CLAYTON UTZ

BRISBANE CITY COUNCIL

BCC

QUEENSLAND FLOODS COMMISSION INQUIRY

Inquiry

Sixth Statement of Colin David Jensen

8 September 2011

Volume 1 of 1

Clayton Utz
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Our reference 12376/15948/80117397

Legal\305055164.1

QFCI

Date: 10/11/11 JM

Exhibit Number: 954

Sixth Statement of Colin David Jensen

I, **Colin David Jensen,** Chief Executive Officer, of 266 George Street, Brisbane, in the State of Queensland, state on oath as follows:

A. Attachment "**CDJ-48**" is a copy of a notice from the Commissioner of the Queensland Floods Commission of Inquiry (**Commission**) dated 26 August 2011 requiring me to provide certain information to the Commission in the form of a statement by 9 September 2011 (**Notice**). This Statement is provided in response to the Notice.

B. For the purposes of responding to the Notice and preparing this Statement I have, in my position as Chief Executive Officer of the Brisbane City Council (**Council**), had access to:

(a) the business records of Council; and

(b) Council officers,

to obtain information to provide a response to the Notice. Unless otherwise stated, the matters set out in this Statement are based on my own knowledge or the information derived from the above sources. I have necessarily relied on Council officers to assist me in preparing this Statement. While I am familiar with the matters dealt with in this Statement, I am Chief Executive Officer of a large organisation and therefore I am not necessarily familiar with all of the detail.

C. I set out below my responses to each of the questions set out in the Notice.

D. The documents from the above sources and attached to this Statement have been collated by Council officers under my instruction.

1. Details of any property owners who, since the January 2011 floods, have indicated a desire to, or who have already commenced, an assessment of the feasibility and appropriateness of establishing levees in their area (as outlined at page 21 of the Brisbane City Council January 2011 Flood Action Plan.

1.1 I am aware of two approaches to Council since the January 2011 Flood Event by property owners who have expressed an interest in an assessment of the feasibility and appropriateness of establishing levees in their area.

1.2 Firstly, at a meeting prior to the lodgement of the development application (pre-lodgement meeting) held on 8 August 2011 in relation to 148 Dunn Road, Rocklea, Powerlink expressed interest in

[redacted]

Colin David Jensen Witn[redacted]

protecting an item of infrastructure at an electricity sub-station from flooding by a levee. It is my understanding that the Development Assessment officers advised Powerlink at the meeting that Council may not support this proposal due to height limitations and overland flow issues. Alternative solutions were discussed including the potential for raising the height of the infrastructure. Attachment "**CDJ-49**" is a copy of Council file 119\80\620\4468 entitled *Pre-lodgement Meeting 148 Dunn Road, Rocklea.*

1.3 Secondly, on or about 19 August 2011, through Councillor Hinchliffe, a resident in Newmarket ([redacted]) suggested constructing a levee in the area behind the Newmarket Hotel as part of Council's Enoggera Creek de-silting project (a flood mitigation project). Councillor Hinchliffe asked if Council could provide expert advice in to respond to Mr Gallagher. Council's City Project engineers provided a technical response indicating that a levee in the area in question was not an appropriate form of flood protection. Councillor Matic, the Chairman for Environment, Parks and Sustainability Committee, wrote to Councillor Hinchliffe on 8 September 2011 advising that the construction of a levee in the suggested location would not be feasible and would work against the objectives of Council's Enoggera Creek de-silting project. Reasons were provided in the letter.

1.4 Attachment "**CDJ-50**" comprises the following documents:

(a) email from Councillor Hinchliffe dated 18 August 2011;

(b) technical response from Council officers; and

(c) letter Councillor Matic to Councillor Hinchliffe dated 8 September 2011.

2. A description of the Brisbane City Council's proposed framework, including any draft local laws, for property owners who wish to assess the feasibility and appropriateness of establishing local levees to protect property at risk of flooding in Rocklea (as outlined at page 21 of the Brisbane City Council January 2011 Flood Action Plan).

2.1 On 25 January 2011, Council engaged GHD, Consulting Engineers, to prepare a report into engineering options that may be available to mitigate flooding in Brisbane. Council obtained a Discussion Paper from GHD in February 2011 entitled *Engineering Solutions for Flood Mitigation in Brisbane* (**GHD Report**). The objective of the Discussion Paper was to provide Council with an overview of the structural measures potentially available to mitigate the impact of flooding, with particular reference to those mechanisms that may assist in reducing flooding from the Brisbane River. One of the structural measures considered in the GHD Report was levees and flood walls. A copy of the GHD Report is Attachment "**CDJ-51**".

[redacted] [redacted]

Colin David Jensen **Witness**

2.2 On 24 March 2011, I received, from the Acting Manager of Council's Water Resources Branch, a briefing note on the findings of the GHD Report. A copy of the briefing note is Attachment "**CDJ-52**". The briefing note summarises the key findings of the GHD report in relation to the potential engineering solution of levees and flood walls as follows:

"*Levees and Flood Walls*

Constructed parallel to waterways to reduce flooding on the landward side. They are used to manage flooding from some inland rivers in Australia but are not considered appropriate alongside the Brisbane River because:

- *The Brisbane River has a very flat longitudinal gradient, requiring levees along the river to be extended for many kilometres including up several low-lying tributaries.*
- *Increased flood levels in the river would result because of reduced flood plain storage.*
- *They pose a significant safety hazard when they fail during a flood.*
- *They are prone to over-topping in the event of a flood that is larger than the "design" flood and restrict upstream drainage systems, leading to a worsening of local flooding across the city.*
- *Flood events such as Jan 2011 can be significantly higher than the river banks and levees and flood walls would need to be built impractically high.*
- *Construction of levees or flood walls would have a significant adverse aesthetic impact on the city, blocking any view of the river from ground level.*"

2.3 The briefing note indicated that the GHD Report concluded that there were no "*silver bullets*" to mitigate flood levels in Brisbane. The briefing note went on to state:

"*While more detailed investigation, including site specific factors, is necessary to establish the viability and a net benefit to the community of these devices, "engineered" or structural measures with the highest potential for application in Brisbane were found to be:*

- *flap valves and possibly "duck-bill" valves in tidally-affected areas, subject to implementation of suitable maintenance regimes*
- *levees around specific, high-value infrastructure (such as Brisbane Markets), but not along waterways, and*

[redacted] [redacted]

Colin David Jensen **Witne[redacted]**

- *flood mitigation dams on the Bremer River and Lockyer Creek upstream of Ipswich."*

2.4 The Flood Response Review Board (**FRRB**) in its May 2011 report into the January 2011 Flood Event recommended, among other things, that:

"Council investigate the feasibility and appropriateness of establishing local levees to protect areas of strategic significance such as the Rocklea Markets. This will require a complete risk based flood management analysis."

2.5 The reason for the requirement for a complete risk based flood management analysis in this context is explained in the FRRB report as follows:

"Levees have been proposed by some for flood protection in a number of locations in Brisbane and it is appropriate that this matter be given due consideration. Important issues that must be weighed before the decision is made to construct levees include:

> *Levees will need to extend over long distances since the river has a small longitudinal gradient in its lower reaches;*
>
> *They will increase flood levels in the river because flood plain storage is reduced;*
>
> *Levees will cause a major safety hazard if they are breached during a flood;*
>
> *Dangerous failures will certainly result in a flood event that is larger than the "design" flood when the levee will be over-topped; and*
>
> *Levees may form a barrier to overland flow paths and may need underground drainage structures across them to allow for normal drainage.*

Nevertheless, levees may be found to be a suitable option to protect specific areas, such as areas with a high population density, some critical infrastructure installations or important industrial areas. One example might be the cold stores at the Brisbane Markets at Rocklea. Each case would require careful consideration of a range of design issues to assess its applicability and whether the benefits outweigh the costs."

[redacted] [redacted]

Colin David Jensen **Witness**

2.6 In response to the above recommendation of the FRRB, Council's January 2011 Flood Action Plan (**Flood Action Plan**) states (at page 21):

Council's Plan	**Delivery Date**
Council supports the investigation by property owners to assess the feasibility and appropriateness of establishing levees. Council will provide a framework to be used by property owners who wish to undertake this assessment. This may include hydrological assessments to be undertaken on a user pays basis. Construction of levees would be the responsibility of the asset owner. Council will work collaboratively with areas of strategic significance, such as the Rocklea Markets, to undertake risk based flood management analysis.	October 2011

2.7 As indicated in the Flood Action Plan, Council is currently undertaking a project to develop an interim framework for management of levees in areas of strategic significance including the Rocklea area. Recommendations on the framework are proposed to be available by the end October 2011.

2.8 Attachment "**CDJ-53**" comprises:

(a) an outline of the proposed framework; and

(b) the Project Brief to consultants dated 15 August 2011 (**Project Brief**).

2.9 Council invited three consultants to provide quotations for this project and subsequently received quotations from two of the invited consultants.

2.10 A proposal from Aurecon Australia Pty Ltd (**Aurecon**) was received on or about 29 August 2011. The proposal was entitled *Proposal to investigate an Assessment Framework for Local Flood Levees to Protect Areas of Strategic Significance* (**Aurecon Proposal**). A copy of the Aurecon Proposal is attachment "**CDJ-54**".

2.11 On 7 September 2011, Council approved the engagement of Aurecon to undertake the services set out in the Aurecon Proposal.

2.12 It is anticipated that the project report will be available by 28 October 2011.

[redacted]

Colin David Jensen

Witness [redacted]

3 *A description of any work done by the Brisbane City Council since the January 2011 floods, with the owners or any tenants of the Brisbane Markets, to undertake a risk based flood management analysis, including whether such an analysis included any consideration given to the construction of levees around the Brisbane Markets precinct.*

3.1 Following the release of the Commission's Interim Report, Council has written to the owners of the Brisbane Markets (on 10 August 2011) to outline the sources of information available from Council (and other sources) that are relevant to flood risk. A copy of that letter is Attachment "**CDJ-55**".

3.2 As set out in paragraph 2.6 and the Project Brief (see Attachment CDJ-53) the work referred to in this item will be undertaken as part of the current project referred to in item 2 of this Statement.

I make this statement conscientiously believing the same to be true, and by virtue of the provisions of the Oaths Act 1867 (Qld).

Dated 8 September 2011

Signed and declared by Colin David Jensen at Brisbane
in the State of Queensland
this 8th day of September 20
Before me:

[redacted]

Signature of person before whom the declaration is made

[redacted]

Signature of declarant

[redacted]

Full name and qualification of person before whom the declaration is made

Our ref: Doc 1690283

30 August 2011

Mr Colin Jensen
Chief Executive Officer
Brisbane City Council
GPO Box 1434
Brisbane QLD 4001

REQUIREMENT TO PROVIDE STATEMENT TO COMMISSION OF INQUIRY

I, Justice Catherine E Holmes, Commissioner of Inquiry, pursuant to section 5(1)(d) of the *Commissions of Inquiry Act 1950* (Qld), require Mr Colin Jensen to provide a written statement, under oath or affirmation, to the Queensland Floods Commission of Inquiry, in which the said Mr Colin Jensen gives:

1. Details of any property owners who, since the January 2011 floods, have indicated a desire to, or who have already commenced, an assessment of the feasibility and appropriateness of establishing levees in their area (as outlined at page 21 of the Brisbane City Council January 2011 Flood Action Plan).

2. A description of the Brisbane City Council's proposed framework, including any draft local laws, for property owners who wish to assess the feasibility and appropriateness of establishing local levees to protect property at risk of flooding in Rocklea (as outlined at page 21 of the Brisbane City Council January 2011 Flood Action Plan).

3. A description of any work done by the Brisbane City Council since the January 2011 floods, with the owners or any tenants of the Brisbane Markets, to undertake a risk based flood management analysis, including whether such an analysis included any consideration given to the construction of levees around the Brisbane Markets precinct.

In addressing these matters, Mr Jensen is to:

- provide all information in his possession and identify the source or sources of that information;
- make commentary and provide opinions he is qualified to give as to the appropriateness of particular actions or decisions and the basis of that commentary or opinion.

Mr Jensen may also address other topics relevant to the Terms of Reference of the Commission in the statement, if he wishes.

400 George Street Brisbane
GPO Box 1738 Brisbane
Queensland 4001 Australia
Telephone 1300 309 634
Facsimile +61 7 3405 9750
www.floodcommission.qld.gov.au
ABN 82 696 762 534

The statement is to be provided to the Queensland Floods Commission of Inquiry by 9 September 2011.

The statement can be provided by post, email or by arranging delivery to the Commission by emailing info@floodcommission.qld.gov.au.

C. Holmes

Commissioner
Justice C E Holmes

CDJ-49

BRISBANE CITY COUNCIL

Action Sheet

119/80/620/4468

Ref Value 3146975

DEVELOPMENT & BUILDING CONTROLS - Assessment - Pre-lodgement

Title 3146975
Prelodgement Meeting
148 Dunn Road Rocklea

Ref Type DA - Development Application

Ref Value 3146975

Related Files/Comments

(1) Date	(2) Officer's name referred to and location	(3) Folio no/s.	(4) Cleared by	TRIM up-dated	(1) Date	(2) Officer's name referred to and location	(3) Folio no/s.	(4) Cleared by	TRIM up-dated
23/02/00	[redacted]	2		✓					
9.8.11	[redacted]			✓					

CC100 (9/2008)
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Stock Code no 280206

119/80/620/4468

Ref Value 3146975

Relevant details pertaining to this file

[redacted]
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Mobile [redacted]
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Email [redacted]

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GPO Box 1434 Brisbane Qld 4001
T 07 3403 8888
www.brisbane.qld.gov.au

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MEETING ATTENDANCE RECORD

Council Reference No Dunn St Rocklea.

Date: 07/08.

Time 3:00pm

Location DA Lounge

Attendees	Company	Contact Details/Email
[redacted]	Powerlink	[redacted]
	Powerlink	
	Powerlink Qld	
	BCC	
Rody Kelly	BCC	
[redacted]	BCC	

Increase Complexity

SBD Q200 + 300mm
- Community Infrastructure.

10.3m AHD - Q200 + 300mm.

- New Control Panels.
- 2-3 platform above ground building.
- approx 6m total height.

Extension to hardstand area.
appears to encroach into waterway corridor.
- fill generally not supported.
- Sand wall at 3 metres.
- Overland flow would be impacted by Sand wall.
- Canals 12.5m AHD - Q200

- Confirm the waterway corridor
- filling on site will need stormwater quality and quality Report.

Brisbane City Council

FloodWise Property Report

Report Reference
1689580

06/06/2011 16:40:32

Dedicated to a better Brisbane

The FloodWise Property Report is a free report to inform Brisbane residents and professionals about flood risks for a specified lot or property so they may better prepare for flooding and to plan and build in accordance with Council requirements. A flood level higher than those shown below can occur in any year, although such events are rare.

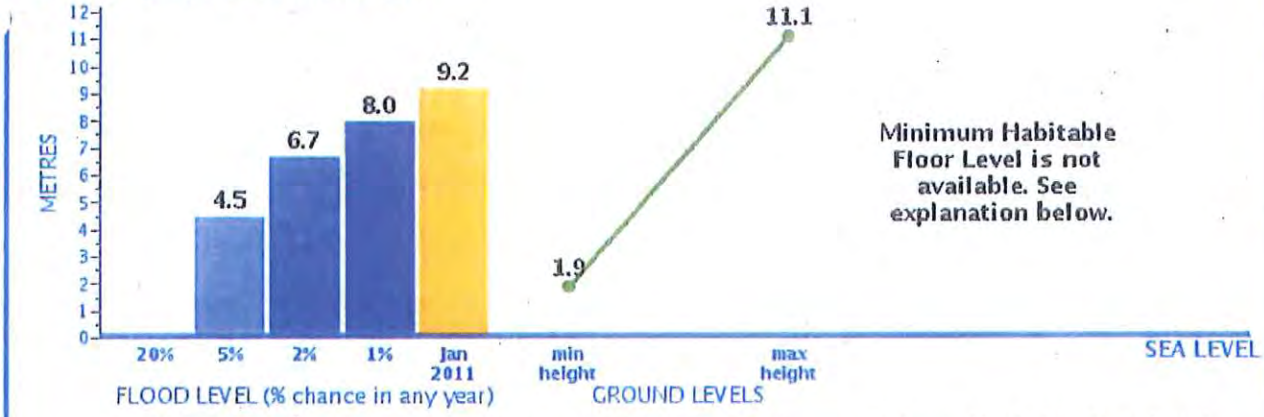
To find out more about how the contents of this report may affect your ability to build or renovate, as well as Council advice on how to protect your property and family by being FloodWise, visit www.brisbane.qld.gov.au, a Customer Service Centre or call (07) 3403 8888.

PROPERTY DETAILS:

Address: 108 DUNN RD ROCKLEA QLD 4106

Lot Details: Multiple Lots (See Appendices) (Reports are available for individual lots)

FLOOD LEVEL INFORMATION



Flood Levels
The blue bars in the graph above show the percentage chance of that level being reached or exceeded in any year. The orange bar shows the January 2011 flood level at this address or lot.

Ground Levels (Min - Max)
The line above shows this property's lowest and highest ground levels. Confirm with a surveyor.

Minimum Habitable Floor Level
If a property is in an overland flow path or a large allotment a minimum habitable floor level cannot be provided. See flood and property flag information over page.

For a detailed summary of anticipated flood levels and flags see technical summary over page.

HIGHEST SOURCE OF FLOODING

RIVER The highest source of flooding affecting this property originates from a river. For more information about flooding in your area you can view and download Council's Flood Flag Maps by visiting www.brisbane.qld.gov.au/floodmap

FLOOD AND PROPERTY DEVELOPMENT FLAGS

Current records indicate this property may be affected by one or more flood or property development flags. Please review the technical summary over page for more detail.

Technical Summary

Use this summary to supply information about this property to surveyors, builders, certifiers, architects and engineers who may request this FloodWise Property Report. This summary has been designed to be easily read if scanned or faxed.

Property Details

Address: **108 DUNN RD ROCKLEA QLD 4106**

Lot Details: **Multiple Lots (See Appendices)** (Reports are available for individual lots)

Flooding Information

Minimum Ground Level (AHD)	1.9 m
Maximum Ground Level (AHD)	11.1 m
Interim Residential Flood Level (IRFL)	9.2 m
Interim Residential Flood Level Source	RIVER
Minimum Habitable Floor Level (AHD)	N/A

Estimated Peak Flooding Levels

ARI (Years)	% chance	Level (AHD)	Source
5	20%	N/A	
20	5%	4.5 m	RIVER
50	2%	6.7 m	RIVER
100 or DFL	1%	8.0 m	RIVER
January 2011		9.2 m	RIVER

Flooding may also occur from:	CREEK/WATERWAY

Flood and Property Development Flags

Waterway Corridor	This property is located within a waterway corridor. A waterway corridor is a defined area along waterways (including rivers, creeks or creek tributaries), designed to protect water flow, water quality, biodiversity and recreation values. The potential to build or extend a home situated within a waterway corridor is restricted. For further information, contact the Development Assessment Customer Liaison Officer on (07) 3403 8888.
Large Allotment	This property is a Large Allotment of over 1000 square metres. Flood levels may vary significantly across allotments of this size. Further investigations may be warranted in determining the variation in flood levels and the minimum habitable floor level across this site. For more information or advice, it is recommended you engage a Registered Professional Engineer of Queensland.

Disclaimer

1 Defined Flood Levels and Interim Residential Flood Levels, and the Minimum Habitable Floor Levels based on them, are determined from the information available to Council at the date of issue. These flood levels, for a particular property, may change if more detailed information becomes available or changes are made in the method of calculating flood levels.

2 Council makes no warranty or representation regarding the accuracy or completeness of a FloodWise Property Report. Council disclaims any responsibility or liability in relation to the use or reliance by any person on a FloodWise Property Report.

Useful Definitions

Australian Height Datum (AHD) – The reference level for defining ground levels in Australia. The level of 0.0m AHD is approximately mean sea level.

Average Recurrence Interval (ARI) or % Chance – The probability of experiencing a flood of a particular magnitude. ARI can be interpreted in terms of years (frequency). ARI levels quoted in this report are measured in height above sea level (AHD). ARI can also be described as the percentage chance that a location will flood in any one year. For example, a 5 year ARI flood event corresponds to a 20% likelihood of a flood of this magnitude or greater occurring in any one year.

Defined Flood Level (DFL) – The flood level associated with a defined flood event. Commonly, the standard used is the 100 year ARI. For further information refer to the House Code in Brisbane City Plan 2000, specifically Table 1: House Flood Immunity Levels for residential property.

Maximum and Minimum Ground Level – Highest and lowest ground levels on the property based on available ground level information. A Registered Surveyor can confirm exact ground levels.

Minimum Habitable Floor Level – The minimum level above sea level at which habitable areas of development (generally including bedrooms, living rooms, kitchen, study, family and rumpus rooms) must be constructed.

City Plan 2000 – City Plan 2000 sets out what you can build and where new development should go. Council assesses proposed new development against the City Plan 2000.

Interim Residential Flood Level (IRFL) – The flooding standard adopted by Council following the January 2011 flood event to be applied to new residential development.

Find Out More

Whether you are building, buying, renting or preparing your property for flooding, obtaining a FloodWise Property Report is the first step in determining your property's flood risk. Council's 'Be FloodWise' series of publications can assist you to plan ahead, respond to and recover from flooding. They are available online at: http://www.brisbane.qld.gov.au/floodwise or by phoning Brisbane City Council on (07) 3403 8888.

The 'Be FloodWise' publications include:

Preparing for Flooding

Assess your flood risk, prepare for and respond to, flood events.

Be FloodWise - A guide for residents

Buying / Renting

Assess the flood risk of a property before making a decision to rent or buy.

Buying and renting fact sheet

Building or Renovating

Renovations around your home or business can impact on your flooding exposure. Ensure your house meets City Plan 2000 flood immunity

Building and renovating fact sheet

If you are planning to renovate or build, Council recommends you engage a Registered Professional Engineer of Queensland to undertake a thorough assessment of all flood risks specific to the property.

Get a Free Flood Flag Map

Find out more about predicted flooding in your suburb or area by downloading a free Flood Flag Map. The map shows overland flow paths and where flooding may occur from creeks, rivers and storm tides on a suburb scale.

For more information visit **www.brisbane.qld.gov.au/floodmap** or visit a Council Customer Service Centre

Appendices

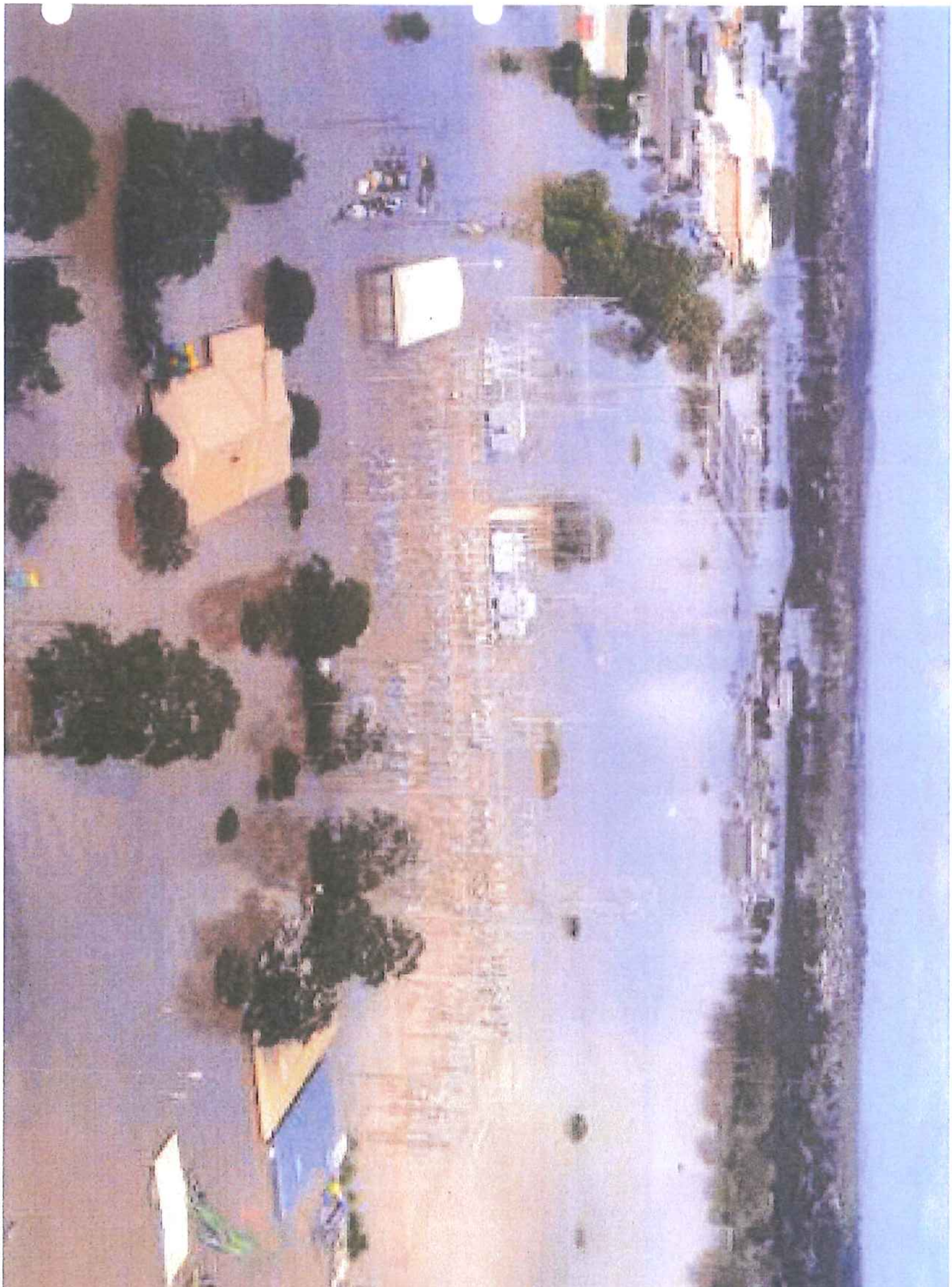
Lot Details:

L.1/RP.126256, L.2/RP.101616, L.1/RP.101616, L.1/RP.144972

NOTE: For the most accurate assessment of flood risks Council recommends you download a FloodWise Property Report for each lot on the property.

BCC.125.0010

BCC.125.0011



Rocklea - Tennyson Underground

LocalityPlan

Legend

- Powerlink Easement
- Rocklea - Tennyson Undergroun Corridor
- Road Parcel
- DCDB
- Watercourse Parcel

N

Region	PROJECT	DRG CLASS	DATE
Southern	NPS	A0	August 2011

Rocklea - Tennyson Underground

Author: Aaron Ambler

Reviewer: Narelle Dennehy

Revision Number: A

Projection: MGA Zone 56 Datum: GDA 94

Scale: 1: 5000

Powerlink Queensland

BCC.125.0013

Brisbane City Council

FloodWise Property Report

Report Reference
1689580
06/06/2011 16:40:32

Dedicated to a better Brisbane

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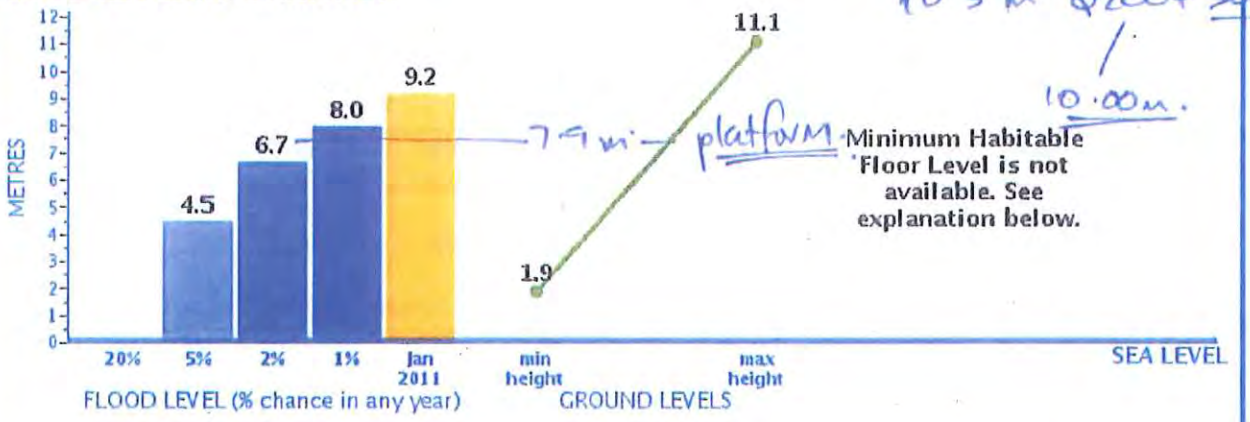

Minimum Habitable Floor Level is not available. See explanation below.

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Current records indicate this property may be affected by one or more flood or property development flags. Please review the technical summary over page for more detail.

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Interim Residential Flood Level Source	RIVER
Minimum Habitable Floor Level (AHD)	N/A

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Flood and Property Development Flags

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Useful Definitions

Australian Height Datum (AHD) – The reference level for defining ground levels in Australia. The level of 0.0m AHD is approximately mean sea level.

Average Recurrence Interval (ARI) or % Chance – The probability of experiencing a flood of a particular magnitude. ARI can be interpreted in terms of years (frequency). ARI levels quoted in this report are measured in height above sea level (AHD). ARI can also be described as the percentage chance that a location will flood in any one year. For example, a 5 year ARI flood event corresponds to a 20% likelihood of a flood of this magnitude or greater occurring in any one year.

Defined Flood Level (DFL) – The flood level associated with a defined flood event. Commonly, the standard used is the 100 year ARI. For further information refer to the House Code in Brisbane City Plan 2000, specifically Table 1: House Flood Immunity Levels for residential property.

Maximum and Minimum Ground Level – Highest and lowest ground levels on the property based on available ground level information. A Registered Surveyor can confirm exact ground levels.

Minimum Habitable Floor Level – The minimum level above sea level at which habitable areas of development (generally including bedrooms, living rooms, kitchen, study, family and rumpus rooms) must be constructed.

City Plan 2000 – City Plan 2000 sets out what you can build and where new development should go. Council assesses proposed new development against the City Plan 2000.

Interim Residential Flood Level (IRFL) – The flooding standard adopted by Council following the January 2011 flood event to be applied to new residential development.

Find Out More

Whether you are building, buying, renting or preparing your property for flooding, obtaining a FloodWise Property Report is the first step in determining your property's flood risk. Council's 'Be FloodWise' series of publications can assist you to plan ahead, respond to and recover from flooding. They are available online at: http://www.brisbane.qld.gov.au/floodwise or by phoning Brisbane City Council on (07) 3403 8888.

The 'Be FloodWise' publications include:

Preparing for Flooding

Assess your flood risk, prepare for and respond to, flood events.

Be FloodWise - A guide for residents

Buying / Renting

Assess the flood risk of a property before making a decision to rent or buy.

Buying and renting fact sheet

Building or Renovating

Renovations around your home or business can impact on your flooding exposure. Ensure your house meets City Plan 2000 flood immunity

Building and renovating fact sheet

If you are planning to renovate or build, Council recommends you engage a Registered Professional Engineer of Queensland to undertake a thorough assessment of all flood risks specific to the property.

Get a Free Flood Flag Map

Find out more about predicted flooding in your suburb or area by downloading a free Flood Flag Map. The map shows overland flow paths and where flooding may occur from creeks, rivers and storm tides on a suburb scale.

For more information visit **www.brisbane.qld.gov.au/floodmap** or visit a Council Customer Service Centre

Appendices

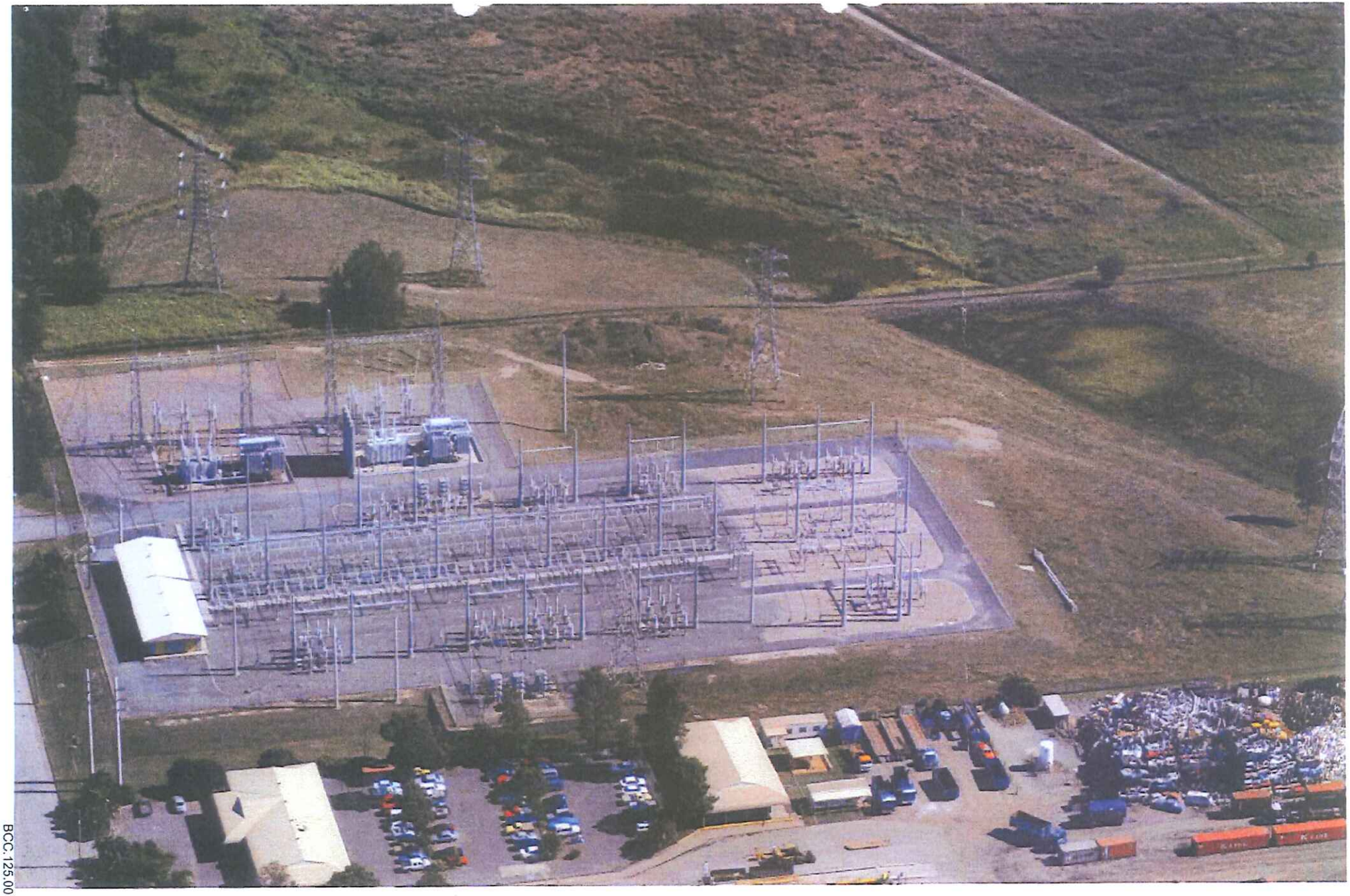
Lot Details:

L.1/RP.126256, L.2/RP.101616, L.1/RP.101616, L.1/RP.144972

NOTE: For the most accurate assessment of flood risks Council recommends you download a FloodWise Property Report for each lot on the property.

110 kV. Refurbishment works.

BCC.125.0018



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Date : Aug 9, 2011
User : 090893

Scale = 1:5,761

Metres 100 200

Location :

6,952,818

N

498,592 500,162

6,951,653

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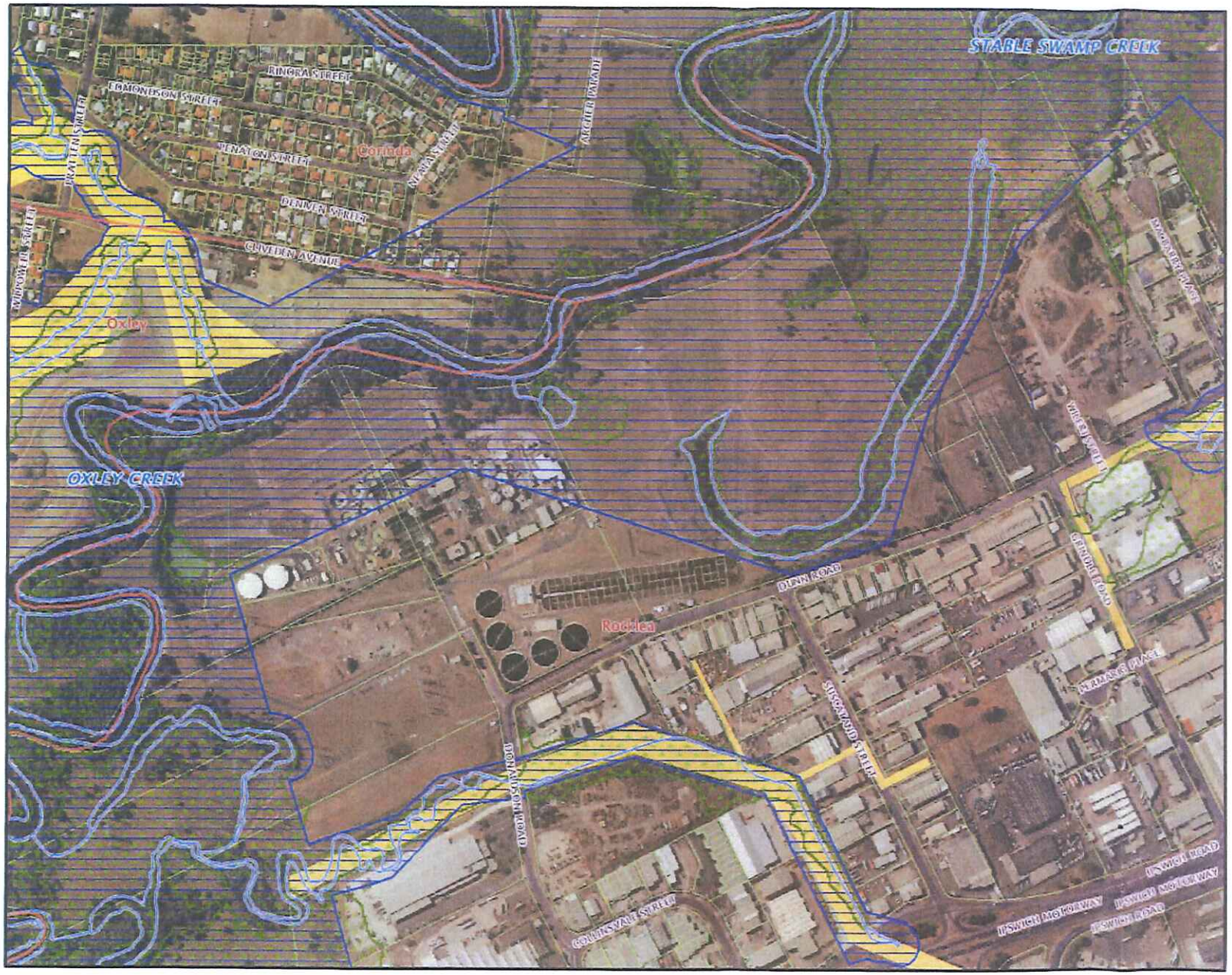
BRISBANE CITY

GDA

Qasco



Date : Aug 9, 2011
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Scale = 1:5,761
Metres 100 200

Location :

6,952,818
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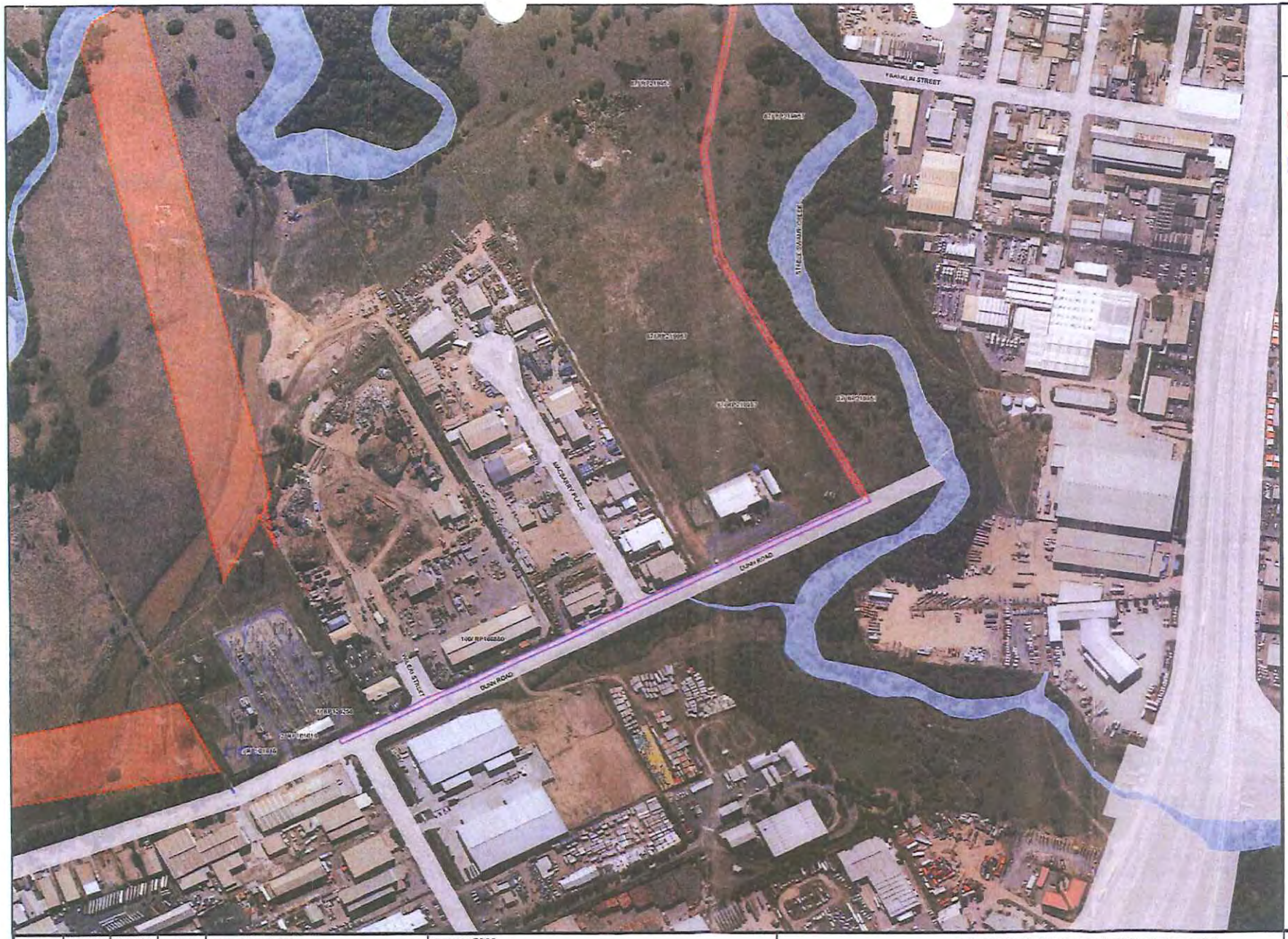

Rocklea - Tennyson Underground

LocalityPlan

Legend

- Powerlink Easement
- Rocklea - Tennyson Undergroun Corridor
- Road Parcel
- DCDB
- Watercourse Parcel

N

Region	PROJECT	DRG CLASS	DATE	Author: Aaron Ambler	Scale: 1: 5000
Southern	NPS	A0	August 2011	Reviewer: Narelle Donnelly	
Rocklea - Tennyson Underground				Revision Number: A	
				Projection: MGA Zone 56 Datum: GDA 94	

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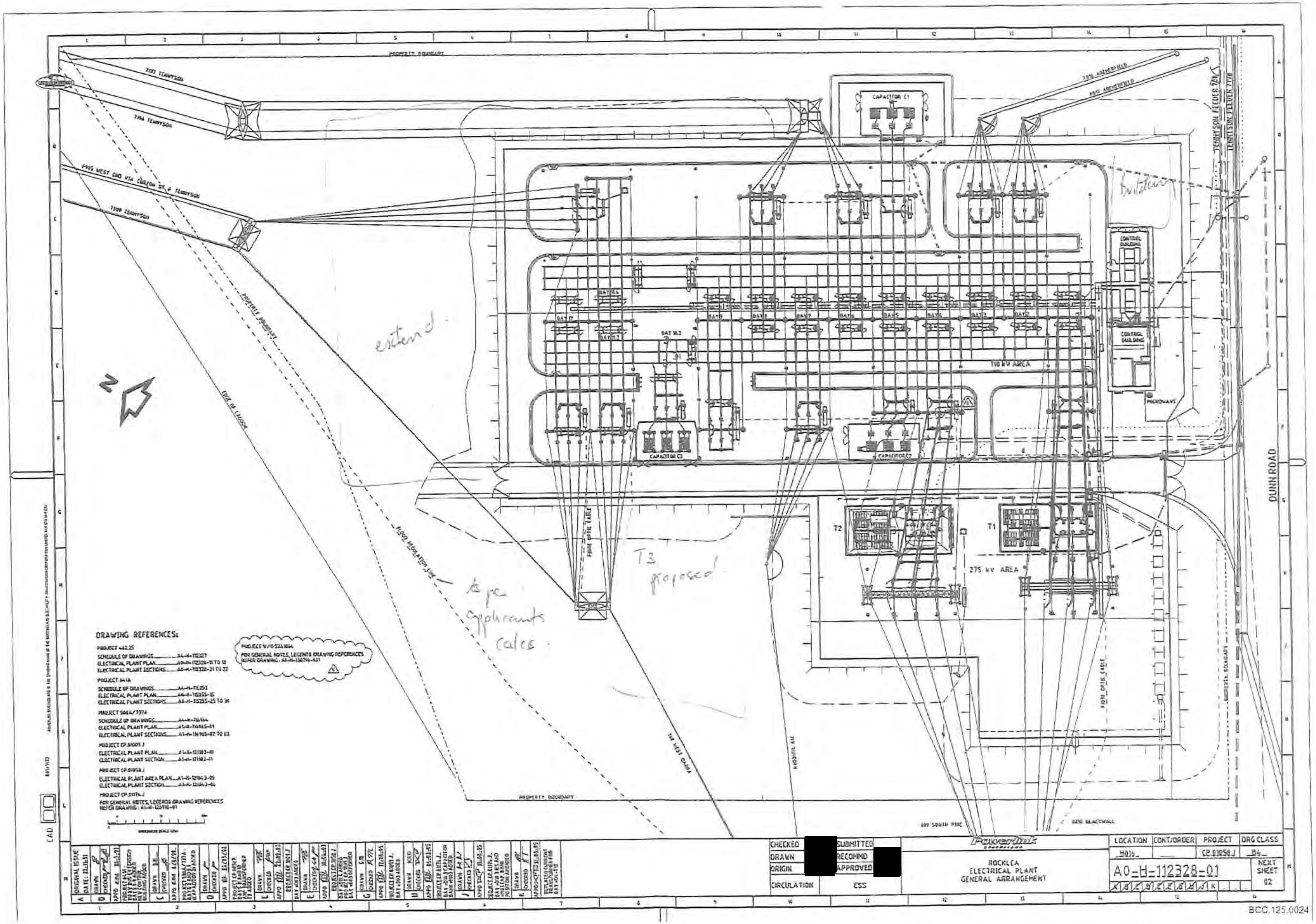
Powerlink Queensland


PROPERTY BOUNDARY
7171 TENNYSON
7194 TENNYSON
7299 TENNYSON
CAPACITOR C1
CAPACITOR C2
CAPACITOR C3
CONTROL BUILDING
CONTROL BUILDING
110 kV AREA
275 kV AREA
T1
T2
MICROWAVE
FIBRE OPTIC CABLE
DUNN ROAD
extend
T3 proposed
As per applicants calcs
DRAWING REFERENCES:
PROJECT 442.25
SCHEDULE OF DRAWINGS
ELECTRICAL PLANT PLAN
ELECTRICAL PLANT SECTIONS
PROJECT 641A
SCHEDULE OF DRAWINGS
ELECTRICAL PLANT PLAN
ELECTRICAL PLANT SECTIONS
PROJECT 566A/737A
SCHEDULE OF DRAWINGS
ELECTRICAL PLANT PLAN
ELECTRICAL PLANT SECTIONS
ELECTRICAL PLANT PLAN
ELECTRICAL PLANT SECTION
ELECTRICAL PLANT AREA PLAN
ELECTRICAL PLANT SECTION
FOR GENERAL NOTES, LEGENDS & DRAWING REFERENCES REFER DRAWING
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[redacted]
SUBMITTED
RECOMMD
APPROVED
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CIRCULATION
ESS
Powerlink
ROCKLEA
ELECTRICAL PLANT
GENERAL ARRANGEMENT
LOCATION
CONT/ORDER
PROJECT
DRG CLASS
CP.01058.J
A0-H-112328-01
NEXT SHEET
02
ORIGINAL ISSUE
CAD

BCC.125.0024

>>> [redacted] 18/08/2011 13:32 >>>

>>> [redacted] 18/08/2011 1:25 pm >>>

Dear [redacted]

As discussed, I have been contacted by [redacted] Market Street, Newmarket who has suggested it would be a good idea during the desilting process of Enoggera Creek to construct a levee along the area behind the Newmarket Hotel (near the soccer grounds) and the current walking track put on top of it.

While I believe there are very real obstacles in a "levee" as such, I noted that the approach of the Review Committee members was that all issues should be considered. I would be grateful if you could provide some expert advice in relation to this proposal so that I might be able to respond to [redacted]

Regards

[redacted]

LEVEES (Authors – Peter Barnes & Evan Caswell)

Levees are most appropriate in very large catchments where there is a significant time difference between the local rainfall/ local flooding and a flood in the main channel. A reasonable time difference gives the local event opportunity to subside before the flood in the main channel arrives. In such scenarios and where the underground drainage is of adequate capacity, levees in conjunction with flap valve arrangements on the drainage system may prevent flood waters from the main channel entering the protected area.

In catchments subject to flash flooding such as the site in question, flood levels in the watercourse rise quickly. Under such conditions where there is limited opportunity for the escape of local flows, a levee will act as a dam to the local runoff. Additionally, the underground drainage system at the subject location is not of an adequate standard to preclude the need for an overland flow path to drain the local area. Obstruction to the overland flow path by the presence of a levee would require an alternate means of dewatering the protected area such as a pump system with a guaranteed electricity supply. Such arrangements cannot be relied upon during electrical storms and/or major flooding.

A levee must extend beyond the expected inundation area if properties are to be protected from flooding. If a levee does not extend far enough then flood waters may eventually enter the levee area and become trapped, worsening the flooding of properties that the levee was intended to protect. On this basis a flood levee for the suggested location would need to extend into private property or dedicated roadway in order to be effective. This is not a desirable outcome for cost and amenity reasons.

For the above reasons a levee is not considered an appropriate form of flood protection for the suggested area.

Cr Peter Matic

Councillor for Toowong Ward

Chairman for Environment, Parks & Sustainability

Tel > 07 3407 2873 Fax > 07 3403 4384
Mail > GPO Box 1434, Brisbane QLD 4001
Email > peter.matic@brisbane.qld.gov.au
Website > www.petermatic.com.au

8 September 2011

Councillor David Hinchliffe
Central Ward
31 Duncan Street
FORTITUDE VALLEY QLD 4006

Dear Councillor Hinchliffe

Thank you for your email of 19 August 2011 forwarding the suggestion of a resident, [redacted] about constructing a levee behind the Newmarket Hotel during the desilting process of Enoggera Creek. I have asked Council officers to investigate this suggestion.

Council's previous investigations have shown that levees are most appropriate in very large catchments where there is a significant time difference between the local rainfall/local flooding and a flood in the main channel. This allows time for the local event to subside before the flood in the main channel arrives.

In catchments subject to flash flooding, such as this location, flood levels in the watercourse rise quickly. Council has identified that under such conditions, where there is limited opportunity for the escape of local flows, a levee would act as a dam to the local runoff.

To be effective, a levee must extend beyond the expected inundation area, which in this location would involve encroaching on private property or dedicated roadway.

In this instance, the construction of a levee in the location suggested would not be feasible and would work against the objectives of the project.

The purpose of the project is to reduce the impact of flooding on people and properties adjacent to Enoggera Creek and includes the removal of silt, sand and gravel and some trimming and removal of mangroves to improve flood immunity.

Stage one works are now underway and are expected to be completed by the end of September 2011, creek conditions and weather permitting.

.../2

BRISBANE CITY

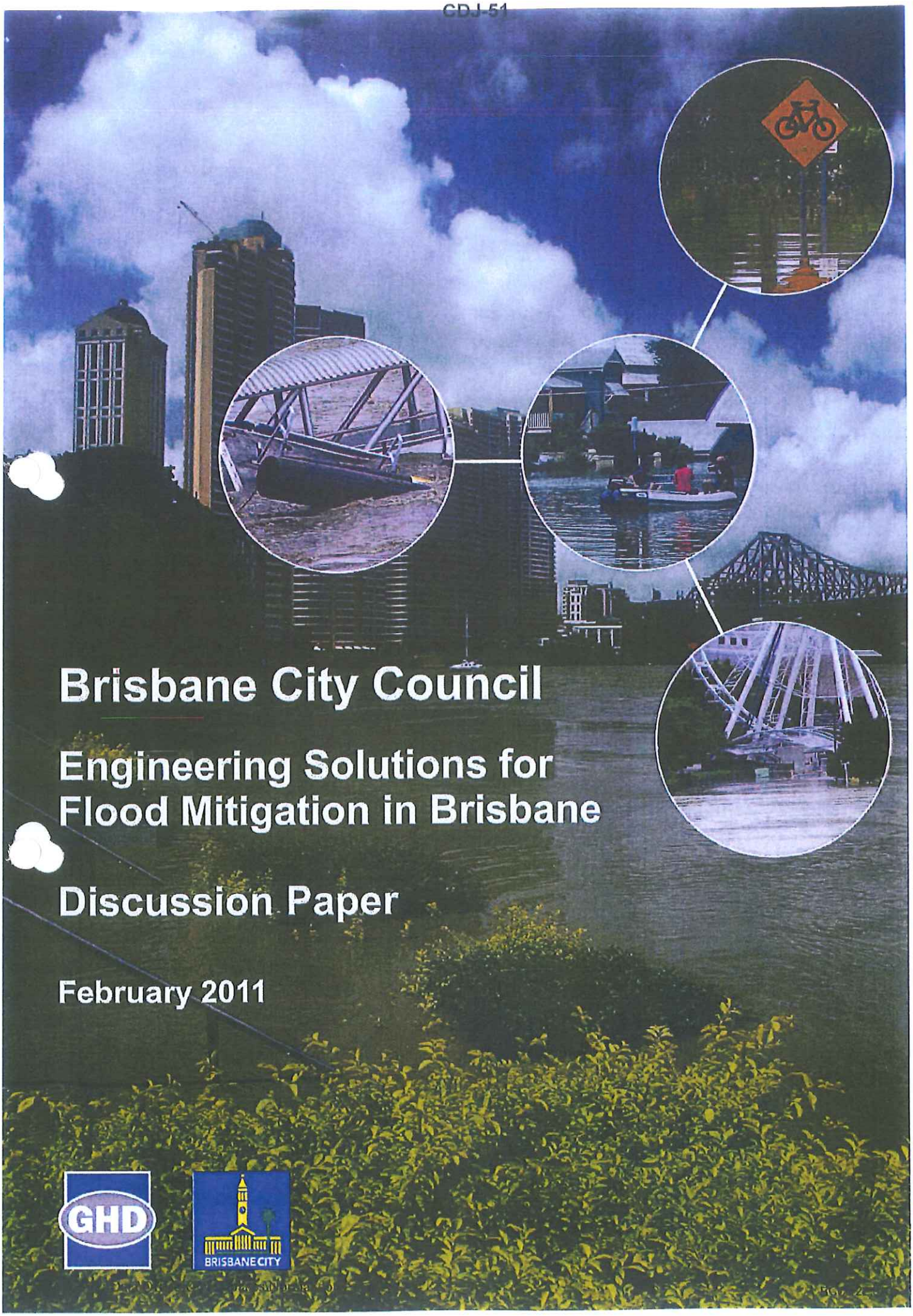
For any further questions, please contact the project on the project information line on 1800 550 712 or via email cityprojects@brisbane.qld.gov.au.

Yours sincerely

[redacted]

Councillor Peter Matic
Chairman
Parks Environment and Sustainability

Ref: CO36321-2011



Brisbane City Council

Engineering Solutions for Flood Mitigation in Brisbane

Discussion Paper

February 2011

GHD

BRISBANE CITY

Contents

Figure Index

1. Introduction

1.1 Background

In January 2011, Brisbane experienced its worst flooding since 1974. Tens of thousands of properties were flooded and there were billions of dollars in damage to private and public infrastructure.

One of the characteristics of the flood was that inundation largely occurred because of elevated water levels in the Brisbane River, with very limited flooding from local rainfall in the suburban area. Among other things, this has led to further consideration of measures that might exist to reduce "backflow" from the river and reduce or eliminate flooding in parts of the city that otherwise would not have been flooded.

High tidal levels alone can also lead to localised "minor" inundation in low lying areas. These high levels also decrease the discharge of the Brisbane River at the outlet and push up river levels for some kilometres upstream. The same principles apply to all other Brisbane waterways discharging directly to Moreton Bay. The "backflow" flooding from high tide levels that occurs from time to time is similar in some ways to the 2011 flood and could be mitigated using similar strategies.

1.2 Overview

1.2.1 Causes of flooding

There are several causes of flooding that Brisbane can experience. These are described in some detail in the report *Strategies to reduce the effect of significant rain events on areas of Brisbane prone to flooding*[1]:

- heavy or sustained rainfalls over the catchments of Brisbane's creeks;
- overloaded stormwater systems as surface runoff makes its way into creeks (overland flow);
- heavy or sustained rainfalls over the catchments of the Brisbane River;
- storm surge in Moreton Bay;
- failure of one of the three dams in the City's environs, Gold Creek Dam, Lake Manchester and Enoggera Dam or the SEQ Water controlled Wivenhoe Dam; and
- a tsunami in the Pacific Ocean.

In considering structural flood mitigation measures, in particular, each of these types of flooding needs to be taken into account. However the main flood risks to Brisbane are caused by heavy or sustained rainfall over the catchments of Brisbane's creeks, overland flows and heavy or sustained rainfalls over the catchments of Brisbane River.

[1] Brisbane City Council (2005), "Strategies to reduce the effect of significant rain events on areas of Brisbane prone to flooding", Report of the Lord Mayor's Taskforce on Suburban Flooding, p(iv)

It should also be stressed that structural measures that provide a benefit in one set of flooding conditions will not necessarily provide a benefit in other conditions and may, in fact, worsen the impacts of flooding.

1.2.2 Structural versus non-structural measures

Measures to mitigate the impact of flooding in suburban areas can largely be divided into two groups - structural and non-structural:

- Structural measures are those that involve physical works to lessen the effects of flooding, such as improvements to drainage infrastructure. These might otherwise be described as "engineered" solutions.
- Non-structural measures are typically linked with town planning policies and building codes and involve longer-term consideration. These might include, for example, restrictions on where construction can take place, limitations on fill in floodplains and specification of minimum habitable floor levels for buildings.

This paper considers structural measures, or "engineered" works to mitigate the impacts of flooding.

1.2.3 Passive and active measures

Structural measures can be further subdivided into active and passive measures. Passive measures require no operation whereas active measures are those that require some form of operation or movement to provide a benefit. Active measures add a layer of complexity when considering the costs and benefits, because they add a level of risk.

If something needs to be operated, there must be an associated operating plan and consideration of "failsafe" mechanisms that will allow operation in highly adverse conditions. Mechanisms that are only occasionally operated - such as when there is a major flood - are inherently subject to an even greater risk during operation. Active measures should only be used where there has been a detailed risk assessment and there is an ongoing commitment to maintenance and operational reviews.

1.2.4 Costs and benefits

Most strategies to mitigate the impact of flooding come with a cost. This can be a direct cost, such as the capital and operating costs associated with structural measures, or an indirect cost such as loss of social amenity or a reduction in property value. Inevitably, these costs need to be balanced against the benefits that are derived.

This discussion paper does not seek to quantify the costs or benefits associated with any particular measure, but detailed consideration of the costs and benefits would need to be considered prior to any commitment.

1.3 Objective of this discussion paper

The objective of this discussion paper is to provide an overview of the structural or "engineered" measures available to mitigate the impact of flooding, with particular reference to those mechanisms that may assist in reducing flooding from the Brisbane River.

2. Engineered solutions

2.1 River barriers

A river barrier is a form of floodgate designed to prevent storm or tidal surges from flooding areas upstream. They permit water to pass in normal conditions but are closed in tidal flood conditions. They range significantly in size and scale. Construction is dependent on the presence of suitable foundation conditions and additional works are often necessary along the river banks downstream of the barrier.

There are numerous installations in the Netherlands and in the UK. Possibly the most well-known example for Australians is the Thames Barrier, pictured below. Types of barriers include inflatable barriers and gates that rise from the floor the waterway. A set of gates is currently under construction in Venice.

Figure 1 Thames Barrier, London

Photo: David Iliff[2]

In Brisbane, a river barrier could provide protection against a tidal or storm surge in Moreton Bay. It could also provide protection against particularly high tides and may have benefits in the longer term if sea levels rise as predicted by climate scientists.

This type of structure would have no benefit, however, in the case of river flooding. If the river were in flood the gates would need to be kept open to maximise the flow of water from the mouth of the river.

These structures are generally very expensive. The Thames Barrier was completed in 1984 at a cost of more than £500 million and it is likely that an equivalent structure for Brisbane in 2011 would be measured in the billions of dollars. The current impact of high tides in Brisbane would not appear to warrant an investment of this magnitude.

Like all active structures, there also remains a risk of faulty operation. Failure of the structure or damage due to external impacts of shipping, for example, could lead to unexpected inundation and significant flood damage. This almost occurred in London in 1997.

[2] http://en.wikipedia.org/wiki/File:Thames_Barrier,_London,_England_-_Feb_2010.jpg accessed 12 February 2011. Refer to http://creativecommons.org/licenses/by-sa/3.0/deed.en for licence conditions.

2.2 Flood gates

Flood gates are adjustable structures used to impede and control the movement of water in a waterway, similar to river barriers in some ways but at a smaller scale. The opening and closure of flood gates depends on a change in water level due to flooding, rainfall or tidal variation. As part of a storm or tidal surge system flood gates may be used to stop water flow entirely. In addition to flood management, flood gates and associated infrastructures can be used to improve water quality and address ecological issues within a water system.

Flood gates are typically attached to a larger structure such as a barrier, dam wall, weir, culvert or headwall within a waterway. In smaller tributaries they may be constructed independently of other structures.

Traditional flood gates include the following types:

- Hinged flap gate - self-operating gate typically attached to a headwall or culvert, suitable for tidal gating of channels when complete isolation is required. Minimal maintenance is required, but they restrict fish passage and are prone to blockage.
- Manually-operated flap gate – similar to a hinged flap gate but with remote operational control via a winch, or mechanical sluice, to allow independent control of water movement.
- Self-regulating tidal gates – as a variation of a hinged gate, self-regulating tidal gates allow automated tidal movements, but prevent flooding during high tides and flood events, primarily using a buoyancy mechanism.

Flood gates may be applicable in Brisbane to control flooding in tributaries and creeks by controlling backflow from the Brisbane River. However, detailed modelling of the hydraulic and environmental impact of any flood gates would be necessary. Among other impacts, flood gates may cause:

- Increased flood levels upstream in the case of local flooding;
- Water stagnation and sedimentation upstream;
- A deterioration of water quality within the waterway;
- Obstruction of fish passages;
- Increased ecological and plant disturbance and increased weed growth; or
- Oxidisation of acid sulphate soils.

A local example of a gated structure serving a similar purpose is the Fitzroy River Barrage at Rockhampton. Although slightly different in its functionality, the barrage provides a barrier which impounds fresh water upstream while preventing tidal saltwater downstream from intruding into the storage. The gates of the barrage are lowered to allow floods to pass.

2.3 Levees and flood walls

A levee is a slope or embankment, typically but not always constructed parallel to the waterway, that prevents or reduces flooding on the landward side. Levees have been used for thousands of years to provide flood protection.

Levees are used to manage flooding from some inland rivers in Australia. Large riverine levee systems have also been constructed in many international locations, including along the Mississippi River in the USA and in Europe along the Danube and the Rhine. Prominent large coastal levee systems have been constructed in Canada (specifically Vancouver), throughout the Netherlands, and in New Orleans in the United States.

Flood walls are similar to levees but tend to be constructed as concrete walls rather than as earthen structures. The same issues for both walls and levies need to be considered.

Figure 2 Flood Walls - New Orleans

Photo: US Army Corps of Engineers

Levees can be a valuable flood protection measure and are often seen as an "obvious" solution to river flooding. However, there are many significant considerations where levees are constructed. Levees:

- typically need to be constructed over long distances;
- increase flood levels in the river because flood plain storage is no longer available;
- pose a significant safety hazard when they fail during a flood;
- remain prone to over-topping in the event of a flood that is larger than the "design" flood, and dangerous failures can result;
- impose a barrier on the operation of drainage systems upstream of the barrier;
- may need underground drainage structures across them to allow for normal drainage.

Despite these concerns, however levees can be a valuable option to protect specific areas - for example areas with a high population density, pieces of critical infrastructure or important industrial areas.

In Brisbane, specific challenges with levees include:

- the river has a very flat longitudinal gradient, meaning that any levees along the river would need to extend for many kilometres;
- moving further up the river, flood events are significantly higher than the river banks, and levees would need to be of varying heights depending on the design flood level. These levees maybe impractically high;
- as the "River City", construction of levees or flood walls would have a significant adverse aesthetic impact on the city, effectively blocking any view of the river from ground level;
- construction of levees would also need to extend up several low-lying tributaries;
- levees would directly block any "overland flow paths" which form the basis of drainage design across the city, and without extensive investment in drainage systems would lead to a worsening of local flooding across the city.

Nonetheless it may be appropriate to consider protection of specific limited areas of high value through the construction of levees. One example might be critical infrastructure such as the cold stores at the Brisbane Markets at Rocklea. Each case would require careful consideration of a range of design issues to confirm its viability and that the benefits outweigh the costs.

2.4 Backflow prevention valves

A flood-tide and backwater valve is intended to ensure one-way flow downstream and prevent water from 'backing up' into piped stormwater systems from downstream. Backwater valves are generally designed and constructed to minimise clogging.

Flood tide and backwater valves are used specifically on sewer overflow pipes and stormwater pipes. A wide range of valve designs is available, varying in complexity from simple flap valves (see Figure 3) through to more complex valves actuated by high downstream water levels. The most common backflow prevention valves are the simple flap valve - used extensively in Australia - and the rubber "duck bill" valve.

Figure 3 Flap Valves, Breakfast Creek

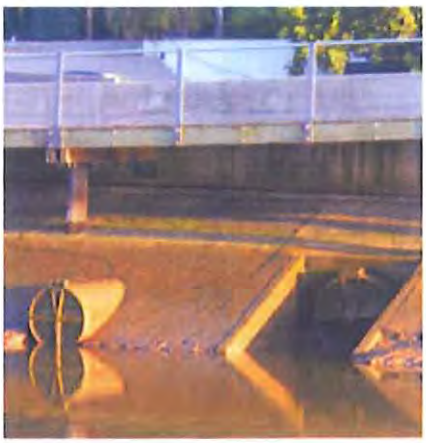


Photo: GHD

Figure 4 Rubber "Duck Bill" valves

Photo: Valvias[3]

In both of these cases, the intention is that the valve will remain closed until there is flow from upstream. The valve will open to release flow from upstream, closing again when flow stops and the downstream water level is lower than the upstream level. Particular issues with these types of valve include the relatively high potential for valves to be stuck "open" (not uncommonly by debris or accumulated sediment downsteam), thereby rendered ineffectual, and the potential for increased pressure losses in the system leading to less effective drainage.

Large urban centres in North America and Europe sometimes have a requirement for backwater valves within the wastewater and stormwater systems for specific buildings or areas prone to flooding. The City of Toronto provides a subsidy for residential and commercial installation of backwater valves. The City of New York promotes and monitors the installation of flood tide and backwater valves for all riverside

[3] http://www.valvias.com/type-rubber-duck-bill-check-valve.php, accessed 12 February 2011

suburbs. Both of these cities have "combined sewers" where sewage and stormwater are mixed, and the circumstances are therefore a little different to Brisbane where sewerage and stormwater drainage are separated.

In Brisbane, flap valves are already widely used in low-lying areas to prevent backflow. Flap valves are a practical means of reducing the impact of tidal backflow, but cannot generally be relied upon because of the relatively high risk that they will be blocked in an open position. If these are installed, they must be continually maintained to ensure effective operation.

Installation is relatively simply on new drainage systems, but they can be more difficult to retrofit on existing drainage systems.

2.5 Dredging

Dredging is the term given to excavation or removal of material to deepen waterways, create harbours, channels, locks, docks and berths, de-silt lakes and keep river entrances and approaches to boat ramps clear. The material removed during dredging can vary greatly and can be any combination of rocks, clays, silts or sands.

Large Australian dredging projects included the dredging of the Port of Melbourne and the proposed dredging of the Port of Gladstone. Neither are flood related dredging activities. In the Netherlands, multiple parts of the major rivers are dredged annually to prevent the formation of river bars that restrict navigation and drainage.

The Brisbane River has been dredged historically in order to improve navigability. Dredging of sand and gravel from the river for construction materials was carried out until 1996. The dredging has increased the length of the tidal estuary and the effects of each tide extend further upstream than occurred historically.

Considerable dredging (and waterway straightening) was undertaken following recommendations arising from the enquiry into the 1974 floods in Brisbane, particularly in some of the tidal tributaries of the river and some of the tidal creeks that discharge to Moreton Bay. These included Breakfast Creek and Schultz Canal.

Dredging provides a mitigating effect for flooding by increasing the cross-sectional area of the waterway and reducing friction losses along the river. Dredging will also increase the impact of tidal influences in the river, and cause an increased tidal variation upstream. An increase in tidal levels may reduce the flow benefits provided through dredging.

Dredging has a number of other effects that need to be considered:

- impact on the environment in the areas dredged and where the dredged material is discarded;
- negative impact on water quality by increasing sediment and nutrient loads and through potential release of toxicants accumulated on the floor;

- potential for increased erosion directly upstream of the limit of dredging due to changed flow conditions;
- ongoing costs of maintenance.

The upstream benefits of dredging would require detailed analysis. The benefits can dissipate relatively quickly upstream depending on the hydraulic.

2.6 Flood mitigation storages

Upstream flood storages along tributaries of the Brisbane River and upstream sections of the Brisbane River itself could potentially be used to reduce peak levels downstream. Brisbane already experiences the benefit of considerable flood storage in Wivenhoe Dam, but the dam is upstream of two major tributaries – Lockyer Creek and the Bremer River.

Dedicated flood mitigation storages would usually be left empty, becoming active only in the event of a major flow in the waterway. Flood mitigation dams can be designed with or without gates. They work by storing water from the initial peak of the flood, with the water released over a longer period of time thereby reducing peak flows and flood levels. Flood storages are widely used at a smaller scale in urban drainage systems ("detention" basins) and at a larger scale in some cities such as Glasgow. The North Para Flood Mitigation Dam near Gawler in South Australia is a more local example.

A flood storage or series of smaller storages upstream of Ipswich on the Bremer River and/or Lockyer Creek may help to reduce peak levels in Ipswich and in Brisbane, however the timing of flows would require considerable detailed analysis. Part of the design strategy would be to delay parts of the flood so that peak flows from different parts of the catchment occurred at different times.

The main disadvantage of flood storages is that large areas of land upstream of the structures will potentially be affected. This may necessitate land acquisition and will require development and other planning controls on land inundated in the event of a flood.

Opportunity may also exist to increase the flood storage capacity of Wivenhoe Dam by raising the level of the dam wall. There have been some studies of this option over the past five to ten years.

3. Conclusions

There are no "silver bullets" to mitigate flood levels in Brisbane. The 2011 flood was characterised by high flows and water levels in the Brisbane River at a time of minimal flows in urban tributaries, and most of the flooding was therefore caused by "backflow" from the river. This was more pronounced than in 1974, for example, where flooding of tributaries such as Oxley Creek was also significant.

The major difficulty in planning for infrastructure to mitigate flooding in Brisbane is that flood events in the catchment and surrounds are rarely the same. A variety of structural measures exist that could potentially be used to reduce the impacts of "backwater" flooding in Brisbane, but none of these measures comes without other impacts and risks.

"Engineered" or structural measures with the highest potential for application in Brisbane are:

- the use of flap valves and possibly "duck-bill" valves in tidally-affected areas, subject to implementation of suitable maintenance regimes (these are already used);
- the use of levees around specific, high-value infrastructure (such as the Brisbane Markets), but not along waterways; and
- possible implementation of flood mitigation dams on the Bremer River and Lockyer Creek upstream of Ipswich.

The last two of these in particular would require further, more detailed, investigation to establish if they are viable and will provide a net benefit to the community.

Non-structural measures have not been considered in this Discussion Paper, but remain a strong longer-term option for mitigating the effects of flooding in Brisbane.

GHD

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date

CDJ-52

BRISBANE CITY

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BRIEFING NOTE

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25 MAR 2011

30 MAR 2011

- 6 APR 2011

INFORMATION MANAGEMENT Brisbane City Council

CA11/76169

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Pls prepare a formal [redacted]

To:	Colin Jensen Chief Executive Office[redacted] Date: 24/03/2011 Councillor Peter Matic PM 29/3/11 Chairman Environment Parks and Sustainability Committee	ATTACH No. Water Resources Branch City Planning & Sustainability Division
Via:	[redacted] MC 25/3 Divisional Manager City Planning and Sustainability	Brisbane Square Level 8 266 George Street Brisbane Qld 4000 GPO Box 1434 Brisbane Qld 4001
From:	[redacted] Acting Manager Water Resources Branch	Phone: Facsimile: Email: [redacted] Internet: www.brisbane.qld.gov.au
Re:	Discussion Paper: Engineering Solutions for Flood Mitigation in Brisbane	

Purpose
To brief the CEO on the findings of the discussion paper entitled *Engineering Solutions for Flood Mitigation in Brisbane*.

Background
On 25 January 2011 Council engaged GHD consulting engineers to complete a desk top review of methodologies to mitigate backwater (including high tides) including identifying the circumstances where they are effective and their general suitability for Brisbane. A draft of this paper was presented to the Establishment and Coordination Committee by GHD on 7 February 2011.

Summary of findings
The key findings of each engineering solution evaluated by GHD are summarised below.

River Barriers
River Barriers could provide protection against tidal or storm surge from Moreton Bay, but would provide no benefit for river flooding and are extremely expensive (billions of dollars for the Brisbane River). They can also cause unexpected inundation and significant flood damage due to the risk of faulty operation or damage from external impact.

Flood Gates
Flood gates control backflow flooding in a river's tributaries and creeks, but are not considered appropriate for Brisbane due to the following impacts and risks:
- increased flood levels upstream in the case of local flooding
- increased water stagnation and sedimentation upstream
- deterioration of water quality within the waterway and obstruction of fish passages
- increased ecological and plant disturbance and increased weed growth, and
- oxidisation of acid sulphate soils.

Levees and Flood Walls
Constructed parallel to waterways to reduce flooding on the landward side. They are used to manage flooding from some inland rivers in Australia but are not considered appropriate alongside the Brisbane River because:
- The Brisbane River has a very flat longitudinal gradient, requiring levees along the river to be extended for many kilometres including up several low-lying tributaries.
- Increased flood levels in the river would result because of reduced flood plain storage.
- They pose a significant safety hazard when they fail during a flood.
- They are prone to over-topping in the event of a flood that is larger than the "design" flood and restrict upstream drainage systems, leading to a worsening of local flooding across the city.
- Flood events such as Jan 2011 can be significantly higher than the river banks and levees and flood walls would need to be built impractically high.

- Construction of levees or flood walls would have a significant adverse aesthetic impact on the city, blocking any view of the river from ground level.

Backflow prevention valves
Designed to ensure one-way flow downstream and prevent water from 'backing up' into piped stormwater systems. Flap valves are already used in low-lying parts of Brisbane but have a high potential to be stuck open due to debris or accumulated sediment. They require continuous maintenance to ensure effective operation and are difficult to retrofit on existing drainage systems.

Dredging
Historically undertaken in the Brisbane River to improve navigation and not recommended as a flood mitigation measure for the Brisbane River because of:
- Increased tidal influence in the river.
- Increased tidal variation upstream reducing the flow benefits of the dredging.
- Impact on the environment in the areas dredged and where the dredged material is discarded.
- Negative impact on water quality by increasing sediment and nutrient loads and through potential release of toxicants accumulated on the floor.
- Increased erosion directly upstream of the limit of dredging due to changed flow conditions.
- Ongoing costs of maintenance.

Flood mitigation storages
Stores the initial peak flow of a flood, located along tributaries of a river, or on the river itself. A flood storage or series of smaller storages upstream of Ipswich on the Bremer River and/or Lockyer Creek may help to reduce peak levels in Ipswich and in Brisbane. However this would significantly affect large areas of land, likely require land acquisition and require development and other planning controls on land inundated in a flood.

Conclusions
The discussion paper concluded "there are no "silver bullets" to mitigate flood levels in Brisbane. It identified a variety of structural measures exist that could potentially be used to reduce the impacts of "backwater" flooding in Brisbane. While more detailed investigation, including site specific factors, is necessary to establish the viability and a net benefit to the community of these devices, "engineered" or structural measures with the highest potential for application in Brisbane were found to be:
- flap valves and possibly "duck-bill" valves in tidally-affected areas, subject to implementation of suitable maintenance regimes
- levees around specific, high-value infrastructure (such as the Brisbane Markets), but not along waterways, and
- flood mitigation dams on the Bremer River and Lockyer Creek upstream of Ipswich.

Recommendations
Recommend that the CEO note the findings of the Draft Discussion Paper and seek Civic Cabinet's direction for further distribution of the report.

Regards,

[redacted]

Acting Manager
Water Resources Branch
CITY PLANNING & SUSTAINABILITY DIVISION

Attachments
1. Draft Discussion Paper: Engineering Solutions for Flood Mitigation in Brisbane

FLOOD RESPONSE REVIEW ACTION PLAN

Project Background

The BCC Flood Response Review Board recommends that;

Council investigate the feasibility and appropriateness of establishing local levees to protect areas of strategic significance such as Rocklea Markets. This will require a complete risk based flood management analysis.

Council's Plan

Council supports the investigation by property owners to assess the feasibility and appropriateness of establishing levees. Council will provide a framework to be used by property owners who wish to undertake this assessment. This may include hydrological assessments to be undertaken on a user pays basis. Council will work collaboratively with areas of strategic significance, such as Rocklea Markets, to undertake risk based flood management analysis.

Project Objective

Provide a framework that owners/managers of areas of strategic significance can follow to assess if local levees are feasible and appropriate for protecting their property, while minimising external negative impacts.

Consultant Project Outline

Phase 1 Deliverables – by October 2011

- Identify & map of Areas of Strategic Significance
- Undertake first pass assessment identifying levee feasibility rating for each area using existing information.
- Provide a guideline for property owners to enable them to assess in detail the appropriateness and feasibility of levees for their area, including flood risk management analysis framework and approvals process.
- Plan for Strategic Framework Development to recommend how to manage levees in the future eg planning amendments, local laws etc. (Phase 2)

Phase 2 Deliverables – by October 2012

- Final Strategic Framework in place

Overall Project Status 26 August 2011

- Consultant procurement underway
- Draft Project Management Plan prepared
- Communication and engagement plan being prepared

Council Future Actions to end 2011

- Obtain Framework
- Obtain direction on approvals and engagement process
- Engage and work with property owners if directed
- Prepare planning amendments/laws to manage levees if required.

Project Brief

To investigate a framework to assess the feasibility and appropriateness of establishing a local flood levees to protect areas of strategic significance.

15 August 2011

Prepared by:

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Document Control								
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01	15/08/2011						[redacted]	
02								
03								
04								

Contents

1. Introduction to Project

In January 2011, Brisbane experienced the second-highest flood in the past 100 years, after the January 1974 flood. There was major flooding through most of the Brisbane River catchment, most severely in the Lockyer and Bremer catchments where many flood height records were set. The flooding caused substantial loss of life in the Lockyer Valley and thousands of properties were inundated in metropolitan Brisbane.

The Lord Mayor of Brisbane, the Right Honourable Campbell Newman, 21 January 2011, appointed a Board of Enquiry to review the response to the flood event in Brisbane during the period Sunday 9 January to Saturday 22 January. The Board consisted of Major General Peter Arnison AC, CVO (Retd), Mr Robert Gotterson QC and Emeritus Professor Colin Apelt.

On Tuesday 24 May 2011, the Flood Response Review Board handed down their report, Brisbane Flood January 2011 – Independent Review of Brisbane City Council's Response, 9-22 January 2011 which identified 16 key recommendations including that Council investigate the feasibility and appropriateness of establishing local levees to protect areas of strategic significance from flooding.

The BCC Flood Response Review Action Plan of 24 June 2011 provides Council's plans in response to the recommendations including the following regarding the investigation by property owners of establishing local levees.

FLOOD RESPONSE REVIEW BOARD RECOMMENDATION

The Board recommends that Council investigate the feasibility and appropriateness of establishing local levees to protect areas of strategic significance such as the Rocklea Markets. This will require a complete risk based flood management analysis.

Council's Plan
July - October 2011

Council supports the investigation by property owners to assess the feasibility and appropriateness of establishing levees. Council will provide a framework to be used by property owners who wish to undertake this assessment. This may include hydrological assessments to be undertaken on a user pays basis. Construction of levees would be the responsibility of the asset owner. Council will work collaboratively with areas of strategic significance, such as the Rocklea Markets, to undertake risk based flood management analysis.

2. Project Objectives, Scope and Tasks

Project Objective

Council does not generally support levees for flood protection as they are considered to increase residual risk for larger floods, often interfere with to the detriment of others flood flows and flood levels and rarely present acceptable outcomes for neighbourhood amenity. It is not intended that this position be generally weakened, however it is recognised that investigation of the application of levees to protect some existing uses may be acceptable in particular, though limited, circumstances.

The overarching project objective is to provide a framework that owners/managers of areas of strategic significance, under particular circumstances, can use to assess if local levees are feasible and appropriate for protecting their property from flooding, while avoiding external negative impacts and not creating a future negative legacy or weakening current planning controls.

The project needs to address risk based flood management analysis frameworks, planning and building outcomes, approval processes and consistency with current strategic directions concerning flood management. This project is restricted to those areas within the inundation extent of the January 2011 Brisbane River flood event.

Project Scope and Tasks

The scope of work for this project is to document the process to establish the feasibility and appropriateness of establishing local levees to protect areas of strategic significance from flooding, including the approvals process. The framework shall include complete flood risk management analysis guidance.

The consultant is invited to vary the scope and tasks outlined below if it will better deliver the project.

Project Management

The consultant shall develop a Project Management Plan generally in accordance with the content areas outlined under Council's PM2 Tier 3 project management process.

Literature review:

Undertake a brief literature review to identify currently available assessment frameworks and current regulations, particularly flood risk management and building and planning controls, appropriate to govern/assess local levees.

Areas of strategic significance:

Establish a definition of areas of strategic significance and develop mapping of these areas. e.g. Rocklea Markets, high density areas, hospitals, major industry centres etc.

Levee options:

Briefly outline the types of levees which may be considered including but not limited to earth levees, structure levees, earth and structure composite levees and temporary levees.

Assessment criteria:

Outline preliminary assessment criteria detailing what factors should be considered

in assessing the feasibility and appropriateness of a proposed local levee under a risk management framework and within a planning and building control environment. In particular the limitations of application need to be documented.

Factors could include consideration of current policy, impacts from a range of flood sources and size floods, cumulative affects, amenity, environment, equity and protection and risk management and maintenance plans, planning, building and environmental controls. If necessary, flood models can be made available to improve the understanding of the feasibility of some areas.

Preliminary Assessment of Levees

Undertake a preliminary assessment, ideally based on currently available information, of the feasibility and appropriateness of levees for the identified areas of strategic significance. This should ideally produce a ranking for sites which could be further investigated in collaboration with property owners. Limitations of sites shall be documented. The principal purpose of this task is to identify those areas with the most potential for levees and those with limited potential. This is a critical element of the consultancy.

Approval controls:

Document the approval process for such levees against existing controls, particularly building and planning regulations. This review is to identify gaps and constraints in the existing assessment framework that may lead to undesirable outcomes.

Interim Levee Assessment Guideline/Framework:

Document an Interim Levee Assessment Guideline/Framework that property owners/managers can use to assess the appropriateness and feasibility of the use of levees for their property. The guide may identify generic levee types, appropriate flood risk analysis frameworks, assessment criteria, statutory controls, approvals processes, management plan considerations and other information as appropriate. In particular, limitations on the use of levees shall be documented.

Strategic Levee Assessment Framework Implementation Plan:

Assess if a Strategic Levee Assessment Framework is required to properly manage and restrict the use of private levees to particular circumstances not in conflict with good planning practice and current policy. If so, develop recommendations for such an implementation plan and framework.

3. Project Deliverables and Timings

The project deliverables are to be completed as is shown in Table 1.

The consultant may propose different deliverables and timings if this better delivers on the Flood Review Response Board Action. The end October 2011 completion date shall not be varied.

Project Deliverables

Project Management Plan

A project management plan generally in accordance with the content areas outlined under Council's PM2 Tier 3 project management process (within 2 weeks of engagement). Confirming project definition is to be a key part of this element.

Map of areas of strategic significance:

Provide a rationale and map of areas identified as being of strategic significance including a preliminary assessment of each areas feasibility and appropriateness for

the use of levees.

Assessment Criteria
Provide criteria to assess if levees are feasible and appropriate.

Preliminary Assessment of Levee Feasibility and Appropriateness
Provide a preliminary assessment of the feasibility and appropriateness of levees for these areas of strategic significance.

Interim levee assessment framework:
Provide an Interim Levee Assessment Framework land owners/managers can use to assess the feasibility and appropriateness of local levees for their property or business and approval processes.

Strategic framework development plan:
If required, an implementation plan for a Strategic Levee Assessment Framework.

Project Report:
A final report documenting the findings of the project and rationale behind deliverables.

Table 1: Proposed project staging and delivery timing summary.

Deliverable	Due
- Project Management Plan	Within 10 days of engagement
- Rationale and Map of areas of strategic significance	16 September 2011
- Preliminary Assessment, criteria, ranking and issues.	03 October 2011
- Interim levee assessment framework	14 October 2011
- Strategic Levee Assessment Framework Implementation Plan (if required)	21 October 2011
- Final Project Report	28 October 2011

4. Engagement and Costs

Council is seeking a consultancy proposal that fulfils the scope of this brief. The study may recommend further studies that will be subject to future evaluation by Council for potential funding.

Payment will be aligned to the delivery and **client acceptance** of key milestone documents. Client acceptance is based on an assessment of whether the deliverable has satisfied all relevant components of the accepted proposal.

Council's payment system results in payments within 30 business days of the receipt of a properly rendered invoice.

Engagement will be in accordance with the standard Terms of Engagement for Panel Providers.

5. Submission of Proposals

A submission will be prepared for Council to assess the consultancy proposal to undertake the specified project. The proposal may make suggestions to changes of scope and tasks to better meet the objectives of the consultancy.

Lodgement of submission

All submissions are to be written and received by Council by 5 pm, Monday 29 August 2011. Submissions are to be addressed to:

[redacted]
Project Manager
Water Resources Branch
Brisbane City Council
GPO Box 1434
BRISBANE QLD 4001

Should you require any further information relating to the proposed project, please contact [redacted] Principal Officer, Water Resources Branch on [redacted]

Selection of the preferred consultant will be based on Value. Value relates to ability to provide the requested consultancy services to a high standard in accordance with this brief in a manner that represents the responsible expenditure of public funds. Value does not necessarily imply that the lowest price submission will be selected as the preferred consultant. The following selection criteria will be used to evaluate submissions and select the preferred consultant:

Criterion	Weighting
Appreciation of project	20%
Project and Resourcing Methodology	25%
Specific building regulation, town planning and flood risk management analysis experience relevant to this project scope	40%
Cost	15%
Total	100%

Evidence of demonstrated experience and skills of the people assigned to the work is required.

6. Other Information

Additional Specific Information

Brisbane Flood January 2011 - Independent Review of Brisbane City Council's Response
http://web.brisbane.qld.gov.au/2010%20Library/2009%20PDF%20and%20Docs/5.Community%20Support/5.4%20Emergency%20management/Floods/emergency_management_Independent_Review_of_BCCs_Response_Final_Report_v4.pdf

Brisbane City Council - FLOOD RESPONSE REVIEW ACTION PLAN
http://web.brisbane.qld.gov.au/prdc/groups/corpwebcontent/documents/documents/039642.pdf

Engineering Solutions for flood mitigation in Brisbane (GHD 2011)
http://web.brisbane.qld.gov.au/2010%20Library/2009%20PDF%20and%20Docs/5.Community%20Support/5.4%20Emergency%20management/Engineering_solutions_for_flood_mitigation_in_Brisbane.pdf

Flood Studies for Brisbane River and creeks.

Draft identification and evaluation of Critical Infrastructure (Not Council Policy)

Specific Exclusions

Specific exclusions are:

- Areas affected that are outside of the Brisbane City Council Local Government Area.

Assumptions

Key assumptions are:

- Information for this review is available through the collation and analysis of existing information available both in the public realm and through key internal and external sources.
- Regular and close consultation with the client and use of client knowledge will ensure the most effective delivery of the project.

Constraints

The main constraints are:

- Deliverables must be completed and submitted to Council as per Table 1, Section 3.
- If required, contact with all key stakeholders must be done with discretion and sensitively.
- There shall not be any indication given that Council is interested entering into any commercial arrangements.

Dependencies

There are no specific dependencies at this stage of investigation.

7. Attachments

- Brisbane City Council Template - Project Management Plan Tier 3 PMT121

CDJ-54

aurecon

Proposal No.
KCBNECTY01-FLLEAS-****
Proposal to Investigate an Assessment Framework for Local Flood Levees to Protect Areas of Strategic Significance

Prepared for
Brisbane City Council

29 August 2011

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Current Revision 1

Approval			
Author Signature	[redacted]	Approver Signature	[redacted]
Name		Name	
Title	Technical Director	Title	Unit Manager

Investigate an Assessment Framework for Local Flood Levees to Protect Areas of Strategic Significance

Date | 29 August 2011
Revision | 1

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Contents

1 Introduction

Aurecon is pleased to provide this Consultancy Services Proposal to Investigate an Assessment Framework for Local Flood Levees to protect areas of strategic significance. We have developed this comprehensive submission to detail our methodology, address the key project issues, illustrate our experience in projects of this nature and demonstrate to the Brisbane City Council (BCC) that the Aurecon team will deliver a robust and defendable assessment framework.

1.1 Project appreciation

The major flooding of January 2011 caused significant inundation in Brisbane and has served as a vivid reminder to the community that significant parts of Brisbane are sited on a major floodplain. The event has also triggered a number of major investigations, with the Independent Review of Brisbane City Council's Response to the flood recommending consideration be given to the feasibility and appropriateness of local levees to protect areas of strategic significance.

It is not intended that these levees be major riverine structures but rather localised permanent or temporary structures that prevent inundation of key facilities during significant events.

The potential introduction of such structures leads to the need to consider a wide range of engineering, flood risk, amenity, cost and planning aspects. This project will examine the background details needed to fully assess potential levee options from each of these perspectives and seek to identify strategic locations which such works could be considered.

A framework will be developed that will outline a recommended process that landholders/ property managers will need to follow to seek approval of any proposed levee works – this framework will clearly identify the required risk assessment steps, levee options, assessment criteria, the approvals process and other critical aspects.

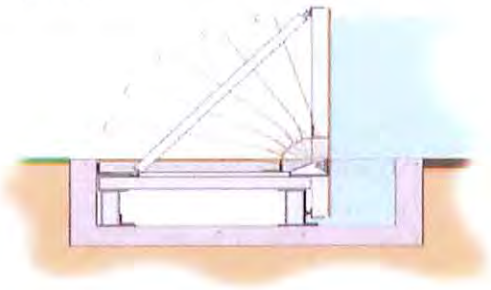
It should be acknowledged that Brisbane City Council has an excellent database of flood information and is very skilled and knowledgeable in the areas of flooding and flood behaviour. Key information in relation to flood behaviour along the Brisbane River would be sought from Council's recent modelling.

1.2 Why Aurecon?

Aurecon is ideally placed to deliver this project, as we have the team with the right experience, including:

- Comprehensive understanding of the best practice principles of floodplain management, in the urban and rural environments, with actual practical experience of managing floodplains throughout Australia
- We offer a fully integrated team that brings together all the multidisciplinary aspects including engineering, risk assessment, planning and development control
- With input from Royal Haskoning, we bring internationally recognised experience in floodplain management best practice and specific recent experience from the UK in strategic levee policy

- Significant experience in undertaking flood and risk management studies for Brisbane City Council and other local authorities
- Detailed local knowledge of the Brisbane River corridor and many of the major creeks and waterways along the Brisbane River and the areas subject to damage during events
- Detailed understanding of local, creek and river flood mechanisms and associated risks
- Comprehensive abilities in development of risk assessment, evaluation and management tools
- Regional planning and collaboration with local authorities to develop planning policies



From the work Aurecon has undertaken on a range of projects in Brisbane (including modelling and assessment on the Brisbane River, Oxley Creek, Norman Creek, Bulimba Creek, Bridgewater Creek etc), we have a good understanding of the city's river, creeks and drainage systems. This combined with our strong technical skills and expertise in flood modelling, impact assessment and development of mitigation measures provides an excellent basis for providing outstanding results for this project. We are able to offer a complete team that can fully address all aspects of this project.

Our track record, project team and approach are included in detail in the following submission.

2 Study team

2.1 Project team structure

For this assignment, Aurecon has established a simple and effective hierarchy of responsibility for the technical and management aspects of the project. We also provide the opportunity for quality checking and peer review utilising personnel outside the day-to-day delivery of the project. Typically our project teams are managed using the following structure:

Project Director – responsible for a portfolio of projects, with a focus on project delivery, the Project Director provides high level oversight and direction for the project.

Project Leader – reporting directly to the Client – overall responsibility for technical standard, input, integration of disciplines, budget and time control and project delivery.

Peer Reviewer – independent review by senior staff with particular experience and expertise relevant to the project.

Technical Specialists – individuals or cells of expertise in a range of specialist areas to prepare and/or review key technical material. These specialists include Aurecon staff and, where required, selected experts tailored to complement the project team experience.

For this project, our Technical Specialists will consist of team members who have firsthand knowledge of Council's existing planning and development control processes as well as specialists with extensive experience flood risk management, structures and experience of the recent 2011 flood event including working on related projects since the time of the flood event. Our team members are highly experienced in taking technical work and integrating it into planning frameworks.

In addition to our Aurecon team members, we have included in our team [redacted] from Royal Haskoning. Royal Haskoning is an international consultancy based in the Netherlands with world leading expertise in the Flood Management, Ports and Coastal areas.

Following extensive flooding in the UK in 2007, building and planning policies have been reviewed including allowance for strategic levees. Royal Haskoning were a key driver of these changes and bring this firsthand experience to this project.

Aurecon has a long standing relationship with Royal Haskoning and have worked closely with them on numerous projects and have existing agreements in place for working together. [redacted] will bring details international experience where levee systems have been implemented and the assessment and evaluation procedures that are followed.

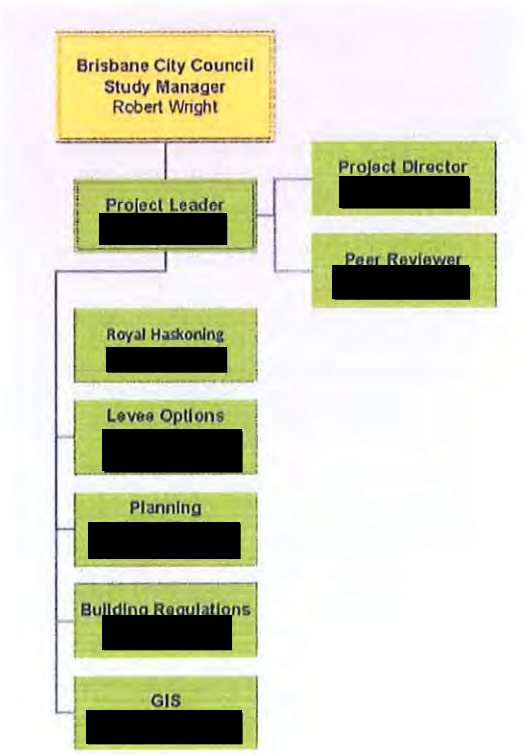
We believe we have assembled a team with the right skills to ensure the success of the project.

2.2 Key roles and responsibilities

The technical specialists who form the team are detailed in the following study team chart. The team would be led by our Project Leader [redacted] who will be the main point of contact for BCC's Study Manager.

Our team include a range of specialists that cover all the areas of expertise required for this project.

With our priority to complete this project to the satisfaction of BCC and having assessed the current workload and commitments of our nominated key personnel, Aurecon can guarantee their availability as required.



2.3 Introducing our key personnel

The following section provides brief introductions to the key members of our study team. Full CVs can be provided upon request.

[redacted]

[redacted] | Project Leader

[redacted] is a key member of Aurecon's Water Group and has over eighteen years' experience in water engineering covering all aspects of catchment and drainage management planning, transport infrastructure studies, development assessments, flood risk assessments, emergency management planning input and flood and storm tide inundation modelling studies.

[redacted] has a wide ranging background in undertaking flood studies and flood risk management plans. She has also undertaken a number of natural disaster risk assessments where she has worked with local authorities to understand the risks associated with natural hazards and developed risk management plans to address the identified risks.

[redacted]

[redacted] | Project Director

[redacted] is a specialist Water Engineer with expertise in all aspects of surface water assessment and analysis. He has worked on a variety of catchment studies, flooding studies, infrastructure drainage works, floodplain and stormwater management plans, natural disaster (flood/storm surge) assessment and mitigation and is a recognised expert in hydrologic and hydraulic (1d and 2d) modelling.

[redacted] has led numerous flood related projects for BCC and has extensive experience in flooding of Brisbane catchments. He also has extensive experience in floodplain management, both in assisting Councils preparing policies and codes, and in actively managing floodplain development on behalf of Councils. He is currently working with Energex in a project reviewing flood protection of Energex's electrical substations in the CBD and Milton – this is looking very carefully at mitigation options including demountable barriers.

[redacted]

[redacted] | Environmental Planning Specialist

[redacted] has extensive planning and management experience specialising in seaport and coastal land use planning. [redacted] has key experience in preparing Land Use Plans, Development Codes and Technical Guidelines, general environmental management plans and strategic/corporate planning regarding the planning and delivery of major infrastructure. [redacted] has recently completed his 'Sir Winston Churchill Fellowship' where he travelled through Asia, Europe, America and Canada examining sustainable major infrastructure planning.

[redacted] works in a research capacity with Griffith University one day per week within the School of Urban & Environmental Planning in the area of major infrastructure interface planning. He also assists with undergraduate and post graduate degree programs.

[redacted] was also a key member of the ATC Infrastructure Working Group (a joint working group with Port of Brisbane, Brisbane Airport, State Development and Brisbane City Council). This experience provides [redacted] with a strong appreciation of infrastructure planning, protection and development issues along the lower reaches of the Brisbane River

[redacted] Environmental Scientist

[redacted] has a broad understanding of local, state and federal environmental legislation and has key experience in environmental approvals and permits. [redacted] has recently joined Aurecon from Brisbane City Council where she most recently worked on the flood recovery of Council parks and infrastructure along the Brisbane River that was inundated and damaged during the Brisbane flood event in January 2011. [redacted] has undertaken numerous environmental assessments and provided advice in regards to environmental issues and applicable state and local environmental approvals and permits. This has involved liaison with many divisions of Council along with DERM and DEEDI in regards to exemptions provided to Council for flood recovery operations.

[redacted] knowledge of the Brisbane River and affected infrastructure will be highly beneficial for this project.

[redacted] | International Flood Levee Policy Input

[redacted] has over 16 years of professional experience principally in flood and erosion risk management, both in the Netherlands and the UK. He has a wide experience in the development of methods, tools and guidance for flood risk management, ranging from detailed design to strategy and policy level. After a ten year career in the Netherlands, [redacted] moved to work in Royal Haskoning's UK head office, based in Peterborough.

[redacted] is still actively involved in Dutch flood risk management which will allow him to apply best practices from both the UK and the Netherlands to international projects. His Dutch experience, particularly the development of various guidance documents and tools, demonstrates thorough knowledge of failure modes and performance models that reflect the central role of levees in Dutch flood risk management. This is balanced by his UK experience with its stronger focus on non-structural measures, connection with spatial planning and the need to justify investment in flood risk management. [redacted] successfully applied this combination of skills in New Orleans where he worked with the US Corps of Engineers to develop a method to incorporate resilience in levee design, and is currently working with (among others) Dutch, French and American organisations on the International Levee Handbook. In addition, he led the flood defence performance reviews for the last three major floods in England (summer 2007, November 2009 and November 2010).

[redacted] | Peer Review

[redacted] is an Associate at Aurecon with a broad range of expertise in surface water management. He has 20 years' experience consulting to the water industry offering expertise in impact assessment of proposed works on tidal, flood, sedimentation and water quality processes in floodplain, estuarine, and coastal environments. [redacted] has a wide range of flood modelling and flood impact assessment experience in Queensland, NSW and Victoria, including assessment of flood response strategies to reduce floodplain hazard mapping for local government planning, impact assessment for works in the floodplain, hydraulic design for road crossings and bridge scour assessment. He has extensive experience in the preparation of "big picture" plans, including the development of strategic management plans for waterway and catchment managers and offers specialist expertise in the assessment of climate change adaptation strategies for vulnerable communities. [redacted] has project experience throughout Australia, particularly in Queensland, Victoria and South Australia, and international experience in South East Asia, the US and Mexico.

[redacted] | Structures Expert

[redacted] is technical director with Aurecon with over 29 years of experience in the design, supervision and construction of bridges, cut and cover tunnels, deep excavations structures, foundations and commercial structures. His expertise includes heavy civil engineering projects and multi-storey buildings in Australia and the United Kingdom.

[redacted] has been involved in a number of flood mitigation style projects. The experience would be suitable for this project. Projects include:

- ENERGEX Substation Flood Protection Study (2011)
- Assessment and remediation of bridges and culverts in the Lockyer Valley after the January 2011 flood event
- Assessment and remediation of bridges and culverts on the Rolleston Coal Rail Spur after the January 2011 flood event
- Barcoo Outlet – Patawalonga Creek (Adelaide) – flood control and tidal outlet
- Medway Tunnel (UK) design of cofferdams and the casting bay levee protection

[redacted] | Levee Options – Geotechnical advice

[redacted] is a Project Engineering Geologist with over 18 years professional experience. [redacted] specialises in geological aspects of geotechnical engineering and the incorporation of these aspects into the design.

[redacted] would provide any required geotechnical advice regarding the levee options that are considered as part of the project.

[redacted] | Building Regulations

[redacted] is a Principal of Aurecon with more than 24 years engineering experience in the design and documentation of commercial, industrial, institutional and residential buildings.

[redacted] would provide guidance with regards to building regulations and the potential impact of local levee structures.

[redacted] GIS Specialist

[redacted] is a Registered Professional Engineer and Professional GIS Practitioner with 21 years' experience of GIS consulting, spatial database design and GIS application development for the planning and maintenance of civil engineering infrastructure. Dave has presented several papers on GIS at various international conferences.

[redacted] will oversee the GIS mapping that will be undertaken to outline the areas of strategic significance and constraints to levee development along the river.

3 Methodology

Aurecon has reviewed the project brief and relevant background material and through this and our team's local knowledge we believe we have a full understanding of the project scope and requirements. The timeframe is reasonably tight and a number of activities will be undertaken concurrently where practical to meet the set deadlines.

It is anticipated that close interaction with BCC's Study Manager and other key BCC Officers will be required during this project.

The following sections set out our proposed approach.

3.1 Phase 1 – Project start up and familiarisation

3.1.1 Inception meeting

An Inception Meeting will be held at Council with the Study Manager at the outset of the project. Key details of the project will be confirmed at this meeting including scope, timeframe, data requirements and deliverables.

At the meeting the Project management plan will be discussed – a preliminary plan will be prepared prior to the meeting – discussions will be held at the meeting to finalise key aspects before the document is submitted to Council for review and finalisation.

This meeting will be attended by our Project Leader, [redacted] and our Environmental Planning Specialist [redacted]

3.1.2 Data collection

A number of key datasets will be required to assist with the project and the nominated deliverables. This includes key GIS datasets such as:

- Cadastre
- Aerial photography
- 2011 flood layer
- Any other relevant data or reports

Access to Council's flood modelling outcomes – in particular flood animations and/or mapping of the 2011 event and flood modelling of other key waterways will be required. Arrangements to review this data will be sought at the project outset.

3.1.3 Literature review

Aurecon are already familiar with a number of the recent reports undertaken in relation to the 2011 event and would use key details from these reports as required.

The project team will undertake a review of relevant state, national and international literature in regards to available assessment framework, current regulations and flood risk management applicable to the scope of the proposed project. The project team will also examine building and planning controls in relation to local levees. In addition, the literature review will include a review of the GHD Report to identify any potential gaps specifically related to the January 2011 Brisbane flood event.

Information gathered in the literature review will be related back to Brisbane and used to develop an applicable framework for potential flood levees that owner/managers of areas of strategic significance may apply. This will include an examination all relevant literature to determine the feasibility and appropriateness of local levees in protecting properties during a flood event.

The literature review will carried out in conjunction with Royal Haskoning to ensure a comprehensive examination of Australian and International approaches is undertaken.

3.2 Phase 2 – Investigation

A number of the following tasks will be able to be undertaken concurrently.

3.2.1 Areas of strategic significance

As mentioned previously, the areas potentially to be protected by levee systems are not anticipated to be associated with major works – such works would be highly likely to result in significant impacts on surrounding properties. It is proposed to review the river corridor and identify potential locations for local levee options – be they of a permanent or temporary nature. These locations will then be mapped.

Areas of strategic significance will be identified using a set of assessment criteria with the priority to identify areas inundated and damaged during the January 2011 flood event. This would include areas that:

- Have a high population density (eg how many people use it and how many would be displaced if unavailable)
- Sustained significant damaged during the flood
- Are places of economic significance (eg Brisbane markets, Universities, major industry centres and infrastructure utilities)
- Are place of cultural significance (eg Sporting stadiums – Suncorp Stadium or GOMA precinct)
- Are places of social significance that are important to local communities (eg schools) and/or
- Are places identified as being critically important for emergency coordination activities during major flood events

Mapping of the identified areas of strategic significance would be undertaken. To supplement this mapping it is proposed that a constraints map be prepared that highlights restrictions along the river that would illustrate aspects that affect the appropriateness of levee structures. For example, impacts on flood storage, flows from local creek systems, nearby flood sensitive properties, etc – this mapping could be used as a first step in reviewing if a levee proposal should be taken forward for more detailed assessment

It is proposed that a workshop/meeting be held with the BCC Study Manager and other appropriate Council Officers to review the identified locations – to confirm the proposed locations and assist in the ranking/prioritisation process.

3.2.2 Levee types

Aurecon has already been working with Energex to determine measures that could be implemented to provide flood protection to substations affected by Brisbane River flooding. Levee options are being considered and this experience would be brought to this project.

This assessment will review levee options which will be suitable for this project. Types of levees to be considered, but not limited to, are earth levees, structural levees, combined levees, demountable levees.

The assessment of demountable levees will need to consider the extent, storage location relative to the site to be protected, anticipated warning time, training of personnel and anticipated time between events.

Details of levee types would be documented with the benefits and limitations of each option outlined.

In addition Royal Haskoning will provide input with regard to levee options used internationally and the practicality of such options being used in Brisbane.

3.2.3 Assessment criteria

The project team will examine the key factors likely to result from the development of levees around the specified areas of significance. The key aim of this portion of the work would be to develop assessment criteria to enable a 'suitability' assessment of proposed levee structures.

This task would be conducted in close consultation with relevant Council's Engineering, City Design, City Planning and Legal Service branches given the statutory implications to property owners and adjoining residents. At this stage, it is likely that an initial project risk assessment based framework would be suggested based on the following criterion:

- Nature of proposed structure
- Predicted Flood data
- Risk/implications of overtopping
- Nature of piped drainage system, communications/electrical conduits
- Review of historical flood information
- Impact on neighbouring properties (range of potential impacts)
- Likely cumulative impacts
- Safety and Emergency Response
- Environmental Impact

Assessment criteria would also be developed for use by private land owners, using industry accepted town planning, environmental and community outcome performance criteria, such as:

- Visual Amenity/View Corridors
- Environmental Management
- Building/Engineering Standards
- Potential impact on neighbouring properties
- Access
- Maintenance
- Practicality

The assessment criterion would be tailored to differentiate between 'permanent' or 'temporary' (ie demountable/disposal). It is anticipated that parameters would change considerably depending upon the level of permanency of any proposed levee structures.

3.2.4 Preliminary assessment of levees

Using the strategic sites and constraints mapping already prepared, and the agreed assessment criteria, a preliminary assessment of levees in these strategic sites would be carried out. This would be a high level review,

with each option rated as either not to proceed further or requiring further detailed assessment or modification.

An assessment for each strategic location will be required. The size and topography at each location will determine suitable options to be considered.

Demountable levee round Rockhampton Airport (2011)

An assessment of the extent of the levee will be undertaken, eg, is the whole site to be protected or is it possible to only protect smaller vital sections and leave the rest to be cleaned out after the event. An example of this would be isolating and protecting an electrical substation, but allowing the remainder of the building/development to flood.

Using the agreed criteria, the assessment will be undertaken and a recommendation regarding levee types, locations and extents will be provided.

3.2.5 Approval controls

The project team will examine the existing approvals processes available through the Brisbane City Council system to enable the proper assessment of proposed levee developments.

A review would of existing approval mechanisms/instruments including:

- Relevant Local Laws
- City Plan 2000 (current) and proposed new City Plan (under development) (including the inter-relationship with Neighbourhood Plans, Codes and City Plan Overlays)
- Powers under the City of Brisbane Act, 2010

This task would be conducted in close consultation with relevant Council's Engineering, City Planning and Legal Service branches given the statutory implications to property owners and adjoining residents.

At this stage, it is considered that the addition of a City Plan Overlay and amendments to the City of Brisbane Act, 2010 may be potential considerations for the administration/ assessment of proposals.

It is suggested an external, independent legal review be considered as part of this phase of work. This would be further discussed (and costed) with Council's Study Manager upon commencement.

3.3 Phase 3 – Interim assessment framework

The Assessment Framework will be built up from the information gathered during the investigation phase. The framework will need to be clear and concise, with appropriate language used and explanations provided (eg use of diagrams to illustrate context in some cases).

The literature review will provide details of other frameworks and their implementation and success or otherwise, and also to provide a bench marking mechanism for the proposed framework. From this review an appropriate framework will be developed. A key aspect will be the use of the base mapping identifying constraints/limitation to levee construction and the preliminary ranking of levee options. This mapping/information could be used for a preliminary overview which would assist in

determining whether or not the assessment should proceed.

For levee options which are to proceed to further investigative stages, a number of steps will be identified that relate to the agreed assessment criteria. The framework will outline how each levee application needs to address the nominated assessment criteria. The framework will include guidelines that outline levee options, their limitations and other considerations to assist property owners/ managers in clearly understanding the assessment process and risks involved.

A draft version of the Assessment Framework will be provided to Council's Study Manager for review and feedback will be addressed.

3.4 Phase 4 – Strategic assessment framework implementation plan

It is understood that there are currently no specific regulations or laws regarding the construction of private levees within Brisbane City. There exists the potential for the cumulative impacts of local levees to exacerbate flood conditions for a number of properties/landholders.

The need to implement a strategic levee assessment framework needs to be reviewed and it needs to be determined if such a measure is required. The operation of such a framework needs to be understood as well as its interaction with Council's policies and planning measures.

This is especially important in relation to temporary levee options that would only be put in place as events occurred and potentially without prior approval (by using the Assessment Framework) Council may find themselves faced with challenging conditions as the flood waters rise. A clear outline of required measures through the implementation of the Strategic Levee Assessment Framework may be the appropriate mechanism to prepare for such risks.

The need for the implementation plan would be discussed with Council's Study Manager and other key Council Officers. If required recommendations for the implementation plan and a consideration of costs involved would be prepared.

3.5 Reporting

An overall report detailing the investigative work undertaken and presenting the Interim Assessment Framework will be prepared. The material included in this report will be prepared progressively as work proceeds with the final report pulling all the material together succinctly.

4 Relevant experience

Aurecon has a long and successful history of natural hazard risk management in Queensland. Aurecon's Water Group has developed extensive hydrologic and hydraulic modelling capabilities and experience over the past 25 years, including the application of current Australian risk assessment and management policies and guidelines.

We have provided brief descriptions of a number of recently completed or ongoing investigations, illustrating that Aurecon continue to be recognised as leaders in the field of natural hazard risk management throughout Australia.

Aurecon's personnel continually develop and maintain long-term relationships with our clients. Our clients continually return to Aurecon for additional work and recommend us to other clients. These relationships and the ongoing work has allowed us to develop an exceptional track record of maintaining models over time and working collaboratively with Councils to manage floodplain development and risk management.

Aurecon's strength comes from the broad expertise and experience of our people. The following projects illustrate the skills that our team would bring to this project.

Flood Protection of Brisbane CBD Substations

Aurecon is currently working with Energex to assess all CBD substations which were impacted by the January 2011 flood to determine whether mitigation works are feasible.

As many substations are located in basements or lower floors of existing buildings, a key consideration is the potential use of demountable flood barriers, and their costs, as wells as flood proofing various conduit and cable trays.

Client
Energex

Location
Brisbane

Flood Studies for Brisbane City Council

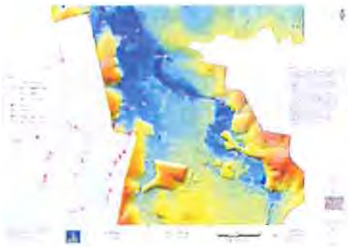
Aurecon has undertaken numerous detailed flood investigations for Brisbane City Council and other state government departments. These studies have involved the development of calibrated hydrologic and hydraulic models of each creek system and use of these models to identify flood risks, evaluate mitigation options, regulation lines and revegetation strategies. Also examined were existing crossings, with appropriate structure upgrades and flood mitigation measures being determined. Creeks that Aurecon has examined include:

- Moolabin and Rocky Waterholes Creeks (1999)
- Oxley Creek (1998 and 2008)
- Lota Creek (1997)
- Kedron Brook (1995)
- Norman Creek (1994)
- Bulimba Creek (1991/92)

In order to successfully undertake these studies it was necessary for Aurecon to tailor specific methodologies that addressed Council's project requirements. Through these projects and many ongoing infrastructure projects (eg Gateway Upgrade Project, Brisbane Airport Drainage, Eastern Busway CDIMP, Northern Busway projects, flood insurance claims etc) the Aurecon team have gained significant first hand local knowledge regarding local flooding issues around Brisbane.

Client
Brisbane City Council

Location
Brisbane, QLD



Oxley Creek Flood Study (Ongoing role)

Aurecon first undertook hydrologic and hydraulic modelling of the Oxley Creek catchment in 1995. In the initial study Aurecon jointly calibrated RAFTS hydrologic and MIKE 11 hydraulic models to six calibration events then used the calibrated models to simulate a range of design floods including the Probable Maximum Flood (PMF). These events were modelled recognising Brisbane City Council's (BCC) Waterway Corridor and Riparian Corridor provisions. The study results have since been used by Council for strategic planning, waterway management and the assessment/control of development within the floodplain.
In the recent Oxley Creek Flood Study, the previously developed hydraulic model was upgraded to utilise a dynamically linked 1D/2D approach. The model was developed using the MIKE FLOOD modelling package and drew on Council's ALS (Lidar) topographic data. Calibration of the MIKE FLOOD model was confirmed using historical flooding records (maximum height gauges and continuously recording stream gauges) and provided a greatly improved understanding of the complex flowpath interactions within the floodplains. A number of Waterway Corridor and Riparian Corridor provisions were analysed and the impacts of these provisions on flood characteristics were assessed. The MIKE FLOOD model predictions were used to develop an extensive array of floodplain mapping.
By continually reviewing previous studies, and revising where appropriate to include new technology as it has become available, Aurecon has maintained the

Client
Brisbane City Council

Location
Brisbane, QLD

status of the Oxley Creek models to assist Council in their understanding of flooding conditions and their implications within the floodplain. The most recent study results have been used to update Council's strategic planning and the models are now used as tools to assess development within the floodplain.

Brisbane Airport Levee Feasibility Study

This study was undertaken to identify all issues and constraints associated with adopting a flood levee system round areas of future development within the airport site. This included commercial development areas and the proposed parallel runway.

The investigation drew upon Aurecon's experience and knowledge gained from the Cairns International Airport levee system and provided BAC with a comprehensive, costed evaluation of the proposed levee system.

Client
Brisbane Airport Corporation

Location
Brisbane, QLD

Flow Study Processes and Methodology Review (2010)

Aurecon was commissioned by Brisbane City Council to undertake a review of Council's current processes and methodologies associated with flood and drainage studies. This review arose from the Lord Mayor's Taskforce on Suburban Flooding (LMTF-SF) which recognised the frequent nature of the flood related damage being sustained by residences, community expectations regarding standards of living and level of safety for their residences and the legal obligations of Council with respect to management of flood risk.

Aurecon undertook a thorough review of Council's current approaches and study methodologies, carrying out an industry practice comparison against other major local authorities and provided advice/guidance in a number of areas including data management, filenaming conventions, improved study outcomes/formats and documentation of common approaches.

Client
Brisbane City Council

Location
Brisbane, QLD

Coastal and Marine Planning Experience (numerous projects)

Client
Various

Location
Queensland

Aurecon has provided key expertise to numerous projects and key clients on land use planning matters, site feasibility studies and approvals frameworks operating in the coastal and marine environment. We have experience in a statutory planning sense at several ports including Mackay, Hay Point, Abbot Point, Brisbane and around Australia.

Aurecon also continues to play a significant role in the development of masterplans, land use plans and planning frameworks for major ports within Queensland. We have a range of dedicated professionals as part of our Environment & Advisory Services Group who specialise in coastal/marine environmental planning work.

Kingsford Smith Drive Upgrade

Client
Brisbane City Council (MIPO)

Location
Brisbane, QLD

Aurecon has developed planning options for the upgrade of Kingsford Smith Drive between the Inner City Bypass and the Gateway Motorway. This stretch of road runs parallel to the Brisbane River and is a major traffic and freight corridor. The Brisbane River has significant scenic amenity and recreational values for local residents, as well as the wider Brisbane community. The development of design options needed to carefully consider and balance competing interests.
In developing and assessing options, the Water Group were responsible for advising the project team of potential hydraulic impacts such as increased flood risk to the local area, scour and deposition and obstruction to navigational paths. The assessment involved the development of a broad scale 2-dimensional hydraulic model (TUFLOW) of the Brisbane River, extending from the Gateway Bridge up to the University of Queensland. The model development required detailed representation of piers and headstocks to allow an accurate assessment of the impact of each design option.

Cairns International Airport Drainage Master Plan Review

Client
Cairns Port Authority

Location
Cairns, QLD

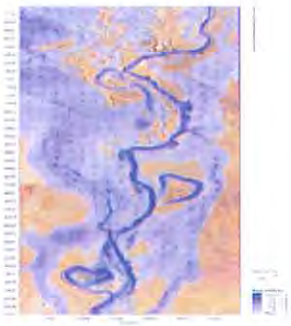
Cairns International Airport is situated on a low-lying floodplain at the mouth of the Barron River, several kilometres north of Cairns City. The airport is vulnerable to a range of events including:

- Local flooding within the airport from intense rainfall events;
- Widespread flooding from nearby Saltwater Creek and the Barron River;
- Cyclonic surge/tide events; and
- Combinations of the above.

The airport is protected by a flood levee system and CPA commissioned Aurecon to examine and assess the capacity of the internal drainage infrastructure within the airport site and to undertake and extreme event analysis.
This process involved:

- Identification of infrastructure modifications required to achieve the design criteria for the current state of airport development;
- Provision of advice regarding the impact, cost and priority of these works;
- Identification and costing of additional modifications required to service the airport at the 20 year design horizon;
- Assessment of performance of airport drainage infrastructure under extreme events (from the 100 year ARI to the PMF); and
- Updating the existing Stage 1 Drainage Master Plan Review Report to include the outcomes of the above tasks.

Hydraulic modelling for the Drainage Master Plan Review of Cairns International Airport consisted primarily of two-dimensional modelling of the lower Barron River using the MIKE 21 software package. Design storm hydrographs were used to determine peak flows in the Barron Delta, while a detailed sensitivity analysis was conducted to determine the influence of coincident tide (tailwater) levels on flood levels upstream. The hydraulic model was used to determine flood heights around the airport levees for a wide range of flowrates and tide levels, and also to determine the scope of additional protection works required and the effectiveness of potential remedial measures.



Client
Barcaldine Regional Council

Location
Jericho and Alpha, QLD

Alpha and Jericho Town Flood Mitigation Studies

Aurecon has undertaken comprehensive flood modelling exercises for the towns of Alpha and Jericho in Central Queensland to identify existing hazards and risk associated with flooding within the towns and to assess various mitigation options to alleviate the effects of flooding.

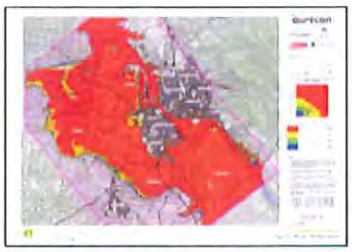
Detailed hydrologic modelling was undertaken using URBS modelling software. URBS was selected for hydrologic modelling as the Bureau of Meteorology uses this in their flood warning system. At the completion of the project Connell Wagner assisted the BoM to incorporate the Jericho model into the flood warning system of the Thompson-Barcoo system. A review of the effectiveness of the existing flood warning system was carried out and recommendations were made for improvements to the system.

Detailed 2-dimensional MIKE 21 hydraulic models were developed of the Jordan Creek through Jericho and Alpha Creek. The MIKE 21 models included bridges and culvert structures and other drainage controls such as levees. Historical flood events were used to calibrate each model and design storm events run through the adopted models. Flood inundation, depth and hazard mapping were produced, in accordance with CSIRO SCARM guidelines, to assist the local counter disaster group to prepare for future flood events.

Aurecon identified several options to mitigate the risk of flooding, in consultation with stakeholders and the community. Where practicable, the structural measures were included in the hydraulic model to assess their effectiveness. A comparison of all options was assessed using weighted criterion to identify preferred mitigation options.

An extensive community consultation exercise was undertaken throughout both

projects, the outcomes of which were used to assist with the joint calibration exercise and confirmation of modelled flood behaviour. Regular community involvement was identified as one of the contributing factors to the community's ready acceptance of the outcomes of the two studies.
More recently Aurecon has worked with Council to design a flood levee to protect Jericho from flood inundation. This process has involved determining appropriate an immunity standard, examining the risks associated with failure or overtopping of the levee, consultation with local residents outside the levee bank to gain approval of the potential impacts upon them during flood events.



Client
Rockhampton Regional Council

Location
Rockhampton, QLD

Fitzroy River Flood Study

Aurecon has recently completed the Fitzroy River Flood Study for Rockhampton Regional Council. The study included both hydrologic modelling and hydraulic modelling (TUFLOW) of the floodplain.
In the initial phase of the study, data collection and collation was undertaken to source available information and ascertain details of floodplain history, calibration data, topographical features and drainage structures critical to flood flow conveyance. Model development was then undertaken and the TUFLOW model was calibrated to 2 historical events and validated to a further 2 historical events. Variations in the model topography and roughness were required to represent the floodplain at various stages of development for each of the historical events. The breakthrough of the river at the Pirate Point bend in the 1991 event was also included in the modelling.
Following calibration, design event modelling was undertaken for a range of design events from the 2 year ARI to the PMF event. Results from the design event modelling were used as input to Council's development planning process through the definition of flood affected areas and classification into flood categories consistent with Council's planning scheme.
Detailed input into Council's emergency management planning was prepared to assist with emergency response in times of flood. This included a set of flood maps relating to specific levels of inundation at the city flood gauge and classification of areas into flood zones. Information for dissemination to the general community was also prepared.

Client
Rockhampton Regional Council

Location
Rockhampton, QLD

Rockhampton Regional Council Natural Disaster Risk Management Assessment (2011)

This project draws upon the past history and local knowledge of our team members and key input from the LDMG and Council to review and assess a wide range of natural hazards including cyclone, wildfire, earthquake, regional flooding, local flooding, heatwave, tsunami, landslip, tornado, severe storms and climate change. Following the approach detailed in the Floodplain Management in Australia: Best Practice Principles and Guidelines and taking into account the draft National Emergency Risk Assessment guidelines, specific risks have been identified and compiled in a risk register. Using the risk register assessment of the current preparedness and recovery measures has been undertaken to determine if current measures are acceptable or to identify future work required to mitigate the impacts of the identified risks.

5 Management skills

This section provides evidence of Aurecon's Quality Assurance accreditation and our OHS and Environmental Management Policies. In addition we have provided information regarding our project management systems.

5.1 Project management

Aurecon understands that time, budget and resource management is critical to the successful outcome of each and every project. We have a number of systems in place to manage projects depending upon the individual project complexity and scope and we select the most effective systems accordingly.

For this study we will prepare regular progress reports including relevant details on any or all of the following:

- Activities during the previous period
- Key issues arising and any change in work scope
- Action list
- Key correspondence received
- Problems, concerns, information dependencies
- Decisions required
- Planned activities for the next period
- Progress versus programme

Specific tasks for time, budget and resource management are outlined in the following sections.

5.2 Time management

Aurecon uses various programs including MS Project for time management. An initial Project Program has been prepared as part of this proposal with key milestone dates.

On a monthly basis the Project Programme will be reviewed and updated. Corrective action will be taken by the Project Leader if required to ensure that key milestone dates are met. Updates on project timing will be included in our monthly progress reports.

5.3 Budget management

Aurecon has a well-integrated cost management system which tracks budgets and costs on a weekly basis. We have a rigorous monthly cost reporting system which requires the Project Leader of each project to review its cost performance. This means that Project Leaders are well aware of the cost constraints of each project and are able to keep clients informed on a regular basis.

5.4 Aurecon quality management system

Quality Endorsed Company

Aurecon is committed to providing our clients with a service that suits their individual needs. To this end, we aim to continually improve our systems and services so that we can respond appropriately – on time and to budget.

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Our quality management system has been certified to the international standard AS/NZS ISO 9001 since 1993. Our third party certifiers are:

- SAI Global Assurance Services – Australia
- Bureau Veritas Quality International. – New Zealand
- IQNet – Asia

The QMS is designed to help meet the needs of our clients by implementing a simple and consistent set of processes, common to the entire Aurecon group. These processes apply to all Aurecon activities, from feasibility to construction. The standard quality management processes are able to be tailored for specific project and client needs. Our Quality System outlines:

- Certification
- Policies, manuals and procedures
- Management responsibilities
- Client satisfaction
- Communication and training
- Resources

The system helps daily work practices be efficient and adhere to the latest standards. Our staff actively use the system to harness their colleagues industry leading knowledge. By sharing information it enables delivery of best practice to our clients across the world.

5.5 Aurecon health and safety system

Aurecon is committed to laying a strong foundation of health and safety. Aurecon's Board is responsible for managing Health and Safety across the group. They monitor the governance requirements and challenge the effectiveness of internal processes, reviewing our system against external benchmarks.

Our current Health and Safety System has been certified in NSW and the ACT to AS/NZS 4801:2001. Aurecon is currently working with SAI global to standardise the certification in all our office locations to AS/NZS 4801, OSHA 18001 and NZ ACC. The safety culture is built on the vision 'no harm to people'

5.6 Environmental and sustainability management system

Aurecon has developed an Environmental and Sustainability Management System (ESMS) which meets the requirements of the international standard AS/NZS ISO 14001.

Our goal is to minimise harm to the environment during the planning, design and construction phase of projects and to build in safeguards for environmental management during operation.

This Environment and Sustainability Management System (ESMS) has been developed to:

- Allow Aurecon's corporate, project specific and legislative environmental requirements and sustainability commitments to be addressed
- Meet the requirements of international standard ISO 14001 including the need for continual improvement in environmental risk management
- Provide a link to other relevant quality and health and safety system processes
- Provide Aurecon personnel with procedures and documentation to enable relevant environmental requirements and sustainability commitments to be addressed

6 Commercial considerations

6.1 Fee estimate

Aurecon propose to undertake the scope of works detailed in Section 3 on a lump sum fee basis. A breakdown of our fee estimate is presented in Table 1.

Table 1 I Project Fee Breakdown

Item	Price (excl GST)
Project management and meetings	$3,856
Phase 1 – Project setup and familiarisation	$7,352
Phase 2 – Investigation tasks	$35,512
Phase 3 – Interim assessment framework	$11,778
Phase 4 – Strategic assessment framework implementation plan	$8,104
Report Compilation	$2,638
Total (Excl GST)	**$69,240**

6.2 Work outside scope

Should any work be required outside the scope detailed in Section 3 then this would be undertaken on a time plus expenses or other mutually agreed basis using the Panel Rates detailed in Table 2.

Due to the high level nature of this project, the personnel nominated as part of the Study Team are generally senior team members with key relevant experience.

Table 2 I Schedule of Rates

Personnel	Hourly Rate (excl GST)
[redacted]	$241/hr
	$273/hr
	$228/hr
	$150/hr
	$228/hr
	$228/hr
	$241/hr
	$228/hr
	$273/hr
	$195/hr

6.3 Assumptions

A number of assumptions have been made in the derivation of this fee:

- All data required for the study is made available to Aurecon free of charge and in a timely manner. Any costs for additional data would be passed directly on to BCC
- Fortnightly progress reports will be required
- Access to data held by BCC would be able to be arranged promptly and not delay the study progress

6.4 Programme

Aurecon understands the importance of meeting programme milestones. As previously discussed, we will apply a thorough management approach to ensure that the project is delivered on-time.

We note the timeframe outlined in the brief and should we be successful would confirm deadlines and schedule project meetings/deliverables with BCC's Study Manager at the Inception meeting.

6.5 Contract conditions

It is understood that the proposed works will be carried out under Contract A100026-09/10 – Provision of Infrastructure Consultancy Services.

aurecon

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Aurecon offices are located in:
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Brisbane City Council ABN 72 002 765 795

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Chief Executive's Office
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www.brisbane.qld.gov.au

Dedicated to a better Brisbane

10 August 2011

Mr Andrew Young
Chief Executive Officer
Brisbane Markets
PO Box 80
ROCKLEA QLD 4106

Dear Mr Young Andrew

As you would be aware, the Queensland Floods Commission of Inquiry Interim Report was released on 1 August 2011. As part of this report, a number of recommendations were made to assist with Brisbane's future flood preparedness.

One of these recommendations related specifically to communication between the Brisbane Markets and Council. In particular, recommendation 6.7 stated:

Brisbane Markets Limited should contact the Brisbane City Council on a regular basis in the lead-up to and during flooding to seek local flood information. In response, the Council should provide readily understood information which, as far as possible, explains the level of flooding to be expected at the Rocklea Markets site.

In order to achieve this, I wanted to take this opportunity to inform you of the tools available that may assist you and the Brisbane Markets in the event of a future flood. These tools are available to residents and businesses and can be accessed through Council's Corporate Website at www.brisbane.qld.gov.au/floodwise. The tools consist of:

- Flood Flag Maps to show overland flow paths and where flooding may occur from creeks, rivers and storm tides.
- The FloodWise Property Report which shows the risk and type of flooding at a property, and how high the water may reach, to enable you to plan and build in accordance with Council's requirements (The Report has been updated to include the estimated January 2011 flood levels and Interim Residential Flood Levels for affected properties).
- Factsheets and checklists include the Be FloodWise Business Plan and Be FloodWise Emergency Kit Checklist for Businesses. I have attached copies of these documents for your perusal.
- The Brisbane Early Warning Alert Service provides free severe weather alerts via email, SMS or telephone for residential properties. You are able to register for this service online via www.brisbane.qld.gov.au/floodwise.

.../2

- Regularly updated information from Council's Contact Centre on 3403 8888, especially in the lead up and during a disaster or emergency event. In particular, during an event, Council's Brisbane River Flood Forecast System is available. This system is able to generate site specific river flood level information that may be of use to callers contacting Council about a particular address.

Furthermore, I would strongly urge you and occupants of the Brisbane Markets to regularly check social media outlets, such as Facebook and Twitter, local radio, and Council's corporate website during an event to ensure you have access to the most up to date information.

You may also be aware that Council is currently setting up a post-flood business recovery project which will be conducted over the next 12 months. As part of this project, Council officers will be visiting businesses around Brisbane, including Brisbane Markets, to assist them in accessing a range of services and networks that might help their economic recovery. It is my hope that by working together, businesses will be able to recover from the January 2011 flood and be in a position to successfully withstand a future event.

Should you wish to discuss the details of this letter, please contact Mr Darren Sullivan, Director – Corporate Disaster Recovery Office, Disaster Response & Recovery on 3403 8888. Mr Sullivan is the senior officer responsible for coordinating Council's recovery effort and as such, is best placed to assist you further.

Yours sincerely

[redacted]

Colin Jensen
CHIEF EXECUTIVE OFFICER

Att.

As part of preparing for flood consider every item in the list below. Implement as many points as possible now. A review every six months is recommended.

Step 1: Understanding your flood risk

- ☐ Obtain a FloodWise Property Report from Council.
- ☐ Consider engaging the services of an engineer.
- ☐ View the property to determine the slope of the land and to identify any potential flood hazards.
- ☐ Find out about your local flood history from neighbouring businesses.
- ☐ Complete the flood cost estimator to calculate your financial exposure to flood.

Step 2: Preparing your business for flood

Administration

- ☐ Prepare your Be FloodWise Business Plan.
- ☐ Prepare an emergency kit.
- ☐ Check your insurance policy for flood cover and purchase flood insurance if necessary.
- ☐ Develop an evacuation plan and display maps.
- ☐ Familiarise yourself with flood warning classifications and where to access information during a flood.

Develop processes and assign responsibilities for:

- ☐ locking doors and securing money
- ☐ switching off mains power
- ☐ computer back up and data recovery
- ☐ accounting – payroll/banking/accounts payable and receivable
- ☐ customer contact and communication.

- ☐ Conduct staff training (including annual refresher training).
- ☐ Brief floor warden/WH&S officer/office coordinator.

Office equipment and fittings

- ☐ Identify and prioritise exposed assets and equipment and consider relocation points.
- ☐ Identify plumbing and sewerage risks and consider management strategies.
- ☐ Consider purchasing a supply of sandbags to have on hand.

Customer service

- ☐ Consider after hours and alternate contact arrangements.

Step 3: Responding when the water comes

Just before the flood

Administration

- ☐ Keep informed of weather updates. Listen to a battery-operated radio for the latest flood information.
- ☐ Be aware of risks during floods to avoid injury.
- ☐ Consider transport arrangements during a flood. Encourage staff to stay informed of changes to road conditions.
- ☐ Ensure neighbouring businesses and nearby properties have been notified of any flood warnings and instructions.
- ☐ Place sandbags or other protection around the premises. Stack sandbags away from the outside walls of your premises to prevent flood waters from entering.
- ☐ Place sandbags in the toilet bowl and over wastewater outlets to avoid sewage entering the building.
- ☐ Remove cars from underground car parks.
- ☐ Back up computers and data.
- ☐ Switch off all computers, mains power and air-conditioning.
- ☐ Keep your emergency kit dry and accessible.

BRISBANE CITY

Office equipment and fittings

- ☐ Take actions to limit damage to property by raising and securing equipment and stock. Relocate valuable stock and equipment above likely flood levels including servers, hard-drives, computers, files, archive boxes and furniture.
- ☐ Move garbage, chemicals and poisons to a high, dry place. Store petrol and other chemicals that react with water in waterproof containers.
- ☐ Remove wooden drawers from cabinets and furniture.
- ☐ Turn off electricity, gas and water mains. Remove fuses from your meter box to reduce the chance of short circuits when power is returned. Avoid switches if wet. Tie down gas bottles or move them to higher ground.
- ☐ Empty freezers and refrigerators and leave doors open so they do not float. Destroy perishable food items.
- ☐ Bring outdoor furniture and signage indoors or tie it down.

Customer service

- ☐ Erect signs on front door/window informing customers of closure period and alternate contact details.
- ☐ Activate answering machine or service and divert telephones. Consider a flood-specific message.

Safety and security

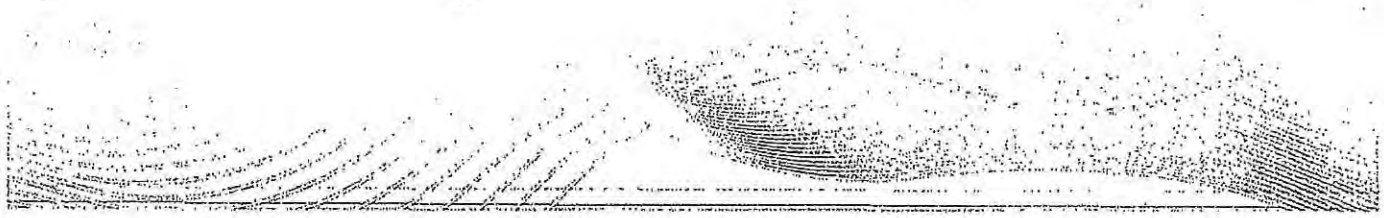
- ☐ Secure windows, doors, money and valuables.
- ☐ Evacuate if necessary, using your agreed plan.

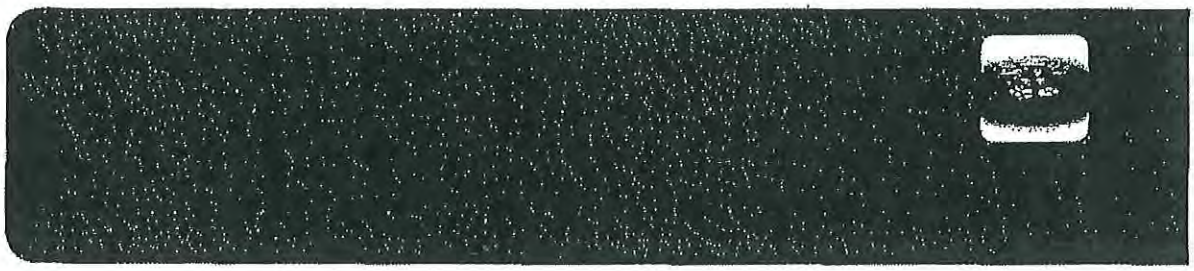
During the flood

- ☐ Listen to the radio for flood updates.
- ☐ Check with the RACQ for safe routes before driving anywhere and don't drive on flooded roads.
- ☐ Provide support to staff not already evacuated.
- ☐ Make arrangements with emergency shelters (if required).

Step 4: Recovering after the flood

- ☐ Contact your insurer or broker and seek directions.
- ☐ Contact the building owner, manager or agent for instructions (if applicable).
- ☐ Be aware of risks after a flood to avoid injury.
- ☐ Engage a licensed electrician to test electricity and wiring.
- ☐ Photograph or video damage prior to cleaning up.
- ☐ Clean all flood-affected property thoroughly.
- ☐ Dispose of any contaminated food or property safely.
- ☐ Implement processes to re-open the business.
- ☐ Replenish supplies in your emergency kit and store for reuse.
- ☐ Update your evacuation plan and procedures from learnings.
- ☐ Contact government or community groups for assistance.
- ☐ Take steps to reduce impacts next time.





The following list contains essential business information and supplies that will assist if you are evacuated. Use a waterproof container to house the following items.

Business

- ☐ Valuables, documents and back up computer data.
- ☐ Spare master set of keys.

Checklist of office procedures to:

- ☐ implement evacuation of staff
- ☐ activate call diversions and message service
- ☐ erect signage on doors advising of closure period and alternate contact details
- ☐ turn off electricity, gas and water
- ☐ activate data back up and computer security
- ☐ secure doors and windows
- ☐ return to business-as-usual (e.g. to re-open).

Safety and supplies

- ☐ List of important numbers including insurance policy numbers and emergency phone numbers (Council, SES, Police, Fire and Ambulance).
- ☐ Portable radio and torch with fresh batteries.
- ☐ Reasonable stocks of fresh water, non-perishable food, can opener and self-contained cooking gear.
- ☐ First aid kit.
- ☐ List of special needs and physical aids.
- ☐ Additional blankets, food, water and first aid (if multiple staff in business).

Other items

- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
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