CONFIDENTIAL ORDINARY COUNCIL MEETING

CONFIDENTIAL MATTERS

Staff Reports

STAFF REPORTS

Matters which cannot be delegated to a Committee or Staff.

18.1 GRFMA - GAWLER RIVER 2016 FLOOD REVIEW

Contact Person: Mr Sam Green

Why is this matter confidential?

Subject to an order pursuant to Section 90 (3) (d) of the Local Government Act 1999, this matter is confidential because the disclosure of this information could reasonably be expected to confer a commercial advantage on a third party because the information details privately owned land areas that will be subject to additional flooding and other areas that will be subject to reduced flooding. Disclosure of this information would likely be taken account of by prospective purchasers of land that will be subject to additional flooding, to the detriment of existing landowners.

Additionally, disclosure of this information would likely lead to premature land sale and purchase speculation prior to any GRFMA mitigation decisions, as to improving value of land in the case of areas proposed for reduced flood risk.

A. COUNCIL/COMMITTEE TO MOVE MOTION TO GO INTO CONFIDENCE

No action – this motion passed in the open section

B. THE BUSINESS MATTER

18.1 GRFMA - GAWLER RIVER 2016 FLOOD REVIEW

Responsible Executive Manager : Mr Sam Green

Report Author : Mr Braden Austin

Delegated Authority : Matters which cannot be delegated to a Committee or Staff.

Attachments :
1. Letter to Council from GRFMA
2. Report by AWE for GRFMA

PURPOSE

To establish council feedback, for the Gawler River Floodplain Management Authority (GRFMA), on a recent preliminary report about (i) a hydrological review of the 2016 Flood, (ii) an evaluation of floodplain model performance and (iii) A review of flood mitigation options in the Lower Gawler River.

STAFF RECOMMENDATION

That Council endorses as a high priority:

1. The GRFMA coordinating the repair of existing breaches to the levee bank system.
2. The development of a detailed design and costing for physical works for a northern floodway, the upgrade and maintenance of the levee system, and the sensitive removal of silt and pest vegetation in the lower reaches of the Gawler River using a risk based approach.
3. That the GRFMA seeks state and federal government funding support for the detailed design and construction of the northern floodway, and levee upgrade, silt and vegetation management in the lower reaches of the Gawler River as a matter of urgency.

That Council endorses as a medium priority:

1. That, in principle, a single entity takes ownership and maintenance responsibility of the high risk reaches of the Gawler River and investigations are undertaken:

    a. into the extent of river land ownership warranted in order to reduce the risk of flooding to the broader community.
    b. into the financial implication for control, upgrade and maintenance of the identified areas.

EXECUTIVE SUMMARY

The 2016 Gawler River flood was approximately a 1 in 20 year event and damaged a lot of property in the Virginia area. The GRFMA commissioned a review of the flood hydrology, the floodplain model performance and options for flood mitigation in the lower Gawler River, downstream of Baker Road. This report discusses the recommendations of that review.

Supporting the recommendations will be consistent with council's Strategic Plan through Outcome 1.2 Improved service delivery, Outcome 3.2 Commercial and industrial growth and Outcome 3.3 Sustainable economic transformation.

The levee system is under multiple private ownership and is generally poorly constructed and maintained. The report recommends that maintenance of the levees and channel should be the responsibility of a single authority. This may not be necessary in the upper reaches.

Three flood mitigation options have been considered:

Option 1: Northern Floodway. ($27M). Favoured option in the report to GRFMA.
Option 2: Channel Widening Works. ($119M).
Option 3: River Desilting and New Outlet to the Sea. (Not costed).

Recommendations generally support those in the report to the GRFMA, with a supplementary recommendation that the extent of river land ownership warranted be further investigated.

1. BACKGROUND

The GRFMA is established to coordinate Gawler River flood mitigation infrastructure. Constituent councils are City of Playford, Adelaide Plains Council, Town of Gawler, Barossa Council, Light Regional Council and Adelaide Hills Council. There have been a number of previous investigations reports and physical works projects completed by the GRFMA.

The 2016 flood has prompted a review and examination of flood mitigation options in the lower Gawler River downstream of Baker Road, including the Virginia and Buckland Park areas of the City of Playford. The resultant report (December 2016) commissioned by the GRFMA and the subject of this report to council is *attached* as Appendix 2. A previous report (February 2016), commissioned by the GRFMA, predicted a breakout of the Gawler River in the vicinity of Baker Road and an overland flow path toward Virginia. The 2016 flood did indeed break out in this area and followed this path causing a significant amount of damage to crops and property. The February 2016 report recommended the raising of the Bruce Eastick Dam and, while this has significant benefits for Gawler, Two Wells, Lewiston and other places, it would provide minimal benefit in the Lower Gawler area. This latest December 2016 report addresses the management of flooding in the area affected by the 2016 flood and proposes a new mitigation options to protect properties adjacent the lower Gawler River.

The concerns of horticultural growers about damage to crops and property from flooding in the lower reaches of the river have been well publicised and there is evidence that the flood prone nature of some land is negatively affecting investment decision making.

The GRFMA established a reference group, who were consulted in the preparation of the report. The reference group comprised the GRFMA's Technical Assessment Panel plus seven landholders and industry representatives, including some from within the City of Playford area.

2. RELEVANCE TO STRATEGIC PLAN

1: Smart Service Delivery Program
Outcome 1.2 Improved service delivery

This decision will allow the GRFMA to make further positive steps to reducing the annual average flood damages in areas affected by the Gawler River, including parts of the City of Playford.

3: Smart Jobs & Education Program
Outcome 3.2 Commercial and industrial growth
Outcome 3.3 Sustainable economic transformation

This decision will allow the GRFMA to protect areas of Playford from flooding and reduce damage to existing and potential horticultural crops, infrastructure and other investment, allowing more intense investment and associated jobs growth.

3. PUBLIC CONSULTATION

There is no requirement to consult the community at this point in time. Throughout the development of the report to the GRFMA, horticultural and industry representatives were actively engaged.

4. DISCUSSION

4.1 Hydrological Review of the 2016 Flood.

The rainfall event and flow data for the Gawler River between 28 September and 4 October 2016 was analysed and is discussed in the report to the GRFMA, which concludes it was approximately equivalent to a 1 in 20 Average Return Interval (or an Annual Exceedance Probability of 5%). The review shows that the South Para Reservoir spillway modifications and, more particularly, the Bruce Eastick Dam (both constructed for the GRFMA) had a large effect in constraining the areas severely flooded in the lower portions of the Gawler River (including the Virginia area). A comparison of actual flooding, in the Lower Gawler during this event, with what the model predicted, shows that the floodplain model provides a reasonable representation of reality. This also shows that the existing protection works provide protection to slightly less than an event of Annual Exceedance Probability of 5%.

4.2 Existing levee integrity and state of the river channel.

Both the report to the GRFMA and a separate report from another consultant to City of Playford have identified that the existing levees are inconsistently and generally poorly constructed, in poor condition and are difficult to inspect and maintain. The fragmented land ownership covering the river bed and levees compounds the problem further.

A coordinated approach is needed to ensure the levees and river are kept clear of nuisance plants and sediment that reduce flow capacity and that levees are appropriately engineered and maintained. Making matters more difficult, there is ambiguity in the legislative framework around responsibility for watercourse management in South Australia. These difficulties are avoided if the river system is under the ownership of one entity.

The report to the GRFMA has recommended that maintenance should be the responsibility of a single authority. In principle this makes sense, however in the middle to upper reaches of the river, single authority responsibility may not be so easily justified because the river is confined and generally does not flood beyond the property that includes the relevant levee/river bank and portion of river bed. In these situations and under current arrangements the only person likely to suffer loss, if a levee or river bank is poorly maintained, is the person responsible for the levee. This needs further investigation.

4.3 Flood mitigation options. The report has explored 3 flood mitigation options, being:

4.3.1 Option 1: Northern Floodway. $27M. Favoured option in report to GRFMA. This comprises:

- Levee improvements from Pederick Road to the rail bridge,
- A north bank side spillway upstream of Old Port Wakefield Road (and new culverts underneath Old Port Wakefield Road).
- A north side levee system to contain flows up to Port Wakefield Road and another spillway for larger flows,
- North side levee systems west of Port Wakefield Road, guiding flows along and then back into the river channel at western Buckland Park.
- Levee works on 13 properties.
- 1 in 50 year Average Return Interval (2% Annual Exceedance Probability) protection for 211 (229 post Buckland Park development) of the 248 properties flooded in 2016 and significantly reduced flooding for another 10 properties. Includes full protection of the high value horticultural land near Virginia.

4.3.2 Option 2: Channel Widening Works. $119M.
This comprises:

- River channel widening by 20 metres from Baker Road to Old Port Wakefield Road.
- River channel widening by 30 metres downstream of Old Port Wakefield Road.
- Replacement of bridges for Baker Road, rail line, Old Port Wakefield Road and Port Wakefield Road.
- Levee improvements from Baker Road to Pederick Road.
- Protection to an additional 8 properties compared to the Northern Floodway option.

4.3.3 Option 3: River Desilting and New Outlet to the Sea. Not costed.
This comprises:

- Removing about 1 metre of silt from the river bed for about 15 km downstream of Baker Road.
- Selected clearing of vegetation and modification of bridge structures as necessary.
- A new outlet channel to direct flood water to the sea from upstream of Buckland Park Lake.
- Does not provide sufficient river channel capacity and new outlet channel would have only a limited effect downstream of Port Wakefield Road.

4.4 The recommendations from the report to the GRFMA, that the GRFMA are seeking feedback on, are:

Recommendation 1*: River and levee maintenance should be the responsibility of a single authority that has the necessary resources and access rights to maintain the river in good condition from a flood conveyance as well as biodiversity perspective.*

Recommendation 2*: River condition and levee maintenance repair work should be undertaken as a matter of high priority.*

Recommendation 3*: The GRFMA proceed with developing concept designs for the establishment of a Northern Floodway, in addition to the construction of a new river levee system so that consultation with affected landholders can proceed.*

4.5 Next Steps

The GRFMA have identified the urgency in progressing flood mitigation options for the Gawler River and have identified alternative mitigation options as a matter of urgency.

The GRFMA will consider the feedback sought from member Councils in February 2017 and it is expected that detailed design and costings for the identified mitigation option will be progressed as a matter of urgency. This information is required to seek the funding of the project from the State and Federal Government and associated funding from member Councils. It is expected that this work will be finalised within 3-6 months.

5. OPTIONS

Recommendation

Option 1

That Council endorses as a high priority:

1. The GRFMA coordinating the repair of existing breaches to the levee bank system.
2. The development of a detailed design and costing for physical works for a northern floodway, the upgrade and maintenance of the levee system, and the sensitive removal of silt and pest vegetation in the lower reaches of the Gawler River using a risk based approach.
3. That the GRFMA seeks state and federal government funding support for the detailed design and construction of the northern floodway, and levee upgrade, silt and vegetation management in the lower reaches of the Gawler River as a matter of urgency.

That Council endorses as a medium priority:

1. That, in principle, a single entity takes ownership and maintenance responsibility of the high risk reaches of the Gawler River and investigations are undertaken:

    a. into the extent of river land ownership warranted in order to reduce the risk of flooding to the broader community.
    b. into the financial implication for control, upgrade and maintenance of the identified areas.

Option 2

That Council endorses as a high priority:

1. That council supports the GRFMA coordinating the repair of existing breaches to the levee bank system.
2. That council supports the development of a detailed design and costing for physical works for a northern floodway, the upgrade and maintenance of the levee system, and the sensitive removal of silt and pest vegetation in the lower reaches of the Gawler River using a risk based approach.
3. That the GRFMA seeks state and federal government funding support for the detailed design and construction of the northern floodway, and levee upgrade, silt and vegetation management in the lower reaches of the Gawler River as a matter of urgency.

6. ANALYSIS OF OPTIONS

6.1 Recommendation Analysis

6.1.1 Analysis & Implications of the Recommendation

Option 1 deals with the recommendations of the GRFMA report and proposes that the following actions have a high priority and likely to be finalised within a 3-6 months.

Repair of existing breaches

The recommendation supports the second recommendation in the report to the GRFMA. Breaches from the 2016 flood occurred across more than one local authority, the repair of levees is not regular work for councils and nor is the management of Gawler River levees an established council responsibility. It would be more efficient and appropriate for the GRFMA to coordinate and secure funding for the various repairs. An overall upgrading and

maintenance regime for the levee system is also considered appropriate and funding should be sought from State and Federal Government for these works.

Northern Floodway

The report to the GRFMA examined two options for the protection of properties (about 230) in the lower Gawler River from flooding; a northern floodway, or channel widening. Both options offer similar protection, but the Northern Floodway option is estimated to cost substantially less. This is considered to be a practical and sensible option that offers clearly positive benefits for the City of Playford and broader community, and should have a high return on investment. Detailed design and costing is expected to prove this to be the case.

State and Federal Funding

Because the Gawler River scheme protects thousands of properties across a number of local authority areas, the benefits are regional. Additionally, it is normal for the state to contribute to stormwater control and flood mitigation works. The horticultural food growing area around Virginia that would be protected by the northern floodway scheme is the single largest of its kind in Australia and as such is of national significance and so it is in the national interest to protect. Both state and federal funding would be appropriate and welcomed in this case. The sooner the scheme is completed the sooner the benefits will accrue and so urgency is required.

Single ownership and control of the river

The control of the river under the single ownership is seen as a medium priority as should be considered over the next 6 to 12 months.

The report to the GRFMA appears to recommend that the entire river be maintained by a single authority with the necessary access rights. Administration considers a more selective approach would be better. The recommended option is for the GRFMA to consider ownership only where there is a benefit to the broader community, where a breach of the river banks/levees results in extensive flooding of properties, beyond that of the property which the river runs through.

There are greater benefits in a single entity having river ownership in the lower reaches and potentially little benefit in a single entity having river ownership in the upper reaches. Additional analysis is required to determine the extent of the Gawler River that should be controlled by a single entity, but a quick analysis would indicate that control should be at least between Wingate Road and Buckland Park, on the basis that breakouts of the river during a flood event occur in these locations. The Town of Gawler may wish to see control further upstream.

6.1.2 Financial Implications

There are no financial or resource implications associated with this report, however, Council will be asked to contribute funding in the future to additional flood mitigation options. Concept designs and further costings are required before Council's contribution can be determined. This work has been request to be conducted by the GRFMA.

6.2 Option 2 Analysis

6.2.1 Analysis & Implications of Option 2

Difference between recommendation options

Options 1 and 2 differ only in relation to proposed feedback on the matter of ownership of the land associated with the river.

Option 2 (not recommended) is that council remains silent on the matter of land ownership.

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5/1/17

Mal Hemmerling
Chief Executive Officer
City of Playford
Playford Civic Centre
10 Playford Boulevard
ELIZABETH SA 5112

Dear Recipient Name,

I am writing regarding the Gawler River 2016 Flood Review - Preliminary Report - Confidential First Draft dated 15 December, 2016.

The scope of the review was determined by the GRFMA at its 25 October 2016 meeting. Australian Water Environments was subsequently engaged to undertake the following tasks:

1. Carry out a hydrological review of the 2016 Flood, with rainfall and streamflow data from across the Gawler River, North Para and South Para catchments to be collated and summarised so that a description of the flood can be developed and its magnitude characterised at key locations across the catchment.

2. Evaluate the floodplain model performance by utilising the results from the hydrological review and feed these into the floodplain model so that its performance could be evaluated against the recorded flood extent information for the 2016 flood.

3. Review options for mitigation in Lower Gawler River, in association with the Technical Assessment Panel and other co-opted stakeholders.

Having now received and subsequently considered the Preliminary Report the Authority is now seeking feedback and comments on the report from constituent councils.

The Preliminary Report provides the following three key recommendations based on Condition and Maintenance of the River and Mitigation Works.

Recommendation 1: *River and levee maintenance should be the responsibility of a single authority that has the necessary resources and access rights to maintain the river in good condition from a flood conveyance as well as biodiversity perspective.*

The very poor condition of the levees, and the river itself reinforces the need for a coordinated and managed approach ensuring the river is kept clear of nuisance plants that unnecessarily impede flow, that sediment deposition and accumulation is controlled, and that any levee system is appropriately engineered and maintained.

Recommendation 2*: River condition and levee maintenance repair work should be undertaken as a matter of high priority*

There are three "no regrets" actions that would provide immediate benefits in terms of reducing flood risk.

- To sensitively remove pest and nuisance plants and revegetate as necessary with appropriate native plants species that will not unnecessarily impede flood flows.
- Undertake repairs to the damaged levees and those sections of levees considered to be most vulnerable to failure during the next flood.
- Sensitively remove accumulated sediment around key structures such as the Railway bridge, Baker Road crossing, Old Port Wakefield Road Bridge and the Port Wakefield Road highway bridges that is impairing the capacity of these crossings to convey flow through them.

Recommendation 3: *The GRFMA proceed with developing concept designs for the establishment of a Northern Floodway, in addition to the construction of a new river levee system so that consultation with affected landholders can proceed.*

The Northern Floodway option provides a similar (albeit slightly less) degree of protection to the channel widening option but it can be achieved at a much reduced cost and without the substantial environmental, cultural heritage and social implications associated with the channel widening options.

Please note that notwithstanding finalising the content of the Preliminary Report there is still a body of work required to be undertaken around ground truthing potential works, review of costings and completion of hydrological assessments before the Final Flood Options Assessment Report can be completed. See page 21 of the Preliminary Report.

Additionally, the Authority is mindful that the important questions around funding options and ongoing liability/risk from consequences of any completed infrastructure are still to be

determined. These considerations will be determined in due course as the project progresses.

More particularly, constituent council support for the recommendations contained within the report will enable the Authority to expedite vital negotiations with the Federal and State Governments regarding potential funding for the flood mitigation works identified within the report (either in individual or a combination of stages recommended within the report) and to continue to work with the State Government and Local Government Association SA in seeking a review of water course management and flood mitigation legislative responsibilities.

Council feedback and comments should be forwarded to davidehitchcock@bigpond.com by 9 February 2017.

Yours sincerely

David E Hitchcock

Executive Officer

Gawler River Floodplain Management Authority

Attachment: Gawler River 2016 Preliminary Report – Confidential Frisrt Draft

Gawler River Floodplain Management Authority

Gawler River 2016 Flood Review

PRELIMINARY REPORT

FIRST DRAFT

December 2016

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Appendices

1 Introduction

The Gawler River Floodplain Management Authority (GRFMA) has engaged Australian Water Environments (AWE) to identify and assess alternative flood mitigation options for the lower Gawler River.

1.1 Scope of Review

The scope of the review was determined by the GRFMA at its 25 October 2016 meeting. Australian Water Environments was subsequently engaged to undertake the following tasks:

1. Carry out a hydrological review of the 2016 Flood, with rainfall and streamflow data from across the Gawler River, North Para and South Para catchments to be collated and summarised so that a description of the flood can be developed and its magnitude characterised at key locations across the catchment.
2. Evaluate the floodplain model performance by utilising the results from the hydrological review and feed these into the floodplain model so that its performance could be evaluated against the recorded flood extent information for the 2016 flood.
3. Review options for mitigation in Lower Gawler River, in association with the Technical Assessment Panel and other co-opted stakeholders.
4. Preliminary report to be received by 14 December 2016.

The scope of is Preliminary Report is to focus on the review of the behaviour of the 2016 flood event in the lower sections of the Gawler River. This is the area which was severely affected by flooding in the September 2016 flood event along the Gawler River.

For the purpose of this Preliminary Report, the lower Gawler River was assumed to be section of river west of the Pederick Road alignment. This location was selected because the channel capacity west of that point becomes increasingly compromised (even when assuming any artificial or natural levees remain intact during a flood).

That is not to say that works upstream of that point are not also required (some of the sections of levee east of Pederick are known to be in very poor condition) but in the main the leakages and flows through the levees were relatively minor whereas downstream of that point flooding was more severe.

1.2 Reference Group

The GRFMA's Technical Assessment Panel established a Reference Group to assist with the work (as requested by the GRFMA, refer item 3 above).

The Reference Group comprised the Technical Assessment Panel plus seven landholders. Eight landholders were originally identified and invited to participate in the Reference Group meetings. Seven of those people being: Adrian Marschall, John Bergamin, Danny De Ieso, Peter Rentoulis, Dino Musolino, Michael Pickard, and Barrie Ormsby; were able to commit the necessary time to participate in the Reference Group.

Table 1 provides a list of Reference Group Members.

TABLE 1 REFERENCE GROUP MEMBERSHIP

Member	
Adrian Marschall	Virginia Resident Action Group Chair and Landowner
Alex Zimmerman	Recovery Coordinator – Northern Adelaide Plains Flood
Barrie Orsmby	Landscape Architect and Consultant
Bill Lipp	Principal Stormwater Engineer, Department of Planning, Transport and Infrastructure
Chrissie Bloss	Senior Flood Management Officer, Department of Environment, Water and Natural Resources
Danny de Leso	AUSVEG SA representative and Landowner
Dean Gollan	Executive Officer, Gawler River Floodplain Management Authority
Dino Musolino	Deputy Mayor, City of Playford and landowner
Ian Baldwin	Presiding Member, Gawler River Floodplain Management Authority
John Bergamin	Landowner
Michael Pickard	Landowner
Peter Rentoulis	Councillor, City of Playford

1.2.1 Terms of Reference

The terms of Reference for the Reference Group (which were confirmed at the first meeting of the Reference Group) were as follows:

- Promote dialogue between landholders and the GRFMA's Technical Assessment Panel.
- Contribute to the identification of flood mitigation options to be assessed for the lower Gawler River and presented to the GRFMA.
- Provide feedback on the merit of the options assessed.
- Identify a preferred option (or provide a short list of preferred options up to three) for presentation to the GRFMA.
- Have its views and decisions noted and reported to the GRFMA by Australian Water Environments. In this regard Australian Water Environments role was to:
    - Ensure that the views of the Reference Group are documented and summarised in its report to the GRFMA.
    - In the event that there is not a agreement within the Reference Group on a single preferred option then AWE will present up to three alternative options in their report to the GRFMA.

The Reference Group was chaired by Mr Ian Baldwin (Presiding Member GRFMA)

1.3 Process of Mitigation Option Development

A series of mitigation options were firstly conceptualised by Australian Water Environments and presented to the Reference Group for discussion. The conceptualisation process involved:

- Reviewing mapping results from:
    - Historical floods, where these were available (only 1992 and 2016)

- Floodplain mapping work undertaken by the GRFMA in 2003, 2007 and in 2014. Some of this modelling included hypothetical levee breaches as part of floodplain modelling sensitivity analyses.

- Reviewing anecdotal information and observations from landholders and SES volunteers. This information was collated and supplied to Australian Water Environments by the Flood Hazard Team of the Department of Environment, Water and Natural Resources (DEWNR).
- Holding one on one meetings with landholder members of the Reference Group to capture their thoughts and understanding of the behaviour of the 2016 and earlier floods.

This process identified three potentially feasible and effective options that were presented to the Reference Group at its first meeting. They were:

- A southern floodway formed by raising Angle Vale Road (along with some additional smaller unsealed roads) to form a flood levee to prevent flood waters pushing south of Angle Vale Road. This option coincided with a partial mitigation option that was included in the Findings Report presented to the GRFMA in March 2016.
- A northern floodway from Old Port Wakefield Road to the Port Wakefield Highway and then extending further west of the Port Wakefield Highway.
- Channel widening from Baker Road downstream with levee reinforcement works upstream where required.

Of these options the Reference Group agreed to proceed with investigations for the northern floodway and the channel widening options.

The southern floodway option was discarded because it was only partially effective and would leave large areas of intense horticulture exposed to flooding.

A third option involving channel desilting, vegetation clearance, along with a new outlet channel to the sea was proposed by some members of the Reference Group. The Reference Group agreed that that option should also be assessed.

Notes on Existing Levees

All three options would also require many sections of the existing levees to be reinforced and/or raised.

In reality, the existing levees are mostly in very poor condition because they were either not constructed to an appropriate standard in the first place and/or have not been maintained. Effectively they need to be replaced with appropriately engineered flood levees that are of sufficient height and thickness to be effective whilst also enabling them to be effectively maintained in good working order.

2 Description of 2016 Gawler River Flood Event

2.1 Brief Description of the Rainfall Event

The Bureau of Meteorology is presently compiling a comprehensive assessment of the rainfall information collated during the flood event and reporting this information to State Government. Raw data collected by the Bureau was made available for this lower Gawler River Flood Mitigation assessment work.

The rainfall covered an extensive area across the North and South Para catchments with falls from the period of specific interest (midday 28 September 2016 through to midday on the 4th October 2016 from a rainfall perspective) ranging typically between 100 to 140 mm in the higher topographic areas of the North and South Para, whilst in the areas of lower relief areas(but still mainly in the North and South Para catchments) rainfalls were typically between 60 to 90 mm during this six day period.

Most sites recorded two main periods of rainfall, one towards the beginning of this period and second towards the later part of the period with around a day of little rain in between.

Whilst the rainfall intensities would not appear to be particularly excessive, these rainfalls fell on an already wet catchment which is likely to have contributed to higher flows than might have otherwise been expected from the observed rainfalls.

2.2 Recorded Flood Hydrology

Water levels along the North Para and South Para are continuously recorded at three key reference points with respect to forecasting flows at Gawler.

- On the North Para at the Bruce Eastick North Para Flood Mitigation Dam (upstream water level)
- On the North Para downstream of the Bruce Eastick North Para Flood Mitigation Dam.
- On the South Para at the South Para South East of Gawler measuring weir.

In addition to these measuring points, water levels are recorded for flood warning purposes on the Gawler River near Virginia (downstream of Old Port Wakefield Road, Gosford Street and near Heaslip Road at Angle Vale). Water flow recordings are also available for the South Para Reservior.

The flow data for the locations on the North Para and South Para are most helpful for assessing the scale of the flood because these measuring locations have relatively reliable rating curves and sufficiently long recordings (many years of continuous data) to enable flood frequency information to be developed. The locations also correspond to the upstream boundary conditions of the floodplain model and hence are necessary for testing and refining the floodplain model.

A thorough review of the above and other data sets is presently underway which will enable further refinement of flood frequency information and flood hydrology for the whole of the Gawler River catchment (ie including the North and South Para). However, that review process will take much longer than the allotted timeframe for this preliminary assessment of options. Hence, this review has been based on an initial assessment of observed water levels and calculated flows at the key reference points on the North and South Para outlined above.

The calculated flows along the North Para, downstream of the Bruce Eastick North Para Flood Mitigation Dam and the South Para, South East of Gawler are presented in Figures 2.1 and 2.2.

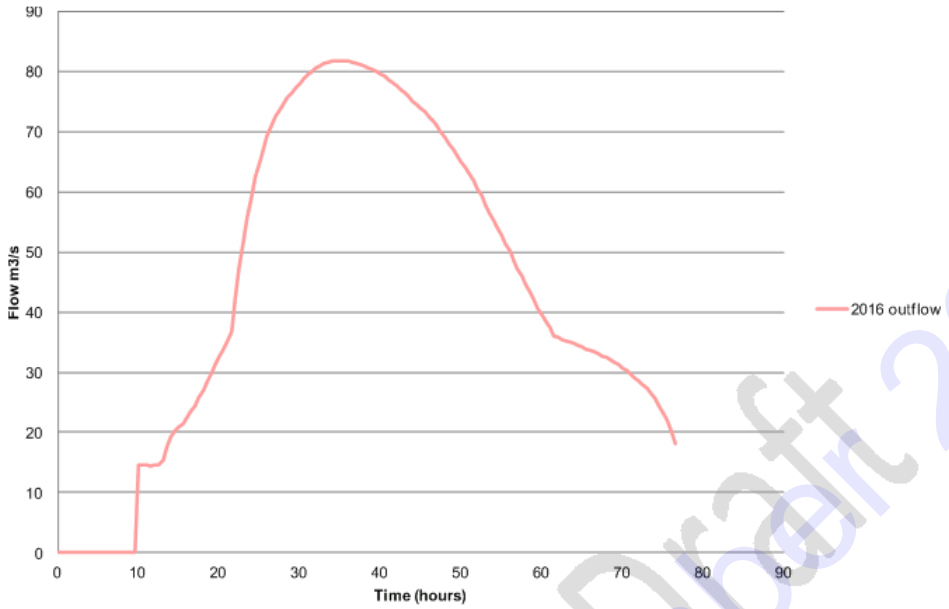


FIGURE 2.1 : CALCULATED NORTH PARA FLOWS DOWNSTREAM OF BRUCE EASTICK NORTH PARA FLOOD CONTROL DAM – 2016 SEPTEMBER FLOOD

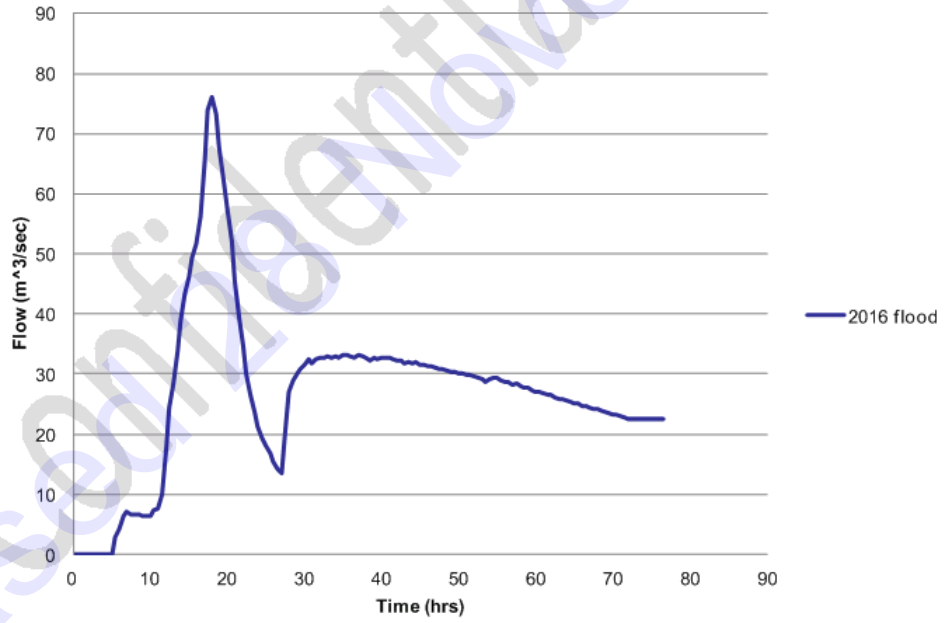


FIGURE 2.2 : CALCULATED FLOWS ALONG THE SOUTH PARA 2.3 KM UPSTREAM OF GAWLER

The peak flow rates estimated at these two locations were compared against the latest flood frequency information available for these locations (Australian Water Environments, 2015). In both cases the calculated peak flows are very similar to the 1 in 20 year Average Recurrence (ARI) Interval flood event. The North Para flows are slightly less, the South Para flows a little more.

It is reasonable to conclude that the recorded flood event at Gawler was (approximately) equivalent to a 1 in 20 year ARI event.

Inspection of the flood hydrograph for the South Para highlights the twin peak characteristic of this river system (in the event that spills occur from the South Para Reservoir). The first, and significantly higher peak flow in the September 2016 flood, was as a result of flows from the local catchment downstream of the South Para Reservoir. Whilst water flowed through the modified spillway of the South Para Reservoir, these flows were much less than those generated from the local catchment.

2.3 Effectiveness of the Bruce Eastick North Para Flood Mitigation Dam

The effectiveness of the Bruce Eastick North Para Flood Mitigation Dam was estimated through a reverse routing process to estimate the inflow to the dam based on the calculated outflow rates and change in storage in the dam. Figure 2.3 illustrates the results.

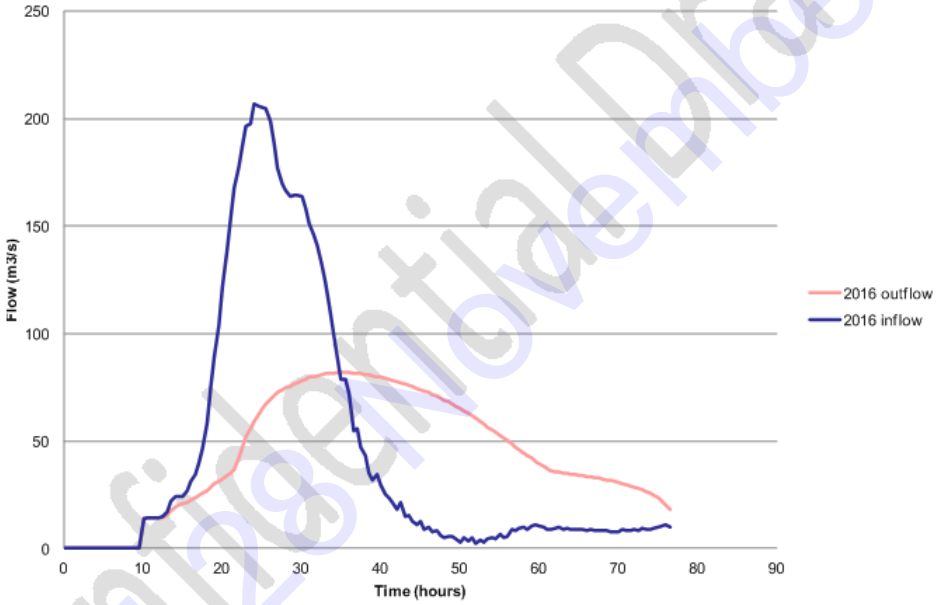


FIGURE 2.3 : CALCULATED INFLOW AND OUTFLOWS FOR THE BRUCE EASTICK NORTH PARA FLOOD MITIGATION DAM – SEPTEMBER 2016 FLOOD

The results highlight that the flood mitigation dam was very effective in minimising flows down the North Para.

The more intensive hydrological review currently underway will conduct a similar assessment for the effectiveness of the spillway modifications recently undertaken on the South Para Reservoir, but suffice to say the outflows from the reservoir would have been less than if the works had not been undertaken.

Figure 2.4 illustrates the benefit received from the flood mitigation on the North Para, for Gawler and further downstream.

In terms of flooding downstream, the dam was effective in constraining the areas severely affected to the lower portions of the Gawler River. Without the dam serious flooding through Lewiston and further downstream towards Two Wells could have been expected.

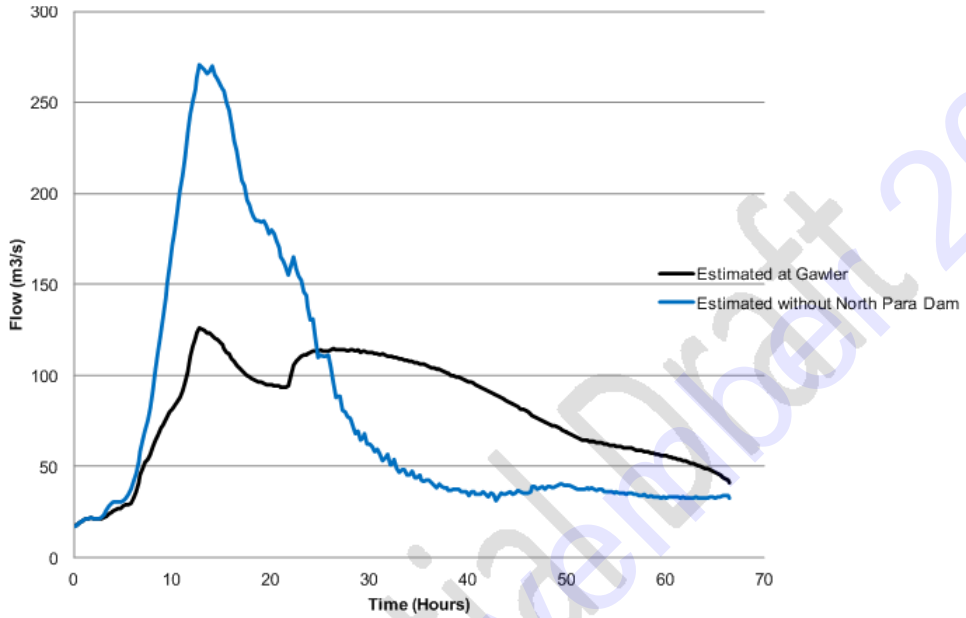


FIGURE 2.4 : ESTIMATED FLOWS DOWNSTREAM OF GAWLER, WITH AND WITHOUT THE BRUCE EASTICK NORTH PARA FLOOD MITIGATION DAM – SEPTEMBER 2016 FLOOD

2.4 Lower Gawler River 2016 Flood Inundation Extent

The information gained from observations of flooding in the lower Gawler River were used to check and/or revise the floodplain model calibration as necessary. Once this was done it was agreed that the model would be suitable for developing and testing potential flood mitigation options for the lower Gawler River.

The Flood Hazard Team of DEWNR has mapped the observed flood extent envelop in the lower Gawler River area from Buckland Park Road upstream to Baker Road. This mapping is provided in Appendix A. Also provided in Appendix A is a map of the recorded breaks in the levees.

This information was used to firstly insert the observed breaks into the floodplain model and then secondly to review the performance of the floodplain model.

The results of this process indicated that the floodplain model provided reasonable representation of the 2016 flood extents within the area where information was available to compare the model results with the observed results.

A map of the modelled 2016 flood extent is provided in Figure 2.5 below.

This map provides a reference point or base map from which the effectiveness of potential mitigation options can be assessed.

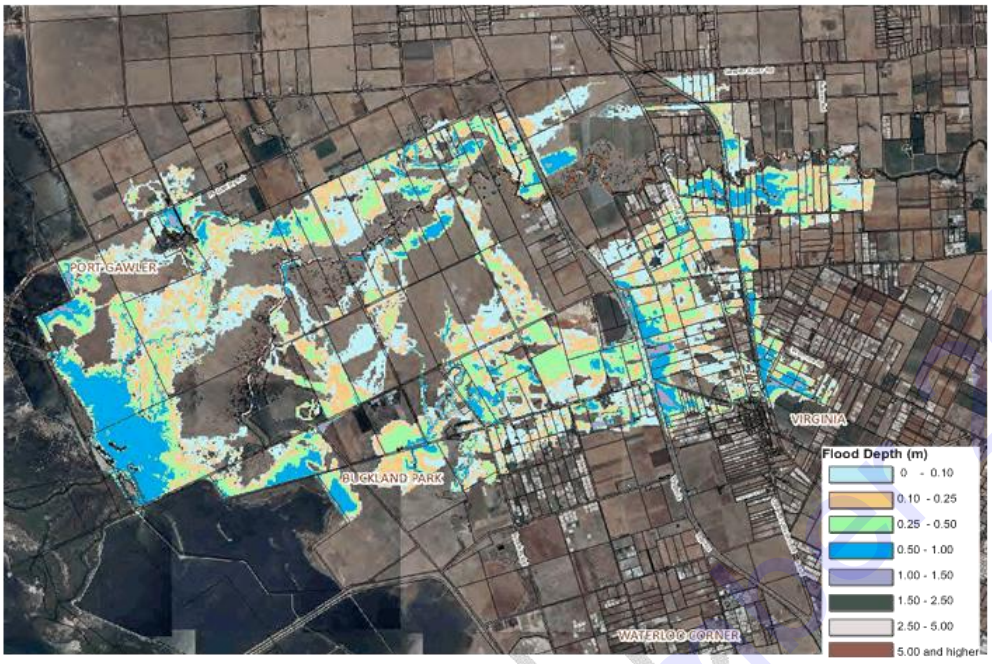


FIGURE 2.5 : SEPTEMBER 2016 FLOOD MODELLED FLOOD EXTENT WITH LEVEE BREACHES

Data on the number of properties actually affected by the flooding in September 2016 is still being collated, however the modelling results suggest that approximately 248 properties (land parcels) could have been directly affected.

3 Characteristics of the Gawler River Floodplain

3.1 River Channel Capacity

Previous assessments of channel capacity of the Gawler River have shown that the capacity steadily decreases from Gawler to the Gulf. For example between Wingate Road and Pederick Road the river's capacity is between 250-350m^3/s. The capacity between Baker Road and Old Port Wakefield Road is in the order of 80-100m^3/s. Figure 3.1 illustrates how the estimated channel capacity changes along the length of the river.

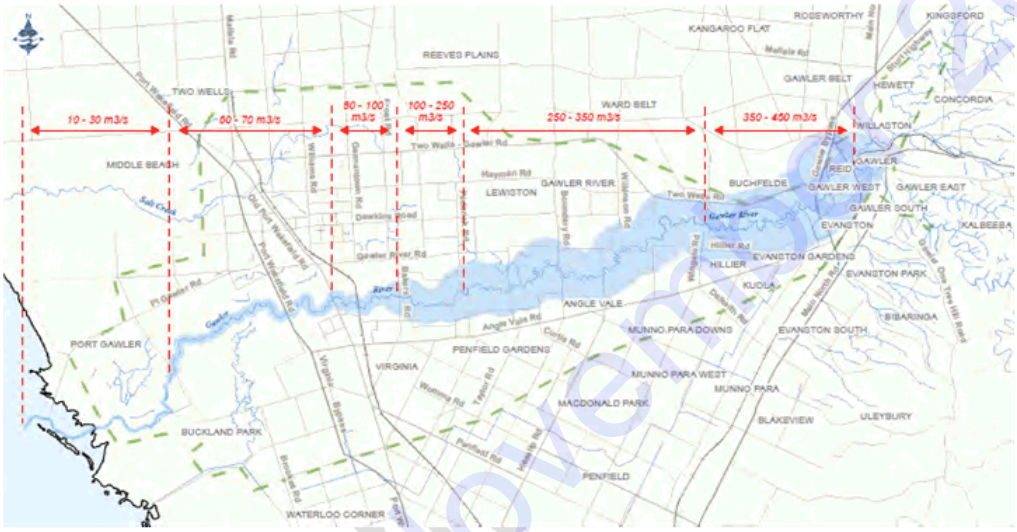


FIGURE 3.1 ESTIMATED CHANNEL CAPACITY, GAWLER TO THE GULF

Hence, even modest flows are likely to cause flooding (at least in parts) of the lower Gawler River, on a relatively regular basis. Whilst this has been the experienced in recent times the results confirm that flooding can be expected to reoccur on a relatively frequent basis (more frequent than a 1 in 20 year ARI flood frequency).

This natural characteristic also means that the benefits of any potential enlargement of the Bruce Eastick North Para Flood Mitigation Dam will be minimal in the lower Gawler River, notwithstanding the fact an enlarged dam would provide significant improvements in flood immunity for Gawler, Lewiston, Two Wells and places and infrastructure in between.

3.2 River Channel Bed Levels

Data is available along the length of the river showing the how the channel bed (invert) and grade (fall toward the Gulf) changes along its length. This data shows that the channel has very shallow grade. This reduces the efficiency of conveyance of flows out to the sea.

The river bed slope averages 0.1% grade (1m vertical every 1km) from Baker Road to Port Wakefield Road. Downstream of Port Wakefield Road the channel grade reduces further an average of 0.04% (0.4m vertical in every 1km).

The data also shows the channel bed goes both up and down many times along the length of the channel. This is evidenced in the field by areas that pool for extended periods of time.

Figure 3.2 illustrates the channel bed levels and how the general grade of the river reduces toward the Gulf.

The reduction in river channel capacity is a natural feature of a perched river system such as the Gawler River. The impacts of this natural characteristic is however further compromised by the increased rates of sediment accumulation (through historic land clearance upstream and in places poor bank stability) in the river bed and dense weed infestations along much of its length.

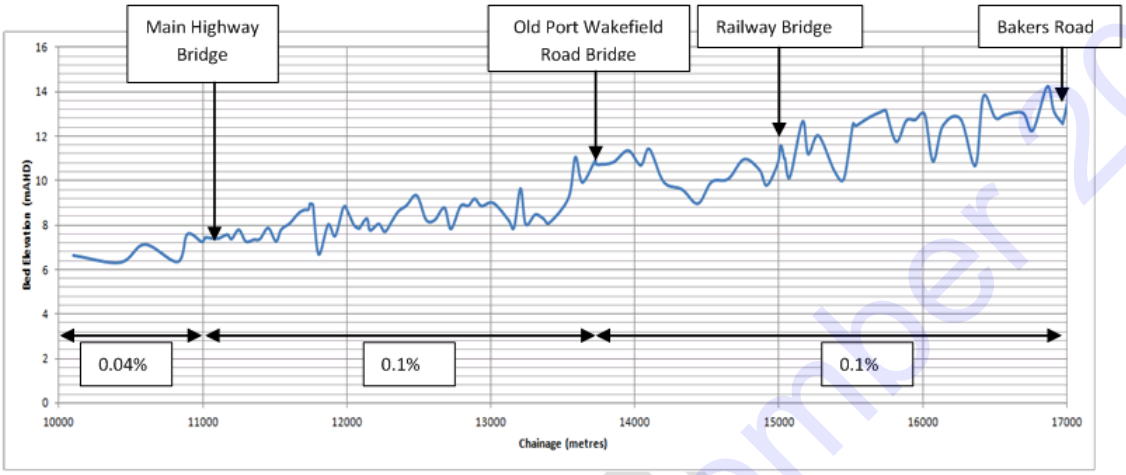


FIGURE 3.2 CHANGES IN RIVER GRADE

4 Flood Mitigation Options

4.1 Introduction

Three flood mitigation options were assessed as part of this preliminary assessment. The process by which these were developed is outlined in Section 1.3 of this report. A brief discussion of each option and their performance in terms of flood mitigation follows.

4.2 Mitigation Option 1: Northern Floodway

This mitigation option would comprise the following core components and features:

- Levee bank improvements from Pederick Road alignment to the Rail bridge.
- A side spillway on the northern bank upstream of Old Port Wakefield Road – new culverts under Old Port Wakefield Road would transfer water from the spillway under Old Port Wakefield Road.
- A levee system containing flows to a designated route on the northern side of the River up to Port Wakefield Road. A spillway near Port Wakefield Road would be provided to allow flood water to spill out further in larger events but still constraining flood inundation south of Gawler River Road.
- Port Wakefield Road immediately north and south of the Gawler River would not be overtopped.
- Levee systems on the floodplain west of Port Wakefield Road guiding flows on the floodplain north of the river channel and then guiding flows back into the river channel towards the western portion of the Buckland Park development area.
- Flows to spread out on the floodplain or to be guided through the Buckland Park residential development flood control channels (should it be developed).

A diagram of the scheme is presented in Figure 4.1.

Northern Floodway Effectiveness

If implemented this system would most likely have protected 211 of the 248 properties potentially flooded in 2016. Flooding on a further 10 properties would have been reduced.

The Northern Floodway option would be expected to provide flood protection for these properties for floods exceeding the 1 in 50 year ARI event, and, with an enlarged Bruce Eastick North Para Flood Mitigation Dam possibly the 1 in 100 year ARI event.

Two revised flood extents for the 2016 flood are provided for this option. The first represents the current landscape, before the Buckland Park residential area is developed (Figure 4.2), the second case is with the residential area developed (Figure 4.3).

The scheme would require the proposed northern flood management channels within the residential development area to be increased in width, but smaller channels, in comparison to those presently proposed, to the south and east of the development area would be required. Under this flood mitigation option Port Wakefield Highway would be trafficable.

With the Buckland Park residential development works in place, this flood mitigation option would protect 229 of the 248 properties potentially affected by flooding in 2016 with again a further 10 properties experiencing significantly less flooding extents.

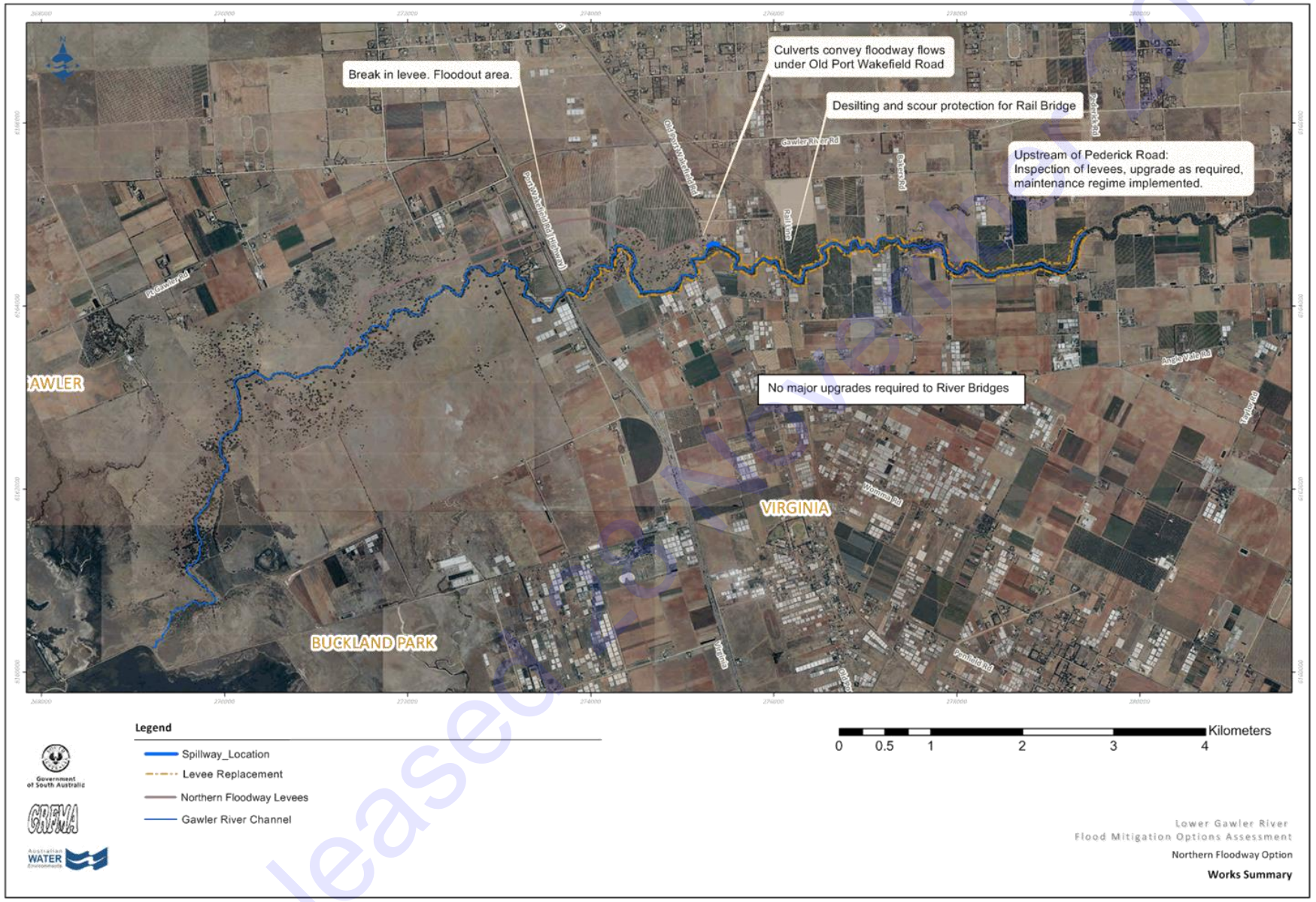


Figure 4.1

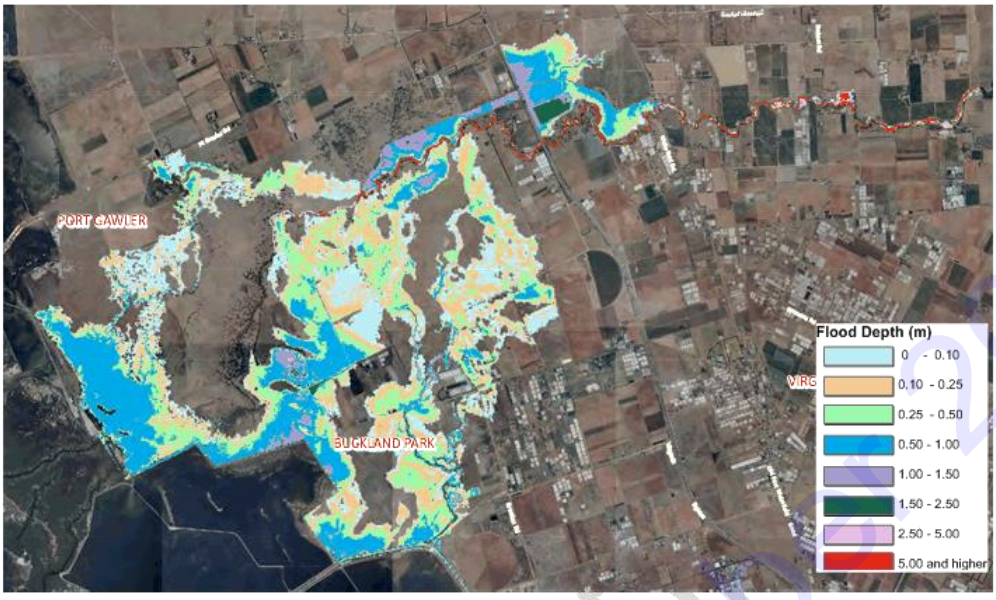


FIGURE 4.2 : NORTHERN FLOODWAY FLOOD INUNDATION EXTENT - CURRENT CONDITIONS

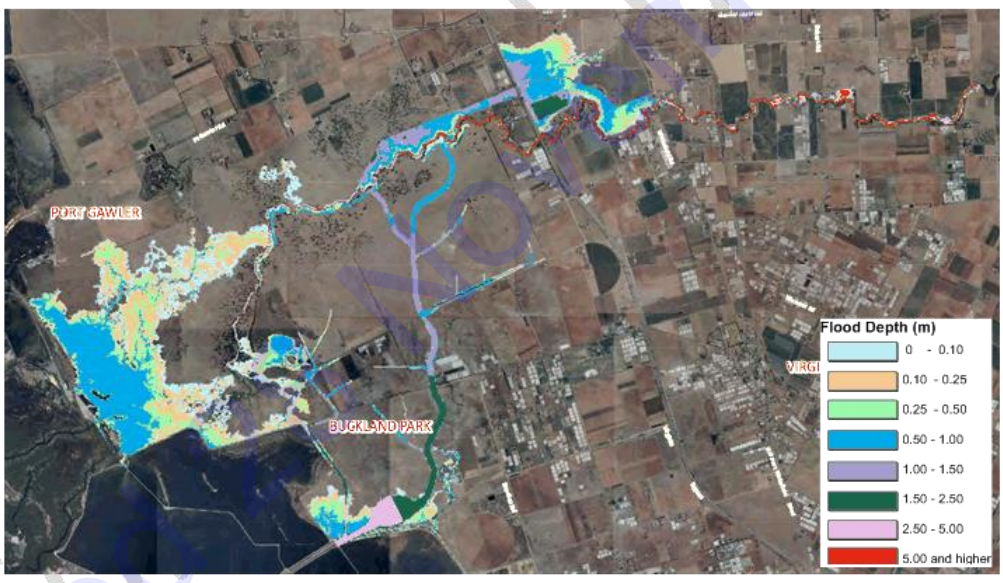


FIGURE 4.3 : NORTHERN FLOODWAY MITIGATION OPTION INUNDATION EXTENT WITH BUCKLAND PARK DEVELOPED

Figure 4.4 presents a comparison of the performance of the Northern Floodway Option in comparison with the modelled flood extent from the 2016 September flood. The green areas in the map are the areas that would be protected from flooding. The high value horticultural areas near Virginia and Virginia itself are fully protected from flooding.

These areas would be increased further if the Buckland Park residential area had been developed, as depicted in Figure 4.5.

Northern Floodway Works and Costs

The scheme would require new flood levee works to be conducted on 13 properties, two possibly three of which may require acquisition. Replacement levees would be required on a further 47 properties.

The scheme has been estimated to have a capital cost of $27 million (including property acquisition).

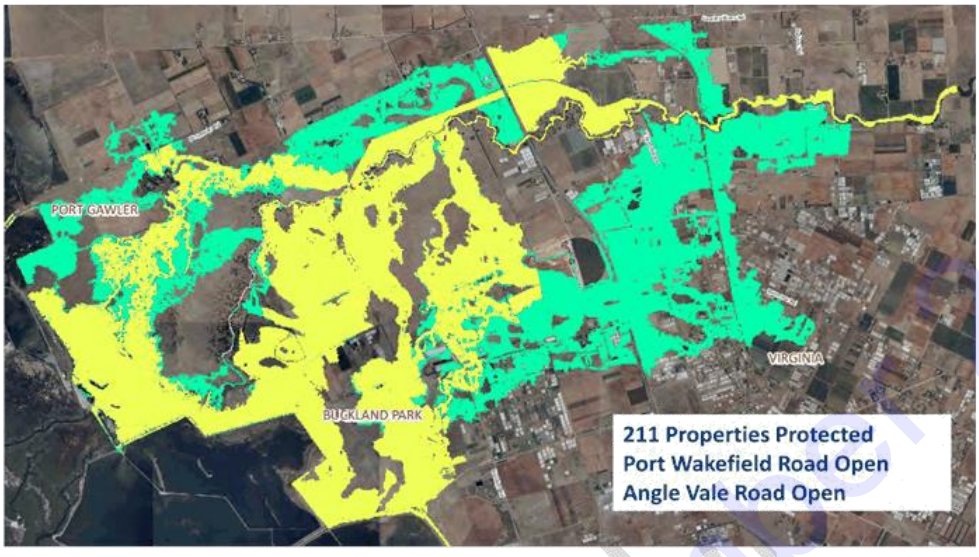


FIGURE 4.4 : NORTHERN FLOODWAY - FLOOD COMPARISON WITH 2016 FLOOD - CURRENT CONDITIONS

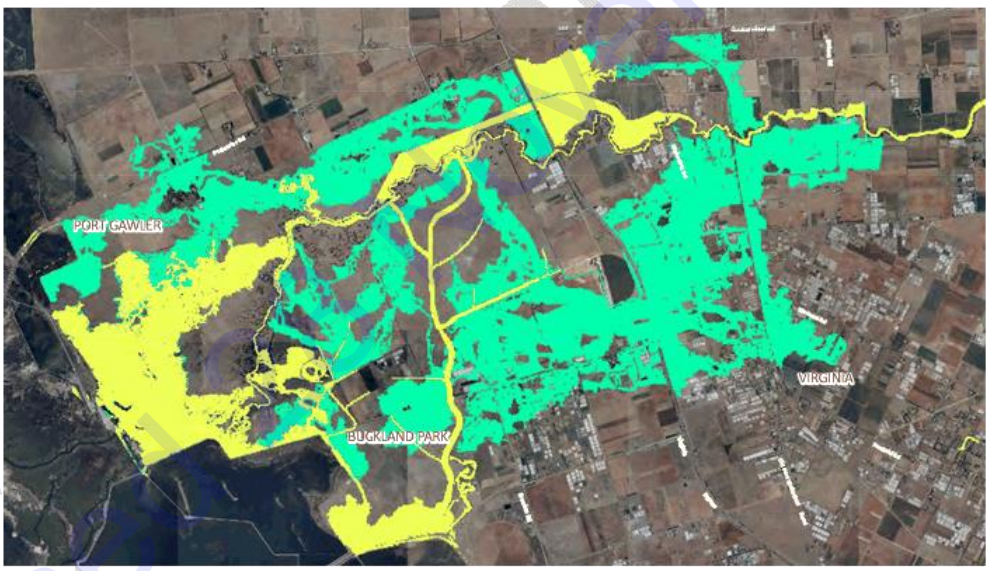


FIGURE 4.5 : NORTHERN FLOODWAY - FLOOD COMPARISON WITH 2016 FLOOD – WITH BUCKLAND PARK DEVELOPED

4.3 Mitigation Option 2: Channel Widening Works

This option was favoured by some landholder members of the Reference Group but not by the majority of Reference Group members. The option would involve enlarging the river channel by excavating the river bed and banks to the extent necessary to provide sufficient capacity to transfer the flows from Gawler to a point west of the Port Wakefield Highway. Some members of the Reference Group preferred that the channel widening continued beyond that which has been assessed to date, through the Buckland Park lake and through the mangroves to the sea. This would require a further 5000 metres of channel widening work. This would need to traverse the internationally recognised shore and water bird habitat areas of the Buckland Park Lake as well as

fishery breeding areas associated with the mangroves immediately west of the river outlet structure. It is also likely that acid sulphate soils would also be encountered in these areas.

The scheme that has been modelled and costed would involve:

- River channel widening at the base of channel by 20 metres from Baker Road to Old Port Wakefield Highway.
- River channel widening at the base by 30 metres downstream of Old Port Wakefield Road
- Major works replacement of the railway bridge and bridges over the Old and new Port Wakefield Roads as well as Baker Road.
- Levee improvements from Baker Road to Pederick Road and most likely a little way beyond would also be required.

The scheme is illustrated in Figure 4.6.

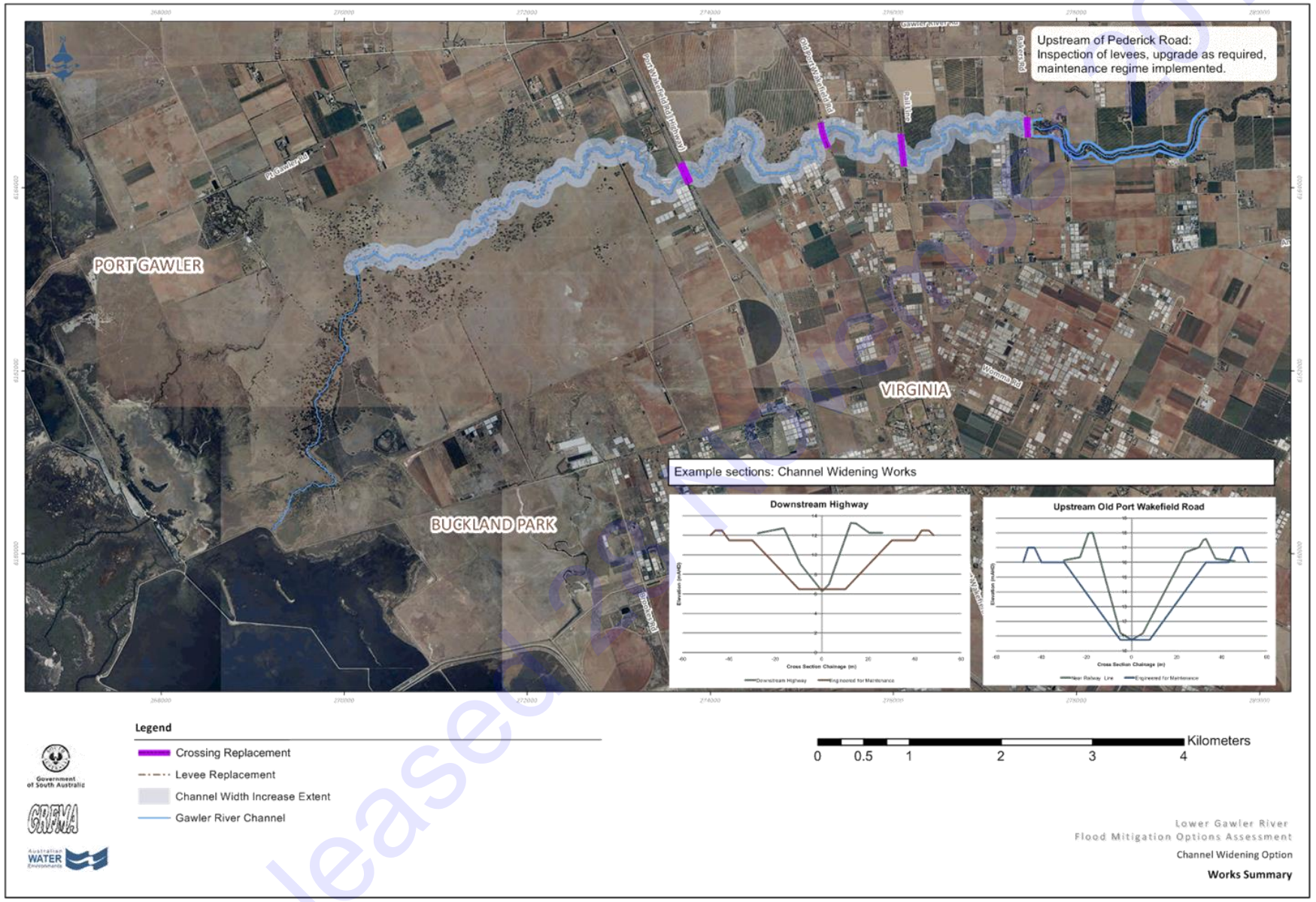


Figure 4.2

Channel Widening Works, Costs and Other Considerations

Whilst conceptually appealing to some (because it keeps floodwater within the channel confines), the scheme still requires works to be undertaken on the same 60 properties as would be required for the Northern Floodway and would result in the same (or at least very similar) results in terms of properties protected. It would also require massive channel excavation and reshaping program costing in excess of $120 million.

Widening the base of the river by 20 to 30 metres, whilst in the process making the river banks less steep, would require the top width of the enlarged river system to be 110 to 120 m wide. This would be the width of land to be either acquired or as a minimum require an encumbrance / easement to be placed over it for ongoing maintenance purposes.

The assessment herein has been confined to engineering and hydrologic/hydraulic implications. Whilst these could be addressed there are known to be significant cultural heritage and native vegetation impacts that would make it very challenging to proceed with this option.

Nevertheless it was a favoured option for a number (but certainly not all) landholder members of the Reference Group. The Technical Assessment Panel members did not support this option. The predicted flood extent is illustrated in Figure 4.7.

Channel Widening Benefits

The Channel Widening options would be expected to provide flood protection to an additional 8 properties in comparison to the Northern Floodway options.

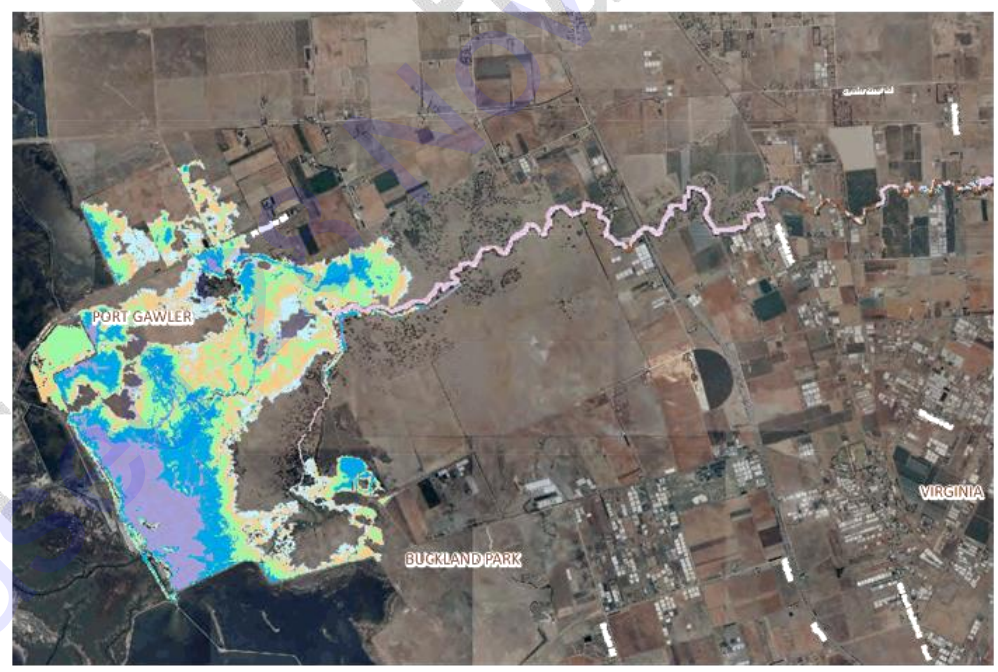


FIGURE 4.7 : MODELLED FLOOD EXTENTS FOR CHANNEL WIDENING OPTION

4.4 Mitigation Option 3: River Desilting and New Outlet to the Sea

The option was developed through discussions with the Reference Group. It would involve desilting works and a new improved outlet to the sea. This would entail:

- Removing accumulated silt from the bed of the river without undertaking major changes to the river banks. This would involve deepening the river bed by around 1 m along a 15 km section of river from near Baker Road to well west of Port Wakefield Highway. The amount of silt removal and channel deepening would be limited by potential bank instability issues associated with bed level deepening.
- Selected clearing of vegetation choking the river and modifications to bridge structures as necessary. The river banks would be left intact and not modified to any significant degree.
- A new outlet channel to take flood waters direct to the sea from a point upstream of Buckland Park Lake.

This option was appealing to some landholder members of the reference group because it would involve minimal impact on floodplain landholders. However, the assessment and modelling work demonstrated that the desilting and vegetation management works were not enough to provide sufficient capacity in the river.

The effect of works at the outlet to bypass the Buckland Park outlet weir was also found to be limited. Whilst improvements were observed, these were limited to relatively lose proximity (within 3,000 m) of the outlet to Buckland Park lake and would certainly have no effects upstream of Port Wakefield Road.

5 Discussion and Recommendations

5.1 Condition and Maintenance of the River

Recommendation 1: *River and levee maintenance should be the responsibility of a single authority that has the necessary resources and access rights to maintain the river in good condition from a flood conveyance as well as biodiversity perspective.*

It is anticipated that the Reference Group would collectively agree with this recommendation.

The capacity of the lower Gawler River is very small in comparison to the large catchment (over 1000 km^2) that feeds it. This is a natural phenomenon of a perched river system. This feature makes the achievement of flood immunity for properties in the lower Gawler very challenging. Whilst the limited capacity is largely a natural characteristic, the gradual accumulation of sediment and increasing density of weed species including exotic trees has further compromised the capacity of the river.

Much of the river is flanked by levees. These are in many places naturally formed levees (again a feature of perched river systems) but have been re-engineered in places by past and present landholders as well as past councils. These levees were found in places to be wanting. There were numerous breaches of the levees and landholders reported them to be leaking (ie water either piping or seeping its way through the levees).

The very poor condition of the levees, and the river itself reinforces the need for a coordinated and managed approach the ensuring the river is kept clear of nuisance plants that unnecessarily impede flow, that sediment deposition and accumulation is controlled, and that any levee system is appropriately engineered and maintained.

Recommendation 2: *River condition and levee maintenance repair work should be undertaken as a matter of high priority.*

It is anticipated that the Reference Group would collectively agree with this recommendation.

There are three "no regrets" actions that would provide an immediate benefits in terms of reducing flood risk.

1. To sensitively remove pest and nuisance plants and revegetate as necessary with appropriate native plants species that will not unnecessarily impede flood flows.
2. Undertake repairs to the damaged levees and those sections of levees considered to be most vulnerable to failure during the next flood.
3. Sensitively remove accumulated sediment around key structures such as the Railway bridge, Baker Road crossing, Old Port Wakefield Road Bridge and the Port Wakefield Road highway bridges that is impairing the capacity of these crossings to convey flow through them.

Whilst these actions both appear to be straight forward they are complicated by the fact that river is in private ownership with property boundaries typically being near the centre of the watercourse.

The length of river requiring work is also significant covering a distance of over two kilometres downstream of Port Wakefield Road and eight kilometres upstream of Port Wakefield Road. Vegetation management and levee works are, in reality, required along this whole length, and in some instance beyond (particularly further upstream of Pederick Road).

In the longer term the levees will need to be completely rebuilt and any immediate repairs should assist with progressing the long term rebuilding of the levees to an appropriate standard and an appropriate alignment.

The responsibility for undertaking these actions should rest with a single authority that has the responsibility and resources allocated for that purpose.

This will also require the establishment (as a minimum) easements on sixty or more properties so that access can be maintained well into the future for levee re-establishment, ongoing maintenance work and ensuring that the river area is not compromised through encroachment.

Ideally the river and the area needed for levees and maintenance works would be under public ownership.

5.2 Flood Mitigation Works

Recommendation 3: *The GRFMA proceed with developing concept designs for the establishment of a Northern Floodway, in addition to the construction of a new river levee system so that consultation with affected landholders can proceed.*

It is anticipated that the majority of the Reference Group would agree with this recommendation but some landholder members of the Reference Group would not.

These investigations for the lower Gawler River have identified two potential options that would both provide improved flood protection for over 230 properties.

The Northern Floodway option provides a similar (albeit slightly less) degree of protection to the channel widening option but it can be achieved at a much reduced cost and without the substantial environmental, cultural heritage and social implications associated with the channel widening options.

The number of properties requiring work to be undertaken is slightly more for the channel widening option (68) than for the Northern floodway option (60). Typically the scale of works on properties is also considered larger for the channel widening option. There are three notable exceptions to this where whole of property acquisitions (with potential lease back arrangements) may be required for the Northern Floodway Option.

It is also recognised that the desired channel widening outcome from those members of the Reference Group who favour that option would be for the channel widening to extend further west to the sea than that presented herein.

This would require a further five kilometres of channel works, substantially further increasing costs and introducing a further range of environmental and culture issues associated with the internationally recognised Buckland Park lake area, Gawler River estuary, and near shore coastal environments.

5.3 Suggested Next Steps

Much of this investigation work has concentrated on modelling and assessment of the 2016 flood which is thought to be approximately equivalent to the 1 in 20 year ARI flood. Both technically feasible options (from an engineering and hydraulic design perspective) would perform well under that flow rate and it is anticipated also under a 1 in 50 year ARI flood.

The Northern Floodway option should be tested under a 1 in 100 year ARI flood event and if minor refinements would achieve 1 in 100 year ARI flood immunity then they should be incorporated in

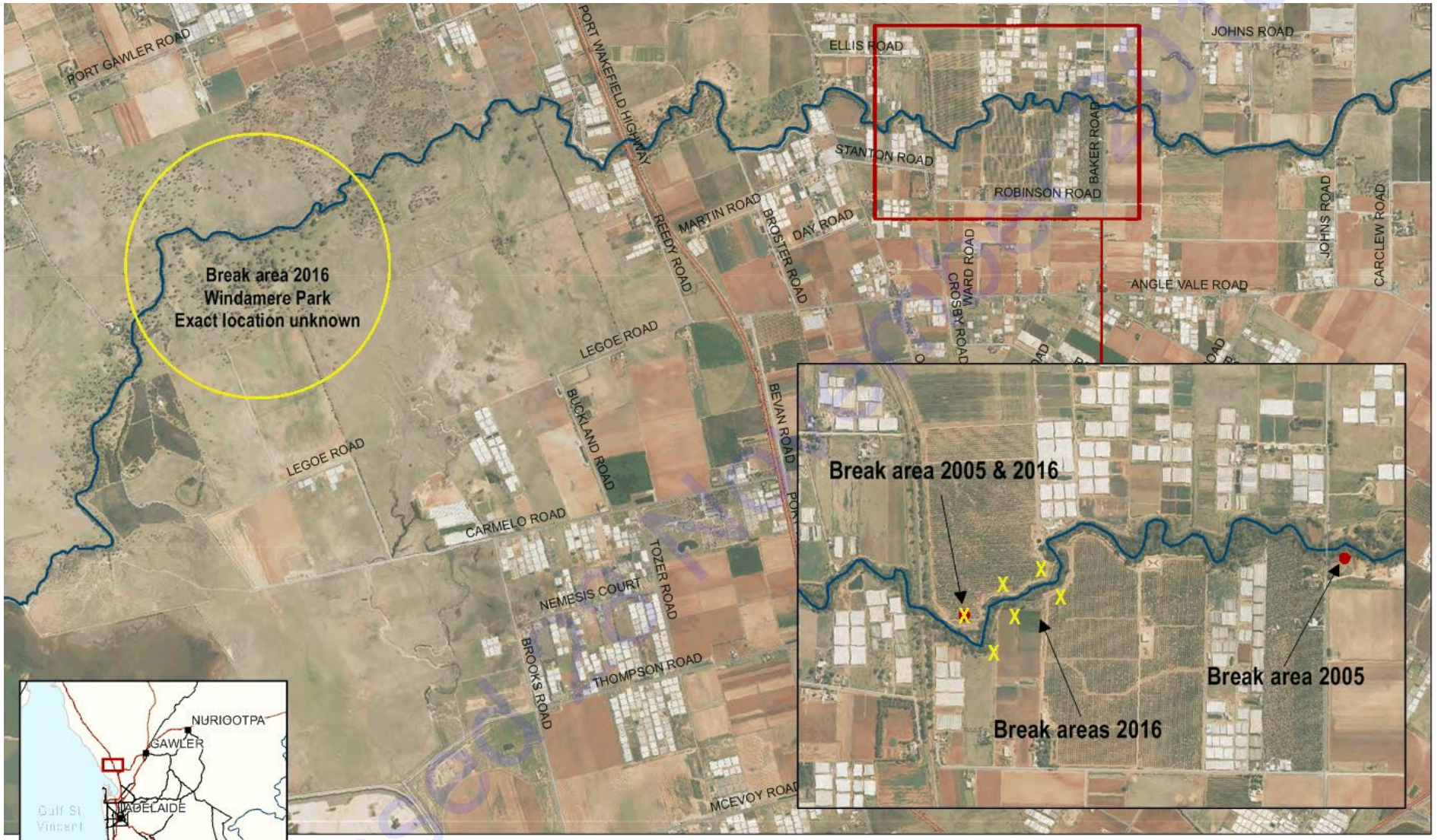
the feasibility designs presented herein. It is anticipated that achieving that level of protection would be a significant selling point for securing community and funding support for the project

Once any desired refinements have been made this Preliminary Report can be finalised.

It is then recommended that the following work should be undertaken so that the Final Flood Options Assessment Report can be completed:

- Ground truth the areas of potential works.
- Review costings following ground truthing.
- Estimate local jobs created by works.
- Complete hydrological assessments for North and South Para.
- Finalise mapping.
- Incorporate information on the flood damages and social impacts into the report.
- Finalise Options Report.

Appendix A : 2016 Flood Maps from DEWNR



Gawler River Break Areas

X Breakouts 2016

● Breakouts 2005

N

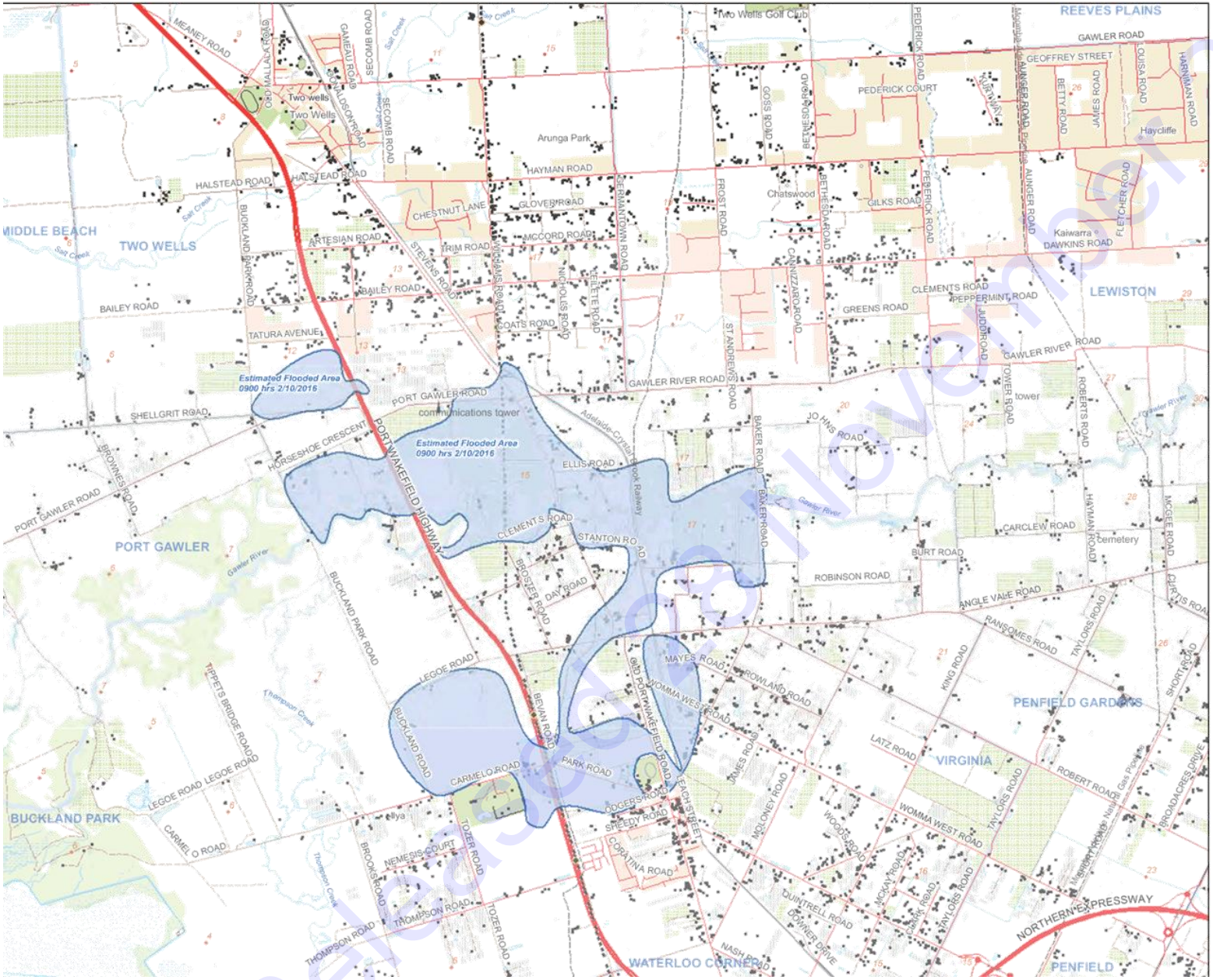
0 0.5 1 1.5 km

1 : 40,000

Produced by: Regional Programs Branch
Map Projection: Lambert Conformal Conic
Map Datum: Geocentric Datum of Australia 1994
Date: November 2016

Government of South Australia
Department of Environment, Water and Natural Resources

Gawler River Flood - Flood Map - 0900 hrs 2/10/2016



Partial Flood Extent Disclaimer

Important:
The extent shown has been derived from aerial reconnaissance photos, elevation data and aerial imagery interpretation.
It is compiled from the best available data, but should only be used for operational decisions in conjunction with field intelligence. It is a partial extent and areas not highlighted should not be assumed to unaffected by flood waters.
This information should not be distributed without appropriate authorisation.

Produced by: Mapping Support Team / Fire Management Offic
Department of Environment, Water and Natural Resources
Location: DEWNR Office

Data Sources: CFS/DEWNR
Photo Date:
Projection: Transverse Mercator
Datum: Geocentric Datum of Australia, 1994
Grid: Map Grid of Australia, Zone 52/53/54

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Appendix B : Cost Estimates

Mitigation Option 1: Northern Floodway and Levee Improvements

	Item	Quantity	Rate ($ex GST)	Units	Cost
1	**Concept Design**				
	Opportunities and Constraints Assessment	1	$ 25,000.00	Item	$ 25,000
	Detailed Review of Existing Levees and Area of Proposed Levees	1	$ 15,000.00	Item	$ 15,000
	Service Location	1	$ 10,000.00	Item	$ 10,000
	Heritage Survey	1	$ 15,000.00	Item	$ 15,000
	Native Vegetation Survey	1	$ 15,000.00	Item	$ 15,000
	Consultation with Landholders (land Acquisition and Localised Design Optimisation)	60	$3,000	per landholder	$ 180,000
	Quantity Survey (More detailed cost estimates)	1	$ 20,000.00	Item	$ 20,000
	Consultation with Approval Bodies and Partners (AMLR NRMB, EPA, Heritage, Native Vegetation Council, Local Government, DPTI, Broader Community, Land Developers)	1	$ 20,000.00	Item	$ 20,000
	Design and Documentation	1	$ 50,000.00	Item	$ 50,000
	Sub Total				**$ 350,000**
2	**Detailed Design**				
	Design, Specification and Documentation	1	$ 50,000.00	item	$ 50,000
	Landholder Consultation	60	$ 1,000.00	per landholder	$ 60,000
	Approvals	1	$ 15,000.00	item	$ 15,000
	Sub Total				**$ 125,000**
3	**Tender and Contract Administration**				
	Tender and Contract Administration	1	$ 100,000.00	item	$ 100,000
	Sub Total				**$ 100,000**
3	**Land Acquisition**				
	Land Acquisition	1834000	5	m2	$ 9,170,000
	Sub Total				**$ 9,170,000**
4	**Construction**				
	Project Management	1	$ 25,000.00	item	$ 25,000
	Environmental Management	1	$ 20,000.00	item	$ 20,000
	Mobilisation	1	$ 50,000.00	item	$ 50,000
	Traffic Management	1	$ 20,000.00	item	$ 20,000
	Large Tree Removal	20	1500	item	$ 30,000
	Clear Site Vegetation and Cart	347340	1.6	sq m	$ 555,744
	Fill and Compact Levees (upstream of floodway)	126,840	20	cu m	$ 2,536,800
	Spillway	2500	40	sq m	$ 100,000
	Old Port Wakefield Road Culverts	150	2400	m	$ 360,000
	Floodway Levees (Fill and Compact)	27,757	20	cu m	$ 555,135
	Rail Line Bridge Works	1	100000		$ 100,000
	Revegetation (Levees, Spillway, Bridge Works)	347340	7	sq m	$ 2,431,380
	Weed Control	283175	14	sq m	$ 3,964,450
	Fencing	17367	25	m	$ 434,175
	Sub Total				**$ 11,182,684**
	Pre Contingency Sub Total				$ 20,927,684
	Contingencies	30%			$ 6,278,305
	Total ex GST				**$ 27,000,000**

Mitigation Option 2: Channel Widening

	Item	Quantity	Rate ($ex GST)	Units	Cost
1	**Concept Design**				
	Opportunities and Constraints Assessment	1	$ 20,000.00	Item	$ 20,000
	Detailed Review of Existing Levees and Area of Proposed Levees	1	$ 15,000.00	Item	$ 15,000
	Service Location	1	$ 10,000.00	Item	$ 10,000
	Heritage Survey	1	$ 15,000.00	Item	$ 15,000
	Native Vegetation Survey	1	$ 15,000.00	Item	$ 15,000
	Consultation with Landholders (land Acquisition and Localised Design Optimisation)	60	$3,000	per landholder	$ 180,000
	Quantity Survey (More detailed cost estimates)	1	$ 20,000.00	Item	$ 20,000
	Consultation with Approval Bodies and Partners (AMLR NRMB, EPA, Heritage, Native Vegetation Council, Local Government, DPTI, Broader Community, Land Developers)	1	$ 10,000.00	Item	$ 10,000
	Design and Documentation	1	$ 50,000.00	Item	$ 50,000
	Sub Total				**$ 335,000**
2	**Detailed Design**				
	Design, Specification and Documentation	1	$ 50,000.00	item	$ 50,000
	Landholder Consultation	60	$ 1,000.00	per landholder	$ 60,000
	Approvals	1	$ 15,000.00	item	$ 15,000
	Sub Total				**$ 125,000**
3	**Tender and Contract Administration**				
	Tender and Contract Administration	1	$ 100,000.00	item	$ 100,000
	Sub Total				**$ 100,000**
3	**Land Acquisition**				
500000	Land Acquisition	872000	$ 5.00	m2	$ 4,360,000
	Sub Total				**$ 4,360,000**
4	**Construction**				
	Project Management	1	$ 25,000.00	Item	$ 25,000
	Environmental Management	1	$ 20,000.00	Item	$ 20,000
	Mobilisation	1	$ 50,000.00	Item	$ 50,000
	Traffic Management	1	$ 20,000.00	Item	$ 20,000
	Large Tree Removal	698	$ 1,500.00	item	$ 1,046,879
	Clear Site Vegetation and Cart	1,386,465	$ 1.60	sq m	$ 2,218,344
	Excavation and forming channel	1,628,406	$ 18.70	cu m	$ 30,451,192
	Fill and Compact New Levees on floodplain	110,334	$ 20.00	cu m	$ 2,206,680
	Fill and Compact Levees (u/s of Bakers Road Ford)	23,893	$ 20.00	cu m	$ 477,855
	Rail Line Bridge Works	1	$ 714,000.00	Item	$ 714,000
	Baker's Road Ford (Repace with bridge)	1	$ 714,000.00	Item	$ 714,000
	Old Port Wakefield Road Works	1	$ 1,122,000.00	Item	$ 1,122,000
	Port Wakefield Road Works	1	$ 2,244,000.00	Item	$ 2,244,000
	Soil Disposal Clean Fill	1,366,265	$ 15.00	cu m	$ 20,493,972
	Soil Disposal Contamination	151,807	$ 80.00	cu m	$ 12,144,576
	Revegetation (Channel)	1,386,465.00	$ 4.00	sq m	$ 5,545,860
	Fencing	15000	$ 25.00	m	$ 375,000
	Sub Total				**$ 79,869,358**
	Pre Contingency Sub Total				$ 84,789,358
	Contingencies	40%			$ 33,915,743
	Total ex GST				**$ 119,000,000**

C. COUNCIL/COMMITTEE TO DECIDE HOW LONG ITEM 18.1 IS TO BE KEPT IN CONFIDENCE

Purpose

To resolve how long agenda item 18.1 is to be kept confidential.

STAFF RECOMMENDATION

Pursuant to Section 90(2) and Section 91(7) of the Local Government Act 1999, the Council orders that the following aspects of Item 18.1 be kept confidential in accordance with Council's reasons to deal with this item in confidence pursuant to Section 90 (3) (d) of the Local Government Act 1999:

- Report for Item 18.1
- Attachment(s) for Item 18.1
- Discussion for Item 18.1
- Decision for Item 18.1

This order shall operate until the Gawler River Flood Management Authority releases the Gawler River 2016 Flood Review.