	<p>A Construction Environmental Management Plan will be prepared and implemented to ensure appropriate environmental management measures are followed during project delivery. The Construction Environmental Management Plan will provide a framework for environmental management during construction and will:</p> <ul style="list-style-type: none"> • Outline all environmental management practices and procedures to be followed during construction and demolition works associated with the project • Describe all activities to be undertaken on the site during construction of the project • Detail how the environmental performance of the construction works will be monitored • Detail what corrective actions will be taken to address identified adverse environmental impacts • Describe of the roles and responsibilities for all relevant employees involved in the project • Include relevant sub-plans. <p>The Construction Environmental Management Plan will be developed in accordance with <i>Guideline for the Preparation of Environmental Management Plans</i> (Department of Infrastructure, Planning and Natural Resources, 2004).</p>	Roads and Maritime Construction contractor	Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Consultation				
<i>Consultation</i>	<i>CO1</i>	<p><i>Roads and Maritime will consult with:</i></p> <ul style="list-style-type: none"> <i>Clarence Valley Council on the potential staging of local road network upgrades in Grafton and South Grafton; the design and potential staging of flood mitigation works; and project's asset ownership and maintenance</i> <i>NSW EPA regarding water, noise and air quality impacts as relevant and required</i> <i>ARTC on the design, construction and ownership transfer of the railway bridge on Pound Street.</i> 	<i>Roads and Maritime</i>	<i>Detailed design</i>
Traffic and transport				
Operational impacts on river navigation and access	TT1	The provision of permanent aids to navigation on the bridge will be investigated as part of detailed design.	Roads and Maritime	Detailed design
Road safety audit	TT2	Roads and Maritime will conduct a project road safety audit as part of detailed design to identify and address potential safety issues associated with the operation of the project	Roads and Maritime	Detailed design
Future traffic demand	TT3	If more detailed information regarding future demand becomes available during detailed design of the project, Roads and Maritime will assess the suitability of incorporating the revised projections.	Roads and Maritime	Pre-construction
Construction impacts on public transport	TT4	Access to bus stops will be maintained during construction <i>or suitable alternatives will be identified</i> in consultation with the bus operators where feasible and reasonable.	Roads and Maritime	Pre-construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Construction traffic impacts	TT5	<p>Construction traffic management measures will be developed and identified as part of the construction environmental management plan. The plan will:</p> <ul style="list-style-type: none"> • Detail how the traffic associated with construction activities will be managed in accordance with the relevant standards, including <i>Traffic Control at Work Sites</i> (Roads and Maritime, 2010), AS1742 and Roads and Maritime Specification G10 • Confirm haulage routes between material source sites and ancillary site / flood levee stockpile access locations • Quantify the impacts on level of service during critical construction periods and demonstrate how the mitigation measures proposed will enable acceptable traffic operations and level of service on the road network during construction • Identify how the continuous, safe and efficient movement of traffic for both the public and construction workers will be maintained • Identify site-specific traffic control measures (including signage) to be provided to manage and regulate traffic movements at relevant locations during construction • Identify access arrangements at both construction sites and quarry sites, detailing vehicle ingress / egress movements • Include requirements and methods to consult and inform the local community of impacts on the local road network and traffic • Describe impacts on all transport modes, identifying appropriate mitigation measures in accordance with the relevant guidelines and in consultation with relevant parties (ie bus and rail operators). • Consider other developments and projects that may also be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic. 	<p>Construction contractor Roads and Maritime</p>	<p>Pre-construction Construction</p>
Construction traffic impacts	TT6	<p>Construction deliveries will be timed to occur outside peak traffic periods when feasible and reasonable, to minimise impacts on road network.</p> <p>Where feasible and reasonable, machinery and materials to be delivered over long distances will be transported to Grafton by rail and hauled to site by road transport. Consultation will be initiated with the appropriate rail operators / owners to explore this opportunity at the appropriate design stage.</p> <p>Emergency services will be notified in advance of changes to traffic conditions (eg partial or total road closures).</p>	<p>Construction contractor Roads and Maritime</p>	<p>Construction</p>

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Construction impacts on the road network	TT7	Local roads used for construction access will be repaired where required and maintained in serviceable condition.	Construction contractor Roads and Maritime	Construction
Construction impacts on public transport	TT8	Roads and Maritime will coordinate the placement of the new Pound Street bridge with ARTC to ensure the North Coast Line possession coincides with other works required along the line. In addition, North Coast Line users (passengers and freight operators) will be notified of impending changes to minimise impacts on them.	Construction contractor Roads and Maritime	Construction
Construction impacts on river navigation and access	TT9	Exclusion zones around critical areas of construction activities and floating construction plant will be clearly marked in accordance with Roads and Maritime advice and requirements.	Construction contractor	Construction
	TT10	Commercial fishing licence holders on the Clarence River at Grafton will be consulted during construction to minimise impacts and address any access issues in and around the construction site.	Construction contractor Roads and Maritime	Construction
	TT11	A proclaimed Marine Notice will be issued through Roads and Maritime alerting river users of ongoing construction activities.	Construction contractor Roads and Maritime	Construction
	TT12	Temporary aids to navigation will be provided where feasible and reasonable and in accordance with Roads and Maritime advice and requirements (such as lighted buoys to mark exclusion zones).	Construction contractor Roads and Maritime	Construction
	TT13	Early and ongoing liaison with local marine events organisers (including Grafton Rowing Club, Grafton River Sailing Club and the Grafton Bridge to Bridge Waterski Race organiser) will be carried out to ensure the viability of these annual events and general activities organised by the clubs.	Construction contractor Roads and Maritime	Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Construction impacts on river navigation and access	TT14	A construction navigation management plan will be prepared and implemented to set out river procedures and impact reduction measures to be adopted during construction.	Construction contractor Roads and Maritime	Construction
<i>Impacts on parking</i>	<i>TT15</i>	<i>Roads and Maritime will investigate opportunities to provide a comparable level of parking on Clarence Street between Pound Street and the railway viaduct in consultation with local business owners.</i>	<i>Roads and Maritime</i>	<i>Detailed design</i>
Flooding and hydrology				
Impacts of flooding on the project construction	FH1	Flood monitoring and response measures will be included as part of the construction environmental management plan. 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: <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. 	Construction contractor	Pre-construction
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	Construction contractor	Pre-construction
Consultation	FH3	Roads and Maritime will consult with affected landowners during detailed design and construction regarding flooding impacts on properties, residences and other structures.	Roads and Maritime	Pre-construction
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.	Roads and Maritime	Pre-construction of bridge

Environmental issue	ID	Environmental management measures	Responsibility	Timing
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.	Roads and Maritime	Pre-construction of bridge
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.	Construction contractor	Pre-construction of bridge
Climate change and sea level rise				
Managing climate change risks to the project	CC1	Bridge approach embankments will be investigated in detailed design to take into account sea level rise and severity of storms and flooding resulting from climate change. The proposed pump station in Grafton will be equipped with redundant power supply capacity. Adopted design flood levels will include an appropriate allowance for increased rainfall intensities due to climate change in accordance with the <i>NSW Floodplain Risk Management Guideline – Practical Considerations of Climate Change (DECC, 2007)</i> .	Roads and Maritime	Detailed design
	CC2	Regular inspections of project elements will be carried out for early identification of potential issues relating to embankments and ground conditions. Operational procedures will be in place for the regular and timely removal of debris and falling trees and branches.	Roads and Maritime	Operation
Noise and vibration				
New railway bridge above Pound Street	NV1	The redeveloped section of rail should be equal to or better than the existing viaduct in terms of noise impact, with no additional noise impact introduced into the system via expansion joints or similar.	Roads and Maritime	Detailed design
Pump station, Grafton	NV2	The pump station and pump station building will be designed to achieve the industrial noise emission criteria outlined in Table 8-33 of the EIS.	Roads and Maritime	Detailed design
Noise wall design	NV3	Noise walls developed for the project would be designed in accordance with the <i>Noise wall design guideline</i> (Roads and Maritime, 2006).	Roads and Maritime	Detailed design

Environmental issue	ID	Environmental management measures	Responsibility	Timing
General	NV4	The appointed construction contractor will be required to prepare a detailed Construction Noise and Vibration Management Plan (CNVMP). This plan will include but not limited to the following: <ul style="list-style-type: none"> • Roles and responsibilities • Noise-sensitive receiver locations • Predicted impacts • Mitigation strategy • Monitoring methodology • Community engagement strategy. 	Roads and Maritime Construction contractor	Construction
	NV5	Workers and contractors will be inducted and trained (such as through toolbox talks) in the use of equipment in ways that minimise noise.	Construction contractor	Construction
	NV6	Site managers will periodically check the site and nearby residences for noise problems so that solutions can be quickly applied, where required.	Construction contractor	Construction
Working hours	NV7	Construction work will be undertaken in accordance with the approved construction hours as outlined in Section 6.4 of the EIS.	Roads and Maritime Construction contractor	Construction
	NV8	Noise from construction work that might be carried out outside the recommended standard hours will follow Section 2.3 of the <i>Interim Construction Noise Guidelines</i> (DECC, 2009) where feasible and reasonable.	Construction contractor	Construction
Sensitive receivers	NV9	The location of stationary plant (such as air-compressors and generators) will be located as far away as feasible and reasonable from sensitive receivers.	Construction contractor	Construction
Noise screening – construction	NV10	Natural screening by topography and vegetation will be used wherever possible to reduce noise impacts.	Construction contractor	Construction
	NV11	Site sheds, other temporary structures or screens will be used to limit noise exposure where feasible and reasonable.	Construction contractor	Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Construction equipment	NV12	Low noise construction equipment and/or methods will be preferred, where feasible and reasonable.	Roads and Maritime Construction contractor	Construction
	NV13	Compliance with the Transport for New South Wales <i>Construction Noise Strategy</i> which summarises the maximum allowable noise levels for construction equipment to be applied to the project.	Roads and Maritime Construction contractor	Construction
Programming	NV14	Construction programming should aim to reduce noise impacts and minimise noisy activities occurring concurrently as far as feasible and reasonable.	Construction contractor	Construction
Community consultation	NV15	The Draft Community Consultation Strategy prepared for the project outlines methods for consultation with the community during construction which are to be followed, including, but not limited to: <ul style="list-style-type: none"> • Advance notification of planned activities and expected disruption/effects • Construction noise complaints handling procedure • Effective monitoring of noise levels in and around potentially affected dwellings. 	Roads and Maritime Construction contractor	Construction
Piling	NV16	Alternative piling methodologies will be investigated to reduce potential impacts from these activities.	Construction contractor	Construction
Vibration	NV17	Limit construction vibration impacts on sensitive receivers.	Construction contractor	Construction
Noise screening – operation	NV18	Operational noise barriers will be installed as early as possible to provide ongoing screening from construction activities, where feasible and reasonable.	Roads and Maritime Construction contractor	Operation Construction
Noise architectural treatments	NV19	Noise architectural treatments at affected properties will be developed and implemented in consultation with property owners.	Roads and Maritime	Operation

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Operational noise	NV20	<p>No later than one year after commencement of operation of the project, Roads and Maritime will undertake operational noise monitoring to compare the actual noise performance of the project against predicted noise performance. The report will include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> Noise monitoring to assess compliance with operational noise levels predicted A review of the operational noise levels in terms of criteria and noise goals Methodology, location and frequency of noise monitoring undertaken Details of any complaints and enquiries received in relation to operational noise Any required recalibrations of the noise model An assessment of the performance and effectiveness of applied noise mitigation measures Any additional feasible and reasonable measures required. 	Roads and Maritime	Operation
Non-Aboriginal heritage				
Prepare an interpretation plan for the project	NH1	<p>A heritage interpretation plan will be prepared to provide opportunities to enhance understanding and appreciation of the heritage items, values and themes associated with Grafton. In particular, the interpretation plan will identify heritage items that are to be removed and provide opportunities for compensating for these losses. This may include incorporating formalised heritage walks and tree-planting programs into the landscaping and planning of the project.</p> <p><i>The heritage interpretation plan will be developed in consultation with Clarence Valley Council and relevant stakeholders.</i></p>	Roads and Maritime	Detailed design
Consideration of heritage in urban design principles	NH2	Heritage considerations will be incorporated into the urban design and landscape objectives developed for the project. These features will be refined further during detailed design development for the project.	Roads and Maritime	Detailed design
Noise mitigation treatment on heritage items	NH3	If required, architectural noise treatments on heritage items will be applied in a sympathetic manner to minimise impact on the significance of the heritage item.	Roads and Maritime	Detailed design Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Construction impacts	NH4	<p>A construction heritage management plan (CHMP) will be prepared as part of the construction environmental management plan for the project.</p> <p>The CHMP will detail how construction impacts on Aboriginal and non-Aboriginal heritage will be minimised and managed.</p> <p>The CHMP will include:</p> <ul style="list-style-type: none"> • Details of Aboriginal and non-Aboriginal cultural heritage sites within and adjacent to the Project • Details of management measures for the project • Procedures for dealing with previously unidentified finds • Heritage training and induction processes for construction personnel • Procedures for ongoing Aboriginal consultation and involvement for the duration of the project. • <i>The CHMP will be provided to the Heritage Council of NSW for comment prior to finalisation.</i> 	Construction contractor	Pre-construction
Heritage values to be considered during flood mitigation works	NH5	Any construction and vegetation clearance within or near the curtilage of heritage items will be sympathetic to minimise the removal of, or impact on, associated heritage values.	Roads and Maritime	Pre-construction
Prepare an archival record before impact occurs and at the completion of the project	NH6	<p>Archival recording will be prepared for the following heritage items: CZB10, CZB11, CZB13, CZB16, CZB17, CZB18, CZB19, CZB20 & CZB21, CZB24, CZB25, CZB26, CZB27, CZB28, CZB29, CZB30, CZB31, CZB32, CZB33, CZB34, CZB35, CZB36 and CZB37.</p> <p>Archival recording will also be carried out for portions of Pound Street within the Grafton Conservation Area (C3).</p> <p>The archival records will record the process of development and alterations to heritage values. A program of archival recording will be completed before impacts occur and at the completion of the project. All archival recording will be completed in accordance with the Heritage Branch guidelines <i>How to Prepare Archival Records for Heritage Items</i> and <i>Photographic Recording of Heritage Items Using Film or Digital Capture</i> (Heritage Office 2001, revised 2004, 2006).</p>	Roads and Maritime	Pre-construction
Relocation of King George V Plaque	NH7	Following archival recording, the King George V Plaque (CZB19) will be relocated to a safe location and later reinstated on the new section of viaduct at Pound Street.	Construction contractor	Pre-construction Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
No-go areas and temporary fencing	NH8	<p>No-go areas will be established around three heritage items:</p> <ul style="list-style-type: none"> • CZB07 (Fisher's Drain) • FMW29 (<i>SS Induna</i> shipwreck) • FMW34 (Water Trough, Lane Park). <p>For CZB07 and FMW34, no-go areas will be established at an appropriate distance to protect the heritage values of the heritage items but allow construction to proceed unhindered.</p> <p>For FMW29, <i>SS Induna</i>, both terrestrial and maritime temporary exclusion areas will be established during construction to exclude the entry of vehicles or equipment associated with construction. The 'no-go' area perimeter will be placed on the existing property boundary to the south of the <i>SS Induna</i>. A maritime exclusion area (to be in accordance with Maritime and navigational requirements) will be placed 15 metres from the shipwreck to remind workboats to not enter this area.</p> <p>No-go areas will be marked on all construction plans and pointed out in induction talks with contractors undertaking work in vicinity to the items.</p>	Construction contractor	Pre-construction Construction
Archaeological monitoring (if required)	NH9	<p>The EIS has determined that the proposed flood mitigation works traverse areas of moderate and high potential for the survival of archaeological resources of local significance. Depending on the level of impact and the form of the proposed works, monitoring of these moderate and high archaeologically sensitive areas may be required. No monitoring is required for sites with low archaeological significance.</p> <p>Monitoring is proposed as it is not appropriate to carry out archaeological testing and salvage within or next to the existing flood levee. This is due to the risks associated with compromising the flood protection measures around Grafton. An archaeological excavation program will expose properties within Grafton to an unacceptable level of risk and therefore is not appropriate in this instance.</p> <p>An archaeological monitoring program will be developed as part of the heritage management sub-plan developed for the project. The monitoring program will provide the following details:</p> <ul style="list-style-type: none"> • Description of the proposed works, including level of disturbance and consideration of previous levee construction activities and how this relates to the impacts from the work • Details of involvement of a suitably qualified archaeologist for all initial ground disturbance works which may impact upon archaeological deposits • Process to be followed should any heritage items be identified during the monitoring period. 	Construction contractor Roads and Maritime	Pre-construction Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Discovery of unexpected non-Aboriginal objects and/or human remains	NH10	If unexpected non-Aboriginal heritage items or skeletal remains are encountered, the <i>Roads and Maritime Services Standard Management Procedure for Unexpected Archaeological Finds (2012)</i> will be implemented.	Construction contractor	Construction
<i>Turntable site in South Grafton</i>	<i>NH11</i>	<i>Investigate design refinement opportunities to avoid direct impact on the turntable site located in railway land in South Grafton.</i>	<i>Roads and Maritime</i>	<i>Detailed design</i>
Aboriginal heritage				
Golden Eel dreaming site	AH1	Detailed design and construction stages will avoid further encroachment towards the Golden Eel dreaming site.	Roads and Maritime	Detailed design Construction
Consultation with Aboriginal community	AH2	The Aboriginal community will continue to be consulted as an identified group within the overall community consultation strategy for the project.	Roads and Maritime	Detailed design Construction
Interpretive strategy for tangible and intangible Aboriginal heritage	AH3	An interpretive strategy will be formulated in conjunction with the local Aboriginal community. This will highlight salient sites and features within the landscape in a manner that respectfully enhances and protects these values. The interpretative strategy will be integrated with the non-Aboriginal heritage interpretation plan for the project.	Roads and Maritime	Detailed design Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Construction impacts	AH4	<p>A construction heritage management plan (CHMP) will be prepared as part of the construction environmental management plan for the project.</p> <p>The CHMP will detail how construction impacts on Aboriginal and non-Aboriginal heritage will be minimised and managed.</p> <p>The CHMP will include:</p> <ul style="list-style-type: none"> • Details of Aboriginal and non-Aboriginal cultural heritage sites within and adjacent to the project • Details of management measures for the project • Procedures for dealing with previously unidentified finds • Heritage training and induction processes for construction personnel • Procedures for ongoing Aboriginal consultation and involvement for the duration of the project. 	Construction contractor	Pre-construction
Aboriginal cultural heritage induction	AH5	The project site induction will incorporate Aboriginal culture awareness training for all relevant staff and contractors. This induction will include information about the Aboriginal culture and history of the locality, the location of sites and items that require protection, heritage management measures and protocols, and legal obligations. This training will be developed in consultation with the Grafton Ngerrie LALC and provided to relevant staff before commencing work on-site.	Construction contractor	Construction
Known Aboriginal objects and places	AH6	Aboriginal sites located in close proximity to the project construction work zone will be designated 'no-go' areas and will be clearly identified and appropriately fenced to prevent access or damage during construction.	Construction contractor	Construction
Discovery of unexpected Aboriginal cultural material and human remains	AH7	In the event that unexpected Aboriginal cultural material or skeletal remains are encountered, the <i>Standard Management Procedure for Unexpected Archaeological Finds</i> (Roads and Maritime, 2012) will be implemented.	Construction contractor	Construction
Socio-economic, property and land use				
Excess land	SE1	Roads and Maritime will prepare an excess land strategy during detailed design and would investigate opportunities to return available regionally significant farmland, following completion of the project.	Roads and Maritime	Detailed design

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Social infrastructure – Basmar Hall	SE2	Roads and Maritime will communicate in a timely way with the tenants of Basmar Hall regarding its closure, to maximise the opportunity for tenants to find alternative space.	Roads and Maritime	Detailed design Pre-construction
Impacted moorings	SE3	Roads and Maritime will consult with the owners of the moorings during the detailed design stage and before construction.	Roads and Maritime	Detailed design Pre-construction
Affected residents	SE4	Roads and Maritime will: <ul style="list-style-type: none"> Continue ongoing timely communication with affected residents on project timing and acquisition processes Deal in an efficient and empathetic manner with residents who seek acquisition on hardship grounds Provide compensation in accordance with the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> and Roads and Maritime policies. 	Roads and Maritime	Detailed design Pre-construction Construction
Local amenity – vegetation	SE5	Roads and Maritime and the construction contractor will minimise impacts, where feasible and reasonable, on existing character trees, including figs and jacarandas. Visual impacts and mitigation measures are outlined in Section 8.8 of the EIS.	Roads and Maritime Construction contractor	Detailed design Construction
Community engagement	SE6	Roads and Maritime will prepare and implement a community consultation strategy to fully inform the community of works during the construction process. The Strategy will be implemented by the construction contractor. A draft of this strategy is presented in Appendix C of the EIS. The mitigation measures below will be incorporated into the strategy.	Roads and Maritime Construction contractor	Pre-construction Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Social infrastructure – Grafton TAFE Campus and Gummyaney Aboriginal pre-school	SE7	Roads and Maritime and the construction contractor will continue to liaise with Grafton TAFE Campus and the Gummyaney Aboriginal pre-school to minimise impacts on access and operations.	Roads and Maritime Construction contractor	Pre-construction Construction
Social infrastructure – Clarence River Sailing Club and other Clarence River event organisers	SE8	Roads and Maritime will consult with Clarence River Sailing Club and other Clarence River event organisers regarding the need to make alternative access arrangements during construction.	Roads and Maritime	Pre-construction Construction
Local amenity – residents and business	SE9	Roads and Maritime and the construction contractor will maintain ongoing and timely communication with nearby residents regarding construction work. This will include notice on timing and duration of activities and potential localised impacts. The community and business will be notified of any construction activities outside standard construction working hours. Management measures to reduce construction noise impacts would be required and would be implemented as identified in Section 8.4 of the EIS.	Roads and Maritime Construction contractor	Pre-construction Construction
Local business and tourism	SE10	Roads and Maritime and the construction contractor will maintain ongoing timely communication with affected businesses on project timing, changes to traffic conditions and access arrangements.	Roads and Maritime Construction contractor	Pre-construction Construction
Social infrastructure – general	SE11	The construction contractor will: <ul style="list-style-type: none"> • Maintain access to existing bridge pedestrian links • Maintain access for river users, including the Clarence River Sailing Club, and provide appropriate safety and maritime directional and safety signage on structures in the river • Maintain communications with police and emergency services in relation to changed access arrangements and traffic management plans. 	Construction contractor	Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Local business and tourism	SE12	The construction contractor will maintain access to affected businesses at South Grafton and Grafton and provide directional signage.	Construction contractor	Construction
Local amenity – construction traffic	SE13	Roads and Maritime will develop construction traffic management measures as part of the construction environmental management plan. The measures will detail access arrangements for residents close to the ancillary sites and construction work zones including residents along Greaves Street and Bridge Street. Mitigation measures are outlined in Section 8.1 of the EIS to enable acceptable traffic operations and level of service on the road network during construction.	Roads and Maritime	Construction
Social infrastructure – Clarence River Visitor Information Centre and other businesses	SE14	Roads and Maritime will maintain access to the Clarence River Visitor Information Centre and other businesses along Spring and Charles streets in South Grafton by providing directional signage in accordance with relevant Roads and Maritime and Government guidelines.	Roads and Maritime	Construction Operation
Visual amenity, built form and urban design				
Impacts in Grafton	V1	Detailed design will investigate opportunities to: <ul style="list-style-type: none"> • Refine car parking arrangements on the southern side of Pound Street • Adjust the kerbline along Pound Street between Clarence Street and Villiers Street. This would enable extra tree planting on both sides of the street and the removal of proposed parallel parking on the southern side. This would improve the visual and pedestrian amenity, reduce the scale of the street and reduce the encroachment of works in TAFE land • Reduce the batter steepness around the water detention basin to avoid the need for fencing • Reduce the construction boundary to reduce impacts on Pound Street and Greaves Street • Refine the drainage detention basin design in Grafton to minimise its visual impact • <i>Incorporate Crime Prevention Through Environmental Design principles into the project where required.</i> 	Roads and Maritime	Detailed design

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Proposed bridge	V2	<p>During detailed design, the pier designs will be developed to further reinforce the complementary relationship between the proposed bridge piers and the piers on the existing bridge. In particular, the option of tapering the piers at their long elevation will be considered.</p> <p>In addition, opportunities will be considered to further streamline the appearance of the bridge, including:</p> <ul style="list-style-type: none"> Aligning the edges of the piers with the outside faces of the girders Investigating monolithic construction as an alternative to the current pier design Ensure the proposed bridge soffit appears as a series of continuous curves with a segmented appearance to be avoided <i>Incorporate Crime Prevention Through Environmental Design principles into the project where required.</i> 	Roads and Maritime	Detailed design
Impacts in South Grafton	V3	<p>Detailed design will consider:</p> <ul style="list-style-type: none"> Flattening the fill embankments to the bridge approach road to better integrate it with the surrounding flat rural landscape Opportunities to enhance the location's role as the southern arrival point to South Grafton and Grafton Incorporating safe and efficient bicycle access on the Iolanthe Street / Pacific Highway / Through Street roundabout and the Gwydir Highway / Pacific Highway roundabout to allow a connection to the regional Coastline Cycleway route on the Pacific Highway <i>Incorporate Crime Prevention Through Environmental Design principles into the project where required.</i> 	Roads and Maritime	Detailed design

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Flood mitigation impacts	V4	<p>Consideration should be given to undertaking an arborist assessment to inform the design development and optimum levee alignment.</p> <p>Where the levee has existing structures (eg a building) a specific levee raising design will be required. Where feasible and reasonable, the design will:</p> <ul style="list-style-type: none"> • Investigate opportunities to avoid changes to the existing structure (eg minor realignment of the levee crest) • Keep changes to the existing structure to a minimum • Identify a construction method that will keep the structure operational while construction work is being carried out (subject to safety considerations). <p>Roads and Maritime will consult with the infrastructure owners during detailed design.</p> <p>For heritage listed items, the design will seek to avoid or minimise the need to modify the structure and investigate non-intrusive options to achieve the required levee level. Levee raising materials and finishes will be sympathetic to minimise impact on the significance of the heritage item.</p>	Roads and Maritime	Detailed design
Construction impacts	V5	<p>Detailed design and documentation drawings will define the extent of all construction activity, including temporary work, to protect the area during construction.</p> <p>Construction facilities will be contained within the construction work zone and occupy the minimum area practicable for the intended use.</p> <p>Suitable barriers will be erected to screen views from nearby areas.</p> <p>Work sites will be returned to at least their pre-construction state once work is complete, or progressively reinstated throughout the construction process, where possible.</p> <p>Pollution and dust emissions will be minimised and monitored throughout the construction period (refer to Section 8.12).</p> <p>Footpaths affected by construction activities will be diverted or re-routed.</p> <p>Trees to be retained within construction facilities areas will be identified, protected and maintained.</p> <p>Temporary lighting will be screened or diverted to reduce unnecessary light spill.</p> <p>Material used for temporary land reclamation will be removed once construction is complete.</p>	Construction contractor	Pre-construction Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Biodiversity				
Impact on hollow-bearing trees and foraging resources	B1	<p>Disturbance and clearing of native vegetation will be minimised, particularly avoiding and minimising vegetation removal wherever possible through the detailed design process. Detailed design will investigate opportunities to retain the two hollow bearing and five habitat trees identified within the project area.</p> <p>A revegetation management sub-plan will be developed as part of the flora and fauna management plan to revegetate with species suitable for the creation of hollows and foraging resources. Strategies to compensate for the loss of hollow bearing/habitat trees will focus on revegetation and rehabilitation activities along riparian and adjoining areas.</p>	Roads and Maritime	Detailed design
Revegetation management and landscaping	B2	<p>As part of the flora and fauna management plan, a revegetation management sub-plan will be developed to provide specific details for the re-establishment of native vegetation on areas disturbed by the project construction.</p> <p>This plan will be developed in accordance with <i>Roads and Maritime Biodiversity Guidelines</i> (RTA, 2011) and the design principles identified in <i>Appendix L, Technical Paper: Flora and Fauna Assessment</i> of the EIS. It will also include details for the regeneration and rehabilitation of areas with a focus on riparian areas within the project area with reference to Guide 3, Guide 6 and Guide 10 of the <i>Roads and Maritime Biodiversity Guidelines</i>.</p> <p>The plan will include objectives to incorporate local native species across all revegetation and landscaping efforts along the Clarence River and in the adjoining project area. This will include species consistent with freshwater wetlands on coastal floodplain and sub-tropical coastal floodplain forest threatened ecological communities species composition, which could potentially provide foraging resources and roosting to threatened fauna species, and increase corridors and connectivity throughout the landscape. <i>This plan will be developed in consultation with OEH.</i></p>	Roads and Maritime	Detailed design
Protection of fish habitat	B3	<p>During detailed design, the project design team will comply with the <i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (DPI, 2013) in relation to requirements for maintaining fish passage via the design and construction of instream structures.</p>	Roads and Maritime	Detailed design

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Flora and fauna management	B4	<p>A flora and fauna management plan (FFMP) will be prepared as part of the construction environmental management plan before construction in accordance with <i>Biodiversity Guidelines – Protecting and Managing Biodiversity on RTA Projects</i> (Roads and Maritime, 2011).</p> <p>The FFMP will detail how impacts on biodiversity will be minimised and managed during construction and operation and will incorporate specific management measures identified in the EIS.</p> <p>Measures outlined in this table will be addressed within the flora and fauna management plan, including timeframes for implementation and monitoring to be developed post-EIS and project approval.</p>	Construction contractor Roads and Maritime	Pre-construction
Vegetation clearing	B5	<p>To minimise the impacts of vegetation clearing and habitat loss the following specific measures will be implemented:</p> <ul style="list-style-type: none"> • Clearing of vegetation will be carried out in accordance with <i>Guide 1 Pre-clearing Process of Biodiversity Guidelines</i> (RTA, 2011). These guidelines cover the felling of both non-habitat and habitat trees and the rescue and relocation of fauna • The pre-clearing process will be consistent with <i>Guide 2 Exclusion zones of Biodiversity Guidelines</i> (RTA, 2011) and include: pre-clearing surveys by an experienced/qualified ecologist and mapping and delineating the boundaries of threatened flora and/or fauna species, threatened ecological communities and/or suitable habitat (hollow bearing/habitat trees) • Pre-clearance surveys to include surveys for Hairy-joint Grass during flowering period (between summer and autumn) within final impact areas • Pre-clearing surveys to be carried out for the Three-toed Snake-tooth Skink, in suitable areas, not yet surveyed (ancillary sites, especially in North Grafton where houses are to be demolished) before demolition and construction works during late spring and early summer in accordance with the relevant guidelines (DSEWPaC,2011; DEC, 2004 and TSSC, 2008) • Construction traffic will be restricted to defined access tracks and construction works zone areas • The location of exclusion zones will be identified, with temporary fencing or flagging tape to indicate the limits of clearing (in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011)) • All relevant staff will be inducted and informed of the limits of vegetation clearing and the areas of vegetation to be retained. 	Construction contractor	Pre-construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Weed management	B6	<ul style="list-style-type: none"> Weeds will be controlled in accordance with RTA (2011a) – <i>Biodiversity Guidelines Guide 6: Weed Management</i> Declared noxious weeds will be managed in accordance with the requirements of the Noxious Weeds Act 1993 Weed infested topsoil will be appropriately stockpiled with sediment fencing and as soon as practical, disposed of or treated appropriately to limit potential impacts on nearby areas of native vegetation. 	Construction contractor	Pre-construction
Pests and pathogens	B7	<p>The FFMP will outline a strategy for the implementation of site hygiene protocols and management measures according to <i>Biodiversity Guide 7 – Pathogen Management from Roads and Maritime (2011)</i> to reduce the risk of localised or regional introduction of Myrtle Rust, <i>Phytophthora cinnamomi</i> and the amphibian chytrid fungus as a result of the project.</p> <p>Measures for preventing the introduction and/or spread of disease causing agents such as bacteria and fungi will be implemented, as detailed in RTA (2011a) – <i>Biodiversity Guidelines Guide 7: Pathogen management</i>.</p>	Construction contractor	Pre-construction
Impact on fauna	B8	<p>Where practical, vegetation removal (especially of the two hollow-bearing and five habitat trees identified) will occur outside the main fauna breeding season (August to February) to avoid potential breeding disturbance to fauna, particularly avifauna (birds and bats).</p> <p>Pruning or lopping tree limbs will be conducted in preference to tree removal wherever possible.</p> <p>An appropriate tree removal procedure will be adopted. It will require the presence of a qualified ecologist or wildlife expert experienced in the rescue of fauna as detailed in <i>RMS Biodiversity Guidelines - Guide 4: Clearing of vegetation and removal of bush rock including the staged removal process (2011)</i>.</p> <p>Woody debris and habitat trees removed for the project will be managed in accordance with <i>RMS Biodiversity Guidelines - Guide 5: Re-use of woody debris and bush rock (2011)</i>.</p> <p>Fauna handling during vegetation removal will be carried out by a licensed fauna ecologist or wildlife carer, as detailed in <i>RMS Biodiversity Guidelines Guide 9: Fauna handling (2011)</i>.</p>	Construction contractor	Pre-construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Threatened flora and fauna	B9	<p>Threatened species guidelines will be developed for threatened flora and fauna likely to occur directly within the project area and which may be impacted during construction, in order to show and educate construction workers of its appearance and outline what should be done if the species is found during construction. Relevant species will include:</p> <ul style="list-style-type: none"> • Hairy-joint grass • Three-toed Snake-tooth Skink • Grey-headed Flying-fox • Microbats. 	Construction contractor	Pre-construction
Unexpected finds	B10	<p>If unexpected threatened fauna or flora species are discovered, works will stop immediately and the <i>Unexpected Threatened Species Find Procedure</i> RTA (2011a) as well as the <i>Biodiversity Guidelines Guide 1: Pre-clearing process</i> (Roads and Maritime, 2011) will be followed. This procedure will be included in the FFMP developed for the project.</p>	Construction contractor	Pre-construction
Nest box and microbat management	B11	<p>Nest boxes and bat roost structures will be installed in accordance with the principles outlined in the <i>Roads and Maritime Guide 8 Nest Boxes</i> (2011). Details of the number and type of nest boxes will be included in the FFMP prepared for the project, and will include the following details:</p> <ul style="list-style-type: none"> • The number and type of nest boxes required based on the number, quality and size of the hollows that will be removed • Specifications for nest box dimensions, installation requirements, locations of nest boxes and ongoing monitoring and maintenance • Installation timeframes, including the installation of 70% of nest boxes before the removal of any vegetation • Staged habitat removal, including removal of secondary or less preferential roosting habitat before removal of primary habitat, such as hollow-bearing trees and houses. • Pre-demolition inspection and exclusion measures to prevent continued use of roosts. These will be prepared to address the subject species, specific habitat, roosting habits at each location, and capture and handling procedures (if required). 	Construction contractor	Pre-construction
Impact on aquatic fauna	B12	<p>Direct disturbance of aquatic fauna and riparian zones will be minimised in accordance with <i>Roads and Maritime Biodiversity Guidelines – Guide 10 Aquatic habitat and riparian zones</i> (2011).</p>	Construction contractor	Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Bank stability, sedimentation and erosion	B13	<p>Erosion and sediment control measures will be implemented and maintained to:</p> <ul style="list-style-type: none"> Prevent sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets Reduce water velocity and capture sediment on-site Minimise the amount of material transported from site to surrounding road surfaces Divert clean water around the site in accordance with <i>Managing Urban Stormwater: Soils and Construction Guidelines</i> (Landcom, 2004). <p>Erosion and sedimentation controls will be checked and maintained on a regular basis (including clearing of sediment from behind barriers) and records kept and provided on request.</p> <p>Erosion and sediment control measures will not be removed until the works are complete and areas are stabilised.</p> <p>Work areas will be stabilised progressively during the works.</p> <p>A progressive erosion and sediment control plan is to be prepared for the works.</p> <p>The <i>Guidelines for in stream works on waterfront land</i> (NSW DPI 2012) will be implemented when constructing and installing piers, bridge footings and undertaking river front landscape works.</p>	Construction contractor	Construction
Impact on aquatic habitat	B14	Where feasible and reasonable any large woody debris that may be encountered during construction will be relocated.	Construction contractor	Construction
Soils, sediments, water and contaminated land				
Acid sulfate soils disturbance	SW1	Acid-resistant construction materials will be used where possible in areas known to contain acid sulfate soils.	Roads and Maritime	Detailed design
Protection of water quality during operation	SW2	Operational water quality management and protection measures, such as swales, to protect nearby waterways from pollutants from the bridge and approaches will be further refined and investigated in consultation with Clarence Valley Council.	Roads and Maritime	Detailed design

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Construction soils and water management plan	SW3	<p>As part of the construction environmental management plan, a soil and water management plan will be prepared in line with current Roads and Maritime specifications. The plan will include (but not limited to):</p> <ul style="list-style-type: none"> • <i>A risk assessment of the potential impacts on water quality and hydrological processes</i> • Details of erosion and sediment controls to be implemented, including erosion and sediment control plans developed for the project • Details of inspection frequency for control measures • Monitoring and maintenance of environmental control measures • Environmental work method statements for high risk activities such as dewatering and works within waterways • Procedures to manage stockpiles generated during construction • Tannin leachate management measures • Acid sulfate management measures • Detailed consideration of measures to prevent (where possible) or minimise any water quality impacts • Measures to manage known and unexpected contamination during the construction stage • Consideration of water dissipation due to wick drains. 	Construction contractor	Pre-construction
Soil erosion and sediment control	SW4	<p>Erosion and sediment control measures will be implemented in accordance with the Landcom/Department of Housing <i>Managing Urban Stormwater, Soils and Construction Guidelines</i> (the Blue Book) and maintained to:</p> <ul style="list-style-type: none"> • Prevent sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets • Reduce water velocity and capture sediment on-site • Minimise the amount of material transported from site to surrounding pavement surfaces • Divert clean water around the site. 	Construction contractor	Construction
	SW5	<p>Erosion and sedimentation controls will be checked and maintained on a regular basis (including clearing of sediment from behind barriers) and records kept and provided on request.</p>	Construction contractor	Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Soil erosion and sediment control	SW6	Erosion and sediment control measures will not be removed until the works are complete and areas are stabilised.	Construction contractor	Construction
	SW7	Work areas will be stabilised progressively during the works.	Construction contractor	Construction
	SW8	Water from site will be used for construction purposes, such as dust suppression, where feasible and reasonable.	Construction contractor	Construction
Acid sulfate soils disturbance	SW9	Where excavation is to be carried out in areas anticipated to contain acid sulfate soils, work will proceed according to the soils and water management plan (acid sulfate soils section). Specific controls to be implemented will include: <ul style="list-style-type: none"> • Capping exposed surfaces with clean fill to prevent oxidation • Placing excavated acid sulfate soils separately in a lined, bunded and covered area • Neutralising acid sulfate soils for reuse (where appropriate) by using additives such as lime • Disposing of acid sulfate soils where necessary in accordance with the relevant guidelines set out in the <i>Acid Sulfate Soils Assessment Guidelines</i> (Ahern et al, 1998). 	Construction contractor	Construction
	SW10	If acid sulfate soils are disturbed, any acid produced will be neutralised and acid waste prevented from leaving the site in accordance with the applicable guidelines.	Construction contractor	Construction
Protection of water quality during construction	SW11	<i>Construction work in proximity to waterways will be undertaken in accordance with best practice and the NSW Office of Water guidelines for controlled activities where feasible and reasonable.</i> Construction water quality management measures to protect nearby waterways from construction activities will be included in the soil and water management plan developed for the project. This plan will include (but not limited to) the following measures: <ul style="list-style-type: none"> • Appropriate controls to minimise risk of release of dirty water into drainage lines and/or waterways • Visual monitoring of local water quality (ie turbidity, hydrocarbon spills/slicks) is to be carried out on a regular basis to identify any potential spills or deficient erosion and sediment controls • Water quality control measures to prevent any materials (eg concrete, grout, sediment etc) entering waterways. 	Construction contractor	Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Temporary working platforms	SW12	Before commencement of works within the river, a workshop will be held with relevant government agencies including representatives from EPA, NSW Office of Water, Department of Primary Industries Fisheries, Roads and Maritime and the construction contractor to discuss potential options for temporary working platforms. Any temporary working platforms will be managed in accordance with the principals detailed in Section 6.6.1 of the EIS.	Construction contractor	Construction
Exposed areas	SW13	Exposed areas will be progressively rehabilitated. Methods will include permanent revegetation, or temporary protection with spray mulching or cover crops.	Construction contractor	Construction
Stockpile site management	SW14	Topsoil, earthworks and other excess spoil material will be stockpiled in accordance with the principles outlined in <i>Stockpile Management Guidelines</i> (Roads and Maritime, 2011).	Construction contractor	Construction
	SW15	Stockpiles will be placed within a designated ancillary site or stockpile area in accordance with the following principles: <ul style="list-style-type: none"> • Not require removal of areas of native vegetation (where feasible and reasonable) • Not be located under the 'dripline' of trees • Be located outside known areas of weed infestation • Be located such that waterways and drainage lines are not directly impacted. 	Construction contractor	Construction
	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.	Construction contractor	Construction
	SW17	All construction stockpiles will comply with the requirements of the <i>Protection of the Environment Operations Act 1997</i> and <i>Waste Avoidance and Resource Recovery Strategy 2007</i> for any waste activities that involve the generation, storage and/or disposal of waste. The NSW Resource Recovery Exemptions will also be applied to the storage and management of stockpiled material.	Construction contractor	Construction
	SW18	Stockpiles containing potential acid sulfate soils will be managed in accordance with the <i>Acid Sulfate Soils Manual</i> (Acid Sulfate Soils Management Advisory Committee, 1998).	Construction contractor	Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Emergency spill response during construction	SW19	Emergency spill response measures will be developed and incorporated into the soils and water management plan as part of the construction environmental management plan. This plan will detail measures for the prevention, containment and clean-up of accidental spills of fuels and chemicals.	Construction contractor	Construction
Chemical use and storage	SW20	The storage, handling and use of the chemicals and fuels will be in accordance with the <i>Work Health and Safety Act 2000</i> and <i>Workcover's Storage and Handling of Dangerous Goods Code of Practice</i> (WorkCover, 2005).	Construction contractor	Construction
Chemical use and storage	SW21	Physical controls to address the potential risks associated with the use and storage of chemicals on-site will include: <ul style="list-style-type: none"> • Bunded storage facilities for chemicals and fuels • Bunded areas for refuelling and washdown • Effective spill kits at all construction sites. 	Construction contractor	Construction
Disturbance of contaminated soils				
Detailed site investigation	CS1	A detailed site investigation will be prepared for the areas of potential contamination identified in the EIS in accordance with <i>Guidelines for Consultants Reporting on Contaminated Sites</i> (OEH, 2011). The site investigation will provide detailed information on the type, extent and level of contamination and assess: <ul style="list-style-type: none"> • Contaminant dispersal in air, surface water, groundwater, soil and dust • The potential effects of contaminants on public health, the environment and the project structures • Off-site impacts on soil, sediment and biota (where applicable) • The adequacy and completeness of all information available to be used in making decisions on remediation. 	Roads and Maritime	Detailed design
Site remedial action plan	CS2	If the results of the detailed site investigation indicate a remedial action plan needs to be prepared and implemented, this plan will be prepared in consultation with Department of Planning and Environment and Office of Environment and Heritage. The plan will be prepared in accordance with <i>Guidelines for Consultants Reporting on Contaminated Sites</i> (OEH, 2011).	Construction contractor	Pre-construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Asbestos on demolished structures	CS3	An asbestos survey will be conducted for structures to be demolished as part of the project. An asbestos certified disposal service will be engaged for properties identified as having asbestos materials.	Construction contractor	Construction
Air quality				
Dust generation during construction	AQ1	<p>An air quality management plan will be developed as part of the construction environmental management plan to manage any increased dust impacts from construction activities. The plan will consider and describe construction activity processes such as: handling of spoil, management of stockpiles, operation of machinery, and traffic management.</p> <p>The plan will have regard to the measures outlined in the <i>Local Government Air Quality Toolkit, Module 3: Guidance note – Construction sites</i> (NSW EPA 2007) and include the following:</p> <ul style="list-style-type: none"> • A plan showing the locations of all potentially affected properties and residences on a map • Details of potential sources and impacts of dust • Air and dust management objectives consistent with EPA guidelines • Details of air quality control measures to be implemented during construction • A monitoring program to assess compliance with the identified objectives • Details of mitigation measures to be implemented during weather conditions where high dust episodes are likely (such as strong winds in dry weather) • A progressive stabilisation/rehabilitation strategy for disturbed surfaces with the aim of minimising exposed surfaces • Contingency plans to be implemented in the event of non-compliances and/or complaints about dust • Procedures for regularly reviewing the effectiveness of the air quality/dust management plan. 	Construction contractor	Pre-construction / construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Concrete batching plant	AQ2	<p>If a concrete batching plant is required, dust control measures would be incorporated into the design of the concrete batching plant. These could include the following:</p> <ul style="list-style-type: none"> • A partially enclosed load hopper (on three sides) when truck loading/delivery is in progress • Continual wetting operations to reduce emissions during all materials handling • Bulk cement would be stored in silos with filter components on the vents • A dry batch dust collector to extract dust during the transfer of the concrete product to the trucks and any emissions from the loading of the weigh hoppers (this system has a dust extraction efficiency of 99.9% for all particulates greater than 5 microns) • A fully enclosed conveyor • Surface wetting along all exposed surfaces and stockpiles during unfavourable meteorological conditions (i.e. windy and dry conditions) • Use of water carts along haul roads and access points as required to minimise generation of dust. 	Construction contractor	Construction
Greenhouse gases				
Lighting	GG1	Roads and Maritime will investigate the use of LED lighting in place of incandescent lamps as part of the project's detailed design, and use them where practicable to reduce electrical energy consumption. Any energy-efficient alternatives will have to meet lighting and safety standards for major roads.	Roads and Maritime	Detailed design
Embodied emissions	GG2	Fly-ash content within concrete will be utilised where feasible. Construction contractors will be required to propose recycled content construction materials where they are cost, quality and performance competitive.	Construction contractor	Pre-construction Construction
	GG3	Reuse of excavated road materials will be maximised as far as possible where they are cost, quality and performance competitive to reduce use of materials (with embedded energy).	Construction contractor	Pre-construction Construction
	GG4	Steel with high recycled content will be utilised where feasible, for example where it is cost, quality and performance competitive. Contractors will be required to propose recycled content construction materials where they are cost, quality and performance competitive.	Construction contractor	Pre-construction Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Vehicle emissions	GG5	The feasibility of using biofuels (biodiesel, ethanol, or blends such as E10 or B80) will be investigated by the construction contractor, taking into consideration the capacity of plant and equipment to use these fuels, ongoing maintenance issues and local sources. Works will be planned to minimise fuel use.	Construction contractor	Pre-construction Construction
Construction energy management plan	GG6	A construction energy management plan will be developed as part of the project's construction environmental management plan. The plan will include a commitment to monitor on-site energy consumption and identify and address on-site energy waste.	Construction contractor	Pre-construction Construction
Vegetation clearance	GG7	Vegetation clearance will be minimised, where feasible, in accordance with the approved project. Areas to be revegetated will be revegetated in accordance with the project landscape plan.	Construction contractor	Construction
Sustainability education	GG8	The environmental induction developed for the project will include measures to promote energy-efficient work practices by construction personnel.	Construction contractor	Construction
Utilities and services infrastructure				
Coordination for future utility infrastructure developments	UI1	The National Broadband Network Co will be consulted during detailed design about the location, timing and cost of a potential conduit attached to the new Grafton Bridge.	Roads and Maritime	Detailed design
	UI2	Essential Energy will be consulted during detailed design about the location and timing of a potential easement across the Clarence River.	Roads and Maritime	Detailed design
Protection or relocation of utility services	UI3	Relevant service utility providers or owners will be consulted to verify locations, impacts and any protection, relocation or decommissioning work required.	Roads and Maritime	Detailed design
	UI4	A Dial Before You Dig search will be carried out to identify the location of utility services.	Construction contractor	Pre-construction
Protection or relocation of utility services	UI5	A services search within land not covered by the Dial Before You Dig search will be carried out to identify the location of utility services.	Construction contractor	Pre-construction
	UI6	Existing services to be potentially impacted by the project will be physically relocated.	Construction contractor	Pre-construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Decommissioning of utility services	UI7	Relevant service utility providers or owners will be consulted before the removal of any decommissioned utility services beneath acquired properties.	Construction contractor	Pre-construction
Waste minimisation and management				
General	WM1	Rubbish bins will be located at strategic locations.	Roads and Maritime	Detailed design
Demolition waste from heritage listed items	WM2	Roads and Maritime will investigate options for reusing or salvaging demolition waste from heritage items.	Roads and Maritime	Pre-construction
General	WM3	<p>A construction waste management plan will be prepared as part of the construction environmental management plan to identify measures for minimising and managing waste. The construction waste management plan will include:</p> <ul style="list-style-type: none"> • The type and volume of all materials to be utilised during the project construction • Destinations for each resource/waste type either for on-site reuse or recycling, off-site reuse or recycling, or disposal at a licensed waste facility • Quantity and classification of excavated material generated as a result of the project • Disposal strategies for each type of material • Details of how waste will be stored and treated on-site • Identification of all non-recyclable waste • Identification of strategies to 'avoid', 'reduce', 'reuse', and 'recycle' • Management of surplus material as documented in Section 9.3.2 of the EIS • Identification of available recycling facilities on and off-site • Identification of suitable methods and routes to transport waste • Procedures and disposal arrangements for unsuitable excavated material or contaminated material • Site clean-up for each stage. 	Construction contractor	Pre-construction Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
General	WM4	<p>A resource use management strategy will be prepared as part of the construction waste management plan to identify the hierarchy for sourcing and use of resources. The strategy will include:</p> <ul style="list-style-type: none"> • Project areas with a deficit in material will import surplus material from other project sections in preference to external sources • Where possible, the distances that earthworks materials are moved across the project as a whole will be minimised • Any unsuitable material will be used for landscaping or disposed of within each project section, either for batter flattening or noise mounds or placed in stockpile • Construction contractors will reduce the amount of unsuitable waste generated during excavations, where feasible (eg treatment at source) • Other locations of disposal of unsuitable material will be considered including borrow source areas created as part of the project • The generation and management of unsuitable material during project earthworks will be monitored to ensure appropriate management of the issue • Details on materials that will be sourced from the project (including location and type) • Proposed sustainable material sourcing (such as recycled materials or use of waste water) • Materials that could be recycled and re-used on-site or transferred to other project sections. 	Construction contractor	Pre-construction Construction
Spills and accidents	WM5	A risk assessment will be carried out to determine the need, location and size, of spill containment mechanisms.	Roads and Maritime Construction contractor	Pre-construction Construction
Asbestos on demolished structures	WM6	Asbestos surveys will be conducted for structures to be demolished as part of the project. An asbestos certified disposal service will be engaged for properties identified as having asbestos materials.	Construction contractor	Before demolition
General	WM7	The handling, storage and transport of hazardous materials and waste will be in accordance with the <i>National Code of Practice Storage and handling of dangerous goods</i> (Workcover, 2001) and the relevant material safety data sheet for the product.	Construction contractor	Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
General	WM8	Regular visual inspections will be conducted to ensure that work sites are kept tidy and to identify opportunities for reuse and recycling.	Construction contractor	Construction
	WM9	Requirements for waste management will form part of site training and induction processes.	Construction contractor	Construction
	WM10	All generated waste will be managed and disposed of in accordance with relevant State legislation and government policies including the <i>Waste Avoidance and Resource Recovery Act 2001</i> , the <i>Waste Avoidance and Resource Recovery Strategy 2007</i> and the <i>Waste Reduction and Purchasing Policy</i> . The <i>Waste Classification Guidelines</i> (DECCW, 2008) will also be used to classify the different types of waste.	Construction contractor	Construction
Beneficial reuse	WM11	The project will aim for the following: <ul style="list-style-type: none"> • 100% beneficial reuse of usable spoil, recognising that there is likely to be a significant volume of excavated material that is potentially contaminated or otherwise unsuitable for reuse. Sampling and testing will confirm which excavated material is suitable for reuse • 95% beneficial reuse of construction and demolition waste • Minimising the need for extracting new material by reusing material from other nearby projects (eg the Woolgoolga to Ballina Pacific Highway upgrade) where feasible and reasonable. 	Construction contractor	Construction
	WM12	For any surplus material the following beneficial re-use options will be considered : <ul style="list-style-type: none"> • Construction of acoustic and visual mounds where there is a benefit to residents and other sensitive receivers • Flattening of road batters • Rehabilitation of borrow pits • Engineered fill • Improvements to flood prone land. 	Construction contractor	Construction
Liquid wastes	WM13	Liquid waste, including waste oil, will be collected and stored in appropriately bunded areas.	Construction contractor	Construction
Records	WM14	A waste register will be maintained for the construction site. It will detail the types of waste collected, amounts, date and time, and details of disposal.	Construction contractor	Construction

Environmental issue	ID	Environmental management measures	Responsibility	Timing
Materials and packaging	WM15	Where feasible and reasonable, materials will be bought in bulk to minimise the amount of packaging required.	Construction contractor	Construction
Materials and packaging	WM16	Sources of material that have sustainable packaging design, such as recycled and recyclable packaging, will be favoured over other material sources where cost effective.	Construction contractor	Construction
	WM17	The use of recycled products in construction work will be investigated.	Construction contractor	Construction
Demolition waste	WM18	Where practicable, houses, redundant services and other structures will be deconstructed rather than demolished to allow as much material as possible to be re-used or recycled off-site.	Construction contractor	Construction
Green waste	WM19	Logs and green waste will be mulched (where not contaminated by weeds) and beneficially reused onsite for rehabilitation and landscaping as a first preference, or offsite in the local area.	Construction contractor	Construction
Cumulative impacts				
Potential cumulative impacts during construction	C11	Construction contractor will identify all other developments and projects occurring in the vicinity of the project and identify environmental impacts to be monitored during construction which have the potential for cumulative effects to occur.	Construction contractor	Pre-construction
	C12	Construction contractor will review environmental impacts every six months during construction. Any new impacts identified during construction will be addressed appropriately to reduce cumulative effects and reported as part of the construction environmental management plan.	Construction contractor	Construction

5 References

Roads and Maritime (2014) *Additional Crossing of the Clarence River at Grafton Environmental Impact Statement*. August 2014.

Roads and Maritime Services (2012). *Additional Crossing of the Clarence River at Grafton Route Options Development Report*. September 2012.

Roads and Maritime Services (2012). *Additional Crossing of the Clarence River at Grafton. Recommended Preferred Option Report*. December 2012.

Appendix A – EIS flooding and hydrology
technical paper peer review

APPENDIX A: EIS Flooding and Hydrology Paper Peer Review – Comments and Responses

1. Purpose:

WMAwater were engaged by Roads and Maritime Services (Roads and Maritime) to conduct an independent review of the Clarence River flood modelling undertaken by BMT WBM that represents existing and proposed additional crossing of the Clarence river floodplain conditions. The model was used to assess flood impacts associated with the proposed additional crossing of the Clarence River at Grafton.

The objective of this review is to ascertain whether the flood model is fit for future assessment of flood impacts of the proposed additional crossing of the Clarence River at Grafton with regard to the criteria established by the Director Generals requirements.

2. Scope of Review

The scope of the peer review covered hydraulic modelling undertaken by BMT WBM focusing primarily on the appropriateness of the model for use in assessing the flood impacts of the additional Clarence River crossing at Grafton. The following peer review comments therefore focus on what is required to make the model suitable for flood assessments required as part of the project. Responses are provided after each peer review comment, which have been developed in discussions with both BMT WBM and WMAwater.

The model setup was examined in terms of general model structure, model schematisation, boundary conditions, roughness, hydraulic structures and model run parameters. Attention was also given to the implementation and modelling of the waterway crossing which has significant influence on the associated flood impacts from the proposed works.

3. Limitations

In undertaking the peer review, WMAwater relied upon, and presumed accurate, information (or absence thereof) provided by Roads and Maritime, Arup, BMT WBM and other sources. Except as otherwise stated in the report, WMAwater did not attempt to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete, then it is possible that WMAwater observations and conclusions as contained in this Appendix may change. Furthermore, WMAwater did not re-run the Clarence River flood model, and it is assumed that the results provided by BMT WBM correspond to the definitions in the control files provided for the model runs.

4. Comments

Comments provided by WMAwater for the peer review focus on the issues which should be addressed before the model is used for assessing the additional crossing of the Clarence River at Grafton. Model issues identified by WMAwater were classified as either requiring attention before the model was used for the additional crossing flood impact assessments or minor issues which can be addressed later. Recommendations are also made for future models of the Clarence River.

Eddy Viscosity - Comment

The Clarence model uses the 2012 version of TUFLOW. The Clarence River model uses default parameters in the 2012 version of TUFLOW other than those manually overwritten.

Eddy viscosity terms are used in two-dimensional depth averaged numerical modelling in order to characterise energy losses caused by turbulence effects at a

sub-grid scale. A constant eddy viscosity term is applied to all model domains. The use of a fixed eddy viscosity term is acceptable but not the preferred option recommended by the TUFLOW Manual (Reference 1). It should be noted that Reference 1 recommends the constant eddy viscosity method is “generally satisfactory when the cell size is much greater than the depth”. In some locations in the model the depth would be approximately double the cell width and therefore a Smagorinsky formulation would typically be recommended.

The model is extremely sensitivity to changes in this parameter. Changing to the Smagorinsky formulation resulted in greater than 0.5m increase in flood levels in south Grafton and a 0.2-0.3m increase in flood levels in Grafton due to a change in the volume of water overtopping the levees. According to WBM the constant eddy viscosity needs to be maintained for the flows at Grafton to match the flood frequency analysis. Models are typically more sensitive to changes in Manning’s roughness than Eddy viscosity.

It is recommended that the model be refined to be less sensitive to changes in the eddy viscosity during detailed design. This would require a minor recalibration of the model.

Eddy Viscosity - Response

The flood model was established in an older version of TUFLOW in which the adopted eddy viscosity approach (a fixed viscosity term) was the default approach and was successfully calibrated to the results of a flood frequency analysis using this approach.

If a different eddy viscosity approach was applied, the model could no longer be considered calibrated and re-calibration of the model and its boundary conditions would be required. BMT WBM agrees that the Clarence River flood model would benefit from refinement (including update of eddy viscosity approach, revised flood frequency analysis, revised design event techniques etc) but this is beyond the remit of this current study and is unlikely to have any material effect on the overall outcomes of the study. As such, the adopted model is considered appropriate for its intended purposes.

Hydrosurvey - Comment

The current Clarence River hydraulic model contains in-bank bathymetry based on hydrosurvey of the river bed undertaken in 1963, 1978 and 1979. The river particularly in the vicinity of the existing and proposed crossing is likely to have changed in the last 30 years. It is recommended that hydrosurvey be collected and incorporated into the model as part of the detailed design. This will also allow for comparisons of any changes to the river bed and banks that occur as a result of construction.

Hydrosurvey - Response

A comparison was undertaken on limited bathymetric survey captured in 2009 with that in the model (see Figures 1 to 3 below). The 2009 data was not extensive enough to be used in the model but provided an opportunity to compare the datasets. Generally, there is good agreement between the 2009 survey and that used in the model.

River systems are generally in dynamic equilibrium with periods of sedimentation during more gentle flows and sediment entrainment and transport occurring (within the channel) during flood events. It is therefore expected that there would be some degree of change in bed elevations (both positive and negative) with time. If anything, we may be modelling a more conservative case by having slightly elevated bed levels from that surveyed in 2009. However it should also be remembered that the model uses a 30m grid cell size in the river and so there is a degree of averaging in the modelled elevations.

We emphasise that the flood model achieved good calibration to flood events in 2009 and 2013 and so the flood model with the bathymetry input used is considered to simulate the existing flood behaviour throughout the study area appropriately.

As part of the detailed design, further survey is likely to be undertaken to inform the bridge design. BMT WBM proposes to compare any additional survey to what is in the model and then assess the relative merits of updating the hydraulic model with the new data.



Figure 1 – Extent of 2009 survey and Cross Section comparison locations



Figure 2 – Comparison of Cross Section 'XS_1' (red 2009 survey; green modelled)



Figure 3 – Comparison of Cross Section 'XS_2' (red 2009 survey; green modelled)

Modelling of the Bridge - Comment

The new bridge is modelled in TUFLOW assuming different loss co-efficient to account for the head loss associated with the bridge deck and piers. It is noted that the application of blockage as well as form loss is contradictory to the latest advice from TUFLOW which suggests only a loss co-efficient is required. The locations of the existing and proposed bridges are so close together and on the bend in a river which results in complex flow interactions. It is recommended that bridge loss verification in HECRAS be undertaken to confirm the head loss in the 2D model. This is industry standard practice. Given the complexity of the bridge arrangement the head loss of the existing bridge should be confirmed separately to the modelling of both bridges. A possible approach would be to model the bridges assuming the river is straight which can be done by using the cross section at the bridge and projecting it upstream. This could be done in HECRAS and TUFLOW, with a comparison of the two simplified models undertaken. If the models gave similar results in this simplified case there would be more confidence in the modelling of the complex case.

Modelling of the Bridge - Response

The bridge modelling approach uses a form loss coefficient which has been estimated outside of the modelling software and is based on Hydraulics of Bridge Highways¹. The losses were reviewed and accepted by the study hydrology/hydraulic independent reviewer at the Concept Option Design stage of the study and so were retained for the EIS. BMT WBM recognises that there are multiple ways to model bridge structures with no firm guidance as to which approach should be used.

The adopted approach whereby the bridge is modelled by both assigning a form loss and constricting the flow width of the grid cells along the bridge crossing (to simulate the effect of the piers in the waterway) is considered a slightly precautionary approach of assessing the potential flood impacts of the proposed bridge in that it is unlikely to underestimate the afflux caused by the structure).

Preliminary testing has shown that representation of the proposed bridge by application of a form loss coefficient only (i.e. removal of the blockage factors) , as suggested by the independent reviewer, would result in a reduction of afflux of between 5mm and 10mm across the different events modelled (around a 10% reduction in each case). For the purposes of this assessment such a minor reduction would not change the overall findings of the study i.e. if predicted afflux for the 1% AEP design flood event would reduce from 100mm to 90mm this would not have a material impact on the proposed mitigation for the purposes of the EIS assessment.

We acknowledge that a verification of the assessed afflux using HEC-RAS would be worthwhile at the detailed design stage when the levee alignment and bridge designs are refined as any small changes which may result, and would not have affected the EIS conclusions, may assist with the design process.

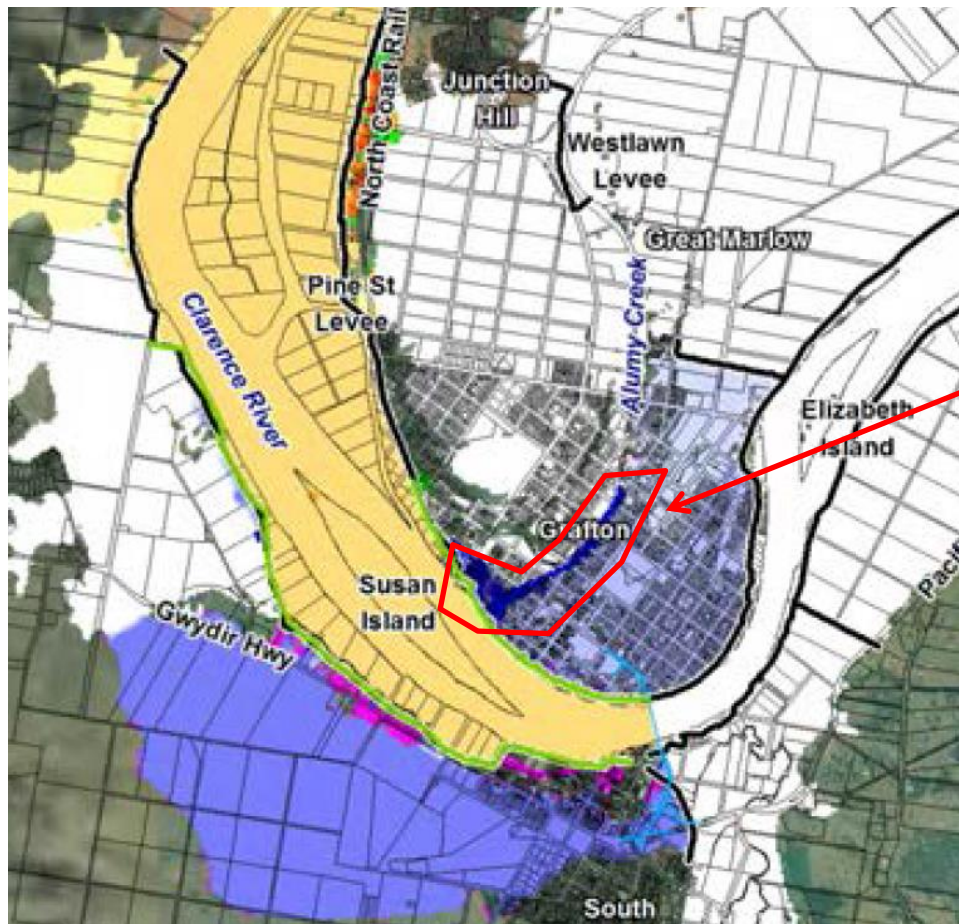
Assessment of Impacts - Comments

An assessment of the impacts of the additional crossing of the Clarence River at Grafton has been undertaken by WBM and is documented in Reference 2. An assessment has been made on the impacts of the crossing on flood levels, depths, velocities and hazard over a range of events. The impacts of the additional crossing are assessed by calculating the difference between the existing and design cases.

A comparison of existing and design case flood level grid files provided with the impact maps presented in the report resulted in some minor discrepancies. For example on Figure 5.1 (Reference 2) the area of <-0.5m impact was not present on the impact maps calculated by WMAwater. The discrepancy is likely caused by the interpolation in the gridding method used in MAPINFO used by WBM in the mapping.

¹ Bradley J N, 1978, 'Hydraulics of Bridge Waterways', Hydraulic Design Series No 1, US Federal Highway Administration, Washington DC.

If these interpolated grids were used in the damages assessment then they will influence the results.



Dark Blue area not Present in WMAwater calculation of impact maps based on results supplied.

No results of an assessment of the change in flood inundation or frequency of inundation are presented in the report although this appears to have been undertaken. Change in flood inundation is typically calculated as the difference in the length of time a location is inundated above ground level between the existing and design cases. This should be undertaken for the full length of the hydrograph. The change in frequency of inundation or overtopping of the levee could be presented graphically. The change in flow or volume overtopping should also be reported as a table or figure.

The large grid size in some areas means that the model will be limited in its ability to model small frequent events in these locations. Refined models may be required in some locations to model local drainage and confirm inundation times.

Assessment of Impacts - Response

The inconsistencies in mapping of impacts were noted during the review of the draft report and have been amended. The final version of the EIS flood report contained updated (amended) maps.

In relation to changes and frequency of inundation, events up to and including the 20 year ARI event do not overtop the main levee system in Grafton and South Grafton. The 20 year ARI event was therefore the smallest event considered in the assessment. Properties affected in smaller events will include those identified as being at residual risk during larger events as they are located outside of the mitigating influence of the proposed mitigation works. Smaller more frequent events will not require consideration due to the events not being sufficiently large enough to

overtop the urban levees. For the 50 and 100 year events, the levee system does overtop. We have updated the report as follows for the 50 and 100 year events:

- Volume of flow overtopping the Grafton and South Grafton levees presented graphically as time series plots;
- Total overtopping volumes presented in tabular form for Grafton and South Grafton²
- Time series plots of water levels allowing the comparison of the onset of flooding between baseline and developed cases for the following representative reporting locations within Grafton and South Grafton (two in each town):
 - Grafton: Alamy Creek near Fry Street and near Pound Street
 - South Grafton: Near Wharf Street and near Iolanthe Street.

Mitigation Measures - Comment

The report discusses a range of modification measures to reduce the impact caused by the additional crossing.

Reference 2 Section 5.2.2 discusses potential property modification measures as a mitigation measure. It is recommended that if houses are to be raised as part of the project that instead of raising them an amount equivalent to the impact, they be raised to the 100 year ARI flood level plus 0.5m freeboard to comply with current minimum floor levels. It should be noted that house raising can be costly when done at this scale and only viable for non slab on ground houses.

The report presents mitigation options which include the raising of the Grafton and South Grafton Levees by 0.2m. The levee raising options consider raising large sections of the levee which extend the area over which impacts occur compared to the unmitigated case while reducing the magnitude of the largest impacts. The location and length of levee raising could be optimised to only raise those areas which overtop first to reduce the volume of water overtopping to the same as the existing case. Levee raising creates winners and losers and therefore the length and height of the raising should be limited to the absolute minimum necessary undertaken unless part of an overall levee raising strategy.

Option 2 produces a velocity impact benefit in the vicinity of Alamy ck. This should be mentioned in the text of the report.

The report would benefit from consideration of impact on agricultural practices as a result of increased flood levels, changes to drainage times and velocity impacts and what could be done to mitigate these. In particular in the farmland protected by the south Grafton levee.

Mitigation measures - Response

Comments on levee raising by 0.2m are noted. Details of the levee raising will be refined during detailed design, with the focus on maintaining the existing flood regime.

The flood impact assessment carried out for the EIS indicates that there would be a small increase in the overtopping volume, during a 50-year flood event, towards the northern end of the South Grafton rural levee. This would occur along part of the existing levee that would not be raised as part of the project, and the additional water would be stored in the South Grafton common.

² Tables 5-3, 5-4, 5-6 and 5-7 of the flood report incorrectly label overtopping volumes as 'unmitigated'. This should read 'mitigated' in each case.

It should be noted that the design of the existing levee system was developed to allow flood water to overtop at this location and for that water to be stored in the South Grafton common. This area is already subject to flooding, as it forms part of the existing flood mitigation storage area for Council. The increased overtopping would result in a minor increase in flood depth of 0.05m and a negligible change in the period of inundation. It is expected that there would be no impacts on dwellings as a result of this small increase in overtopping volume.

Given the above, and the anticipated minor impacts to agricultural land in an area already subject to inundation, impacts on agricultural practices would be minor and further analysis of this would not be necessary to understand the overall project impacts.

Floor level survey - Comments

It is recommended that detailed survey of floor levels in areas impacted be undertaken as part of the detailed design. This will help with the determination of mitigation measures. It is also important to determine which houses were not flooded under existing conditions and are flood above floor level in the proposed bridge case.

Floor level survey - Response

A detailed floor level survey was not available for the assessment and the EIS makes recommendations that this is undertaken to establish the relative impact to each property remaining at 'residual' risk. It is anticipated this will happen as part of the detailed design stage.

Flood frequency analysis and design events - Comments

While the WBM 2004 study did use the new draft chapter of ARR on flood frequency analysis some advances have been made since the study was complete. The latest version of FLIKE includes the Grubbs Beck test for multiple outliers. In addition several events have occurred since the year 2000 (the last year used in the flood frequency analysis). While not required as part of the study it is recommended that in the future the flood frequency analysis be updated.

While not part of the scope of the project it is recommended in the longer term that the Clarence River model undergo a major review and along with a review of the hydrology and that the models be updated to reflect current practice post the release of the new Australian Rainfall and Runoff.

The PMF event modelled is not a true PMF event but a scaled up version of the 100 year ARI or 1% AEP event. This is often referred to as an Extreme Event. An Extreme Event is often 3 times the 100 year ARI. The event used is consistent with previous studies for the Clarence River and is consistent with common practice. It is suggested that Note 1 on page 6 Reference 2 could use more clarification for non-flooding experts.

Flood frequency analysis and design events - Response

Noted

Minor report issues - Comment

The flood frequency analysis section refers to the ARR chapter by Kuczera and Franks. The reference in the reference list is incorrect and should be updated to:

- Kuczera G and Frank S, Australian Rainfall and Runoff, Book IV, Estimation of Peak Discharge-Draft, Engineers Australia, Jan 2006

Minor report issues - Response

Noted

5. Summary

The majority of comments made by the peer reviewers related to minor issues and legacy model issues that did not impact on the ability of the model to be used for its intended purpose but which are recommended to be addressed should the opportunity arise.

On the basis of this review the Clarence River model was considered suitable for assessing flood impacts of proposed works with the additional crossing of the Clarence River in Grafton.