Bundaberg Flood Protection Study
Department of Infrastructure Local Government and Planning

Stage 2 Consultation Report

16 December 2016
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1. Introduction

Jacobs was engaged by the Department of Infrastructure, Local Government and Planning (DILGP) to conduct the Bundaberg flood protection study, involving identification and assessment of flood mitigation options and community and stakeholder engagement.

This report provides an overview of the community and stakeholder engagement activities undertaken for Stage 2 of the Bundaberg flood protection study between April 2016 and December 2016 and provides an overview of the consultation findings.

1.1 Project background

The Queensland Government is working towards development of a long-term action plan for flood mitigation works in Bundaberg, building on previous flood risk management study undertaken in 2013 by the Bundaberg Regional Council (BRC) to identify flood mitigation projects.

The objectives for DILGP for the Bundaberg flood protection study are to:

- build on existing work already undertaken
- better understand flooding behaviours from local community
- engage stakeholders to confirm all feasible flood mitigation options are thoroughly considered
- communicate eventual decisions taken on the proposed mitigation strategies so that stakeholders understand and ultimately accept the decisions made
- provide government with the confidence that the 10-year action plan is both relevant and fully costed.

Figure 1.1 shows the key stages in developing the action plan. Stage 1 of this study was undertaken in late 2015 and involved the review of previous work undertaken by BRC as well as engagement with local communities to capture local knowledge about flooding and potential flood solutions.

Stage 2 of the study commenced in March 2016 and involved evaluation and assessment of flood mitigation options, including community and stakeholder engagement on the assessment process and preliminary findings of the options assessment.

The findings of the Bundaberg flood protection study will inform the development of the 10-year action plan for flood mitigation in Bundaberg. Engagement on the action plan will be conducted in 2017.

Figure 1.1: Development of the action plan
2. Objectives and program

This section provides an overview of the community engagement objectives and program of activities undertaken for Stage 2 of the study, between April 2016 and December 2016.

2.1 Engagement objectives

The overarching purpose of engagement in Stage 2 was to gather feedback and input to inform the assessment of the flood mitigation options. More specifically, engagement activities in Stage 2 sought to:

- gather community and stakeholder feedback on the project objectives and refinement of the assessment criteria
- provide information to the community and key stakeholders about the findings of the preliminary options assessment, including the options assessed and key outcomes
- gather community and stakeholder feedback on the flood mitigation options and findings of the preliminary options assessment, to inform the final assessment of the mitigation options
- ensure community members and stakeholders understand the next steps in developing the flood mitigation options and for finalising the 10-year action plan.

The final outcomes of the options assessment and community and stakeholder feedback will input to the completion of the 10-year action plan by the Queensland Government.

2.2 Program

An outline of the program for community and stakeholder engagement activities in Stage 2, including timing, purpose and key activities is provided in Table 2.1.

A four week public consultation period on the findings of the preliminary assessment was conducted between Monday, 24 October 2016 and Sunday, 20 November 2016. A range of communication and engagement activities were undertaken during this period to allow community members and stakeholders to find out more about the flood mitigation options and provide feedback on the findings of the preliminary assessment.

Further consultation on the 10-year action plan will be conducted with Bundaberg communities in 2017.

Table 2.1: Stage 2 engagement program

<table>
<thead>
<tr>
<th>Timing</th>
<th>Purpose</th>
<th>Key engagement activities</th>
</tr>
</thead>
</table>
| April 2016         | Review and refinement of the assessment criteria – gather input on the assessment process, including objectives and assessment criteria. | • Meeting with the key community representative groups (i.e. Burnett River Flood Protection Organisation Committee, former BRC flood study Community Reference Group, CBD traders)  
• Meetings with BRC officers  
• Website update about Stage 2 activities |
| October-December 2016 | Findings of preliminary options assessment – gather community and stakeholder feedback on the flood mitigation options and findings of the preliminary assessment to inform the options assessment. | • Community information sessions  
• Distribution of newsletter and options papers  
• Website update, including interactive mapping and discussion papers  
• Invitation for written submissions  
• Project information line and email  
• Meetings with BRC officers and elected representatives.  
• Meeting with Queensland Government agencies |
| 2017               | 10-year action plan – engagement on the 10-year action plan | • To be determined |
3. Stakeholders

A range of stakeholder groups participated in engagement activities for Stage 2, including local communities, representative groups and government. Key stakeholders engaged as part of the Stage 2 engagement activities are outlined in Table 3.1.

Table 3.1: Key stakeholder groups

<table>
<thead>
<tr>
<th>Stakeholder groups</th>
<th>Stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community</td>
<td>• Residents</td>
</tr>
<tr>
<td></td>
<td>• Property owners</td>
</tr>
<tr>
<td></td>
<td>• Business owners</td>
</tr>
<tr>
<td></td>
<td>• Community members</td>
</tr>
<tr>
<td>Representative groups</td>
<td>• Burnett River Communities Flood Prevention Organisation (BRCFPO)</td>
</tr>
<tr>
<td></td>
<td>• Burnett River Floodplain Action Plan Community Reference Group (CRG)</td>
</tr>
<tr>
<td></td>
<td>• CBD Traders Group</td>
</tr>
<tr>
<td>Government</td>
<td>• Bundaberg Regional Council Councillors and staff</td>
</tr>
<tr>
<td></td>
<td>• Department of Communities, Child Safety and Disability Services</td>
</tr>
<tr>
<td></td>
<td>• Department of Agriculture and Fisheries</td>
</tr>
<tr>
<td></td>
<td>• Department of Natural Resources and Mines</td>
</tr>
<tr>
<td></td>
<td>• Department of Transport and Main Roads</td>
</tr>
<tr>
<td></td>
<td>• Department of Infrastructure, Local Government and Planning</td>
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<tr>
<td></td>
<td>• Department of Environment and Heritage Protection</td>
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<tr>
<td></td>
<td>• Queensland Fire and Emergency Services</td>
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<tr>
<td></td>
<td>• Queensland Police*</td>
</tr>
<tr>
<td></td>
<td>• Department of Premier and Cabinet*</td>
</tr>
<tr>
<td></td>
<td>• Queensland Reconstruction Authority</td>
</tr>
<tr>
<td></td>
<td>• Queensland Treasury</td>
</tr>
<tr>
<td></td>
<td>• Member for Bundaberg</td>
</tr>
<tr>
<td>Media</td>
<td>• Bundaberg News Mail</td>
</tr>
<tr>
<td></td>
<td>• ABC Wide Bay</td>
</tr>
<tr>
<td></td>
<td>• WIN</td>
</tr>
<tr>
<td></td>
<td>• Radio 4BU</td>
</tr>
</tbody>
</table>
4. **Communication and engagement activities**

4.1 **Overview of engagement activities**

A range of communication and engagement activities were implemented between April and December 2016. These were selected to provide stakeholders with sufficient opportunity to receive information about the study and to provide inputs on the mitigation options, assessment process and preliminary findings. Key communication activities included:

- distribution of a fact sheet including through the project website; letterbox drop to residents in Bundaberg North, East, South and Central; and hard copies at selected locations
- letter to property owners and residents in Bundaberg North
- distribution of discussion papers on the flood mitigation options through the project website and community information sessions
- website updates, including interactive flood mapping for each of the mitigation options
- advertisements in the Bundaberg News Mail.

Community and stakeholder engagement activities included:

- community information sessions
- stakeholder meetings
- invitation to make written submissions to the project team (electronically or via post).

Further information on these engagement activities is provided in the following sections.

4.2 **Communicating with stakeholders**

4.2.1 **Project website**

A website was established by DILGP for the study. This was used as the central hub for communicating information about the study and key findings of the options assessment. The website was also used by stakeholders to register their interest in participating in community information sessions.

Information available on the website included:

- details of the study process, including key stages for developing the study and next steps
- project materials such as fact sheets, discussion papers on each of the mitigation options and interactive mapping
- details of community information sessions, including how stakeholders could register
- details on how community members could provide their feedback and make a written submission
- findings of Stage 1 of the Bundaberg Flood Protection Study, including outcomes of the review of previous work and report on community and stakeholder engagement undertaken in Stage 1.

A number of website updates were made during Stage 2, including:

- at early phase of Stage 2 investigations, providing information on the Stage 2 study process and outcomes of Stage 1 consultation
- prior to the commencement of engagement in October 2016, providing an update on the project and mitigation options and details of upcoming engagement activities
- the commencement of engagement on the preliminary options assessment, providing information on the flood mitigation options, including the discussion papers and fact sheet; community information session and details on how people could provide written feedback.
4.2.2 Project fact sheet

A project fact sheet was prepared to provide a study update and details on how community members could participate in engagement activities and provide feedback. A copy of the fact sheet is in Appendix A.

The fact sheet was distributed via letterbox drop to approximately 4,300 residents in Bundaberg North, Bundaberg East, Bundaberg South and Central Bundaberg during the week commencing 24 October 2016. The fact sheet was also hand delivered to businesses within the Bundaberg CBD. Copies of the fact sheet were also available:

- through the project website
- at key locations within Bundaberg such as Council office, Bundaberg library, Sugarland Shopping Town, and IGA (Northway Plaza)
- at community information sessions.

4.2.3 Property owner letter

A letter was sent to about 600 owners of properties in Bundaberg North providing information on the flood mitigation options and encouraging property owners to participate in engagement activities for the project. Property owners were also invited to contact the information line to talk to a member of the project team about the mitigation options or opportunities for individual consultation.

Letters were specifically sent to property owners in Bundaberg North as a number of the flood mitigation options would have potential property impacts on properties in this area. Letters were mailed to property owners on 20 October 2016.

A copy of the letter is available in Appendix B.

4.2.4 Discussion papers

Discussion papers were prepared for each of the 11 flood mitigation options to provide an overview of the flood mitigation options and the findings of the preliminary assessment. These included:

- option overviews, providing a high level summary of the mitigation option and key findings
- technical discussion papers, providing detail on the mitigation option and how the option changes flooding in Bundaberg, and a summary of how the option performs against each of the assessment criteria.

The option overviews and technical discussion papers are provided in Appendix C.

Both discussion papers were available through the project website from the commencement of consultation on 24 October 2016. Copies of the options overviews were also available for the community to take at the community information sessions, while copies of the technical discussion papers were available for review at the community information sessions. Copies were also provided to community members on request.

4.2.5 Interactive mapping

Interactive mapping was available on the project website from the commencement of consultation on 24 October 2016. The mapping allowed community members to see how each of the flood mitigation options would change flooding in their area. The mapping included a feature that allowed community members to enter a specific property address and compare flood depths at their property for each of the mitigation options against the existing flooding situation.

Information for each option was provided for the 1% AEP or 100 year ARI flood event. This flood event was almost as large as the January 2013 flood event. Information for the Bundaberg North levee and floodway and Bundaberg East levee was also provided for a 2% or 50 year ARI flood event, which was similar to the 1942 flood event.
The interactive mapping was also available for use by community members at the community information sessions.

Screenshots of the interactive mapping is provided in Table 4.1. The interactive mapping received about 330 views during the consultation period in October and November.
4.2.6 Display posters and mapping

Display posters were prepared to support community engagement at the community information sessions. Five display posters were prepared that provided information to community members on:

- study overview and timeline
- approach to assessment of the flood mitigation measures
- overview of the flood mitigation options
- preliminary findings of the flood mitigation options assessment
- how to get involved and provide feedback.

A copy of the display posters is provided in Appendix D.

A large scale, hard copy map of each of the flood mitigation options was also available at the community information sessions to support discussion with community members.

4.2.7 Email and project information line

A project email address (bundabergfloodstudy@jacobs.com) and information line (1800 994 015) were established for communicating with community members and stakeholders. Project updates, project fact sheet and information were distributed via email to stakeholders.

About 25 emails were received from community members and stakeholders between late October and early December 2016. The majority of these emails related to registration to attend a community information session or submission on preliminary options assessment.

4.2.8 Advertisements

Advertisements were placed in the Bundaberg News Mail on Saturday, 22 October 2016 and Wednesday, 26 October 2016 providing details about community information session and how community members could provide written comments on the flood mitigation options. Copies of the advertisements are included in Appendix E.

4.2.9 Media

Media activity generated during Stage 2 of the study included:

- media stories in the News Mail and on 4BU radio in late June/ early July 2016 to coincide with the release on the website of the Stage 1 reports
- media article in the News Mail on the 20 September 2016, informing community members of the upcoming consultation in October
- media article in the News Mail on 21 October 2016, informing community members about the release of the flood mitigation options the following week
- media stories in the News Mail, and on ABC Wide Bay and WIN News during the week commencing 24 October 2016 to coincide with the commencement of the community engagement activities for the flood mitigation options and the outcomes of the preliminary assessment
- media article in the News Mail on 2 November 2016 about potential impacts on the North Burnett area from mitigation Option I (dams in the upper catchment).

Copies of selected articles from the News Mail are in Appendix F.
4.3 Consulting with stakeholders

4.3.1 Community information sessions

Three community information sessions were held in Bundaberg during the consultation period in October and November 2016. These were designed as ‘drop in’ style sessions, with community members invited to turn up during the opening times to talk to members of the project team. Information on the community information sessions are provided in Table 4.1.

Details of community information session were advertised through the fact sheet distributed to households and business and at key locations within Bundaberg; letter to property owners in Bundaberg North; project website; and advertisements in the Bundaberg News Mail. People were encouraged to register to attend the community information sessions, either online, by email or through the project information line.

A total of about 140 people participated in the three community information sessions in late October and early November 2016. The information sessions provided community members with the opportunity to talk to the project team about the mitigation options and their specific interests. Information on the mitigation options and findings of the preliminary assessment was also provided at the sessions through display posters and maps, discussion papers and the interactive mapping.

Comment forms were available at the information sessions for community members to provide their feedback on the mitigation options and the findings of the preliminary assessment. Feedback was also captured through discussions between community members and the project team.

Table 4.1 : Community information sessions

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Participants</th>
</tr>
</thead>
</table>
| Tuesday 25 October, 1pm – 3:30pm | North Bundaberg Progress Hall  
Cnr of Queen and Gavegan Streets, Bundaberg North | 40 participants |
| Saturday 29 October 2016, 9am – 12pm | Bundaberg Civic Centre – Supper Room  
190 Bourbong Street, Bundaberg | 54 participants |
| Thursday 3 November 2016, 4pm – 7pm | North Bundaberg Progress Hall  
Cnr of Queen and Gavegan Streets, Bundaberg North | 47 participants |
| Total                 |                                                                          | 141 participants |

4.3.2 Stakeholder meetings

Meetings were conducted with various stakeholder groups in Stage 2 to gather information on the assessment process and also feedback on the flood mitigation options and preliminary findings of the options assessment. Details of the stakeholder meetings are provided in Table 4.2.

Table 4.2 : Stakeholder meetings

<table>
<thead>
<tr>
<th>Date</th>
<th>Stakeholders</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| 7 April 2016 | Bundaberg Regional Council staff                                      | • Provide update of the study and proposed investigations for Stage 2  
• Gather feedback on the assessment process, including objectives and assessment criteria |
| 7 April 2016 | Representatives of Lower Burnett Floodplain Risk Management Plan Community Reference Group; Burnett River Communities Flood Prevention Organisation; CBD Trader | • Provide update of the study and Stage 2 investigations  
• Provide overview of the assessment process and flood mitigation options  
• Gather feedback on the assessment process, including objectives and assessment criteria |
4.3.3 Feedback

Feedback on the flood mitigation options and findings of the preliminary options assessment was invited between 24 October and 20 November 2016. In particular, community members and stakeholders were invited to make written submissions to the project team, electronically via the project website, email or post.

About 75 pieces of feedback were received from community members and stakeholders during consultation in October and November. This was received through:

- written submission to the project team, including by email and post
- comment forms at community information sessions, completed by community members or through discussions between community members and project team members
- stakeholder meetings
- the project information line/telephone.

Table 4.3 provides a summary of the feedback received during the consultation period in October and November.
Table 4.3: Feedback breakdown

<table>
<thead>
<tr>
<th>Feedback method</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community information sessions</td>
<td>61</td>
</tr>
<tr>
<td>Post</td>
<td>3*</td>
</tr>
<tr>
<td>Email</td>
<td>6</td>
</tr>
<tr>
<td>Telephone/ project information line</td>
<td>17*</td>
</tr>
<tr>
<td>Stakeholder meetings</td>
<td>4</td>
</tr>
</tbody>
</table>

*Includes feedback received following the consultation period

4.4 Stakeholder database

A stakeholder database was established for the project, to record feedback and interaction with stakeholders identified at the project commencement as well as stakeholders who registered interest in participating in the study via DILGP’s website or thorough community information sessions.
5. Engagement findings

This section provides a summary of the key findings from community and stakeholder engagement in Stage 2.

5.1 Summary of feedback – April 2016

Table 5.1 provides a summary of feedback received during stakeholder consultation in April 2016. This included feedback received during the meeting with community representative groups.

Table 5.1: Summary of feedback – April 2016

<table>
<thead>
<tr>
<th>Issue</th>
<th>Summary of feedback</th>
</tr>
</thead>
</table>
| Assessment process, including objectives and assessment criteria | • Objectives provide a good mix and indicate good practice – the inclusion of an objective around climate change was seen as positive and criteria relating to the urban environment was also seen as important  
• Long-term focus of mitigation options (e.g. long-term reduction in flood risk and adaptability to future changes) was considered important and a priority for flood mitigation options  
• Reduced flood risk to life and impacts on people was identified as a priority. Reduced risk to property was also identified as important  
• Social and economic issues of flooding and flood mitigation were also identified as important, but this objective was generally considered a lower priority than risks to life and property  
• Need to balance individual vulnerability and community vulnerability – vulnerability of communities in rural areas generally relates to isolation and communications being cut  
• Effects on community values was identified as important in relation to the objective for ‘balance between social, economic and environmental issues’  
• Long term benefits and ability to stage implementation of mitigation measures were identified as important criteria for assessment  
• Criteria relating to reduced impact on people of very large/ rare floods and increasing people’s resilience to flooding were considered important criteria for the ‘reduced flood risk to life and impacts on people’ objective  
• Increased property resilience to flooding was identified as an important criteria |
| Preliminary mitigation options | • What is the plan to stop water coming into Bundaberg  
• Need for mitigation options to consider areas outside of the Bundaberg urban area (e.g. Pine Creek), with comment made that the hinterland area is affected by flooding every two years and can be isolated for up to six weeks  
• The scope of the river diversions should be expanded to outside of the Burnett River (for example, back of Gin Gin) – don’t want back-up flooding if can connect Burnett River to other rivers. The diversion to the Kolan River was identified  
• Why the land swap option was only being considered for Bundaberg North and whether this was something that could be considered for other areas, including rural  
• The land purchase option should ‘all or nothing’ to avoid social issues and issues around unmaintained properties  
• A flood refuge option would have a number of disaster management and social issues  
• Need for further detail around dredging (e.g. where, how much area would be dredged, etc)  
• The obvious alignment for the Bundaberg North level is along the railway line  
• Some people considered the dam/ storage option made sense, although it was identified that the need for more water associated with the Paradise Dam option was unlikely  
• Connectivity to Council’s proposed evacuation centre south of the Burnett River is important  
• Low level levee would give more time for evacuation |
| Other feedback | • Timeframe for the action plan, particularly flood mitigation beyond the 10-year action plan timeframe  
• Whether the consequences of failure was captured in the multi-criteria assessment and the stage-damage curves to be used for the damages assessment |
## 5.2 Summary of feedback – October to December 2016

Table 5.2 provides a summary of community and stakeholder feedback received during consultation on the flood mitigation options and preliminary options assessment. Feedback received on specific mitigation options is provided in Table 5.3. A detailed overview of feedback received is in Appendix G.

### Table 5.2: Summary of feedback – October to December 2016

<table>
<thead>
<tr>
<th>Issue</th>
<th>Summary of feedback</th>
</tr>
</thead>
</table>
| **Study process**            | *People generally welcomed the study was progressing, although concerns raised that ‘have been talking about this for a long time’*  
                           | *Mitigation options are centred on the city whilst other far reaching alternatives have been scantily looked upon. Majority of options presented for the lower reaches of the Burnett River around the city could all be a non-requirement should options further upstream be deployed*  
                           | *Study did not look into the basic premise of ‘stopping the water before it reached the city proper’. If prevent the flood water getting into the city then all other major problems are solved instantly*  
                           | *The pricing criteria does not seem to take into account other vital financial factors such as ‘loss of business, the human factor, property valuations, insurance costs and many other intangible items such as costs associated with evacuation and emergency services’*  
                           | *Estimates appear to be ‘hard line mercenary engineering figures’*  
                           | *Comments regarding environmental approvals should not be in the reports*  
                           | *Timing around decisions and whether any decisions have been made*                                                                                                                                                                   |
| **Flood behaviour**          | *Greatest impact on flooding in the last 50 years has been the ‘new’ weir – restricted the water and caused much of the sediment build up*  
                           | *Sandy Hook weir has increased sand and mangroves in the Burnett River*  
                           | *Building up of roads in the past has caused flooding and created dams/ levees (e.g. road from the IGA to North School Hill, new bridge off-ramp)*  
                           | *Paddy’s Creek drain – the square pipes beneath the bridge through this area are not adequate*  
                           | *Main reason for flooding in Paradise Dam as the Burnett River flow is not able to take sand, etc out to sea*  
                           | *Paddy’s Creek has had many obstacles built in its pathway, including the recent Chinese Garden, which need to be addressed*                                                                                                           |
| **General feedback on mitigation options** | *Lots of elderly people in Bundaberg North – evacuation of them is critical*  
                           | *Point of anxiety for many people (particularly elderly) is who is going to help during an emergency*  
                           | *Emergency management and evacuation is critical – helping people to escape, and when to make the decision to get out*  
                           | *Need to consider people before property*  
                           | *Mitigation options need to focus on local Bundaberg North flooding (small catchments)*  
                           | *Not in favour of one option or another – need to do a number of smaller projects and take parts of a number of options (e.g. remove trees from Harriet Island, do some dredging, progressively buy back houses, small dams in the river headwaters, etc)*  
                           | *Removing obstructions in the Burnett River (particularly in the lower floodplain) will help to reduce the flood levels (e.g. Harriet Island, Millaquin Bend, trees on Harriet Island causing sedimentation) and increase flow rate to the sea*  
                           | *None of the proposed mitigation options are any good*  
                           | *Options A, C and D would have beneficial impacts of saving lives, creating employment in town, reducing insurance costs, health impact improvements and sell dredged sand to overseas market*  
                           | *Numerous ‘low cost’ options that should be considered (e.g. removing obstacles, maintenance of drains, etc)*                                                                                                                     |
| **General feedback on dredging** | *Dredging would have a benefit from a psychological point of view*  
                           | *Recognise that dredging would require ongoing maintenance*  
                           | *Dredging is an expensive option. Dredge spoil will be costly to move*                                                                                                                                                         |
## Summary of feedback

### Issue

- Issue about where to put the dredge spoil and environmental issues with disposal
- Potential to reuse the dredged material around Bundaberg, e.g., some of the spoil downstream of the old bridge could be used to build up land and reduce flooding on properties; dredge material could be used at Kendall Flats, or else sell dredged sand to overseas markets
- Dredging from the barrages downstream to town is needed. Dredging to the mouth was also identified as an option to be considered

### General feedback on levees

- Levees are not really an option
- If put in levees, would need pumps to make sure they don’t hold the water back. Possible issues after a few years if not properly maintained and tested
- Levees will exacerbate the problem – better to free up path of floodway and river
- Levees would clear the passage of water for a long time
- Minor levees should be removed as they impede flows

### Other structural flood mitigation options

- Need for regular maintenance of existing drains and watercourses;
  - Need to clear mangroves from the slipway to improve the flood flow
  - Need to clear the river banks of rubbish – keep the trees and ‘useful’ vegetation
  - Clean drain behind Hinkler Park and Federation Park
- Replacing ‘little square drains’ with better drainage would be less expensive (e.g., Bundaberg Gin Gin Road)
- Need to start in headwaters and catch the rain where it falls (USA Fire River example) – get water into the underground system (recharges underground system, reduces water in River)
- Consideration of small dams on properties
- Need to remove the Ben Anderson barrage and recreate the port mouth to its original opening

### Other non-structural mitigation solutions

- Need for better emergency management, such as better evacuation, sirens, earlier warnings (12 hours warning would be good), education and awareness, register of people who need help with evacuation (e.g., elderly people, people with disability, etc)
- Need for better traffic management during flood events (e.g., restricting access to property owners/residents)
- Need to stop building on the delta – there should be a moratorium on development in the floodway. Filling of riverbank areas is causing an issue – creating ‘dams’. Some areas are 9.5 metres high, which is causing issues
- Previously had time to evacuate, but no one said that people should go
- Currently, possible bottleneck in the bank between Whittingstons Road and McKenzies Road that if opened up in conjunction with a channel to the ocean, could possibly help
- Evacuation centre should be built north of the Burnett River
- Need to ‘trip’ the barrage every year at the start of the wet season to flush out the River and then reinstate

### Consultation

- Not enough information provided to well understand the impacts of the options – although mapping and asking questions helped
- Notification of potentially affected property owners
- Consultation with local Indigenous groups is necessary in future investigations

### Table 5.3: Feedback on specific mitigation options

<table>
<thead>
<tr>
<th>Mitigation option</th>
<th>Summary of feedback</th>
</tr>
</thead>
</table>
| Option A: improving conveyance on Burnett River (i.e., dredging, removing Harriet Island, etc) | This option had a level of support from community feedback
  - Harriet Island becomes an obstacle when flooding occurs in the River and currently pushes water over towards the Botanic Gardens
  - Concerns raised in relation to this option, included:
    - This option is a waste of money if the foundry is still going to there
<table>
<thead>
<tr>
<th>Mitigation option</th>
<th>Summary of feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitigation option</td>
<td>Summary of feedback</td>
</tr>
<tr>
<td>• This won’t work as there is ‘one little river’ to take a ‘whole lot of water’</td>
<td></td>
</tr>
<tr>
<td>• Dredging and removal of Harriet Island won’t do much – the island shouldn’t be removed</td>
<td></td>
</tr>
<tr>
<td>• Long-term commitment would be required</td>
<td></td>
</tr>
<tr>
<td>Option B: Bundaberg North floodway</td>
<td>• This is probably the best option as water goes where it wants to</td>
</tr>
<tr>
<td></td>
<td>• Floodways are used world-wide, so should be considered in Bundaberg</td>
</tr>
<tr>
<td></td>
<td>• Safety concerns with the lakes – would be a magnet for kids</td>
</tr>
<tr>
<td></td>
<td>• The lakes are a waste of money – money would be better spent on drainage</td>
</tr>
<tr>
<td>Option C: Bundaberg North levee and floodway</td>
<td>• Some support received for this option</td>
</tr>
<tr>
<td></td>
<td>• Best solution would be to relocate the whole of Bundaberg North to a much safer area</td>
</tr>
<tr>
<td>Option D: Bundaberg East levee</td>
<td>• This option was generally supported</td>
</tr>
<tr>
<td></td>
<td>• Best option for costs, impact on properties, including Hinkler Place shopping centre, and impact on infrastructure in Bundaberg South and East</td>
</tr>
<tr>
<td></td>
<td>• This option would save a lot of expense and will help to stop local flooding</td>
</tr>
<tr>
<td></td>
<td>• Issues raised in relation to this option related to:</td>
</tr>
<tr>
<td></td>
<td>• Impacts on property values and property access due to the levee</td>
</tr>
<tr>
<td></td>
<td>• Potential for levee to back up local drains and keep water in</td>
</tr>
<tr>
<td></td>
<td>• Concerns about potential for the floodgate to cause flooding in areas not currently affected, impacting on insurance</td>
</tr>
<tr>
<td>Option E: Fairymead levee removal</td>
<td>• This received limited support</td>
</tr>
<tr>
<td>Option F: Millaquin Bend widening</td>
<td>• Generally supported by people that would like to see dredging/ removal of mangroves/ tree and sediment removal</td>
</tr>
<tr>
<td></td>
<td>• This option would improve water flow</td>
</tr>
<tr>
<td></td>
<td>• Sand levels at Millaquin Bend have increased 2-3 metres. This area should be lowered</td>
</tr>
<tr>
<td></td>
<td>• Suggested that this would not be sufficient to be effective</td>
</tr>
<tr>
<td>Option G: Burnett River diversion</td>
<td>• Diversion goes through farmland – would be better if this went through areas of State Forest – less private land</td>
</tr>
<tr>
<td></td>
<td>• This option just moves the issue elsewhere – would have affect the Elliot River and people living near this</td>
</tr>
<tr>
<td></td>
<td>• Suggested that this option doesn’t warrant any further consideration</td>
</tr>
<tr>
<td></td>
<td>• Diversion to the Elliot River would impact on wetlands in creeks off of the Elliot River - these are a major filtration for the River</td>
</tr>
<tr>
<td></td>
<td>• The mouth of the Elliot River is currently silted up and the diversion would increase sediment in area that is clogged</td>
</tr>
<tr>
<td></td>
<td>• Elliot River is not part of the Burnett River catchment and diversion to this River would spoil a catchment that is ‘gentle’ in comparison</td>
</tr>
<tr>
<td>Option H: Improved evacuation (Tallon Bridge extension)</td>
<td>• This option was generally supported by people</td>
</tr>
<tr>
<td></td>
<td>• Evacuation is important – once bridges are out, people become isolated</td>
</tr>
<tr>
<td></td>
<td>• This option would give many residents of Bundaberg North access to the evacuation centre being built at the old showgrounds south of the River</td>
</tr>
<tr>
<td></td>
<td>• Single lane generally seemed acceptable ‘all that’s needed’, although some people suggested it should be a dual carriageway and permanent roadway</td>
</tr>
<tr>
<td></td>
<td>• Concern raised that this option only provides four hours – educating people would be enough</td>
</tr>
<tr>
<td></td>
<td>• Some people indicated that they did not support this option</td>
</tr>
<tr>
<td>Option I: Dams in the upper catchment</td>
<td>• Big dams are very expensive. Landholders could be encouraged to build smaller dams with very little cost to local/ State government. Farmers could be offered a small incentive if necessary</td>
</tr>
<tr>
<td></td>
<td>• Option I was not considered a priority for the study. Many different alternatives for the use of the by-product of this action, not the least creating revenue and jobs by the created value adding resource</td>
</tr>
</tbody>
</table>
### Mitigation option

<table>
<thead>
<tr>
<th>Mitigation option</th>
<th>Summary of feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Cost of the dam has been made without identifying specific sites</td>
</tr>
<tr>
<td></td>
<td>- No reason why the ‘successful revenue earning Kolani/ Monduran irrigation scheme’ could not be duplicated upstream – this should be investigated further</td>
</tr>
<tr>
<td></td>
<td>- Possibly a good idea if want to grow sugar cane around the Gayndah district</td>
</tr>
<tr>
<td>Option J: Floodway house purchase</td>
<td>- This option was supported by a number of people</td>
</tr>
<tr>
<td></td>
<td>- Purchase or relocate all Bundaberg North and make this into a park</td>
</tr>
<tr>
<td></td>
<td>- Important that only buy back most at risk. Progressively buy back houses (e.g. start with those houses that are worst affected, e.g. 5 metre flood level, then 6 metres, etc)</td>
</tr>
<tr>
<td></td>
<td>- Consideration of land swap scheme as part of the house purchase – would be cheaper than buying back houses</td>
</tr>
<tr>
<td></td>
<td>- Would like to see this option go further</td>
</tr>
<tr>
<td></td>
<td>- Some people affected by this option indicated they would not be keen to sell or relocate</td>
</tr>
<tr>
<td></td>
<td>- Question about how much would property owners get for their property</td>
</tr>
<tr>
<td></td>
<td>- Would the buy-back also include the Bundaberg Rail Museum or the aged care men’s shed – these need to be preserved and should be relocated</td>
</tr>
<tr>
<td>Option K: Upper floodplain evacuation improvements</td>
<td>- No specific comments were made in relation to this option, although evacuation was identified as important</td>
</tr>
</tbody>
</table>

### 5.3 Consultation outcomes

The outcomes of Stage 2 consultation have informed the options assessment process and finalisation of the options assessment. In particular, feedback informed:

- weightings attributed to the objectives and criteria included in the multi-criteria assessment
- review and refinement of scores attributed to criteria relating to such things as community and social health benefits, environmental and economic benefits, for the options within the multi-criteria assessment.

The findings of the options assessment process are reported in the Bundaberg Flood Protection Study Flood Mitigation Options Assessment Report prepared by Jacobs.
6. Summary

This report provides an overview consultation outcomes for Stage 2 of the Bundaberg flood protection study, including activities conducted and summary of feedback received on the assessment process, mitigation options and preliminary assessment.

Community and stakeholder feedback on the flood mitigation options and finding of the preliminary options assessment was invited between 24 October and 20 November 2016.

About 70 pieces of feedback were received from community members and stakeholders during this period, including through written submissions, comment forms at information sessions, stakeholder meetings and project information line/ telephone.

The following provides an overview of the key findings from consultation conducted between October and December 2016 on the mitigation options and preliminary assessment.

6.1 General feedback

- High level of interest in the study and the outcomes
  - people generally welcomed that study is progressing, although some concerns that ‘have been talking about this for a long time’
  - some people believed that study should have stronger focus on ‘stopping the water’, while others believed that study should have stronger focus on ‘getting the river flowing’ (e.g removing sediment and mangroves from the river)
  - some people wanted to see better evacuation, warning and helping people get out was something people raised as important – ‘people before property’

- Community feedback on the options varied
  - mixed responses to each of the options – feedback included both support for and issues with most options

6.2 Feedback on mitigation options

- A: Improving conveyance on Burnett River (i.e. dredging, removing Harriet Island, etc)
  - Option had level of support from number of people; ‘remove obstructions in the River’, ‘improve flood flow’. The main concerns included: ‘expensive’, ‘won’t do much’, ‘will need ongoing maintenance’, ‘requires long term commitment

- B: Bundaberg North floodway
  - Option generally had a low level of support, with the general view was that the obstruction was actually at Gin Gin Road

- C: Bundaberg North Levee and Floodway
  - This option generally had low level of support, with concerns relating to: people living inside of levee did not want wall around them, people concerned about overtopping/ fast filling

- D: Bundaberg East levee
  - This option was generally supported, recognised that would have positive impact on businesses. Issues raised related to: impact on property access, negative impacts on property values, potential to back up local drains, need for pumps and issues of ongoing maintenance

- E: Fairymead levee removal
  - This option had limited support.

- F: Millaquin Bend widening
- This option was generally supported by people that would like to see dredging/ mangrove removal/ tree removal/ sediment removal. It was seen as part of a larger river ‘improvement’ scheme, generally considered to have limited value by itself

- **G: River diversion(s)**
  - This option wasn’t considered a viable option by most people, with concerns relating to cost (expensive), property impacts along the diversion alignment, environmental impacts, and impact on people and properties along Elliott River. The option was supported by some people as it was seen to be ‘stopping water’ and provided opportunities to add value to the economy

- **H: Improved evacuation (Tallon Bridge extension)**
  - This option was generally supported, improving evacuation identified as important by many people, and the single lane generally seemed acceptable e.g. people ‘don’t want people going in to North Bundaberg during floods’. Concerns were raised about the cost of this option when it only provides extra four hours to evacuate (misunderstanding)

- **I: Dams in upper catchment**
  - This option was seen as positive by number of people as it would ‘stop the water’ and would have additional benefits for agriculture/ economy. Concerns related to: expense, suggested solution included number of smaller dams on rural properties

- **J: Floodway house purchase**
  - This option had support from a number of people, especially in relation to a land swap. The need to focus on ‘most at risk’ properties was recognised. Some people affected by this option indicated they would maybe sell in coming years, while others indicated they were not interested at all in relocating

- **K: Upper floodplain evacuation improvements**
  - Limited comments were received about these options (likely due to location of open sessions)

A number of other options were identified during consultation, including:

- structural mitigation solutions such as
  - regular maintenance of existing drains, watercourses – remove debris to allow water to flow
  - removing obstructions in the river and floodplain, including barrage; remove foundry and Queen Street/ Gin Gin Road (or more culverts under)

- emergency management – e.g. better evacuation, earlier warnings, helping people get out, register of people who need help (e.g. elderly).
Appendix A. Project fact sheet
Bundaberg flood protection study
Developing a 10-year action plan for flood mitigation in Bundaberg.

The Bundaberg flood protection study is a vital component of the Queensland Government’s commitment to develop a 10-year action plan for flood mitigation works in Bundaberg. It is recognised that the works and actions required to reduce flood risks in Bundaberg will require a considerable period of time – that is why a 10-year timeframe is proposed.

Delivering the plan
Stage 1 of the study was conducted in late 2015 and involved review of previous work undertaken by Bundaberg Regional Council in 2013 and engagement with local communities in Bundaberg to gather information on flood behaviour and other possible solutions for flood management.

Stage 2 of the study started in early 2016 and involves assessing 11 flood mitigation options and completing the Bundaberg flood protection study. Jacobs has been engaged by the State government to undertake a study of the various options and associated community engagement. Engagement on the 10-year action plan will occur in 2017.

Assessment of the mitigation options
Eleven flood mitigation options are being assessed in Stage 2, including those identified by community members during Stage 1.

The flood mitigation options being assessed include a mix of works that involve changing flood behaviour and measures that change how residents on the floodplain respond to flooding.

- Works being assessed that involve changing flood behaviour include:
  - levees at Bundaberg North and Bundaberg East
  - the removal of downstream levees at Fairymead
  - a Bundaberg North floodway
- Measures being assessed that change how residents on the floodplain respond to flooding include:
  - river dredging, removal of Harriet Island and widening of Millaquin Bend
  - diversion of flow from the Burnett River into other river catchments (e.g. Elliot River)
  - dam or dams in upper Burnett River catchment
  - evacuation route improvements at Bundaberg North
  - evacuation and flood access route improvements in the upper Burnett River floodplain
  - house purchase / land swap
Get involved
Community consultation on the flood mitigation options and the findings of the options assessment will take place from 24 October to 20 November 2016.
Community feedback will be important in finalising the options assessment and completing the Bundaberg flood protection study.
To find out more about the flood mitigation options and to provide your feedback, you can:

Come along to a community information session
These are ‘drop-in’ style sessions – turn up during the opening times to talk to the project team.
Details of the information sessions are provided below.
To let us know if you’re coming, please register at www.qld.gov.au/bundabergfloodstudy, email us at bundabergfloodprotection@jacobs.com or call us on 1800 994 015 (during business hours).

Tuesday, 25 October 2016
1 pm – 3:30 pm
North Bundaberg Progress Hall
Cnr of Queen and Gavegan Streets, Bundaberg North

Saturday, 29 October 2016
9 am – 12 pm
Bundaberg Civic Centre – Supper Room
190 Bourbong Street, Bundaberg

Thursday, 3 November 2016
4 pm – 7 pm
North Bundaberg Progress Hall
Cnr of Queen and Gavegan Streets, Bundaberg North

Send us your feedback
If you can’t make it to one of the community information sessions, you can make a written submission to:
Bundaberg flood protection study
PO Box 15009
CITY EAST QLD 4002
Email: bundabergfloodprotection@jacobs.com
Or online at: www.qld.gov.au/bundabergfloodstudy
Written submissions must include:
1. Full name
2. Organisation or group (if applicable)
3. Postal and/or email address

Visit the website
www.qld.gov.au/bundabergfloodstudy
Interactive mapping is available on the website so that you can see how each of the flood mitigation options would change flooding in your area.

Contact the project team
Email: bundabergfloodprotection@jacobs.com
Telephone: 1800 994 015 (during business hours)

Next steps
The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017.
The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.

Visit www.qld.gov.au/bundabergfloodstudy to learn more about work undertaken to date.
Appendix B. Property owner letter
Important information for the property owner

To the property owner,

The Queensland Government is developing a long-term action plan for flood mitigation works in Bundaberg. Jacobs has been engaged by the State government to carry out community engagement and undertake an independent assessment of the various options.

Stage 1 of the Bundaberg flood protection study was undertaken in late 2015 and involved review of previous work undertaken by Bundaberg Regional Council in 2013 and engagement with local communities in Bundaberg to gather information on flood behaviour and possible solutions for flood management.

Stage 2 of the study commenced earlier this year and involves assessing 11 flood mitigation options. These include:

- Works that change how high floods reach or where flood water goes, for example levees, dredging, dams and diversions
- Measures that change how residents on the floodplain respond to flooding, for example improved flood evacuation, improved access during floods and changes to housing.

Some flood mitigation options, if adopted and implemented, could affect private property and the local community. We are writing to you because your Bundaberg North property is in an area where possible flood mitigation options are currently being independently assessed and we would like your feedback.

At this time, a wide range of flood mitigation options are being investigated and no decisions have been made about any of the options. Your feedback will assist us in finalising the options assessment and completion of the Bundaberg flood protection study. Engagement on the 10-year action plan will occur in 2017.

It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.

We would like to encourage you to come along to a community information session to find out more about the flood mitigation options and the findings of the options assessment. Members of the project team will be available for you to ask questions and provide your feedback. Details of the community information sessions are attached.

The Queensland Government will continue to consult with residents, property owners and the Bundaberg community as the action plan develops and as further information becomes known.


Regards

Bundaberg flood protection study team
Community information sessions

Community feedback is important in finalising the options assessment and completing the Bundaberg flood protection study.

Three community information sessions are planned in October and November. These are ‘drop-in’ style sessions – turn up during the opening times to talk to the project team.

Details of the information sessions are provided below. To let us know if you’re coming, please register at www.qld.gov.au/bundabergfloodstudy, email us at bundabergfloodprotection@jacobs.com or call us on 1800 994 015 (during business hours).

If you cannot make it to a community information session, please contact 1800 994 015 (during business hours) to talk to a member of the project team about the flood mitigation options or about opportunities for individual consultation.

Community information sessions

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuesday, 25 October 2016</td>
<td>1:00pm – 3:30pm</td>
<td>North Bundaberg Progress Hall</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Corner of Queen and Gavegan Streets, Bundaberg North</td>
</tr>
<tr>
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<tr>
<td></td>
<td></td>
<td>190 Bourbong Street, Bundaberg</td>
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<td>Thursday, 3 November 2016</td>
<td>4.00pm – 7.00pm</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Corner of Queen and Gavegan Streets, Bundaberg North</td>
</tr>
</tbody>
</table>
Appendix C. Discussion papers
Bundaberg flood protection study
Developing a 10-year action plan for flood mitigation in Bundaberg.

Option A – Burnett River conveyance improvement
Option A involves river dredging along the town reach, removing Harriet Island, widening Millaquin Bend and regular maintenance dredging.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015. The following provides an overview of the assessment of Option A.

Viability
A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:

- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option A found that this option is likely to have significant costs relating to construction and ongoing maintenance.

Costs and benefits
Initial cost estimates indicate that construction of this option would cost around $188 million. This assumes that Harriet Island is removed via a cost-neutral extraction agreement. Ongoing maintenance of dredging activities would be about $6 million per year.

The total cost of construction and ongoing maintenance for Option A has been estimated at $235 million. The estimated reduction in flood damages (i.e. the tangible benefits) would be in the order of $35 million.

Summary of assessment against key criteria

- This option would result in more flow in the river and less flow on the floodplain. This would reduce flood levels in some urban areas.
- The increased flood flow in the river would result in some increased flood levels in Bundaberg North (up to 0.3m) for smaller, more frequent flood events.
- Approximately 470 properties in the Bundaberg area would not be inundated in the 1% AEP flood event.
- Construction and ongoing maintenance of this option would cost around $235 million making it a moderate to high cost option.
- The cost of this option would be about five times the estimated monetary benefits.
- The option would require the treatment of dredged material and land-based disposal of dredge spoil due to the very low likelihood of at-sea disposal.
- It is expected that there would be difficulties in obtaining an environmental approval for such a large dredging program.

Likelihood of obtaining environmental approval

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Status</th>
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<tbody>
<tr>
<td>May achieve with modification</td>
<td></td>
</tr>
</tbody>
</table>

Affordability

| Likely to achieve |

Tolerable impacts outside benefited area

| Likely to achieve |

October 2016 – not Government policy

---

1 1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.
Option overview

Option A aims to increase the amount of flood flow conveyed within the Burnett River. This would help to reduce flood levels on the floodplain. It would involve:

- Dredging of the Burnett River within the town reach (to -6m Australian Height Datum (AHD))
- Dredging and excavation at Millaquin Bend
- Removal of Harriet Island (and dredging to -6m AHD)
- Regular ongoing maintenance dredging of these three areas.

Figure 1: Option layout

2.2 Changes to flood behaviour

Flood modelling has been undertaken for the proposed mitigation option. In general, the option does increase flow conveyance within the Burnett River and decreases flows along the Hinkler/Federation park flowpath; however, large conveyance improvements are limited to the 2% AEP event and events more rare than this. Additionally, improvements are limited to about 12km upstream of Harriet Island, with increased flood levels occurring downstream of Millaquin Bend.

Find out more about this option

Community consultation on the flood mitigation options and the findings of the options assessment will take place from 24 October to 20 November 2016. To find out more about the flood mitigation options and to provide your feedback:

- Visit the website: www.qld.gov.au/bundabergfloodstudy
- Interactive mapping is available on the website so that you can see how the flood mitigation options would change flooding in your area.

- Contact the project team:
  - Email: bundabergfloodprotection@jacobs.com
  - Telephone: 1800 994 015 (during business hours)

Next steps

The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.

The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015. The following provides an overview of the assessment of Option B.

**Viability**

A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:

- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’. The assessment of Option B found that this option may be viable with modifications to reduce costs and impacts to areas outside of the benefited area. However the effectiveness of the option would also be impacted decreasing the relatively small reduction in flood damages achieved.

**Costs and benefits**

Initial cost estimates indicate that construction of the lakes would be about $124 million. The estimated reduction in flood damages (i.e. the tangible benefits) would be in the order of $7 million.

**Summary of assessment against key criteria**

- This option would involve diverting floodwater through Hinkler and Federation Parks, reducing flood levels in the Burnett River and Bundaberg North.
- Downstream of the lakes and floodway, some properties would experience increased flood levels.
- This option would have high costs due to the large volume of excavation and the need to treat and dispose of this material.
- Benefits of this option are limited due to the ability to lower flood levels in this area. The flow rate through this area would not change and the flood levels in the urban area are not significantly lowered.
- The costs for this option would be about 16 times the estimated monetary benefits.

| Likelihood of obtaining environmental approval | ![Likely to achieve](https://example.com) |
| Affordability | ![May achieve with modification](https://example.com) |
| Tolerable impacts outside benefited area | ![Unlikely to achieve](https://example.com) |

- Likely to achieve
- May achieve with modification
- Unlikely to achieve
Option overview

Option B aims to decrease flood levels in the Burnett River by increasing flow through Hinkler and Federation Parks. It would involve construction of:

- a series of four lakes in the parks (two either side of Hinkler Avenue)
- regrading of Thornhill Road to improve the flow of floodwater through the floodway
- a 2 km long, 100 m wide channel from Queen Street to Waterview Road.

Construction of this option would require some property acquisitions, including farmland.

Figure 1: Option layout

Find out more about this option

Community consultation on the flood mitigation options and the findings of the options assessment will take place from 24 October to 20 November 2016. To find out more about the flood mitigation options and to provide your feedback:

Visit the website
www.qld.gov.au/bundabergfloodstudy
Interactive mapping is available on the website so that you can see how the flood mitigation options would change flooding in your area.

Contact the project team
Email: bundabergfloodprotection@jacobs.com
Telephone: 1800 994 015 (during business hours)

Next steps

The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.

The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Bundaberg flood protection study
Developing a 10-year action plan for flood mitigation in Bundaberg.

Option C – Bundaberg North levee and floodway
Option C involves constructing a levee around most of Bundaberg North. Lakes and widening of the rail bridge at Hanbury Street would also be required to improve conveyance through Bundaberg North.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015.

The following provides an overview of the assessment of Option C.

Viability
A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:

- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option C found that this option may be viable with modifications to reduce costs and impacts to areas outside of the benefited area. However any modifications are likely to decrease the reduction of flood damages achieved.

Costs and benefits
Initial cost estimates indicate that construction of Option C would be approximately $85 million. This would include about $20 to $30 million for the levee and about $50 to $60 million for construction of the floodway (including property acquisitions). The total cost of the option including ongoing maintenance is estimated at $100 million.

Estimated reduction in flood damages (i.e. the tangible benefits) would be in the order of about $11 million.

Summary of assessment against key criteria
- This option would direct floodwaters around Bundaberg North through the construction of a levee and floodway (lake) system.
- This option would provide protection for about 450 properties up to the 1.5% AEP\(^1\) flood event.
- For events rarer/larger than the 1.5% AEP flood event, initial overtopping of the levee would occur along the northern (earth) sections, rather than a sudden overtopping, allowing safer evacuation.
- There is a risk that people inside the levee may become complacent about flood risk and become less resilient during events that overtop the levee.
- The levee would have a major impact on the urban area, restricting access and creating a visual barrier.
- Increased flood levels of up to 0.6m would be experienced by some properties outside of the levee.
- The total cost of construction and ongoing maintenance of this option would be about $100 million.
- The costs for this option would be about 10 times the estimated monetary benefits.

Likelihood of obtaining environmental approval
Affordability
Tolerable impacts outside benefited area

- Likely to achieve
- May achieve with modification
- Unlikely to achieve

\(^1\) 1.5% AEP flood is the name given to a flood event which has about a 1 in 70 or 1.5% chance of occurring in any year.

\(^2\) 1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year.

It would be similar to the January 2013 flood.
Option overview
Option C aims to direct floodwaters to the west of Bundaberg North through the construction of a levee and floodway system. It would involve:
- Construction of a levee around parts of Bundaberg North, comprising both concrete and earth levees.
- Construction of floodgates at intersections of the levee route with roads.
- Construction of a floodway (lakes) between the Burnett River and Hinkler Park, replacing the flow capacity lost through Bundaberg North.
- Lowering of ground levels between the Burnett River and proposed lakes, widening of the railway bridge near Hanbury Street and regrading of Thornhill Road to improve the flow of floodwater through the floodway.

The southern part of the levee would be constructed to the 1% AEP flood level (with a freeboard). The northern part of the levee would be constructed to the 1.5% AEP flood level. In large events, this would allow initial overtopping of the levee to occur along the northern (earth) sections, rather than a sudden overtopping, allowing safer evacuation. Construction of this option would require some property acquisitions.

Next steps
The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.

The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Bundaberg flood protection study
Developing a 10-year action plan for flood mitigation in Bundaberg.

Option D – Bundaberg East levee
Option D includes construction of a levee along the south bank of the river to reduce flooding in Bundaberg East. It would require construction of two floodgates (with one large floodgate for Saltwater Creek).

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015.

The following provides an overview of the assessment of Option D.

Viability
A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:

- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option D found that this option will be viable. Environmental impacts are likely to be low because of the urban nature of the levee route. Adverse impacts outside the benefitted area will be tolerable as the levee will prevent flood water from the river backing up into Bundaberg South rather than diverting flows.

Costs and benefits
Initial cost estimates indicate that construction of Option D would be approximately $30 to $35 million. Maintenance costs are approximately $500,000 per annum. The total cost of the project including ongoing operation and maintenance of the option is $38 million. Estimated reduction in flood damages (i.e. the tangible benefits) of this option is around $29 million.

Summary of assessment against key criteria
- This option would prevent floodwaters from the Burnett River backing up into Bundaberg South for events up to the 1.5% AEP flood event.
- This option would provide protection for about 440 properties up to the 1.5% AEP (70 year ARI) flood event.
- It would reduce flooding for about 320 properties in the 1% AEP flood event.
- A flood-gate structure would be required across Saltwater Creek to prevent Burnett River back-up flooding but allow local floods to pass.
- There is a risk that people inside the levee become complacent about flood risk and become less resilient during events which overtop the levee.
- Localised rainfall that causes flooding in Saltwater Creek may inundate properties to a greater amount if the event occurs concurrently with a Burnett River flood and the flood gate is shut.
- Construction and on-going maintenance of this option would be in the order of $38 million.
- The costs for this option are similar to the estimated monetary benefits.

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1 1.5% AEP flood is the name given to a flood event which has about a 1 in 70 or 1.5% chance of occurring in any year.

2 1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year.

It would be similar to the January 2013 flood.
Option overview

Option D aims to protect Bundaberg East by constructing a levee on the river bank and across the Saltwater Creek floodplain. The levee would protect the Bundaberg East area from inundation from the Burnett River in the 1.5% AEP flood event.

It would involve:
- Construction of a levee generally following Quay Street and a section heading north towards the mill. The levee would be a combination of concrete wall and earthen mound.
- A flood gate across Saltwater Creek, which would be closed during times of Burnett River floods.

Find out more about this option

Community consultation on the flood mitigation options and the findings of the options assessment will take place from 24 October to 20 November 2016. To find out more about the flood mitigation options and to provide your feedback:

Visit the website
www.qld.gov.au/bundabergfloodstudy
Interactive mapping is available on the website so that you can see how the flood mitigation options would change flooding in your area.

Contact the project team
Email: bundabergfloodprotection@jacobs.com
Telephone: 1800 994 015 (during business hours)

Next steps

The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.

The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Bundaberg flood protection study
Developing a 10-year action plan for flood mitigation in Bundaberg.

Option E – Fairymead levee removal
Option E involves removal of existing levees at Fairymead on the floodplain downstream of Bundaberg.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015.

The following provides an overview of the assessment of Option E.

Viability
A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:

- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option E found that this option is likely to have significant impacts on areas outside of the benefited area.

Costs and benefits
Initial cost estimates indicate that capital costs for removing the Fairymead levees would be about $3.4 million.

The estimated reduction in flood damages (i.e. the tangible benefits) would be in the order of $0.1 million.

Summary of assessment against key criteria
- The option increases flow over the floodplain to the north and west, increasing flood levels in this area.
- Several buildings would experience an increase in flood level of 300 mm in a 1% AEP\(^1\) event.
- Due to the distance between the Fairymead levee and the Bundaberg urban area, the removal of this levee would reduce flood levels by a very small amount in Bundaberg.
- Reduced flood levels would be experienced upstream of the levees and on the eastern floodplain. In a 1% AEP event the benefit is limited to a distance of about 3 km upstream of the levee.
- The costs for this option would be about 30 times the estimated monetary benefits.

| Likelihood of obtaining environmental approval | ⚫ |
| Affordability | ⚫ |
| Tolerable impacts outside benefited area | ⚫ |

- Likely to achieve
- May achieve with modification
- Unlikely to achieve

\(^1\) 1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.
**Option overview**

The existing levees at Fairymead were originally constructed to protect the old Fairymead sugar mill. The levees are estimated as being around 2 m to 3 m in height, with levee crest level at around 5 m to 6 m AHD.

Following the Burnett River, the levees are located approximately 7.2 km downstream of Bundaberg CBD. Option E involves removal of about 2.5 km of the existing Fairymead levees.

**Figure 1: Option layout**

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**Find out more about this option**

Community consultation on the flood mitigation options and the findings of the options assessment will take place from **24 October to 20 November 2016**. To find out more about the flood mitigation options and to provide your feedback:

**Visit the website**

www.qld.gov.au/bundabergfloodstudy

Interactive mapping is available on the website so that you can see how the flood mitigation options would change flooding in your area.

**Contact the project team**

Email: bundabergfloodprotection@jacobs.com

Telephone: 1800 994 015 (during business hours)

**Next steps**

The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.

The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Bundaberg flood protection study
Developing a 10-year action plan for flood mitigation in Bundaberg.

Option F – Millaquin Bend widening
Option F involves deepening, widening and regular maintenance dredging of a section of the left bank of the Burnett River by excavation and dredging to improve flood conveyance through a constricted part of the river.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015.

The following provides an overview of the assessment of Option F.

Viability
A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:

- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option F found that this option may be viable with modifications to reduce impacts to areas outside of the benefited area. Dredging and mangrove removal works may negatively impact the local environment, and there is no opportunity for staging.

Costs and benefits
Initial cost estimates indicate that construction of widening the Burnett River at Millaquin Bend would be in the order of $60 million. Ongoing, maintenance dredging would be required at a cost of about $3 million per year, bringing the total construction and maintenance costs to $95 million.

The preliminary flood damages assessment for this option suggests that the estimated reduction in flood damages (i.e. the tangible benefits) would be in the order of $30 million.

Summary of assessment against key criteria
- This option reduces flood levels within Bundaberg through increased conveyance in the Burnett River.
- Approximately 440 properties would not be inundated in the 1% AEP\(^1\) flood event.
- Much of the benefit from this option occurs within Bundaberg East, meaning that the majority of benefits of this option would be lost if it was built in conjunction with another option that reduces damages in East Bundaberg (e.g. a levee).
- The costs for this option would be about three times the estimated monetary benefits.

<table>
<thead>
<tr>
<th>Likelihood of obtaining environmental approval</th>
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<tbody>
<tr>
<td>Affordability</td>
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<tr>
<td>Tolerable impacts outside benefited area</td>
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- Likely to achieve
- May achieve with modification
- Unlikely to achieve

\(^1\) 1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.
Option overview
Option F aims to increase conveyance within the Burnett River by reducing the flow constraint at Millaquin Bend. It would involve:

- deepening and widening of Burnett River through excavation and dredging activities, predicted to be 900,000 m³ of cut
- Construction of an engineered rock revetment wall of 1.4 km length
- 10 m wide level terrace, with a batter slope at the edge down to -5 m AHD (1 in 20 slope)
- Possible acquisition of parts of properties (but not houses) along the eastern side of Mariner’s Way
- Removal of mangrove vegetation
- Regular maintenance dredging of this area.

Figure 1: Option layout

Find out more about this option
Community consultation on the flood mitigation options and the findings of the options assessment will take place from 24 October to 20 November 2016. To find out more about the flood mitigation options and to provide your feedback:

Visit the website
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Interactive mapping is available on the website so that you can see how the flood mitigation options would change flooding in your area.

Contact the project team
Email: bundabergfloodprotection@jacobs.com
Telephone: 1800 994 015 (during business hours)

Next steps
The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.

The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Bundaberg flood protection study
Developing a 10-year action plan for flood mitigation in Bundaberg.

Option G – Elliot River diversion
Option G involves construction of a diversion channel from the Burnett River into the Elliot River.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015. The following provides an overview of the assessment of Option G.

Viability
A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:

- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option G found that this option is unviable as it would result in significant impacts along the route of the diversion and in the Elliot River and would cost of the order of $9,000 million, much more than the benefits delivered.

Costs and benefits
Initial cost estimates indicate that construction and maintenance of Option G would be approximately $9,000 million. This is mainly due to the volumes of cut required (about 300,000,000 m$^3$) to construct the channel. Costs would also include property purchase, bridge construction and ongoing vegetation management and maintenance within the diversion channel.

The estimated reduction in flood damages (i.e. the tangible benefits) for this option is around $90 million.

Summary of assessment against key criteria

- This option would reduce flow in the Burnett River and increase flow in the Elliot River. This would reduce flood levels in Bundaberg.
- This option would reduce flooding for about 3000 properties in the 1% AEP$^1$ flood event and prevent over-floor flooding in 1450 properties in the 1% AEP flood event.
- This option would have significant costs (in the order of $9,000 million). These costs would be approximately 100 times the benefits realised through reduced damages.
- Increased flood flow in the Elliot River would result in increased flood levels (up to 8 m higher) and very high velocities for properties along this river. This would impact about 60 houses along the Elliot River.
- Environmental issues would arise from diverting very large flows into the Elliot River, which has a small catchment and small flows compared to the Burnett River (100 times smaller).

Likelihood of obtaining environmental approval
Affordability
Tolerable impacts outside benefited area

Likely to achieve
May achieve with modification
Unlikely to achieve

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$^1$ 1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.
Option overview
Option G aims to decrease flow within the Burnett River by diverting floodwater into the Elliot River. It would involve construction of a 15 km diversion channel about 760 m wide and 30 m deep from the Burnett River, just south of Branyan, to the Elliot River. The diversion would fall about 9 m over the length of the channel.

The diversion channel between the Burnett River and Elliot River would need to traverse areas of high ground. The indicative alignment has been selected as it limits the volume of earthworks required as well as provides enough fall for the efficient flow of floodwater.

Construction of this option would require some property acquisitions, including farmland. It would also require a number of new bridges to be constructed across the diversion channel, including along the Bruce Highway and local roads.

Options to divert the Burnett River to other rivers, such as the Gregory and Isis rivers, were considered but were discounted due to these rivers being at higher elevation than the Burnett River.

A diversion into the Kolan River was also considered and would result in a similar performance, costs and impacts as the Elliot River diversion.

Figure 1 : Option layout

Find out more about this option
Community consultation on the flood mitigation options and the findings of the options assessment will take place from 24 October to 20 November 2016. To find out more about the flood mitigation options and to provide your feedback:

Visit the website
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Email: bundabergfloodprotection@jacobs.com
Telephone: 1800 994 015 (during business hours)

Next steps
The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.

The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Option H – Improving Emergency Access to Tallon Bridge

Option H involves improving emergency access to Tallon Bridge by creating an extension to the bridge from Gavin Street through to the roundabout near Bundaberg North Primary School.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015. The following provides an overview of the assessment of Option H.

Viability

A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:

- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option H found that this option will be viable. Environmental approval is likely due to the works being undertaken mainly in road reserves. The adoption of a viaduct to provide the access minimises the likelihood of impacts outside of the benefited area. Whilst the option has been identified as affordable it is difficult to quantify the benefits.

Costs and benefits

Initial estimates indicate that the construction and maintenance of this option would cost approximately $42 million.

Although there is no reduction in flood damages, approximately 1400 properties would no longer be isolated in a 1% AEP flood event. In addition, the available evacuation times for Bundaberg North would increase by about four hours.

Summary of assessment against key criteria

- This option would enable 1400 properties in Bundaberg North to have emergency access to Bundaberg South during a 1% AEP flood event.
- It would assist in reducing impacts on people as isolation is reduced and access to emergency services is increased.
- It would also decrease stress due to reduced isolation and improved access to emergency services during flood events.
- This option has limited benefits in very large events (e.g. larger than 2013).
- This option would have limited benefit for those properties to the east of Hinkler Drive or south of Hinkler Park.
- Afflux from the viaduct has not been assessed and would need to be considered in future design development.
- The costs for this option would be more than 10 times the estimated monetary benefits. It is difficult to quantify the benefits of this option as they are improvements to access and not reduced flood damages.

Likelihood of obtaining environmental approval

- Likely to achieve
- May achieve with modification
- Unlikely to achieve

Affordability

- Likely to achieve

Tolerable impacts outside benefited area

- Likely to achieve

1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.
Option H aims to enhance emergency access to Tallon Bridge by creating an extension to the bridge from Gavin Street through to the roundabout near Bundaberg North Primary School. A two-lane viaduct to replace Hinkler Drive was previously proposed, although this option was considered cost prohibitive. This option consists of a one-lane viaduct, which would run parallel to Hinkler Drive. The viaduct would only be used for evacuation purposes. This option would involve:

- Construction of a one-lane viaduct linking the existing Tallon Bridge (near Gavin Street) to the roundabout near Bundaberg North Primary School.
- An on-ramp at Gavin Street and raising of Gavin Street by 300 mm.
- Associated roadworks near the bridge piers and near the roundabout.

Find out more about this option

Community consultation on the flood mitigation options and the findings of the options assessment will take place from 24 October to 20 November 2016. To find out more about the flood mitigation options and to provide your feedback:

Visit the website
www.qld.gov.au/bundabergfloodstudy
Interactive mapping is available on the website so that you can see how the flood mitigation options would change flooding in your area.

Contact the project team
Email: bundabergfloodprotection@jacobs.com
Telephone: 1800 994 015 (during business hours)

Next steps
The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.

The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Bundaberg flood protection study
Developing a 10-year action plan for flood mitigation in Bundaberg.

Option I – Dams in the upper catchment
Option I involves construction of dam(s) in the upper Burnett River catchment to temporarily store floodwaters. No specific sites have been chosen.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015. The following provides an overview of the assessment of Option I.

Viability
A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:

- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’. The assessment of Option I found that this option is unviable with significant issues identified in all matters considered.

Costs and benefits
Initial cost estimates indicate that construction and maintenance of this option would be approximately $1300 million. This is based on the unit costs (i.e. cost per megalitre of volume) to construct other dams in Queensland.

The estimated reduction in flood damages (i.e. the tangible benefits) for this option is around $90 million.

Summary of assessment against key criteria
- This option would temporarily detain floodwater from the Burnett River and could reduce flood levels from the 1% AEP flood event to the 5% AEP flood event level.
- This would reduce flooding for about 3000 properties in the 1% AEP flood event and prevent over-floor flooding in 1450 properties in the 1% AEP flood event.
- Environmental approval of this option would be unlikely due to the environmental impacts in the impounded area.
- The temporary impounding of floodwaters would require the acquisition of large areas of agricultural and forested land.
- The costs would be very high ($1300 million) and more than 14 times the benefits realised through reduced damages.
- Benefits (in terms of reduced flood damages) would be in the order of $90 million.
- There is a risk that people downstream of the dam become complacent about flood risk and become less resilient during events which overtop/exceed the dam wall.

1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.
**Option overview**

Option I aims to protect properties on the lower Burnett River floodplain by constructing dams in the upper catchment, somewhere upstream of Mundubbera. No specific dam location has been investigated at this stage. This assessment has been carried out to determine whether dams in the upper catchment could provide enough flood mitigation to create significant benefits for the Bundaberg township.

Dams in the upper catchment could mitigate flood flows from the Upper Burnett, Auburn and/or Boyne catchments. This option could lower flood levels for a range of AEP events for all properties downstream of the dam. It would involve construction of a large 1.7 million megalitre dam built across the Burnett River floodplain or a number of smaller dams located in each of the Upper Burnett, Auburn and Boyne catchments. The aim would be to reduce the 1% AEP flood flow in Bundaberg from 17,000 m$^3$/s to 9,500 m$^3$/s which is similar to a 5% AEP flood event.

This option would require acquisition of land inundated by the dam and immediately downstream of the spillway.

**Find out more about this option**

Community consultation on the flood mitigation options and the findings of the options assessment will take place from 24 October to 20 November 2016. To find out more about the flood mitigation options and to provide your feedback:

**Visit the website**

www.qld.gov.au/bundabergfloodstudy

Interactive mapping is available on the website so that you can see how the flood mitigation options would change flooding in your area.

**Contact the project team**

Email: bundabergfloodprotection@jacobs.com

Telephone: 1800 994 015 (during business hours)

**Next steps**

The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.

The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
**Bundaberg flood protection study**

Developing a 10-year action plan for flood mitigation in Bundaberg.

**Option J – Floodway house purchase scheme**

Option J would involve either purchase or relocation (via land-swap) of select residential blocks in Bundaberg North that are deemed to be in a floodway with high depths and velocities.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015.

The following provides an overview of the assessment of Option J.

**Viability**

A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:

- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option J found that this option is viable. Environmental approval is likely due to the works being undertaken mainly in the urban area and limited impacts expected outside the benefitted area. The option was ranked as affordable due to the non-tangible benefits associated with reducing the risk to life during floods.

**Costs and benefits**

Initial cost estimates indicate that this option would cost in the order of $39 million. Costs would also include ongoing vegetation management and maintenance.

The preliminary flood damages assessment for this option suggests that the estimated reduction in flood damages (i.e. the tangible benefits) would be in the order of $5 million.

**Summary of assessment against key criteria**

- This option would remove 130 properties from the floodplain.
- The purchase of houses would have a result in social changes and social impacts in this area.
- In rare floods (i.e. larger than 2013 flood), the flooding conditions in this area become extremely hazardous and would likely result in destruction of many houses.
- The costs of the option are more than eight times the benefits to be realised through reduced flood damages. However, there are other non-tangible benefits associated with reducing the risk to life during floods, especially rare floods.

| Likelihood of obtaining environmental approval | 🟢 |
| Affordability | 🟢 |
| Tolerable impacts outside benefitted area | 🟢 |

- 🟢 Likely to achieve
- 🟠 May achieve with modification
- 🟥 Unlikely to achieve

1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.
Option overview

Option J involves either purchase or relocation (via land-swap) for all houses in the high flood hazard parts of Bundaberg North. A land-swap scheme would involve a change in land titles and a new parcel of land (located out of the floodplain) provided for property owners in return.

The houses to be purchased or relocated would be determined based on those parts of the residential precinct with a very high flood hazard. The flood modelling assessments indicate there are numerous residential blocks west of Hinkler Avenue (and a smaller area east of Hinkler Avenue) where the 1% AEP flood results in high depth and high velocity floodwater. One possible threshold for selection for purchase or land-swap is that the velocity-depth product for the whole residential block (i.e. an area bounded by four streets) is greater than 2.0 m²/s. This indicates a highly hazardous area as the standard for adult wading safety is 0.6 m²/s. These results are consistent with the high flood flows experienced in January 2013.

About 130 buildings have been identified within these high flood hazard residential blocks. Purchase of only some of these houses (possibly through a voluntary purchase scheme) would result in potentially increased flood hazard for those left behind. However, planting of vegetation on these vacant blocks could allow removal of houses over a longer period of time (say 10 years).

Figure 1 shows the high flood hazard residential blocks which meet the high flood hazard criteria.

Find out more about this option

Community consultation on the flood mitigation options and the findings of the options assessment will take place from 24 October to 20 November 2016. To find out more about the flood mitigation options and to provide your feedback:

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Interactive mapping is available on the website so that you can see how the flood mitigation options would change flooding in your area.

Contact the project team
Email: bundabergfloodprotection@jacobs.com
Telephone: 1800 994 015 (during business hours)

Next steps

The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.

The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Bundaberg flood protection study
Developing a 10-year action plan for flood mitigation in Bundaberg.

Option K – Upper floodplain evacuation improvements
Option K involves provision of better evacuation routes and access during floods to the communities of Goodnight, Morganville, Pine Creek, Givelda and Electra through raising of the Perry River Bridge on Walla Road and construction and upgrading of 4WD tracks.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015.

The following provides an overview of the assessment of Option K.

Viability
A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:

- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option K found that this option is viable. Environmental approval is likely due to the scale and type of works proposed and limited impacts are expected outside the benefitted area. The option was ranked as affordable due to the intangible benefits of reduced isolation and the decreased costs of emergency management during flood events.

Costs and benefits
Initial cost estimates indicate that construction of this option would be:

- Perry River bridge: about $15 to $17 million
- Pine Creek evacuation route: about $0.5 to $1 million

This option would not reduce flood inundation of any houses. However, it would significantly reduce the duration of isolation for a large rural community. Although there is no reduction in flood damages (i.e. the tangible benefits) an assessment of the loss of wages due to flood isolation has been undertaken. Based on the history of flood levels in the Burnett River, it is estimated that the Perry River bridge is cut for approximately 14 days per decade (or 140 days per century). The proposed bridge upgrade would reduce the time that the bridge is cut to one day per decade (or ten days per century). Based on the loss of income, this reduction in isolation would result in an estimated benefit of $0.7 million. However, the intangible benefits of reduced isolation and the decreased costs of emergency management during flood events (e.g. food drops etc) would result in greater economic benefits for this option.

Summary of assessment against key criteria

- This option would reduce isolation time for communities in the Goodnight Scrub, Givelda, Pine Creek localities during large flood events. Approximately 400 to 600 properties would have improved access during flood periods requiring less reliance upon emergency supplies.
- Construction of this option would be in the order of $16 million for the Perry River Bridge and $1 million for construction of the 4WD evacuation routes.
- This option has minimal impacts on others and would have a high likelihood of obtaining environmental approval.

| Likelihood of obtaining environmental approval | 🟢 |
| Affordability | 🟢 |
| Tolerable impacts outside benefitted area | 🟢 |

- Likely to achieve
- May achieve with modification
- Unlikely to achieve

<sup>1</sup> 1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.
Option overview

Option K aims to provide better evacuation access in Goodnight, Morganville, Pine Creek, Givelda and Electra which can be isolated for up to two weeks due to low level bridge crossings and the lack of adequate and maintained 4WD access tracks.

To provide better access, it is proposed to:

- Raise the level of the Perry River Bridge on Walla Road from 24.5 m AHD to 32.3 m AHD
- Upgrade the existing 4WD evacuation route for Pine Creek, Givelda and Electra.

Figure 1: Option layout

Find out more about this option

Community consultation on the flood mitigation options and the findings of the options assessment will take place from 24 October to 20 November 2016. To find out more about the flood mitigation options and to provide your feedback:

Visit the website
www.qld.gov.au/bundabergfloodstudy

Interactive mapping is available on the website so that you can see how the flood mitigation options would change flooding in your area.

Contact the project team

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Next steps

The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.

The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Option A – Burnett River conveyance improvement

Option A involves river dredging along the town reach, removing Harriet Island, widening Millaquin Bend and regular maintenance dredging.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015.

Option overview

Option A aims to increase the amount of flood flow conveyed within the Burnett River. This would help to reduce flood levels on the floodplain. It would involve:

- Dredging of the Burnett River within the town reach (to -6m Australian Height Datum (AHD))
- Dredging and excavation at Millaquin Bend
- Removal of Harriet Island (and dredging to -6m AHD)
- Regular ongoing maintenance dredging of these three areas.

Figure 1: Option layout
What would this option achieve?

Dredging the river and removing Harriet Island would keep more of the flood flow within the banks of the river. This option:

• Avoids over-floor flooding for about 470 properties in Bundaberg in a 1% AEP flood event, of which 160 are located in Bundaberg North, and 250 in Bundaberg East (with the remainder outside these two areas).

• Avoids over-floor flooding for up to 330 properties in Bundaberg North for flood events smaller than the 1% AEP flood event, such as the 1942 and 2010 flood events.

• Reduces peak flood levels upstream of Millaquin Bend by about 0.5 m to 0.8 m.

For smaller flood events (more frequent than the 1% AEP flood event) the dredging may increase flood levels in parts of Bundaberg North. These impacts would mainly affect agricultural land, although some residential properties could have increases of about 0.03 m (i.e. 30 mm).

As the river narrows at Millaquin Bend, additional water is pushed through this narrow point, causing flood levels in the river to rise. This would result in additional water breaking out at the end of Mariners Way, causing higher peak flood levels (up to 0.3 m) in Bundaberg North.

Figure 2 shows the changes to flood levels for the 1% AEP flood event.

Figure 2 : 1% AEP Flood Aflux (m)

1 1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.
Viability
A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:
- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option A found that this option is likely to have significant costs relating to construction and ongoing maintenance.

Costs and benefits
Initial cost estimates indicate that construction of this option would cost around $188 million. This assumes that Harriet Island is removed via a cost-neutral extraction agreement. Ongoing maintenance of dredging activities would be about $6 million per year.

The total cost of construction and ongoing maintenance for Option A has been estimated at $235 million. The estimated reduction in flood damages (i.e. the tangible benefits) would be in the order of $35 million.

Summary of assessment against key criteria
Each option has been assessed against a set of 16 criteria. These criteria, if achieved by an option, indicate a strong link between the option and the overall objectives of the Bundaberg Flood Protection Study.

The performance of this option against the 16 criteria is presented on the next page. These assessments will be used to derive an overall multi-criteria analysis score for this option. This score is then used in conjunction with other assessments to compare this option against the other options.

A summary of the performance of this option against the criteria as well as the costs, benefits and viability issues is presented below.

- This option would result in more flow in the river and less flow on the floodplain. This would reduce flood levels in some urban areas.
- The increased flood flow in the river would result in some increased flood levels in Bundaberg North (up to 0.3 m) for smaller, more frequent flood events.
- Approximately 470 properties in the Bundaberg area would not be inundated in the 1% AEP flood event.
- Construction and ongoing maintenance of this option would cost around $235 million making it a moderate to high cost option.
- The cost of this option would be about five times the estimated monetary benefits.
- The option would require the treatment of dredged material and land-based disposal of dredge spoil due to the very low likelihood of at-sea disposal.
- It is expected that there would be difficulties in obtaining an environmental approval for such a large dredging program.
<table>
<thead>
<tr>
<th>Objective</th>
<th>Criteria</th>
<th>How does it perform against the criteria?</th>
<th>Preliminary Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achieve a balanced investment approach that considers social, economic</td>
<td>Economic benefits (increased confidence leading to economic growth) for the broader region</td>
<td>Increased economic confidence due to decreased frequency of flooding.</td>
<td>✓</td>
</tr>
<tr>
<td>and environmental issues</td>
<td>Environmental benefits: Terrestrial, aquatic, riverine benefits, effects upon heritage</td>
<td>Dredging the river and removal of Harriett Island has no environmental benefits, and may cause moderate environmental harm.</td>
<td>✗</td>
</tr>
<tr>
<td>Considering social, economic and environmental issues (independent of</td>
<td>Social Health benefits: Effects upon mental health, psychological issues, stress</td>
<td>Reduced stress for properties which have reduced flood depths.</td>
<td>✓</td>
</tr>
<tr>
<td>the improvements to flooding)</td>
<td>Community benefits: Effects upon “livability” of the area, urban amenity, social cohesion</td>
<td>Loss of Harriett Island may reduce the urban amenity of the area.</td>
<td>✗</td>
</tr>
<tr>
<td>Long term reduction in flood risk and adaptable levels of protection</td>
<td>Adaptable flood performance with respect to climate change</td>
<td>Limited ability to undertake further dredging to allow for the increased flood levels and sea level rises as a result of climate change.</td>
<td>✓</td>
</tr>
<tr>
<td>A focus on the long-term benefits and adaptability of options and also</td>
<td>Long term benefits</td>
<td>Dredging would need to re-occur over time to maintain the capacity of the Burnett River. This has been included in cost estimate.</td>
<td>✓</td>
</tr>
<tr>
<td>the impact on future development land</td>
<td>Decreases flood damage to areas of future development</td>
<td>Minor decrease in 1% AEP inundation extent in areas available for development.</td>
<td>−</td>
</tr>
<tr>
<td></td>
<td>Staged benefits with staged construction / investment</td>
<td>Dredging could occur over time with the benefits realised gradually.</td>
<td>−</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Harriett Island to be removed over time using a sand extraction licence.</td>
<td>−</td>
</tr>
</tbody>
</table>

✓ Achieves the criteria  ✗ Partially achieves criteria or has no change to current status  ✗ Does not achieve the criteria
Technical Discussion Paper

Find out more about this option
Community consultation on the flood mitigation options and the findings of the options assessment will take place from 24 October to 20 November 2016. To find out more about the flood mitigation options and to provide your feedback:

Visit the website
www.qld.gov.au/bundabergfloodstudy
Interactive mapping is available on the website so that you can see how the flood mitigation options would change flooding in your area.

Contact the project team
Email: bundabergfloodprotection@jacobs.com
Telephone: 1800 994 015 (during business hours)

Next steps
The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.
The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Option B – Bundaberg North floodway

Option B involves construction of four lakes either side of Hinkler Avenue to improve conveyance through Bundaberg North and a channel from Queen Street to Waterview Road.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015.

Option overview

Option B aims to decrease flood levels in the Burnett River by increasing flow through Hinkler and Federation Parks. It would involve construction of:

- a series of four lakes in the parks (two either side of Hinkler Avenue)
- regrading of Thornhill Road to improve the flow of floodwater through the floodway
- a 2 km long, 100 m wide channel from Queen Street to Waterview Road.

Construction of this option would require some property acquisitions, including farmland.

Figure 1: Option layout

Note: The outcome depicted is a potential only of the implications associated with this option – and this outcome may not occur or eventuate...
What would this option achieve?

Creating a floodway trough Hinkler/ Federation Park would increase flow through this location by about 20%, and reduce peak flow in the Burnett River by up to 350 m³/s. This option:

- Avoids over-floor flooding for about 110 properties in Bundaberg in a 1% AEP\(^1\) flood event, of which 95 are located in Bundaberg North, and 10 in Bundaberg East.
- Avoids over-floor flooding for up to 60 properties in Bundaberg North for flood events smaller than the 1% AEP flood event, such as the 1942 and 2010 flood events.
- Reduces peak flood levels in the Burnett River near Harriet Island by about 0.04 m (i.e. 40 mm).

The floodway does not reduce the number of buildings with over-floor flooding in frequent flood events (i.e. events more frequent than and including the 5% AEP flood event).

The floodway increases flood levels downstream in the farmland near Waterview Road and Paddy Island. In a 1% AEP event, this increases over-floor flooding for one building. In rarer flood events, up to 12 houses experience increased over-floor flooding.

Figure 2 shows the changes to flood levels for the 1% AEP flood event.

**Figure 2 : 1% AEP Flood Afflux (m)**

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\(^1\) 1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.
Viability

A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:

- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option B found that this option may be viable with modifications to reduce costs and impacts to areas outside of the benefited area. However, the effectiveness of the option would also be impacted decreasing the relatively small reduction in flood damages achieved.

Costs and benefits

Initial cost estimates indicate that construction of the lakes would be about $124 million.

The estimated reduction in flood damages (i.e. the tangible benefits) would be in the order of $7 million.

Summary of assessment against key criteria

Each option has been assessed against a set of 16 criteria. These criteria, if achieved by an option, indicate a strong link between the option and the overall objectives of the Bundaberg Flood Protection Study. The performance of this option against the 16 criteria is presented on the next page. These assessments will be used to derive an overall multi-criteria analysis score for this option. This score is then used in conjunction with other assessments to compare this option against the other options.

A summary of the performance of this option against the criteria as well as the costs, benefits and viability issues is presented below.

| Likelihood of obtaining environmental approval | ☺ |
| Affordability | ☟ |
| Tolerable impacts outside benefited area | ☟ |

- Likely to achieve
- May achieve with modification
- Unlikely to achieve

- This option would involve diverting floodwater through Hinkler and Federation Parks, reducing flood levels in the Burnett River and Bundaberg North.
- Downstream of the lakes and floodway, some properties would experience increased flood levels.
- This option would have high costs due to the large volume of excavation and the need to treat and dispose of this material.
- Benefits of this option are limited due to the ability to lower flood levels in this area. The flow rate through this area would not change and the flood levels in the urban area are not significantly lowered.
- The costs for this option would be about 16 times the estimated monetary benefits.
## Technical Discussion Paper

### Evaluation criteria

<table>
<thead>
<tr>
<th>Objective</th>
<th>Criteria</th>
<th>How does it perform against the criteria?</th>
<th>Preliminary Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reduce flood risk to life and reduced flood impacts on people</strong></td>
<td>Improves people’s safety during flood events and people’s ability to evacuate</td>
<td>• Minor increases flows over Hinkler Avenue, decreasing access to Tallon Bridge and hindering evacuation</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Reduces the impacts on people for very large / rare floods (larger than say Jan 2013 flood)</td>
<td>• Minor reductions in flood levels in events greater than the 1% AEP event.</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Increase people’s resilience to flooding by improving their preparation for flood events and ability to recover after flood events</td>
<td>• Minor decreases in over-floor flooding would improve ability to recover after flood events.</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Targets vulnerable community members or areas (e.g. elderly, poor)</td>
<td>• Targets Bundaberg North (vulnerable community).</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Reduce flood risk to property</strong></td>
<td>Reduces damages and costs to residential property caused by floods</td>
<td>• Minor decreases in flood damages.</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Reduces damages and costs to business / industry / government caused by floods</td>
<td>• Minor decreases in flood damages.</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Reduces the impacts on property for very large / rare floods (larger than say Jan 2013 flood)</td>
<td>• Minor reductions in flood levels in events greater than the 1% AEP event.</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Increase a property’s “flood resilience” (improving a property so it is less affected by a flood event and recovery after an event is faster)</td>
<td>• Minor decreases in flood levels would improve resilience.</td>
<td>—</td>
</tr>
<tr>
<td><strong>Achieve a balanced investment approach that considers social, economic and environmental issues</strong></td>
<td>Economic benefits (increased confidence leading to economic growth) for the broader region</td>
<td>• No change for existing situation.</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Environmental benefits: Terrestrial, aquatic, riverine benefits, effects upon heritage</td>
<td>• Acid sulphate soils would be generated but would be treated in this option.</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Social Health benefits: Effects upon mental health, psychological issues, stress</td>
<td>• Positive impact on mental health resulting from undertaking mitigation works.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Community benefits: Effects upon “livability” of the area, urban amenity, social cohesion</td>
<td>• Improves livability via creation of new amenity area.</td>
<td>—</td>
</tr>
<tr>
<td><strong>Long term reduction in flood risk and adaptable levels of protection</strong></td>
<td>Adaptable flood performance with respect to climate change</td>
<td>• The lakes and floodway would be difficult to adapted to change performance once operational.</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td><strong>Long term benefits</strong></td>
<td>• Floodway and lakes would have long design life.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Decreases flood damage to areas of future development</td>
<td>• Minimal change to existing situation.</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Staged benefits with staged construction / investment</td>
<td>• Construction of floodway could not be easily staged.</td>
<td>✗</td>
</tr>
</tbody>
</table>

- ✓ Achieves the criteria
- — Partially achieves criteria or has no change to current status
- ✗ Does not achieve the criteria
Technical Discussion Paper

Find out more about this option
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The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Option C – Bundaberg North levee and floodway

Option C involves constructing a levee around most of Bundaberg North. Lakes and widening of the rail bridge at Hanbury Street would also be required to improve conveyance through Bundaberg North.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015.

Option overview

Option C aims to direct floodwaters to the west of Bundaberg North through the construction of a levee and floodway system. It would involve:

- Construction of a levee around parts of Bundaberg North, comprising both concrete and earth levees.
- Construction of floodgates at intersections of the levee route with roads.
- Construction of a floodway (lakes) between the Burnett River and Hinkler Park, replacing the flow capacity lost through Bundaberg North.
- Lowering of ground levels between the Burnett River and proposed lakes, widening of the railway bridge near Hanbury Street and regrading of Thomhill Road to improve the flow of floodwater through the floodway.

The southern part of the levee would be constructed to the 1% AEP flood level (with a freeboard). The northern part of the levee would be constructed to the 1.5% AEP flood level. In large events, this would allow initial overtopping of the levee to occur along the northern (earth) sections, rather than a sudden overtopping, allowing safer evacuation. Construction of this option would require some property acquisitions.

Figure 1: Option layout
What would this option achieve?

Construction of the levee would prevent any flood water to enter the area surrounded by the levee during flood events up to and including the 1.5% AEP flood event. This option:

- Avoids over-floor flooding for about 150 properties in Bundaberg in a 1% AEP flood event, all of which are located in Bundaberg North.
- Avoids over-floor flooding for up to 175 properties in Bundaberg North for flood events smaller than the 1.5% AEP flood event, such as the 1942 and 2010 flood events.
- Reduces peak 1% AEP flood levels for properties within the levee by 0.3m to 1.2m.
- Increases flood levels generally around 0.2 m for some properties outside the levee.

For floods rarer/larger than the 1.5% AEP flood, the levee would be designed to overtop in a controlled manner along the northern earth section of the levee. This would result in back-up flooding from the north prior to overtopping of the southern (concrete) levee section.

Overtopping of the levee would pose a risk for the community within the levee in relation to emergency evacuation. In particular, evacuation may be hindered and become dangerous due to changes in flood behaviour, the velocity and depth of rising floodwater, and peoples’ response to the flood threat.

Changes to flood levels for the 1% AEP flood event are shown in Figure 2.

Figure 2: 1% AEP Flood Afflux (m)

1 1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.

2 1.5% AEP flood is the name given to a flood event which has about a 1 in 70 or 1.5% chance of occurring in any year.
Viability
A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:
• The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
• Significant or unaffordable costs of construction or ongoing maintenance
• Potential for unacceptable impacts on other areas.
An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option C found that this option may be viable with modifications to reduce costs and impacts to areas outside of the benefited area. However any modifications are likely to decrease the reduction of flood damages achieved.

Costs and benefits
Initial cost estimates indicate that construction of Option C would be approximately $85 million. This would include about $20 to $30 million for the levee and about $50 to $60 million for construction of the floodway (including property acquisitions). The total cost of the option including ongoing maintenance is estimated at $100 million.

Estimated reduction in flood damages (i.e. the tangible benefits) would be in the order of about $11 million.

Summary of assessment against key criteria
Each option has been assessed against a set of 16 criteria. These criteria, if achieved by an option, indicate a strong link between the option and the overall objectives of the Bundaberg Flood Protection Study. The performance of this option against the 16 criteria is presented on the next page. These assessments will be used to derive an overall multi-criteria analysis score for this option. This score is then used in conjunction with other assessments to compare this option against the other options.

A summary of the performance of this option against the criteria as well as the costs, benefits and viability issues is presented below.

• This option would direct floodwaters around Bundaberg North through the construction of a levee and floodway (lake) system.
• This option would provide protection for about 450 properties up to the 1.5% AEP flood event.
• For events rarer/larger than the 1.5% AEP flood event, initial overtopping of the levee would occur along the northern (earth) sections, rather than a sudden overtopping, allowing safer evacuation.
• There is a risk that people inside the levee may become complacent about flood risk and become less resilient during events that overtop the levee.
• The levee would have a major impact on the urban area, restricting access and creating a visual barrier.
• Increased flood levels of up to 0.6m would be experienced by some properties outside of the levee.
• The total cost of construction and ongoing maintenance of this option would be about $100 million.
• The costs for this option would be about 10 times the estimated monetary benefits.
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Reduce flood risk to life and reduced flood impacts on people</td>
<td>Improves people’s safety during flood events and people’s ability to evacuate</td>
<td>• About 450 properties may not be flooded in the 1.5% AEP event.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Evacuation would be required if levee bank was going to be exceeded.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Safety decreased – risk of levee or flood gate failure.</td>
<td></td>
</tr>
<tr>
<td>Reducing the occurrence of flood deaths and injury and improving people’s ability to plan for and recover after a flood</td>
<td>Reduces the impacts on people for very large / rare floods (larger than say Jan 2013 flood)</td>
<td>• Levee begins to overtop in the 1.5% AEP flood event.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Minor increase in impacts for large events due to lack of preparedness when levee overtops.</td>
<td></td>
</tr>
<tr>
<td>Increase people’s resilience to flooding by improving their preparation for flood events and ability to recover after flood events</td>
<td>• Reduced resilience due to complacency.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• However, increased resilience for those flood events that do not overtop levee.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Levee and/or floodgates have a risk of overtopping or failure.</td>
<td></td>
</tr>
<tr>
<td>Targets vulnerable community members or areas (eg. elderly, poor)</td>
<td></td>
<td>• Targets Bundaberg North (vulnerable community).</td>
<td>✓</td>
</tr>
<tr>
<td>Reduce flood risk to property</td>
<td>Reduces damages and costs to residential property caused by floods</td>
<td>• Moderate decrease in flood damages.</td>
<td>✓</td>
</tr>
<tr>
<td>Reducing flood damages and properties and improving the recovery of businesses after floods</td>
<td>Reduces damages and costs to business / industry / government caused by floods</td>
<td>• Moderate decrease in flood damages.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Reduces the impacts on property for very large / rare floods (larger than say Jan 2013 flood)</td>
<td>• Minor increase in impacts for large events due to lack of preparedness when levee overtops.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increase a property’s “flood resilience” (improving a property so it is less affected by a flood event and recovery after an event is faster)</td>
<td>• The levee will prevent properties from being inundated for events up to the 1.5% AEP, so partially meets criteria.</td>
<td></td>
</tr>
<tr>
<td>Achieve a balanced investment approach that considers social, economic and environmental issues</td>
<td>Economic benefits (increased confidence leading to economic growth) for the broader region</td>
<td>• Potential for increased confidence due to flood protection of commercial premises, so partially meets criteria.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environmental benefits: Terrestrial, aquatic, riverine benefits, effects upon heritage</td>
<td>• No environmental benefits are expected.</td>
<td></td>
</tr>
<tr>
<td>Considering social, economic and environmental issues (independent of the improvements to flooding)</td>
<td>Social Health benefits: Effects upon mental health, psychological issues, stress</td>
<td>• Reduced stress due to reduced frequency of flooding.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Community benefits: Effects upon “livability” of the area, urban amenity, social cohesion</td>
<td>• Lakes may provide new areas of urban amenity.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The levee (particularly the concrete section) could negatively detract from the liveability and amenity of the area.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Construction would have noise impacts.</td>
<td>X</td>
</tr>
<tr>
<td>Long term reduction in flood risk and adaptable levels of protection</td>
<td>Adaptable flood performance with respect to climate change</td>
<td>• Would be difficult to raise levees due to increased obstructions and heights in urban areas.</td>
<td>X</td>
</tr>
<tr>
<td>A focus on the long-term benefits and adaptability of options and also the impact on future development land</td>
<td>Long term benefits</td>
<td>• Benefits realised over the long term.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Decreases flood damage to areas of future development</td>
<td>• No decreased flood damage to areas identified as “Emerging Communities” or greenfill urban residential land.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Staged benefits with staged construction / investment</td>
<td>• Very difficult to stage as all of ring levee needs to be fully completed to gain benefits. Also difficult to raise further in future.</td>
<td>X</td>
</tr>
</tbody>
</table>

✓ Achieves the criteria  ❌ Partially achieves criteria or has no change to current status  ❌ Does not achieve the criteria
Technical Discussion Paper

Find out more about this option
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Visit the website
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Interactive mapping is available on the website so that you can see how the flood mitigation options would change flooding in your area.

Contact the project team
Email: bundabergfloodprotection@jacobs.com
Telephone: 1800 994 015 (during business hours)

Next steps
The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.

The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Option D – Bundaberg East levee

Option D includes construction of a levee along the south bank of the river to reduce flooding in Bundaberg East. It would require construction of two floodgates (with one large floodgate for Saltwater Creek).

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015.

Option overview

Option D aims to protect Bundaberg East by constructing a levee on the river bank and across the Saltwater Creek floodplain. The levee would protect the Bundaberg East area from inundation from the Burnett River in the 1.5% AEP flood event.

It would involve:
- Construction of a levee generally following Quay Street and a section heading north towards the mill. The levee would be a combination of concrete wall and earth mound.
- A flood gate across Saltwater Creek, which would be closed during times of Burnett River floods.

1 1.5% AEP flood is the name given to a flood event which has about a 1 in 70 or 1.5% chance of occurring in any year.
What would this option achieve?

Building a levee would protect Bundaberg South and Bundaberg East from Burnett River flooding in events up to a 1.5% AEP flood event. This option:

- Avoids over-floor flooding for about 320 properties in Bundaberg in a 1% AEP\(^2\) flood event, all of which in are located in Bundaberg South and East.
- Avoids over-floor flooding for up to 440 properties in Bundaberg South and East for flood events smaller than the 1.5% AEP flood event, such as the 1942 and 2010 flood events.

Some localised flooding may occur if a flood event occurs in Saltwater/Bundaberg Creek when the floodgates are closed.

Overtopping of the levee would pose a risk for the community within the levee in relation to emergency evacuation. In particular, evacuation may be hindered and become dangerous due to changes in flood behaviour, the velocity and depth of rising floodwater, and peoples’ response to the flood threat.

Changes to flood levels for the 1% AEP flood event are shown in Figure 2.

---

\(^2\) 1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.
Viability
A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:

- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option D found that this option will be viable. Environmental impacts are likely to be low because of the urban nature of the levee route. Adverse impacts outside the benefitted area will be tolerable as the levee will prevent flood water from the river backing up into Bundaberg South rather than diverting flows.

Costs and benefits
Initial cost estimates indicate that construction of Option D would be approximately $30 to $35 million. Maintenance costs are approximately $500,000 per annum. The total cost of the project including ongoing operation and maintenance of the option is $38 million.

Estimated reduction in flood damages (i.e. the tangible benefits) of this option is around $29 million.

Summary of assessment against key criteria
Each option has been assessed against a set of 16 criteria. These criteria, if achieved by an option, indicate a strong link between the option and the overall objectives of the Bundaberg Flood Protection Study. The performance of this option against the 16 criteria is presented on the next page. These assessments will be used to derive an overall multi-criteria analysis score for this option. This score is then used in conjunction with other assessments to compare this option against the other options.

A summary of the performance of this option against the criteria as well as the costs, benefits and viability issues is presented below.

<table>
<thead>
<tr>
<th>Likelihood of obtaining environmental approval</th>
<th>Likely to achieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affordability</td>
<td>Likely to achieve</td>
</tr>
<tr>
<td>Tolerable impacts outside benefited area</td>
<td>Likely to achieve</td>
</tr>
</tbody>
</table>

- This option would prevent floodwaters from the Burnett River backing up into Bundaberg South for events up to the 1.5% AEP flood event.
- This option would provide protection for about 440 properties up to the 1.5% AEP (70 year ARI) flood event.
- It would reduce flooding for about 320 properties in the 1% AEP flood event.
- A flood-gate structure would be required across Saltwater Creek to prevent Burnett River back-up flooding but allow local floods to pass.
- There is a risk that people inside the levee become complacent about flood risk and become less resilient during events which overtop the levee.
- Localised rainfall that causes flooding in Saltwater Creek may inundate properties to a greater amount if the event occurs concurrently with a Burnett River flood and the flood gate is shut.
- Construction and on-going maintenance of this option would be in the order of $38 million.
- The costs for this option are similar to the estimated monetary benefits.
<table>
<thead>
<tr>
<th>Objective</th>
<th>Criteria</th>
<th>How does it perform against the criteria?</th>
<th>Preliminary Score</th>
</tr>
</thead>
</table>
| Reduce flood risk to life and reduced flood impacts on people | Improves people’s safety during flood events and people’s ability to evacuate | • Approximately 440 properties Bundaberg South would not be flooded in the 2% AEP event, and around 320 in the 1% AEP event.  
• Evacuation would be required if the levee overtops.  
• Reduced safety due to levee or floodgate failure, but safe routes exist to higher ground to south and west. | ✓ |
| Reducing the occurrence of flood deaths and injury and improving people’s ability to plan for and recover after a flood | Reduces the impacts on people for very large / rare floods (larger than say Jan 2013 flood) | • Levee begins to overtop in the 1.5% AEP flood event.  
• Minor increase in impacts for large events due to lack of preparedness when levee overtops. | — |
| Increase people’s resilience to flooding by improving their preparation for flood events and ability to recover after flood events | • Reduction in number of properties inundated would result in an increased ability to recover for those events.  
• Reduced resilience due to complacency. Emergency management education relating to levee evacuation plan may enable community to be more prepared and therefore more resilient.  
• Levee and/or floodgates have a risk of overtopping or failure. | ✓ |
| Targets vulnerable community members or areas (e.g. elderly, poor) | • Targets Bundaberg East (partially vulnerable community). | ✓ |
| Reduce flood risk to property | Reduces damages and costs to residential property caused by floods | • High decrease in flood damages. | ✓ |
| Reducing flood damages and properties and improving the recovery of businesses after floods | • High decrease in flood damages. | ✓ |
| Reduce flood risk to property | Reduces damages and costs to business / industry / government caused by floods | • Minor increase in impacts for large events due to lack of preparedness when levee overtops. | — |
| Reduce flood risk to property | Reduces the impacts on property for very large / rare floods (larger than say Jan 2013 flood) | • The levee will prevent properties from being inundated for events up to the 1.5% AEP so partially meets criteria. | ✓ |
| Achieve a balanced investment approach that considers social, economic and environmental issues | Economic benefits (increased confidence leading to economic growth) for the broader region | • Increased investment due to lower flood risk. | ✓ |
| Considering social, economic and environmental issues (independent of the improvements to flooding) | Environmental benefits: Terrestrial, aquatic, riverine benefits, effects upon heritage | • Possible impacts to heritage sites along route (e.g. pedestrian bridge over Saltwater Creek). | ❌ |
| Social Health benefits: Effects upon mental health, psychological issues, stress | • Reduced stress due to reduced frequency of flooding. | ✓ |
| Community benefits: Effects upon “livability” of the area, urban amenity, social cohesion | • The levee (in particular the concrete wall section) could negatively detract from the liveability and amenity of the area.  
• Construction of levees will have some noise impacts. | ❌ |
| Long term reduction in flood risk and adaptable levels of protection | Adaptable flood performance with respect to climate change | • Levees could be raised over time to increase protection for an increase in severity and frequency of flooding.  
• Concrete levee wall could be designed to be adaptable. | ✓ |
| A focus on the long-term benefits and adaptability of options and also the impact on future development land | Long term benefits | • Benefits of the levee would be realised over the long term. | ✓ |
| | Decreases flood damage to areas of future development | • No decreased flood damage to areas identified as “emerging Communities” or green fill urban residential land. | — |
| | Staged benefits with staged construction / investment | • The levee could be the first stage of a higher levee. | ✓ |

✓ Achieves the criteria  ❌ Partially achieves criteria or has no change to current status  ✗ Does not achieve the criteria
Technical Discussion Paper

Find out more about this option
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Interactive mapping is available on the website so that you can see how the flood mitigation options would change flooding in your area.

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Next steps
The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.

The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Technical Discussion Paper

Bundaberg flood protection study

Developing a 10-year action plan for flood mitigation in Bundaberg.

Option E – Fairymead levee removal

Option E involves removal of existing levees at Fairymead on the floodplain downstream of Bundaberg.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015.

Option overview

The existing levees at Fairymead were originally constructed to protect the old Fairymead sugar mill. The levees are estimated as being around 2 m to 3 m in height, with levee crest level at around 5 m to 6 m AHD. Following the Burnett River, the levees are located approximately 7.2 km downstream of Bundaberg CBD. Option E involves removal of about 2.5 km of the existing Fairymead levees.

Figure 1: Option layout
Technical Discussion Paper

What would this option achieve?
Removal of the Fairymead levee allows floodwaters to flow over the floodplain to the north and west. This option:

- Provides no reduction in the number of properties with over-floor flooding in a 1% AEP flood event.
- Reduces flood levels upstream of the levee and on the eastern floodplain by 0.06 to 0.24 m (i.e. 60 mm to 240 mm) in a 1% AEP event. This benefit is limited to a distance of 3 km upstream of the levee.
- Reduces flood levels for around 80 houses in Gooburrum and Burnett Heads.
- Increases flood levels for several buildings behind the levee by up to 0.3 m.

Additional flow over the floodplain to the north and west increases flood levels in this area. In a 1% AEP event, the land directly behind the levee experiences up to 0.5 m increase in peak flood levels. Other buildings behind the levee experience an increase of between 0.08 m and 0.16 m in the 1% AEP event. Areas of caneland further downstream experience an increase in peak flood levels of 0.15 m to 0.27 m.

Figure 2 shows the changes to flood levels for the 1% AEP flood event.

Figure 2 : 1% AEP Flood Afflux (m)

1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.
Viability
A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:

- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option E found that this option is likely to have significant impacts on areas outside of the benefited area.

Costs and benefits
Initial cost estimates indicate that capital costs for removing the Fairymead levees would be about $3.4 million.

The estimated reduction in flood damages (i.e. the tangible benefits) would be in the order of $0.1 million.

Summary of assessment against key criteria
Each option has been assessed against a set of 16 criteria. These criteria, if achieved by an option, indicate a strong link between the option and the overall objectives of the Bundaberg Flood Protection Study. The performance of this option against the 16 criteria is presented on the next page. These assessments will be used to derive an overall multi-criteria analysis score for this option. This score is then used in conjunction with other assessments to compare this option against the other options.

A summary of the performance of this option against the criteria as well as the costs, benefits and viability issues is presented below.

- The option increases flow over the floodplain to the north and west, increasing flood levels in this area.
- Several buildings would experience an increase in flood level of 300 mm in a 1% AEP event.
- Due to the distance between the Fairymead levee and the Bundaberg urban area, the removal of this levee would reduce flood levels by a very small amount in Bundaberg.
- Reduced flood levels would be experienced upstream of the levees and on the eastern floodplain. In a 1% AEP event the benefit is limited to a distance of about 3 km upstream of the levee.
- The costs for this option would be about 30 times the estimated monetary benefits.
## Technical Discussion Paper

### Evaluation criteria

<table>
<thead>
<tr>
<th>Objective</th>
<th>Criteria</th>
<th>How does it perform against the criteria?</th>
<th>Preliminary Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reduce flood risk to life and reduced flood impacts on people</strong></td>
<td>Improves people’s safety during flood events and people’s ability to evacuate</td>
<td>• No material change to people’s safety.</td>
<td></td>
</tr>
<tr>
<td><strong>Reducing the occurrence of flood deaths and injury</strong></td>
<td>Reduces the impacts on people for very large / rare floods (larger than say Jan 2013 flood)</td>
<td>• The option does not have any benefit in very large / rare floods.</td>
<td></td>
</tr>
<tr>
<td><strong>Increasing people’s resilience to flooding by improving their preparation for flood events and ability to recover after flood events</strong></td>
<td>Increase people’s resilience to flooding by improving their preparation for flood events and ability to recover after flood events</td>
<td>• No change to people's preparation or recovery.</td>
<td></td>
</tr>
<tr>
<td><strong>Targets vulnerable community members or areas (e.g. elderly, poor)</strong></td>
<td>Targets vulnerable community members or areas (e.g. elderly, poor)</td>
<td>• Does not specifically target more vulnerable areas.</td>
<td></td>
</tr>
<tr>
<td><strong>Reduce flood risk to property</strong></td>
<td>Reduces damages and costs to residential property caused by floods</td>
<td>• Some very minor reduction in damages so partially meets criteria.</td>
<td></td>
</tr>
<tr>
<td><strong>Reducing flood damages and properties and improving the recovery of businesses after floods</strong></td>
<td>Reduces damages and costs to business / industry / government caused by floods</td>
<td>• Insignificant changes to damages affecting business / industry / government.</td>
<td></td>
</tr>
<tr>
<td><strong>Reduce flood risk to property</strong></td>
<td>Reduces the impacts on property for very large / rare floods (larger than say Jan 2013 flood)</td>
<td>• The option does not have any benefit in very large / rare floods.</td>
<td></td>
</tr>
<tr>
<td><strong>Increase a property’s “flood resilience” (improving a property so it is less affected by a flood event and recovery after an event is faster)</strong></td>
<td>Increase a property’s “flood resilience” (improving a property so it is less affected by a flood event and recovery after an event is faster)</td>
<td>• No change from existing situation.</td>
<td></td>
</tr>
<tr>
<td><strong>Achieve a balanced investment approach that considers social, economic and environmental issues</strong></td>
<td>Economic benefits (increased confidence leading to economic growth) for the broader region</td>
<td>• No change from existing situation.</td>
<td></td>
</tr>
<tr>
<td><strong>Considering social, economic and environmental issues (independent of the improvements to flooding)</strong></td>
<td>Environmental benefits: Terrestrial, aquatic, riverine benefits, effects upon heritage</td>
<td>• No change from existing situation.</td>
<td></td>
</tr>
<tr>
<td><strong>Social Health benefits: Effects upon mental health, psychological issues, stress</strong></td>
<td>Social Health benefits: Effects upon mental health, psychological issues, stress</td>
<td>• No change from existing situation.</td>
<td></td>
</tr>
<tr>
<td><strong>Community benefits: Effects upon “livability” of the area, urban amenity, social cohesion</strong></td>
<td>Community benefits: Effects upon “livability” of the area, urban amenity, social cohesion</td>
<td>• No change from existing situation.</td>
<td></td>
</tr>
<tr>
<td><strong>Long term reduction in flood risk and adaptable levels of protection</strong></td>
<td>Adaptable flood performance with respect to climate change</td>
<td>• No opportunity for adaptable performance.</td>
<td></td>
</tr>
<tr>
<td><strong>A focus on the long-term benefits and adaptability of options and also the impact on future development land</strong></td>
<td>Long term benefits</td>
<td>Permanent removal of levees means benefits would occur over the long-term.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decreases flood damage to areas of future development</td>
<td>• No decreased flood damage to areas identified as &quot;emerging communities&quot; or green fill urban residential land.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Staged benefits with staged construction / investment</td>
<td>• No opportunity for staging.</td>
<td></td>
</tr>
</tbody>
</table>

- **Achieves the criteria**
- **Partially achieves criteria or has no change to current status**
- **Does not achieve the criteria**
Technical Discussion Paper

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The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Option F – Millaquin Bend widening

Option F involves deepening, widening and regular maintenance dredging of a section of the left bank of the Burnett River by excavation and dredging to improve flood conveyance through a constricted part of the river.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015.

**Option overview**

Option F aims to increase conveyance within the Burnett River by reducing the flow constraint at Millaquin Bend. It would involve:

- deepening and widening of Burnett River through excavation and dredging activities, predicted to be 900,000 m$^3$ of cut
- Construction of an engineered rock revetment wall of 1.4 km length
- 10 m wide level terrace, with a batter slope at the edge down to -5 m AHD (1 in 20 slope)
- Possible acquisition of parts of properties (but not houses) along the eastern side of Mariner's Way
- Removal of mangrove vegetation
- Regular maintenance dredging of this area.
What would this option achieve?

Widening of Millaquin Bend would allow flood water to flow more easily through Bundaberg. This option:

- Avoids over-floor flooding for about 440 properties in Bundaberg in a 1% AEP flood event, of which about 150 are located in Bundaberg North, and 250 in Bundaberg East.
- Avoids over-floor flooding for up to 320 properties in Bundaberg North for flood events smaller than the 1% AEP flood event, such as the 1942 and 2010 flood events.
- Reduces flood levels in Bundaberg East by up to 0.6 m, and in Bundaberg North by up to 0.4 m in a 1% AEP event.

Some properties downstream of Millaquin Bend (less than five buildings) would experience increased flood levels due to the increased conveyance in the Burnett River.

In events more rare than the 1% AEP event, this option also decreases flood levels and eliminates above-floor flooding for buildings.

Widening of Millaquin bend does not have benefits for as many properties in more frequent flood events, with 40 properties avoiding over-floor flooding in a 5% AEP event, and only a few buildings in events more frequent than this.

Figure 2 shows the changes to flood levels for the 1% AEP flood event.

---

1 1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.

2 5% AEP flood is the name given to a flood event which has a 1 in 20 or 5% chance of occurring in any year. It would be similar to the December 2010 flood.
Viability

A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:

- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option F found that this option may be viable with modifications to reduce impacts to areas outside of the benefited area. Dredging and mangrove removal works may negatively impact the local environment, and there is no opportunity for staging.

Costs and benefits

Initial cost estimates indicate that construction of widening the Burnett River at Millaquin Bend would be in the order of $60 million. Ongoing, maintenance dredging would be required at a cost of about $3 million per year, bringing the total construction and maintenance costs to $95 million.

The preliminary flood damages assessment for this option suggests that the estimated reduction in flood damages (i.e. the tangible benefits) would be in the order of $30 million.

Summary of assessment against key criteria

Each option has been assessed against a set of 16 criteria. These criteria, if achieved by an option, indicate a strong link between the option and the overall objectives of the Bundaberg Flood Protection Study. The performance of this option against the 16 criteria is presented on the next page. These assessments will be used to derive an overall multi-criteria analysis score for this option. This score is then used in conjunction with other assessments to compare this option against the other options.

A summary of the performance of this option against the criteria as well as the costs, benefits and viability issues is presented below.

- This option reduces flood levels within Bundaberg through increased conveyance in the Burnett River.
- Approximately 440 properties would not be inundated in the 1% AEP flood event.
- Much of the benefit from this option occurs within Bundaberg East, meaning that the majority of benefits of this option would be lost if it was built in conjunction with another option that reduces damages in East Bundaberg (e.g. a levee).
- The costs for this option would be about three times the estimated monetary benefits.
# Technical Discussion Paper

## Evaluation criteria

<table>
<thead>
<tr>
<th>Objective</th>
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</tr>
</thead>
</table>
| **Reduce flood risk to life and reduced flood impacts on people** | Improves people’s safety during flood events and people’s ability to evacuate | • Decreases flood levels in Bundaberg.  
• About 440 buildings would not be flooded in a 1% AEP event. | ✓ |
| **Reducing the occurrence of flood deaths and injury and improving people’s ability to plan for and recover after a flood** | Reduces the impacts on people for very large / rare floods (larger than say Jan 2013 flood) | • Decreases flood levels and reduces over-floor flooding in very large / rare floods. | ✓ |
| | Increase people’s resilience to flooding by improving their preparation for flood events and ability to recover after flood events | • No change to people’s preparation.  
• Reduction in number of properties inundated would result in an increased ability to recover for those events. | ✓ |
| | Targets vulnerable community members or areas (e.g. elderly, poor) | • Does not specifically target more vulnerable areas. | ✓ |
| **Reduce flood risk to property** | Reduces damages and costs to residential property caused by floods | • Moderate to high decrease in flood damages. | ✓ |
| **Reducing flood damages and properties and improving the recovery of businesses after floods** | Reduces damages and costs to business / industry / government caused by floods | • Moderate to high decrease in flood damages. | ✓ |
| | Reduces the impacts on property for very large / rare floods (larger than say Jan 2013 flood) | • Decreases flood levels in very large / rare floods. | ✓ |
| | Increase a property’s “flood resilience” (improving a property so it is less affected by a flood event and recovery after an event is faster) | • Resilience improved due to lower flood levels. | ✓ |
| **Achieve a balanced investment approach that considers social, economic and environmental issues** | Economic benefits (increased confidence leading to economic growth) for the broader region | • Increased economic confidence due to decreased frequency of flooding. | ✓ |
| | Environmental benefits: Terrestrial, aquatic, riverine benefits, effects upon heritage | • Dredging and mangrove removal works negatively impact the local environment. | X |
| | Social Health benefits: Effects upon mental health, psychological issues, stress | • Reduced stress due to reduced frequency of flooding. | ✓ |
| | Community benefits: Effects upon “livability” of the area, urban amenity, social cohesion | • Dredging will have some minor noise and visual impacts. | ✓ |
| **Long term reduction in flood risk and adaptable levels of protection** | Adaptable flood performance with respect to climate change | • Limited ability to undertake further dredging to allow for the increased flood levels and sea level rises as a result of climate change. | ✓ |
| | Long term benefits | • Dredging would need to re-occur over time to maintain the capacity of the widened bend.  
This has been included in cost estimate. | ✓ |
| | Decreases flood damage to areas of future development | • No decreased flood damage to areas identified as “emerging communities” or green fill urban residential land. | ✓ |
| | Staged benefits with staged construction / investment | • No opportunity for staging. | ✓ |

- ✓ Achieves the criteria  
- ✗ Partially achieves criteria or has no change to current status  
- ❌ Does not achieve the criteria
Find out more about this option
Community consultation on the flood mitigation options and the findings of the options assessment will take place from **24 October to 20 November 2016.** To find out more about the flood mitigation options and to provide your feedback:

Visit the website
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Interactive mapping is available on the website so that you can see how the flood mitigation options would change flooding in your area.

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Next steps
The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.
The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Technical Discussion Paper

Bundaberg flood protection study

Developing a 10-year action plan for flood mitigation in Bundaberg.

Option G – Elliot River diversion

Option G involves construction of a diversion channel from the Burnett River into the Elliot River.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015.

Option overview

Option G aims to decrease flow within the Burnett River by diverting floodwater into the Elliot River. It would involve construction of a 15 km diversion channel about 760 m wide and 30 m deep from the Burnett River, just south of Branyan, to the Elliot River. The diversion would fall about 9 m over the length of the channel.

The diversion channel between the Burnett River and Elliot River would need to traverse areas of high ground. The indicative alignment has been selected as it limits the volume of earthworks required as well as provides enough fall for the efficient flow of floodwater.

Construction of this option would require some property acquisitions, including farmland. It would also require a number of new bridges to be constructed across the diversion channel, including along the Bruce Highway and local roads.

Options to divert the Burnett River to other rivers, such as the Gregory and Isis rivers, were considered but were discounted due to these rivers being at higher elevation than the Burnett River.

A diversion into the Kolan River was also considered and would result in a similar performance, costs and impacts as the Elliot River diversion.

Figure 1: Option layout

Note: The outcome depicted is a potential only of the implications associated with this option – and this outcome may not occur or eventuate.
What would this option achieve?

This diversion would reduce flow through the Burnett River in a 1% AEP flood event from a peak of 15,400 m³/s upstream of the diversion to 8,500 m³/s downstream of the diversion. This option:

- Avoids over-floor flooding for about 1,450 properties in Bundaberg in a 1% AEP flood event, of which 580 are located in Bundaberg North, and 660 in Bundaberg East.
- Reduces flood levels in Bundaberg in a 1% AEP flood event by about 2.5 m (from about 10 m AHD to 7.5 m AHD).

The diversion would convey 6,800 m³/s into Elliot River during a 1% AEP flood event in the Burnett River. This would be more than 10 times the estimated 1% AEP peak flow in the Elliot River, currently about 600 m³/s.

Floodwater would also be diverted from the Burnett River during more frequent flood events (for example, the 10% AEP or 5% AEP Burnett River flood event).

The additional flow would cause high velocity and high hazard flood waters within the Elliot River, impacting the river and its ecosystem, and affecting riparian vegetation. Diverting 6,800 m³/s from the Burnett River would increase flood depths in the Elliot River by about 8 m. This would increase the extent of the river’s floodplain and would impact about 60 houses along the Elliot River.

Figure 2 shows the changes to flood levels for the 1% AEP flood event.

---

1 1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.

2 10% AEP flood is the name given to a flood event which has a 1 in 10 or 10% chance of occurring in any year.

3 5% AEP flood is the name given to a flood event which has a 1 in 20 or 5% chance of occurring in any year. It would be similar to the December 2010 flood.
Viability
A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:

- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option G found that this option is unviable as it would result in significant impacts along the route of the diversion and in the Elliot River and would cost of the order of $9,000 million, much more than the benefits delivered.

Costs and benefits
Initial cost estimates indicate that construction and maintenance of Option G would be approximately $9,000 million. This is mainly due to the volumes of cut required (about 300,000,000 m³) to construct the channel. Costs would also include property purchase, bridge construction and ongoing vegetation management and maintenance within the diversion channel.

The estimated reduction in flood damages (i.e. the tangible benefits) for this option is around $90 million.

Summary of assessment against key criteria
Each option has been assessed against a set of 16 criteria. These criteria, if achieved by an option, indicate a strong link between the option and the overall objectives of the Bundaberg Flood Protection Study. The performance of this option against the 16 criteria is presented on the next page. These assessments will be used to derive an overall multi-criteria analysis score for this option. This score is then used in conjunction with other assessments to compare this option against the other options.

A summary of the performance of this option against the criteria as well as the costs, benefits and viability issues is presented below.

- This option would reduce flow in the Burnett River and increase flow in the Elliot River. This would reduce flood levels in Bundaberg.
- This option would reduce flooding for about 3000 properties in the 1% AEP flood event and prevent over-floor flooding in 1450 properties in the 1% AEP flood event.
- This option would have significant costs (in the order of $9,000 million). These costs would be approximately 100 times the benefits realised through reduced damages.
- Increased flood flow in the Elliot River would result in increased flood levels (up to 8 m higher) and very high velocities for properties along this river. This would impact about 60 houses along the Elliot River.
- Environmental issues would arise from diverting very large flows into the Elliot River, which has a small catchment and small flows compared to the Burnett River (100 times smaller).
## Technical Discussion Paper

### Evaluation criteria

<table>
<thead>
<tr>
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<th>How does it perform against the criteria?</th>
<th>Preliminary Score</th>
</tr>
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<tbody>
<tr>
<td><strong>Reduce flood risk to life and reduced flood impacts on people</strong></td>
<td>Improves people's safety during flood events and people's ability to evacuate</td>
<td>• Reduced flooding for about 1,450 properties in Bundaberg in the 1% AEP event. Lower flood levels would improve evacuation.</td>
<td>✓</td>
</tr>
<tr>
<td>Reducing the occurrence of flood deaths and injury and improving people’s ability to plan for and recover after a flood</td>
<td>Reduces the impacts on people for very large / rare floods (larger than say Jan 2013 flood)</td>
<td>• Less dwellings and commercial properties with above-floor flooding in events greater than the 1% AEP flood event.</td>
<td>✓</td>
</tr>
<tr>
<td>Reduce flood risk to property</td>
<td>Reduces damages and costs to residential property caused by floods</td>
<td>• Around 50% decrease in residential flood damages.</td>
<td>✓</td>
</tr>
<tr>
<td>Reducing flood damages and properties and improving the recovery of businesses after floods</td>
<td>Reduces damages and costs to business / industry / government caused by floods</td>
<td>• Around 70% decrease in commercial / industrial / infrastructure flood damages.</td>
<td>✓</td>
</tr>
<tr>
<td>Reduce flood risk to property</td>
<td>Reduces the impacts on property for very large / rare floods (larger than say Jan 2013 flood)</td>
<td>• Lower flood levels for events rarer than the 1% AEP event.</td>
<td>✓</td>
</tr>
<tr>
<td>Increase people’s resilience to flooding by improving their preparation for flood events and ability to recover after flood events</td>
<td>Increase a property's &quot;flood resilience&quot; (improving a property so it is less affected by a flood event and recovery after an event is faster)</td>
<td>• Resilience improved due to lower flood levels.</td>
<td>✓</td>
</tr>
<tr>
<td>Achieve a balanced investment approach that considers social, economic and environmental issues</td>
<td>Economic benefits (increased confidence leading to economic growth) for the broader region</td>
<td>• Increased confidence resulting from mitigation works.</td>
<td>✓</td>
</tr>
<tr>
<td>Considering social, economic and environmental issues (independent of the improvements to flooding)</td>
<td>Environmental benefits: Terrestrial, aquatic, riverine benefits, effects upon heritage</td>
<td>• Would change existing flow regime and negatively impacts local ecosystems. Increased scour in Elliot River – vegetation loss and increased sediment discharge.</td>
<td>☠️</td>
</tr>
<tr>
<td>Achieve a balanced investment approach that considers social, economic and environmental issues</td>
<td>Social Health benefits: Effects upon mental health, psychological issues, stress</td>
<td>• Reduced frequency of flooding.</td>
<td>✓</td>
</tr>
<tr>
<td>Achieve a balanced investment approach that considers social, economic and environmental issues</td>
<td>Community benefits: Effects upon &quot;livability&quot; of the area, urban amenity, social cohesion</td>
<td>• Large impacts on liveability of Elliot River area.</td>
<td></td>
</tr>
<tr>
<td>Long term reduction in flood risk and adaptable levels of protection</td>
<td>Adaptable flood performance with respect to climate change</td>
<td>• The diversion would be difficult to adapted to change performance once operational.</td>
<td>☠️</td>
</tr>
<tr>
<td>A focus on the long-term benefits and adaptability of options and also the impact on future development land</td>
<td>Long term benefits</td>
<td>• Diversion would have long design life.</td>
<td>✓</td>
</tr>
<tr>
<td>A focus on the long-term benefits and adaptability of options and also the impact on future development land</td>
<td>Decreases flood damage to areas of future development</td>
<td>• Increased developable land within Bundaberg.</td>
<td>✓</td>
</tr>
<tr>
<td>A focus on the long-term benefits and adaptability of options and also the impact on future development land</td>
<td>Staged benefits with staged construction / investment</td>
<td>• Construction could not be staged.</td>
<td>☠️</td>
</tr>
</tbody>
</table>

- ✓ Achieves the criteria
- ☠️ Partially achieves criteria or has no change to current status
- ☠️ Does not achieve the criteria
Technical Discussion Paper

Find out more about this option
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Interactive mapping is available on the website so that you can see how the flood mitigation options would change flooding in your area.

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Telephone: 1800 994 015 (during business hours)

Next steps
The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.

The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Option H – Improving Emergency Access to Tallon Bridge

Option H involves improving emergency access to Tallon Bridge by creating an extension to the bridge from Gavin Street through to the roundabout near Bundaberg North Primary School.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015.

Option overview

Option H aims to enhance emergency access to Tallon Bridge by creating an extension to the bridge from Gavin Street through to the roundabout near Bundaberg North Primary School. A two-lane viaduct to replace Hinkler Drive was previously proposed, although this option was considered cost prohibitive. This option consists of a one-lane viaduct, which would run parallel to Hinkler Drive.

The viaduct would only be used for evacuation purposes. This option would involve:

- Construction of a one-lane viaduct linking the existing Tallon Bridge (near Gavin Street) to the roundabout near Bundaberg North Primary School.
- An on-ramp at Gavin Street and raising of Gavin Street by 300 mm.
- Associated roadworks near the bridge piers and near the roundabout.

Figure 1: Option layout
What would this option achieve?

Enhancing the emergency access to Don Tallon Bridge significantly improves the ability for emergency services to access Bundaberg North and provide additional evacuation time for flood events up to the 1% AEP event. This option:

- Provides no reduction in the number of properties with over-floor flooding in a 1% AEP flood event
- Provides an additional four hours of evacuation time to properties located to the east and west of Hinkler Avenue
- Improves evacuation of Bundaberg North residents to the north and west of the roundabout for an extended period of time, for floods up to the 1% AEP flood event.

Further assessment of the option is required to determine whether this option would cause unacceptable increase in flood levels due to the construction of the piers.

Figure 2 shows the localities which would be able to access the viaduct.

---

1 1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.
Technical Discussion Paper

Viability
A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:
- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.
An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.
The assessment of Option H found that this option will be viable. Environmental approval is likely due to the works being undertaken mainly in road reserves. The adoption of a viaduct to provide the access minimises the likelihood of impacts outside of the benefited area. Whilst the option has been identified as affordable it is difficult to quantify the benefits.

Costs and benefits
Initial estimates indicate that the construction and maintenance of this option would cost approximately $42 million.
Although there is no reduction in flood damages, approximately 1400 properties would no longer be isolated in a 1% AEP flood event. In addition, the available evacuation times for Bundaberg North would increase by about four hours.

Summary of assessment against key criteria
Each option has been assessed against a set of 16 criteria. These criteria, if achieved by an option, indicate a strong link between the option and the overall objectives of the Bundaberg Flood Protection Study. The performance of this option against the 16 criteria is presented on the next page. These assessments will be used to derive an overall multi-criteria analysis score for this option. This score is then used in conjunction with other assessments to compare this option against the other options.
A summary of the performance of this option against the criteria as well as the costs, benefits and viability issues is presented below.

- This option would enable 1400 properties in Bundaberg North to have emergency access to Bundaberg South during a 1% AEP flood event.
- It would assist in reducing impacts on people as isolation is reduced and access to emergency services is increased.
- It would also decrease stress due to reduced isolation and improved access to emergency services during flood events.
- This option has limited benefits in very large events (e.g. larger than 2013).
- This option would have limited benefit for those properties to the east of Hinkler Drive or south of Hinkler Park.
- Afflux from the viaduct has not been assessed and would need to be considered in future design development.
- The costs for this option would be more than 10 times the estimated monetary benefits. It is difficult to quantify the benefits of this option as they are improvements to access and not reduced flood damages.

<table>
<thead>
<tr>
<th>Likelihood of obtaining environmental approval</th>
<th>Likely to achieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affordability</td>
<td>Likely to achieve</td>
</tr>
<tr>
<td>Tolerable impacts outside benefited area</td>
<td>Likely to achieve</td>
</tr>
</tbody>
</table>
# Technical Discussion Paper

## Evaluation criteria

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<tbody>
<tr>
<td>Reduce flood risk to life and reduced flood impacts on people</td>
<td>Improves people’s safety during flood events and people’s ability to evacuate</td>
<td>• Approximately 1400 are no longer isolated in the 1% AEP event.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Evacuation could occur throughout the event and would enable better access to emergency services.</td>
<td></td>
</tr>
<tr>
<td>Reduce the occurrence of flood deaths and injury and improving people’s ability to plan for and recover after a flood</td>
<td>Reduces the impacts on people for very large / rare floods (larger than say Jan 2013 flood)</td>
<td>• Don Talon Bridge access likely to be cut in larger rare flood events.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increase people’s resilience to flooding by improving their preparation for flood events and ability to recover after flood events</td>
<td>• Does not increase people’s resilience.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Targets vulnerable community members or areas (e.g. elderly, poor)</td>
<td>• Does target more vulnerable areas.</td>
<td>✓</td>
</tr>
<tr>
<td>Reduce flood risk to property</td>
<td>Reduces damages and costs to residential property caused by floods</td>
<td>• No change in flood damages.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reduces damages and costs to business / industry / government caused by floods</td>
<td>• No change in flood damages.</td>
<td></td>
</tr>
<tr>
<td>Reduce flood damages and properties and improving the recovery of businesses after floods</td>
<td>Reduces the impacts on property for very large / rare floods (larger than say Jan 2013 flood)</td>
<td>• Does not reduce the impact to people for very large events.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increase a property’s “flood resilience” (improving a property so it is less affected by a flood event and recovery after an event is faster)</td>
<td>• No change.</td>
<td></td>
</tr>
<tr>
<td>Achieve a balanced investment approach that considers social, economic and environmental issues</td>
<td>Economic benefits (increased confidence leading to economic growth) for the broader region</td>
<td>• None foreseen.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environmental benefits: Terrestrial, aquatic, riverine benefits, effects upon heritage</td>
<td>• Construction of the viaduct is likely to have no environmental impacts.</td>
<td></td>
</tr>
<tr>
<td>Consider social, economic and environmental issues (independent of the improvements to flooding)</td>
<td>Social Health benefits: Effects upon mental health, psychological issues, stress</td>
<td>• Reduced stress due to reduction in isolation and access to emergency services.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Community benefits: Effects upon “livability” of the area, urban amenity, social cohesion</td>
<td>• May assist with social cohesion due to north and south being linked during large events so partially meets criteria.</td>
<td></td>
</tr>
<tr>
<td>Long term reduction in flood risk and adaptable levels of protection</td>
<td>Adaptable flood performance with respect to climate change</td>
<td>• Viaduct sufficiently high that gradual increases in flood severity will not impact on flood immunity.</td>
<td>✓</td>
</tr>
<tr>
<td>A focus on the long-term benefits and adaptability of options and also the impact on future development land</td>
<td>Long term benefits</td>
<td>• Benefits of the viaduct would be realised over the long term.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Decreases flood damage to areas of future development</td>
<td>• No change to flood extent for developable land.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Staged benefits with staged construction / investment</td>
<td>• There is no ability to stage construction.</td>
<td></td>
</tr>
</tbody>
</table>

✓ Achieves the criteria  ❍ Partially achieves criteria or has no change to current status  ❌ Does not achieve the criteria
Technical Discussion Paper

Find out more about this option
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Next steps
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The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Option I – Dams in the upper catchment

Option I involves construction of dam(s) in the upper Burnett River catchment to temporarily store floodwaters. No specific sites have been chosen.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015.

Option overview

Option I aims to protect properties on the lower Burnett River floodplain by constructing dams in the upper catchment, somewhere upstream of Mundubbera. No specific dam location has been investigated at this stage. This assessment has been carried out to determine whether dams in the upper catchment could provide enough flood mitigation to create significant benefits for the Bundaberg township.

Dams in the upper catchment could mitigate flood flows from the Upper Burnett, Auburn and/or Boyne catchments. This option could lower flood levels for a range of AEP events for all properties downstream of the dam.

It would involve construction of a large 1.7 million megalitre dam built across the Burnett River floodplain or a number of smaller dams located in each of the Upper Burnett, Auburn and Boyne catchments. The aim would be to reduce the 1% AEP\(^1\) flood flow in Bundaberg from 17,000 m\(^3\)/s to 9,500 m\(^3\)/s which is similar to a 5% AEP\(^2\) flood event.

This option would require acquisition of land inundated by the dam and immediately downstream of the spillway.

\(^1\) 1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.

\(^2\) 5% AEP flood is the name given to a flood event which has a 1 in 20 or 5% chance of occurring in any year. It would be similar to the December 2010 flood.
What would this option achieve?

Constructing several smaller dams, or one large dam with similar capacity, could reduce flooding to properties downstream from Burnett River flooding for a range of flood events. The creation of the dams or dam could lower flood levels for a 1% AEP event to the 5% AEP flood event levels. This option:

- Avoids over-floor flooding for about 1,450 properties in Bundaberg in a 1% AEP flood event, of which 580 are located in Bundaberg North, and 660 in Bundaberg East.

However, large areas of inundation would occur upstream of the dams which could affect residential dwellings and large areas of productive farmlands. Additional land downstream of the dams would also need to be resumed.

Velocity of the floodwater due to releases could become significant downstream of the dams and could increase the hazard of the floodwater. Also, overtopping or failure of the dams would pose a risk for the community downstream.

Changes to flood levels for the 1% AEP flood event are shown in Figure 2.
Viability
A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:

• The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
• Significant or unaffordable costs of construction or ongoing maintenance
• Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option I found that this option is unviable with significant issues identified in all matters considered.

Costs and benefits
Initial cost estimates indicate that construction and maintenance of this option would be approximately $1300 million. This is based on the unit costs (i.e. cost per megalitre of volume) to construct other dams in Queensland.

The estimated reduction in flood damages (i.e. the tangible benefits) for this option is around $90 million.

Summary of assessment against key criteria
Each option has been assessed against a set of 16 criteria. These criteria, if achieved by an option, indicate a strong link between the option and the overall objectives of the Bundaberg Flood Protection Study. The performance of this option against the 16 criteria is presented on the next page. These assessments will be used to derive an overall multi-criteria analysis score for this option. This score is then used in conjunction with other assessments to compare this option against the other options.

A summary of the performance of this option against the criteria as well as the costs, benefits and viability issues is presented below.

• This option would temporarily detain floodwater from the Burnett River and could reduce flood levels from the 1% AEP flood event to the 5% AEP flood event level.

• This would reduce flooding for about 3000 properties in the 1% AEP flood event and prevent over-floor flooding in 1450 properties in the 1% AEP flood event.

• Environmental approval of this option would be unlikely due to the environmental impacts in the impounded area.

• The temporary impounding of floodwaters would require the acquisition of large areas of agricultural and forested land.

• The costs would be very high ($1300 million) and more than 14 times the benefits realised through reduced damages.

• Benefits (in terms of reduced flood damages) would be in the order of $90 million.

• There is a risk that people downstream of the dam become complacent about flood risk and become less resilient during events which overtop/exceed the dam wall.
## Technical Discussion Paper

### Evaluation criteria

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</thead>
<tbody>
<tr>
<td><strong>Reduce flood risk to life and reduced flood impacts on people</strong></td>
<td>Improves people’s safety during flood events and people’s ability to evacuate</td>
<td>• Reduced flooding for about 1,450 properties in Bundaberg in the 1% AEP event. • Lower flood levels would improve evacuation.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Reduces the impacts on people for very large / rare floods (larger than say Jan 2013 flood)</td>
<td>• Less dwellings and commercial properties with above-floor flooding in events greater than the 1% AEP flood event.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Increase people’s resilience to flooding by improving their preparation for flood events and ability to recover after flood events</td>
<td>• Reduced number of properties inundated increasing ability to recover for flood events.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Targets vulnerable community members or areas (e.g. elderly, poor)</td>
<td>• Would benefit communities in Bundaberg North and East.</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Reduce flood risk to property</strong></td>
<td>Reduces damages and costs to residential property caused by floods</td>
<td>• High decrease in flood damages.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Reduces damages and costs to business / industry / government caused by floods</td>
<td>• High decrease in flood damages.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Reduces the impacts on property for very large / rare floods (larger than say Jan 2013 flood)</td>
<td>• In very large events the dam wall could be overtopped/fail and properties will be inundated.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Increase a property’s “flood resilience” (improving a property so it is less affected by a flood event and recovery after an event is faster)</td>
<td>• Decreases over floor level flooding for properties downstream.</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Achieve a balanced investment approach that considers social, economic and environmental issues</strong></td>
<td>Economic benefits (increased confidence leading to economic growth) for the broader region</td>
<td>• Increased confidence resulting from mitigation works.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Environmental benefits: Terrestrial, aquatic, riverine benefits, effects upon heritage</td>
<td>• Dam construction and temporary storing of water is likely to have impacts on riverine habitat.</td>
<td>✗</td>
</tr>
<tr>
<td></td>
<td>Social Health benefits: Effects upon mental health, psychological issues, stress</td>
<td>• Reduced stress due to reduced frequency of flooding.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Community benefits: Effects upon “livability” of the area, urban amenity, social cohesion</td>
<td>• Dam will require large areas to be resumed to account for the inundation areas upstream of the wall and immediately downstream.</td>
<td>✗</td>
</tr>
<tr>
<td><strong>Long term reduction in flood risk and adaptable levels of protection</strong></td>
<td>Adaptable flood performance with respect to climate change</td>
<td>• Costly to raise dams to deal with increased flows.</td>
<td>✗</td>
</tr>
<tr>
<td></td>
<td>Long term benefits</td>
<td>• Benefits of the dam would be realised over the long term.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Decreases flood damage to areas of future development</td>
<td>• Decreased flood damage to areas identified as “emerging Communities” or green fill urban residential land.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Staged benefits with staged construction / investment</td>
<td>• If multiple dam sites, possible to stage, so partially meets criteria.</td>
<td>✗</td>
</tr>
</tbody>
</table>

*✓ Achieves the criteria  ✓ Partially achieves criteria or has no change to current status  ✗ Does not achieve the criteria*
Technical Discussion Paper

Find out more about this option
Community consultation on the flood mitigation options and the findings of the options assessment will take place from 24 October to 20 November 2016. To find out more about the flood mitigation options and to provide your feedback:

Visit the website
www.qld.gov.au/bundabergfloodstudy
Interactive mapping is available on the website so that you can see how the flood mitigation options would change flooding in your area.

Contact the project team
Email: bundabergfloodprotection@jacobs.com
Telephone: 1800 994 015 (during business hours)

Next steps
The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.
The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Technical Discussion Paper

Bundaberg flood protection study
Developing a 10-year action plan for flood mitigation in Bundaberg.

Option J – Floodway house purchase scheme

Option J would involve either purchase or relocation (via land-swap) of select residential blocks in Bundaberg North that are deemed to be in a floodway with high depths and velocities.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015.

Option overview

Option J involves either purchase or relocation (via land-swap) for all houses in the high flood hazard parts of Bundaberg North. A land-swap scheme would involve a change in land titles and a new parcel of land (located out of the floodplain) provided for property owners in return.

The houses to be purchased or relocated would be determined based on those parts of the residential precinct with a very high flood hazard. The flood modelling assessments indicate there are numerous residential blocks west of Hinkler Avenue (and a smaller area east of Hinkler Avenue) where the 1% AEP flood results in high depth and high velocity floodwater. One possible threshold for selection for purchase or land-swap is that the velocity-depth product for the whole residential block (i.e., an area bounded by four streets) is greater than $2.0 \text{ m}^2/\text{s}$. This indicates a highly hazardous area as the standard for adult wading safety is $0.6 \text{ m}^2/\text{s}$.

These results are consistent with the high flood flows experienced in January 2013.

About 130 buildings have been identified within these high flood hazard residential blocks. Purchase of only some of these houses (possibly through a voluntary purchase scheme) would result in potentially increased flood hazard for those left behind. However, planting of vegetation on these vacant blocks could allow removal of houses over a longer period of time (say 10 years).

Figure 1 shows the high flood hazard residential blocks which meet the high flood hazard criteria.

Figure 1: Option layout

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1 1% AEP flood is the name given to a flood event which has a 1 in 100 or 1% chance of occurring in any year. It would be similar to the January 2013 flood.
What would this option achieve?
Removing buildings from a major flow path through Bundaberg North would increase conveyance in this area, potentially lowering flood levels for other Bundaberg North residents. This option would:

- Avoid over-floor flooding for 130 properties in Bundaberg North in a 1% AEP flood event by removing these properties and their inhabitants from the floodplain, such that the moved buildings are no longer affected by Burnett River flooding.

The residential blocks have the potential to be turned into sports facilities or parkland, becoming a useful and enjoyable recreational area for Bundaberg residents.

The social impacts of removing families from communities are not insignificant on an individual scale. For those who are eligible, the scheme may have moderate social impacts due to residents moving away from their local community.
Viability
A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:
- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option J found that this option is viable. Environmental approval is likely due to the works being undertaken mainly in the urban area and limited impacts expected outside the benefitted area. The option was ranked as affordable due to the non-tangible benefits associated with reducing the risk to life during floods.

Costs and benefits
Initial cost estimates indicate that this option would cost in the order of $39 million. Costs would also include ongoing vegetation management and maintenance.

The preliminary flood damages assessment for this option suggests that the estimated reduction in flood damages (i.e. the tangible benefits) would be in the order of $5 million.

Summary of assessment against key criteria
Each option has been assessed against a set of 16 criteria. These criteria, if achieved by an option, indicate a strong link between the option and the overall objectives of the Bundaberg Flood Protection Study.

The performance of this option against the 16 criteria is presented on the next page. These assessments will be used to derive an overall multi-criteria analysis score for this option. This score is then used in conjunction with other assessments to compare this option against the other options.

A summary of the performance of this option against the criteria as well as the costs, benefits and viability issues is presented below.

- This option would remove 130 properties from the floodplain.
- The purchase of houses would have a result in social changes and social impacts in this area.
- In rare floods (i.e. larger than 2013 flood), the flooding conditions in this area become extremely hazardous and would likely result in destruction of many houses.
- The costs of the option are more than eight times the benefits to be realised through reduced flood damages. However, there are other non-tangible benefits associated with reducing the risk to life during floods, especially rare floods.
# Technical Discussion Paper

## Evaluation criteria

<table>
<thead>
<tr>
<th>Objective</th>
<th>Criteria</th>
<th>How does it perform against the criteria?</th>
<th>Preliminary Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce flood risk to life and reduced flood impacts on people</td>
<td>Improves people’s safety during flood events and people’s ability to evacuate</td>
<td>• Removing houses from the floodplain increases people’s safety so partially meets criteria.</td>
<td>☞</td>
</tr>
<tr>
<td>Reducing the occurrence of flood deaths and injury and improving people’s ability to plan for and recover after a flood</td>
<td>Reduces the impacts on people for very large / rare floods (larger than say Jan 2013 flood)</td>
<td>• Removing houses from the floodplain reduces the impact of very large / rare floods on people so partially meets criteria.</td>
<td>☞</td>
</tr>
<tr>
<td></td>
<td>Increase people’s resilience to flooding by improving their preparation for flood events and ability to recover after flood events</td>
<td>• Removing people from the floodplain means they will no longer experience flooding, removing the need to prepare and recover from flood events so partially meets criteria.</td>
<td>☞</td>
</tr>
<tr>
<td></td>
<td>Targets vulnerable community members or areas (e.g. elderly, poor)</td>
<td>• Would benefit vulnerable communities in Bundaberg.</td>
<td>☑</td>
</tr>
<tr>
<td>Reduce flood risk to property</td>
<td>Reduces damages and costs to residential property caused by floods</td>
<td>• Minor reduction in residential flood damages.</td>
<td>☞</td>
</tr>
<tr>
<td>Reducing flood damages and properties and improving the recovery of businesses after floods</td>
<td>Reduces damages and costs to business / industry / government caused by floods</td>
<td>• Close to no change to existing situation.</td>
<td>☞</td>
</tr>
<tr>
<td></td>
<td>Reduces the impacts on property for very large / rare floods (larger than say Jan 2013 flood)</td>
<td>• Removing houses from the floodplain reduces the impact of very large / rare floods on property so partially meets criteria.</td>
<td>☞</td>
</tr>
<tr>
<td></td>
<td>Increase a property’s “flood resilience” (improving a property so it is less affected by a flood event and recovery after an event is faster)</td>
<td>• Removing a property from the floodplain increases its resilience so partially meets criteria.</td>
<td>☞</td>
</tr>
<tr>
<td>Achieve a balanced investment approach that considers social, economic and environmental issues</td>
<td>Economic benefits (increased confidence leading to economic growth) for the broader region</td>
<td>• No change to existing situation.</td>
<td>☞</td>
</tr>
<tr>
<td>Considering social, economic and environmental issues (independent of the improvements to flooding)</td>
<td>Environmental benefits: Terrestrial, aquatic, riverine benefits, effects upon heritage</td>
<td>• Possible creation of parkland no change to existing situation.</td>
<td>☑</td>
</tr>
<tr>
<td></td>
<td>Social Health benefits: Effects upon mental health, psychological issues, stress</td>
<td>• Removing people from the floodplain removes the stress and psychological issues associated with flooding.</td>
<td>☑</td>
</tr>
<tr>
<td></td>
<td>Community benefits: Effects upon “livability” of the area, urban amenity, social cohesion</td>
<td>• Removing properties can interrupt a landscape, affecting amenity, which may result in significant impacts to social cohesion.</td>
<td>☑</td>
</tr>
<tr>
<td></td>
<td>Staged benefits with staged construction / investment</td>
<td>• Staging the removal of blocks of land is possible over log period of time (10 years). However, there is a need to ensure flows are not made worse for remaining houses.</td>
<td>☑</td>
</tr>
</tbody>
</table>
Technical Discussion Paper

Find out more about this option
Community consultation on the flood mitigation options and the findings of the options assessment will take place from **24 October to 20 November 2016**. To find out more about the flood mitigation options and to provide your feedback:

Visit the website
www.qld.gov.au/bundabergfloodstudy
Interactive mapping is available on the website so that you can see how the flood mitigation options would change flooding in your area.

Contact the project team
Email: bundabergfloodprotection@jacobs.com
Telephone: 1800 994 015 (during business hours)

Next steps
The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017. It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.

The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Option K – Upper floodplain evacuation improvements

Option K involves provision of better evacuation routes and access during floods to the communities of Goodnight, Morganville, Pine Creek, Givelda and Electra through raising of the Perry River Bridge on Walla Road and construction and upgrading of 4WD tracks.

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015.

Option overview

Option K aims to provide better evacuation access in Goodnight, Morganville, Pine Creek, Givelda and Electra which can be isolated for up to two weeks due to low level bridge crossings and the lack of adequate and maintained 4WD access tracks.

To provide better access, it is proposed to:

- Raise the level of the Perry River Bridge on Walla Road from 24.5 m AHD to 32.3 m AHD
- Upgrade the existing 4WD evacuation route for Pine Creek, Givelda and Electra.

Figure 1: Option layout
What would this option achieve?
The upgrade to the Perry River bridge would significantly shorten the time of isolation for 400 to 600 people located in the Goodnight Scrub area from 2 weeks to approximately 5 days. Upgrade of the bridge would enable residents to continue to work and reduce the reliance on resupply during a severe flood.
Alternatively a 4WD access through the Goodnight Scrub National Park could be constructed to allow access to GinGin. Although a smaller capital cost outlay, the ongoing maintenance of the access would be considerable.
Currently a 4WD route access exists for the residents of Givalda and Pine Creek. However, the evacuation route requires ongoing maintenance to ensure that there is free passage should a flood event occur. By consistently maintaining this access road, access to Childers Road would reduce the time of isolation for these communities.
It should be noted that in large events, the bridge structure and evacuation routes may become damaged and unpassable. Therefore, no improvement on the current isolation risk would be realised.

Costs and benefits
Initial cost estimates indicate that construction of this option would be:
- Perry River bridge: about $15 to $17 million
- Pine Creek evacuation route: about $0.5 to $1 million

This option would not reduce flood inundation of any houses. However, it would significantly reduce the duration of isolation for a large rural community. Although there is no reduction in flood damages (i.e. the tangible benefits) an assessment of the loss of wages due to flood isolation has been undertaken. Based on the history of flood levels in the Burnett River, it is estimated that the Perry River bridge is cut for approximately 14 days per decade (or 140 days per century). The proposed bridge upgrade would reduce the time that the bridge is cut to one day per decade (or ten days per century). Based on the loss of income, this reduction in isolation would result in an estimated benefit of $0.7 million. However, the intangible benefits of reduced isolation and the decreased costs of emergency management during flood events (e.g. food drops etc) would result in greater economic benefits for this option.

Summary of assessment against key criteria
Each option has been assessed against a set of 16 criteria. These criteria, if achieved by an option, indicate a strong link between the option and the overall objectives of the Bundaberg Flood Protection Study. The performance of this option against the 16 criteria is presented on the next page. These assessments will be used to derive an overall multi-criteria analysis score for this option. This score is then used in conjunction with other assessments to compare this option against the other options.

A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:
- The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
- Significant or unaffordable costs of construction or ongoing maintenance
- Potential for unacceptable impacts on other areas.

An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

The assessment of Option K found that this option is viable. Environmental approval is likely due to the scale and type of works proposed and limited impacts are expected outside the benefitted area. The option was ranked as affordable due to the intangible benefits of reduced isolation and the decreased costs of emergency management during flood events.

Viability

| Likelihood of obtaining environmental approval | Likely to achieve |
| Affordability | Likely to achieve |
| Tolerable impacts outside benefited area | Likely to achieve |

October 2016 – not Government policy Technical Discussion Paper
## Evaluation criteria

<table>
<thead>
<tr>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce flood risk to life and reduced flood impacts on people</td>
</tr>
<tr>
<td>Reducing the occurrence of flood deaths and injury and improving people’s ability to plan for and recover after a flood</td>
</tr>
<tr>
<td>Reduce flood risk to property</td>
</tr>
<tr>
<td>Reducing flood damages and properties and improving the recovery of businesses after floods</td>
</tr>
<tr>
<td>Achieve a balanced investment approach that considers social, economic and environmental issues</td>
</tr>
<tr>
<td>A focus on the long-term benefits and adaptability of options and also the impact on future development land</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improves people’s safety during flood events and people’s ability to evacuate</td>
</tr>
<tr>
<td>Reduces the impacts on people for very large / rare floods (larger than say Jan 2013 flood)</td>
</tr>
<tr>
<td>Increase people’s resilience to flooding by improving their preparation for flood events and ability to recover after flood events</td>
</tr>
<tr>
<td>Targets vulnerable community members or areas (e.g. elderly, poor)</td>
</tr>
<tr>
<td>Reduces damages and costs to residential property caused by floods</td>
</tr>
<tr>
<td>Reduces damages and costs to business / industry / government caused by floods</td>
</tr>
<tr>
<td>Reduces the impacts on property for very large / rare floods (larger than say Jan 2013 flood)</td>
</tr>
<tr>
<td>Increase a property’s “flood resilience” (improving a property so it is less affected by a flood event and recovery after an event is faster)</td>
</tr>
<tr>
<td>Economic benefits (increased confidence leading to economic growth) for the broader region</td>
</tr>
<tr>
<td>Environmental benefits: Terrestrial, aquatic, riverine benefits, effects upon heritage</td>
</tr>
<tr>
<td>Social Health benefits: Effects upon mental health, psychological issues, stress</td>
</tr>
<tr>
<td>Community benefits: Effects upon “livability” of the area, urban amenity, social cohesion</td>
</tr>
<tr>
<td>Adaptable flood performance with respect to climate change</td>
</tr>
<tr>
<td>Long term benefits</td>
</tr>
<tr>
<td>Decreases flood damage to areas of future development</td>
</tr>
<tr>
<td>Staged benefits with staged construction / investment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How does it perform against the criteria?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Improves the ability for the community to evacuate and limits the needs for resupply so partially meets criteria.</td>
</tr>
<tr>
<td>• No change.</td>
</tr>
<tr>
<td>• Reduction in number of properties isolated would result in an increased ability to recover for those events so partially meets criteria.</td>
</tr>
<tr>
<td>• Targets areas that are currently flood vulnerable due to long periods of isolation during floods.</td>
</tr>
<tr>
<td>• No decrease in flood damages.</td>
</tr>
<tr>
<td>• No decrease in flood damages.</td>
</tr>
<tr>
<td>• No change.</td>
</tr>
<tr>
<td>• No change.</td>
</tr>
<tr>
<td>• Enables community to return to work due to not being isolated so partially meets criteria.</td>
</tr>
<tr>
<td>• No environmental benefits.</td>
</tr>
<tr>
<td>• Reduced stress due to reduced isolation.</td>
</tr>
<tr>
<td>• Liveability improved due to reduced isolation.</td>
</tr>
<tr>
<td>• Difficult and expensive to raise the bridge and access roads.</td>
</tr>
<tr>
<td>• Benefits of the evacuation routes would be realised over the long term.</td>
</tr>
<tr>
<td>• No change.</td>
</tr>
<tr>
<td>• Possible to construct 4WD tracks first and then bridge upgrade.</td>
</tr>
</tbody>
</table>

| Preliminary Score |

- Achieves the criteria
- Partially achieves criteria or has no change to current status
- Does not achieve the criteria
**Technical Discussion Paper**

**Find out more about this option**
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**Next steps**
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The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Appendix D. Display posters
Bundaberg flood protection study
Developing a 10-year action plan for flood mitigation in Bundaberg.

The Bundaberg flood protection study is a vital component of the Queensland Government’s commitment to develop a 10-year action plan for flood mitigation works in Bundaberg.

Stage 1 of the study was conducted in late 2015 and involved review of previous work undertaken by Bundaberg Regional Council in 2013 and engagement with local communities in Bundaberg to gather information on flood behaviour and other possible solutions for flood management.

Stage 2 of the study started in early 2016 and involves assessing 11 flood mitigation options and completing the Bundaberg flood protection study. Jacobs has been engaged by the State government to undertake a study of the various options and associated community engagement.

Engagement on the 10-year action plan will occur in 2017.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Key activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late 2015</td>
<td><strong>Stage 1</strong>&lt;br&gt;Review of previous studies and community and stakeholder consultation</td>
</tr>
<tr>
<td>Early 2016</td>
<td><strong>Stage 2</strong>&lt;br&gt;Confirm elevation criteria and objectives and mitigation options to be evaluated</td>
</tr>
<tr>
<td>Mid 2016</td>
<td>Assessment of mitigation options</td>
</tr>
<tr>
<td>Late 2016</td>
<td>Community and stakeholder engagement</td>
</tr>
<tr>
<td>2017</td>
<td>Engagement on 10-year action plan</td>
</tr>
</tbody>
</table>
Bundaberg flood protection study
Developing a 10-year action plan for flood mitigation in Bundaberg.

Approach to assessment
Stage 2 of the study commenced in March 2016 and involves evaluation of flood mitigation options. Eleven flood mitigation options are being assessed including those identified by community members during Stage 1.

The three key elements of the assessment included:

1. **Assessing the overall viability of each option**
   A key step in the options assessment involves identifying issues that may mean construction or implementation of the option is not viable. These relate to matters such as:
   - The likelihood of obtaining environmental approvals, due to unacceptable environmental impacts
   - Significant or unaffordable costs of construction or ongoing maintenance
   - Potential for unacceptable impacts on other areas.

   An assessment has been made of each option against these ‘non-negotiable’ requirements. An option is considered to be unviable where the assessment identifies one or more of these matters are ‘unlikely to be achieved’.

2. **Determining the costs and benefits of each option**
   The estimated costs of the construction and maintenance were determined for the 11 flood mitigation options.
   
   The costs of each option are compared against the estimated benefits of each option. The estimate of benefits considered both monetary benefits (for example, savings in flood damages) and non-monetary benefits (for example, improved community safety).

3. **Assessing each option against the following objectives**
   An assessment was conducted of each flood mitigation option against four objectives and a number of supporting criteria.
   
   - **Reduced flood risk to life and impacts on people**, for example reducing potential loss of life and injury and improving how people plan for an recover from flood events
   - **Reduced flood risk to property**, for example, reduce risks/costs of damage to homes, business and infrastructure and improve how businesses and property recover after flood events
   - **Long term reduction in flood risk and adaptable to future changes**, for example, long-term benefits and adaptability of mitigation options, potential for staging of mitigation options, reduce risk/impact on future development
   - **Balance between social, economic and environmental issues**, for example, balancing benefits/impacts for the community, economy and environment, independent of the improvements to flooding.
Bundaberg flood protection study
Developing a 10-year action plan for flood mitigation in Bundaberg.

Flood mitigation options
Stage 2 of the study commenced earlier this year and involves assessing 11 flood mitigation options. These include:

- Works that change how high floods reach or where flood water goes
- Measures that change how residents on the floodplain respond to flooding

Any effective outcome needs a mix of both types of measures.

The flood mitigation options being assessed include a mix of works that involve changing flood behaviour and measures that change how residents on the floodplain respond to flooding.

Works being assessed that involve changing flood behaviour include:

- levees at Bundaberg North and Bundaberg East
- the removal of downstream levees at Fairymead
- a Bundaberg North floodway
- river dredging, removal of Harriet Island and widening of Millaquin Bend
- diversion of flow from the Burnett River into other river catchments (e.g. Elliot River)
- dam or dams in upper Burnett River catchment.

Measures being assessed that change how residents on the floodplain respond to flooding include:

- evacuation route improvements at Bundaberg North
- evacuation and flood access route improvements in the upper Burnett River floodplain
- house purchase/land swap.
Bundaberg flood protection study
Developing a 10-year action plan for flood mitigation in Bundaberg.

Findings of flood mitigation options assessment

Stage 2 of the Bundaberg flood protection study involves assessing 11 flood mitigation options, including those identified through consultation with the Bundaberg community in late 2015. Engagement on the 10-year action plan will occur in 2017.

The following provides a summary of the key findings of the options assessment.

For further information on the flood mitigation options and assessment findings, visit www.qld.gov.au/bundabergfloodstudy.

<table>
<thead>
<tr>
<th>Option</th>
<th>Summary</th>
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| **Option A – Burnett River conveyance improvement** | This option would result in more flow in the river and less flow on the floodplain. This would reduce flood levels in some urban areas.  
• The increased flood flow in the river would result in some increased flood levels in Bundaberg North (up to 0.3 m) for smaller, more frequent flood events.  
• Approximately 470 properties in the Bundaberg area would not be inundated in the 1% AEP flood event.  
• Construction and ongoing maintenance of this option would cost around $235 million making it a moderate to high cost option.  
• The cost of this option would be about five times the estimated monetary benefits.  
• The option would require the treatment of dredged material and land-based disposal of dredge spoil due to the very low likelihood of it being disposed.  
• It is expected that there would be difficulties in obtaining an environmental approval for such a large dredging program. |
| **Option B – North Bundaberg floodway** | This option would involve diverting floodwater through Hinkler and Federation Parks, reducing flood levels in the Burnett River and Bundaberg North.  
• Downstream of the lakes and floodway, some properties would experience increased flood levels.  
• This option would have high costs due to the large volume of excavation and the need to treat and dispose of this material.  
• Benefits of this option are limited due to the ability to lower flood levels in this area. The flow rate through this area would not change and the flood levels in the urban area are not significantly lowered.  
• The costs for this option would be about 16 times the estimated monetary benefits. |
| **Option C – Bundaberg North levee and floodway** | This option would divert floodwaters around Bundaberg North through the construction of a levee and floodway (lake) system.  
• This option would provide protection for about 350 properties up to the 1.5% AEP flood event.  
• For events rarer/larger than the 1.5% AEP flood event, initial overtopping of the levee would occur along the northern (earth) sections, rather than a sudden overtopping, allowing safer evacuation.  
• There is a risk that people inside the levee may become complacent about flood risk and become less resilient during events that overtop the levee.  
• The levee would have a major impact on the urban area, restricting access and creating a visual barrier.  
• Increased flood levels of up to 0.6 m would be experienced by some properties outside of the levee.  
• Construction of this option would be about $85 million, with a net present value cost of $100 million.  
• The costs for this option would be about 10 times the estimated monetary benefits. |
| **Option D – Bundaberg East levee** | This option would prevent floodwaters from the Burnett River backing up into Bundaberg South for events up to the 1.5% AEP flood event.  
• This option would provide protection for about 340 properties up to the 1.5% AEP flood event.  
• It would reduce flooding for about 320 properties in the 1% AEP flood event.  
• A flood-gate structure would be required across Saltwater Creek to prevent Burnett River back-up flooding but allow local floods to pass.  
• There is a risk that people inside the levee become complacent about flood risk and become less resilient during events which overtop the levee.  
• Localised rainfall that causes flooding in Saltwater Creek may inundate properties to a greater amount if the event occurs concurrently with a Burnett River flood and the flood gate is shut.  
• Construction and ongoing maintenance of this option would be in the order of $58 million.  
• The costs for this option are similar to the estimated monetary benefits. |

It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the action plan.

1% AEP flood is the same given to flood events which have a 1% chance of occurring in any year. It would be similar to the January 2000 flood
1.5% AEP flood is the same given to flood events which have a 1.3% chance of occurring in any year.
## Bundaberg flood protection study

Developing a 10-year action plan for flood mitigation in Bundaberg.

<table>
<thead>
<tr>
<th>Option</th>
<th>Summary</th>
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| **Option E** Fairymead levee removal | This option involves removal of existing levees at Fairymead on the floodplain downstream of Bundaberg.  
- The option increases flow over the floodplain to the north and west, increasing flood levels in this area.  
- Several buildings would experience an increase in flood level of 300mm in a 1% AEP event.  
- Due to the distance between the Fairymead levee and the Bundaberg urban area, the removal of this levee would reduce flood levels by a very small amount in Bundaberg.  
- Reduced flood levels would be experienced upstream of the levees and on the eastern floodplain. In a 1% AEP event the benefit is limited to a distance of about 3 km upstream of the levee.  
- The costs for this option would be about 30 times the estimated monetary benefits. |
| **Option F** Millquin Bend | This option involves deepening, widening and regular maintenance dredging of a section of the left bank of the Burnett River by excavation and dredging to improve flood flows through a constricted part of the river.  
- This option reduces flood levels within Bundaberg through increased conveyance in the Burnett River.  
- Approximately 440 properties would not be inundated in the 1% AEP flood event.  
- Much of the benefit from this option occurs within Bundaberg East, meaning that the majority of benefits of this option would be lost if it was built in conjunction with another option that reduces damages in East Bundaberg (e.g. a levee).  
- The costs for this option would be about three times the estimated monetary benefits. |
| **Option G** Elliot River diversion | This option involves construction of a diversion channel from the Burnett River into the Elliot River.  
- This option would reduce flow in the Burnett River and increase flow in the Elliot River. This would reduce flood levels in Bundaberg.  
- This option would reduce flooding for about 3000 properties in the 1% AEP flood event and prevent over-flow flooding in 1450 properties in the 1% AEP flood event.  
- This option would have significant costs (in the order of $5,000 million). These costs would be approximately 100 times the benefits realised through reduced damages.  
- Increased flood flow in the Elliot River would result in increased flood levels (up to 8 m higher) and very high velocities for properties along this river. This would impact about 60 houses along the Elliot River.  
- Environmental issues would arise from diverting very large flows into the Elliot River, which has a small catchment and small flows compared to the Burnett River (100 times smaller). |
| **Option H** Improving emergency access to Tallon Bridge | This option involves improving emergency access to Tallon Bridge by creating an extension to the bridge from Gavin Street through to the roundabout near Bundaberg North Primary School.  
- This option would enable 1400 properties in Bundaberg North to have emergency access to Bundaberg South during a 1% AEP flood event.  
- It would assist in reducing impacts on people as isolation is reduced and access to emergency services is increased.  
- It would also reduce stress due to reduced isolation and improved access to emergency services during flood events.  
- This option has limited benefits in very large events (e.g., larger than 1% AEP).  
- This option would have limited benefit for those properties to the east of Hinkler Drive or south of Hinkler Park.  
- Afflux from the valetude has not been assessed and would need to be considered in future design development.  
- The costs for this option would be more than 10 times the estimated monetary benefits. It is difficult to quantify the benefits of this option as they are improvements to access and not reduced flood damages. |
| **Option I** Dams in upper catchment | This option involves construction of dam(s) in the upper Burnett River catchment to temporarily store floodwaters. No specific sites have been chosen.  
- This option would temporarily detain floodwater from the Burnett River and could reduce flood levels from the 1% AEP flood event to the 5% AEP flood event level.  
- This would reduce flooding for about 3000 properties in the 1% AEP flood event and prevent over-flow flooding in 1450 properties in the 5% AEP flood event.  
- Environmental approval of this option would be unlikely due to the environmental impacts in the impounded area.  
- The temporary impounding of floodwaters would require the acquisition of large areas of agricultural and forested land.  
- The costs would be very high ($300 million) and more than 14 times the benefits realised through reduced damages.  
- Benefits (in terms of reduced flood damages) would be in the order of $60 million.  
- There is a risk that people downstream of the dam become complacent about flood risk and become less resilient during events which overlap (i.e., exceed the dam wall). |
| **Option J** Floodway house purchase scheme | This option would involve either purchase or relocation (via land-swap) of select residential blocks in Bundaberg North that are deemed to be in a floodway with high depths and velocities.  
- This option would remove up to 150 properties from the floodplain.  
- The purchase of houses would have a result in social changes and social impacts in this area.  
- In rare floods (i.e., larger than 2013 flood), the flooding conditions in this area become extremely hazardous and would likely result in death of many houses.  
- The costs of the option are more than eight times the benefits to be realised through reduced flood damages. However, there are other non-tangible benefits associated with reducing the risk to life during floods, especially rare floods. |
| **Option K** Upper floodplain evacuation improvements | This option involves provision of better evacuation routes and access during floods to the communities of Goodnight, Morganville, Pine Creek, Givelda and Electra through raising of the Perry River Bridge at Walla and construction of 4WD tracks.  
- This option would reduce isolation time for communities in the Goodnight Scrub, Givelda, Pine Creek localities during large flood events. Approximately 400 to 600 properties could have improved access during flood periods requiring less reliance upon emergency supplies.  
- Construction of this option would be in the order of $16 million for the Perry River Bridge and $3 million for construction of the 4WD evacuation routes.  
- This option has minimal impacts on others and would have a high likelihood of obtaining environmental approval. |

It is important to note that the flood mitigation options have not yet been considered by the State government and are not government policy. No commitment will be made on any of the options until the State government has consulted with the community and stakeholders on the 10-year action plan.

The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.
Bundaberg flood protection study
Developing a 10-year action plan for flood mitigation in Bundaberg.

Get involved
Community consultation on the flood mitigation options and the findings of the options assessment will take place from 24 October to 20 November 2016.
Community feedback will be important in finalising the options assessment and completing the Bundaberg flood protection study.

To find out more about the flood mitigation options and to provide your feedback, you can:

Come along to a community information session
These are ‘drop-in’ style sessions – turn up during the opening times to talk to the project team.
Details of the information sessions are provided below. To let us know if you’re coming, please register at www.qld.gov.au/bundabergfloodstudy, email us at bundabergfloodprotection@jacobs.com or call us on 1800 994 015 (during business hours).

**Tuesday, 25 October 2016**
1 pm – 3:30 pm
North Bundaberg Progress Hall
Cnr of Queen and Gavegan Streets, Bundaberg North

**Saturday, 29 October 2016**
9 am – 12 pm
Bundaberg Civic Centre – Supper Room
190 Bourbong Street, Bundaberg

**Thursday, 3 November 2016**
4 pm – 7 pm
North Bundaberg Progress Hall
Cnr of Queen and Gavegan Streets, Bundaberg North

Send us your feedback
You can make a written submission to:
Bundaberg flood protection study
PO Box 15009
CITY EAST QLD 4002
Email: bundabergfloodprotection@jacobs.com
Or online at: www.qld.gov.au/bundabergfloodstudy
Written submissions must include:
1. Full name
2. Organisation or group (if applicable)
3. Postal and/or email address

Visit the website
www.qld.gov.au/bundabergfloodstudy
Interactive mapping is available on the website so that you can see how each of the flood mitigation options would change flooding in your area.

Contact the project team
Email: bundabergfloodprotection@jacobs.com
Telephone: 1800 994 015 (during business hours)

Next steps
The Bundaberg flood protection study is due to be completed later this year. Engagement on the 10-year action plan will occur in 2017.
The Queensland Government will continue to engage with the Bundaberg community as the action plan develops.

Visit www.qld.gov.au/bundabergfloodstudy to learn more about work undertaken to date.
Appendix E. Advertisements

Bundaberg flood protection study

The Bundaberg flood protection study is a vital component of the Queensland Government’s commitment to develop a 10-year action plan for flood mitigation works in Bundaberg.

Stage 1 of the study was conducted in late 2015 and involved review of previous work undertaken by Bundaberg Regional Council in 2013 and engagement with local communities in Bundaberg.

Stage 2 of the study started in early 2016 and involves assessing 11 flood mitigation options and completing the Bundaberg flood protection study. Jacobs has been engaged by the State government to undertake a study of the various options and associated community engagement. Engagement on the 10-year action plan will occur in 2017.

Get involved

Community consultation will take place from 26 October to 20 November 2016. To find out more about the flood mitigation options and to provide your feedback, you can:

Come along to a community information session

These are ‘drop-in’ style sessions – turn up during the opening times to talk to the project team.

Tuesday, 25 October 2016
1 pm – 3:30 pm
North Bundaberg Progress Hall
Corner of Queen and Gwavegan Streets, Bundaberg North

Saturday, 29 October 2016
9 am – 12 pm
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Thursday, 3 November 2016
4 pm – 7 pm
North Bundaberg Progress Hall
Corner of Queen and Gwavegan Streets, Bundaberg North

To let us know if you’re coming, please register at www.qld.gov.au/bundabergfloodstudy, email us at bundabergfloodprotection@jacobs.com or call us on 1800 994 015.*

Provide your written comments

You can make a written submission to:
Bundaberg flood protection study
PO Box 15009
CITY EAST QLD 4670

Email: bundabergfloodprotection@jacobs.com
Or online at: www.qld.gov.au/bundabergfloodstudy

Written submissions must include your:
1. Full name
2. Organisation or group (if applicable)
3. Postal and/or email address

Visit

www.qld.gov.au/bundabergfloodstudy

Call the project team
1800 994 015*
Appendix F. Media articles
MEMBER for Bundaberg Leanne Donaldson has welcomed the release of Stage 1 of the Bundaberg Flood Protection Study which has been released by the Queensland Government today.

Ms Donaldson said Stage 1 of the Study had identified a number of flood mitigation options, while Stage 2 would evaluate options and inform the development of a draft 10-year action plan to better protect Bundaberg homes and businesses through flooding events.

“I know first-hand that the people of Bundaberg are resilient by nature. This study, and the 10-year action plan, is about making sure that our homes and businesses are just as resilient,” Ms Donaldson said.

“The Bundaberg Flood Protection Study is a vital component of the Queensland Government’s commitment to developing a 10-year action plan for major flood mitigation works in the Bundaberg region.

“Findings from Stage 1 of the study are now available online, which identify a number of flood mitigation options for consideration including flood levees and evacuation route improvements.

Stage 2 of the study, which is now underway, will thoroughly test and investigate these options including:

- Levees at North Bundaberg and East Bundaberg
- The removal of downstream levees at Fairymead
- A North Bundaberg floodway
- Removal of Harriet Island and widening of Millaquin Bend
- North Bundaberg evacuation route improvements
- Dam or dams in upper Burnett River catchment
- Voluntary house purchase/land swap.

Ms Donaldson said there would be a number of consultation activities scheduled over the coming months to provide the community with ongoing opportunities to provide input into the Study.

“I am urging the community to get involved and share their feedback in the next round of community consultation, through focus groups and information sessions,” Ms Donaldson said.

“It’s important that the people who are directly affected by flooding are involved in the discussion about the best options available to protect them. **State Member for Bundaberg** Ph: 07 4111 3100 Email: bundaberg@parliament.qld.gov.au Cnr Quay and Barolin Streets Bundaberg Qld 4670.

“People here in Bundaberg have endured enough with devastating floods in 2010 and 2013 so it is vital that our local knowledge informs the development of this action plan.”

It is anticipated a draft action plan will be released in later year this further feedback before the final report and 10-year action plan is released.

“The 10-year action plan will harness the collective knowledge of the Bundaberg community, experts and government to prioritise cost-effective flood mitigation solutions for Bundaberg’s people, homes, businesses and economy,” Ms Donaldson said.

To read the Bundaberg Flood Protection Scoping Study Stage 1 report visit: www.qld.gov.au/bundabergfloodstudy.
Flood Mitigation Survey Released

Stage 1 of the Flood Mitigation Survey has been released by the Queensland Government.

Member for Bundaberg Leanne Donaldson says the survey will look at ways Bundaberg city can reduce the impacts of flood events.

She says that increased insurance levies were of a great concern for residents and businesses owners.

"I think one of the benefits we may expect to see, if there is flood mitigation work that does reduce the risk, we could possibly see a reduction in insurance premiums which would be absolutely welcomed."
SEVEN options, including a new dam on the Burnett River, are now being investigated to mitigate flooding in Bundaberg.

The seven options in the recently released Bundaberg Flood Protection Study include: levees at North Bundaberg and East Bundaberg; the removal of downstream levees at Fairymead; a North Bundaberg floodway; removal of Harriet Island and widening of Millaquin Bend; North Bundaberg evacuation route improvements; dam or dams in upper Burnett River catchment; and a voluntary house purchase/land swap.

Member for Bundaberg Leanne Donaldson welcomed the release of Stage 1 of the Bundaberg Flood Protection Study.

She said Stage 1 of the study had identified the flood mitigation options and Stage 2 would evaluate options and inform the development of a draft 10-year action plan to better protect Bundaberg homes and businesses through flooding events.

"I know first-hand that the people of Bundaberg are resilient by nature," Ms Donaldson said.

"This study, and the 10-year action plan, is about making sure that our homes and businesses are just as resilient.

"The Bundaberg Flood Protection Study is a vital component of the Queensland Government’s commitment to developing a 10-year action plan for major flood mitigation works in the Bundaberg region.”

Findings from Stage 1 of the study are now available online.

Ms Donaldson said there would be a number of consultation activities scheduled over the coming months to provide the community with ongoing opportunities to provide input into the study.

"I am urging the community to get involved and share their feedback in the next round of community consultation through focus groups and information sessions," Ms Donaldson said.

"It’s important that the people who are directly affected by flooding are involved in the discussion about the best options available to protect them."
To read the Bundaberg Flood Protection Scoping Study Stage 1 report visit:
BUNDABERG can expect to hear results of community consultation for the Bundaberg Flood Protection Study at the end of October.

The draft expert report on further flood risk management options will be released then, Member for Bundaberg Leanne Donaldson announced yesterday.

She said the report would bring the community a step closer to understanding the options for improved flood resilience and mitigation.

““This part of the Bundaberg Flood Protection Study has taken a little longer as our experts are thoroughly investigating the options that arose during the community consultation,” Ms Donaldson said.

“I also recently met with the Premier and Deputy Premier to bring them up to date with the study progress as they are interested in the results and the flood protection of the Bundaberg region.”
Stage 1 of the study identified flood mitigation options to be tested and investigated including levees at North Bundaberg and East Bundaberg, a North Bundaberg floodway, dams and improved evacuation routes.

“It is important to understand that the release of this draft report is just the next stage in the project,” she said.

“I thank the people of Bundaberg and Burnett River Catchment for their patience and efforts so far.

“We said that we would listen to local knowledge and ensure the adoption of any flood mitigation option is well communicated so I look forward to sharing and discussing the expert report.”

The Bundaberg Flood Protection Study is a vital component of the Queensland Government’s commitment to develop a 10-year action plan for major flood mitigation in the Bundaberg region.

Internationally recognised engineering firm Jacobs is conducting the study, which includes reviewing previous flood studies, floodplain risk management plans and the community consultation.

The Bundaberg community suffered devastating floods in 2010 and in 2013.

For more information visit www.qld.gov.au/bundabergfloodstudy
Eleven flood mitigation options ready to be released

DETAILED independent assessments of 11 Bundaberg flood mitigation options will be released next week for the community to examine and provide feedback on.

The flood mitigation options found in the Bundaberg Flood Protection Study include improved evacuation routes, levees at North Bundaberg and East Bundaberg, plus dams and river diversions.

Member for Bundaberg Leanne Donaldson stressed no decisions had been made about any of the options at this stage.

“It is important the community reads the information and notes that based on the work undertaken to date, there is no single, viable and or sustainable option of major flood mitigation which will address all the impacts of flooding for Bundaberg,” she said.

“The documents set out the findings of the independent experts who have assessed each option against numerous criteria to ascertain the project’s viability including unacceptable levels of environmental impact and unacceptable impacts to other areas.

“We are putting all the cards on the table, so the community is fully informed and can give their feedback.”
Brochures outlining the assessment results will be delivered to households starting on Monday, while the community can ask questions at three scheduled forums, this first to be held on Tuesday.

Special interactive maps will also be available online so the community can see the potential benefits and effects of each option.

"This important feedback will assist in narrowing the list of projects to those that warrant further investigation and possible inclusion in the 10-year action plan," Ms Donaldson said.

Community feedback sessions will be held on Tuesday, October 25, 1-3:30pm at the North Bundaberg Progress Hall corner of Queen and Gavegan Sts; Saturday, October 29, 9am-noon, Bundaberg Civic Centre Supper Room; and Thursday, November 3, 4-7pm, North Bundaberg Progress Hall, corner of Queen and Gavegan Sts.

The Flood Protection Study is a component of the Queensland Government's commitment to develop a 10-year action plan for major flood mitigation in Bundaberg.

The Queensland Government has engaged internationally recognised engineering firm Jacobs to conduct the independent Bundaberg Flood Protection Study, which includes reviewing previous flood studies, floodplain risk management plans and the community consultation.

For more information and to inspect the interactive maps visit; www.qld.gov.au/bundabergfloodstudy
FLOOD PLANS: Locals look at the options available at the North Bundaberg Progress Hall.

Ashley Clark and Jim Alouat | 25th Oct 2016 2:49 PM

MAJOR flooding of the Burnett River may be a thing of the past if any one of eleven options - collectively worth more than $11 billion - are adopted by the State Government.

Yesterday the government released plans to reduce flooding that include redirecting the Burnett River, buying up homes, installing levees and building dams.

The 10-year plan for major flood mitigation is in its second stage, with residents now being asked for input during a three-day community consultation process.

Read about the options below and then vote in our poll

Building on the work done by Bundaberg Regional Council, the plan aims to harness the collective knowledge of the community, experts and government to prioritise cost-effective flood mitigation solutions for Bundaberg's people, homes, businesses and economy.

The first consultation session was held on Tuesday at Bundaberg North Progress Hall.

Division 4 Councillor Helen Blackburn was on the floor answering questions and said the consultation process was important in gaining knowledge from locals who had experienced previous floods.

"It is integral to the whole decision making process of the community," she said.

"It isn't about the local or state governments making the decisions, the residents have to understand how those decisions are made and what the impacts will be.

"There are a number of residents who were involved in rescuing, clean ups and particularly those who were here when the floods came through. They understand where the water came from, how high and how fast it was."

"Those sorts of things which local and state government won't understand because we weren't
necessarily here on the ground when it was happening.”

The Bundaberg flood protection study is due to be completed late this year.

The next community consultation is on Saturday, October 29 at the Bundaberg Civic Centre from 9am-noon.

Find out more at http://tinyurl.com/jkg3mb.

Below are the 11 options

Click on the slider and move left to right so the difference.

Option A: Burnett River conveyance improvement

*This option involves river dredging along the town reach, removing Harriet Island, widening Millaquin Bend and regular maintenance dredging.*

**WHAT:** This option would result in more flow in the river and less flow on the floodplain. This would reduce flood levels in some urban areas.

The increased flood flow in the river would result in some increased flood levels in Bundaberg North (up to 0.3m) for smaller, more frequent flood events.

Approximately 470 properties in the Bundaberg area would not be inundated in the 1% AEP 1 flood event.

The option would require the treatment of dredged material and land-based disposal of dredge spoil due to the very low likelihood of at-sea disposal.

**COST:** $235 million, moderate to high cost option.

**BENEFITS:** The estimated reduction in flood damages would be in the order of $35 million.

**ISSUES:** It is expected that there would be difficulties in obtaining an environmental approval for such a large dredging program.

Option B: North floodway

*This option involves construction of four lakes either side of Hinkler Avenue to improve conveyance through Bundaberg North and a channel from Queen St to Waterview Rd.*
Diverting the Burnett River to Elliott Heads?

1. WHAT: This option would involve diverting floodwater through Hinkler and Federation Parks, reducing flood levels in the Burnett River and Bundaberg North.

   Downstream of the lakes and floodway, some properties would experience increased flood levels.

2. COST: $124 million

3. BENEFITS: The estimated reduction in flood damages would be in the order of $7 million.

   Benefits of this option are limited due to the ability to lower flood levels in this area. The flow rate through this area would not change and the flood levels in the urban area are not significantly lowered.

4. ISSUES: This option would have high costs due to the large volume of excavation and the need to treat and dispose of this material.

Option C: North levee and floodway

This option involves constructing a levee around most of Bundaberg North. Lakes and widening of the rail bridge at Hanbury St would also be required to improve conveyance through Bundaberg North.

WHAT: This option would direct floodwaters around Bundaberg North through the construction of a levee and floodway (lake) system.

   This option would provide protection for about 450 properties up to the 1.5% AEP 1 flood event.

   For events rarer/larger than the 1.5% AEP flood event, initial overtopping of the levee would occur along the northern (earth) sections, rather than a sudden overtopping, allowing safer evacuation.

   COST: $100 million

   BENEFITS: Estimated reduction in flood damages would be in the order of about $11 million.

   ISSUES: There is a risk that people inside the levee may become complacent about flood risk.

   The levee would have a major impact on the urban area, restricting access and creating a visual barrier.
Increased flood levels of up to 0.6m would be experienced by some properties outside of the levee.

Option D: Bundaberg East levee
This option includes construction of a levee along the south bank of the river to reduce flooding in Bundaberg East. It would require construction of two floodgates (with one large floodgate for Saltwater Creek).

WHAT: This option would prevent floodwaters from the Burnett River backing up into Bundaberg South for events up to the 1.5% AEP1 flood event.
This option would provide protection for about 440 properties up to the 1.5% AEP (70 year ARI) flood event.
It would reduce flooding for about 320 properties in the 1% AEP 2 flood event.
A flood-gate structure would be required across Saltwater Creek to prevent Burnett River back-up flooding but allow local floods to pass.
COST: $38 million
BENEFITS: Estimated reduction in flood damages of this option is around $29 million.
ISSUES: Localised rainfall that causes flooding in Saltwater Creek may inundate properties to a greater amount if the event occurs concurrently with a Burnett River flood and the flood gate is shut.

Option E: Removal of Fairymead levee
This option involves removal of existing levees at Fairymead on the floodplain downstream of Bundaberg.

WHAT: The option increases flow over the floodplain to the north and west, increasing flood levels in this area.
Several buildings would experience an increase in flood level of 300 mm in a 1% AEP 1 event.
Due to the distance between the Fairymead levee and the Bundaberg urban area, the removal of this levee would reduce flood levels by a very small amount in Bundaberg.
Reduced flood levels would be experienced upstream of the levees and on the eastern floodplain. In a 1% AEP event the benefit is limited to a distance of about 3 km upstream of the levee.

**COST:** $3.4 million

**BENEFIT:** The estimated reduction in flood damages would be in the order of $0.1 million.

**ISSUES:** The assessment of Option E found that this option is likely to have significant impacts on areas outside of the benefited area.

Option F: Millaquin bend

*This option involves deepening, widening and regular maintenance dredging of a section of the left bank of the Burnett River by excavation and dredging to improve flood conveyance through a constricted part of the river.*

**WHAT:** This option reduces flood levels within Bundaberg through increased conveyance in the Burnett River.

Approximately 440 properties would not be inundated in the 1% AEP1 flood event.

Much of the benefit from this option occurs within Bundaberg East, meaning that the majority of benefits of this option would be lost if it was built in conjunction with another option that reduces damages in East Bundaberg (e.g., a levee).

**COST:** $95 million

**BENEFIT:** The preliminary flood damages assessment for this option suggests that the estimated reduction in flood damages would be in the order of $30 million.

**ISSUES:** Dredging and mangrove removal works may negatively impact the local environment, and there is no opportunity for staging.

Option G: Diverting flood to Elliott River

*This option involves construction of a diversion channel from the Burnett River into the Elliott River.*

**WHAT:** This option would reduce flow in the Burnett River and increase flow in the Elliott River.
**WHAT:** This option would reduce flow in the Burnett River and increase flow in the Elliott River. This would reduce flood levels in Bundaberg.

This option would reduce flooding for about 3000 properties in the 1% AEP 1 flood event and prevent over-floor flooding in 1450 properties in the 1% AEP flood event.

**COST:** $9,000 million

**BENEFIT:** The estimated reduction in flood damages for this option is around $90 million.

**ISSUES:** This option would have significant costs. These costs would be approximately 100 times the benefits realised through reduced damages.

Increased flood flow in the Elliott River would result in increased flood levels (up to 8m higher) and very high velocities for properties along this river. This would impact about 60 houses along the Elliott River.

Environmental issues would arise from diverting very large flows into the Elliott River, which has a small catchment and small flows compared to the Burnett River (100 times smaller).

**Option H: Improving access to Tallon Bridge**

This option involves improving emergency access to Tallon Bridge by creating an extension to the bridge from Gavin St through to the roundabout near Bundaberg North State School.

**WHAT:** This option would enable 1400 properties in Bundaberg North to have emergency access to Bundaberg South during a 1% AEP flood event.

It would assist in reducing impacts on people as isolation is reduced and access to emergency services is increased.

It would also decrease stress due to reduced isolation and improved access to emergency services during flood events.

**COST:** $42 million.

**BENEFIT:** Although there is no reduction in flood damages, approximately 1400 properties would no longer be isolated in a 1% AEP 1 flood event. In addition, the available evacuation times for Bundaberg North would increase by about four hours.

**ISSUES:** This option has limited benefits in very large events (e.g. larger than 2013).

This option would have limited benefit for those properties to the east of Hinkler Drive or south of Hinkler Park.

Afflux from the viaduct has not been assessed and would need to be considered in future design development.

**Option I: Dams in upper catchment**

This option involves construction of dam(s) in the upper Burnett River catchment to temporarily store floodwaters. No specific sites have been chosen.
Diverting the Burnett River to Elliott Heads?

WHAT: This option would temporarily detain floodwater from the Burnett River and could reduce flood levels from the 1% AEP flood event to the 5% AEP flood event level. This would reduce flooding for about 3000 properties in the 1% AEP flood event and prevent over-floor flooding in 1450 properties in the 1% AEP flood event.

COST: $1300 million

BENEFIT: The estimated reduction in flood damages for this option is around $90 million.

ISSUES: Environmental approval of this option would be unlikely due to the environmental impacts in the impounded area. The temporary impounding of floodwaters would require the acquisition of large areas of agricultural and forested land. The costs would be very high ($1300 million) and more than 14 times the benefits realised through reduced damages.

Option J: Scheme to buy houses over North

This option would involve either purchase or relocation (via land-swap) of select residential blocks in Bundaberg North that are deemed to be in a floodway with high depths and velocities.

WHAT: This option would remove 130 properties from the floodplain. The purchase of houses would have a result in social changes and social impacts in this area. In rare floods (i.e. larger than 2013 flood), the flooding conditions in this area become extremely hazardous and would likely result in destruction of many houses. The costs of the option are more than eight times the benefits to be realised through reduced flood damages. However, there are other non-tangible benefits associated with reducing the risk to life during floods, especially rare floods.

COST: $39 million

BENEFIT: The preliminary flood damages assessment for this option suggests that the estimated reduction in flood damages would be in the order of $5 million.
Option K: Upper floodplain evacuation improvements

This option involves provision of better evacuation routes and access during floods to the communities of Goodnight, Morganville, Pine Creek, Givelda and Electra through raising of the Perry River Bridge and construction and upgrading of 4WD tracks.

**WHAT:** This option would reduce isolation time for communities in the Goodnight Scrub, Givelda, Pine Creek localities during large flood events. Approximately 400 to 600 properties would have improved access during flood periods requiring less reliance upon emergency supplies.

Construction of this option would be in the order of $16 million for the Perry River Bridge and $1 million for construction of the 4WD evacuation routes.

This option has minimal impacts on others and would have a high likelihood of obtaining environmental approval.

**COST:** Perry River bridge: about $15 to $17 million
Pine Creek evacuation route: about $0.5 to $1 million

**BENEFIT:** This option would not reduce flood inundation of any houses. However, it would significantly reduce the duration of isolation for a large rural community.

Based on the history of flood levels in the Burnett River, it is estimated that the Perry River bridge is cut for approximately 14 days per decade. The proposed bridge upgrade would reduce the time that the bridge is cut to one day per decade.

Based on the loss of income, this reduction in isolation would result in an estimated benefit of $0.7 million. However, the intangible benefits of reduced isolation and the decreased costs of emergency management during flood events would result in greater economic benefits for this option.
New plan floods the Burnett to save Bundaberg

Tobi Loftus | 2nd Nov 2016 3:40 PM

Parts of the North Burnett could be flooded and turned into dams if a plan to stop Bundaberg from flooding is enacted.

Option I of the Bundaberg Flood Protection Study aims to protect properties on the lower Burnett River floodplain by constructing dams in the upper catchment, close to Mundubbera.

The study, conducted by engineering group Jacobs for the Queensland Government, said dams in the upper catchment could mitigate flood flows from the Upper Burnett, Auburn and Boyne catchments.

It would involve construction of a large 1.7 million megalitre dam across the Burnett River floodplain or a number of smaller dams located in each of the river catchments.

It would cost about $1.3 billion.

North Burnett Mayor Rachel Chambers said such a construction would only happen over her dead body.

"I take my hat off to State Government for putting it in public eye," she said.

"What they said after the floods was they would bring every option to the community which is what they've done.

"(Though) our communities' impact must be taken into consideration."

A spokesman for Deputy Premier Jackie Trad said no decisions had yet been made regarding Option I.

"The Bundaberg Flood Protection Study was a key election commitment of the Palaszczuk Government," the spokesman said.

"Jacobs are currently inviting community feedback on the detailed assessments of all 11 flood-mitigation options, including those which affect communities in the North Burnett catchment.

"The North Burnett community are important stakeholders in this process and are invited to make submissions during the consultation period.

"All assessments have been released so the community is fully informed and can give their feedback. No decisions have been made about any of the options."

Mayor Rachel Chambers in unimpressed with the study.

Tobi Loftus
Despite all options being presented to the State Government for consideration, the report said Option I would be unlikely to achieve the desired outcome, as environmental approvals would be unlikely and the cost would be 14 times the benefits.
## Appendix G. Summary of community feedback

<table>
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<tr>
<th>Feedback no.</th>
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| 1 | - Options need to focus on local Bundaberg North flooding (small catchments)  
- Preferred option is the purchase or relocate all Bundaberg North and make park  
- The option would be improved through: sirens, better evacuations and warning. (12 hours warning would be good) |
| 2 | - Option D: concerned about property devaluation due to Bundaberg East levee, and about property access due to levee |
| 3 | - Need more bridges under railway line at Hanbury Street  
- Option J: not keen to sell or to be relocated |
| 4 | - Option A: waste of money as the foundry is still there |
| 5 | - Need for clearing of mangroves from slip way – semi-clearance to improve flood flow |
| 6 | - Need register of people who need help – point of anxiety about who was going to help (e.g. elderly people, people with disability, etc). This could be a voluntary register |
| 7 | - Preferred option is Option F – Millaquin Bend widening |
| 8 | - Need to get straight into it – have been talking about this for a long time. If flood comes we will still be talking about this  
- What will the flood mitigation measures mean for rates? |
| 9 | - Notifying residents earlier in an emergency  
- Preferred option is dredging – from a psychological point of view, this would have had a benefit |
| 10 | - Preferred option is dams in the upper catchment  
- Not enough information provided to well understand the impacts of the options, although mapping and asking questions helped |
| 11 | - The diversion of the Elliot River goes through farmland – would be better if this went through State Forest – less private land  
- Property owner of farmland. Concerned that hadn't heard about the mitigation options |
| 12 | - Removal of Harriet Island won't work – you've then got one little river to take a whole lot of water  
- Consultation should be a sit-down session so that the options could be explained better |
| 13 | - Preferred option is the removal of Harriet Island. Currently the island pushes the water over towards the Botanical Gardens. Also need to address how the water is getting into the river first  
- Bundaberg North resident – property was 1.9 metres under water during the last floods. The water was coming up the drain pipes and flooding properties. Worse still, the debris from the drains was getting stuck in people's fences and meant the water could not flow through, which caused more damage. Drainage must be addressed before these flood mitigation options are put in.  
- North Bundaberg should never have been build where it is, as the area from the Botanical Gardens to the Railway Hotel used to be a river bed. |
| 14 | - The greatest impact in the last 50 years on flooding has been the 'new' weir, which has restricted the water and caused much of the build-up. |
| 15 | - Question why Option H is a single lane viaduct?  
- Current rail connection and security for North rail line need to be considered |
| 16 | - Lots of elderly people in Bundaberg North as this area is close to the hospital. Evacuation for this group is critical  
- Evacuation is important as once bridges are out, become isolated |
| 17 | - Preferred options include river dredging and viaduct. Single level is all that is needed and recognise that dredging will need ongoing maintenance  
- Emergency management and evacuation is critical – when to make decision to get out. Helping people to escape is also important. In 2011, while not in danger, people were stuck in relation to access to services, medical, etc.  
- People before property is important  
- Levees are not really an option |
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| 18          | • Not in favour of one option over another. Suggest that take on parts of some (eg: remove trees from Harriet Island, do some dredging etc). Can do number of smaller projects rather than putting all of the money to just one option (eg: could spend $5 M each on a few options)  
• Removing obstructions in the Burnett River will help to reduce the flood levels, eg: Harriet Island, Millaquin Bend, trees on Harriet Island causing sedimentation (i.e. trapping sand)  
• If put in levees, need to make sure that they don't hold water back. These would require pumps. After a few years, potential for this to become an issue if maintenance and testing is not properly kept up  
• Have any decisions about the mitigation options been made? |
| 19          | • There are less expensive options, e.g. replace little square drains with better drainage  
• Need to clear the banks along the Burnett River of rubbish. Keep the trees and the 'useful' vegetation |
| 20          | • To reduce water in the Burnett River, need to start up in headwaters, e.g. catch raindrops where they fall (USA example – Fire River) and don’t get all of water at same time. Also get water into underground system:  
  • recharges underground system  
  • reduces water in river  
  • small dams on properties  
• Dredging is an expensive option:  
  • issues about where to put dredge spoil, i.e. environment issues with disposal of spoil  
  • would need a slipway if taking spoil. Could then use around Bundaberg  
• Don't think the channel is a viable option – is moving the issue elsewhere  
• For property buy back, only buy most at risk properties |
| 21          | • Can part of a few options be started together? For example:  
  • remove all vegetation from Harriet Island – some of the trees are millable and could be sold  
  • remove some/ all of the sand from Harriet Island – sell the sand and make money  
  • remove the earth slipway on the north side downstream of the old traffic bridge  
  • progressively buy back houses (i.e. start with those affected by 5 metre flood, then 6 metre and 7 metre)  
  • small dams in the river headwaters – catch and hold the rain where it falls  
• Preferred option(s) is:  
  • remove part of Harriet Island – above high tide mark  
  • part of slipway and Millaquin Bend – only do work above high tide level  
  • establish many small dams on rural properties in the whole of the river catchment. Farmers could be offered a small incentive if necessary (e.g. make the approval process easier for landholders)  
  • The greatest costs are in dredging – if the work starts in the areas above the high tide level, will get more value for money. Dredge spoil will be the most costly to move and the biggest headache where to put it  
  • Big dams are very expensive – landholders could be encouraged to build much smaller dams with very little cost to the local/ State government  
  • Start the house buy back scheme with those worst affected  
  • Some of the spoil downstream of the old bridge could be used to build up land and reduce the flood effects on those properties |
| 22          | • The existing weir is a problem and needs to be revisited  
• None of the options are any good |
| 23          | • Preferred option is the floodway – water goes where it wants to  
• Federal government flood management plan – things were done in the past that should no longer occur, e.g. built up roads causing flooding (dams water)  
• Levees will exacerbate problem (stay away from levees/ free up path of floodway and river)  
• Stop building on the delta – should be a moratorium on development in the floodway  
• Filling of areas of the riverbank is causing issues – this 'dams' the water. Some areas up to 9.5 metres high |
## Feedback no. 24
- Water through the Botanical Gardens is a big issue
- The landfill is another issue as the water can no longer go through places it once could
- Bigger drains are needed – current ones are inadequate for the water flows
- None of these options adequately address the real issues. Just moving the water from one place to another
- When can we expect something to happen?
- Council have lowered the land valuations for the purposes of buying our land for these options
- The weir has created a major issue with the Burnett River, i.e. the River is now restricted where it once flowed freely

## Feedback no. 25
- Remove the debris at Millaquin Bend
- Ben Anderson Barrage should also be removed to get the silt through

## Feedback no. 26
- The Ben Anderson Barrage should be removed
- The mouth of the Port should be recreated to its original opening
- Preferred option is removal of Harriet Island, channel silitation/ mangroves

## Feedback no. 27
- How much would property owners get under the voluntary house purchase? Not happy with resumptions

## Feedback no. 28
- Preferred options are the house buy back scheme and the removal of Fairymead levee

## Feedback no. 29
- Consideration should be given to creating a marina with financial uplift

## Feedback no. 30
- Further consideration need for Option H in relation to:
  - making this a dual carriageway
  - making it a permanent roadway
  - removing the northern abutment
  - possibly putting a new rail line through the Hinkler Avenue alignment

## Feedback no. 31
- Further consideration should be given to putting fill from dredging into Kendalls Flat (near Bundaberg East)
- Sand levels at Millaquin Bend have increased (2-3 metres) – this area should be lowered with machinery

## Feedback no. 32
- Remove Sandy Hook weir – this has increased sand in the river and mangroves

## Feedback no. 33
- Further consideration needed for area north of North Bundaberg Primary School
- Does not like the Tech Park levee

## Feedback no. 34
- Cheapest way out is Bundaberg East levee and house purchase scheme

## Feedback no. 35
- No one made the call to evacuate during the previous floods – previously had time to evacuate, but no one said should go
- Consideration should be given to land swap scheme as part of house purchase – cheaper than buying back houses

## Feedback no. 36
- Paddy's Creek drain (bypass) – only square pipes beneath piled bridge through that area, which are not adequate
- The lakes in the floodway option are a waste of money – would be better spent on drainage. The lakes would become a magnet for kids, increasing safety concerns. Would also create mosquito concerns at the caravan park
- Viaduct – leave old bridge open to 8 metres

## Feedback no. 37
- Needs to dredge from the barrages downstream to the town
- Removal of Harriet Island, which seems to become an obstacle when flooding occurs in the Burnett River
- Preferred options are Option A, Option D and Option C
- Benefits of these options:
  - saving lives
  - creating employment in town
  - reduce insurance costs
  - health impact improvements
  - sell dredged sand to overseas markets
- Challenges of these options: Bundaberg North and East had similar damages in 2013
- Consideration of advice from engineers in the USA, e.g. the Mississippi River regularly floods in places and they have similar issues
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<tr>
<td>38</td>
<td>• Water adjacent to the Bundaberg CBD should be cleaned up, e.g. Lily Lane is high catchment area and water can’t escape to Bundaberg Creek</td>
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| 39          | • Bundaberg Gin-Gin Road needs to be lowered/ bigger culverts  
• Levee along Hansbury Street needs further consideration |
| 40          | • Remove Paradise Dam and Ben Anderson Barrage and siltation in the Burnett River  
• Bundaberg East levee could back up local drains |
| 41          | • Preferred option is Bundaberg East levee and better warnings  
• None of the options preferred in Bundaberg North |
| 42          | • North Bundaberg levee would result in ugly wall |
| 43          | • Continue dredging to mouth of the Burnett River  
• Get rid of the Bundaberg East barrage  
• Preferred options are dredging and removal of Millaquin Bend and mangroves |
| 44          | • Preferred options are dredging, removal of Millaquin Bend and Harriet Island |
| 45          | • Dredge from the barrage to Millaquin mouth  
• Not interest in the voluntary house purchase |
| 46          | • Preferred option is the Bundaberg East levee |
| 47          | • Preferred option is the Bundaberg East levee. This would be the best option for property at East Bundaberg, which has been devalued significantly  
• The Bundaberg East levee is the best option for costs and benefits properties including Hinkler Place shopping centre and much infrastructure in south and east Bundaberg |
| 48          | • Preferred option is the floodway  
• Question about the responsibility of the Federal Government – should also contribute to funding |
| 49          | • Marker on the front gate indicating 6 metres above sea level. Water finds its way easy to East Bundaberg and then it backs up to North Bundaberg and Bundaberg Creek. Suggest that water can’t find an easy way to Port Bundaberg and to the sea. There is at least a 4 metre difference in water level height between East Bundaberg and Port Bundaberg even on the extra high tide.  
• Whatever is done in Bundaberg will not solve the problem and dredging the Burnett River between East Bundaberg and the Port will not help very much. The only way to solve this problem is to create a corridor of low land between East Bundaberg and the Port at least 500 metres wide, which can still be used as agriculture land under normal conditions. |
| 50          | • Preferred options are the house purchase option/ house swap  
• Don’t believe anything is going to happen (i.e. not the political will) |
| 51          | • Preferred option is flood gates at East Bundaberg. Most flooding is from upstream – the floodgates will help to stop local flooding |
| 52          | • Concern that floodgates will cause flooding of areas not currently affected  
• Main reason for flooding is Paradise Dam, i.e. there is no current to take the sand, etc out to sea  
• Increased flooding of areas not currently flooded will increase costs of insurance  
• Dredging and removal of island won’t do much good. Don’t think it can be fixed. The island shouldn’t be removed |
| 53          | • Preferred options are Option F, Option C, and Option A  
• Challenge is time of evacuation as correct information not given during flood event |
| 54          | • Preferred options are Option F and Option C |
| 55          | • There is a possible bottleneck in the bank between Whittingtons Road and McKenzies Road. If this was opened up in conjunction with a channel to the ocean, it would possibly help and could be a cost effective option in conjunction with other proposals (would be interested to know the results of a computer model of this suggestion)  
• Preferred options are Bundaberg East levee and Bundaberg North levee |
### Summary of comments

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| 56 | - The mouth of the Elliot River is silted up – diversion would increase sediment in an area that is already clogged  
- Wetlands in creeks off the Elliot River are major filtration for the Elliot River.  
- The Elliot River is not part of the Burnett River catchment. The diversion would spoil a catchment that is ‘gentle’ in comparison. Is diverting the Burnett River higher up an option?  
- Would the buy back option include Bundaberg rail museum and aged care men’s shed? These need to be preserved and should be relocated |
| 57 | - Don’t prefer any of the options  
- Would like the Bundaberg-Gin Gin Road near the IGA supermarket to have larger pipes – take more water away instead of damming in  
- No need for Option H – would only get 4 hours to get away – previously, people were given time to go based on Paradise Dam levels. Educating people will be enough |
| 58 | - Currently an evacuation centre is being built at the old showground on the south side. This will not assist the residents on the north side during a flood event – should be building an evacuation centre on the north side.  
- During last floods, the schools that formed the evacuation points were insufficiently prepared.  
- Preferred options are Option F and Option H:  
  - Option F – the greatest benefit would be improve water flow  
  - Option H – would give many residents of Bundaberg North access to the evacuation centre currently being built |
| 59 | - Option D will save a lot of expense  
- ‘Tripping’ the barrage every year at the start of the wet season would flush out the Burnett River and would assist with mitigation (e.g. would clean out the Burnett River and keep degree of silt out of the River if this occurred on an annual basis). This could be reinstated after the flush.  
- This would need warning for local residents – river would naturally flood when barrage wasn’t there |
| 60 | - Further consideration needed to removing:  
  - the Millaquin Mill pond on McGills Road  
  - minor levies as the impede flows  
  - the roadway from IGA to North School Hill as it acts as a levee |
| 61 | - Problem between Bundaberg and the Port – believe that restrictions start beyond the Port. Need to look at the corridor and take high spots out beyond the Port  
- Dredging is the second suggestion to alleviate flooding |
| 62 | - Don’t like Option H  
- Need to look for preference that reflects the dredging beyond Paddy’s reach  
- The rock wall at the mouth needs to be opened up  
- Option G – Gavin Street 1.3 seems low  
- Clean the drain out behind Hinkler Park and Federation Park  
- Would like to see the buy back scheme go further |
| 63 | - Welcome the update on the proposed mitigation strategies.  
- Feel that the general public (i.e. those not living within the city limits) have been thrown over in the study in the quest to provide concentrated alternatives that are centred on the city whilst other far reaching alternatives have been scantily looked upon.  
- Expressed opinion that the majority of cases presented for the lower reaches of the Burnett River around the city could all be a non-requirement should options further upstream be deployed.  
- The study did not look into the basic premise of stopping the water before it reached the city proper. If you can prevent the flood water getting to the city then all other major problems are solved instantly.  
- Option I (dams) was not considered to be of priority importance by the study. There are many different alternatives for the use of the by-product of this action not the least, creating revenue and jobs from the value adding resource. An estimate of $1,300 M has been put on this option and red flags identified without coming up with specific sites. Not sure how can price something without knowing what is being priced.  
- The superbly successful revenue earning Kolan/ Monduran irrigation scheme was broached, that was and still is the |
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<td>premium scheme for a vast area of irrigation here and in the environs, has not been considered. This has been the lynch pin to our success in the industry of agriculture and no reason why it can’t be duplicated elsewhere upstream. This vital element should be further investigated.</td>
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| 64          | The options divide themselves into three distinct groups regarding flood reduction:  
- positive proactive actions – Options A, B, E, F, G, I  
- negative reactive actions – Options C, D  
- neutral people impact actions – Options H, J, K  
The best option for the long term flood protection of Bundaberg is Option A in conjunction with Option B. These two options are the only positive suggestions for getting the flood flow through Bundaberg cutting as quickly and efficiently as possible, resulting in the reduction of physical, economic and psychological damage |
| 65          | Option A: long term commitment to such an idea is a fanciful political fairy tale  
Option B: the use of these is world-wide, even elsewhere in Australia, so why not here  
Option C: the best solution is to simply move the whole of Bundaberg North to a much safer area  
Option D: walls may keep water back, but they can also keep water in  
Option E: sounds great in theory, but why were the walls put there to start with  
Option F: consider this to be not sufficient to be effective  
Option G: this option does not warrant any consideration. Nothing said about what effects this would have on the Elliott River or the people  
Option H: Cunningham was told by the older people that what was delivered was not good enough and it would cause problems. Cunningham was told that the bridge to North School Hill needed to have those two lanes right through. Powers to be knew more than locals, so today we have this unspoken legacy of Cunningham.  
Option I: probably a very good idea if one wishes to grow sugar cane around the Gayndah district  
Option J: you have to be fair dinkum on this resolution and never means never  
Option K: access needs to be improved  
Buxton may be isolated for a short period, but if a flood in the Burrum River got to my back door, there would be a major disaster. All we need in Buxton is access to the community hall if needed. Understand the causeway at Buxton is being looked into, and some funding could have come from similar proposals  
| 66          | A portion of flood levels can be attributed to water flow obstructions in the Bundaberg region. Removing obstructions within Bundaberg city and downstream would reduce flood levels, by increasing water flow rate to sea.  
- The Burnett River has a lower and upper flood plain in Bundaberg and downstream.  
- The lower flood plain (levels from normal river height to just below Bundaberg height, can be cleared to assist water flow (water clearance rate increased)  
- Upper flood plain is Bundaberg North, which cannot be cleared of houses. Attention needs to be directed to the new bridge off-ramp (northside) and Queen Street approach to School Hill, which both cause a partial dam effect, artificially raising water level and forces as observed in the last flood  
Clearing the lower flood plains area would reduce chances of Bundaberg North flooding |
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| 67          | • As a flood affected resident in Bundaberg North, feel better prepared to cope with the aftermath of future events.  
• Although one issue that had a major impact on the residents in this area and made clean up very difficult  
• On the first day residents were allowed access to our properties, with checkpoints to confirm local address access. This was very helpful although was a slow process gaining access to facilities in the city area to gather materials etc  
• On the 2nd day, the ‘private’ access was removed and all and sundry were allowed access to northside. Traffic flow was hindered to such an extent by tourists, that it took residents 2-3+ hours to find their way back across the river to gain access to vital city facilities.  
• This hindered flood affected residents and those who were there legitimately to help.  
• Hope that in future events, this policy will be delayed by a few days to allow residents, their friends and other helpers to work unhindered and begin the clean-up without the nightmare of being hindered at every turn in very trying circumstances |
| 68          | • Lived in Malaysia for a few years which has annual monsoons. There was never any flooding because every street had deep monsoon drains made of cement. All the runoff went down there and out to sea or was channelled into dams for irrigation and drinking water. |
| 69*         | • Preferred option is the Bundaberg North levee and floodway option. This is the most cost effective.  
• Why not go to the railway bridge – flood starts to come through at 7.5 metres. The bridge could create a barrier at 7.5 metres, but allow water to overflow at 8.6 metres allowing water to disperse through the floodway. |
| 70*         | • Option A is the most important project that would prevent flooding in North Bundaberg  
• Only part of Harriet Island needs to be removed to widen the Burnett River, but the land should be kept to the same height as the land under the Burnett Bridge on the north side so water could flow over the top during flood and filling in the channel on the north side of the island would create a large recreational area.  
• The Burnett River on the west side of Tallon Bridge is shallow. Some dredging and widening of this area would help.  
• Something should also be done to get the water away from East Bundaberg to the sea. Widening and dredging of the river at Fairymead is essential.  
• 2010-11 flood came from Paddy’s Island way – big tide pushing up river while flood water is coming down – water has nowhere to go but up.  
• House purchase/land swap is very concerning – would not get anything for land or house.  
• Where is the money coming from for the mitigation options? Money should be spent making other towns (e.g. Innisfail, Cardwell, Tully, etc) that are influenced by cyclones every year).  
• Option A: low lying areas have been built up with landfill (e.g. Bundaberg North IGA). Where would the dredged material be placed? Harriet Island should be left – it is a buffer. If dredging needed, should dredge around it.  
• Option B: landfill is mainly the cause for water rising above previous heights. Are the lakes going to be empty – only filling when there is a flood? Ordinarily, flooding comes from backwater.  
• Option C: leave as is. Rather take chances with next flood. Flood gates seize up.  
• Option D: question ‘green rating’ for tolerable impacts outside benefitted area. Where is the maintenance money coming from? Good for Bundaberg East, but what about properties north of Bundaberg Creek – water has to go somewhere.  
• Option E: got flooded out by 200 millimetres above ground level in 2010-11 by tide pushing up river, raising flood level. Floodwater came from the northeast (Paddy’s Island). If wasn’t for landfill, would not have gotten any flooding.  
• Option F: has tick of approval – simple option. If worried about continuous cost of dredging, get rid of the dam wall across the river at Sandy Hook – constant flow of river will dredge itself. Keep going to the Port. River has silted up since barrage stopped natural flow. This area has turned into a bottle neck. This option doesn't worry anyone or property.  
• Option G: this option will ‘kill’ the Burnett River – river needs good fresh now and then – forget it. The impact on other |
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<tr>
<th>Feedback no.</th>
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<tr>
<td></td>
<td>areas would be enormous.</td>
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<td>• Option H: go back to lakes, channel and floodway – these areas were lakes before</td>
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<td>they were drained and became the Chinese Gardens then cane. If doing this option,</td>
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<td>make a two lane viaduct.</td>
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<td>• Option I: would be good, but would cost more than a few lakes and floodway channel</td>
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<td>and dredging Millaquin Bend. What is the point when there is a flood and they are</td>
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<td>full – all the lakes and dams were full in 2013.</td>
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<td>• Option J: going to take house and home – not taking house. This is the best part of</td>
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<td>Bundaberg – wouldn’t live anywhere else. Pay to raise them all up – this would be</td>
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<td>a lot cheaper.</td>
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<td>• Option K: option does not concern residents of Bundaberg, although needs to be done.</td>
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</table>

*note, feedback received after submission period (i.e. after 20 November)*