HUMPHREYS
REYNOLDS
PERKINS
planning consultants

BRISBANE
Level 11
40 Creek Street
Brisbane 4000 Australia
T 07 3221 8833
F 07 3221 0278
E mail@hrppc.com.au
W www.hrppc.com.au

DIRECTORS
Jeff Humphreys
BRTP(Hons),BA,FPIA
David Perkins
BRTP,MPIA
Steve Reynolds
BRTP,MSc(EnvMgt),MPIA

ASSOCIATES
John Morwood
BAS(BE),GDURP,MPIA
Leisa Sinclair
BAppSc(Surv),GDURP,MPIA,MUDIA
John Van As
BRTP(Hons),MBA,AssocDipBus(REV),MPIA
Ben Lyons
BBltEnv(Urb&RegPlan),GDURP,MPIA

Associated Humphreys Reynolds Perkins practices:

GOLD COAST
T 07 5594 1322
F 07 5594 1366

NORTH QUEENSLAND
T 07 4953 2877
F 07 4953 2577

SUNSHINE COAST
T 07 5451 0044
F 07 5443 1688

Flood Mapping in Queensland Planning Schemes

Recommendations to the
Queensland Floods Commission of Inquiry

Prepared by Steve Reynolds
Humphreys Reynolds Perkins
Planning Consultants

9 November 2011

Humphreys Reynolds Perkins
Pty Ltd
ABN 93 010 721 294

Disclaimer:
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1.0 INTRODUCTION

1. This report provides recommendations to the Queensland Floods Commission of Inquiry (QFCI) about the mapping of flood events in Queensland planning schemes. The report has been commissioned by the QFCI.

2. The report has been prepared by Steve Reynolds, a Director of Humphreys Reynolds Perkins Planning Consultants (refer **Appendix A – Curriculum Vitae**). Humphreys Reynolds Perkins is a specialist planning consultancy based in Brisbane with offices in North Queensland, Gold Coast and the Sunshine Coast.

3. The opinions expressed in this report are those of the author, although consultation was undertaken with senior colleagues within the firm[1].

4. In the preparation of this report, a variety of documents have been reviewed including various submissions to the QFCI, many existing planning schemes in Queensland, key research applicable to flood management, the latest version of the Queensland Planning Provisions (QPP v3.0) and examples of approaches adopted for flood management by government agencies outside Queensland. The extent of investigation was necessarily limited due to the length of engagement. Nevertheless, enough information was gathered to sensibly carry out the analysis and to justify the recommendations.

5. This report is focussed on mapping flood events in planning schemes. It does not contain analysis or recommendations about the written provisions of planning schemes nor the implementation of planning schemes by local government. Nevertheless, the author has necessarily taken into account the broader aspects of these considerations in the preparation of this report.

[1] Stephen Patey; Jason Kruger; John Van As; Ben Lyons; Andrew Hall and David Ransom.

2.0 ROLE OF PLANNING IN FLOOD MANAGEMENT

2.1 Introduction

6. This section addresses key issues relating to the role of planning in flood management.

2.2 A Partial Response

7. Land use planning is only part of a broader toolkit for addressing the affects of flooding. Nevertheless, most tools in the toolkit seek to address the same objectives, focussed on minimising loss or harm to the community or environment arising from flood events. Personal safety and the protection of property are an important and common focus.

8. Land use planning can address future risk, as it relates to land use distribution and the way in which development is carried out. However, the considerations and requirements for flood management in land use planning, may be different to other flood strategies, such as emergency planning, physical works, public information or land resumptions (to name a few).

9. Within the land use planning system, mapping is only one element. Other aspects of the planning system essential to flood management include the written provisions of planning schemes (strategic and development control components) as well as the implementation of planning schemes by local government. The overall performance of the planning system, comprising all its component parts, is beyond the scope of this report.

2.3 Challenges

10. There exist a suite of challenges to the achievement of effective flood management under the planning system. It is important to acknowledge these challenges in order to move forward to improve performance. These challenges include:

    a. Lack of Data (availability of data to input to flood studies; existence of flood studies);
    b. Lack of funding (competing demands for funding; high cost of flood studies);
    c. Lack of awareness about flood risk (historic events; degree of hazard; warning time);
    d. Lack of coordination across local government boundaries (management in one authority has downstream affects in another; inconsistent regulations across boundaries);
    e. Relates to risk management (unusual for planning system; typical response is to geographically isolate the use causing the risk – not possible with floods);

f. Emotion (directly affects peoples lives in a potentially significant way). This was acknowledged in 1998[2]:

> *"…there is strong concern within local government that published flood information could draw strong adverse responses from landholders who consider their property either incorrectly identified as potential flood affected and/or that the information has significantly reduced the value of their property".*

g. Liability (potentially exposes local government to liability). This can have two dimensions. Firstly, compensation may arise for injurious affection from a change to a planning scheme which reduces the value of land. The potential for compensation, as it relates to flood management, is limited by the *Sustainable Planning Act 2009* (SPA), as it was under the *Integrated Planning Act 1998* (IPA). SPA limits compensation for changes due to '*risk to persons or property from natural processes (including flooding*…)', but it is a limited exclusion as it does not apply if conditions on development could have significantly reduced the risk instead. Nevertheless, it remains an impediment for some local governments to 'downzone' conceptually. Second, claims for liability (Civil proceedings) can arise as a consequence of decisions taken by local government (eg. alleged adverse consequences downstream as a consequence of decisions upstream; or not properly assessing flood risk prior to approving development).

h. Uncertainty (lack of accuracy and surety). This challenge has always applied to flood management through the planning system and continues today. In 1998[3] it was recognised:

> *"Many local governments … are reluctant to include flood map information in planning schemes since the risk to properties from flood hazard cannot be established precisely"*

i. Recently in 2011[4], it was recognised there remains uncertainty around flood studies and that climate change may even affect the reliability of past flood records:

> *'…any actual flood event will vary in some manner from the theoretical events from floodplain computer models'.*

2.4 Cumulative Impacts

11. The planning system can assist to manage cumulative impacts upon floods. The planning system has two basic components:
    a. Strategic planning. Strategic decisions about land use structure are made at the time the planning scheme is prepared. These decisions result in the allocation of zones and use rights across the local government area. Provisions to regulate (restrict or limit) development are made as part of this strategic planning process. It is via strategic planning that cumulative impacts of development upon flood management can be taken into account and managed.

[2] Draft State Flood Mitigation Policy Discussion Paper (2000), section 5.4.4 pg19

[3] Draft State Flood Mitigation Policy Discussion Paper (2000), section 5.4.4 pg19

[4] Understanding Floods – Questions and Answers (June 2011), pgs 22 and 23

b. Development Assessment. This is the ongoing implementation of the planning scheme via the assessment of individual development applications. Cumulative impacts cannot be appropriately addressed at this stage (because the impacts of individual proposals '…may, in isolation, have minimal impact[5]), unless already incorporated as part of the strategic planning underpinning the planning scheme.

2.5 Building Regulation

12. The development assessment process has an interface with the building regulation process in specific ways, including for flood management:

    a. Existing building code requirements. Where a flood level is adopted in a planning scheme, building work can trigger (under sections 32 and 33 of the Building Act 1975) building assessment provisions or 'alternative solutions' applicable to building work. For example, many planning schemes include a 'freeboard' level, which an additional height above the flood level for habitable rooms, to provide a factor of safety (usually 300mm – 500mm)[6].
    b. Proposed building code requirements. The Australian government intends, in 2013, to amend the Building Code of Australia (BCA) to include a national standard for construction in flood hazard areas (including specific performance requirements and deemed to satisfy provisions). The Queensland government is intending to adopt the draft standard early, as a mandatory part of the Queensland Development Code (QDC). As well, the QDC will include new voluntary provisions to be adopted by local government through a planning scheme, Temporary Local Planning Instrument (TLPI) or by resolution. Unless there is mapping in the planning scheme to identify whether a building is within a flood prone area, these provisions may not be triggered.[7]

[5] Floodplain Management in Australia – Best Practice Principles and Guidelines (2000), G.2.1 pg56).).

[6] Queensland Planning Provisions – Draft Version 3.0 (10 August 2011), part 1.7

[7] Planning for Stronger, More Resilient Floodplains: Part 1 – Interim Measures to Support Floodplain Management in Existing Planning Schemes (September 2011), Section 3, pg 12. The Temporary State Planning Policy 1/11 is partly intended to facilitate the delineation of such areas via a low cost and timely process

3.0 EXISTING PRACTICE IN QUEENSLAND

3.1 Introduction

13. This section contains observations relevant to the existing flood mapping in planning schemes, principally drawn from a brief review of the following documents:
    a. State Planning Policy (SPP) 1/03 and the accompanying Guideline;
    b. Temporary State Planning Policy (TSPP) 1/11 and the accompanying document "Planning for stronger, more resilient floodplains";
    c. a review by PSA Consultants for the Queensland Reconstruction Authority on flood provisions contained in all Queensland planning schemes; and
    d. a review of the flood mapping contained in the following planning schemes (see **Appendix B – Planning Scheme Mapping Extracts** for the mapping examples referred to in this section):
        i. Brisbane;
        ii. Bundaberg (including Bundaberg; Burnett; Isis and Kolan);
        iii. Cairns (including Cairns and Douglas);
        iv. Gladstone (including Calliope; Gladstone and Miriam Vale);
        v. Gold Coast;
        vi. Ipswich;
        vii. Lockyer Valley (including Gatton and Laidley);
        viii. Logan City (including Logan; Beaudesert and Gold Coast);
        ix. Mackay (including Mackay, Mirani and Sarina);
        x. Moreton Bay (including Caboolture; Pine Rivers and Redcliffe);
        xi. Redland;
        xii. Rockhampton (including Rockhampton; Fitzroy; Livingstone and Mount Morgan);
        xiii. Sunshine Coast (including Caloundra; Maroochy and Noosa);
        xiv. Townsville (including Townsville and Thuringowa); and
        xv. Whitsunday (including Whitsunday and Bowen).

3.2 State Planning Policy1/03

14. In 2000 it was estimated that 100,000 properties in Queensland were liable to the 1 in 100 year flood in Queensland.[8] These observations led to the government introducing SPP 1/03, which requires planning schemes to 'appropriately reflect' various flood management provisions. However, the effect of SPP 1/03 upon flood management in Queensland planning schemes has been marginal:

[8] Draft State Flood Mitigation Policy Discussion Paper (2000), pg1

> *"Implementation of SPP1/03 to date has resulted in varied planning provisions, mapping standards, and mapping coverage in pre-amalgamation planning schemes."*[9]
> *'…the full implementation of SPP1/03 into local government planning schemes has been relatively limited…"*[10]

15. In 2011[11] only 24% of planning schemes in Queensland (24 out of 127) appropriately reflected SPP 1/03. The key mapping terminology required by SPP 1/03 is a '*natural hazard management area (flood)*'. Only 27 planning schemes use this term.

3.3 Overview of Existing Planning Schemes

16. Many planning schemes in Queensland contain land use provisions that seek to regulate some form of development within flood prone areas. The manner in which this is achieved varies widely across the State. In many cases it is not tied to any mapping:
    a. 34 schemes exclusively nominate Q100. Some refer to 1% Annual Exceedance Probability (AEP). In addition, 30 schemes partially nominate Q100 (or 1% AEP).
    b. 121 (95%) of schemes include land use provisions that seek to regulate some form of development within flood prone areas.
    c. 63% of schemes did not contain flood mapping[12].

3.4 Annual Exceedance Probability (AEP)

17. The most common flood management trigger in planning schemes is the 1 in 100 year flood event, or 1% AEP.

18. For more than a decade the 1% AEP has been consistent with traditional practice in Australia[13]. It was acknowledged in 1999 to be '*generally accepted industry standard …(for planning and development control)"* [14] and is also consistent with SPP 1/03:

> *"The Queensland Government's position is that, generally, the appropriate flood event for determining a natural hazard management area (flood) is the 1% Annual Exceedance Probability (AEP) flood. However, it may be appropriate to adopt a different DFE depending on the circumstances of individual localities."*[15]

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9 Submission #2 to Queensland Flood Commission of Inquiry (7 April 2011), section 2.5

10 Statement of Brendan John Nelson (19 September 2011), para 143

11 all statistics in this section from Draft Review and Analysis of Existing Queensland Planning Schemes – Flood Provisions (15 September 2011)

12 Statement of Brendan John Nelson (19 September 2011), para 146

13 Floodplain Management in Australia – Best Practice Principles and Guidelines (2000),K4 pg 75).

14 Draft State Flood Mitigation Policy Discussion Paper (2000), section 3, pg6

15 State Planning Policy 1/03 – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (1 September 2003), pg16 A3.2

19. The guidance in SPP 1/03 for determining a 'different' AEP is limited. For example, the SPP 1/03 guideline contemplates a 'lower' DFE based on analysis (see para 5.8), but makes no mention of a higher DFE.

20. Contemporary best practice in 2011 acknowledges:
    "Currently the 1% AEP event is designated as having an 'acceptable risk' for planning purposes nearly everywhere in Australia. However, good planning needs to consider more than just the one percent AEP flood'.[16]

3.5 Urban Drainage Mapping

21. In most urban areas, underground drainage is insufficient to accommodate minor flood events. In these cases overland flow is not uncommon.

22. A limited number of urban local authorities map overland flow paths in their planning system. This is possibly due to the difficulty in capturing the information, as it is highly detailed in nature. Nevertheless, it is an important component of the flood management matrix, at the urban level where higher densities prevail and human intervention has radically altered natural conditions.

23. Examples include:
    a. Brisbane City Council maps 'overland flow paths' on its Flood Flag Maps. These maps were made available on-line sometime in the past few years, but have recently been called-up into the planning scheme via the TLPI introduced after the 2011 flood events.
    b. Ipswich City Council has mapped 'urban stormwater flow path areas' as part of its TLPI, also introduced after the 2011 flood events.
    c. Maroochy Planning Scheme uses the term 'Drainage Deficiency Areas'.

3.6 Storm Surge Mapping

24. Many local government areas in Queensland are on the coast. However, few include storm surge mapping, which ought to be an important part of the flood management matrix.

25. Whilst storm surge, in the absence of a flood event, can have consequences that warrant a planning response, the combined affect of storm surge and flood events can be more severe. National guidance suggests this is unlikely to occur, so as to warrant planning measures[17].

[16] Understanding Floods – Questions and Answers (June 2011), pg4

[17] Floodplain Management in Australia – Best Practice Principles and Guidelines (2000),C10.1 on pg 44

But with the advent of climate change science, it is less clear whether this is still the case[18].

26. Examples of storm tide mapping exist at Burnett, Bundaberg, Gladstone, Whitsunday, Bowen, Redlands and Moreton Bay (some produced by Emergency Management Queensland). Some show flood depth contours. Not all are called up under a planning scheme.

3.7 Hazard Mapping

27. Hazard mapping within the DFE is unusual in Queensland planning schemes, even though it has been recommended as national best practice and is used in other States for flood management.

28. Isis planning scheme shows high and low hazard flood areas. Rockhampton planning scheme shows six hazard categories ('floodway' high and low; 'flood storage' high and low; 'flood fringe' high and low). These are based on ratios of water depth and velocity applicable to 1% event (a diagram is included in Code derived from that in the national best practice guidelines[19]). The terms 'floodway' and 'flood fringe' are consistent with the terms recommended in the national best practice guidelines.[20]

29. Whilst not based on 'hazard' areas, the Ipswich planning scheme TILP (June 2011) provides a similar level of resolution to its flooding triggers, by relying on flood frequency to 'fine tune' the development requirements called up by the mapping. The TILP maps the 1 in 20 year flood event as well as the 1974 flood event (referred to as the Adopted Flood Regulation Line) to effect the different requirements.

3.8 Lack of Information

30. Many local government areas do not have adequate flooding information. SPP 1/03 acknowledges (at para 7.6) that it may not be cost effective to undertake specific flood study for a whole local government area, such as for areas that are not subject to significant development pressures. But at a minimum should address all areas identified in the planning scheme as existing or proposed urban development, including rural residential. This guidance is practical, as in regional areas of Queensland there tends to be a greater reliance on historical flood event data, where detailed information is not available.

31. Examples of planning scheme maps with 'blanket' designations of unknown flood extent include Gladstone planning scheme (which uses

[18] Understanding Floods – Questions and Answers (June 2011), pg27

[19] Floodplain Management in Australia – Best Practice Principles and Guidelines (2000), page 72

[20] Floodplain Management in Australia – Best Practice Principles and Guidelines (2000), diagram on page xvi

the label '*Unknown Extent of Flooding (Lack of Information')*) and Livingstone planning scheme (which uses the label *'Areas in which data is unavailable'*).

3.9 Level of Detail

32. Planning schemes are inconsistent with respect to providing information or mapping triggers beyond the DFE. For example, whilst a 1% AEP line is a useful trigger for flood requirements, further resolution can improve management within that line (to determine, say, whether flood waters are damaging to safety and property or not). Examples of a higher level of detail exist in Isis and Ipswich planning schemes (see 'Hazard Areas' discussion above). These different mapped triggers enable a finer resolution of planning control for different uses and types of development.

33. Another method is to provide the depth maps for water, derived from the underlying flood studies. Bundaberg is an example. This is useful information, particularly for community interpretation of the planning documents.

34. Other planning schemes include additional AEPs to provide additional resolution. For example, Q100 and Q50 for the same locality.

35. Problems can also arise due to lack of detail. It is often not clear from the planning scheme what source of information has been used to generate the mapping. Inaccuracies or gaps in mapping can also lead to confusion of interpretation. This is not uncommon.

36. A common criticism of flood mapping is the lack of resolution for local flood events (eg. creeks), as opposed to broader events (eg. rivers). The former can cause flash flooding, where local catchments cannot accommodate high rainfall events and localised flooding occurs (usually for only a short period). It is unusual for planning schemes to provide mapping at this level of resolution. It has been incorporated into urban drainage mapping (referred to above). This is most appropriate to minimise the number of triggers to be mapped.

3.10 Cautious Mapping

37. The national best practice guideline recommends '*flooding features … should not be depicted with unjustifiable accuracy (ie. with 'hard edges'). Rather, the boundary of flooding features should reflect the underlying uncertainty in analysis*'.[21] It provides similar advice in relation to hazard mapping: *"In preparing such maps, hazard zones should be defined broadly*

[21] Floodplain Management in Australia – Best Practice Principles and Guidelines (2000), section 3.8 pg 22

and that any excessively detailed variation of hazard be 'smoothed' out'.[22] In contrast, almost all mapped flood boundaries in planning schemes are 'hard edge' finely depicted lines.

38. An example of a cautious approach to mapping is in Redcliffe planning scheme, where the Q100 is drawn with 'hard edges', but a 30 metre buffer is added. There are advantages in this approach, as it allows a buffer for inaccuracy. However, it results in planning to a DFE higher than the Q100 level, but unspecified.

3.11 Public Facilities and Emergency Services

39. Some planning schemes include a higher standard of flood immunity for emergency services and public facilities. This is consistent with the National best practice guidelines[23] and guidance in SPP 1/03. A similar higher test might apply to aged care facilities. This higher standard is tied to a higher DFE (eg. 1 in 200 flood or 0.5% AEP).

40. Examples include:
    a. Logan City planning scheme which specifies 1 in 200 to 1 in 500 for various facilities;
    b. Livingstone planning scheme, which lists a variety of uses such as 'major utility' (0.5% AEP) and several 'Special Uses' (0.2% to 0.5% AEPs).
    c. Rockhampton an Whitsunday are other examples.

3.12 Temporary State Planning Policy 2/11

41. Temporary State Planning Policy 2/11 'Planning for stronger, more resilient floodplains' (TSSP 2/11) takes effect on 14 November 2011. The intention is for the TSPP to operate for 12 months, then be incorporated into a review of SPP 1/03.

42. The purpose of the TSPP is to enable incorporation of '*Interim Floodplain Assessment Overlay'* mapping by Queensland Reconstruction Authority (QRA) and '*Interim Floodplain Assessment Overlay Model Code'* via an expedited process under SPA (a 'minor' amendment to a planning scheme).

43. The TSPP is intended to be relevant to local governments with lesser resources (eg. low growth councils). The interim mapping is able to be adopted with or without amendment by the local government. Once adopted, the mapping will trigger the model code provisions as well as

[22] Floodplain Management in Australia – Best Practice Principles and Guidelines (2000), J4 pg73).

[23] Floodplain Management in Australia – Best Practice Principles and Guidelines (2000), K3 pg75

enable triggering of the new QDC building requirements (when enacted by the State).

44. The TSPP principally provides an assessment trigger. The interim mapping is not intended to alter the level of assessment for development within the overlay area.

45. The TSPP mapping is unique, in that it is based on sub-basin catchments across local government boundaries. This facilitates consistency of approach and a common understanding of the floodplain systems.
46. The key development outcomes sought by the model code relate to building design; extent of filling; storing hazardous materials and siting community infrastructure.[24]

[24] Statement of Brendan John Nelson (19 September 2011), para 104

4.0 EXISTING PRACTICE OUTSIDE QUEENSLAND

4.1 Introduction

47. This section derives from a very brief and selective review of approaches to flood management mapping by authorities outside Queensland. It is not intended to accurately describe other systems. It is intended as a point of reference only(examples of Victorian and NSW mapping appear in **Appendix B – Planning Scheme Mapping Extracts**).

4.2 Victoria

48. The Victorian Department of Sustainability and Environment acknowledge:

    '*Land use planning is considered to be the most effective means of reducing future risks and damages from flooding'.* [25]

49. The Government of Victoria was the forerunner in Australia in standardising planning schemes. They have done so for many years. The government requires a certain format and enables only certain zones and overlays to be used. The provisions that apply to flood management are of considerable interest.

50. The Victorian flood management (and mapping) system is clearly explained in a document titled: *"Applying the flood provisions in planning schemes: A guide for Councils (August 2000)"* (**Appendix C – Victorian Flood Provisions Guide**).

51. The key features of the Victorian system relevant to this study are the following:
    a. Based on a DFE of 1% AEP, expressed as '100-year ARI' (Average Recurrence Interval). If not available: '*the DFE should be based on the known extent of the largest recorded historic flood or on other available information'* (pg4). This is important. The Victorian system puts in place a default method for mapping and managing flood events, when there is a lack of information. No other method is permitted. In these cases, the LSIO (refer below) must be used.
    b. The system allows for the mapping of only four triggers: one zone and three overlays. Together, they take into account the type of flooding and the level of risk. Each is described below.
    c. Urban Floodway Zone (UFZ). This is the only zone permitted specific to flooding and is not intended to be widely used. It is for high-risk areas unsuitable for intensification, where strict controls on land use (including prohibitions) are appropriate. It only applies to urban land and usually where there is a presence of existing development.

[25] www.water.vic.gov.au/environment/floodplains/planning

d. Floodway Overlay (FO). This overlay is for areas of lesser risk than the UFZ; where there is less need to prohibit use but to focus on managing development.
e. Land Subject to Inundation Overlay (LSIO). This is for mainstream flooding in urban and rural areas. Where the extent of flooding is identified it is used where there is a lower risk than UFZ or FO. Where extent of flooding is not known, it is to cover total extent of land affected by flooding as an interim measure (ie. no other overlays is to be used). In these cases (of insufficient data) the government requires mapping '…even if the LSIO boundary is based on limited information' (pg5).
f. Special Building Overlay (SBO). This addresses 'stormwater flooding' where underground drainage is insufficient so causes overland flows. It applies in urban areas only, where there exist development pressures.
g. The system imposes an obligation for planning schemes to include a 'Municipal Strategic Statement' on flooding with certain elements, as well as local provisions.

4.3 New South Wales

52. An example of flood mapping from Willoughby City Council illustrates a variety of flood information. It includes '*Local Overland Flooding – Local Drainage'*; 'Local *Overland Flooding – Major Drainage'* and '*Main Stream Flooding'* which are each subject to development controls. More detailed information is available in separate flood studies[26] such as the *Scotts Creek Flood Study,* which provides more information over a specific area and includes Q5/Q20/Q100/PMF[27] on one map and 'low hazard/high hazard' areas in the Q100 on another map.

53. The detail of information provided is high but remains relatively simple to interpret and identify on a cadastral base.

4.4 Western Australia

54. The government of Western Australia has guidelines[28] for flood management which also require a higher resolution within the 1% AEP. The guideline uses the terms '*floodway'* and '*flood fringe'* to describe the floodplain within the DFE (adopted as 100 year ARI[29]). The guidelines aim to restrict development in the '*floodway'* and require minimum floor levels in the '*flood fringe'*. Whilst this seems simplistic, no further research was carried out to interrogate further.

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26 it is not understood whether these are tied to the planning scheme but would be available for assessment purposes

27 PMF means Probable Maximum Flood

28 Government of Western Australia Department of Water – Water Facts WF14 Floodplain Management

29 this is the term used in the guideline which is equivalent to 1% AEP

4.5 South Australia

55. In South Australia, the 0.5% AEP event has been adopted for floodplain management and planning purposes along the River Torrens[30]

4.6 Overseas

56. Overseas DFE examples include:
    a. Thames estuary 0.2% (1 in 500)[31];
    b. Netherlands 0.1% (1 in 1000)[32];
    c. USA States around Gulf of Mexico have adopted 0.2% AEP storm surge flood[33].

[30] Floodplain Management in Australia – Best Practice Principles and Guidelines (2000), K4

[31] Understanding Floods – Questions and Answers (June 2011), pg24.

[32] Understanding Floods – Questions and Answers (June 2011), pg24.

[33] Floodplain Management in Australia – Best Practice Principles and Guidelines (2000), K4

5.0 OBJECTIVES FOR FLOOD MANAGEMENT IN PLANNING SCHEMES

5.1 Introduction

57. This section sets out the objectives, or criteria, for assessing flood management mapping alternatives in planning schemes. It is derived from the research and the author's professional knowledge and experience.

58. In overview, when drafting a planning scheme, the scheme drafters need maps with lines to be able to:
    a. trigger different levels of assessment (eg. code or impact assessment);
    b. trigger assessment criteria (eg. floor levels; minimum access levels; maximum fill levels); and
    c. provide information to enhance community understanding.

5.2 Criteria for Assessment

59. The qualities of the system necessary to achieve this outcome are set out in the table below.

Table 1: Objectives for Flood Management in Planning Schemes

Criteria	Description
1. Robustness	a. Ability to take on more data as it comes to hand; b. Does not fail to have effect if there is a lack of detail; c. Does not prohibit development unnecessarily.
2. Clarity	d. Easily understood by the public (not subject to misinterpretation); e. Users must readily understand how to apply and interpret[34] f. Acknowledges and does not overplay the accuracy of mapping: 'flood maps are necessarily inexact'[35] g. Specifies information requirements up front. Planning Scheme Policies can drafted to require studies (Codes cannot require studies). This might nominate two levels of investigation: when there is no data and when a known risk requires interrogation.

[34] Queensland Planning Provisions – Draft Version 3.0 (10 August 2011), this is the same as Drafting Principle 2

[35] Floodplain Management in Australia – Best Practice Principles and Guidelines (2000), section 3.8 pg 22

3. Consistency	h. Achieves consistent approach across local government boundaries. i. Achieves consistent scheme structure and language within the State[36]
4. Efficiency	j. Minimises regulation – assessment categories limit regulation to the minimum practicable to achieve the outcomes and level of community involvement sought[37]
5. Effectiveness	k. Facilitates proper assessment of flood risk in development assessment decisions. l. Based on facts and is justified.
6. Strategic	m. Facilitates proper assessment of flood risk in planning scheme preparations (in choosing zones and use rights as well as drafting provisions) n. Facilitates the assessment of cumulative impacts.
7. Flexibility	o. Adapts to different circumstances in different local governments in Queensland (small/large; rural/urban; high/low growth; high/low density) p. Accommodates lack of data (eg. enabling use of interim mapping where there is no detailed data) q. Facilitates amendment as more information comes to hand.
8. Economical	r. Able to be implemented without significant cost. s. Able to be implemented in a timely manner without awaiting detailed studies.
9. Integration	t. Ability to incorporate all flooding types including storm surge and urban drainage areas (including local or 'flash' flooding if required).

[36] Queensland Planning Provisions – Draft Version 3.0 (10 August 2011), this is the same as Drafting Principle 6

[37] Queensland Planning Provisions – Draft Version 3.0 (10 August 2011), this is the same as Drafting Principle 5

6.0 ASSESSMENT OF FLOOD MAPPING METHODS

6.1 Introduction

60. This section identifies alternative methods of mapping flooding in planning schemes. It assesses the benefits and disadvantages of those alternatives, having regard to the objectives identified in the previous section.

6.2 DFE Mapping (1% AEP)

61. In planning, it is often necessary to commit to a line or threshold for efficiency and workability, even if that line is known to be imperfect. That is, it is legitimate to choose a line which best balances performance and efficiency, for 'convenience'. In flood management this is the DFE.

62. The threshold of 1% AEP has proven mostly practical and robust DFE. There is no practical reason to move away from it, although there may be reason to reconsider it as a 'minimum' (see below), unless exceptional circumstances apply in the public interest.

63. The use of the AEP terminology is strongly supported to maximise clarity and minimise misunderstanding. It is preferred over terms such as Q100 or 1 in 100 year ARI. Furthermore, it is essential that planning schemes include very clear statements explaining what each overlay flood line means in plain English.

64. It is not necessary to 'smooth out' AEP lines38 or to provide a 'buffer' to them, as the AEP will be resorted to in any event, if development is triggered by a broader buffer for planning assessment (which would thereby result in inefficiencies by triggering development unnecessarily).

6.3 DFE Mapping (Other AEP)

65. The National best practice guidelines recognise that:

> *Different DFE's may be appropriate for structural measures (eg. levees), different categories of land use and for emergency planning. The concept of a range of DFEs supersedes sole focus on the 1% AEP flood event, as in earlier practice".*[39]

66. It is possible that a higher AEP is warranted for planning regulation purposes (as DFE), in some local government areas, in particular cases. This should be permitted if the local community expectations and circumstances warrant. This might relate to the importance of the locality

38 which might seem consistent with the Floodplain Management in Australia – Best Practice Principles and Guidelines (2000)

39 Floodplain Management in Australia – Best Practice Principles and Guidelines (2000), Glossary ('DFE'), pg 96

to the wider community, or to the likelihood of devastation if the 1% AEP is exceeded. As recently clarified by the Queensland Chief Scientist:

> *"Good planning needs to consider more than just the one percent AEP flood…for planning purposes, it is important to decide what level of flood risk is acceptable for individuals and the community. This should take into consideration both the chance of a flood happening and the consequences of a flood."*[40]
>
> *"There are often strong social and economic reasons for considering a higher standard than the one percent AEP flood."*[41]

67. An AEP less than 1% for planning regulation purposes (as DFE) is far less likely to be justified and ought to be contemplated only in exceptional circumstances, where there is an overriding public interest to do so.

68. It can be acceptable practice to provide a higher resolution of flood frequency risk (eg. 2% AEP), when used in conjunction with the 1% (or higher) AEP as the DFE, in the absence of hazard mapping (refer below). Doing so can 'fine tune' planning regulation within the DFE.

69. In most cases, it is recommended to provide additional AEP lines for information only (not as DFE), which do not trigger levels of assessment or development assessment requirements. This is permitted under QPP v3.0 as part of Overlay mapping[42]. Doing so can clarify and enhance community expectations, which are underpinned by the planning scheme. Typically, if 1% AEP is chosen as the DFE, it is also recommended to provide a 2% (1 in 50) or 5% (1 in 20) AEP for information only (the level chosen will depend on local conditions).

70. SPP 1/03 identifies[43] the type of issues relevant to determining the DFE, which ought to be addressed if a DFE different to 1% AEP is proposed:
    a. economic and social impacts of a range of flood events;
    b. community expectations;
    c. environmental values;
    d. consistency with adjoining localities DFEs;
    e. emergency response requirements; and
    f. management and mitigation measures.

6.4 PMF Mapping

71. The term PMF means 'Probable Maximum Flood'. It defines the whole floodplain and distinguishes between 'flood prone land' within the PMF and 'flood free land' outside.

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40 Understanding Floods – Questions and Answers (June 2011), pg 23

41 Understanding Floods – Questions and Answers (June 2011), pg 24

42 Queensland Planning Provisions – Draft Version 3.0 (10 August 2011), refer 8.1(4)

43 see State Planning Policy 1/03 Guideline – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (June 2003) at A2.37 and Understanding Floods – Questions and Answers (June 2011), at pg 8

72. It is a term defined and used in the National best practice guideline, SPP 1/03, the recent 2011 advice of the Queensland Chief Scientist and elsewhere in Australia. It is described as "…an extremely rare event and defines the extent of flood-prone land".[44]

73. There is some dispute in the literature about whether the PMF is useful for planning regulation:

    The Victorian government states: "*In general, it is not practical or economical to provide land use planning or flood protection up to PMF*"[45];

    The guideline to SPP 1/03 state "*the PMF defines the extent of flood-prone land. Generally, it is not physically or financially possible to provide general protection against this event*" (Glossary to guideline).

    The guideline to SPP 1/03 also states: "" …*it is generally impractical (and probably overly cautious) to adopt the PMF for the purposes of managing floodplain land use and development*."[46]

    The SPP 1/03 Policy Document says: "*Considerations should be given to adopting the PMF event as the DFE for emergency services planning and for determining the location and floor levels of facilities such as telephone exchanges, police stations, hospitals and schools*." (Glossary pg12);

    The Queensland Chief Scientist says: "*critical public infrastructure such as hospitals and emergency management centres are ideally located outside the influence of the PMF*".[47]

74. Having regard to the circumstances for risk of flooding in Queensland, which include diversity of conditions and potential high consequences, it is strongly recommended the PMF is incorporated into planning scheme mapping. It will assist community understanding for flood systems; provide context for the meaning of the DFE and enable planning controls to be implemented (selectively) beyond the DFE. Depending on circumstances, it would be acceptable to map the PMF to either:
    a. trigger a change to levels of assessment, such as to regulate critical public infrastructure and services. In some cases, local government

[44] Floodplain Management in Australia – Best Practice Principles and Guidelines (2000), K3 on pg74

[45] Victorian flood management practice guide pg3. Note The Victorian system does not use the PMF for planning regulation.

[46] State Planning Policy 1/03 Guideline – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (June 2003), Appendix 2, pg 32

[47] Understanding Floods – Questions and Answers (June 2011), pg26

may choose to restrict new residential development in greenfield areas within the PMF.
b. trigger development assessment requirements, such as the levels of higher order roads for evacuation purposes or the scale of certain earthworks; or
c. inform the community as information only, without triggering any change in level of assessment or development assessment requirements.

6.5 Hazard Mapping

75. The behaviour of floodwaters will vary across the floodplain due to:
    a. flood volume;
    b. depth,;
    c. velocity;
    d. rate of flood level rise;
    e. duration of inundation; and
    f. areal extent[48].

76. Some areas carry significant volumes of water at high velocity[49]. Others store water at low velocity. Many areas experience very low depths of floodwater over large areas. The mapping of this different hazard risk level can be a very useful planning tool for planning regulation. This is recognised in SPP 1/03, which encourages categories of flood severity to be used where the information is available[50]. However, this has rarely been done in Queensland to date.

77. The variation of risk in Queensland, within the DFE, can be significant due to the wide variety of terrain and diversity of other conditions. SPP 1/03 recognises that floodplain and catchment characteristics in Queensland can have a significant impact on the level of hazard:

> *"For example, on a western Queensland floodplain the difference in depth between a 1% AEP flood and a 0.5% AEP flood may be only 0.5 metres with little increase in velocities. Whereas on a coastal floodplain the difference in depth may be metres with flow velocities also many times greater."*[51]

78. The mapping of flood hazard areas is also recommended in the National best practice guidelines.

79. It is strongly recommended that two categories of hazard (low and high) are identified with the DFE in local government planning schemes, to

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48 State Planning Policy 1/03 Guideline – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (June 2003), A2.27

49 Understanding Floods – Questions and Answers (June 2011) says that flash flooding accounts for most flood fatalities in Australia (pg 19)

50 State Planning Policy 1/03 – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (1 September 2003), footnote 14 on g 6

51 State Planning Policy 1/03 Guideline – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (June 2003), Appendix 2, A2.22

assist a finer resolution of planning regulation. More categories would be cumbersome for planning regulation and more confusing for the community.

80. It is recognised there exists a tension between measuring the risk of flood frequency compared to the risk of hazard. The community is more broadly concerned with the former and more selectively with the latter (except soon after a major flood event). However, it is the latter that is at the core of flood management priorities: human safety and loss of property and infrastructure. For this reason, planning regulation is best focussed on the latter. This means the planning system needs to prioritise hazard as tool (but it can still provide flood frequency for information purposes). Where hazard information is not available, it is acceptable to base planning regulation on frequency (as an interim solution).

6.6 QRA Interim Floodplain Maps

81. The production of the Interim Floodplain Maps by the QRA is a significant step forward for flood management in Queensland. Whilst the maps are a 'desktop' exercise, based on remote data sets and do not provide an AEP, they are a significant step forward for low growth councils where no better (or any) mapping exists.

82. The project has already mapped approximately 40% of the State's area and by mid 2012, will result in floodplain maps for most relevant areas of the entire State (when combined with existing flood mapping).[52]

83. Appropriately, the maps are titled 'Interim'. This is important and reflects their genesis and intention to be upgraded over time. They are also not to be used to affect levels of assessment, which is appropriate.

84. In the absence of more accurate information to determine a DFE, the QRA Interim Floodplain Maps are suitable for mapping purposes in planning schemes. However, like historical flood event mapping, it must be clarified that when such data is used, it has a different meaning to a DFE determined having regard to scientific principles (which may adjoin, for example, across a local government boundary).

85. It may be appropriate to 'smooth out' the delineation of the lines provided on the Interim Floodplain Maps, to emphasise their regulatory role and downplay their 'hard edged' accuracy. This would be consistent with the National best practice guidelines. In this case there would be no more scientific or accurate flood line available (such as an AEP).

[52] Planning for Stronger, More Resilient Floodplains: Part 1 – Interim Measures to Support Floodplain Management in Existing Planning Schemes (September 2011), pg 13

6.7 Historical Flood Events Mapping

86. Where there is a lack of scientific study to determine the DFE, some local governments have used historical flood event data instead (eg. aerial photography).

87. SPP 1/03 recognises that where there is limited new development, selection of the DFE to define a natural hazard management area (flood) could be based on historical flood levels without detailed assessment of the potential flood impacts.[53]

88. The TSPP 1/11 also recognises that a local government may adopt a flood level based on historical highest recorded flood levels across their local government area to give greater regulatory coverage to development. This may require amendment of the interim floodplain maps to reflect the adopted flood level.[54]

89. In the absence of scientific study, local government ought to adopt historic flood data as an interim measure to regulate planning assessment. It ought to be clarified that when such data is used, it has a different meaning to a DFE determined having regard to scientific principles (which may adjoin, for example, across a local government boundary).

6.8 No Mapping Data

90. It is recognised that with the introduction of the QRA Interim Floodplain Mapping project, there is a likelihood that a lack of data for flood mapping may become a thing of the past.

91. Nevertheless, where no mapping is available the following considerations apply:
    a. where there is no mapping across the entire local government area, it is suitable to provide development assessment provisions in development codes (either as a component of use codes or as a separate flood code). That is, no map need be provided.
    b. where there is some mapping for the local government area, it is appropriate to 'map' the balance area (with no data) as a blanket designation on the same flood map, to centralise flooding mechanisms in the planning scheme. This is preferable to locating flood requirements throughout the planning scheme and is consistent with section 8.1(5) of QPP v3.0. In this case, it will be important to choose terminology (language) carefully, so as not to heighten expectation there is a flooding problem. These 'blanket'

[53] State Planning Policy 1/03 Guideline – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (June 2003), A2.40

[54] Planning for Stronger, More Resilient Floodplains: Part 1 – Interim Measures to Support Floodplain Management in Existing Planning Schemes (September 2011), pg 17

areas with no data may include high land. It is important to also be cognisant of insurance implications for landholders, which might otherwise arise by being triggered on a flood map.

c. in either case, levels of assessment ought not be altered.
d. two tiers of information requirements may need to be provided in the Planning Scheme Policies, where no data is available. The first 'tier' could determine whether the site has characteristics, which warrant further study. The second 'tier' could set out the usual flood study requirements sought by the local government.

6.9 Urban Drainage Path Mapping

92. In urban areas, there is significant benefit to planning regulation and community awareness, to map urban surface drainage paths (variously referred to as overland flow paths/drainage problem areas/urban stormwater flow path areas/drainage deficiency areas).

93. There is unlikely to be any utility (regulatory benefit) in providing such mapping outside urban areas.

94. The preferred terminology is 'Urban Stormwater Flow Paths'.

6.10 Storm Surge Mapping

95. The Queensland Coastal Plan includes provisions applicable to climate change and coastal management that may be relevant to floodplain management in Queensland. The interface between coastal planning and floodplain management warrants investigation when preparing planning schemes. The Queensland Chief Scientist suggests the effects of climate change should be reflected in floodplain management, as it is likely to lead to more storm surge levels and flash flooding.[55]

96. At least, it is appropriate to map storm surge flooding as part of the flood mapping overlays on planning schemes.

97. It is less clear whether there is a benefit of mapping the concurrent risk of storm surge with flooding events (or King Tide with flood events)[56]. Local conditions and study will reveal the necessity of such an approach. It may be appropriate to:
    a. map the concurrent events and use that line to trigger planning assessment, where the risk or consequences are high;

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55 Understanding Floods – Questions and Answers (June 2011), pg 29

56 the Floodplain Management in Australia – Best Practice Principles and Guidelines (2000) say that it is "*…unlikely that extreme rainfalls and extreme storm surges will occur simultaneously. Experience bears this out … both flooding mechanisms are likely to occur together, but it is unlikely that both mechanisms will achieve extreme severity simultaneously*" (c.10.1 pg 44). These comments may not be as applicable in Queensland or consistent with current climate change science. Further investigation is warranted.

b. map the concurrent events and provide the line for information purposes only, without triggering any change to level of assessment or development requirements; or
c. not map the concurrent events in the planning scheme, because it is of such low likelihood and risk.

6.11 Topographic Mapping

98. It is unreliable to define flood triggers on a planning scheme map based on topography alone. The TSPP guideline states:

> *"There may be circumstances where the topography suggests floods are not an issue (ie. large elevated areas such as plateaus with no significant watercourses). Care should be taken in making such a determintation, as land subject to flood hazards is not always obvious."*[57]

99. It may be acceptable to use topographic information (eg. RL or AHD) as a measure in a planning assessment provision in a planning scheme, depending on context.

[57] Planning for Stronger, More Resilient Floodplains: Part 1 – Interim Measures to Support Floodplain Management in Existing Planning Schemes (September 2011), pg 17

7.0 RECOMMENDATIONS FOR QUEENSLAND PLANNING SCHEMES

7.1 Introduction

100. This section describes a recommended mapping approach for flood management in Queensland planning schemes, having regard to the assessment above. Issues relevant to implementation are dealt with in the following section.

101. Refer to previous sections for a more detailed explanation of the recommendations. They are provided here in summary format for clarity.

102. In providing any recommendation, a key tension for resolution is between keeping triggers and mapping simple (to maximise efficiency and to avoid community misinterpretation) and providing more detail for better management of complex processes.

103. As a general observation, the Victorian floodplain management system (mapping designations) has much to commend it. There would be benefit in consultation with practitioners in Victoria, to gain an understanding of their practical use of the system (which has now been many years). Those lessons could better inform the approach to be adopted in Queensland.

104. It is also very important to emphasise that whilst recommendations are offered below, there remains uncertainty as to their workability and practicality, until they are 'road tested' in real planning scheme scenarios. Until that time, the recommendations remain theoretical.

7.2 Generally

105. Where mapping data exists, all flooding matters should be dealt with in the 'Flood' overlay and code of the planning scheme. If no data is available, then no overlay map necessary.

106. The DFE should be based on the 1% AEP, but note:
    a. maintain the terminology of 'AEP';
    b. the meaning of terms must be clearly explained;
    c. a higher DFE may apply if justified;
    d. a lower DFE should only apply in exceptional circumstances;

107. Whilst plain English terminology is recommended, it should be investigated whether it is preferable to adopt alpha-numeric categories as terminology. The risk factors and varied uncertainty of flooding information does not lend itself to plain English. Unusually, this is in contrast with normal drafting convention. That is, the message to the community may be less likely to be confused with alpha-numeric category titles (instead of plain English titles), providing they are tied to

full explanations of meaning. For example, 'low hazard', 'high hazard', 'floodway' and 'flood fringe' are potentially problematic terms, if they suggest a level of accuracy, by description, that may not be warranted. It may be necessary to undertake consultation to test this recommended terminology.

7.3 When a DFE Study is Available

108. It is recommended the following flood mapping categories be adopted when a DFE study is available:

Table 2: Flood Categories When DFE Study is Available

Flood Category	Description
Floodway	a. Within the DFE (generally central to it) b. Based on 'high' hazard risk assessment c. If no hazard mapping, may be based on lower AEP frequency.
Flood Fringe	d. Within the DFE (generally either side of the Floodway) e. Based on 'low' hazard risk assessment. f. If no hazard mapping, based on extent of DFE AEP.
PMF	g. Probable Maximum Flood. h. May be utilised to trigger regulation or for information purposes only. In either case it should be mapped.
Urban Stormwater Flow Paths	i. Only for urban areas. j. Acceptable to identify only those flow paths in areas subject to development pressure.
Storm Surge	k. Based on acceptable study.
Storm Surge/Flooding (Combined)	l. Based on Storm Surge and DFE events concurrent. m. May be utilised to trigger regulation or for information purposes only. n. Optional.
Information Only	o. PMF if used for information only (no PMF Category in this case). p. Storm Surge and DFE combined (no Storm Surge/Flooding (Combined) category in this case) q. Depth maps for water levels in DFE. r. Lower AEP (if using hazard mapping to define the Floodway)

7.4 Where No DFE Study is Available

109. It is recommended a reduced suite of the following flood mapping categories be adopted when no DFE study (or if no accurate storm surge or drainage study) is available:

Table 3: Flood Categories When No DFE Study is Available

Flood Category[58]	Description
Interim Flood Line	a. Based on QRA maps or historic flood records, but 'smoothed out' to reflect status as a trigger mechanism. b. Should not affect level of assessment.
No Flood Data Available	c. No Data Available ('blanket' designation) d. May trigger development assessment requirements. e. Should not trigger level of assessment.
Interim Urban Stormwater Flow Paths	f. Only urban areas. g. Estimate of extent. h. Should not trigger levels of assessment.
Interim Storm Surge	i. Interim Storm Surge line. j. Based on historic records or topography. k. Should not trigger levels of assessment.

7.5 When a Combination of the Above

110. In many local government areas, there will be a mixture of accurate flood information (DFE) available for part of the area, with no information (or at least the QRA mapping) available for the balance of the area.

111. In these situations, the categories above may be 'mixed and matched'. It is a modular system, with common terminology. In such cases, the level of assessment tables and code requirements must carefully link to the mapped categories.

[58] Note: The term 'interim' is important, because the intent should be to improve that data over time and it is important the community understand the lines do not purport to be 'final'

8.0 IMPLEMENTING THE RECOMMENDED APPROACH

8.1 Introduction

112. This section identifies some implementation issues applicable to the recommendations above, including relationships with the QPP v3.0.

8.2 Existing Planning Schemes (non-QPP)

113. For existing planning schemes prepared outside the QPP framework, the same mapping recommendations apply.

8.3 Levels of Assessment

114. The QPP specifies a limited number of zones able to be used by local government in the preparation of a planning scheme (none of these are flood specific, like the Urban Flood Zone in Victoria). Consequently, the Overlay for flooding is the only mechanism able to affect level of assessment in a targeted way, within flood areas. This sets up an internal tension with the QPP, where "…it is recommended that changing the level of assessment by an overlay be used rarely" (QPP v3.0, part 8). That is, to promote efficiency in the planning system, the QPP aims to avoid 'tricking up' development to higher levels of assessment by multiple overlays (thereby avoiding the situation prevalent in some existing planning schemes). However, in the case of flood management, this ought to be facilitated.

115. SPA has introduced an additional type of development called 'compliance assessment'. This may be a useful mechanism to regulate certain development (eg. operational works; building work) within flood areas. this ought to be considered further.

116. Scheme drafters may impose stronger provisions in undeveloped (greenfield) areas, compared to areas already developed (where a 'management approach' may apply). The mapping recommended in this report can facilitate those decisions without modification.

8.4 Part or Whole of a Lot

117. QPP V3.0 includes a provision[59] that where development is proposed on a lot or premises partly affected by an overlay, the level of assessment and assessment criteria for the overlay only relate to the part of the lot or premises affected by the overlay. Similarly, the SPP 1/03 guideline[60] states a similar intent. However, this is problematic for flood management when mapping is not precise and a cautious

[59] Queensland Planning Provisions – Draft Version 3.0 (10 August 2011), paragraph 1.5(9)

[60] State Planning Policy 1/03 Guideline – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (June 2003), para 6.9 (and figure 3)

approach should apply. Such an approach assumes a higher degree of accuracy in flood mapping than may exist for interim mapping and introduces ambiguity about whether flood criteria apply.

118. An appropriate response, rather than challenge the QPP, is for mapping of interim flood lines to be based on cadastral boundaries (ie. including whole allotments rather than part). Alternatively, a combination of 'smoothing out' interim flood lines or adding an additional buffer distance may be appropriate, depending on local circumstances.

8.5 Referrals under SPA

119. Under current legislation, there exist referrals with some relationship to flooding:
    a. interfering with water in drainage and embankment areas or wild river floodplain management areas;
    b. tidal works or development in a Coastal Management Control District; and
    c. Land in or near a wetland.

120. For any referral which may be proposed by the State based on flood levels, it is impractical to base the triggers on local government mapping or specified levels. There is so much inconsistency across local government and interpretation on the meaning of levels, that such triggers would be unworkable.

121. Rather, the recommended approach would need to rely on a mapping database help by the State, most likely derived from the mapping being carried out by QRA, supplemented by more detailed local government mapping information to cover gaps and provide more accuracy (so as to minimise inefficiencies of unnecessary referrals). If the referral applied selectively, say to local governments that have not appropriately reflected SPP 1/03 or which have adopted only 'interim' flood categories, then the mapping database could exclude other local governments.

8.6 Mapping Standards

122. QPP v3.0 doesn't restrict overlays to the categories identified in the QPP (being '*flooding and inundation*' and '*overland flow paths*'). Part 8 states "*A local government may propose additional overlays or sub-categories to an existing overlay, where it is necessary to reflect particular local circumstances that are not included in the standard suite*…" This might apply to different flood categories or hazard levels.

8.7 Information Requirements

123. QPP v3.0 provides for Planning Scheme Policies in Schedule 6 (consistent with SPA provisions). These can be relevant to flood

management. They can apply to all or part of the planning scheme area. They may:

a. state information a local government may request for a development application, such as the components of a flood study (see earlier comments about possible two 'tier' information requirements in relation to flooding);
b. may contain standards identified in a code, such as construction standards or flood hazard standards;
c. may include guidelines or advice about satisfying assessment criteria in the planning scheme, such as flood management principles.

Building Regulation

124. The selection by local government of the flood category to trigger building code matters may require caution. If too large an area is selected, mandatory requirements may apply to all building work with unexpected consequences (depending on the mandatory requirements: for example, pole houses or unnecessary works such as raised ground).

CONCLUSIONS

125. There exists substantial inconsistency across local government in Queensland, relating to the mapping and regulation of land use and development in flood prone areas. This has arisen despite the existence of State Planning Policy 1/03 since 2003.

126. This report has undertaken a desktop review of existing practice in Queensland and elsewhere, to determine appropriate methods to map flood land in planning schemes.

127. The review takes into account the implications of the current version of the Queensland Planning Provisions (QPP v3.0), which intend to standardise planning scheme content, in a selective manner throughout the State.

128. The key challenge is to balance the desire for a simple approach (to maximise efficiency and avoid community misunderstanding), against the imperative to provide sufficient detail to better manage complex processes.

129. The recommended approach aims to standardise terminology across Queensland planning schemes, selecting practical triggers for mapping thereby raising the standard of mapping in most local government areas.

130. An important aspect of the recommended approach is to accommodate imperfect knowledge and provide a pathway to accommodate additional information as it comes to hand. Flood information varies significantly across the State and within local government areas. A flexible approach is necessary. A realistic approach is required.

131. There will exist other approaches that may also be valid, but a standard approach ought to be adopted, which will inevitably require a compromise, to strike the appropriate balance.

132. The final solution should not be decided until road testing is carried out to ground truth the recommended mechanisms and to establish the workability of the recommended approach.

Steve Reynolds
Humphreys Reynolds Perkins
Planning Consultants

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PSA Consulting: *Draft Review and Analysis of Existing Queensland Planning Schemes – Flood Provisions* (15 September 2011)

Victorian Government (Department of Natural Resources and Environment and Melbourne Water): *Applying the Flood Provisions in Planning Schemes – A Guide for Councils* (August 2000)

APPENDICES

Appendix A – Curriculum Vitae of Steve Reynolds

Appendix B – Planning Scheme Mapping Extracts

Appendix C – Victorian Flood Provisions Guide

Appendix A – Curriculum Vitae of Steve Reynolds

STEVE REYNOLDS

BRTP Msc (Env Mgt) MPIA

DIRECTOR

HUMPHREYS
REYNOLDS
PERKINS
planning consultants
BRISBANE OFFICE
LEVEL 20,
344 QUEEN STREET
BRISBANE 4000
TEL: 07 3221 8833
FAX: 07 3221 0278
EMAIL: steve.reynolds@hrppc.com.au
WEB: www.hrppc.com.au

curriculum vitae

QUALIFICATIONS:

Bachelor of Regional and Town Planning, University of Queensland 1984

Master of Science (Environmental Management), Griffith University 1994

PROFESSIONAL AFFILIATIONS:

Member, Planning Institute of Australia

Member, Queensland Environmental Law Association

Past President, Brisbane Development Association

Former Member, Transit Oriented Development (TOD) Task Force

Former Member, Urban Renewal Task Force

FIELDS OF SPECIAL COMPETENCE

Statutory Town Planning

Strategic Planning

Environmental Planning

Expert Witness

CAREER

March 1992 to Present:
Humphreys Reynolds Perkins Planning Consultants
(Director since 1998)

April 1988 to August 1991:
Senior Planner at Michael Burrough Associates Town Planning Consultants, United Kingdom

November 1987 to April 1988:
Contract Planning Officer at London Borough of Newham, United Kingdom

April 1986 to May 1987:
Planning Officer at Queensland Department of Local Government, Brisbane

March 1985 to April 1986:
Assistant Planning Officer at Mulgrave Shire Council, Cairns

December 1984 to February 1985:
Contract Town Planner at Heathwood Cadillo and Wilson Planning Consultants, Brisbane

October 1983 to February 1984:
Contract Planning Assistant at Australian Survey Office – Queensland Branch

Planning Scheme Documents

Preparation and review of statutory and strategic planning scheme provisions, including contributing to:

- Beaudesert Shire Planning Scheme;
- Albert Shire Planning Scheme;
- Mulgrave Shire (now Cairns) Planning Scheme;
- Douglas Shire Planning Scheme;
- Various local government draft Town Planning Schemes and Local Government by-laws relating to town planning and associated matters submitted to the Department of Local Government for approval;
- Preparation of statutory planning controls embodying policies of State significance, (for example, the retention of quality agricultural land);

curriculum vitae

STEVE REYNOLDS

BRTP Msc (Env Mgt) MPIA
DIRECTOR

HUMPHREYS
REYNOLDS
PERKINS
planning consultants
BRISBANE OFFICE
LEVEL 20,
344 QUEEN STREET
BRISBANE 4000
TEL: 07 3221 8833
FAX: 07 3221 0278
EMAIL: steve.reynolds@hrppc.com.au
WEB: www.hrppc.com.au

Studies and Investigations

Planning Studies

Preparation of studies and investigative reports on planning issues relevant to statutory and strategic planning, either leading project or as sub-consultant, including:

- Queensland State Coastal Management Plan for the Environmental Protection Agency;
- Cardwell/Hinchinbrook Regional Coastal Management Plan, in partnership with the Department of Environment and Heritage and the Great Barrier Reef Marine Park Authority;
- Preparation of a Centre Development Plan and subsequent management plans for Maroochydore Town Centre;
- Preparation of town centre redevelopment plan for Murwillumbah town centre;
- Regional Business Centre analysis in Albert Shire relating to the Brisbane to Gold Coast railway for Queensland Rail;
- Preparation of a report detailing the potential land capacity of certain Commonwealth properties, in particular, the development potential and future use of the existing Brisbane International and Domestic Airports.
- Growth model for future population and employment over a 30 year horizon in the Brisbane Statistical Area, as an input to traffic forecasts for the Airport Link project;
- Local area capacity studies and broad population analysis relevant to urban growth projections applying to the Northern Link project;
- Hervey Bay Coastal Management Study recommending works and strategic policy direction for coastal protection;
- Byron Shire Coastal Management Plan.

System Reform

- Project direction of a multidisciplinary study into the management of significant coastal landscapes in Queensland, for the Department of Environment;
- Report recommending implementation mechanisms for a regional open space system (ROSS) in south-east Queensland, for the Department of Lands and DHLGP;
- Review of the Local Government (Planning and Environment) Act and the recommendation of legislative reforms with relation to zoning mechanisms, development processes, compensation and plan making processes for the Department of Housing, Local Government and Planning;

STEVE REYNOLDS

BRTP Msc (Env Mgt) MPIA
DIRECTOR

HUMPHREYS
REYNOLDS
PERKINS
planning consultants
BRISBANE OFFICE
LEVEL 20,
344 QUEEN STREET
BRISBANE 4000
TEL: 07 3221 8833
FAX: 07 3221 0278
EMAIL: steve.reynolds@hrppc.com.au
WEB: www.hrppc.com.au

- Preparation of report to Government on regional planning procedures and legislation in the United Kingdom and its relevance to the future regional planning framework in Queensland.

Environmental Management

- National review and report on biodiversity conservation in urban and semi-urban areas for the Commonwealth Department of Environment, Sports and Territories;
- Review of proposed Environmental Protection Legislation for the Department of Environment and Heritage, to identify the scope of legislative and non-legislative reforms to better integrate planning and environmental protection processes;
- Preparation of ("Greens Plans") for Pine Rivers Shire and Logan City;
- National audit of Environmental Protection and Biodiversity Conservation Act for the National Department of Environment and Heritage to test compliance at local government level.

Master Planning

Preparation of master plans for town centre and urban expansion areas either as team leader or a sub-consultant, including:

- land use study for Roma Street Goodsyard site and the Queensland Place site for the Queensland Government;
- Rocky Springs Masterplan for a new community of 40,000 persons in Townsville;
- Hervey Bay Main Street urban development parcel, integrating new development into surrounding fabric;
- Various masterplanning projects in China, mostly as multidisciplinary team leader, including Dalian City coastal urban expansion project; Xia Chang Huangzou CBD Masterplan and Grand Canal Masterplan Huangzou;
- Mango Hill (now North Lakes) Masterplan for Lend Lease Developments;
- City Port masterplan project in Cairns for major marina expansion;
- Maroochydore regional Centre Development strategy;

Development Projects

Strategic planning advice and implementation of development processes for private sector development projects throughout Queensland, including:

- mixed use and CBD projects requiring design guidance and multidisciplinary coordination;
- significant retail experience in all major urban areas for clients including Westfield, Stockland, Leda, AMP, Lend Lease and others;

STEVE REYNOLDS

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DIRECTOR

HUMPHREYS REYNOLDS PERKINS
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BRISBANE OFFICE
LEVEL 20,
344 QUEEN STREET
BRISBANE 4000
TEL: 07 3221 8833
FAX: 07 3221 0278
EMAIL: steve.reynolds@hrppc.com.au
WEB: www.hrppc.com.au

curriculum vitae

- residential, commercial and industrial development proposals throughout Queensland;
- Preparation and coordination of development applications and planning reports relating to a wide variety of major development proposals throughout the United Kingdom

Expert Advice for Courts of Law

- Significant experience providing expert evidence in the Planning and Environment Court, Land Court and Supreme Court, relevant to all areas of planning expertise.

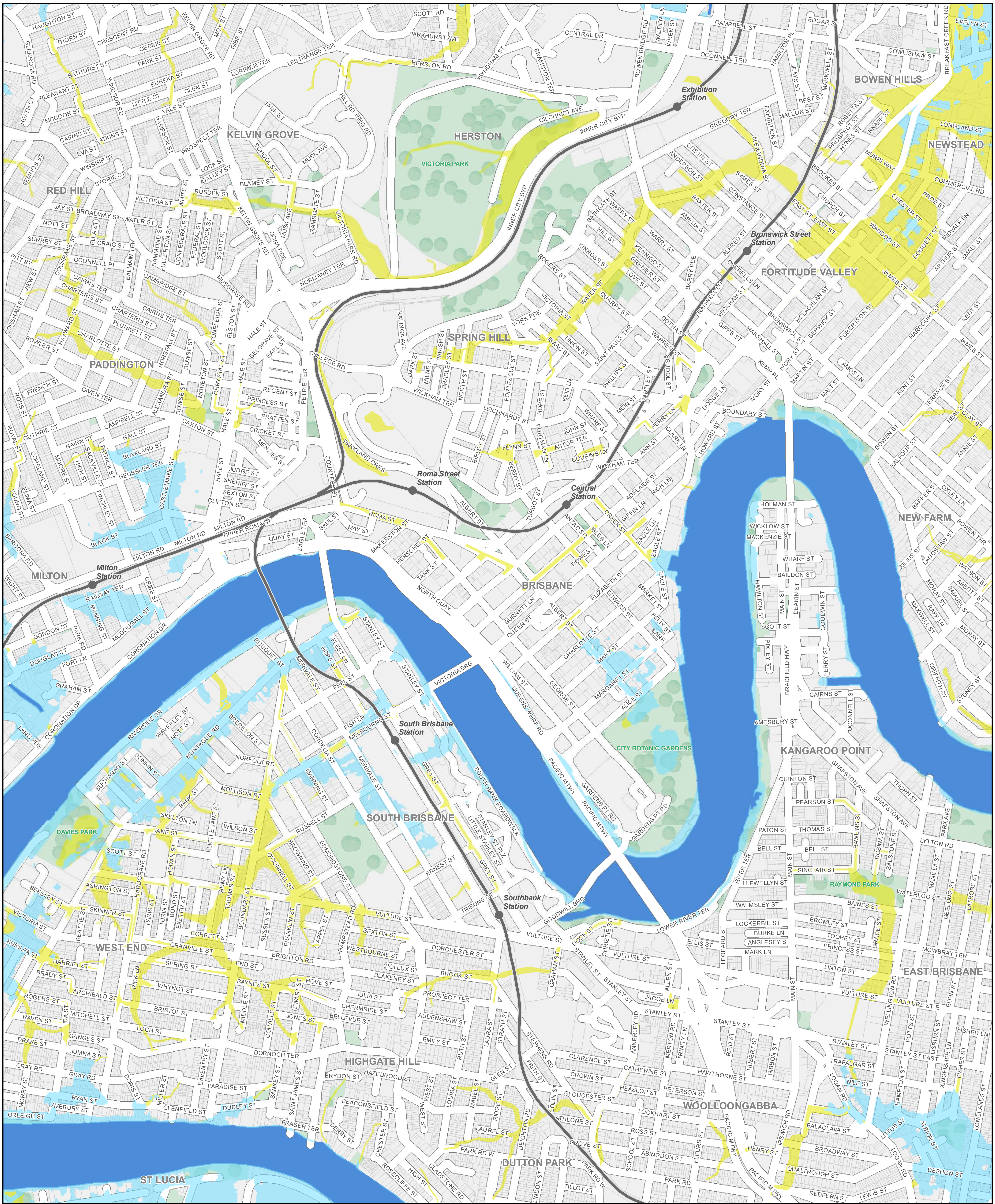
Publications

Steve regularly prepares and presents papers on topical planning issues. Recent papers include:

- *'Implementing ESD under the SPA'*
- *An introduction to The Sustainable Planning Bill 2009*;
- *Creating a Standard Planning Scheme: The Queensland Planning Provisions*;
- *Integrated Planning Act – Is it Too Complex?*;
- *Bureaucracy and Mediocrity – Development Assessment Under IPA*.

These papers are available for download from www.hrppc.com.au.

Appendix B – Planning Scheme Mapping Extracts



DATA INFORMATION

Flood Flag Maps are determined from the information available to Council at the date of issue. The Flood Flag Maps may change if more detailed information becomes available, or changes are made in the method of calculating flood data.

Brisbane City Council Information
GPO Box 1434
Brisbane Qld 4001

For more information visit www.brisbane.qld.gov.au or call (07) 3403 8888

Parks

Waterways *(Including rivers and creeks)*

Creek, River or Tidal Flooding *(Shading indicates areas where creek, river or tidal flooding may occur).*

Overland Flow Path *(Shading indicates areas where overland flow paths may occur).*

If your property is within the shaded areas, you can get further information from the Flood Flag User Guide. You can also access a Flood Fact Sheet that explains overland flow paths and other sources of flooding from www.brisbane.qld.gov.au/floodmap or call the Contact Centre on (07) 3403 8888

0 150 300 600 900
Meters

Publisher : Spatial Information Services
Publication Date : 02-October-2009

Reference : BM076936

Projection : Map Grid of Australia, Zone 56
Horizontal Datum : Geocentric Datum of Australia 1994

BRISBANE CITY

FLOOD FLAG MAP

BRISBANE

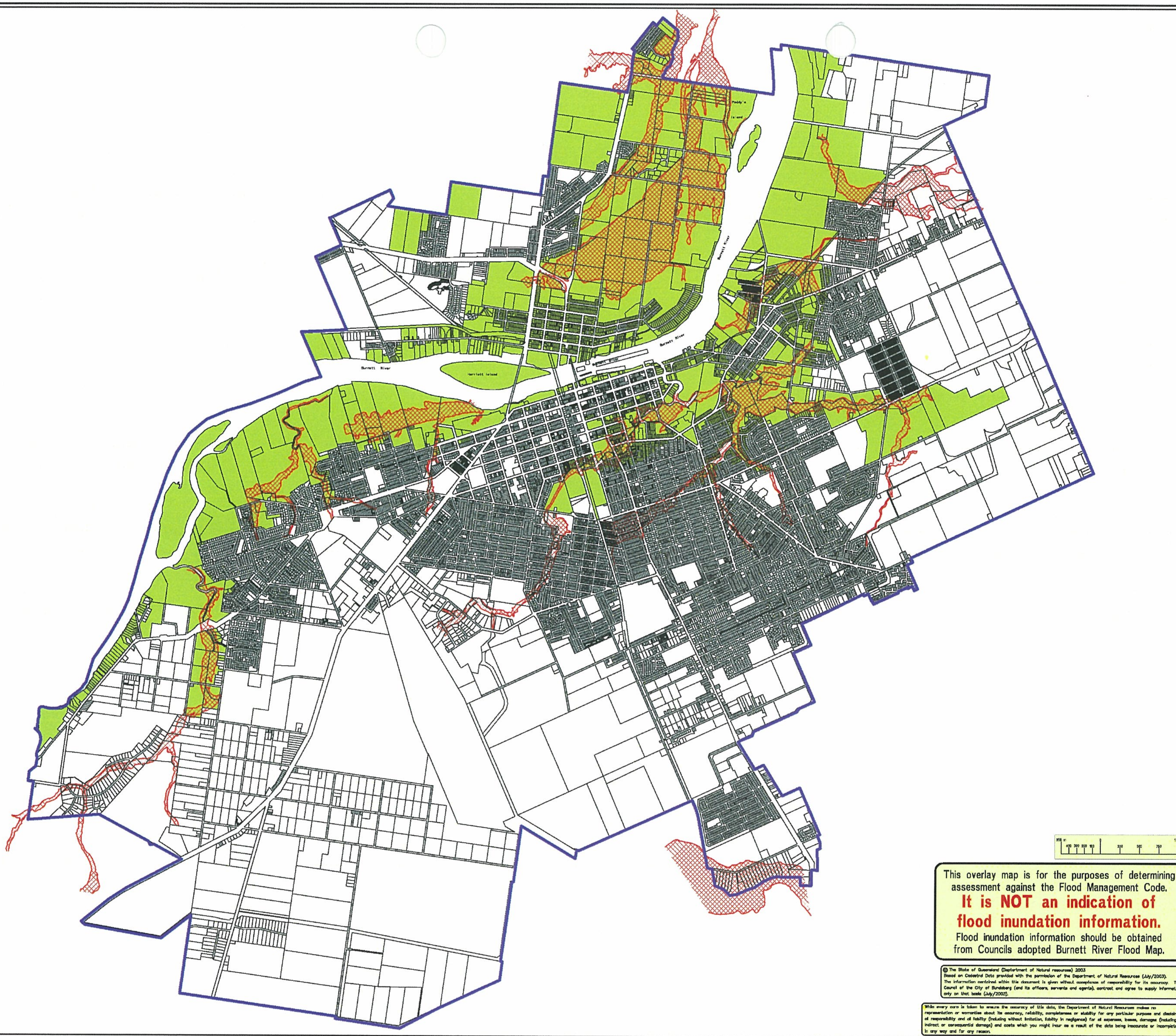
Dedicated to a better Brisbane

Planning Scheme for the City of Bundaberg

Flood Management

Legend

- City Boundary
- Subject to Flood Management Code Assessment
- Subject to Q100 ARI Localised Flood Management Code Assessment



This overlay map is for the purposes of determining assessment against the Flood Management Code.

It is NOT an indication of flood inundation information.

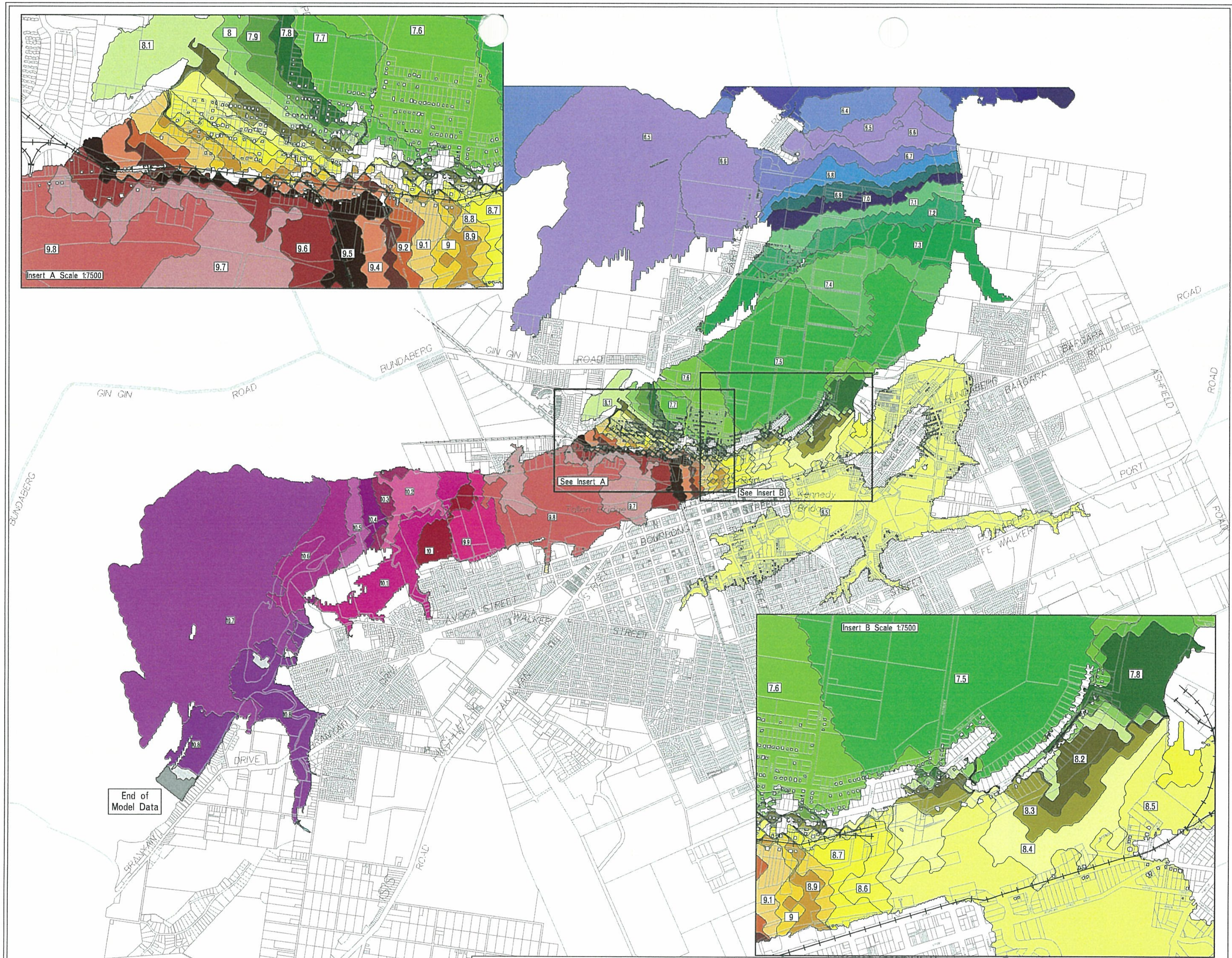
Flood inundation information should be obtained from Councils adopted Burnett River Flood Map.

Map 3.11

BUNDABERG CITY COUNCIL
Planning and Development

Produced by Bundaberg City Council GIS Section on Fri Jul 18 2003

Burnett River 2% Annual Exceedance Probability Flood



Legend

Height
5.9
6.0
6.1
6.2
6.3
6.4
6.5
6.6
6.7
6.8
6.9
7.0
7.1
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9.9
10.0
10.1
10.2
10.3
10.4
10.5
10.6
10.7
10.8
10.9
11.0
11.1

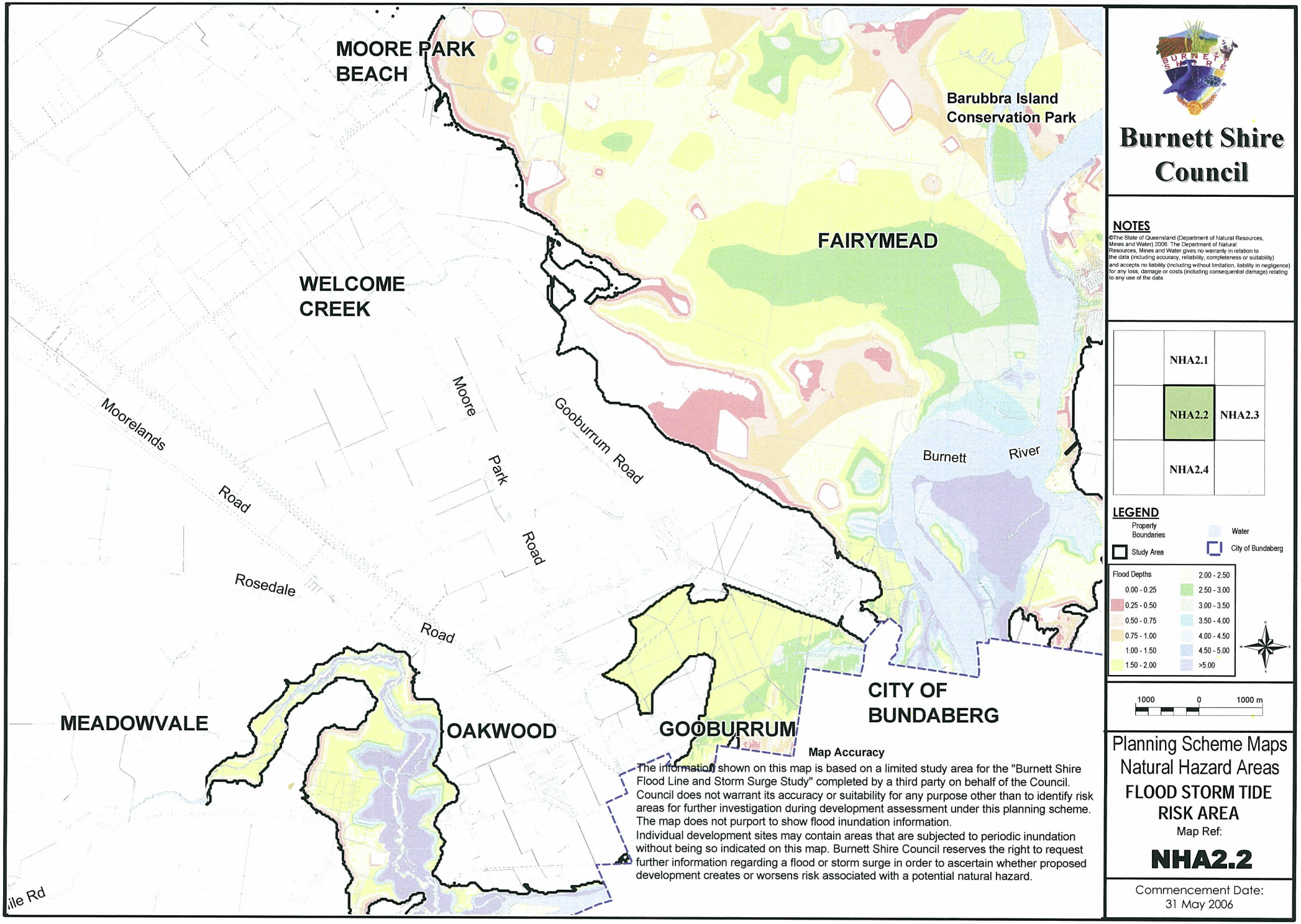
Heights are in metres Australian Height Datum.

Bundaberg City Council

Burnett River 2% Annual Exceedance Probability Flood

Produced by Bundaberg City Council
GIS Section on Fri May 20 2005
GIS Ref: MPA: Flood, File: FLDINDEX2

Scale 1:20,000 on A1 Sheet



Burnett Shire Council

NOTES

NHA2.1
NHA2.2 NHA2.3
NHA2.4

LEGEND

Property Boundaries
Study Area
Water
City of Bundaberg

Flood Depths

0.00 - 0.25	2.00 - 2.50
0.25 - 0.50	2.50 - 3.00
0.50 - 0.75	3.00 - 3.50
0.75 - 1.00	3.50 - 4.00
1.00 - 1.50	4.00 - 4.50
1.50 - 2.00	4.50 - 5.00
	>5.00

1000 0 1000 m

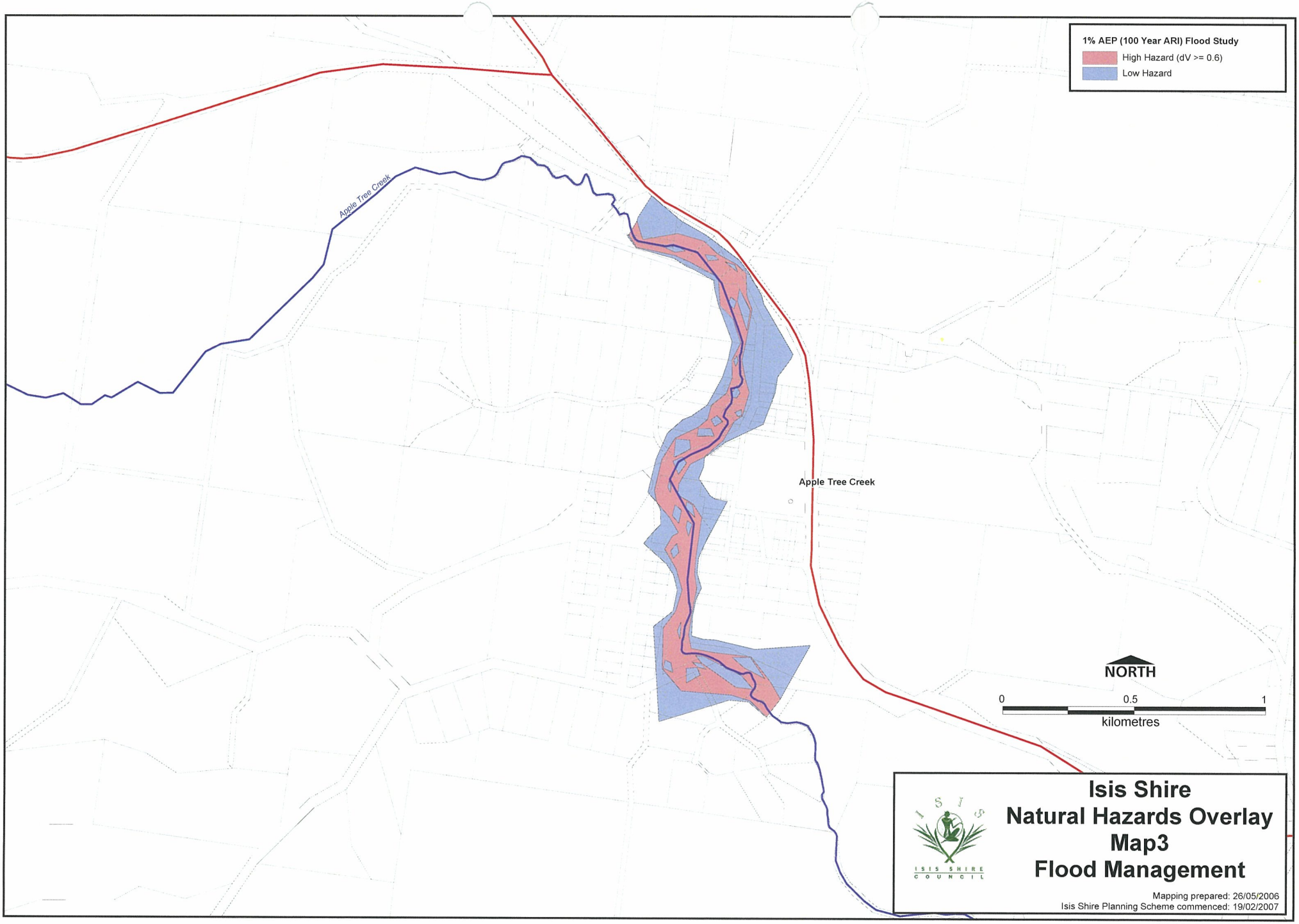
Map Accuracy

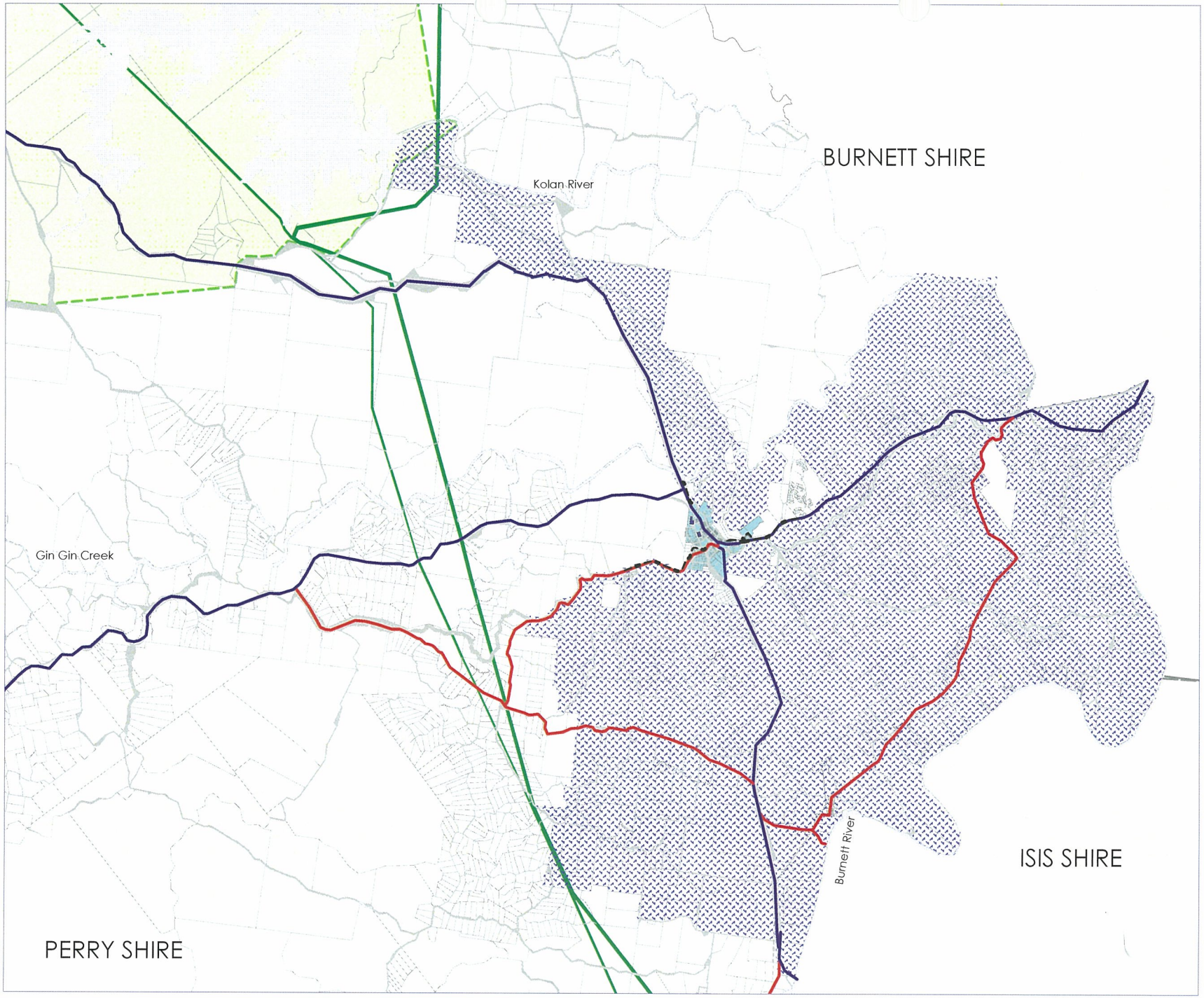
The information shown on this map is based on a limited study area for the "Burnett Shire Flood Line and Storm Surge Study" completed by a third party on behalf of the Council. Council does not warrant its accuracy or suitability for any purpose other than to identify risk areas for further investigation during development assessment under this planning scheme. The map does not purport to show flood inundation information.
Individual development sites may contain areas that are subjected to periodic inundation without being so indicated on this map. Burnett Shire Council reserves the right to request further information regarding a flood or storm surge in order to ascertain whether proposed development creates or worsens risk associated with a potential natural hazard.

Planning Scheme Maps
Natural Hazard Areas
FLOOD STORM TIDE RISK AREA
Map Ref:

NHA2.2

Commencement Date:
31 May 2006


1% AEP (100 Year ARI) Flood Study
High Hazard (dV >= 0.6)
Low Hazard
Apple Tree Creek
Apple Tree Creek
NORTH
0
0.5
1
kilometres
ISIS SHIRE COUNCIL
Isis Shire
Natural Hazards Overlay
Map3
Flood Management
Mapping prepared: 26/05/2006
Isis Shire Planning Scheme commenced: 19/02/2007



Kolan Shire Council

NOTES

The State of Queensland (Department of Natural Resources Mines and Energy) 2004. The Department of Natural Resources, Mines and Energy gives no warranty in relation to the data (including accuracy, reliability, completeness or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data.

INFRA 1.1	INFRA 1.2	
INFRA 1.3	INFRA 1.4	
	INFRA 1.5	

LEGEND

- Irrigation Area
- State Controlled Roads
- Principal Local Government Roads
- Walking and Cycling Tracks
- Powerlink Corridors
- Town Service Area
- Fred Haigh Dam Declared Catchment Area
- Property Boundaries
- Flood and Drainage Liability
- Stock Routes
- Water
- Roads

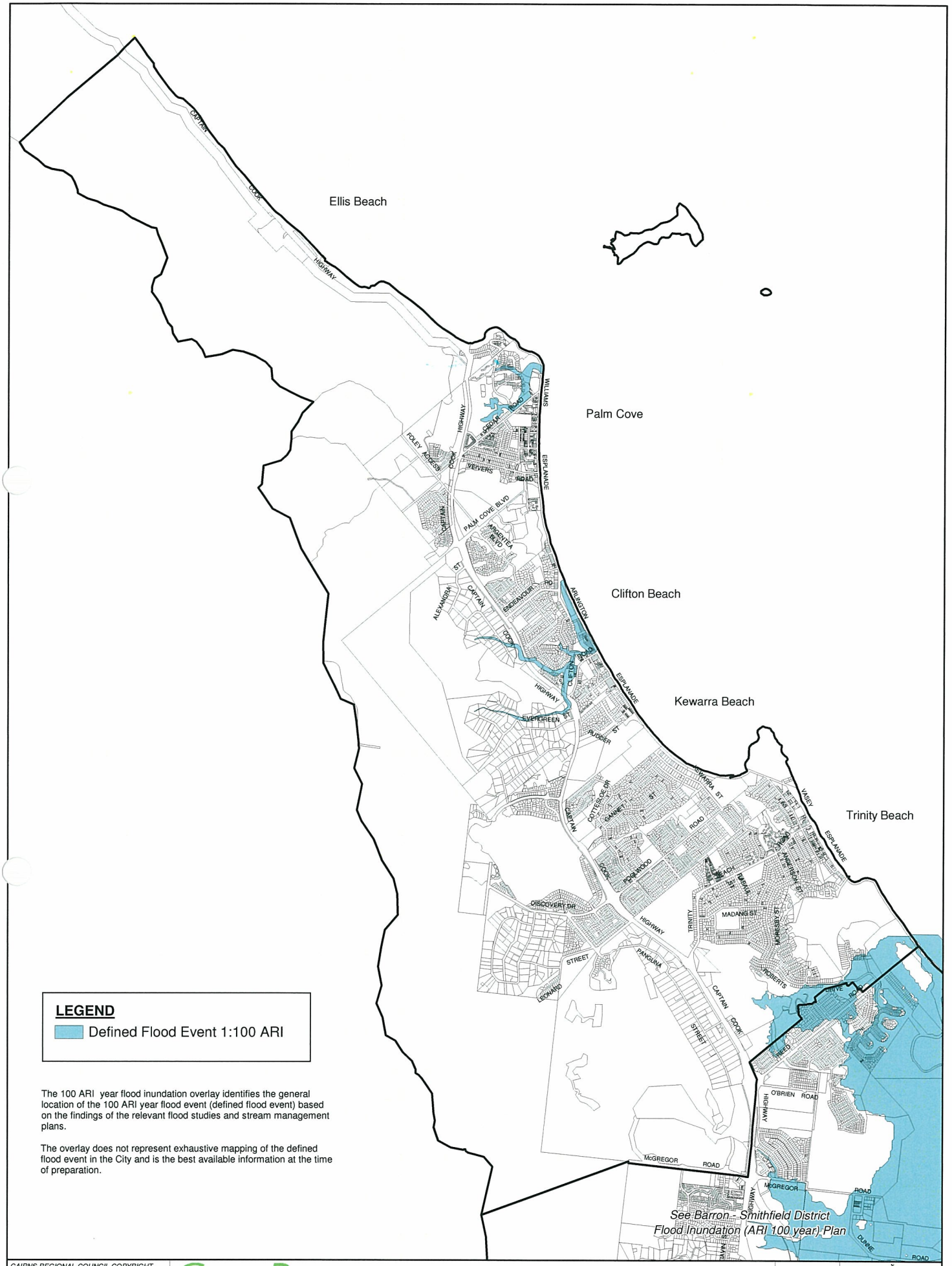
N W E S

1 0 1 2 3 4 5 km

Planning Scheme Maps
Infrastructure Overlay
Map Ref:

INFRA 1.4

Commencement Date
26 April 2006



LEGEND

Defined Flood Event 1:100 ARI

The 100 ARI year flood inundation overlay identifies the general location of the 100 ARI year flood event (defined flood event) based on the findings of the relevant flood studies and stream management plans.

The overlay does not represent exhaustive mapping of the defined flood event in the City and is the best available information at the time of preparation.

NOT TO SCALE

P.O. Box 359
Cairns, Qld., 4870
Tel: (07) 4044 3044
Fax:(07) 4044 3022

CAIRNS PLAN
Planning Scheme for the City of Cairns

Cairns Regional Council

Cairns Beaches District Plan
Flood Inundation (ARI 100 year) Overlay

Cairns Regional Council

Q100_All.WOR

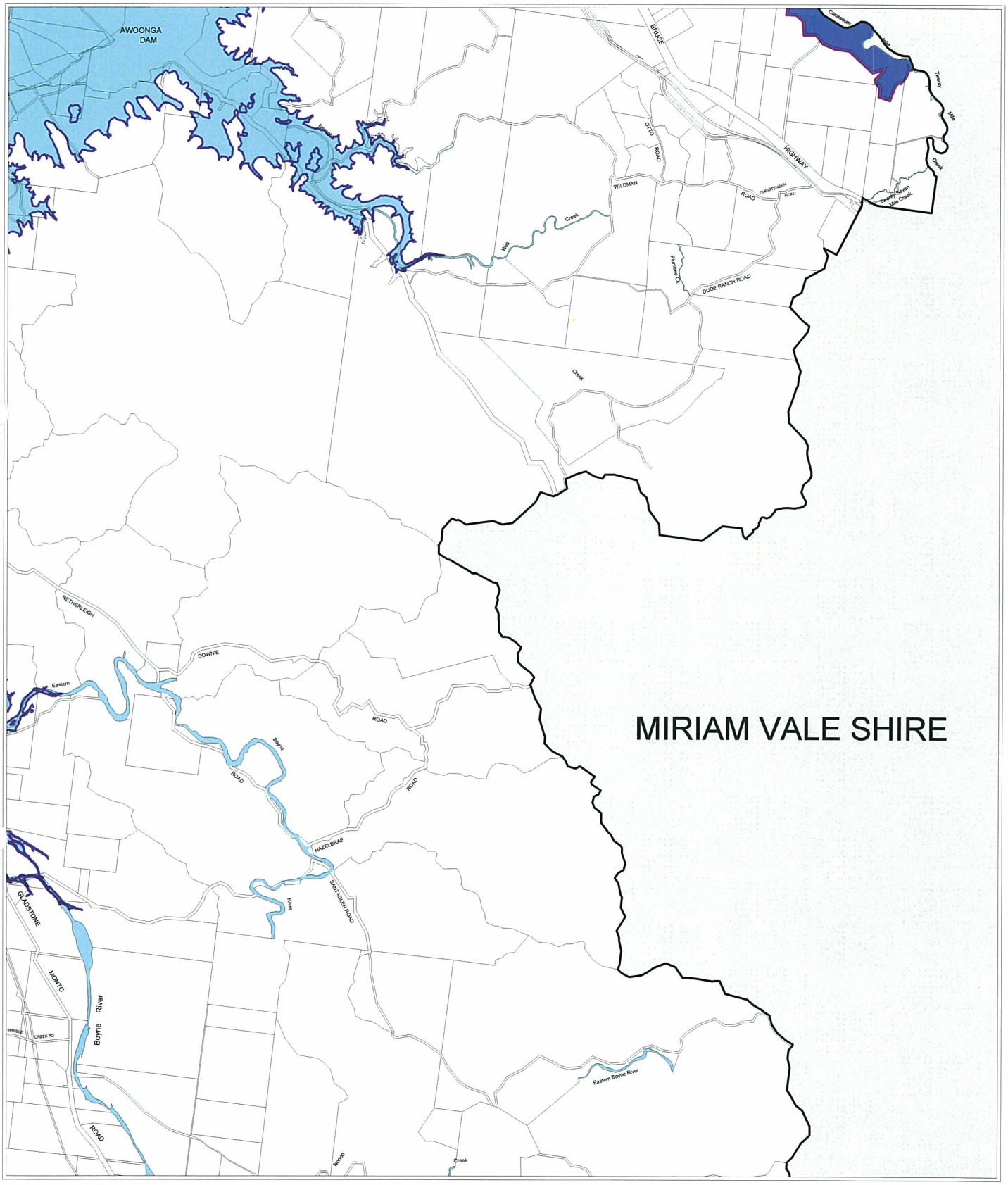
Commencement Date:	Mar 2009
Amendment Date:	

CALLIOPE SHIRE COUNCIL PLANNING SCHEME

SERIES 07

FLOOD INUNDATION MANAGEMENT OVERLAY

SHEET No. 16



PRODUCED BY CALLIOPE SHIRE COUNCIL
DEVELOPMENT SECTION

Data Source:
© Calliope Shire Council 2006. In consideration of Calliope Shire Council permitting use of this data you acknowledge and agree that Calliope Shire Council gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accept no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.

© The State of Queensland (Department of Natural Resources and Water) 2006. In consideration of the State and permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accept no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.

Flood data provided by Calliope Shire Council. (Current as at October 2004).

LEGEND

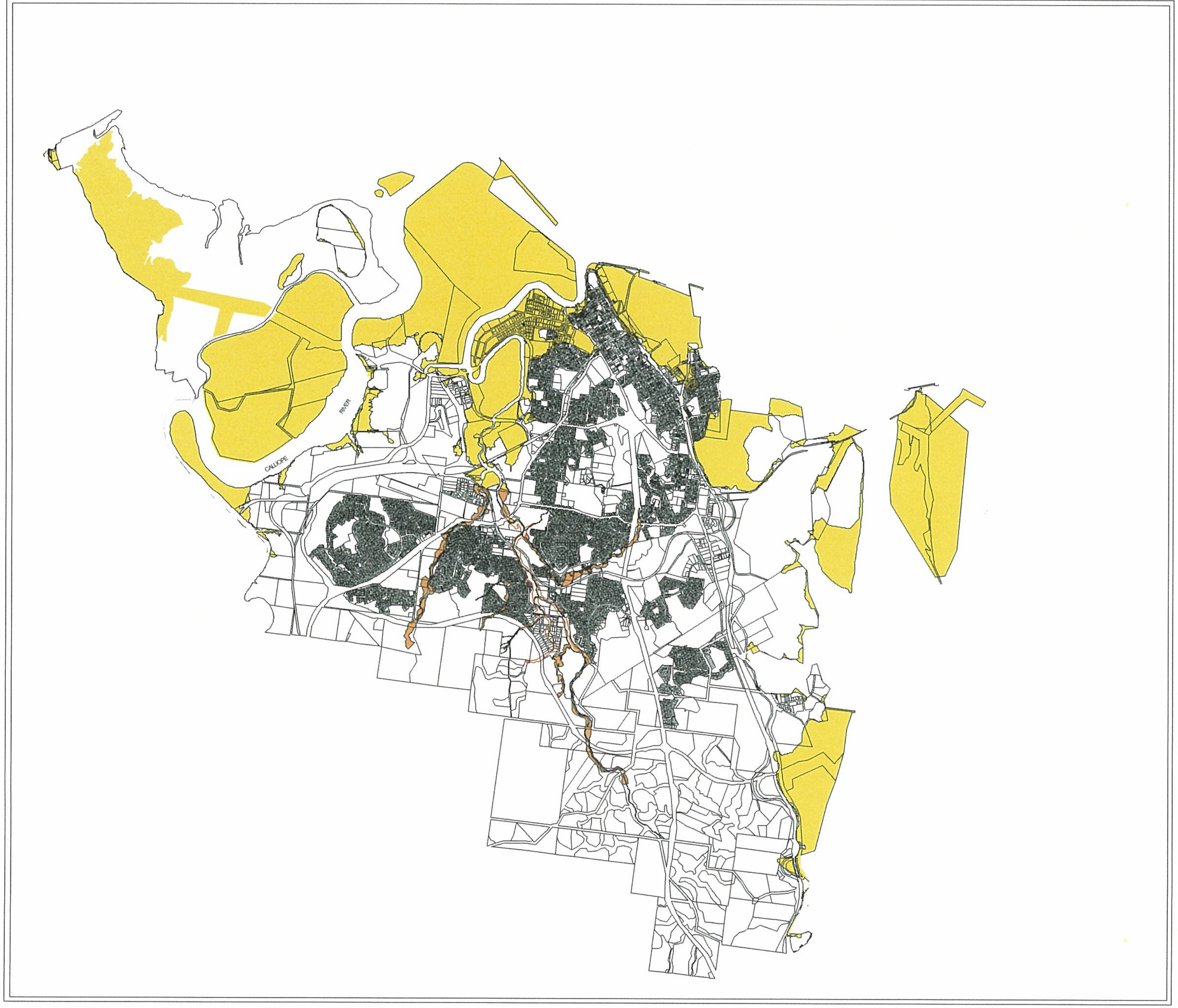
- STORM SURGE
- WATER (OCEAN/RIVER/CREEK)
- FLOOD RISK LINE
- SHIRE BOUNDARY
- AWOONGA DAM FULL SUPPLY LEVEL RL 40m AHD - SUPPLIED BY GAWB

1000 0 1000 2000 m

Scale: 1:80,000

GDA

CALLIOPE SHIRE COUNCIL



GLADSTONE CITY COUNCIL PLANNING SCHEME

REGULATORY PLAN 1

FLOOD & STORM SURGE MAPPING FOR A 100 YEAR ARI (1% AEP)

Sheet 1 of 1

LEGEND

- Probable River/Creek Flood Extents (100 Year ARI)
- Storm Tide Surge Extents (4m AHD or 100 Year ARI)
- Unknown Extent of Flooding (Lack of Information)
- Water (Ocean/River/Creek)

Scale 1:50,000

1000 0 1000 2000 3000 4000 5000 m

Map Version 1
Map Revision E
Map Produced 07/12/2006

NORTH

While every care has been taken in the compiling of this map Gladstone City Council declares that the map was prepared solely for the council's strategic planning purposes. Gladstone City Council does not accept liability for any loss or damage which any person may suffer arising from any inaccurate information (actual or potential) or misstatement actual or potential) contained in it. Gladstone City Council does not accept responsibility to any person for the contents of this map.

This flood map does not in itself indicate whether any property has or has not been affected by floods. That conclusion requires separate interpretation or measurement.

Areas of potential flood inundation shown on this map have been compiled from various sources and hydraulic reports available at the date of issue. While some of the inundation areas are based on computer hydraulic modelling of standard floods used for planning purposes, the information used to calibrate such models is usually based on reported flood marks which are often widely spaced and may not have been recorded at a particular floods peak level.

Based on cadastral data provided with the permission of the Department of Natural Resources & Mines.

DISCLAIMER

While every care is taken to ensure the accuracy of this data, the Gladstone City Council makes no representations or warranties about the data accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and liability for all expenses, losses, damages and costs which you might incur as a result of using this data.

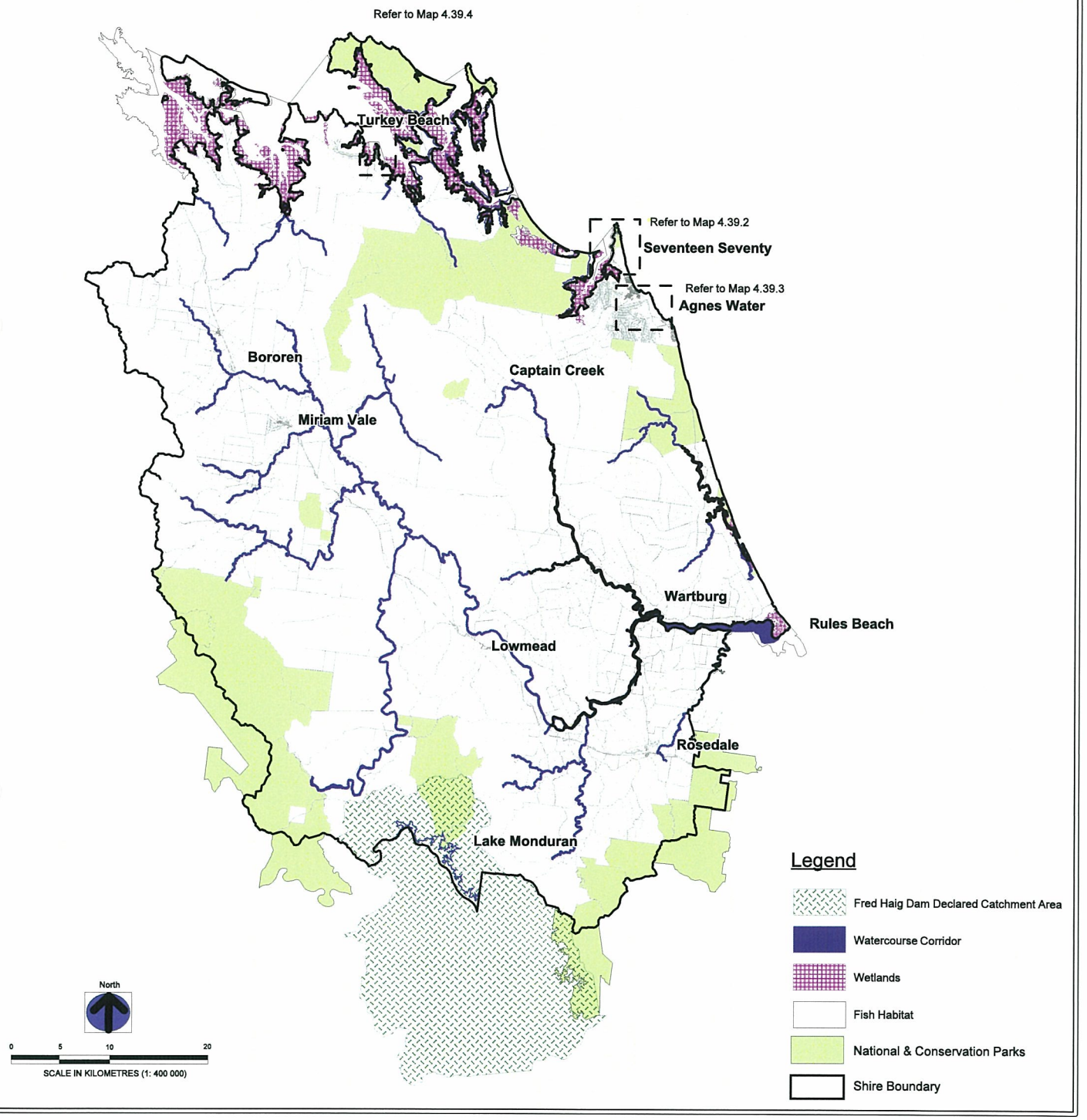
The Cadastre and other information shown on this plan is approximate only and should not be considered as more than indicative only.

The information shown on this plan has been collected for Gladstone City Council internal purposes only and should not in any way be considered survey accurate. This plan should only be used for the purpose that it was intended for.

GDA

Gladstone City Council

ENVIRONMENTAL MANAGEMENT OVERLAY



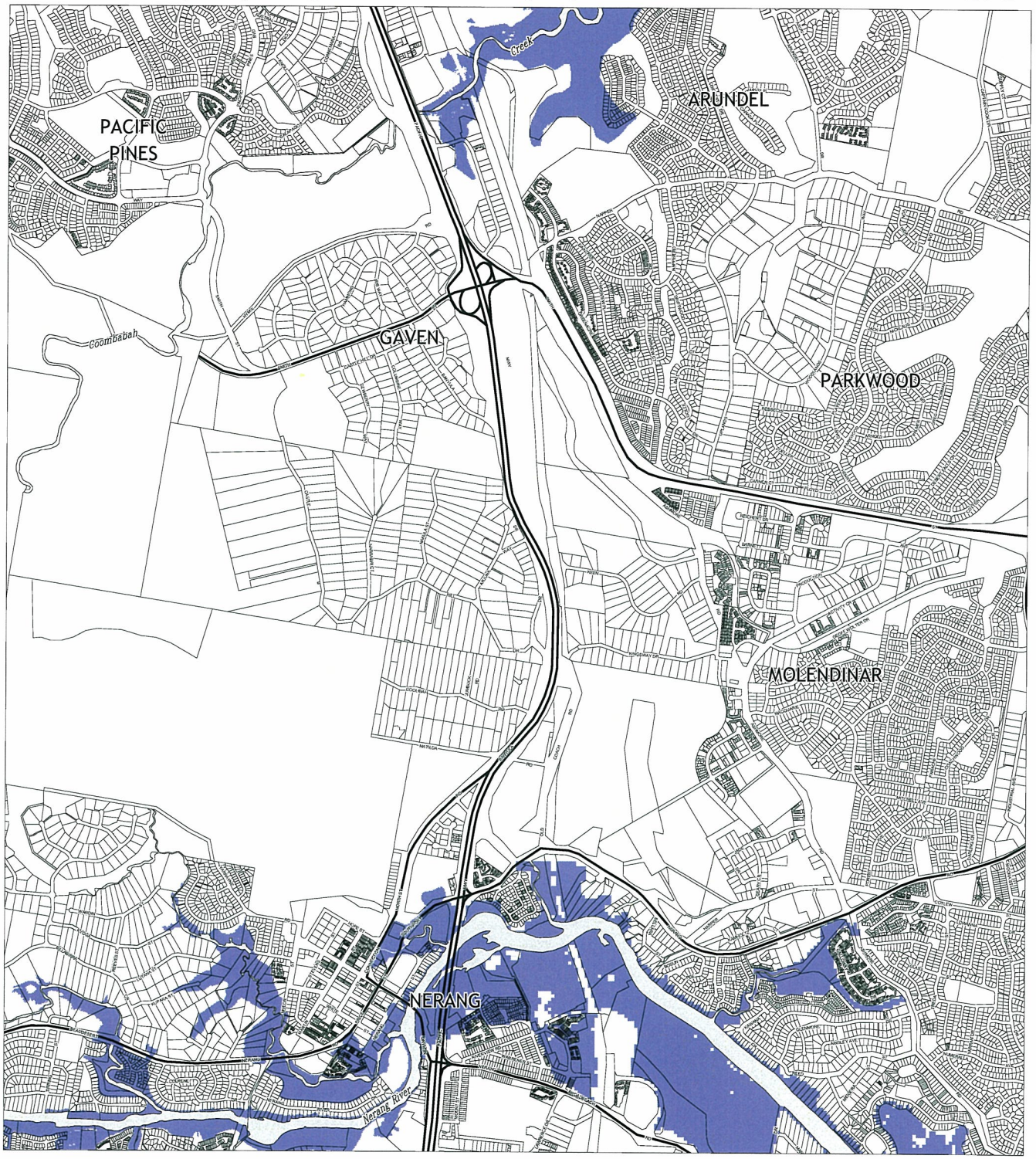
GLADSTONE REGIONAL COUNCIL

Miriam Vale Shire Planning Scheme Map 4.39.1

Commencement Date 27 February 2009

Natural Hazard (Flood) Management Areas - Overlay Map OM17-25

Ver. 1.2



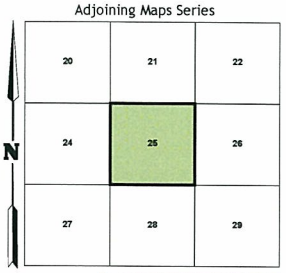
Legend

DESIGNATED FLOOD AFFECTED AREA

WATER BODY

500 0 500 1000 1500 m

Adjoining Maps Series

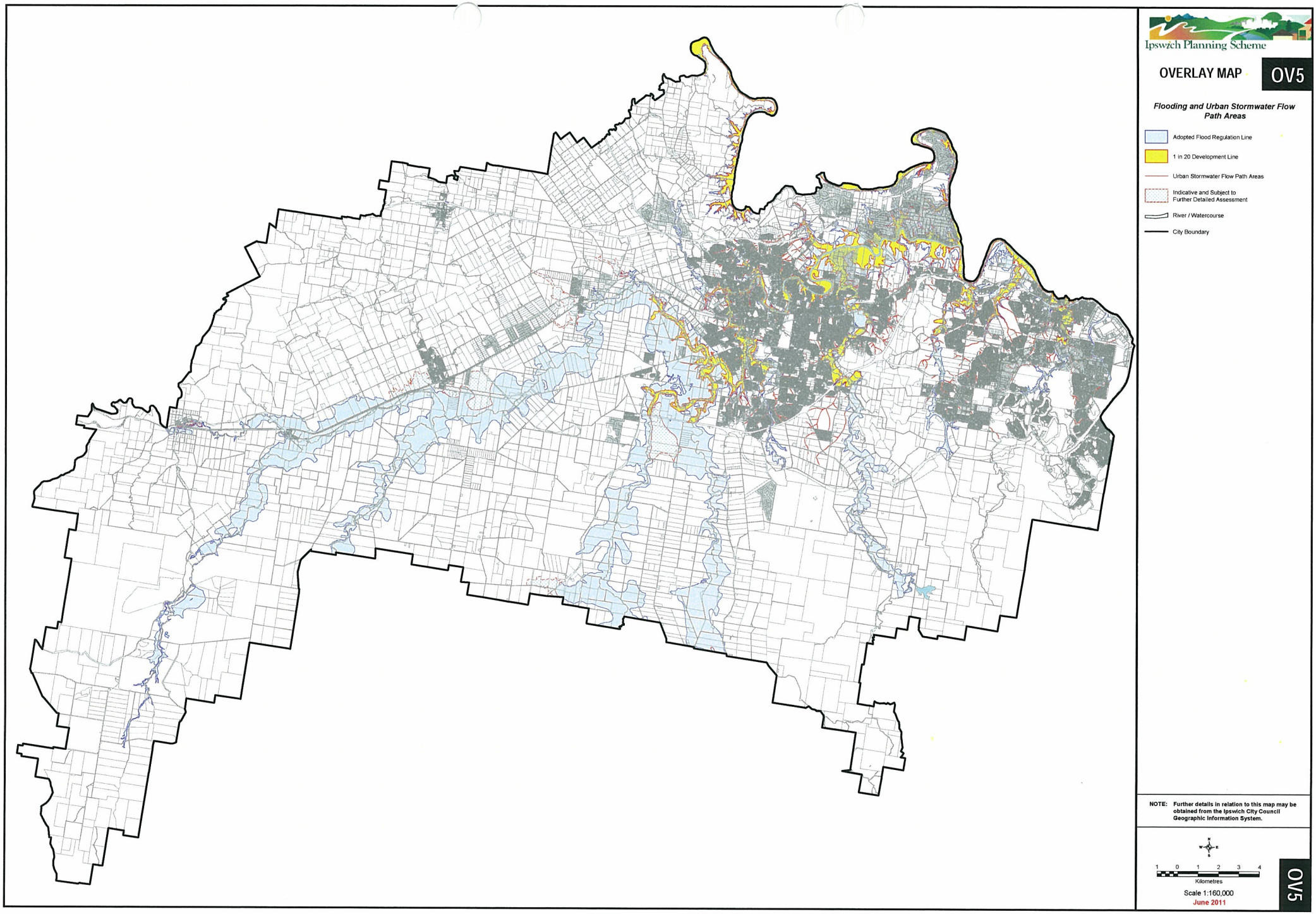


This flood map does not in itself indicate whether any property has or has not been affected by floods. That conclusion requires separate interpretation or measurement.

Areas of potential flood inundation shown on this map have been compiled from various sources and hydraulic reports available at the date of issue. Whilst some of the inundation areas are based on computer hydraulic modelling of standard floods used for planning purposes, the information used to calibrate such models is usually based on reported flood marks which are often widely spaced and may not have been recorded at a particular flood's peak level.

GDA

Gold Coast City Council



Ipswich Planning Scheme

OVERLAY MAP OV5

Flooding and Urban Stormwater Flow Path Areas

- Adopted Flood Regulation Line
- 1 in 20 Development Line
- Urban Stormwater Flow Path Areas
- Indicative and Subject to Further Detailed Assesment
- River / Watercourse
- City Boundary

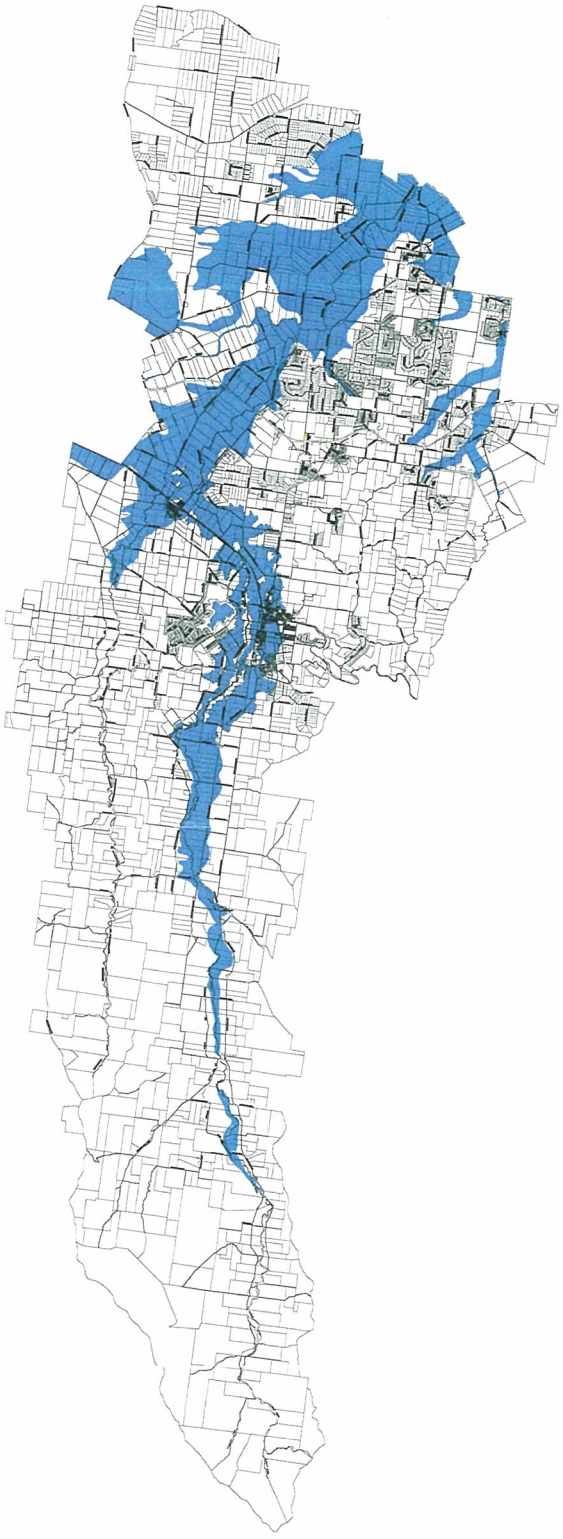
NOTE: Further details in relation to this map may be obtained from the Ipswich City Council Geographic Information System.

1 0 1 2 3 4
Kilometres

Scale 1:160,000

June 2011

OV5



Based on data provided with the permission of The Department of Natural Resources & Mines [DCDB] (11/01)

LAIDLEY
SHIRE COUNCIL

Laidley Shire Planning Scheme

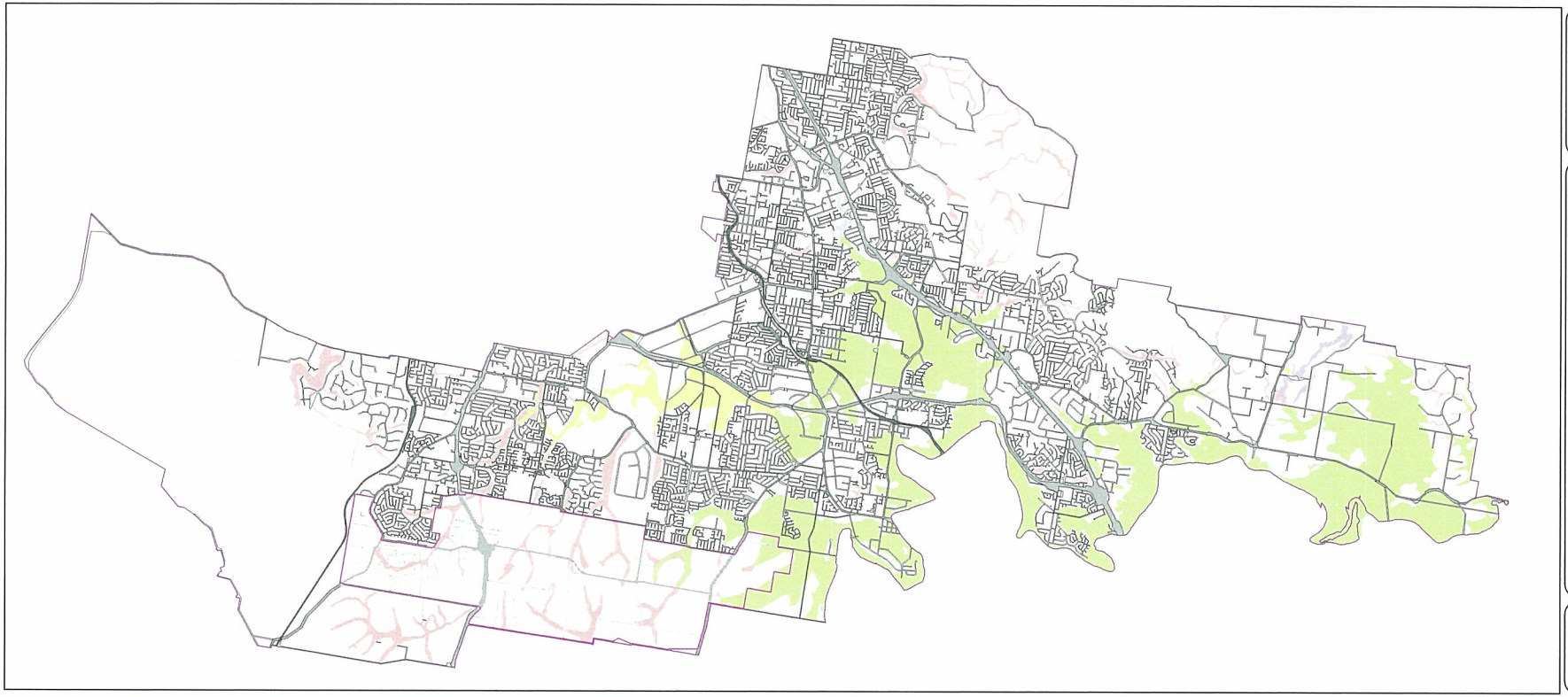
OVERLAY MAP: AREAS OF NATURAL AND ENVIRONMENTAL SIGNIFICANCE

FLOOD INUNDATION AREAS

Scale

Revision 1

Map No. **F**



OL Map 2

FLOOD PLAIN MANAGEMENT AREA

1 - Prescribed Flood District
2 - Logan River District
3 - Scrubby Creek District
4 - Slacks Creek District
5 - Native Dog Creek District

PARK RIDGE SCHEME AMENDMENT AREA

Endorsed by Council on 25 January 2011

A boundary specified in this planning scheme map is to be determined in accordance with section 1.4.10 (Interpretation of planning scheme maps).

1 0 1 2 3
Kilometres

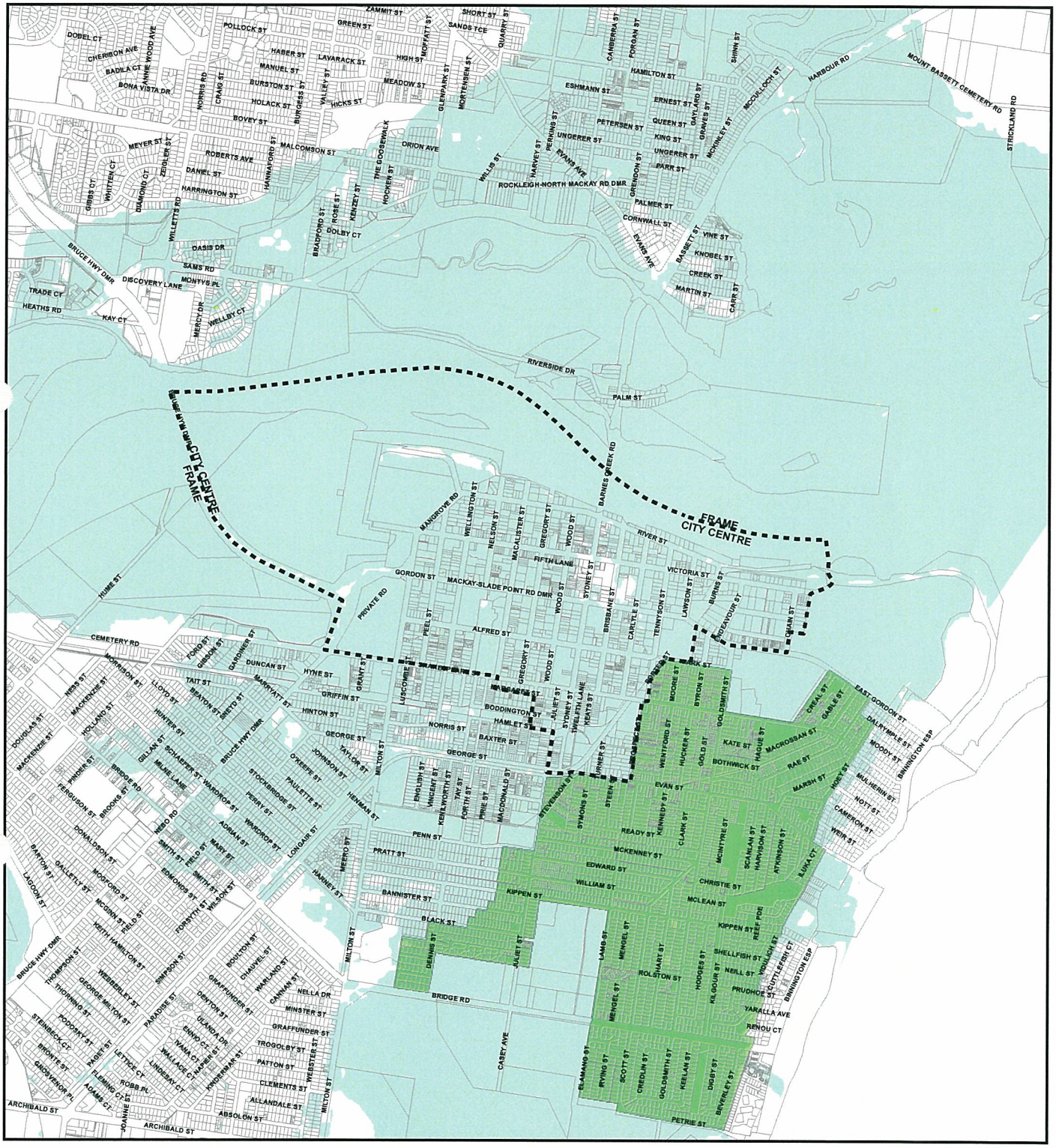
Scale: 1:60,000

LOGAN PLANNING SCHEME 2006
AMENDMENT INSTRUMENT 2009 NO 5.

LOGAN CITY COUNCIL

Mackay City Council Planning Scheme

FLOOD & INUNDATION MANAGEMENT OVERLAY



PRODUCED BY MACKAY REGIONAL COUNCIL - GIS SECTION

Based on Cadastral Data provided with the permission of the Department of Natural Resources & Water. (Current as at July 2008)

Locality Boundaries

Extent of Overlay

Self Assessable Category - Dwelling House

Limit of Inundation relates to Riverine flooding only

The limit of inundation is generally based on the 1% AEP (100 year ARI) flood level

THE FLOODING INFORMATION IS INDICATIVE ONLY AND SHOULD NOT BE USED FOR ANY OTHER PURPOSE OTHER THAN FOR PLANNING SCHEME INTERPRETATION. (This information refers to riverine flooding only)

0 200 400 600 800 1,000

Metres

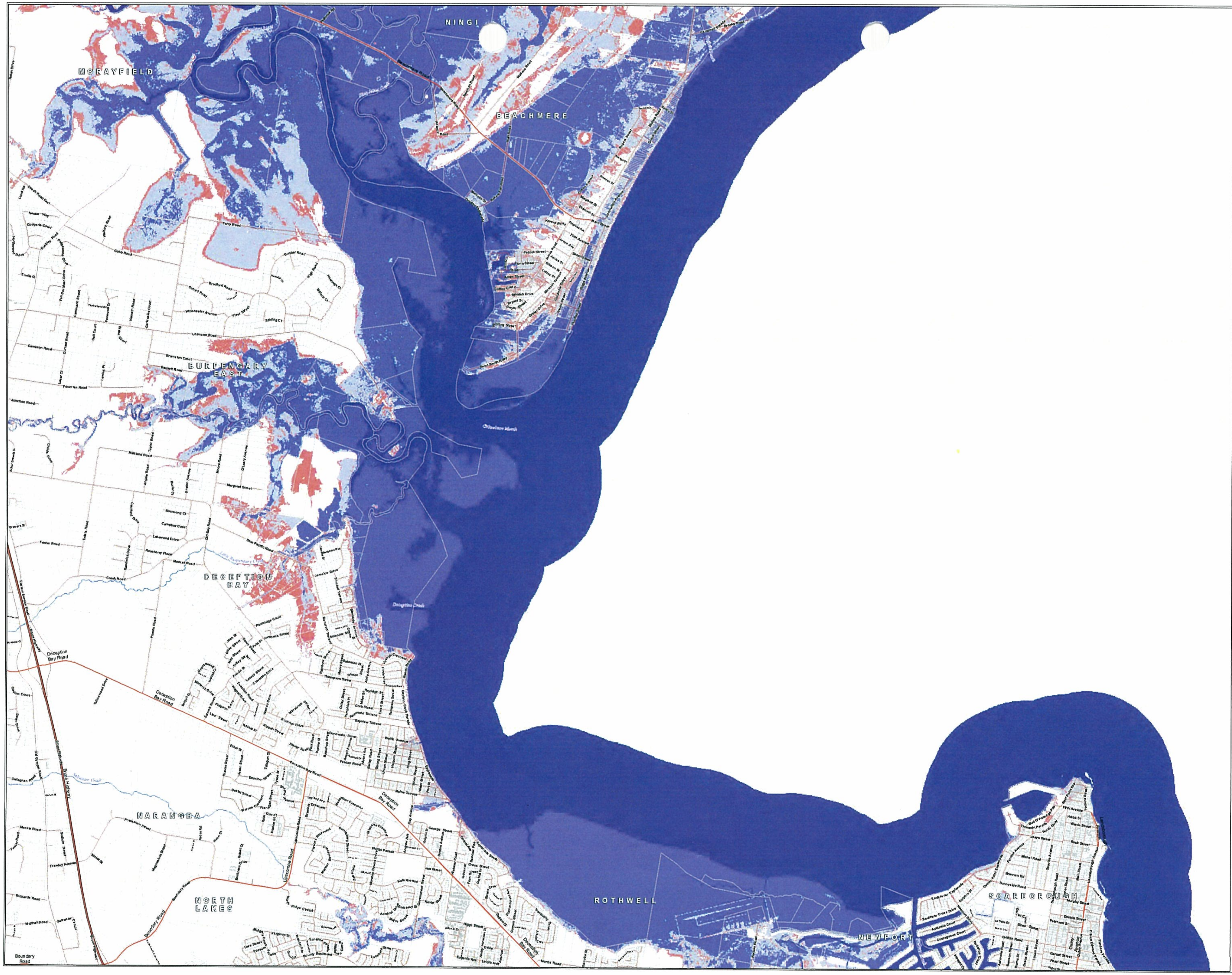
N

Mackay REGIONAL COUNCIL

Series 31 - City Centre

Amendments took effect on 24 April 2009

Apr 22, 2009



Moreton Bay Regional Council

Areas of Potential Inundation During a '1 in 100 Year' Storm Tide Flood

Map 13 of 18

Approximate Flood Depth

- 0 - 0.5m
- 0.5 - 1.5m
- 1.5m Plus
- Possible Future Extent

Key to Map Features

- Property Boundaries
- Major Streams
- Motorway
- Major Roads
- Significant Roads
- Roads
- Railway

Important Advisory Notes and Disclaimers:

1. The information provided on these plans illustrates the potential extent of inundation of the ground surface during a '1 in 100 year' flood. A '1 in 100 year' flood is a flood event that has a 1 in 100 chance of occurring in any 1 year. It is a large flood that is currently used as the standard measure for setting flood controls on properties in the Moreton Bay Region. Many other councils throughout Australia have also adopted the '1 in 100 year' flood as their standard measure for the same purpose. Over a 100 year period, it is likely that such an event will be observed at the location shown at least once. It is also possible, though less likely, that a '1 in 100 year' flood or even greater flood could occur more than once over a 100 year period.

2. Moreton Bay Regional Council makes no representation and gives no warranty about the accuracy, reliability, completeness or suitability for any particular purpose of the data shown on these plans. To the full extent that it is able to do so in law, the Council disclaims all liability, (including liability in negligence), for losses and damages, (including indirect and consequential loss and damage), caused by or arising from anyone using or relying on the data for any purpose whatsoever.

3. The information provided on these plans is extracted from the Council's flood study for the area. Changes in catchment and floodplain conditions since the study was prepared could alter the extent of inundation experienced. Future studies may also change or qualify the information provided on these plans.

4. The extent of inundation shown on these plans was calculated using the Council's ground surface elevation data, which has known accuracy limitations. The extent of inundation shown on these plans should therefore be considered approximate only, particularly if the property is flat near the limit of the inundation shown. If the property was created as part of a subdivision but is identified as being inundated this may be because the land surface was modified.

5. The areas of blue shading shown on the plan represent areas potentially subject to inundation during a 1 in 100 year storm tide under current climatic conditions. The area of pink shading shows those additional areas that could also become inundated during a 1 in 100 year storm tide under a possible future climate condition where global warming increases the intensity of cyclone activity in the Moreton Bay Region. This additional area does not include the effects of sea level rise.

6. The information provided does not relate to or take into account localised areas of inundation resulting from overland runoff from adjacent properties or when the capacity of street or local drainage systems is exceeded. In such circumstances, runoff will pond or flow to the lowest point and flow overland via the lowest available route.

7. Copyright in the spatial data shown on these plans is owned by Moreton Bay Regional Council and the Department of Environment and Resource Management.

8. You may obtain a more comprehensive flood search by contacting the Council on (07) 3205 0555 to request a flood search request form or by referring to the following Council website link www.moretonbay.qld.gov.au/floodplains.

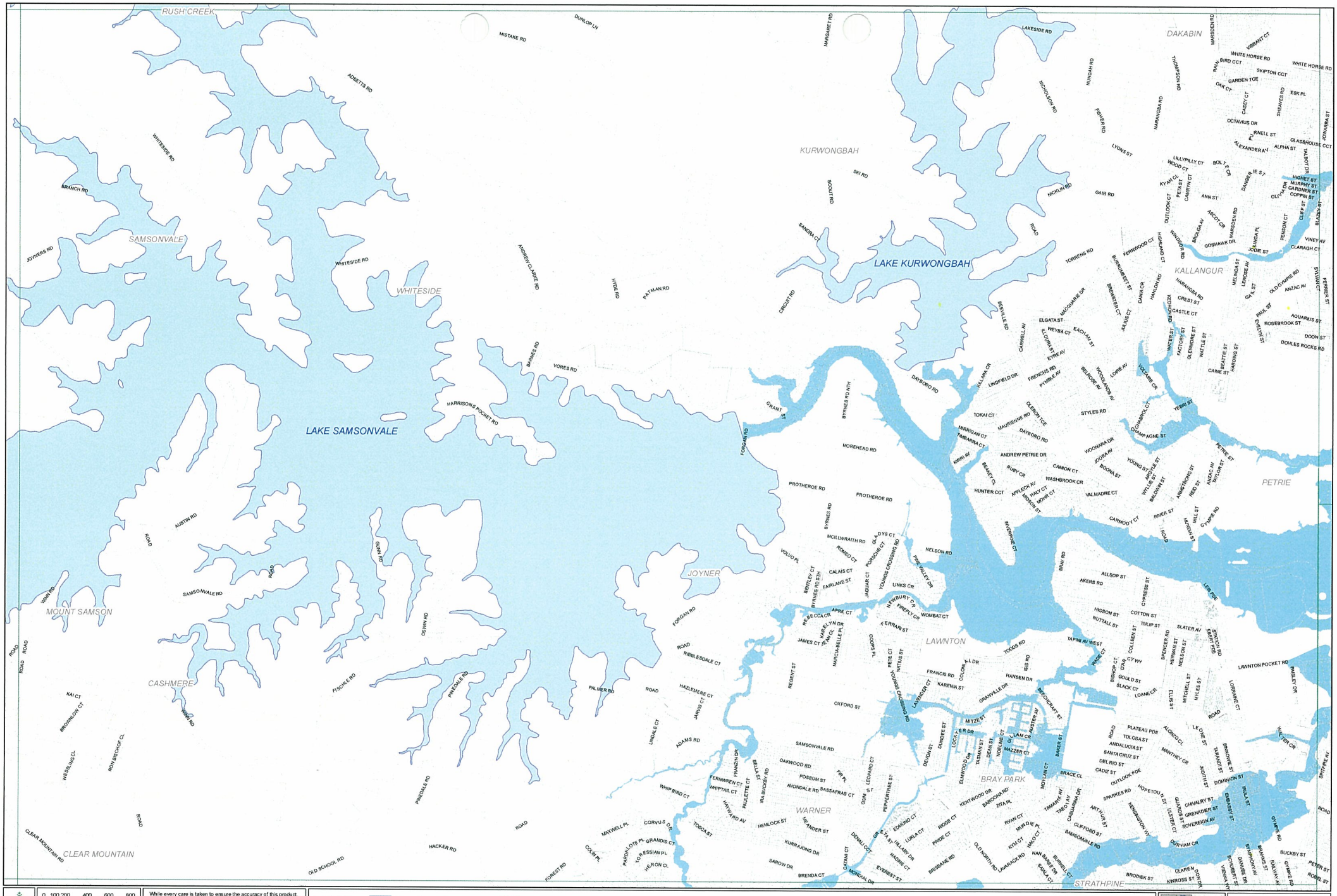
Map 1	Map 2			
Map 3	Map 4	Map 5	Map 6	
Map 7	Map 8	Map 9	Map 10	
	Map 11	Map 12	Map 13	
	Map 14	Map 15	Map 16	
	Map 17	Map 18		

N W E S

Moreton Bay Regional Council
PO Box 159 CABOOLTURE QLD 4510
Ph: (07) 3205 0555, Fax: (07) 3205 0599
Email: mbrc@moretonbay.qld.gov.au
Web: www.moretonbay.qld.gov.au

0 250 500 750 1,000
Metres

Date: 1 Sept 2011 | Scale: 1:20,000 (at A1)



0 100 200 400 600 800
Metres

Legend

- Plan Boundary
- Parcel Boundaries
- Lakes
- Flood Management Area

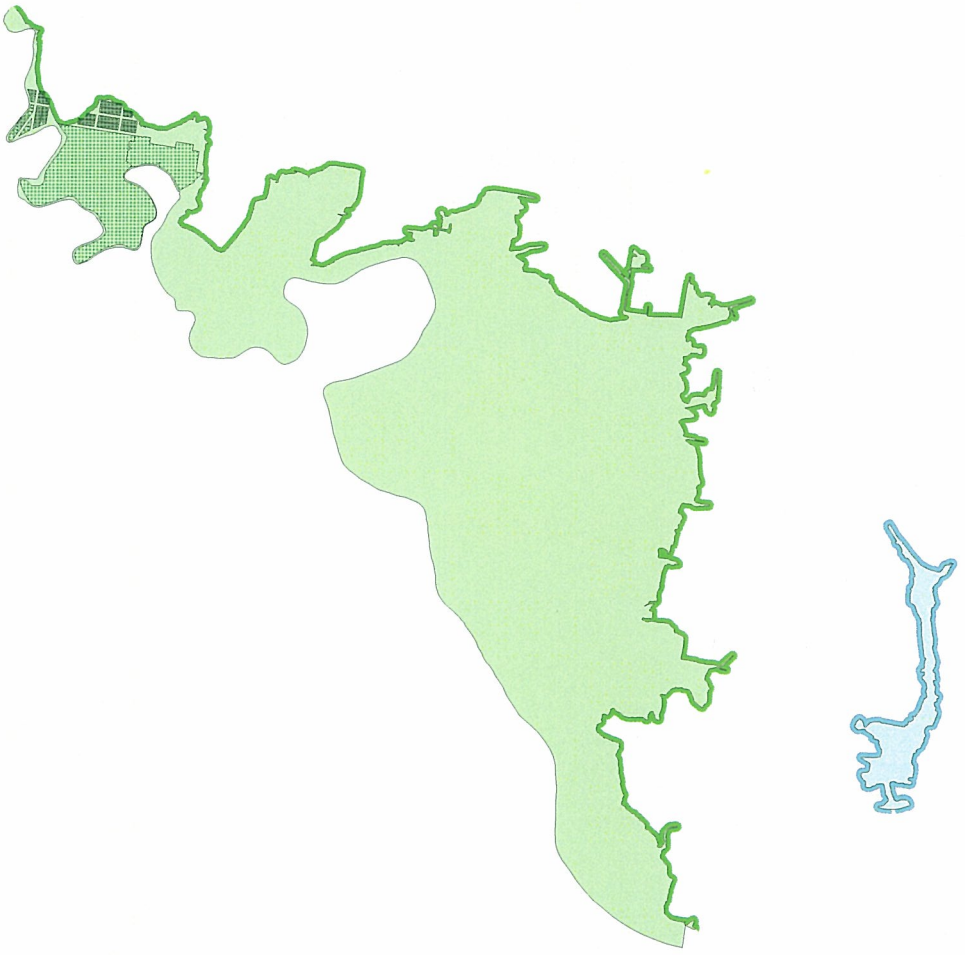
2.2	3.2	4.3
	3.3	4.4
2.4	3.4	
2.5	3.5	

PineRiversPlan

OVERLAY CODE MAP 8
MAJOR FLOOD EVENTS

Effective from 15 December 2008

MAP 3.3 Sheet 5 of 9



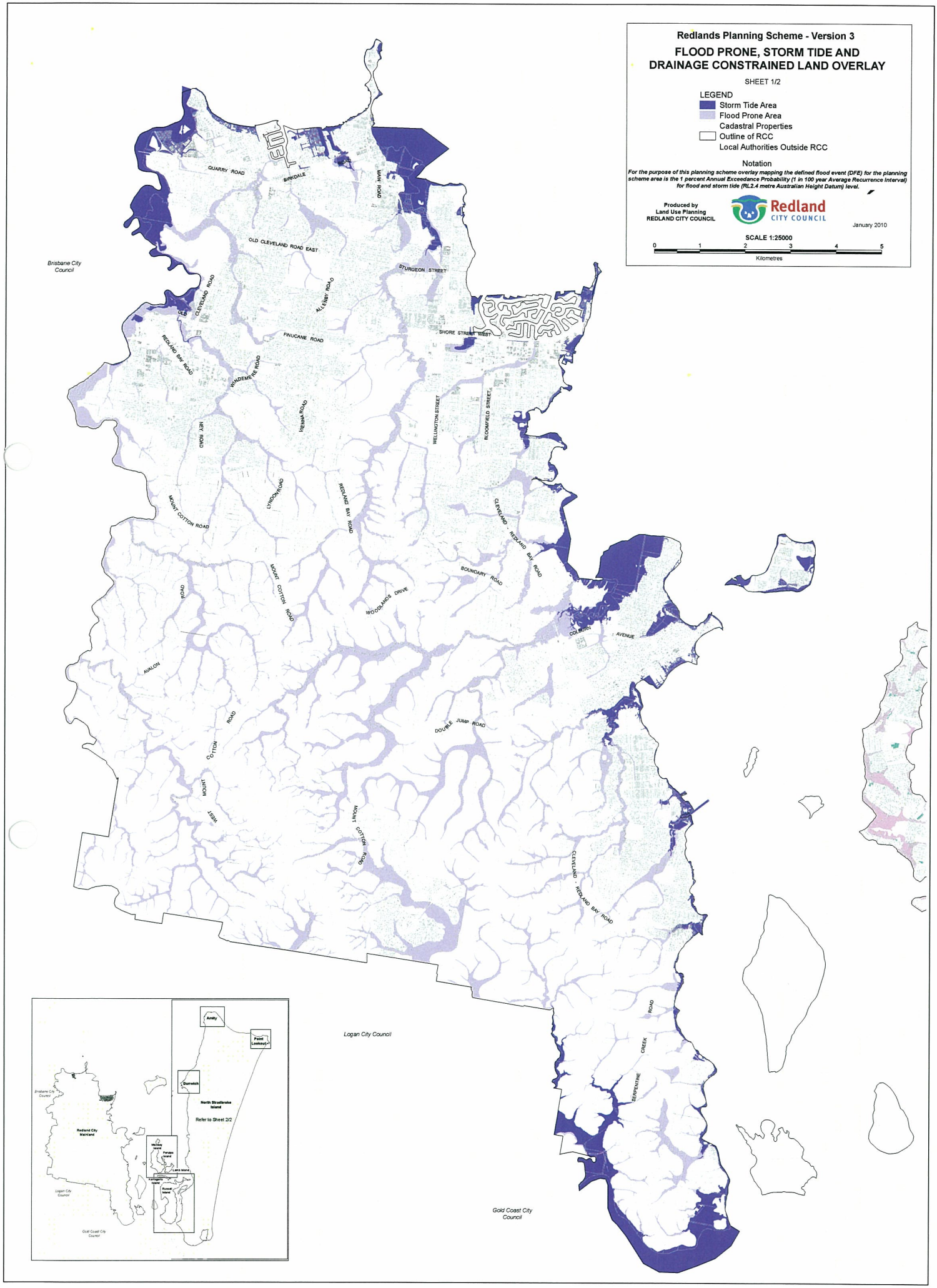
OVERLAY MAP 3
Drainage Problem Areas and Flooding
Consolidated map of drainage problem areas and Q100 flood level + 30m buffer

SCALE 1 : 35000

N
W E
S

Drainage Problem Areas
Q100
Saltwater Ck
Bells Ck
Bells Ck Q100 30m Buffer
Saltwater Ck Q100 30m Buffer
Property Outline

REDCLIFFE
CITY COUNCIL


Redlands Planning Scheme - Version 3
FLOOD PRONE, STORM TIDE AND DRAINAGE CONSTRAINED LAND OVERLAY
SHEET 1/2
LEGEND
Storm Tide Area
Flood Prone Area
Cadastral Properties
Outline of RCC
Local Authorities Outside RCC
Notation
For the purpose of this planning scheme overlay mapping the defined flood event (DFE) for the planning scheme area is the 1 percent Annual Exceedance Probability (1 in 100 year Average Recurrence Interval) for flood and storm tide (RL2.4 metre Australian Height Datum) level.
Produced by
Land Use Planning
REDLAND CITY COUNCIL
Redland CITY COUNCIL
January 2010
SCALE 1:25000
0 1 2 3 4 5
Kilometres
Brisbane City Council
Logan City Council
Gold Coast City Council
QUARRY ROAD
BIRKDALE
MAIN ROAD
OLD CLEVELAND ROAD EAST
STURGEON STREET
CLEVELAND ROAD
ALLENBY ROAD
SHORE STREET WEST
FINUCANE ROAD
REDLAND BAY ROAD
WINDEMERE ROAD
VIENNA ROAD
WELLINGTON STREET
BLOOMFIELD STREET
NEIL ROAD
LYNDON ROAD
MOUNT COTTON ROAD
CLEVELAND - REDLAND BAY ROAD
BOUNDARY ROAD
WOODLANDS DRIVE
COLBURN AVENUE
AVALON ROAD
DOUBLE JUMP ROAD
COTTON ROAD
MOUNT WEST
SERPENTINE CREEK ROAD
Amity
Point Lookout
Dunwich
North Stradbroke Island
Refer to Sheet 2/2
Redland City Mainland
Moreton Island
Peel Island
Lamb Island
Karragarra Island
Russell Island

Redlands Planning Scheme - Version 3

FLOOD PRONE, STORM TIDE AND DRAINAGE CONSTRAINED LAND OVERLAY

SHEET 2/2

LEGEND
- Storm Tide Area
- SMBI Flood Prone and Storm Tide Area
- Drainage Constrained Land
- Cadastral Properties
- Outline of RCC
- Local Authorities Outside RCC

Notation

For the purpose of this planning scheme overlay mapping the defined flood event (DFE) for the planning scheme area is the 1 percent Annual Exceedance Probability (1 in 100 year Average Recurrence Interval) for flood and storm tide (RL2.4 metre Australian Height Datum) level.

Redland CITY COUNCIL
Produced by
Land Use Planning
REDLAND CITY COUNCIL

N

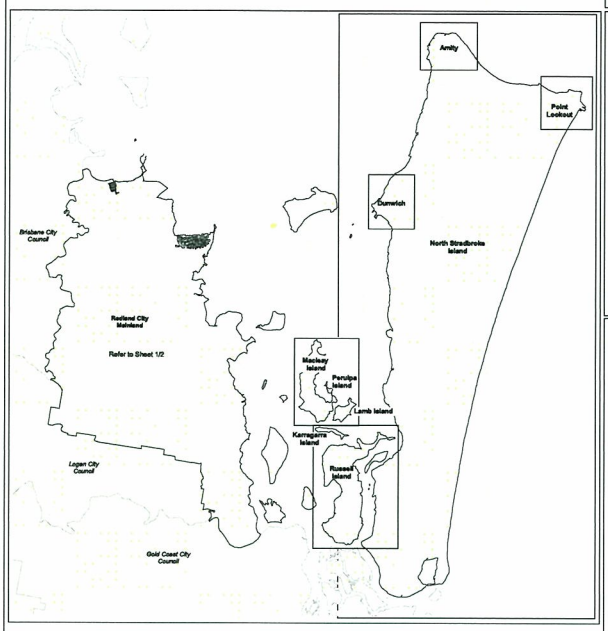
March 2010

NORTH STRADBROKE ISLAND

SCALE 1:75000

2000 0 2000 4000 6000

Metres



DUNWICH

SCALE 1:25000

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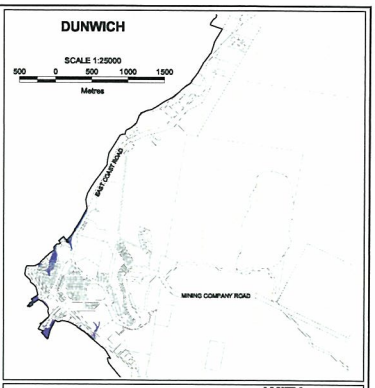
Metres



AMITY

SCALE 1:25000

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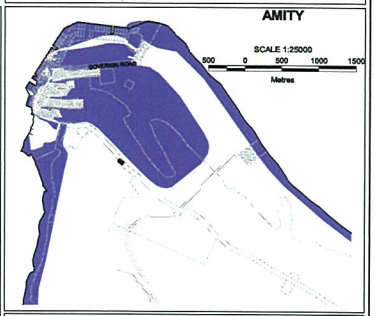
Metres



POINT LOOKOUT

SCALE 1:25000

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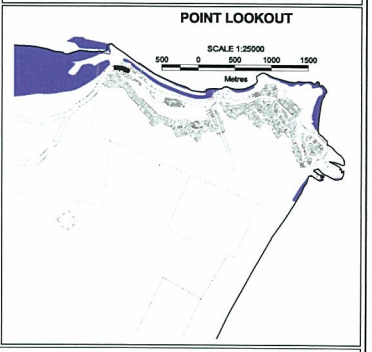
Metres

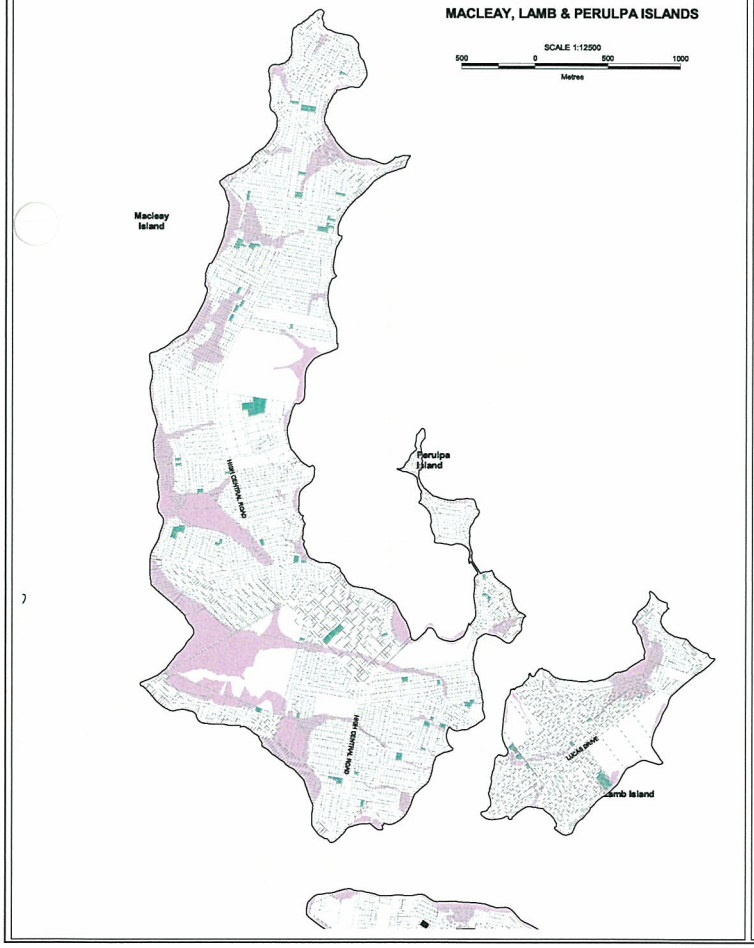


MACLEAY, LAMB & PERULPA ISLANDS

SCALE 1:12500

500 0 500 1000

Metres



RUSSELL & KARRAGARRA ISLANDS

SCALE 1:15000

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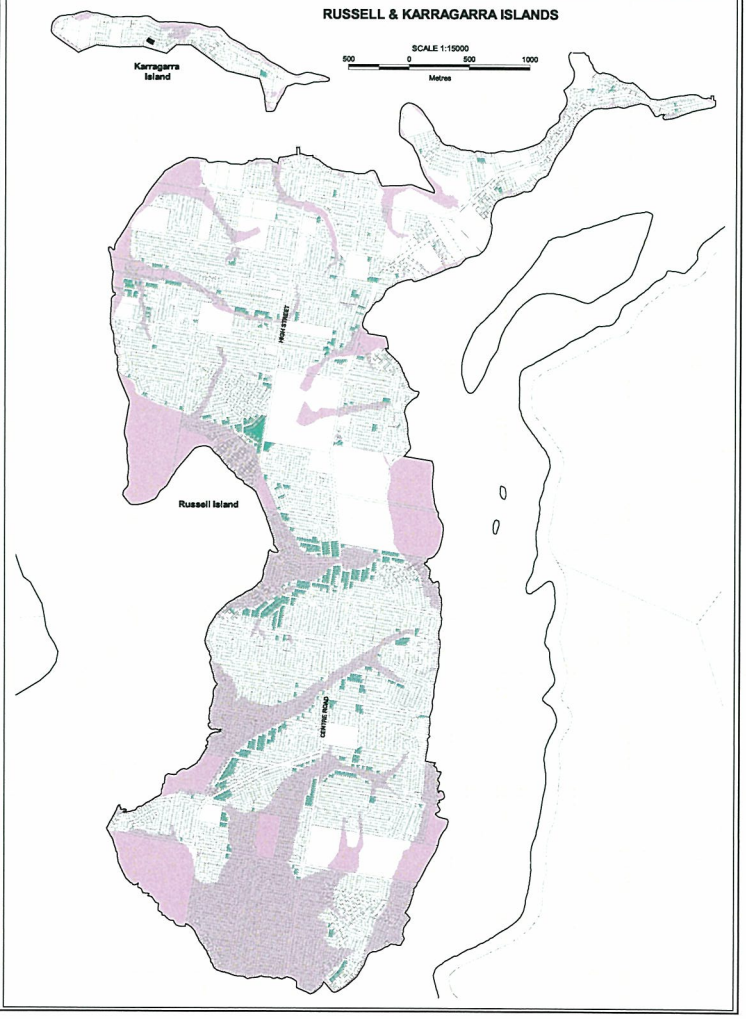
Metres



Fitzroy Shire Council

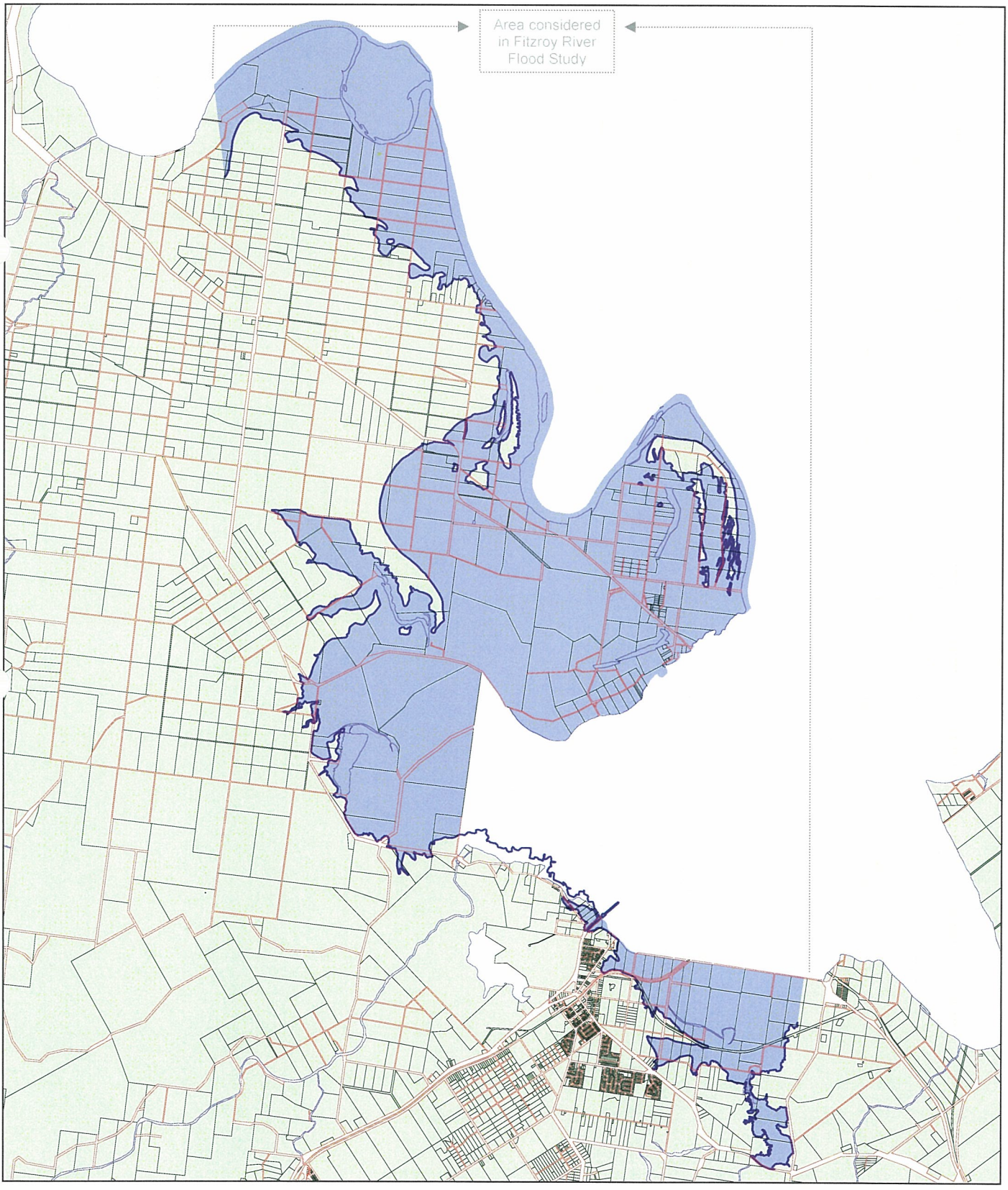
Map - B10

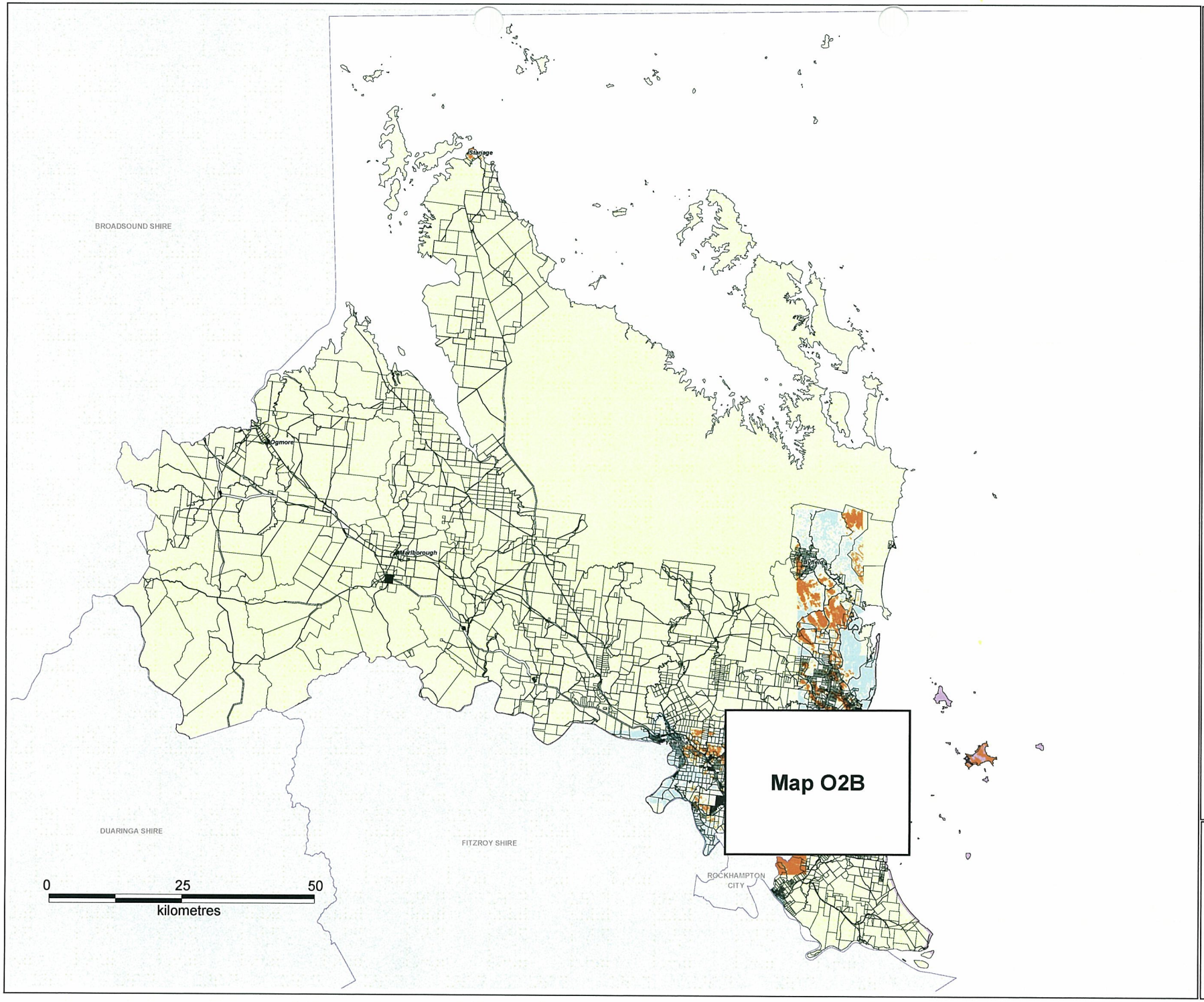
Flood Prone Land Overlay

LEGEND

— Flood Boundary

Flood Area





Special Management Areas

Known areas of:

- Drainage Problem
- Erosion Prone Land
- Steep Land

Areas in which data is unavailable:

In these areas land may be subject to drainage problem, excessive steepness or prone to erosion. Determination of these constraints would have to be confirmed through site survey.

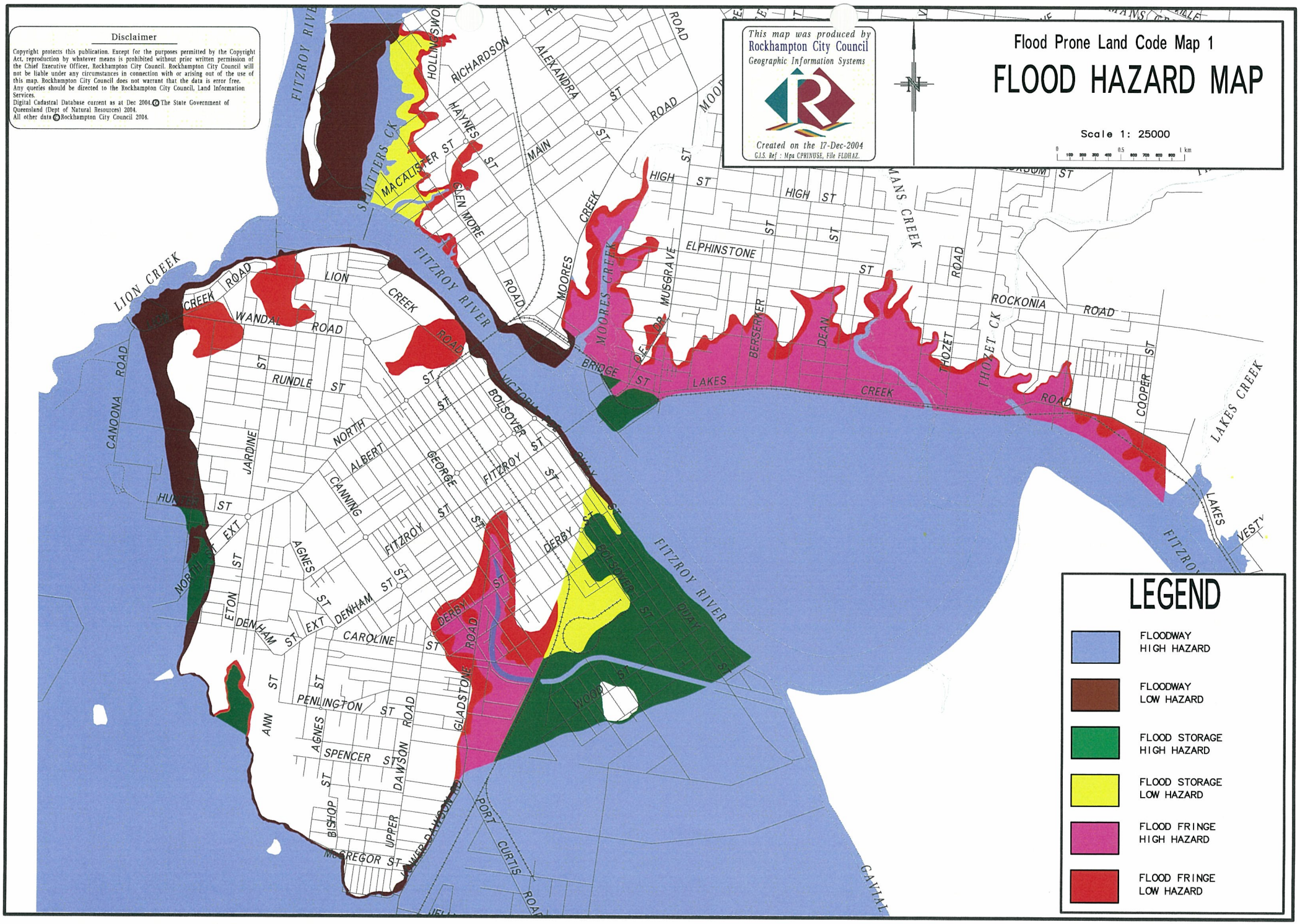
North

Source Information: GIS data supplied by Livingstone Shire, 2003.
Projection: AGD 84, Zone 56

Planning Scheme 2005
living for lifestyle

Overlay Map
O2A

Commencement date: 17 October 2005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Digital Cadastral Database current as at Dec 2004. © The State Government of Queensland (Dept of Natural Resources) 2004.
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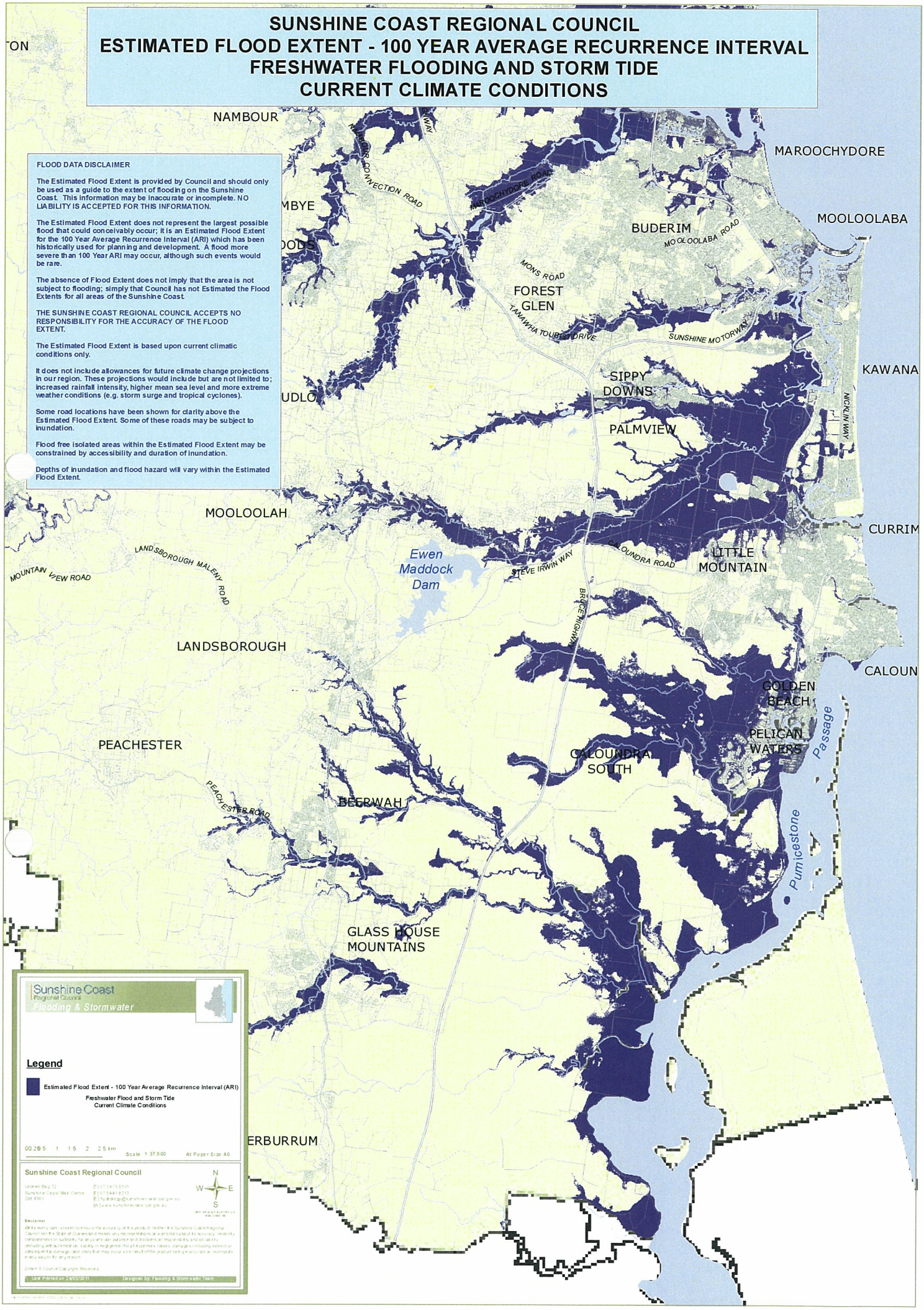
This map was produced by
Rockhampton City Council
Geographic Information Systems
Created on the 17-Dec-2004
G.I.S. Ref : Mpa CPRINUSE, File FLDHAZ.
Flood Prone Land Code Map 1
FLOOD HAZARD MAP
Scale 1: 25000
0 100 200 300 400 0.5 600 700 800 900 1 km
FITZROY RIVER
LION CREEK
CANOONA ROAD
LION CREEK ROAD
WANDAL ROAD
RUNDLE ST
NORTH ST EXT
HUNTER ST
JARDINE ST
ALBERT ST
CANNING ST
GEORGE ST
FITZROY ST
BOLSOVER ST
AGNES ST
ETON ST
DENHAM ST
DENHAM ST EXT
CAROLINE ST
DERBY ST
PENLINGTON ST
ANN ST
SPENCER ST
DAWSON ROAD
BISHOP ST
UPPER DAWSON RD
McGREGOR ST
GLADSTONE ROAD
QUAY ST
WOOD ST
PORT CURTIS ROAD
GAVIAL
SUTTERS CK
HOLLINGSWO
RICHARDSON
MACALISTER ST
HAYNES ST
GLEN MORE ROAD
ALEXANDRA ST
MAIN ST
MOORES CREEK
MOORES CREEK ROAD
HIGH ST
ELPHINSTONE ST
MUSGRAVE ST
BRIDGE ST
BERSERKER ST
DEAN ST
THOZET ROAD
THOZET CK
ROCKONIA ROAD
LAKES CREEK ROAD
COOPER ST
LAKES CREEK
LEGEND
FLOODWAY HIGH HAZARD
FLOODWAY LOW HAZARD
FLOOD STORAGE HIGH HAZARD
FLOOD STORAGE LOW HAZARD
FLOOD FRINGE HIGH HAZARD
FLOOD FRINGE LOW HAZARD

SUNSHINE COAST REGIONAL COUNCIL
ESTIMATED FLOOD EXTENT - 100 YEAR AVERAGE RECURRENCE INTERVAL
FRESHWATER FLOODING AND STORM TIDE
CURRENT CLIMATE CONDITIONS



FLOOD DATA DISCLAIMER

The Estimated Flood Extent is provided by Council and should only be used as a guide to the extent of flooding on the Sunshine Coast. This information may be inaccurate or incomplete. NO LIABILITY IS ACCEPTED FOR THIS INFORMATION.

The Estimated Flood Extent does not represent the largest possible flood that could conceivably occur; it is an Estimated Flood Extent for the 100 Year Average Recurrence Interval (ARI) which has been historically used for planning and development. A flood more severe than 100 Year ARI may occur, although such events would be rare.

The absence of Flood Extent does not imply that the area is not subject to flooding; simply that Council has not Estimated the Flood Extents for all areas of the Sunshine Coast.

THE SUNSHINE COAST REGIONAL COUNCIL ACCEPTS NO RESPONSIBILITY FOR THE ACCURACY OF THE FLOOD EXTENT.

The Estimated Flood Extent is based upon current climatic conditions only.

It does not include allowances for future climate change projections in our region. These projections would include but are not limited to; increased rainfall intensity, higher mean sea level and more extreme weather conditions (e.g. storm surge and tropical cyclones).

Some road locations have been shown for clarity above the Estimated Flood Extent. Some of these roads may be subject to inundation.

Flood free isolated areas within the Estimated Flood Extent may be constrained by accessibility and duration of inundation.

Depths of inundation and flood hazard will vary within the Estimated Flood Extent.

Sunshine Coast Regional Council
Flooding & Stormwater

Legend

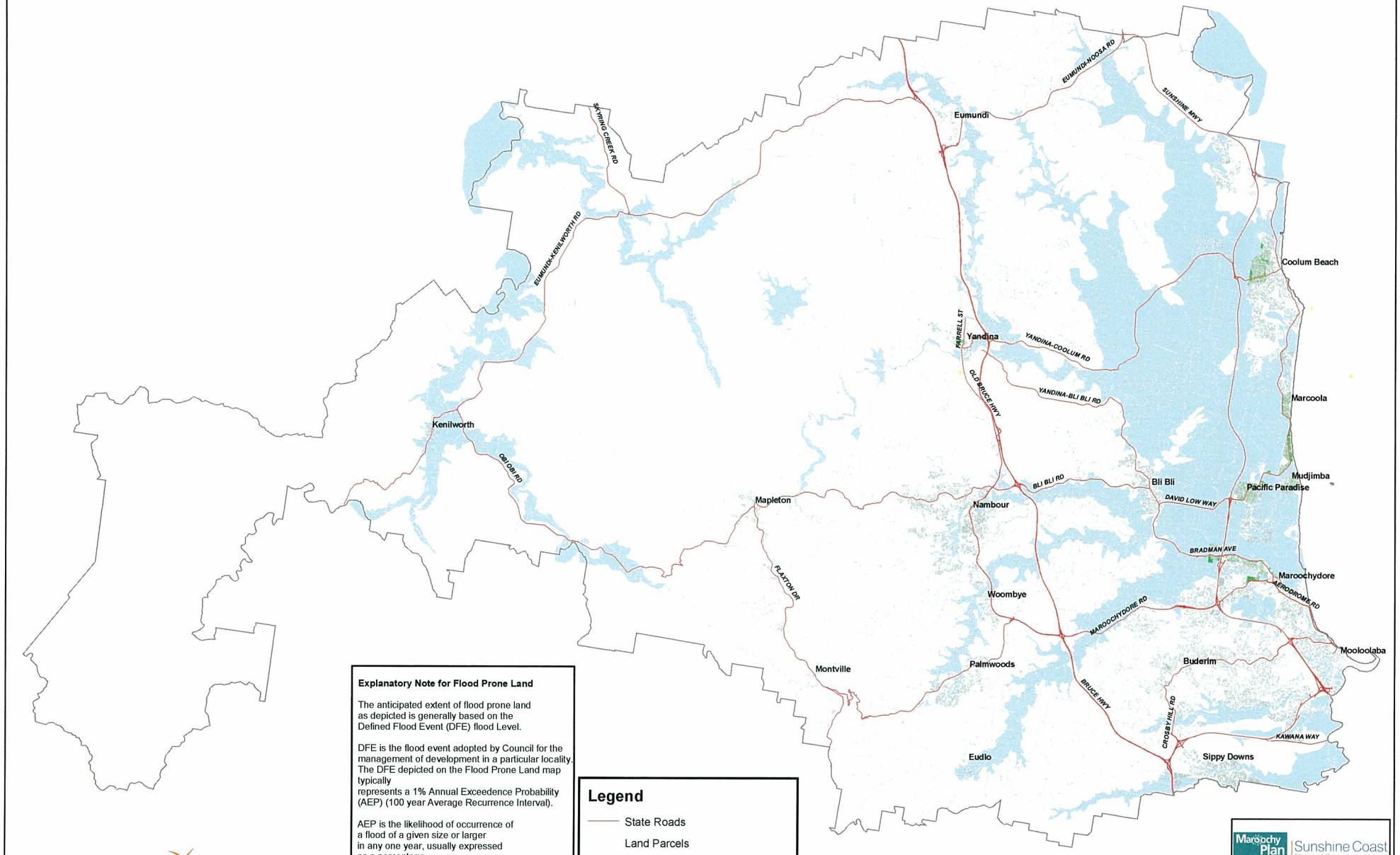
Estimated Flood Extent - 100 Year Average Recurrence Interval (ARI)
Freshwater Flood and Storm Tide
Current Climate Conditions

0 0.25 0.5 1 1.5 2 2.5 km
Scale 1:37,500 At Paper Size A0

Sunshine Coast Regional Council
Locked Bag 72
Sunshine Coast Mail Centre
Qld 4560
T [07] 5475 5501
F [07] 5441 8213
E fly.stormy@sunshinecoast.qld.gov.au
W www.sunshinecoast.qld.gov.au

Last Printed on 24/03/2011 Designed by Flooding & Stormwater Team

Flood Prone and Drainage Constraint Areas
Special Management Area
Regulatory Map 1.5



Explanatory Note for Flood Prone Land

The anticipated extent of flood prone land as depicted is generally based on the Defined Flood Event (DFE) flood Level.

DFE is the flood event adopted by Council for the management of development in a particular locality. The DFE depicted on the Flood Prone Land map typically represents a 1% Annual Exceedence Probability (AEP) (100 year Average Recurrence Interval).

AEP is the likelihood of occurrence of a flood of a given size or larger in any one year, usually expressed as a percentage.

Note: For all Cadastre on all mapping, please refer to the CD Version or Development Assessment, Information Services Support Officers located in Nambour or Maroochydore.

Legend

- State Roads
- Land Parcels
- Drainage Deficiency Areas
- Flood Prone Land
- Planning Scheme Area Boundary

GDA

0 1 2 3 4 5
Kilometres

Amended 5th November, 2010

Maroochy Plan 2000 | Sunshine Coast Regional Council

Flood Prone and Drainage Constraint Areas
Special Management Area
Regulatory Map 1.5

inner: Property boundaries shown on these base plans are approximate only and should not be used for set design. Please arrange for an identification survey if any work occurs in the vicinity of the property boundar

Map 7.2: Defined Flood Event

Proserpine Flood and Drainage Study Maximum Surface Elevation Levels for the 100 year ARI 1 hour Duration Event
Existing Case

Appendix D

BOWEN SHIRE - OVERLAY MAP 04
NATURAL FEATURES AND RESOURCES
OVERLAY - SPECIAL MANAGEMENT AREAS
DON RIVER FLOOD PLAIN

SHIRE OF BOWEN
TOP OF THE WHITSUNDAYS

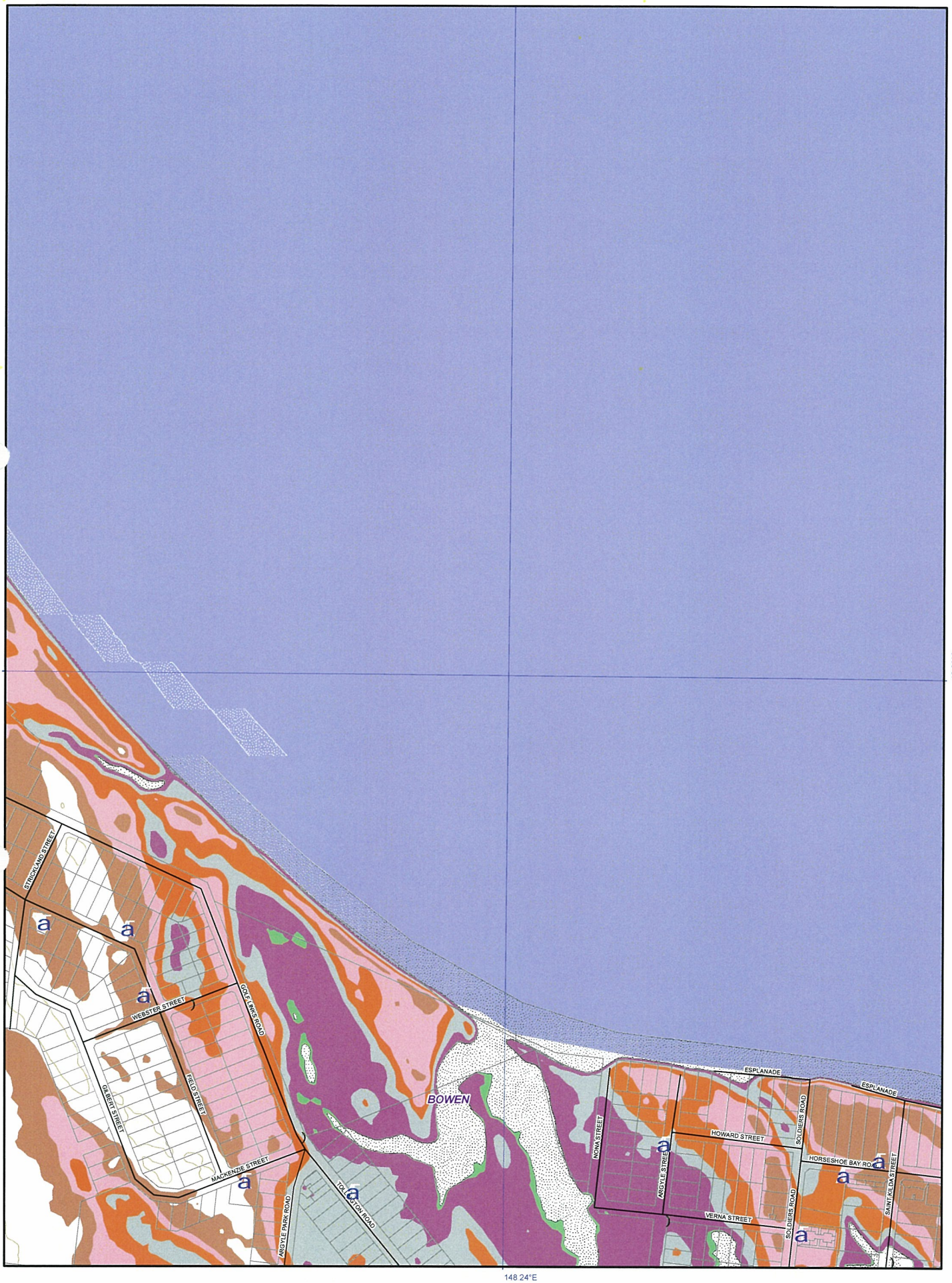
BOWEN SHIRE PLANNING SCHEME

LEGEND

Don River Flood Plain Area

1 June 2006

BOWEN *Emergency Zones* Map 04 *STORM TIDE*



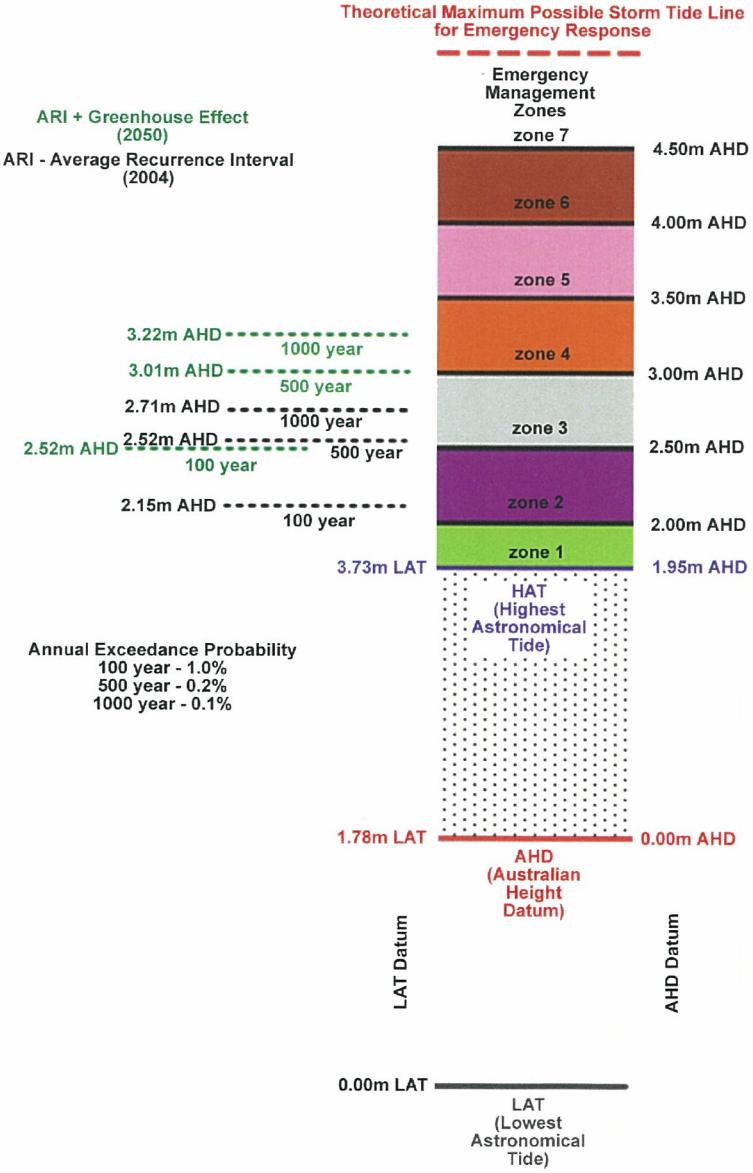
0 50 100 200
Metres
1:5000

BOWEN Legend STORM TIDE

- 4.0m to 4.5m AHD
- 3.5m to 4.0m AHD
- 3.0m to 3.5m AHD
- 2.5m to 3.0m AHD
- 2.0m to 2.5m AHD
- H.A.T (1.95M) to 2.0m
- 0m to H.A.T (1.95m) AHD
- Water Body

- Queensland Ambulance Service
- SES Centre
- Air Sea Rescue
- Bowen Bus Depot
- Pharmacy
- Bowen Shire Council
- Bowen Shire Council Depot
- Water Bore
- Hail and ride pickup
- Bowen Sewerage Treatment Plant
- Pumpstation

- Queensland Fire Service
- Queensland Police Service
- Medical Centre/Hospital
- School
- Aged Care Facility
- Freeway/Motorway
- Highway
- Road
- DCDB



Australian Government
Bureau of Meteorology
Department of Transport and Regional Services

Queensland Government
Department of Emergency Services
Environmental Protection Agency
Natural Resources and Mines

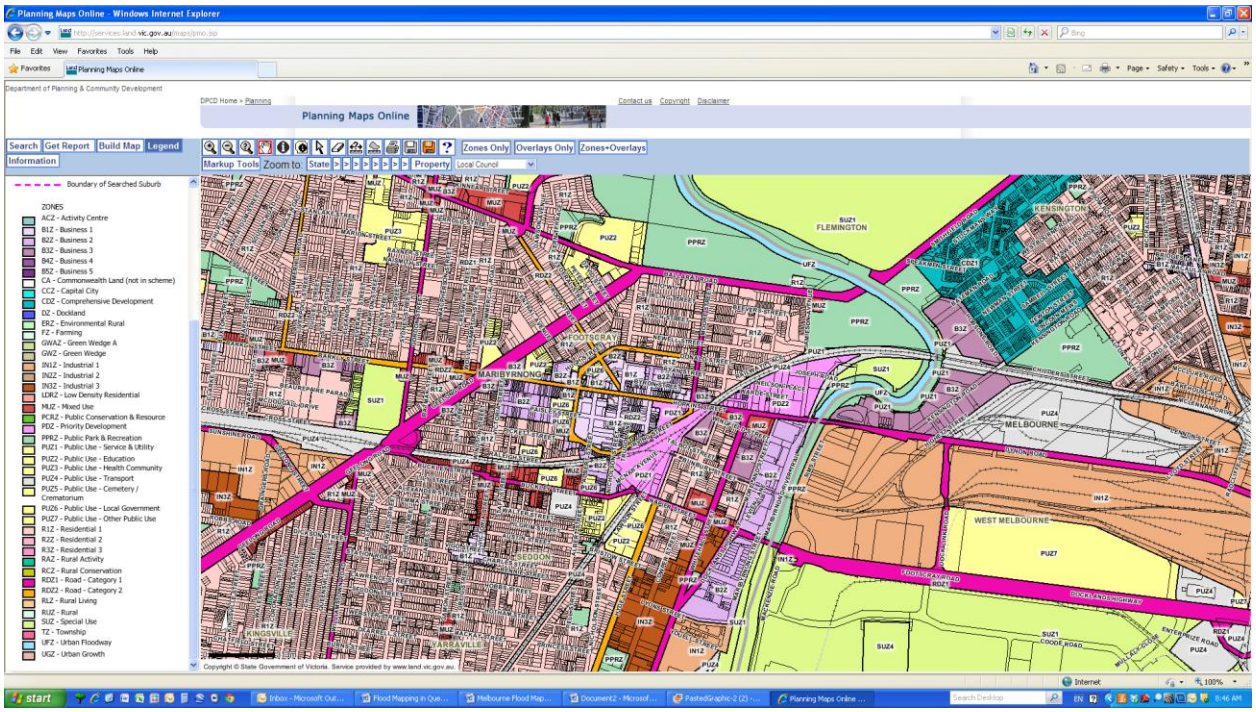
Emergency Management EMQ Queensland

BOWEN SHIRE COUNCIL

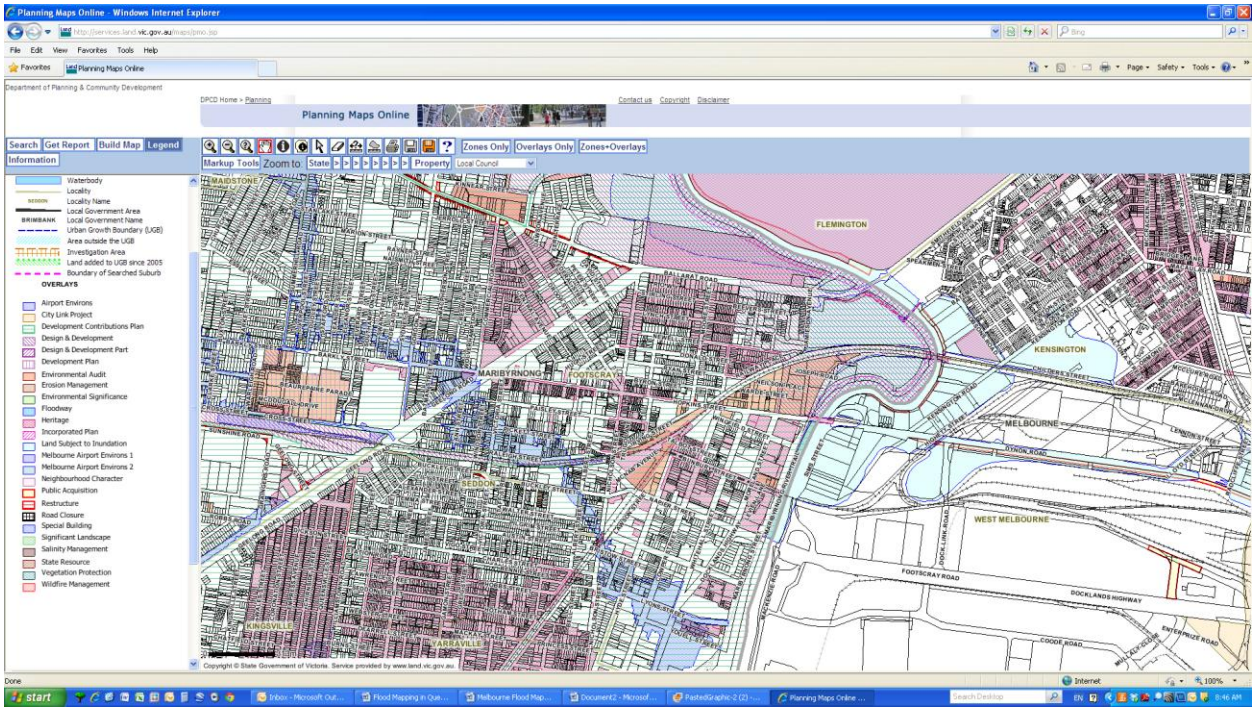
Melbourne, Victoria

On-line planning scheme maps

<u>Zoning Map (showing UZF)</u>



<u>Overlay Map (showing FO; LSIO; SBO)</u>



Source: hrrp://services.land.vic.gov.au/maps/pmo.jsp

0 50 100 m
Scale

NOTE

THE EXTENTS OF FLOODING SHOWN WERE DETERMINED FROM SURVEYED CROSS SECTIONS OF THE CREEK AND FLOODPLAIN AND AVAILABLE CONTOUR DATA AND ARE APPROXIMATE ONLY. THE EXTENT OF INUNDATION OF INDIVIDUAL ALLOTMENTS NEAR THE FLOOD FRINGE MUST BE CONFIRMED BY SITE SPECIFIC SURVEY.

LEGEND

- PMF
- 100 YEAR ARI
- 20 YEAR ARI
- 5 YEAR ARI
- 1261.47 HEC-RAS CROSS SECTION AND RIVER STATION NUMBER

SCOTTS CREEK FLOOD STUDY

Figure 6.2a

INDICATIVE EXTENTS OF INUNDATION
5, 20, 100 YEAR ARI AND EXTREME FLOOD EVENTS
HAVILAH STREET TO PENSHURST STREET

N

0 50 100 m
Scale

NOTE

THE EXTENTS OF FLOODING SHOWN WERE DETERMINED FROM SURVEYED CROSS SECTIONS OF THE CREEK AND FLOODPLAIN AND AVAILABLE CONTOUR DATA AND ARE APPROXIMATE ONLY. THE EXTENT OF INUNDATION OF INDIVIDUAL ALLOTMENTS NEAR THE FLOOD FRINGE MUST BE CONFIRMED BY SITE SPECIFIC SURVEY.

LEGEND

- HIGH HAZARD
- LOW HAZARD
- 1261.47 HEC-RAS CROSS SECTION AND RIVER STATION NUMBER

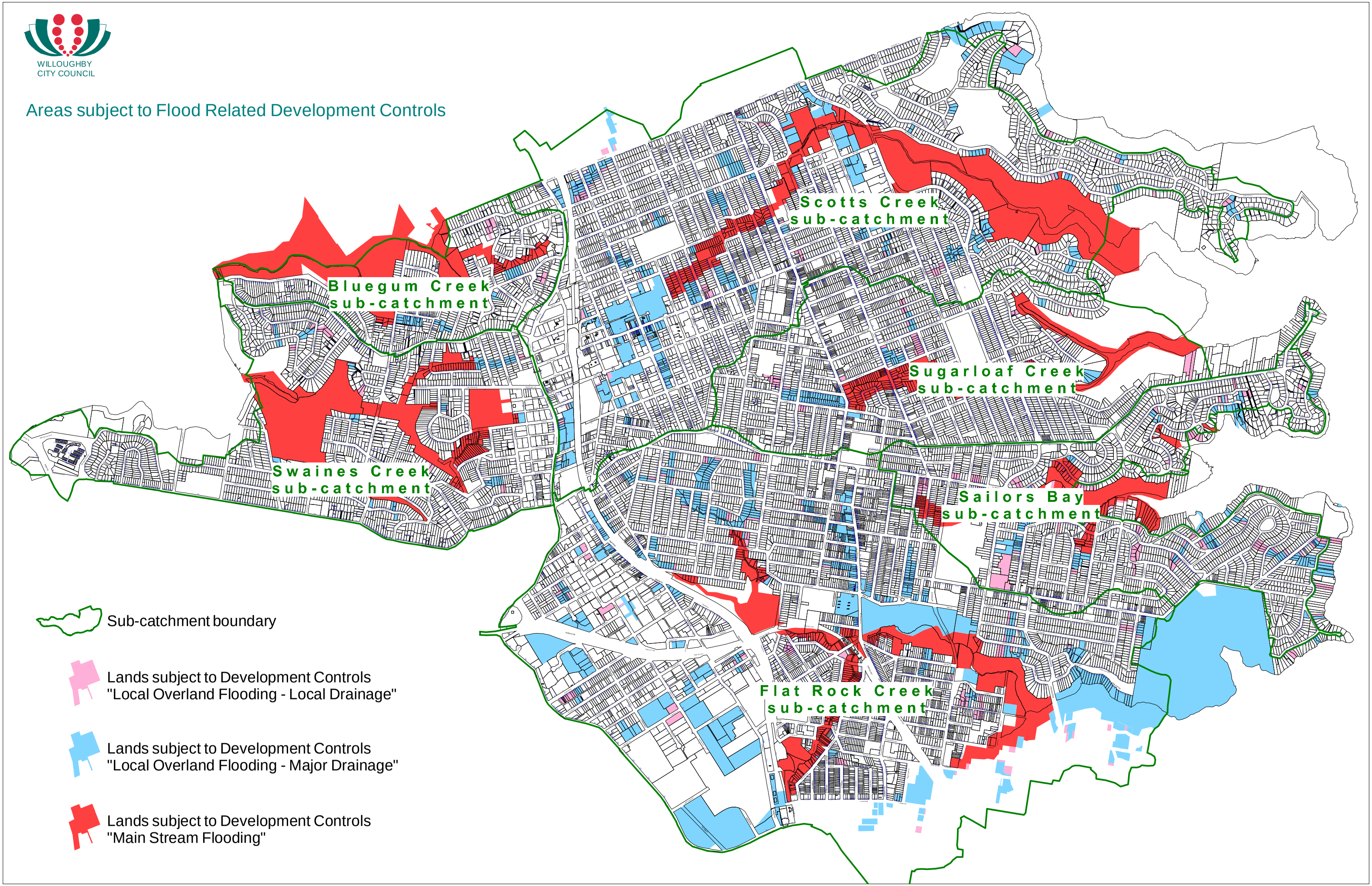
SCOTTS CREEK FLOOD STUDY

Figure 6.3a

PROVISIONAL FLOOD HAZARD DIAGRAM
100 YEAR ARI
HAVILAH STREET TO PENSHURST STREET

WILLOUGHBY
CITY COUNCIL

Areas subject to Flood Related Development Controls



Sub-catchment boundary

Lands subject to Development Controls
"Local Overland Flooding - Local Drainage"

Lands subject to Development Controls
"Local Overland Flooding - Major Drainage"

Lands subject to Development Controls
"Main Stream Flooding"

Appendix C – Victorian Flood Provisions Guide

INFRASTRUCTURE

Victoria
The Place To Be

APPLYING THE FLOOD PROVISIONS IN PLANNING SCHEMES

A guide for councils

This VPP Practice Note provides guidance about applying the flood provisions in planning schemes including the preparation of policy, identifying land affected by flooding, preparing a local floodplain development plan and the application and operation of the flood provisions, including the preparation of schedules.

This Practice Note is one of two practice notes on planning for flooding.

The other Practice Note, *Applying for a Planning Permit under the Flood Provisions – A guide for councils, referral authorities and applicants*, explains the requirements of the flood provisions and provides guidance about making an application for a planning permit where flooding is a consideration and about how an application will be assessed.

Flooding is a natural hazard but, unlike most other natural hazards, floods are to a great degree predictable in terms of their location, depth and extent. This means that appropriate measures can be developed to reduce flood damage. Land use planning is recognised as being the best means of avoiding future flooding problems. Through careful planning, flood risks to life, property and community infrastructure can be minimised and the environmental significance of our floodplains protected.

Section 6(e) of the *Planning and Environment Act 1987* enables planning schemes to '*regulate or prohibit any use or development in hazardous areas, or areas likely to become hazardous*'. As a result, planning schemes contain State planning policy for floodplain management requiring, among other things, that flood risk be considered in the preparation of planning schemes and in land use decisions.

The statutory authorities responsible for the collection of flood information and for land use planning in flood-affected areas are councils and floodplain management authorities (CMAs, Melbourne Water and NRE). The specific roles and responsibilities of each organisation and a map showing the distribution of floodplain management areas in Victoria are attached.

Bridge Street, Benalla, 1993 Broken River Flood (Source: Herald and Weekly Times)

This Practice Note has been prepared in conjunction with the Department of Natural Resources and Environment and Melbourne Water.

Abbreviations

ARI	Average Recurrence Interval	LSIO	Land Subject to Inundation Overlay
CMA	Catchment Management Authority	MSS	Municipal Strategic Statement
DOI	Department of Infrastructure	NPL	Nominal Protection Level
DFE	Design Flood Event	NRE	Department of Natural Resources and Environment
EPA	Environment Protection Authority	PMF	Probable Maximum Flood
FO	Floodway Overlay	SBO	Special Building Overlay
LPPF	Local Planning Policy Framework	UFZ	Urban Floodway Zone

Councils can use flood information to articulate local planning objectives and strategies for flooding in their Local Planning Policy Framework (LPPF) and apply the most appropriate flood provision to control land use and development in flood affected areas.

The planning authority has a range of tools to choose from to identify flood affected land in its planning scheme. There are four types of flood provisions available; the Urban Floodway Zone (UFZ), Floodway Overlay (FO), Land Subject to Inundation Overlay (LSIO) and Special Building Overlay (SBO). These have been derived based on the type of flooding and the potential level of risk to life and property.

The level of planning control in each provision is commensurate with the potential flood risk. For example, the UFZ is a restrictive provision that prohibits most uses and development. It is designed to be applied to urban environments where there is a high potential flood risk and only low intensity uses and development (such as recreation) are suitable. In contrast, the LSIO is used for both urban and rural environments to identify land with a lower potential flood risk or as an interim measure, areas where accurate flood mapping to identify the floodway is yet to be carried out. The LSIO only requires a permit for buildings and works and does not prohibit either use or development.

The flood provisions do not address the cause of flooding, but the way future land use and development will impact on the flooding problem or be impacted themselves by flooding. The cause needs to be dealt with by separate means. This may include other actions of council and/or the floodplain management authority, such as flood mitigation measures, that may be linked to a corporate plan or a floodplain management strategy.

For more information on floodplain management, see the references at the end of this practice note. A glossary of commonly used terms in floodplain management (some used in this practice note) is also included.

Identifying land affected by flooding

Before flood provisions can be introduced to a planning scheme, information on the type and extent of flooding is required to accurately map land affected by flooding and apply the most appropriate flood provision.

Types of flooding

Floods in Victoria are usually caused by heavy or prolonged rainfall, which can result in either 'mainstream flooding' or 'stormwater flooding'. These two types of flooding are the basis of the flood zone and overlays in planning schemes. Other types of flooding such as flooding associated with the failure of dams or water-supply systems are not specifically addressed in planning schemes.

Mainstream flooding

Heavy rainfall produces surface run-off which flows into streams and rivers. When there is a large amount of run-off, water overflows the river banks on to adjacent low-lying land causing flooding. This is called mainstream flooding and can occur in both rural and urban areas. The UFZ, FO and LSIO identify areas affected by mainstream flooding in planning schemes.

Stormwater flooding

During severe storms in urban areas, land can be affected by overland flows. These occur when the rainfall run-off exceeds the

Footscray main drain, December 1992 (Source: Melbourne Water)

capacity of the piped drainage system and no provision has been made for overland flows. This is called stormwater flooding and often occurs in areas where there is a high density of existing development and a high flood damage potential. The SBO identifies areas affected by stormwater flooding in planning schemes.

Defining the extent of flooding

The 'probable maximum flood' (PMF) determines the maximum possible extent and height of flooding. This is the largest flood that could conceivably occur at a particular location. The area defined by the PMF is referred to as 'flood prone' and the area outside the PMF is referred to as 'flood-free' (see Figure 1).

In general, it is not practical or economical to provide land use planning or flood protection up to the PMF. A lesser flood standard, known as the 'design flood event' (DFE), is adopted for land use planning purposes and is the area applicable for planning schemes. The area defined by the DFE will be referred to as 'land subject to inundation' and can be divided into its relevant UFZ, FO, LSIO and SBO components as the case requires.

In Victoria, the DFE for land use planning and building purposes is the 100-year ARI (average recurrence interval) flood, which occurs on average once every 100 years. This is the basis for declaring flood levels and flood areas under the *Water Act 1989* and for setting minimum building floor levels under the *Building Act 1993*.

Floodways

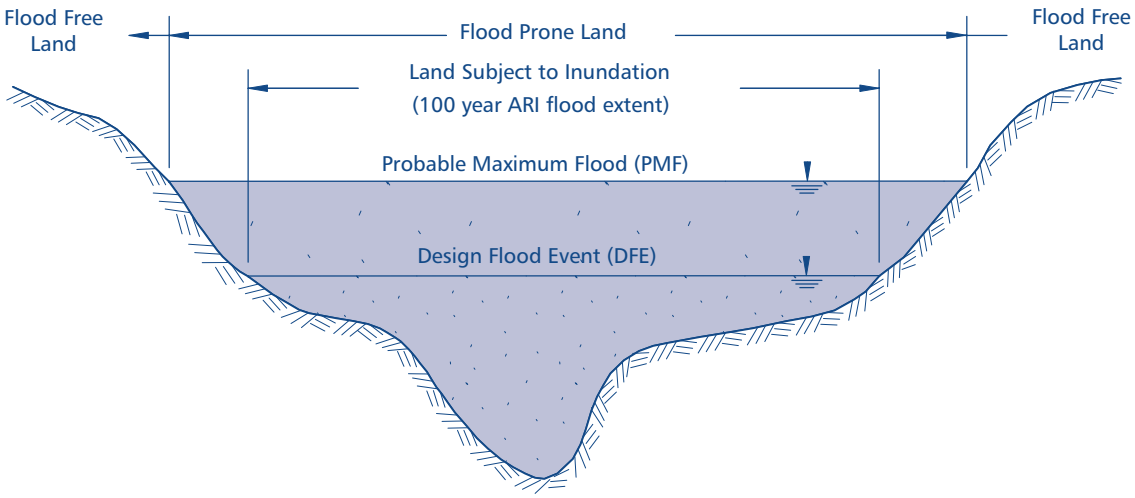
Floodways are areas that are important for the discharge or storage of water during major floods. They are usually aligned with naturally defined channels and depressions and often carry relatively deep and high velocity flows. Filling or even partial blockage of floodways can redistribute flood flows causing increased flood levels and flow velocities and increased flood risk for nearby properties. A blockage of a floodway can also have adverse environmental impacts, such as isolating wetlands, destroying natural habitats, eroding stream channels and increasing siltation.

The identification of floodway areas requires an assessment of the level of flood risk. One or more flood risk factors may apply to a given area and not all factors are given the same weight. The higher the potential flood risk, the more likely that the area will be defined as a floodway. Detailed guidelines for delineating floodways are contained in NRE's *Advisory Notes for Delineating Floodways* (1998).

Flood risk factors include:

- land use
- duration of flooding
- available flood storage capacity
- size and frequency of flood
- rate of rise of floodwater
- access and evacuation
- depth and velocity of floodwater
- available flood warning time
- environmental values.

Figure 1. Defining flood-prone land



The area designated as 'Land Subject to Inundation' is the area used for planning scheme purposes.

Flood information

Where possible, the DFE that defines the extent of land subject to inundation should be based on the 100-year ARI flood. Remember that this is not the maximum extent of flooding, which is defined by the PMF, a much larger event. If the magnitude of the 100-year ARI flood has not been determined, the DFE should be based on the known extent of the largest recorded historic flood or on other available information.

The floodplain management authority or council usually collects flood information for an area for use in planning schemes. This information should be included in a flood information report prepared by the relevant floodplain management authority and held for reference by the authority and the council. The report should link the flood boundaries shown in the planning scheme to a set of statements which reference the source of their delineation and include any necessary qualifications. An example for a council might state:

- The flood areas shown represent the best estimate of flood extent based on currently available information.
- Delineation of the LSIO is based on aerial photography of the October 1993 flood, which is currently the best estimate of the 100-year ARI flood.
- The flood areas shown do not necessarily represent the maximum possible extent of flooding and can be exceeded by a larger flood event.
- Other areas in the municipality may be liable to flooding, but are not shown on the planning scheme maps due to lack of information at the present time.
- The flood areas are subject to change and new flood areas may be introduced as additional information becomes available and further investigations are carried out.

Myrtleford, Ovens River 1993 flood (Source: Ewen Javis Pty Ltd)

Sources of flood information

Flood information is available from various sources, including detailed flood studies, flood mapping projects, aerial photographs, historic flood levels, ground levels, soil and geology maps, river surveys, and local knowledge.

In many parts of Victoria, investigations have been undertaken to assess flood risk and identify land subject to inundation and its various components, including floodways and overland flow paths. At present, flood maps are not available for all areas of the State. Councils and floodplain management authorities should continually extend and update their current flood

mapping database, giving priority to the higher flood-risk areas. Where adequate flood maps have not been prepared for a particular area, all available local knowledge should be documented and a flood mapping investigation should be initiated.

If detailed information on flooding is not available, in the interim the floodplain management authority should identify land known to be subject to inundation as best it can and the LSIO should be applied, even if the LSIO boundary is based on limited information. The boundary should be adjusted, and floodway provisions included if necessary, after detailed flood mapping has been completed.

NRE has undertaken a comprehensive flood mapping program for regional Victoria, which involves the presentation of available information on flood maps for use by catchment management authorities and councils. These maps apply only to mainstream flooding and show the extent of flooding, floodways and flood levels. Melbourne Water has carried out detailed studies to identify overland flow paths of stormwater in urban areas of Melbourne, as well as mainstream flooding in some urban and rural areas.

What are the flood provisions?

State Planning Policy Framework (SPPF)

The State planning policy for floodplain management (clause 15.02) provides the broad framework for the integration of flood policy and provisions into planning schemes. It brings together various strands of policy and strategic planning from all areas of government that have a bearing on floodplain management. It also aims to provide consistency in planning controls for flood affected areas of the State.

The objective of the State planning policy for floodplain management is to assist in the protection of:

- life, property and community infrastructure from flood hazard
- the natural flood-carrying capacity of rivers, streams and floodways
- the flood storage function of floodplains and waterways
- floodplain areas of environmental significance.

The policy states that flood risk must be considered in the preparation of planning schemes and in land use decisions, so as to avoid intensifying the impact of flooding through inappropriately located uses and developments. It also states that land affected by flooding should be shown on planning scheme maps and recognises that land affected by flooding is land inundated by the 1-in-100-year flood event or as determined by the floodplain management authority.

Planning authorities should have regard to the following documents when preparing planning schemes for areas affected by flooding:

- regional catchment strategies and special area plans (under the *Catchment and Land Protection Act 1994)*
- State environmental protection policies
- any floodplain management manual of policy and practice, or catchment management or floodplain management strategy adopted by the relevant floodplain management authority
- any best practice environmental management guidelines for stormwater adopted by the EPA.

Local Planning Policy Framework

The LPPF sets out the local policy context for a municipality and includes the following key elements:

Municipal Strategic Statement

If flooding is a planning issue in a municipality, this should be identified in the Municipal Strategic Statement (MSS). The MSS should describe the characteristics of flooding (including the location of affected areas, flooding impacts and specific issues), the objectives of floodplain management and strategies, and implementation measures for achieving the objectives. It should also identify the data source for flooding information.

An example of a MSS extract on the issue of flooding is attached.

Local planning policies

Where additional guidance is needed for decision-making on planning permit applications in flood affected areas, a local planning policy on flooding may be warranted. This can be for general application or for specific areas. The local policy may include locality plans that are linked to policies for future development of flood-affected areas. An example of a typical local policy for flooding is attached. Alternatively, a local floodplain development plan can be prepared.

Flood zone and overlays

The flood zone and overlays are specifically designed to identify land with particular flood characteristics.

Which flood zone or overlay should apply?

The nature of the flood risk and the type of flood information available will determine how and to what extent the flood provisions are applied in the planning scheme.

The flood zone and overlay provisions ensure that the use and development of land subject to inundation is made compatible with the level of flood risk through the planning permit process.

The UFZ applies to urban areas where the potential flood risk is high and strict controls over land use are required. The three overlays (FO, LSIO and SBO) cover a range of situations in both urban and rural areas where the potential flood risk is less than in the UFZ, and where control over development (buildings, works and subdivision) and not land use, is sufficient.

One or more of these tools can be applied to cover a particular flooding situation. The ways the flood zone and overlays can be applied in a rural and urban context are shown in Table 1 and Figure 2.

Urban Floodway Zone

The UFZ applies to mainstream flooding in urban areas where the primary function of the land is to convey active flood flows. It applies to urban floodway areas where the potential flood risk is high due to the presence of existing development or to pressures for new or more intensive development.

The UFZ restricts the use of such land, as the risk associated with flooding renders it unsuitable for any further intensification of use or development. The land use is therefore restricted to activities such as apiculture, animal husbandry and recreational activities. Most other uses are prohibited (see Case 1 in Table 1 and Figure 2.3).

Sometimes the UFZ can cover the full extent of land subject to inundation, including situations where the floodplain is relatively narrow and deep.

The UFZ is not widely used due to its restrictive nature. As an alternative, a flood overlay can be used in conjunction with an appropriate zone (such as the Floodway Overlay and the Public Park and Recreation Zone) to enable the primary use of the land to be recognised at the same time as acknowledging its flooding characteristics.

Floodway Overlay

The FO applies to mainstream flooding in both rural and urban areas. These areas convey active flood flows or store floodwater in a similar way to the UFZ, but with a lesser flood risk. The FO is suitable for areas where there is less need for control over land use, and the focus is more on control of development.

As with the UFZ, in some cases the FO can cover the full extent of land subject to inundation, for example, in situations where the floodplain is relatively narrow and deep.

The FO can be applied in three situations (see Cases 2 to 4 in Table 1 and Figures 2.2 and 2.3).

Land Subject to Inundation Overlay

The LSIO applies to mainstream flooding in both rural and urban areas. In general, areas covered by the LSIO have a lower flood risk than UFZ or FO areas.

The LSIO can be applied in three situations (see Cases 5 to 7 in Table 1 and Figures 2.1, 2.2 and 2.3).

Special Building Overlay

The SBO applies to stormwater flooding in urban areas only (see Case 8 in Table 1 and Figure 2.4).

Before 1975, drainage systems were designed to a lower standard than those used today. Often they were designed for a five-year ARI storm capacity, and sometimes for a lesser standard. Usually no provision was made for overland flows, so land is often flooded when the capacity of the underground drainage system is exceeded.

With the redevelopment of existing urban areas and the proposed development of new areas, there will be pressure to develop within overland flow-path areas. The purpose of the SBO is to manage development in these areas.

While the SBO is primarily intended for overland flow path areas in the Melbourne metropolitan area, it can also be applied to urban areas affected by stormwater flooding in regional towns.

Earthworks

Earthworks include land forming, laser grading, levee banks, lanes, tracks, aqueducts, surface and subsurface drains and any associated structures.

Inappropriate earthworks have the potential to obstruct or divert flood flows, reduce natural flood storage areas, impact on environmental values and increase flood flows, flow velocities and flood damage.

Significant earthworks, including levees and raised roads, are inappropriate for floodway land. In rural areas, private levees may be constructed without regard for the potential effects of these works beyond the farm boundaries. In urban areas,

Table 1. Application of the flood zone and overlays

	Urban Floodway Zone	Floodway Overlay	Land Subject to Inundation Overlay	Special Building Overlay
Urban or rural areas?	Urban areas only	Both urban and rural areas	Both urban and rural areas	Urban areas only
Mainstream or stormwater flooding?	Mainstream flooding from a river or stream	Mainstream flooding from a river or stream	Mainstream flooding from a river or stream	Stormwater flooding along overland flow paths
Application	**Case 1 (see Figure 2.3)** • Urban land which is mainly undeveloped • The stream channel or primary flow path area • Important for conveying and/or storing floodwater • Higher flood depths and/or flow velocities • Higher potential flood risk • Unsuitable for intensive urban development.	**All cases** • The stream channel or primary flow path area • Important for conveying and/or storing floodwater • Higher flood depths and/or flow velocities • Higher potential flood risk, but usually not as severe as in the UFZ. **Case 2 (see Figure 2.2)** • Rural land which is mainly undeveloped. **Case 3 (see Figure 2.3)** • Urban land which is mainly undeveloped • Unsuitable for intensive urban development but may be suitable for development compatible with the flood risk (for example, public purpose uses, such as school grounds, golf courses, sports grounds and recreation areas). **Case 4 (see Figure 2.3)** • Urban land that is fully or substantially developed (for example, currently zoned residential, commercial or industrial areas).	**Case 5 (see Figure 2.1)** • Rural or urban areas where the extent of the floodway has not been identified and only the extent of land subject to inundation is known • Areas that cover the total extent of land subject to inundation, including the higher risk floodway component • LSIO is intended as an interim measure until further mapping of the floodway is carried out. **Case 6 (see Figure 2.2)** • Rural land that is mainly undeveloped • Areas where the extent of the floodway has been identified and LSIO covers the balance of land subject to inundation, excluding the floodway component • Lower flood depths and/or flow velocities • Lower potential flood risk. **Case 7 (see Figure 2.3)** • Urban land that is fully or substantially developed ('flood fringe') • Areas where the extent of the floodway has been identified and the LSIO covers the balance of land subject to inundation, except the floodway component • Lower flood depths, lower flow velocities • Lower potential flood risk.	**Case 8 (see Figure 2.4)** • Urban land that is inundated if the capacity of the drainage system is exceeded during heavy rainfall • Currently used by Melbourne Water in the Melbourne metropolitan area • Can be applied by councils for regional towns provided overland flow path areas are delineated.

Figure 2. Application of flood zone and overlays

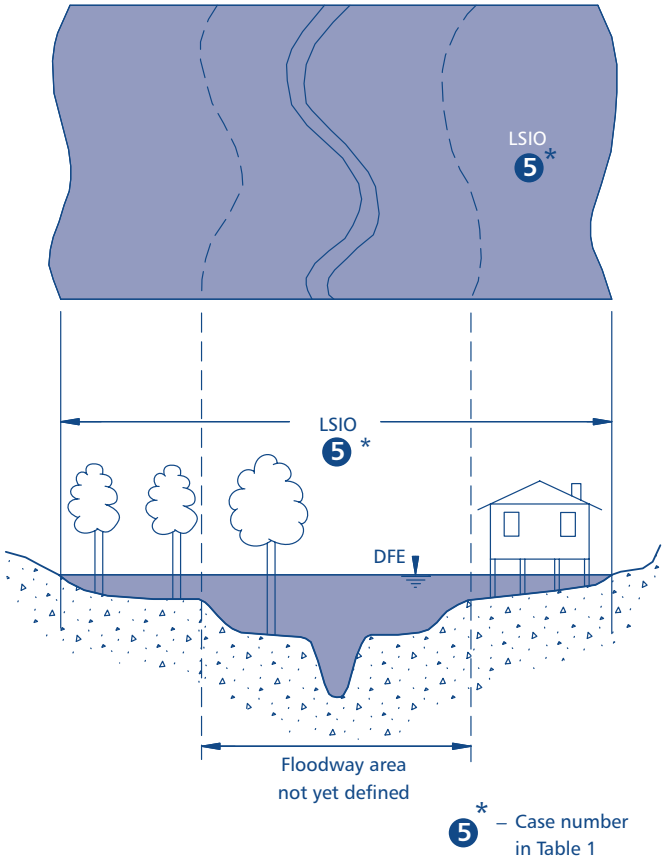


Figure 2.1.
Rural and urban areas
Mainstream flooding
Case 5

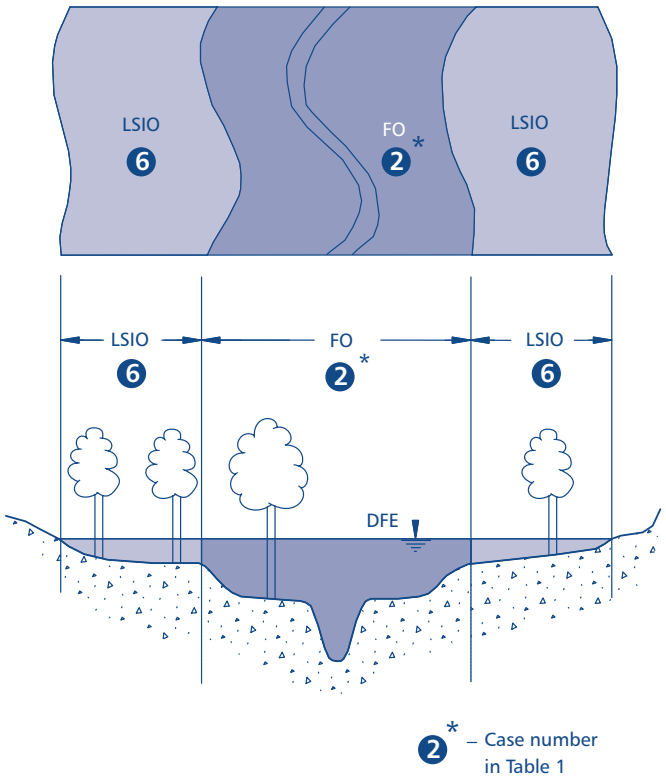


Figure 2.2.
Rural areas
Mainstream flooding
Cases 2 and 6

Figure 2. Application of flood zone and overlays *continued*

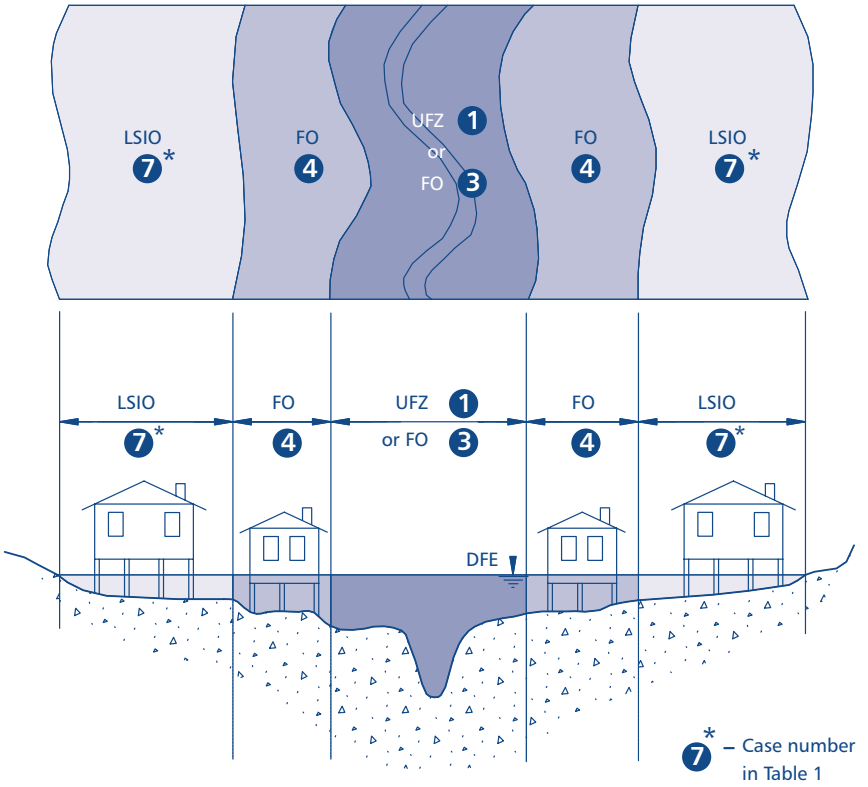


Figure 2.3.
Urban areas
Mainstream flooding
Cases 1, 3, 4 and 7

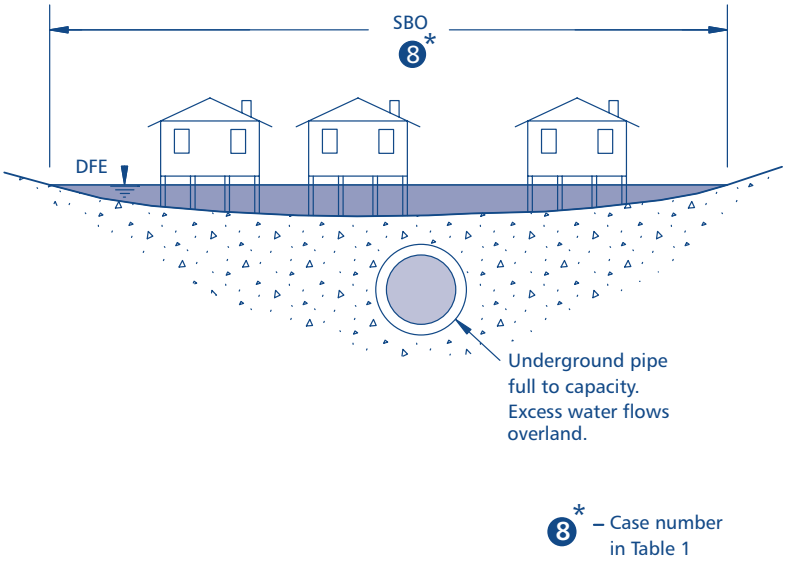


Figure 2.4.
Urban areas
Stormwater flooding
Case 8

earthworks can interfere with local drainage and divert floodwater onto other properties. Councils should consider introducing earthworks provisions into their planning schemes where necessary as an additional measure in protecting floodplains.

Any change to the planning scheme to introduce earthworks provisions should be linked to strategies in the MSS and preferably supported by some guidelines for the application of the earthworks provisions in a local floodplain development plan or local planning policy.

Preparing schedules to overlays

Apart from the standard exemptions for buildings and works in the overlays, the schedules to the overlays can be used to exempt certain buildings and works from the need for a permit. Care should be taken when specifying types of development to be exempted, and this should be done in consultation with the floodplain management authority.

Exemptions in schedules should respond to local conditions, taking into account specific types of development and local needs. For example, in rural areas, typical exempt buildings and works that would not have a significant effect on flood risk might include minor earthworks, farm sheds and hay sheds. In view of the need to monitor development more carefully in floodway areas, exempt buildings and works in the FO should be more limited than in the LSIO.

The SBO includes standard exemptions for common urban developments such as minor extensions to dwellings, replacement fencing, carports, pergolas and in-ground swimming pools.

The principal benefit of 'scheduling out' specific buildings and works is that the planning permit application process will be more streamlined. The effective use of schedules should reduce the number of planning permit applications the council and the flood plain management authority need to process.

Attached is an example of a schedule that could apply to an LSIO in a rural area.

Preparing a local floodplain development plan

A local floodplain development plan enables the council and local floodplain management authority to include specific local requirements in the planning scheme. It has two purposes:

- to provide a set of requirements and guidelines for development in a particular area. It should address local circumstances and record local flooding information.
- to simplify and streamline the consideration of planning permit applications and avoid the need to prepare a flood risk report.

A council usually prepares a local floodplain development plan in consultation with the floodplain management authority. Once the plan has been adopted, the planning scheme should be amended to include it as an incorporated document.

In preparing a local floodplain development plan, the council and floodplain management authority should consider what objectives they are trying to achieve in managing the floodplain area and how the plan can best achieve those objectives. The plan should be carefully drafted as the planning scheme requires that any planning permit application must be consistent with it. If the plan is too prescriptive it may restrict development unnecessarily. A planning permit application that is inconsistent with the local floodplain development plan should be refused.

For subdivision in the UFZ and FO, if the subdivision provisions in the local floodplain development plan differ from the subdivision provisions in the UFZ or FO, the local floodplain development plan prevails. Once the plan has been adopted, an applicant need not prepare a flood risk report in these areas.

A local floodplain development plan should include:

- flood history
- flood information sources
- flood impacts (description of the types of flood behaviour in the UFZ, FO, LSIO and SBO areas and their importance)
- flora, fauna and other environmental values and constraints
- development guidelines for permissible subdivisions, buildings and works, including earthworks (these may vary for different zone and overlay areas)
- guidelines to assist the council prepare its local policies, schedules and referral agreements.

Flood conditions vary for different areas, so a local floodplain development plan may need to include a number of sub-plans to reflect differences in flooding behaviour.

Councils and floodplain management authorities should give a high priority to the preparation of local floodplain development plans, particularly in areas of significant flood risk and where a large number of applications are anticipated. For the local floodplain development plan to have effect, it must be adopted by the council in consultation with the floodplain management authority.

A suggested basis for a local floodplain development plan is attached. This is not the only form such a plan can take. Performance-based plans provide more flexibility to respond to particular local flooding issues.

More information

Flood information and advice

For information on flood risks and other flooding matters in an area, contact the relevant floodplain management authority.

Regional Victoria

In regional Victoria the floodplain management authorities are the CMA and NRE.

Corangamite CMA	(03) 5232 9100	North East CMA	(02) 6055 6133
East Gippsland CMA	(03) 5153 0462	West Gippsland CMA	(03) 5175 7800
Glenelg Hopkins CMA	(03) 5571 2526	Wimmera CMA	(03) 5382 1544
Goulburn Broken CMA	(03) 5822 2288	NRE Floodplain Management Unit	
Mallee CMA	(03) 5022 4377	(for the Wimmera and Mallee regions	
North Central CMA	(03) 5448 7124	and parts of the Port Phillip area)	(03) 9412 4763

Greater Melbourne area

The floodplain management authority for the Greater Melbourne area is Melbourne Water. Contact the relevant local retail water company first as they issue property information statements, including flood risk information, on behalf of Melbourne Water.

City West Water 13 1691 South East Water 13 1694 Yarra Valley Water 13 1721

For further flood information and advice, contact the Waterways and Drainage Group of Melbourne Water on (03) 9235 2100.

References

Department of Natural Resources and Environment (1998) *Advisory Notes for Delineating Floodways*

Department of Justice and Department of Natural Resources and Environment (1998) *Victoria Flood Management Strategy*

Melbourne Water Corporation, Waterways and Drainage (2000) *Guidelines for Development in Overland Flow Paths*

Agriculture and Resource Management Council of Australia and New Zealand (2000) *Floodplain Management in Australia: Best practice principles and guidelines*

Glossary

This glossary is based on that used in the *Victoria Flood Management Strategy* (Department of Justice, NRE 1998). Other terms used in this practice note may be defined in the *Planning and Environment Act 1987*.

Average Recurrence Interval (ARI) The likelihood of occurrence of flooding expressed in terms of the long-term average number of years between the occurrence of a flood as large or larger than the DFE. For example, floods with a discharge as large as or larger than the 100-year ARI flood event will occur on average once every 100 years.

Catchment The area draining to a particular site. It always relates to a specific location and includes the catchments of tributary streams as well as the main stream.

Design Flood Event (DFE) A flood event of known magnitude or average recurrence interval, or a historic event which is selected for land use planning, emergency planning and engineering design purposes. The DFE for land use planning purposes should be the 100-year ARI flood where information is available. Note that the design flood does not define the maximum extent of land liable to flooding, which is defined by the PMF.

Discharge (or flow) The rate of flow of water measured in terms of volume over time (for example, cubic metres per second). It is to be distinguished from the speed or velocity, which is a measure of how fast the water is moving rather than how much is moving.

Flood Relatively high flows which overtop the natural or artificial banks in any part of a creek, river, estuary, lake, dam or artificial channel.

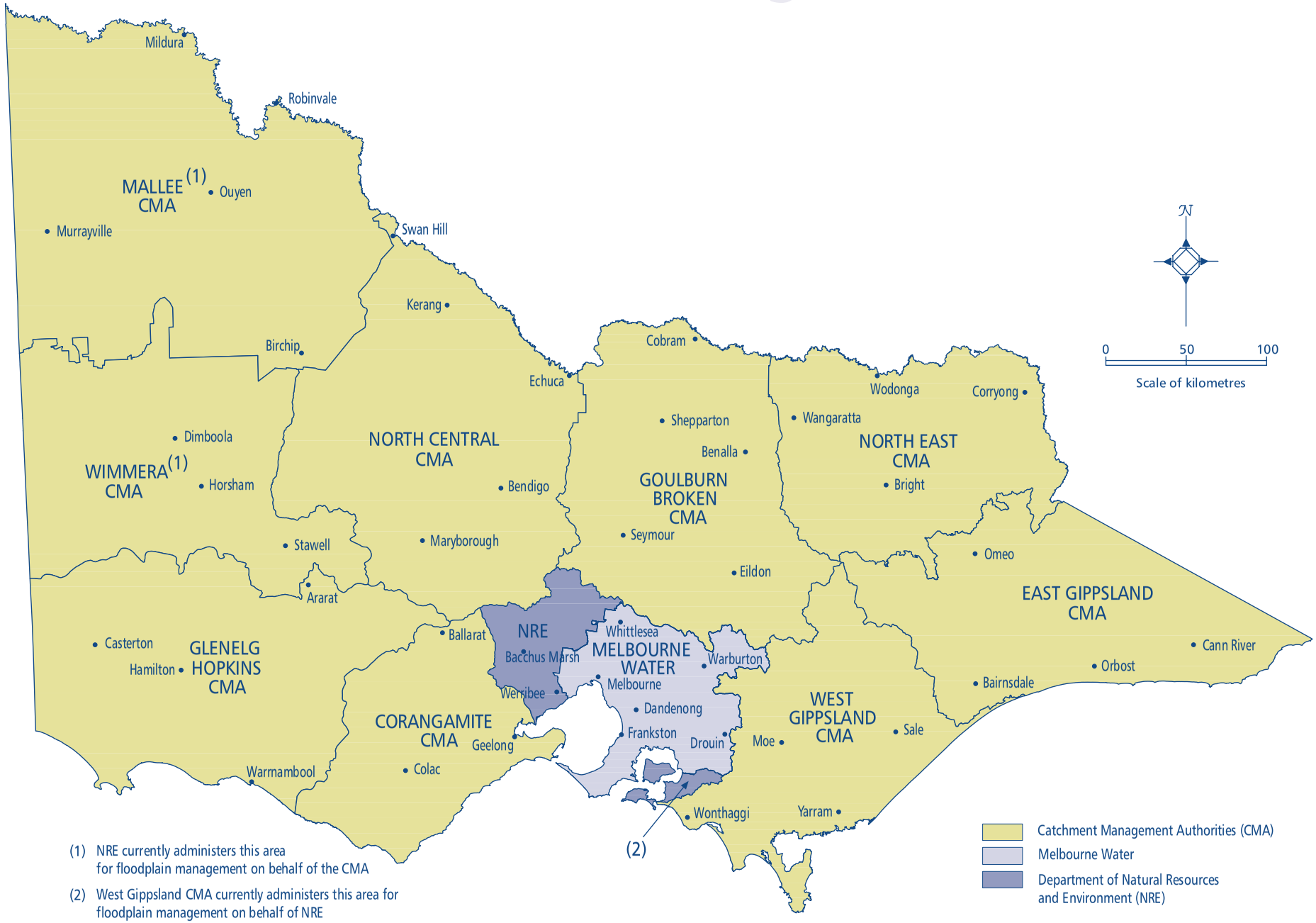
Flood awareness An appreciation of the likely effects of flooding and a knowledge of the relevant flood warning, response and evacuation procedures.

Flood damage The tangible and intangible costs of flooding.

Flood fringe Those areas that include already developed land, future infill development areas or protected areas. They are areas of land which are not effective for the free passage and temporary storage of floodwater and which are associated with a relatively low flood risk.

Flood mitigation works	Structural works (including levees, excavated floodways, water storages, retarding basins, stream channel modification, flood-proofing and house-raising) built to protect existing development and assets from flood risk and damage up to the DFE.
Flood-prone land	Land affected by the PMF, which defines the maximum possible extent of flooding.
Flood-proofing	A combination of measures incorporated in the design, construction and alteration of buildings or structures subject to flooding to reduce or eliminate flood damage.
Flood risk	Potential for loss or damage to property, including environmental assets, or harm to people due to flooding.
Flood storage areas	Those parts of the floodplain which would temporarily store floodwater to be later discharged as the flood recedes. These parts of the floodplain are important for the attenuation of a flood and for the reduction of its severity during its passage.
Floodplain	The area of land adjacent to a creek, river, estuary, lake, dam or artificial channel which is affected by the PMF, that is, flood-prone land.
Floodplain management	The range of measures (including land-use planning, development and building controls, flood mitigation works, flood warning and flood awareness) available to prevent or reduce flood risk.
Floodplain management authority	Any authority with 'direct' or 'delegated' functions for Floodplain Management under Part 10, Division 4 of the *Water Act 1989*. The main floodplain management authorities are Melbourne Water and the regional catchment management authorities for their respective areas. In areas not covered by the 'delegated' authority, the Minister for Environment and Conservation is the authority.
Floodway	The channel, stream and that portion of land subject to inundation necessary to convey the main flow of floodwater, and usually comprising the high-hazard portion of the floodplain where most development is to be avoided. Floodways are often, but not necessarily, the areas of deeper flow or the areas where higher velocities occur.
Freeboard	A factor of safety above design flood levels typically used in relation to the setting of floor levels. It is usually expressed as a height above the level of the DFE.
Hydraulics	The determination of parameters such as flood levels, flood depth and flow velocity in a river, stream, adjacent floodplain or overland flow path.
Hydrology	The study of the rainfall and run-off process as it relates to the determination of flows or discharges for given floods.
Land subject to inundation	The estimated area that would be inundated by the DFE. This will vary for different purposes, but should be based on the 100-year ARI flood for land use planning. Its extent will be less than the extent of flood-prone land, which is based on the PMF.
Local floodplain development plan	The principle means of managing development on land subject to inundation. It includes both written and diagrammatic information and guidelines which describe how the land is to be developed, particularly in relation to subdivisions, buildings and works.
Mainstream flooding	Inundation of normally dry land occurring when water overflows the natural or artificial banks of a watercourse in a catchment. Mainstream flooding generally excludes water carriers constructed with pipes or artificial channels, which are considered as stormwater channels.
Nominal Protection Level (NPL)	The 100-year ARI flood level plus a freeboard margin of 300 mm.
Planning authority	Any government minister or agency that has the power to prepare a planning scheme amendment, and which may include a council or public authority.
Probable Maximum Flood (PMF)	The largest flood that could conceivably occur at a particular location. The extent, nature and potential consequences of flooding associated with the PMF event should be assessed in a flood study. The PMF event may form the basis of evacuation planning and the identification of refuge areas. Considerations should be given to adopting the PMF event as the DFE for emergency services planning and for determining the location and floor levels of facilities such as telephone exchanges, police stations, hospitals and schools.

Responsible authority	The body or agency which administers and enforces a planning scheme, usually the municipal council.
Risk management	The systematic application of management policies, procedures and practices to the tasks of identifying, analysing, assessing, treating and monitoring risk.
Run-off	The portion of rainfall that drains into the surface drainage network, also known as rainfall excess.
Stormwater flooding	Stormwater flooding can be caused by local run-off exceeding the capacity of an urban stormwater drainage system or by the backwater effects of mainstream flooding causing the urban stormwater drainage system to overflow.
Velocity	A measure of how fast water is moving in terms of distance over time (for example, in metres per second). It is to be distinguished from the discharge or flow, which is a measure of how much volume of water is moving rather than its speed.



(1) NRE currently administers this area for floodplain management on behalf of the CMA

(2) West Gippsland CMA currently administers this area for floodplain management on behalf of NRE

Source: Department of Natural Resources and Environment (NRE)

Figure 3. Floodplain management areas in Victoria

Roles and responsibilities of statutory authorities

Statutory authorities	Legislation	Roles and responsibilities
Floodplain management authorities • Catchment Management Authorities (see attached map of Floodplain Management Areas in Victoria) • Melbourne Water • Department of Natural Resources and Environment	Floodplain management functions under the *Water Act 1989*, *Catchment and Land Protection Act 1994* (to be replaced by the Catchment Management Act) and *Melbourne and Metropolitan Board of Works Act 1958*.	**Catchment management authorities** • manage and control waterways, drainage and floodplains • promote community awareness of management of land and water resources • develop regional catchment management strategies • prepare and implement floodplain management plans • maintain and enhance flood information, including the extent and height of floodwater • provide advice about flooding and controls on development of land to local councils, the Department of Infrastructure and the community. **Melbourne Water** • manages and controls waterways, drainage and floodplains • promotes community awareness of water resource management issues • prepares comprehensive drainage and flood mitigation schemes for new development areas and corridors, and for existing areas undergoing redevelopment • prepares detailed information on overland flow paths and floodplains to guide orderly planning for future land development activities • updates individual property information and encumbrance databases so that interested parties can gain easy access to flood information • regulates development in the Melbourne metropolitan area as a formal referral authority under local planning schemes. **Department of Natural Resources and Environment** • develops national and Statewide flood policy • promotes best practice in floodplain management • coordinates the Statewide flood database • administers the Mallee and Wimmera Catchment Authority regions and parts of the Port Phillip region (until these regions are given enabling powers under the Water Act 1989).
Responsible authorities • All municipal councils	Administer and enforce planning schemes under the *Planning and Environment Act 1987*. Municipal councils also have responsibilities for building approvals under the *Local Government Act 1989* and the *Building Act 1993*.	**Municipal councils** • provide for the fair, orderly, economic and sustainable use and development of land • provide for the protection of natural resources and man-made resources and the maintenance of ecological processes and genetic diversity • establish a system of planning schemes to be the principal way of setting out objectives, policies and controls for the use, development and protection of land • ensure that environmental, social and economic effects are considered when decisions are made about the use and development of land • provide for effective enforcement procedures to achieve compliance with planning schemes, permits and agreements • regulate or prohibit any use or development in hazardous areas or in areas which are likely to become hazardous • facilitate accountability at all levels by maintaining information and reporting systems. • prepare 'designated special area' maps for areas liable to flooding • set minimum floor levels for buildings in areas liable to flooding • consider the likely danger to life, health and safety of the occupants of a proposed building due to flooding.

Examples

This appendix provides examples to illustrate a typical approach to addressing flood issues in a planning scheme. It is hoped that they will be of assistance to councils and floodplain management authorities.

The examples are intended as a guide only, and their content is not necessarily recommended for any particular situation. Councils and floodplain management authorities should agree on the format and content of documentation that will suit the requirements of a given area.

The examples are:

- Clause 21.05 - an MSS extract
- Clause 22.03-3 – a local planning policy
- A schedule to the LSIO
- A local floodplain development plan.

Clause 21.05 – an MSS extract

21.05-2 Flooding

Overview

Much of the Gumnut Shire is subject to regular flooding due to the number of rivers flowing through the area, the topography and the use of irrigation channels for drainage throughout the Shire. Figure 4 shows the extent of flooding in the Shire.

Flood mapping for the Shire provided by NRE in 2000 identifies 600 square kilometres of land within the municipality as flood prone. Significant floods occurred in 1890, 1916, 1934, 1952, 1974, 1990 and 1993.

Flooding is costly to the community. In June 1993, Yellow River experienced a 70-year ARI flood that caused some $25m in damages in Johnsville.

Flooding is the most critical physical planning issue within the Shire and drives many Council policies for economic and land use development. Council is aware that inappropriate development within designated floodways and floodplains can significantly exacerbate flood impacts, not only at the development site, but elsewhere in the floodplain. The floodways and floodplains of the municipality also provide an important agricultural resource and need to be maintained for active farming.

Dealing with flood issues requires an integrated approach to floodplain management, therefore, there needs to be improved coordination between Council and the Catchment Management Authority.

21.05-2.1 Objectives and Strategies

Objective 1

To recognise that a large proportion of Gumnut Shire is flood prone and to implement appropriate floodplain management strategies.

Strategies

- Promote the effective management, maintenance and upgrade of levee construction along the Green River and Yellow River flood plains.
- Limit the maximum bank height to the 10 year ARI flood level.
- Promote effective laser grading, land forming, irrigation and drainage works in the Sunrise Horticultural Estate that ensure the capacity of floodplains to carry and store floodwaters is not diminished.
- Encourage an integrated approach to flood management, fostering close coordination between Council, the Catchment Management Authority and affected landowners.
- Develop local floodplain development plans that allow buildings and works and forms of subdivision that do not increase the level of flood risk.

Objective 2

To minimise the risk to life, health and safety from the effects of flood waters.

Strategies

- Ensure that new buildings and works minimise the potential for flood risk and damage resulting from floodwater.

Clause 21.05 – an MSS extract *continued*

LOCAL PROVISION

Objective 3

To preserve the natural function of floodplains, including their inherent wetland values.

Strategies

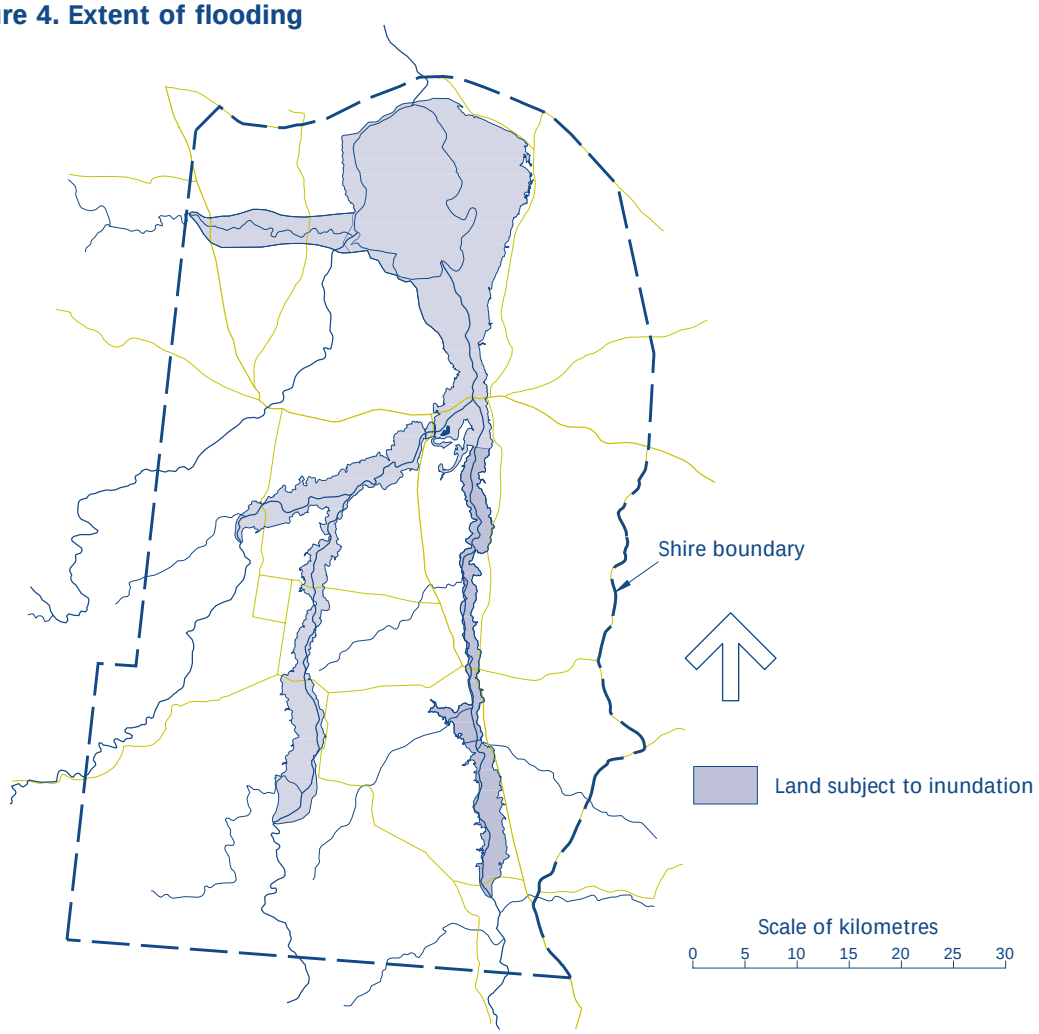
- Promote community awareness and education of the value of floodplains and wetlands through the development of recreational and tourism opportunities.
- Promote land use practices that preserve or enhance existing natural water storage and wetland areas.

21.05 – 2.2 Implementation

Further strategic work

- In conjunction with the Catchment Management Authority, undertake a detailed review of the existing flood mapping and floodplain management plans by December 2000 and incorporate any alterations through an amendment to the Gumnut Planning Scheme.
- Establish a monitoring and review program for the implementation of the Gumnut Shire Local Floodplain Development Plan – Yellow River Precinct (2000).

Figure 4. Extent of flooding



Clause 22.03-3 – a local planning policy

22.02.3 Floodplain Management

This policy applies to all areas within the Urban Floodway Zone, the Land Subject to Inundation Overlay and the Floodway Overlay.

Policy Basis

Flooding is the most critical physical planning issue within the Shire and drives much of the Council's policies for economic and land use development.

Much of the Shire is subject to regular flooding. Natural flooding cannot be prevented, but minimisation of flood risk and damage is possible through floodplain management plans and emergency management procedures.

Objectives

- To coordinate the management of floodplains throughout the catchment.
- To ensure that the location and design of all new development recognises the identified flood hazard and local drainage characteristics.
- To minimise the construction of inappropriate works in floodplains.
- To protect important wetlands.

Policy

It is policy that, when considering applications, the responsible authority will have regard to the requirements in the Gumnut Shire Local Floodplain Development Plan – Yellow River Precinct (2000):

References

Yellow River Flood Study/Strategy Plan, Gumnut Shire Council, 1996

Green River Flood Study/Strategy Plan, Gumnut Shire Council, 1996

A schedule to the LSIO

SCHEDULE TO THE LAND SUBJECT TO INUNDATION OVERLAY

Shown on the planning scheme map as **LSIO**.

1.0 Permit requirement

A permit is not required to construct or carry out the following:

Buildings

- A non-habitable building with a floor area less than 100 square metres.
- An extension to a non-habitable building provided that the total area of the building is less than 100 square metres.
- An extension to an existing dwelling provided that the floor area of the extension is less than 40 square metres and is less than 50% of the existing floor area.
- Pergolas, carports, in-ground swimming pools and hay sheds with open sides.

Works

- Earthworks that do not raise ground level topography by more than 200 millimetres.
- A protective wall or levee bank around the immediate surrounds of a dwelling provided that the buildings or works are in accordance with the Gumnut Shire Local Floodplain Development Plan – Yellow River Precinct (2000).
- Repairs and routine maintenance which do not affect the height, length or location of a levee, embankment or road.
- Open type fencing (excluding paling fencing, brick and concrete walls) and a replacement fence of the same type and materials as the existing fence.
- Works associated with apiaries and vine or horticultural trellises.
- Sports grounds with no grandstands or raised viewing areas.
- Golf courses, playgrounds, picnic shelters and barbeques.

Gumnut Shire Local Floodplain Development Plan – Yellow River Precinct (2000)

Before deciding on an application, the responsible authority must consider the Gumnut Shire Local Floodplain Development Plan Yellow River Precinct (2000).

2.0 Referral of applications

An application for a permit is not required to be referred to the floodplain management authority if the application is in accordance with an adopted local floodplain development plan.

YELLOW RIVER PRECINCT, SHIRE OF GUMNUT (2000)

Application

This local floodplain development plan has been prepared under the Gumnut Planning Scheme.

The plan provides requirements for buildings and works and subdivision in the Yellow River Precinct in Gumnut Shire shown on Figure 5. An application for a planning permit under the Floodway Overlay (FO), Land Subject to Inundation Overlay (LSIO) and Urban Floodway Zone (UFZ) must be consistent with this local floodplain development plan.

Flood history

Rural flooding in the Shire is frequent, with relatively high flood depths and velocities in the active floodway areas. The Yellow River has a long history of flooding, with major floods in this century occurring in 1916, 1934, 1952, 1974 and 1993. During the 1993 flood there were substantial losses to stock, fencing and crops in rural floodplain areas, and 600 urban properties were inundated in Johnsville.

Floodwater breaks out from the Yellow River during events greater than the 10-year ARI flood. In a 100-year ARI flood, floodwater up to 2 km in width spread across the floodplain.

Urban development in Johnsville began in the 1920s and, in the absence of sound land use planning strategies, has progressively obstructed floodplain land, diminishing its ability to convey, store and drain floodwater. Inappropriate development has caused increases in flood levels and flood risk. In the 1993 flood, flooding depths of up to 2 m were experienced in the town.

Flood information

Figure 5 completed by NRE in 2000 shows the extent of flooding of the Yellow River. The project made use of historic flood levels documented in past floods, aerial photography, and ground level information. UFZ, FO and LSIO areas are based on the relative flood risk assessed for different parts of the floodplain, considering factors such as flood depth, velocity, natural storage and warning time.

Flood impacts

Flood impacts in the FO areas of Gumnut Shire are significant, resulting in road closures, loss of access for rural communities, stranding of livestock and soil erosion.

Flood impacts in the UFZ of Johnsville are also significant, resulting in road closures, loss of access for urban residents, risks to emergency personnel during sand-bagging and evacuation operations, and damage to buildings constructed below flood level.

Flood impacts in both the rural and urban LSIO areas are less than in the floodway areas. However, urban flood damage costs in the urban LSIO area of Johnsville can still be considerable because of the high density of development.

Development requirements for the Floodway Overlay in rural areas

Dwellings

- No more than one dwelling is permitted per lot, provided the average dwelling density is not less than one dwelling per X hectares.
- A new dwelling should not be permitted on a lot if the 100-year ARI flood depth at the proposed house site, or along the accessway to the house site from a main road, is more than 0.5 m above the natural surface level.
- The minimum floor level of all new dwellings, or of extensions greater than 20 m^2 to existing dwellings, is 300 mm above the 100-year ARI flood level.

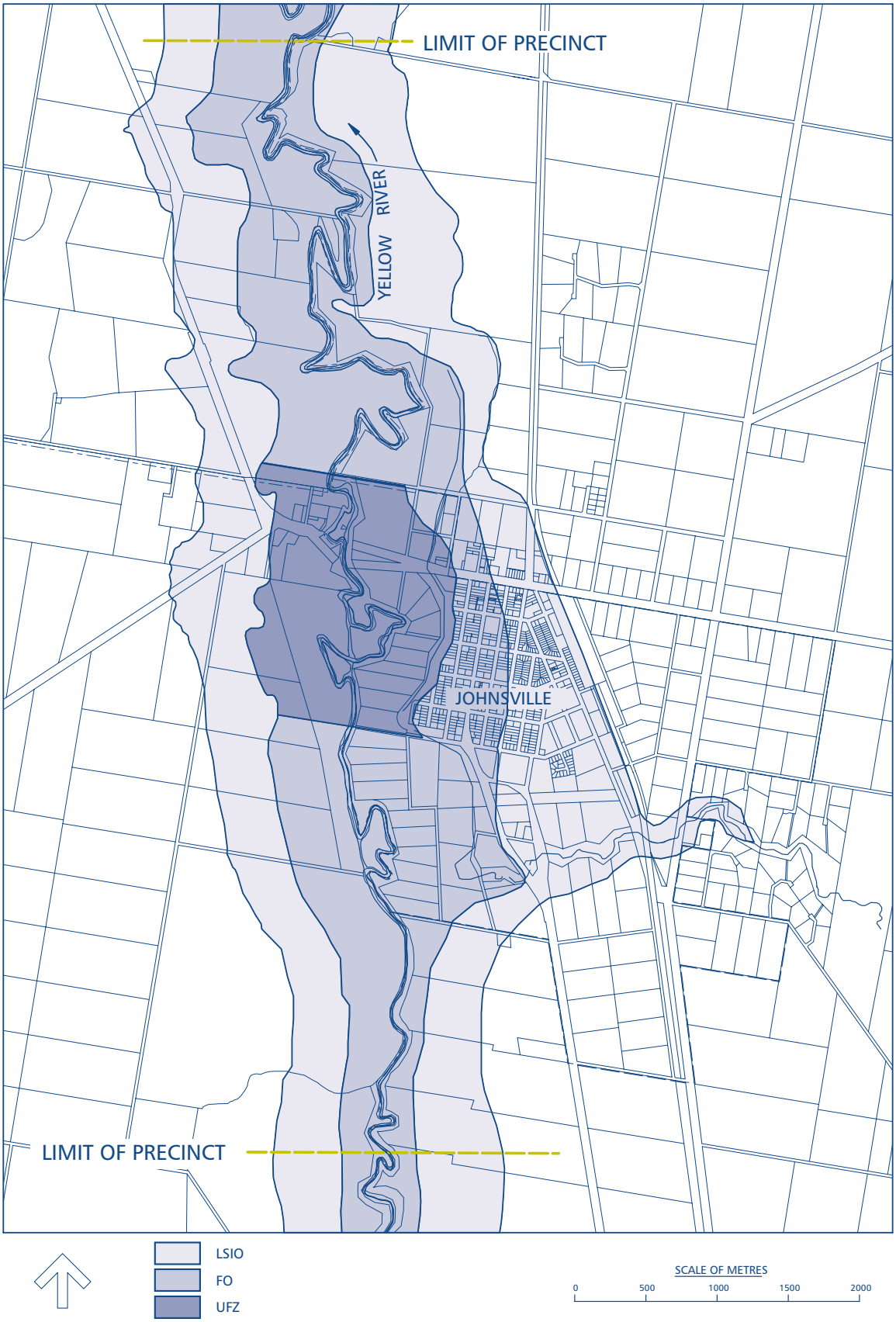
Commercial and industrial buildings

- New commercial and industrial buildings should not be permitted.

All buildings

- Buildings should be aligned with their longitudinal axis parallel to the direction of flood.
- The design of a building should minimise the damage caused by flooding to the structure and its contents, such as by raising floor levels, using water-resistant materials and raising electrical fittings above flood level.
- Building pads should be restricted as near as practical to the building envelope.

Figure 5. Local floodplain development plan – Yellow River Precinct



Earthworks

- A permit is not required for earthworks which would raise the natural surface levels by less than 100 mm.
- Significant earthworks, including levees and raised roads, are inappropriate for floodway land.
- If requested by the floodplain management authority, an hydraulic impact assessment by an appropriate specialist consultant must be undertaken for proposed earthworks which would raise natural surface levels by more than 100 mm (other than building pads and works to protect the immediate surrounds of existing dwellings).

Development requirements for the Land Subject to Inundation Overlay in rural areas

Subdivision

- Any new lot must be at least X hectares.

Dwellings

- No more than one dwelling should be permitted per lot, provided the average dwelling density is not less than one dwelling per X hectares.
- A new dwelling should not be permitted on a lot if the 100-year ARI flood depth at the proposed house site is more than 0.5 m above the natural surface level, or if the flood depth along the accessway to the house site from a main road is more than 0.8 m above the natural surface level.
- The minimum floor level of all new dwellings is 300 mm above the 100-year ARI flood level.
- The minimum floor level of extensions to existing dwellings is 300 mm above the 100-year ARI flood level, unless the extension is less than 40 m^2 and is less than 50 per cent of the existing floor area.

All buildings

- Buildings should be aligned with their longitudinal axis parallel to the direction of flood flow.
- The design of buildings should minimise the damage caused by flooding to the structure and its contents, such as by raising floor levels, using water-resistant materials and raising electrical fittings above flood level.
- Building pads should be restricted, as near as practical, to the building envelope.

Earthworks

- A permit is not required for earthworks which would raise natural surface levels by less than 200 mm.
- If requested by the floodplain management authority, an hydraulic impact assessment by an appropriate specialist consultant must be undertaken for proposed earthworks which would raise natural surface levels by more than 200 mm (other than building pads or works to protect the immediate surrounds of existing dwellings).

Development requirements for the Floodway Overlay in Johnsville

Dwellings

- There should be no increase in the number of dwellings in the township.
- A new dwelling should not be permitted on a lot if the 100-year ARI flood depth at the proposed house site, or along the accessway to the house site from a main road, is more than 0.5 m above the natural surface level.
- The minimum floor level of all new dwellings, or of extensions greater than 20 m^2 to existing dwellings, is 300 mm above the 100-year ARI flood level.
- In the case of a replacement dwelling or extension to an existing dwelling, the maximum increase in the building envelope area is 40 m^2.