



Bribie Island Road – Transport Corridor Review Ningi to Bribie Island Bridge

Option Review

Department of Main Roads

4 April 2007

MAUNSELL | AECOM

Ningi to Bribie Island Bridge

Prepared for

Department of Main Roads

Prepared by

Maunsell Australia Pty Ltd

12 Cribb Street, PO Box 1823, Milton QLD 4064, Australia
T +61 7 3858 6700 F +61 7 3858 6705 www.maunsell.com

ABN 20 093 846 925

4 April 2007

10304406

© Maunsell Australia Pty Ltd 2007

The information contained in this document produced by Maunsell Australia Pty Ltd is solely for the use of the Client identified on the cover sheet for the purpose for which it has been prepared and Maunsell Australia Pty Ltd undertakes no duty to or accepts any responsibility to any third party who may rely upon this document.

All rights reserved. No section or element of this document may be removed from this document, reproduced, electronically stored or transmitted in any form without the written permission of Maunsell Australia Pty Ltd.

Quality Information

Document Ningi to Bribie Island Bridge
Ref 10304406
Date 4 April 2007
Prepared by James Fjeldsoe, Brian Parkinson
Reviewed by Bob Taylor, Phillip Hawes

For Information

Revision History

| Revision | Revision Date | Details | Authorised | |
|----------|---------------|-------------------------|---|-----------------|
| | | | Name/Position | Signature |
| A | 06/03/2007 | Draft for Client Review | Leo Hammett Director Planning & Advisory Services | Original Signed |
| 0 | 21/03/2007 | Final Issued to Client | Leo Hammett Director Planning & Advisory Services | Original Signed |
| 1 | 04/04/2007 | Issued to Client | Leo Hammett Director Planning & Advisory Services | Original Signed |

Table of Contents

| | | |
|-------------------|---|----|
| Executive Summary | | i |
| 1.0 | Introduction | 1 |
| | 1.1 Background | 1 |
| | 1.2 Study Area | 2 |
| | 1.3 Report structure | 3 |
| 2.0 | Previous Studies | 3 |
| | 2.1 The Bribe Island Road Planning Study (BIRPS) | 3 |
| | 2.2 The Bribe Island Road Planning Study Review of Environmental Factors (Planning) | 3 |
| 3.0 | Opportunities and Constraints Analysis | 4 |
| | 3.1 Review of Existing Data Layers | 4 |
| | 3.2 Revised Mapping | 5 |
| | 3.3 Consultation with Caboolture Shire Council | 6 |
| 4.0 | Options Development | 6 |
| | 4.1 Design Criteria | 7 |
| | 4.2 Development Process | 7 |
| 5.0 | Option Description | 9 |
| | 5.1 Bypass Option A | 9 |
| | 5.1.1 Description | 9 |
| | 5.1.2 Key Features | 9 |
| | 5.1.3 Issues | 10 |
| | 5.2 Bypass Option B | 10 |
| | 5.2.1 Description | 11 |
| | 5.2.2 Key Features | 11 |
| | 5.2.3 Issues | 11 |
| | 5.3 Bypass Option C | 12 |
| | 5.3.1 Description | 12 |
| | 5.3.2 Key Features | 12 |
| | 5.3.3 Issues | 13 |
| | 5.4 Bypass Option D | 13 |
| | 5.4.1 Description | 14 |
| | 5.4.2 Key Features | 14 |
| | 5.4.3 Issues | 14 |
| | 5.5 Upgrade of Bribe Island Road | 15 |
| | 5.5.1 Description | 15 |
| | 5.5.2 Key Features | 15 |
| | 5.5.3 Issues | 16 |
| | 5.6 Relocation of Utility Services | 16 |
| 6.0 | Assessment of Options | 16 |
| | 6.1 Traffic | 16 |
| | 6.1.1 Review of Cardno MBK modelling | 16 |
| | 6.1.2 Midblock Capacity Analysis | 18 |
| | 6.1.3 Intersections | 18 |
| | 6.1.4 Travel Times | 18 |

| | | |
|------------|-------------------------------|----|
| 6.2 | Environmental | 19 |
| 6.2.1 | Ecology | 19 |
| 6.2.2 | Other Environmental Issues | 20 |
| 6.3 | Land Use and Social Impacts | 23 |
| 6.3.1 | Zoning | 23 |
| 6.3.2 | Development Approvals | 24 |
| 6.3.3 | Other Land Use Considerations | 24 |
| 6.3.4 | Summary of Potential Impacts | 25 |
| 6.4 | Economic | 25 |
| 7.0 | Summary of Impacts | 28 |
| 8.0 | Conclusion | 30 |
| Appendix A | Figures | a |
| Appendix B | Alignment Drawings | b |
| Appendix C | Flora and Fauna Review | c |

Executive Summary

The potential future upgrade of Caboolture-Bribie Island Road has been the subject of a series of ongoing studies and investigations since 2000. In that time the opportunities for a bypass of Ningi have steadily diminished as urban development proceeded within the study area. This being the case, the objective of this report was to update the work previously undertaken by Cardno MBK in the *Bribie Island Road Planning Study* (BIRPS, 2002) in order to determine whether or not feasible bypass options still exist.

It was confirmed through an initial opportunities and constraints analysis that options for a bypass have indeed become significantly further constrained since the preparation of the BIRPS. A series of four revised bypass options were then developed based on the remaining opportunities within the study area for comparison against a 4 lane upgrade of the existing Bribie Island Road which was considered to be the base case scenario.

Based on engineering grounds alone with no consideration of cost, environmental and social impacts, bypass options A and B provide the most direct and highest speed routes between the Bribie Island Bridge and Browns Road. Of these two alignments, Option A would be the easier corridor to preserve due to the majority of the alignment either being located within Crown tenure, mining lease or being otherwise unlikely to develop for urban purposes. Option B is however significantly shorter (new road) than Option A and makes use of the existing 4 lane section of road between Browns Road and Bestmann Road.

However, the assessment has found that whilst the bypass options would result in benefits associated with improved travel times and road network connectivity, these benefits would be offset by high ecological impacts, medium to high land use and social impacts and project costs 200-300% greater than an upgrade of the existing road.

Alternatively, a 4 lane upgrade of the existing road would have relatively minor environmental, land use and social impacts although the connectivity of the local Ningi road network would be somewhat reduced. The 4 lane upgrade option would also be significantly cheaper to develop, could be staged over a number of years and would also cost less than half of the cheapest bypass option.

In particular relation to ecological impacts it was found that all remaining bypass options would impact on essential habitat for a number of threatened frog and bird species afforded protection under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC). For the purposes of the EPBC Act, a 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.

To be 'likely', it is not necessary for a significant impact to have a greater than 50% chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility. Furthermore, if there is insufficient information available to determine whether or not impacts or potential impacts are serious or irreversible, the precautionary principle is applicable. Accordingly, a lack of scientific certainty about the potential impacts of an action will not itself justify a decision that the action is not likely to have a significant impact on the environment.

This being the case, it is considered that for the purposes of the EPBC Act, all of the bypass options have the potential for 'significant impacts' on the essential habitat of the above mentioned threatened species. As such, development of any bypass option would trigger referral under the EPBC and result in assessment and mitigation requirements similar to that experienced for other major road projects in sensitive environmental areas including the Tugun Bypass.

Therefore, the ecological impacts of the bypass options are considered to be such that they materially affect the feasibility of the remaining available alignments, particularly where a viable alternative exists (4 lane upgrade of existing road). As such, an upgrade of the existing road to 4 lanes as described in detail in section 5.5 is considered to be the preferred option.

According to the traffic volumes developed in the BIRPS, a 4 lane upgrade of the existing road is likely to have a design life beyond 2031. This is considered to be a conservative estimate given that the BIRPS did not consider a practical upper limit for development on Bribie Island. It is recommended therefore that a supplementary investigation is undertaken to revise these traffic numbers and provide a more accurate indication of the likely life of the 4 lane upgrade option beyond 2031.

1.0 Introduction

Maunsell have been engaged by the Department of Main Roads (DMR) to update the work previously undertaken by Cardno MBK in the *Bribie Island Road Planning Study* (BIRPS, 2002) in light of recent changes to the extent of urban development within the study area (existing and proposed) as well as changes to environmental values. Secondly, the report will use the updated data in order to determine whether or not feasible bypass options for the township of Ningi still exist.

For the purposes of this study, the upgrade of the existing corridor to four lanes (without service roads) as previously adopted by DMR as the preferred upgrade option has been carried forward as a base case scenario given that only minor changes have occurred to the existing corridor in the intervening time. The on-line upgrade option has been further refined and developed as discussed in Chapter 5.0.

In order to achieve the above-mentioned objectives the focus of this report is on those issues that have changed in the time since the Cardno report (2002) and therefore may alter the feasibility of bypass options.

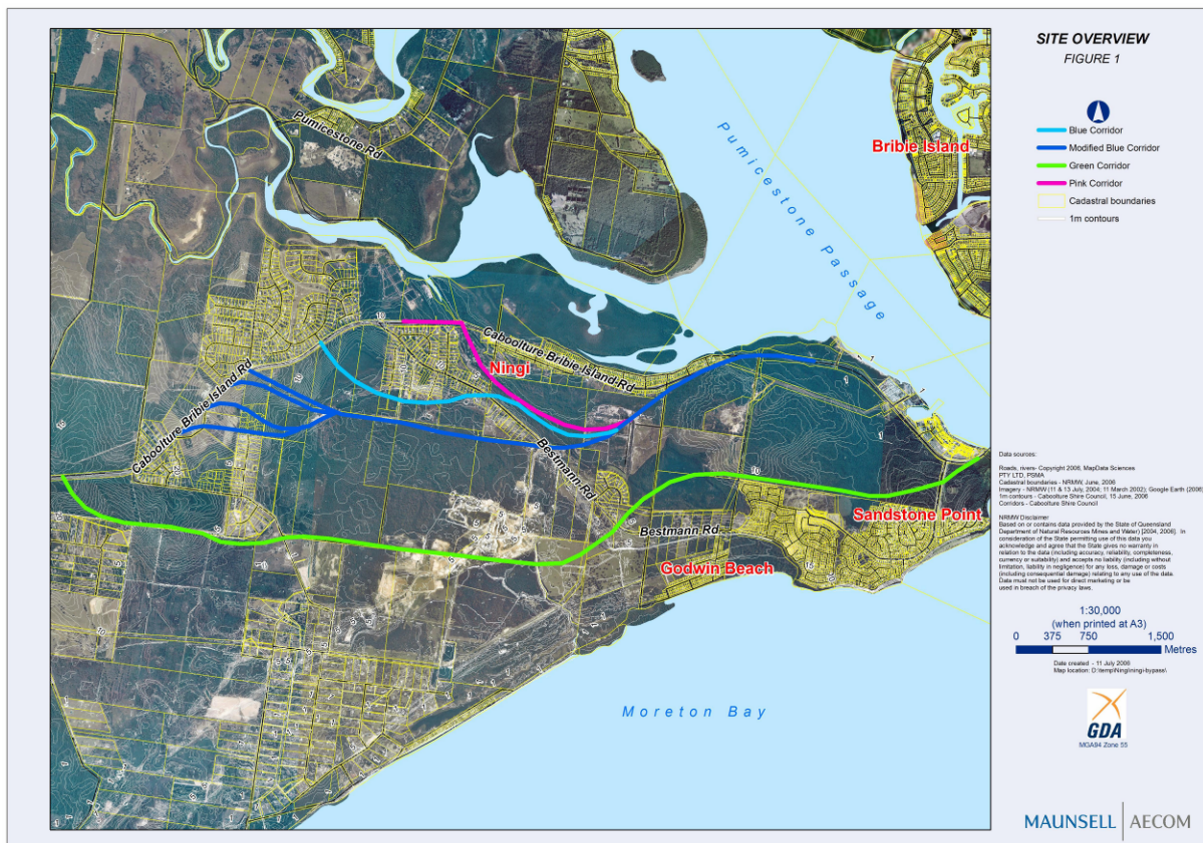


Figure 1 Study Area – Including Previous Bypass Options

1.1 Background

In response to issues raised in representations from the community, DMR commissioned Cardno MBK in April 2000 to prepare the BIRPS and an associated Review of Environmental Factors – Planning (REF). The study objectives were to recommend an upgrading strategy for the road and evaluate alternative routes (bypass options) to maximise traffic efficiency and residential amenity in Ningi. The bypass corridors considered in the BIRPS are indicated above in Figure 1.

The study found that in 2000, traffic volumes on Caboolture-Bribie Island Road at Ningi were approximately 15,000 vpd AADT (vehicles per day Annual Average Daily Traffic). The forecast traffic volumes west of Ningi for 2031 were predicted to rise to over 35,000 vpd AADT, with peak seasonal loadings that may be significantly higher than indicated by this forecast. Based on this information, traffic analysis undertaken as part of the BIRPS determined that the existing two lane Caboolture-Bribie Island Road was likely to be deficient within the decade to 2012.

The BIRPS recommended a short bypass, the pink corridor (see Figure 1), as the preferred option for upgrade of the road. Public display of the preferred option resulted in a significant split within the local community between those in favour of the route (or a bypass in general) versus those in favour of upgrading the existing road.

Adding further complication to the situation, Caboolture Shire Council (Council) distributed a brochure to residents in the area which opposed both the proposed pink corridor and an upgrade of the existing road. Council instead requested that DMR (re)consider variations of the previous Blue Corridor (see Figure 1).

In a media release on the 5th of August 2002, the then Minister for Transport and Main Roads decided not to adopt the short bypass option and committed to a progressive upgrade of the existing road. In coming to this decision it was acknowledged that Council favoured a long bypass option, but that these options were not looked upon favourably based on cost, environmental impacts and potential cultural heritage issues.

In February of 2005, DMR conducted a survey of the wider Ningi and Bribie Island community in order to gather information on the perceived issues with traffic and how these issues may best be resolved in a balanced and affordable way. The results of the survey showed that the community was relatively evenly divided and that no one option had a clear majority.

Council now believes that the previously considered short bypass options are no longer viable because of recent development applications and approvals. Council has previously indicated support for a longer bypass of Ningi and agreed to work with DMR to further investigate the feasibility of a longer bypass with respect to proposed developments and environmental issues.

1.2 Study Area

The study area is bounded by Browns Road to the west, Ningi Creek to the north, Pumicestone Passage/Bribie Island to the west, and Moreton Bay to the south (see Figure 1). The area is located on coastal lowlands within Caboolture Shire.

Within this study area, Caboolture-Bribie Island Road provides the link between Bribie Island and the mainland. This road commences at the Bruce Highway to the west of Ningi and is approximately 19 km in length. It crosses over the Pumicestone Passage as a two lane, multiple span bridge. Caboolture-Bribie Island Road also provides access to mainland residential areas such as Godwin Beach, Sandstone Point and Beachmere.

1.3 Report structure

The structure of this report has been specifically developed to address the objectives and scope outlined above. As such, it does not follow the outline of a normal planning study or environmental assessment report. The following major headings have been adopted:

1. *Introduction* – outlining the background to the report, scope and structure;
2. *Previous Studies* – summarising the findings of the BIRPS and associated REF;
3. *Opportunities and Constraints Analysis* – highlighting changes that have occurred since the preparation of the BIRPS that may alter the feasibility or otherwise of bypass options;
4. *Options Development* – outlining the process by which revised bypass options were developed in accordance with the findings of Section 3.0;
5. *Option Description* – outlining the potential bypass options including an assessment of their technical performance (including functionality and connectivity) as well as cost;
6. *Assessment of Options* – providing an assessment of the various options (including upgrade of existing) based on economic, social and environmental factors;
7. *Summary of Impacts* – providing a summary of the impacts of the various options; and
8. *Conclusion* – including a discussion regarding the preferred option.

2.0 Previous Studies

There are two previous studies published by Cardno MBK that form the basis for this report: *The Bribie Island Road Planning Study (2002)* and *The Bribie Island Road Planning Study, Review of Environmental Factors (Planning) (2002)*. It should be noted that both studies were prepared concurrently and that the REF formed the supporting background information for the BIRPS.

2.1 The Bribie Island Road Planning Study (BIRPS)

The BIRPS commenced in April 2000 and was required “to identify a preferred strategy that would ensure appropriate upgrading of the Bribie Island Road to deliver an adequate level of service in the future and to improve the capacity and safety of the road without unacceptable impact upon the environment”. Several bypass options for Ningi were identified in this study. The study utilised conventional methodologies to determine options for the road corridor. These methodologies included extensive community consultation, research of existing conditions, traffic analysis, development of options and refinement to a recommended upgrade strategy.

The BIRPS received a mixed response from the community and Caboolture Shire Council. The then Minister for Transport and Main Roads decided not to adopt a bypass option and instead confirmed the original plans to upgrade the existing road through Ningi. This option was opposed by some Ningi residents and Caboolture Shire Council reconsidered its position.

2.2 The Bribie Island Road Planning Study Review of Environmental Factors (Planning)

The Bribie Island Road Planning Study Review of Environmental Factors (Planning) concentrated on the environmental characteristics that may have been impacted by the options that were in development for the BIRPS. The REF included:

- Description of the study area and its justification;
- Description of the existing environment of the study area;
- Examination of the likely impacts of the proposed options on the environment;
- Environmental constraints and issues along each proposed upgrade option; and
- Recommendation of a preferred upgrade strategy.

Six potential road corridor options were initially examined in the REF, with a seventh option added to the REF following public consultation. The REF considered such factors as climate, topography, soils, geology, hydrology, water quality, noise, flora and fauna, and visual impact. This review concluded that the option with the least environmental impact was to upgrade the existing road within the existing corridor.

The list was shortened to four options (Figure 1) following public consultation and a preliminary ranking utilising a multi-criteria analysis:

- Pink Corridor – a short southern bypass;
- Blue Corridor – a longer southern bypass;
- Modified Blue Corridor – a variation of the Blue Corridor based on input from Southern Pacific Sands; and
- Green Corridor – the longest southern bypass based on the direct route from Caboolture-Bribie Island Road (west of residential areas) to the Bribie Island Bridge.

The multi-criteria analysis included engineering, environmental, social/heritage and economic issues. Weighted scores were adopted to reflect a balanced view between 14 sub-elements of these criteria.

Following detailed evaluation of these options, a Modified Pink Corridor was developed to minimise impact on regional ecosystems, hydraulic characteristics of the area and cultural heritage areas. The Modified Pink Corridor was evaluated using the same criteria and weightings. This option was assessed to be the preferred option after this evaluation and was released for community consultation.

Following feedback from the community and Caboolture Shire Council the original option to upgrade the existing road was adopted. Further work on the BIRPS was finalised based on this decision.

3.0 Opportunities and Constraints Analysis

3.1 Review of Existing Data Layers

The following table indicates the data layers utilised by Cardno MBK in the BIRPS. The cells highlighted in red indicate that the data set has changed significantly since completion of the BIRPS in 2002. Cells that are highlighted in green indicate that the data set remains valid.

Table 1 Changes in Data Layers Since Completion of the BIRPS

| Planning Layers | Data Since 2002 | Comments |
|---------------------|-----------------|--|
| Land Use and Zoning | Changed | A new Caboolture Shire Planning Scheme was released in December 2005. The new planning scheme has consolidated urban zoned areas within the study area. The previous zonings had been more general in nature and had identified large areas for future residential and/or rural residential development. |
| Regional Ecosystems | Changed | New Regional Ecosystem (RE) mapping was released in 2005. Several Of Concern REs were reclassified to Not Of Concern and the RE adjoining the north-west side of Bestmann Road was reclassified from Of Concern to Endangered. |
| Protected Areas | Changed | A search of the EPA mapping of the study area identified an additional layer "Essential Habitat". This layer identifies areas that provide critical habitat for scheduled species under the <i>Nature Conservation Act 1992</i> . |
| Fauna | Valid | See protected areas (above). |
| Cultural Heritage | Valid | Not re-assessed. |

| Planning Layers | Data Since 2002 | Comments |
|--------------------|-----------------|--|
| Climate | Valid | Not re-assessed. |
| Topography | Valid | Not re-assessed. |
| Geology and Soils | Valid | Not re-assessed. |
| Acid Sulfate Soils | Valid | High risk acid sulfate soil mapping was received from Caboolture Shire Council and was included in the opportunities and constraints mapping. The mapping also included land that was below 5 m AHD to identify areas of potential acid sulfate soils. |
| Hydrology | Valid | Not re-assessed. |
| Water Quality | Valid | A waterway and wetland mapping layer was received from Caboolture Shire Council and was included in the opportunities and constraints mapping. |
| Air Quality | Valid | Not re-assessed. |
| Noise | Valid | Not re-assessed. |

3.2 Revised Mapping

As a result of the analysis summarised above, a revised set of GIS maps were produced detailing the key opportunities and constraints within the study area (see Appendix A).

Table 2 Revised GIS Maps

| Map Number | Title |
|------------|---|
| 1 | Overview |
| 2 | Contours |
| 3 | Zoning |
| 4 | SEQ Regional Plan |
| 5 | Development Applications (West) |
| 6 | Development Applications (East) |
| 7 | Extractive Resources and Electricity Infrastructure |
| 8 | Nature Conservation Areas |
| 9 | Waterways and Wetlands |
| 10 | Acid Sulfate Soils |
| 11 | Geology |

Concurrently, information regarding current development proposals was obtained from Council. The following key changes were identified:

- Introduction of the new *Caboolture Shire Planning Scheme* featuring consolidated urban zonings within the study area;
- Introduction of the *South East Queensland Regional Plan* including an “urban footprint”;
- The commencement of a number of developments within the study area and the proposal of several others; and
- Changes to a number of *Regional Ecosystem* classifications.

These changes were consolidated with existing constraint mapping in order to produce a base map for identification of potential bypass corridors. The combined outcome of these changes was a general reduction in the opportunities for a bypass corridor and/or an increase the impacts associated with the potential corridors.

Specific issues in relation to individual opportunities and constraints are discussed in detail as they relate to potential bypass options in Section 6.0.

3.3 Consultation with Caboolture Shire Council

In addition to the review of material outlined above, a number of meetings have been held with the relevant officers from Caboolture Shire Council regarding a range of issues, including, Council's current road hierarchy planning, environmental constraints, changes brought about as a result of the new planning scheme and development activity since the previous studies.

Arrangements were also made with Council for the acquisition of a variety of GIS data layers for the purposes of the study as discussed above.

4.0 Options Development

This section identifies the issues related to the geometric design of the indicative alignments for bypassing Ningi and also upgrading of the existing Bribie Island Road through Ningi. The options are based on a re-examination of the corridors previously considered in the BIRPS to take into account changes in environmental values and development (proposed and existing) within the study area. This process was informed by an opportunity and constraints analysis, a summary of which is described above in Section 3.2. The options were developed progressively through a series of informal workshops involving Maunsell traffic planners, environmental planners, ecologists, road designers as well as DMR representatives.

The potential options for bypassing Ningi as shown on Sketches 10304406-SK001 and SK009 to SK012 (see Appendix B) inclusive are:

- Bypass Option A - Bypass of Ningi commencing at the southern abutment of the bridge to Bribie Island then running in a westerly direction to the north of Sandstone Point before passing south of the rural residential area to the east of Bestmann Road west. The alignment then runs in a westerly direction passing south and parallel to Bentley Road and connecting to the Bribie Island Road about 600m west of the intersection with Browns Road;
- Bypass Option B - Bypass of Ningi commencing at the southern abutment of the bridge to Bribie Island, then running in a westerly direction to the north of Sandstone Point before passing north of the rural residential area to the east of Bestmann Road west. The alignment then continues west and connects to the Bribie Island Road about 1km west of the intersection with Bestmann Road west;
- Bypass Option C – Bypass of Ningi commencing at the southern abutment of the bridge to Bribie Island, following the existing alignment west to Redondo Street, turning south and parallel to Redondo Street, passing south of the rural residential area to the east of Bestmann Road west and then connecting to the Bribie Island Road about 1km west of the intersection with Bestmann Road west; and
- Bypass Option D - Bypass of Ningi commencing at the southern abutment of the bridge to Bribie Island, then running in a westerly direction to the north of Sandstone Point before passing south of the rural residential area to the east of Bestmann Road west. The corridor then connects to the alignment for Option C west of Bestmann Road before connecting to the Bribie Island Road about 1km west of the intersection with Bestmann Road west.

An on-line upgrade of the existing Bribie Island Road would involve reconstruction of the existing 2 lane carriageway to a 4 lane divided carriageway with a 60 kph speed limit from the intersection with Bestmann Road to about 1000m east of the intersection with Redondo Street as shown on Sketches 10304406-SK002 to SK008 inclusive (see Appendix B).

4.1 Design Criteria

The geometric design criteria are based on the design criteria in the “Road Planning and Design Manual” by Queensland Department of Main Roads. The principal design criteria for the development of the alignments are:

Upgrade Bribie Island Road

- Design speed - 70 kilometres per hour, signposted to 60kph;
- Initially 4 lane divided carriageway;
- Direct access to fronting properties; and
- Maintenance of local traffic interconnections at Redondo Street, Regina Avenue and Bestmann Road.

Bypass Option A

- Design speed - 110 kilometres per hour, signposted to 100kph;
- Posted speed reduced to 80kph or 60kph at intersections as appropriate;
- Initially 4 lane carriageway, with provision to widen in the median to 6 lanes;
- Maintenance of local traffic interconnections at Bestmann Road, Peel Road and Browns Road; and
- Limited access from adjoining land and residential streets.

Bypass Options B

- Design speed - 110 kilometres per hour, signposted to 100kph;
- Posted speed reduced to 80kph or 60kph at intersections as appropriate;
- Initially 4 lane carriageway, with provision to widen in the median to 6 lanes
- Maintenance of local traffic interconnections at Bestmann Road; and
- Limited access from adjoining land and residential streets.

Bypass Options C and D

- Design speed - 90 kilometres per hour, signposted to 80kph;
- Posted speed reduced to 60kph at intersections as appropriate;
- Initially 4 lane carriageway, with provision to widen in the median to 6 lanes
- Maintenance of local traffic interconnections at Bestmann Road; and
- Limited access from adjoining land and residential streets.

The typical cross section for the above options is shown on Sketch 10304406-SK013 (see Appendix B). It should be noted that although the geometric design of bypass options A and B allows for a 100kph speed limit, the frequency of intersections along the routes is such that sections of the alignments may be limited to 80kph.

4.2 Development Process

The layout for the potential road corridors for bypassing Ningi are shown on Sketch 10304406-SK009 to SK012 inclusive. The layout for upgrading of the existing road through Ningi is shown on Sketch 10304406-SK002 to SK008 inclusive. The layouts developed are indicative and will need to be refined/modified during the design development process, as appropriate, to take account of information derived from:

- Detailed survey;
- Geotechnical assessments, particularly potential for reuse of existing pavement and drainage;
- Hydraulic modelling analysis;

- Refinement of horizontal and vertical geometric design constraints;
- Discussions with utility authorities concerning proposals for future public infrastructure;
- Identification of utility services that will require relocation (e.g. telecom, water, power etc);
- Further assessment of potential environmental constraints;
- Identification of changes to land use and developments;
- Consultation with land owners and other stakeholders; and
- Assessment of mitigation options to minimise potential social impacts;
- Resolution of environmental constraints; and
- Resolution of the extent of mitigating works required to minimise environmental impacts.

Intersections are proposed at key roads where they cross the various bypass corridor alignments, namely at:

- Browns Road;
- Pell Road;
- Bestmann Road (West); and
- Bestmann Road (East).

It has been assumed that intersections between cross roads and the bypass will be at-grade. If at some future date traffic numbers on the bypass route warrant, the at-grade intersections may be replaced with grade separated interchanges. Grade separated interchanges would also allow the sign posted speed to be increased to 100kph for the full length of the bypass option(s). It should be noted that grade separation would add significantly to the cost of bypass options and that this cost has not been included in the cost estimate in section 6.4.

In addition to the intersections provision has been included for a haul road overpass on bypass Options A, B and D. West facing on/off ramps would be provided in the vicinity of the overpass to provide a direct connection for sand mine haulage vehicles to remove them from Bestmann Road. The need for the overpass and ramps would be determined based on an assessment of the impacts on the sand mining operations in the area and quantum of potential compensation.

5.0 Option Description

This section will provide a detailed description and assessment of the various upgrade options based on technical (engineering) grounds alone.

5.1 Bypass Option A

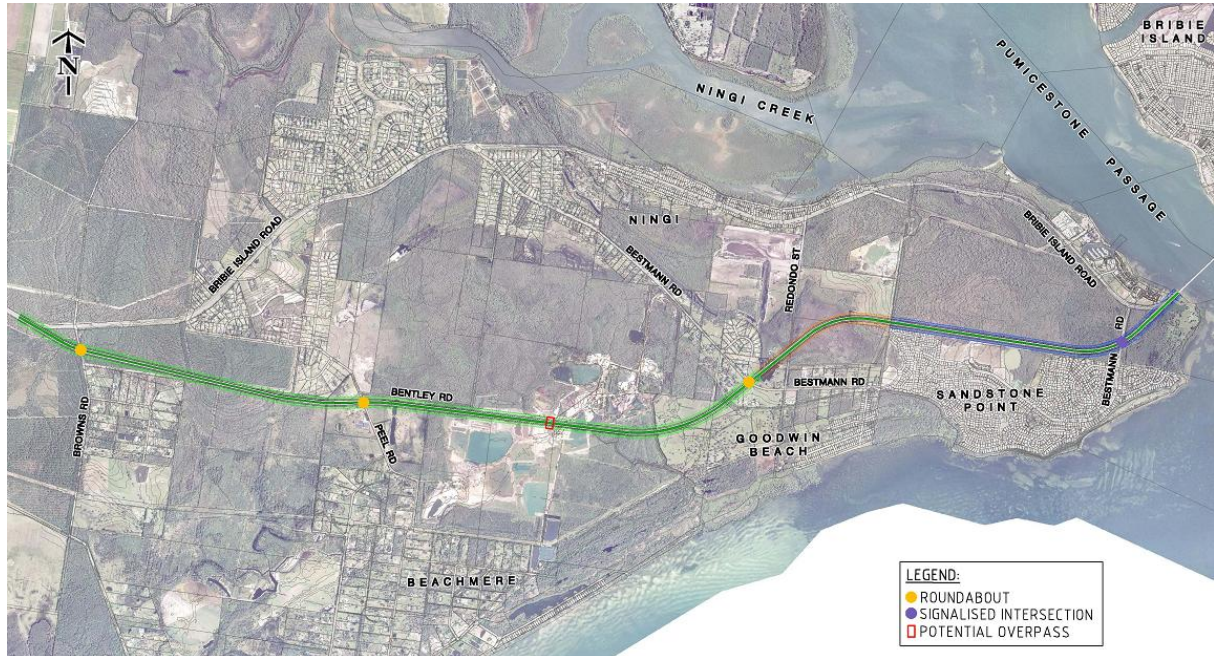


Figure 2 Bypass Option A

5.1.1 Description

Bypass of Ningi commencing at the southern abutment of the bridge to Bribie Island then running in a westerly direction to the north of Sandstone Point before passing south of the rural residential area to the east of Bestmann Road west. The alignment then runs in a westerly direction passing south and parallel to Bentley Road and connecting to the Bribie Island Road about 600m west of the intersection with Browns Road.

The proposed alignment for the bypass is shown on Sketch 10304406-SK009.

5.1.2 Key Features

The following are the key features of the Bypass Option A alignment:

- Length 11,000m;
- Meets the desirable geometric design standards;
- Travel speed of 100kph, to match the 100kph speed zone on Bribie Island Road west of Browns Road, (slower either side of intersections);
- Provides an alternate traffic route to the existing Bribie Island Road through Ningi from Bribie Island Bridge to Browns Road;
- Provides direct access to the bypass at Browns Road, Peel Road and the eastern and western intersections with Bestmann Road;
- Provides for separation of local Ningi and Sandstone Point traffic from through traffic to/from Bribie Island;

- Provides a corridor with capacity for potential increase in traffic in the long-term (i.e. beyond 20 years planning horizon); and
- Provides for direct access from the sand mining area to the bypass.

5.1.3 Issues

The following additional issues apply to Bypass Option A

| Issue | Description |
|---------------------|--|
| <i>Technical</i> | <ul style="list-style-type: none"> • Preloading may be required to minimise future settlement • Potential acid sulphate soil (PASS) to be managed; and • Requires low level bridge structures over significant drainage flowpaths with sensitive environmental wetlands to provide for fauna movement. |
| <i>Connectivity</i> | <ul style="list-style-type: none"> • Provides a relative high speed connection between the existing 100kph zone in Bribie Island Road from Bribie Island Bridge to west of Browns Road; • Traffic from Ningi has access to the bypass at Browns Road, Bestmann Road, east and west intersections; • Traffic from Sandstone Point has 2 potential accesses to the bypass by the east and west intersections with Bestmann Road; • An elevated overpass may be required for haul vehicles to maintain the sand mining operations; and • Traffic from Godwin Beach has access to the bypass via Peel Road. |

5.2 Bypass Option B

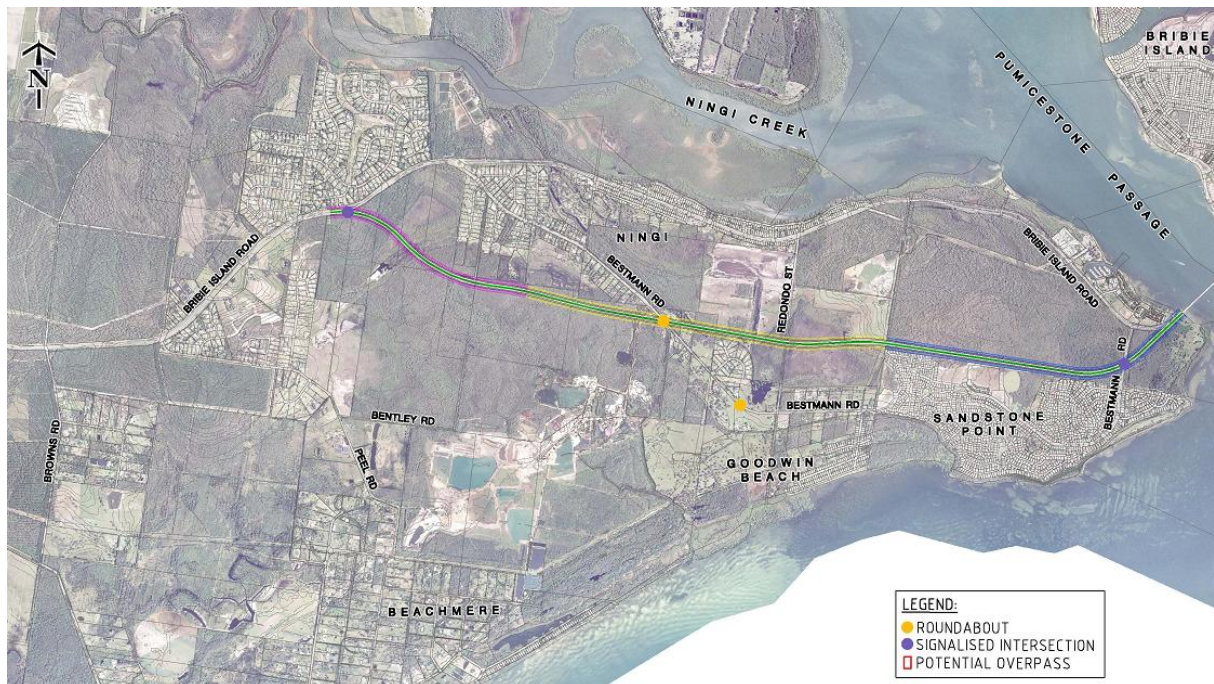


Figure 3 Bypass Option B

5.2.1 Description

Bypass of Ningi commencing at the southern abutment of the bridge to Bribie Island, then running in a westerly direction to the north of Sandstone Point before passing north of the rural residential area to the east of Bestmann Road west. The alignment then continues west and connects to the Bribie Island Road about 1km west of the intersection with Bestmann Road west.

The proposed alignment for the bypass is shown on Sketch 10304406-SK010.

5.2.2 Key Features

The following are the key features of the Bypass Option B alignment:

- Length 7,850m;
- Meets the desirable geometric design standards;
- Travel speed of 100kph, to match the 100kph speed zone on Bribie Island Road west of Browns Road (slower either side of intersections);
- Provides an alternate traffic route to the existing Bribie Island Road through Ningi from Bribie Island Bridge to 300m east of intersection with Alward Road;
- Provides direct access to the bypass at Bestmann Road (east and west);
- Provides for separation of local Ningi and Sandstone Point traffic from through traffic to/from Bribie Island;
- Provides a corridor with capacity for potential increase in traffic in the long-term (i.e. beyond 20 years planning horizon); and
- Provides for indirect access from the sand mining area to the bypass.

5.2.3 Issues

The following additional issues apply to Bypass Option B.

| Issue | Description |
|---------------------|---|
| <i>Technical</i> | <ul style="list-style-type: none"> • Preloading may be required to minimise future settlement • Potential acid sulphate soil (PASS) to be managed; and • Requires low level bridge structures over significant drainage flowpaths with sensitive environmental wetlands to provide for fauna movement. |
| <i>Connectivity</i> | <ul style="list-style-type: none"> • Provides a relative high speed connection between the existing 100kph zone in Bribie Island Road from Bribie Island Bridge to west of Browns Road; • Western connection for Ningi about 300m east of Alyward Road; • Traffic from Ningi also has access to the bypass at Bestmann Road, east and west intersections; • Traffic from Sandstone Point has access to the bypass by the east and west intersections with Bestmann Road; • A connection to Bestmann Road is available for haulage vehicles from sand mining operations; and • Traffic from Godwin Beach has access to the bypass via Bestmann Road. |

5.3 Bypass Option C

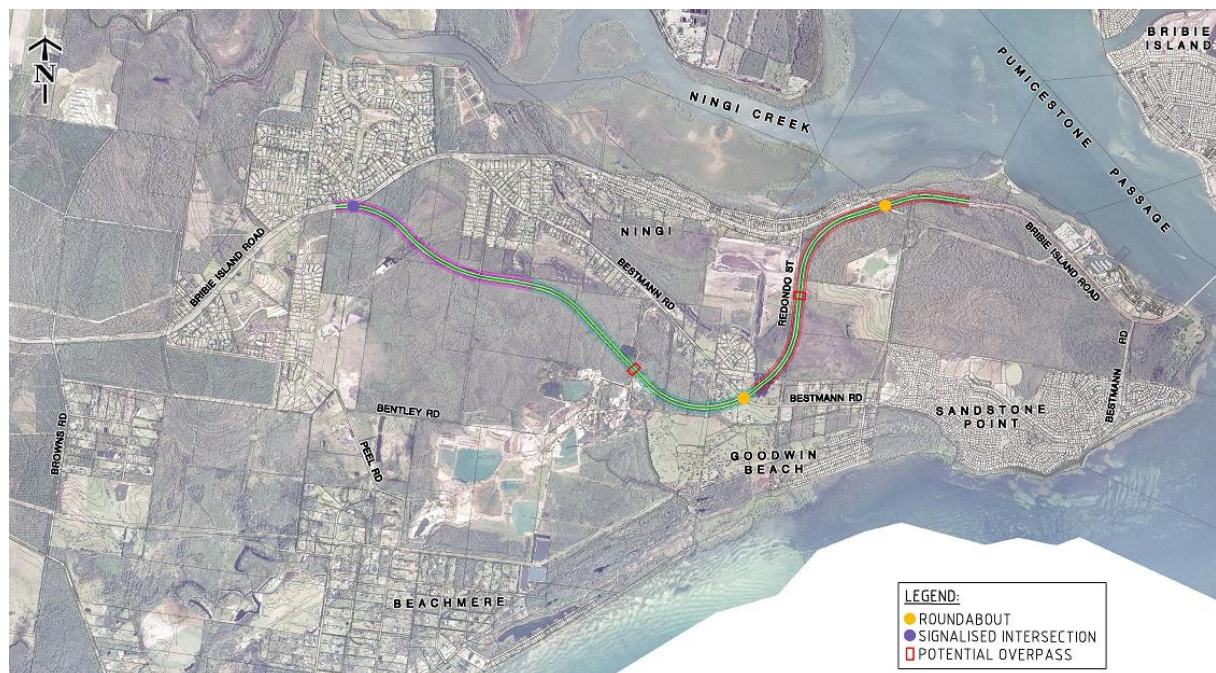


Figure 4 Bypass Option C

5.3.1 Description

Bypass of Ningi commencing at the southern abutment of the bridge to Bribie Island, following the existing alignment west to Redondo Street, turning south and parallel to Redondo Street, passing south of the rural residential area to the east of Bestmann Road west and then connecting to the Bribie Island Road about 1km west of the intersection with Bestmann Road west.

The proposed alignment for the bypass is shown on Sketch 10304406-SK011.

5.3.2 Key Features

The following are the key features of the Bypass Option C alignment:

- Length 7,200m;
- Meets the desirable geometric design standards (90kmh design speed, 80kph posted speed limit);
- 100kph posted speed limit may be achievable for short sections west of Bestmann Road west;
- Requires overpass bridge structure where Sandstone Boulevard crosses the alignment;
- Provides an alternate traffic route to the existing Bribie Island Road through Ningi from 1000m east of Redondo Street to 300m east of the intersection with Alward Road;
- Provides direct access to the bypass at the western intersection with Bestmann Road;
- Provides for separation of local Ningi and Sandstone Point traffic from through traffic to/from Bribie Island;
- Provides a corridor with capacity for potential increase in traffic in the long-term (i.e. beyond 20 years planning horizon); and
- Provides for indirect access from the sand mining area to the bypass.

5.3.3 Issues

The following additional issues apply to Bypass Option C.

| Issue | Description |
|---------------------|---|
| <i>Technical</i> | <ul style="list-style-type: none"> • Preloading may be required to minimise future settlement • Potential acid sulphate soil (PASS) to be managed; • Requires low level bridge structures over significant drainage flowpaths with sensitive environmental wetlands to provide for fauna movement; and • May require overpass over Sandstone Boulevard at a future time, to provide for local connectivity. |
| <i>Connectivity</i> | <ul style="list-style-type: none"> • Provides an 80 kph connection between the existing 100kph zone in Bribie Island Road from east of Browns Road to the Bribie Island Bridge; • Eastern connection for Ningi about 250m east of Redondo Street; • Western connection for Ningi about 300m east of Alyward Road; • Traffic from Ningi also has access to the bypass at the western intersection with Bestmann Road; • Traffic from Sandstone Point has access to the bypass by the eastern and western intersections with Bestmann Road; • A connection to Bestmann Road is available for haulage vehicles from sand mining operations; and • Traffic from Godwin Beach has access to the bypass via western intersection with Bestmann Road. |

5.4 Bypass Option D

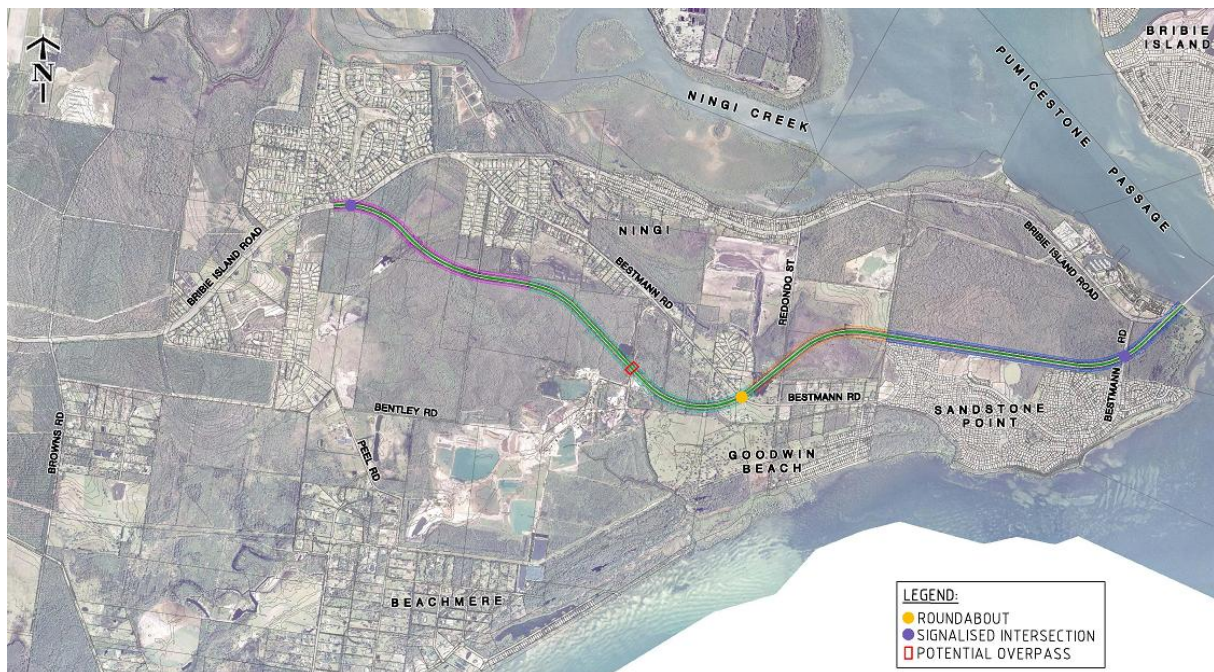


Figure 5 Bypass Option D

5.4.1 Description

Bypass of Ningi commencing at the southern abutment of the bridge to Bribie Island, then running in a westerly direction to the north of Sandstone Point before passing south of the rural residential area to the east of Bestmann Road west. The corridor then connects to the alignment for Option C west of Bestmann Road before connecting to the Bribie Island Road about 1km west of the intersection with Bestmann Road west.

The proposed alignment for the bypass is shown on Sketch 10304406-SK012.

5.4.2 Key Features

The following are the key features of the Bypass Option D alignment:

- Length 8,400m;
- Meets the desirable geometric design standards (90kmh design speed, 80kph posted speed limit);
- 100kph posted speed limit may be achievable for short sections west of Bestmann Road west and east of Sandstone Lakes;
- Provides an alternate traffic route to the existing Bribie Island Road through Ningi from Bribie Island Bridge to 300m east of intersection with Alward Road;
- Provides direct access to the bypass at the western intersection with Bestmann Road;
- Provides for separation of local Ningi and Sandstone Point traffic from through traffic to/from Bribie Island;
- Provides a corridor with capacity for potential increase in traffic in the long term (i.e. beyond 20 years planning horizon); and
- Provides for indirect access from the sand mining area to the bypass.

5.4.3 Issues

The following additional issues apply to Bypass Option D.

| Issue | Description |
|---------------------|--|
| <i>Technical</i> | <ul style="list-style-type: none"> • Preloading may be required to minimise future settlement • Potential acid sulphate soil (PASS) to be managed; • Requires low level bridge structures over significant drainage flowpaths with sensitive environmental wetlands to provide for fauna movement; |
| <i>Connectivity</i> | <ul style="list-style-type: none"> • Provides an 80 kph connection between the existing 100kph zone in Bribie Island Road from the Bribie Island Bridge to east of Browns Road; • Western connection for Ningi about 300m east of Alyward Road; • Traffic from Ningi also has access to the bypass at the western intersection with Bestmann Road; • Traffic from Sandstone Point has access to the bypass by the eastern and western intersections with Bestmann Road; • A connection to Bestmann Road is available for haulage vehicles from sand mining operations; • Traffic from Godwin Beach has access to the bypass via Bestmann Road; |

5.5 Upgrade of Bribie Island Road

The layout for the upgrade of the Bribie Island Road through Ningi from a 2 lane carriageway to a 4 lane divided carriageway is shown on Sketch's 10304406-SK002 to SK008 inclusive. The layout of the carriageways is similar to that proposed in the BIRPS.



Figure 6 Bribie Island Road Upgrade

5.5.1 Description

- Upgrade the existing 2 lane road to a 4 lane divided carriageway joining the existing 4 lane divided carriageway 1000m east of the intersection with Redondo Street to the existing 4 lane divided carriageway at Bestmann Road;
- 60 kph speed limit from 1000m east of the intersection with Redondo Street to the intersection with Bestmann Road;
- Intermediate signalised intersection in the vicinity of Ross Street to provide a second controlled intersection in addition to the one at Redondo Street, for access to the properties in Ningi Esplanade; and
- Turn lanes and storage are provided at signalised intersections to provide protected movements and storage.

5.5.2 Key Features

The following are the key features of the Ningi online upgrade option:

- Length 4,300m;
- Meets the desirable geometric design standard for a 60 kph urban road;
- Access is directly available from the road to abutting residential, commercial premises and community facilities;
- Minimal impact on existing land use;
- Minimal environmental impacts; and
- Minimal engineering and construction issues.

5.5.3 Issues

The following additional issues apply to the Bribie Island Road Upgrade alignment.

| Issue | Description |
|---------------------|--|
| <i>Technical</i> | <ul style="list-style-type: none">• Potential conflict with turning movements to/from local residential side streets;• Potential conflict with movements to and from abutting residential, commercial and community land uses; and• Existing utility services located within the road reserve may need to be relocated. |
| <i>Connectivity</i> | <ul style="list-style-type: none">• Maintains current connectivity between Bestmann Road, Regina Avenue and Redondo Street;• Median along centre of road reduces opportunity for movement to the east and west from mid-block properties within Ningi; and• A signalised intersection mid way between Regina Avenue and Redondo street, in the vicinity of the community centre is proposed to facilitate access to the community centre and Church. |

5.6 Relocation of Utility Services

No information is available as to the nature and type of public utility services located within the potential Bribie Island Road upgrade through Ningi or within the potential road reserves for the Ningi bypass. It could be assumed that there will be telecom, water, power and potentially sewerage infrastructure to be relocated within the potential road reserve through Ningi between Bestmann Road and Redondo Streets.

Additionally there may be some underground power infrastructure in the vicinity of the electricity sub-station that will need to be relocated/modified. It could also be assumed that there will be some minor telecom, water, power and potentially sewerage infrastructure to be relocated within the potential road reserve for the Bypass Options.

6.0 Assessment of Options

This section will provide an assessment of the bypass and on-line upgrade solutions in respect to a range of economic, social and environmental criteria. Focus has been placed on those issues that are likely to present either points of differentiation between the bypass and on-line options or a showstopper for any particular option(s). Issues that are normally manageable through design, such as water quality, have not been considered further.

6.1 Traffic

6.1.1 Review of Cardno MBK modelling

The travel demand and associated analysis in the BIRPS is considered to be reasonable and has been adopted as the basis for the following discussion on traffic. Even so, there are certain observations to be noted in using the link flows, as discussed below.

Traffic forecasts

The 2006 daily traffic count on Bribie Island Bridge was 18,500 vehicles (source DMR) so the forecast flow of 31,600 in 2031 represents a 70% growth.

This represents considerable growth of development on Bribie Island that may not be sustainable, due to current limited opportunities for potential further development. The annual growth for the various periods in Figure 8 of the BIRPS (Volume 3) varies as shown in Table 3 below, which at least indicates a tapering in development.

Table 3 Annual growth rates – Bribie Island Bridge

| Year | 2006 | %pa | 2011 | %pa | 2016 | %pa | 2031 |
|-------|--------|------|--------|------|--------|------|--------|
| Veh/d | 18,500 | 3.43 | 21,900 | 2.19 | 24,400 | 1.74 | 31,600 |

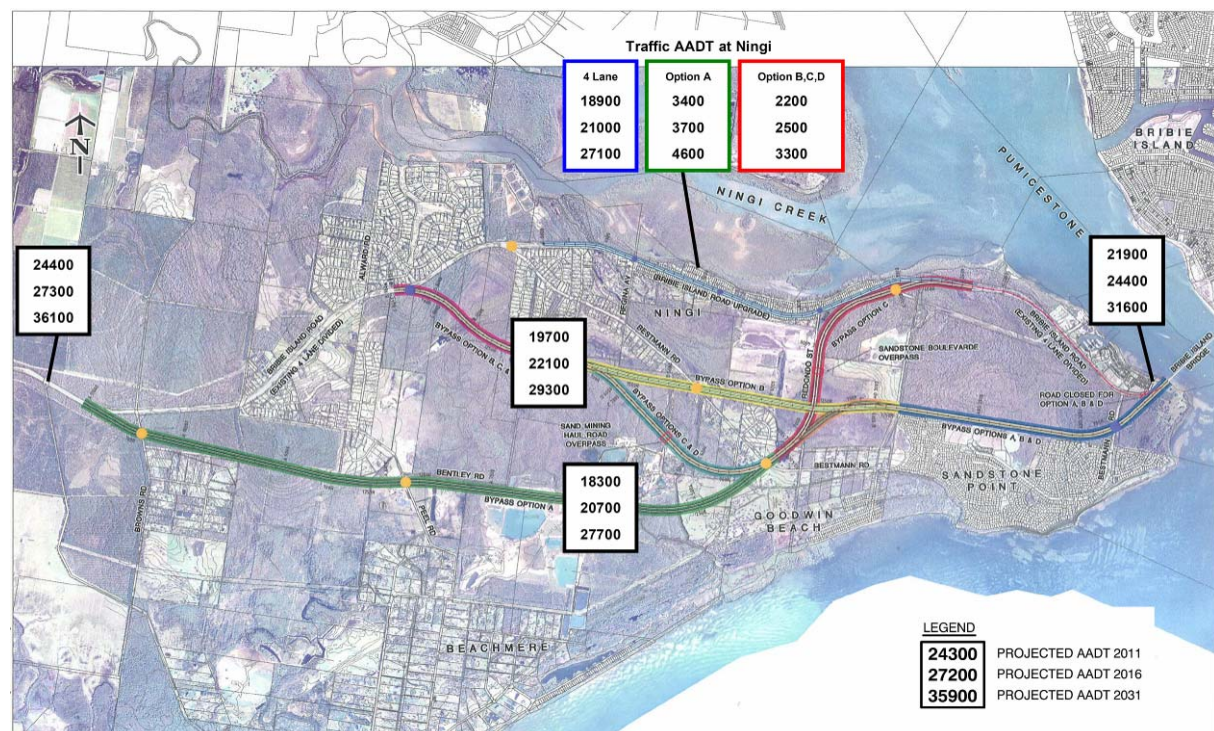
Trip distribution

The Forecast Link Flows in the Figures 6 – 10 of the BIRPS show that the volume of traffic on the bypass decreases for the longer options (further south of Ningi township). This is unexpected as Ningi is not a major generator in itself, especially when compared to Bribie Island, and Sandstone Point to a lesser degree. Thus it would be more reasonable to expect that the function of a bypass would increase as the bypass becomes more direct between Bribie Island and west of Ningi because of the shorter overall travel distance). It can be assumed that Cardno have reached the numbers for the Blue and Green options in the BIRPS based on an assumption of a higher number of local trips to and from Ningi although it should be noted that this scenario is considered unlikely.

The model results also show that traffic along Bestmann Road would reduce for the shorter options but increase significantly for the green (long) option. In fact the long option would be a “more attractive” route for Sandy Point and Bribie Island trips, and hence have the greatest effect in reducing traffic along Bestmann Road. Similarly, there is no clear explanation why traffic flows would increase rather than reduce on Bestmann Road through Sandy Point. This is not in accordance with the model.

The overall daily traffic flow for the previous bypass options varies between 19,100 for the short (pink) option and 16,600 for the long (green), for the segments east of Bestmann Road west. So for the purposes of this report, and in consideration of the preceding comments, the higher Forecast Link Flow has been adopted as the generic flow along each bypass option. The resultant forecast link flows with and without a bypass are shown in Figure 7.

Figure 7 Daily Forecast Flow Links



6.1.2 Midblock Capacity Analysis

The midblock capacity of a 4 lane divided road through Ningi has been analysed in order to determine the likely operating conditions and life of the road. In fact, intersections are usually the determining constraint for a road in urban conditions. The capacity of the road has been adjusted accordingly based on the criteria in Chapter 5.2.4 of the DMR - *Road Planning and Design Manual* and summarised in Table 4 below.

Table 4 Level of Service (LOS) Criteria

| LOS | C | D | E |
|-------------|------------|------------|-------------|
| Veh/hr/lane | 1000 -1300 | 1300 -1500 | 1500 - 1600 |

Assuming a directional split of 60/40, and peak hour factor of 8% (based on 2005 DMR Census) the single direction peak flow through Ningi would be about 1100 equivalent passenger car units in 2031. This shows that the route through Ningi would be operating well within LOS C in 2031. The Main Roads guidelines stipulate that for a state- controlled road in rural areas, LOS C should be considered as a minimum standard, hence the 4 lane divided road would be adequate beyond 2031.

6.1.3 Intersections

Intersection treatments would differ for scenarios through and bypassing Ningi:

Bypass

Intermediate intersections between the bypass and local roads are proposed at Peel Street (long option only) and Bestmann Road (east and west). The forecast traffic flows for the local roads are relatively small so at grade intersections would be appropriate. Large roundabouts could be used along the bypass for planning purposes, similar to the intersection treatments used at other locations along Bribie Island Road. The final form of intersection would be best decided during the planning and design phases when more detailed information is available. The two lane Bribie Island Bridge will be an important consideration as it will be a potential constraint on the capacity and type of intersection treatment.

The traffic modelling shows that flows across the bridge will have the potential to increase by about 50% for the period 2011 and 2031. The capacity of the bridge will likely need to be increased to carry the forecast 31,600 vehicles in 2031.

Ningi Intersection Treatments

The form of intersection treatments associated with upgrading the road through Ningi is more apparent, as the intersections will need to provide for through traffic as well as local trips (which includes vehicles, cyclists and pedestrians). The key intersections would need to be signalised while other intersections would operate as "T" type intersections with movements controlled by the central median and openings. Traffic signals would be linked and coordinated to assist through traffic move through Ningi with minimum interruptions and delays.

6.1.4 Travel Times

Travel time provides the main measure for comparing the user-benefit between various route options. The following assumptions have been used to establish travel times for the various options:

- Distances are measured between Bribie Island Bridge and Browns Road;
- The speed limit along the existing Bribie Island Road is 80kph except for the 60 kph section through Ningi.

- Travel speeds between intersections are at the proposed posted speed for the respective sections of each new route as follows:
 - Option A speed is 100 kph between intersections for the entire route;
 - Option B has a combination of speeds between intersections, 80kph along the existing road and 100kph on the on the new alignment; and
 - Options C and D have a combination of 80kph and 100kph between intersections.
- Traffic will slow at intersections so a delay factor has been added to the travel times on the following basis:
 - Vehicles will slow to 80kph over about 500m which combined with a nominal delay so a total factor of 1 minute is added for each intersection, other than through Ningi (see next point). The route length is then adjusted to allow for the intersection effect.
 - Traffic signals at the proposed 3 signalised intersections in Ningi will be linked so delays to through traffic, if any, would normally occur once (at the first signals). A one minute delay has been allowed for delays through Ningi.
- The existing T-type intersections along Bribie Island Road are not considered to impede through traffic, however one new intersection has been included between Bestmann and Browns Roads to allow for the increased development occurring in the area.
- The terminal intersections at Browns Road and Bribie Island Bridge are common for all options so they have not been included in the analysis.

The resultant travel times for the options are shown below in Table 5. The results show that Option A provides the shortest travel time and the route through Ningi provides the longest. Option C is the longest distance of all options but it would still be quicker than the route through Ningi.

Table 5 Travel Times

| Option | Through Ningi | Bypass Option A | Bypass Option B | Bypass Option C | Bypass Option D |
|--------------------------|----------------------|------------------------|------------------------|------------------------|------------------------|
| <i>Length (km)</i> | 11.3 | 11 | 11.05 | 12.6 | 11.6 |
| <i>Travel time (min)</i> | 11.80 | 8.00 | 9.55 | 11.50 | 10.25 |

6.2 Environmental

6.2.1 Ecology

The ecological impacts of the various options have been investigated in detail in a separate report, which is attached as Appendix C. The conclusions of the report are summarised below in Table 6, which assesses each option in relation to a range of issues. It was found that the proposed upgrade options would result in a range of impacts to the ecological values of the Ningi locality. Construction of the identified bypass options would have the potential to:

- Impact upon a number of threatened species protected at both Commonwealth and State levels;
- Impact upon matters of national environmental significance triggering requirements under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- Impact upon significant regional ecosystems triggering requirements under the *Vegetation Management Act 1999*;
- Impact on state significant wetlands; and
- Result in other adverse impacts upon the environment that would require significant and potentially costly measures to be implemented to minimise the likely impacts.

In particular relation to ecological impacts it was found that all remaining bypass options would impact on essential habitat for a number of threatened frog and bird species afforded protection under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC). For the

purposes of the EPBC Act, a 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.

To be 'likely', it is not necessary for a significant impact to have a greater than 50% chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility. Furthermore, if there is insufficient information available to determine whether or not impacts or potential impacts are serious or irreversible, the precautionary principle is applicable. Accordingly, a lack of scientific certainty about the potential impacts of an action will not itself justify a decision that the action is not likely to have a significant impact on the environment.

This being the case, it is considered that for the purposes of the EPBC Act, all of the bypass options have the potential for 'significant impacts' on the essential habitat of the above mentioned threatened species.

As such, development of any bypass option would trigger referral under the EPBC and result in assessment and mitigation requirements similar to that experienced for other major road projects in sensitive environmental areas including the Tugun Bypass.

Alternatively, upgrading the existing Bribie Island Road would result in low ecological impacts when compared to the bypass options. This option is therefore the preferred option from an ecological perspective as the potential impacts to significant ecological values in the Ningi area would be minimal.

6.2.2 Other Environmental Issues

All bypass options would result in impacts associated with disturbance of potential acid sulphate soils, impacts on hydrology, water quality and drainage patterns and reduced air quality. Whilst all of these issues are important considerations they do not materially affect the feasibility or otherwise of an option. Rather they present a management issue that may result in higher construction costs associated with specific mitigation measures.

Table 6 Summary of Assessment of Ecological Impacts

| Option | Habitat Fragmentation | Habitat Removal/ Modification | Loss of Significant Species | Barrier Effects | Road Strike | Overall Assessment |
|-----------------|---|---|--|---|---|---------------------------|
| <i>Option A</i> | High State Significant Wetlands providing known habitat for federal and state listed species will be bisected by this option. | High <ul style="list-style-type: none"> • 15.07 ha Endangered RE 12.5.3 will be cleared. • 8.24 ha of Significant Wetlands 12.3.5 and 12.3.6 would be cleared. • Habitat for Federal and State Significant Fauna Species would be cleared. | High <ul style="list-style-type: none"> • Commonwealth listed threatened species are likely to be impacted. • State listed threatened species are likely to be impacted. | Moderate Substantial areas of habitat will be bisected by this proposed alignment. | Moderate As habitat will be bisected by this proposed alignment, road strike is expected to be significant. Mitigative measures including directional fencing and fauna underpasses will mitigate this impact. | High |
| <i>Option B</i> | High State Significant Wetlands providing known habitat for Commonwealth and State listed species will be bisected by this option. | High <ul style="list-style-type: none"> • 11.39ha of Endangered RE 12.5.3 would be cleared. • 35.38 ha of Significant Wetlands 12.3.5 and 12.3.6 will be cleared. | High <ul style="list-style-type: none"> • Commonwealth listed threatened species are likely to be impacted. • State listed threatened species are likely to be impacted. | Moderate Substantial areas of habitat will be bisected by this proposed alignment. | Moderate As habitat will be bisected by this proposed alignment, road strike is expected to be significant. Mitigative measures including directional fencing and fauna underpasses will mitigate this impact. | High |

| Option | Habitat Fragmentation | Habitat Removal/ Modification | Loss of Significant Species | Barrier Effects | Road Strike | Overall Assessment |
|-----------------------------------|--|--|---|---|---|--------------------|
| <i>Option C</i> | High State Significant Wetlands providing known habitat for federal and state listed species will be bisected by this option. | High <ul style="list-style-type: none"> 3.71ha of Endangered RE 12.5.3 would be cleared. 30.93 ha of Significant Wetlands 12.3.5 and 12.3.6 would be cleared. 0.04ha of mangroves would be cleared. | High <ul style="list-style-type: none"> Commonwealth listed threatened species are likely to be impacted. State listed threatened species are likely to be impacted | Moderate Substantial areas of habitat will be bisected by this proposed alignment. | Moderate As habitat will be bisected by this proposed alignment, road strike is expected to be significant. Mitigative measures including directional fencing and fauna underpasses will mitigate this impact. | High |
| <i>Option D</i> | High State Significant Wetlands providing known habitat for federal and state listed species will be bisected by this option. | High <ul style="list-style-type: none"> 11.39ha of Endangered RE 12.5.3 would be cleared. 39.41ha of Significant Wetlands 12.3.5 and 12.3.6 would be cleared | High Commonwealth listed threatened species would be impacted. | Moderate Substantial areas of habitat will be bisected by this proposed alignment. | Moderate As habitat will be bisected by this proposed alignment, road strike is expected to be significant. Mitigative measures including directional fencing and fauna underpasses will mitigate this impact. | High |
| <i>Existing Alignment Upgrade</i> | Low Upgrading of the existing alignment will not lead to further fragmentation. | Low Minor clearing will be required for the installation of this option. | Low <i>Acacia bauerii</i> may be impacted by this alignment. No other threatened species would be impacted. | Low Upgrading of the existing alignment will not lead to further barrier effects. | Low Locally occurring fauna are acclimatised to the existing traffic on the existing roadway. | Low |

6.3 Land Use and Social Impacts

6.3.1 Zoning

The zoning assessment in the BIRPS was based upon Caboolture Shire Council's previous planning scheme. This scheme was repealed in December 2005 and replaced with a new *Integrated Planning Act 1997* (IPA) compliant Planning Scheme.

The new planning scheme made significant changes to the zoning of land within the study area. The new planning scheme consolidated urban zoned areas within the study area and the associated potential for further residential development was reduced. The previous zonings had been more general in nature and had identified large areas for future residential and/or rural residential development. The new zonings are more refined and accurately reflect existing development commitments.

Zonings within the study area are described below in Table 7 (see Map 3, Appendix A for detail).

Table 7 Summary of Zoning within the Study Area

| Zoning | Study Area Affected |
|--------------------------|---|
| <i>Local Centre</i> | Individual Sites at: <ul style="list-style-type: none"> Shopping complex on Bestmann Rd East, Sandstone Point; Shopping complex on the corner of Bribie Island Rd and Regina Av; Other minor sites along Bribie Island Road. |
| <i>Open Space</i> | Various sites throughout the study area, including perhaps most importantly: <ul style="list-style-type: none"> Within the Sandstone Point and Sandstone Lakes development areas; and On the corner of Bribie Island Road and Rita Avenue associated with a local community centre. |
| <i>Residential A</i> | Existing and proposed urban areas associated with the localities of: <ul style="list-style-type: none"> Ningi; Sandstone Point; Sandstone Lakes; and Godwin Beach |
| <i>Residential B</i> | Area adjacent to the marina at the eastern end of the study area. |
| <i>Rural</i> | The Rural zoning covers much of the study area, in particular: <ul style="list-style-type: none"> The area to the north of Sandstone Point and south of Bribie Island Road; and The large area south of Bestmann Road between Godwin Beach and the western end of the study area. |
| <i>Rural Residential</i> | Significant areas at the western end of the study area adjacent to Bestmann Road and Peel Road. |
| <i>Special Use</i> | Various sites associated with the Council Landfill site and electricity infrastructure. |

Other policy changes since the 2002 Cardno reports include the introduction of the South East Queensland Regional Plan (SEQRP). The SEQRP outlines an urban footprint, outside of which development is subject to strict controls. The urban footprint is an important indicator of future development potential within the study area. In general, the urban footprint correlates closely to the boundary of urban zones under Council's planning scheme and therefore does not need to be considered independently (See Map 4, Appendix A).

6.3.2 Development Approvals

A number of development applications for residential development within the study area have either been approved or are currently being assessed by Council (See Maps 5 and 6, Appendix A).

In particular, there has been significant development activity in the area to the east of Bestmann Road in the form of Sandstone Lakes Estate (see Figure 8). Council has previously granted preliminary approval to the entire master planned estate with Stages 1-3 of the development, adjacent to Redondo Street, having recently been completed. Stages 4-6 of the estate are currently being constructed with development applications for stages 7-16 to follow.

Figure 8 Sandstone Lakes Estate – Aerial Photograph Showing Area Proposed for Development



A number of development approvals/applications also exist within the rural residential area at the western end of bypass options B, C and D.

6.3.3 Other Land Use Considerations

Land use considerations other than those discussed above relate generally to the provision of infrastructure and resources. Appendix A includes a composite map of extractive resource areas, high voltage electricity easements, sub-stations and other significant infrastructure.

In the centre of the study area there is a large extractive resource area covered by a mining lease, this lease is currently actively mined (sand). At this stage however mining is limited to the areas immediately south of Bestmann Road and north of Peel Road, while the northern portion of the area is not actively mined. It is not known if there are plans to mine the area in the future.

Any potential road alignment through this area would need to give consideration to the potential impacts on existing and future mining operations.

An Energex 110/132 kV electricity easement traverses the study area running east west. This connects with a substation adjacent to Bribie Island Road, Sandstone Point, opposite Kal Ma Kuta Drive. Additionally, there is another substation at the western end of the study area also adjacent to Bribie Island Road, opposite Beames Road.

At the eastern end of the study area is the Ningi Landfill Site run by Council's waste management division. The landfill site takes a large area of land adjacent to Bribie Island Road near Donald Street. Caboolture Council has indicated that the landfill site is due to be decommissioned in the near future but the site will be retained as a transfer station.

6.3.4 Summary of Potential Impacts

The land use impacts of the various bypass options consist primarily of impacts on areas of existing and proposed urban residential development. The land use impacts associated with a 4 lane upgrade of the existing Bribie Island Road would consist of land resumptions associated with new intersection works and an increase in traffic noise for residences along the existing road. The impacts for all options are summarised below in Table 8.

Table 8 Summary of Land Use Impacts

| Upgrade Option | Description of Impact | Significance |
|-----------------|---|--|
| A, B & D | <ul style="list-style-type: none"> Resumption of the proposed Stage 16 of the Sandstone Lakes Estate. Amenity impacts for a large number of existing and proposed residences (including a retirement community) at Sandstone Point. This outcome would be likely seen by the Sandstone Point residents as shifting the Ningi problem to their 'backdoor.' Minor impacts on proposed Rural Residential development at western end of alignments (Options B and D only). | High (potentially manageable through design measures) |
| C | <ul style="list-style-type: none"> Bisects the partially constructed Stage 4 of Sandstone Lakes Estate adjacent to Redondo Street creating connectivity and amenity issues for future residences. Minor impacts on proposed Rural Residential development at western end of alignments | High |
| 4 Lane Existing | <ul style="list-style-type: none"> Minimal resumptions for new intersections designs. Increased amenity impacts (noise and air pollution) for residences on Bribie Island Road. | Medium |

6.4 Economic

Assessment of economic impacts associated with the various alignments has been limited to a preliminary estimation of the financial cost to develop each option. To this extent, no consideration has been given to issues such as loss of or increase in trade for businesses and associated impacts. An estimate of the total project cost to develop each of the options is outlined below.

Potential construction costs have been developed based on the plan area of the various road alignments as shown on the appropriate sketches in Appendix B. No longitudinal design or hydraulic designs have been carried out to quantify the extent of civil works.

The following is a summary of the potential costs of the options for the upgrading of the Bribie Island Road through Ningi and for bypassing Ningi:

Table 9 Summary of Potential Construction Costs (\$ Millions, Out-turn year 2010)

| Description | Upgrade of Bribie Is Rd | Bypass of Ningi | | | |
|-----------------------------|-------------------------|-----------------|----------------|----------------|----------------|
| | | Option A | Option B | Option C | Option D |
| General | \$9.3 | \$28.2 | \$20.7 | \$23.0 | \$23.1 |
| Earthworks | \$1.3 | \$20.1 | \$14.4 | \$13.4 | \$15.4 |
| Pavements | \$6.4 | \$12.8 | \$9.1 | \$8.4 | \$9.7 |
| Bituminous Surfacing | \$20.1 | \$40.4 | \$28.8 | \$26.5 | \$30.9 |
| Road Furniture | \$8.9 | \$14.5 | \$10.5 | \$10.8 | \$11.5 |
| Bridge Structures | \$0.0 | \$9.0 | \$9.0 | \$9.0 | \$9.0 |
| Intersections | \$1.0 | \$15.0 | \$10.0 | \$23.0 | \$15.0 |
| Construction Cost | \$46.9 | \$140.0 | \$102.5 | \$113.9 | \$114.7 |
| Total Owners Costs | \$19.7 | \$34.0 | \$25.4 | \$27.0 | \$27.9 |
| Contingency (40%) | \$21.4 | \$69.6 | \$51.2 | \$56.4 | \$57.0 |
| Escalation (median 3 years) | \$17.1 | \$52.4 | \$38.4 | \$42.6 | \$42.9 |
| Total Project Cost | \$105.2 | \$296.1 | \$217.4 | \$239.9 | \$242.6 |
| Road length | 4200 | 11000 | 7850 | 7200 | 8400 |
| Cost/km | \$25.0 | \$26.9 | \$27.7 | \$33.3 | \$28.9 |

The above potential opinions of cost of construction are for comparison purposes only. The quantities for the works have been based on the length and plan areas of the potential road works.

The costing for upgrading the Bribie Island Road through Ningi is based on:

- Plan area of the carriageways;
- Length of carriageways;
- \$10,000,000 for relocation of services;
- 10% of cost for drainage;
- 10% of cost for traffic management under traffic;
- % for preliminary and detailed Engineering Design;
- 0.5 % for Geotechnical Engineering;
- 5.5% for Project Administration costs;
- 40% contingency; and
- 7.5% escalation over 3 year period.

The costing for the Ningi Bypass Options are based on:

- Plan area of the roads;
- Length of road;
- Assumed average embankment height of 2m for the 50% of length of the Bypass Options;
- Assumed 3m high preloading of 50% of road length, with 100% recoverable for use in embankment;
- Intersections with Bribie Island Road at the eastern and western ends, intersections at Bestmann Road, Browns Road and Peel Road;
- Land acquisition costs of \$50,000/ha
- \$2,000,000 for relocation of services;
- Low level bridge construction costs of \$3,000/m² of deck;
- 10% of cost for environmental management;

- 2.5% of cost for traffic management;
- 10% of cost for drainage;
- 6.5% for preliminary and detailed Engineering Design ;
- 1.0% for Geotechnical Engineering;
- 5.5% for Project Administration costs;
- 40% contingency; and
- 7.5% escalation over 3 year period.

7.0 Summary of Impacts

The impacts on each of the features discussed above is summarised for each option in Table 10.

Table 10 Summary of Impacts

| | Bypass Option A | Bypass Option B | Bypass Option C | Bypass Option D | Upgrade Existing |
|--|------------------------|------------------------|------------------------|------------------------|-------------------------|
| Land Use and Social | | | | | |
| Impact on Amenity of Existing Uses | High | High | High | High | Medium |
| Impact on Proposed Development Areas | Medium | Medium | High | Medium | None |
| Resumptions | Medium | Medium | Medium | Medium | Low |
| Environmental | | | | | |
| Ecological | High | High | High | High | Low |
| Engineering | | | | | |
| Technical | | | | | |
| 1. Standard | Complex | Complex | Complex | Complex | Standard |
| 2. Complex | | | | | |
| 3. Difficult | | | | | |
| Connectivity | | | | | |
| 1. Improved | Improved | Improved | Unchanged | Improved | Reduced |
| 2. Unchanged | | | | | |
| 3. Reduced | | | | | |
| Traffic | | | | | |
| Travel time (min) (Bridge to Browns Rd) | 8.00 | 9.55 | 11.50 | 10.25 | 11.80 |
| Road Life (LOS C) | 2031+ | 2031+ | 2031+ | 2031+ | 2031+ |
| Economic | | | | | |
| Cost | \$296.1 | \$217.4 | \$239.9 | \$242.6 | \$105.2 |

The above table is not intended to represent an exhaustive assessment of all of the issues that would need to be addressed during the planning for any one of the individual alignments. Instead it has focused on those issues that have either changed significantly since the finalisation of the BIRPS and/or are likely to provide differentiation between the options.

Based on engineering grounds alone with no consideration of cost, environmental and social impacts, bypass options A and B provide the most direct and highest speed routes between the Bribie Island Bridge and Browns Road. Of these two alignments, Option A would be the easier corridor to preserve due to the majority of the alignment either being located within Crown tenure, mining lease or being otherwise unlikely to develop for urban purposes. Option B is however significantly shorter (new road) than Option A and makes use of the existing 4 lane section of road between Browns Road and Bestmann Road.

However, the assessment has found that whilst the bypass options would result in benefits associated with improved travel times and road network connectivity, these benefits would be offset by high ecological impacts, medium to high land use and social impacts and project costs 200-300% greater than an upgrade of the existing road.

Alternatively, a 4 lane upgrade of the existing road would have relatively minor environmental, land use and social impacts although the connectivity of the local Ningi road network would be somewhat reduced. The 4 lane upgrade option would also be significantly cheaper to develop, could be staged over a number of years and would also cost less than half of the cheapest bypass option.

In particular relation to the ecological impacts it was found that all of the revised bypass options considered within this report would have similar ecological impacts as that of the green corridor previously considered in the BIRPS. In terms of ecological impacts the previous green corridor was by far the worst performing of the bypass options considered in the BIRPS.

Cardno MBK raised particular concern in the REF regarding the green corridor's impact on the wetland community located south of Sandstone Lakes Estate and north of Bestmann Road. It was highlighted in the REF that this area was an important habitat for a number of frog and bird species afforded protection under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) and that road construction should avoid this area wherever possible. The significance of this area was reassessed and confirmed through the flora and fauna review which is attached as Appendix C. It should be noted that impacts on this important habitat area would trigger referral under the EPBC Act.

As a result of the increase in urban development in the study area since the BIRPS, all remaining options for a bypass traverse this significant wetland area (see SK001). As such it can be reasoned that all of the remaining options for a bypass of Ningi would result in environmental impacts that both the previous and current studies have considered to be of a significance that should be avoided wherever possible. It is reasonable to conclude therefore that it would be inappropriate to pursue a bypass option that resulted in such impacts when it has been demonstrated that a 4 lane upgrade of the existing road would provide an acceptable level of service up to 2031 with relatively few impacts and at a much lower cost.

8.0 Conclusion

The potential future upgrade of Caboolture-Bribie Island Road has been the subject of a series of ongoing studies and investigations since 2000. In that time the opportunities for a bypass of Ningi have steadily diminished as urban development proceeded within the study area. This being the case, the objective of this report was to update the work previously undertaken by Cardno MBK in the BIRPS in order to determine whether or not feasible bypass options still exist.

It was confirmed through an initial opportunities and constraints analysis that options for a bypass have indeed become significantly further constrained since the preparation of the BIRPS. A series of four revised bypass options were then developed based on the remaining opportunities within the study area for comparison against a 4 lane upgrade of the existing Bribie Island Road which was considered to be the base case scenario.

An assessment of the impacts associated with the bypass and on-line options was then undertaken. This assessment did not seek to re-examine issues that had been addressed previously in the BIRPS and had not changed since. Rather the assessment focused on those issues that were likely to present either points of differentiation between the bypass and on-line options or a showstopper for any particular option(s). Issues that are normally manageable through standard design measures have not been considered further.

Based on engineering grounds alone with no consideration of cost, environmental and social impacts, bypass options A and B provide the most direct and highest speed routes between the Bribie Island Bridge and Browns Road. In general however, the assessment found that whilst the bypass options would result in benefits associated with improved travel times and road network connectivity, these benefits would be offset by high ecological impacts, medium to high land use and social impacts and project costs 200-300% greater than an upgrade of the existing road.

In particular relation to ecological impacts it was found that all remaining bypass options would impact on essential habitat for a number of threatened frog and bird species afforded protection under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC). For the purposes of the EPBC Act, a 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.

To be 'likely', it is not necessary for a significant impact to have a greater than 50% chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility. Furthermore, if there is insufficient information available to determine whether or not impacts or potential impacts are serious or irreversible, the precautionary principle is applicable. Accordingly, a lack of scientific certainty about the potential impacts of an action will not itself justify a decision that the action is not likely to have a significant impact on the environment.

This being the case, it is considered that for the purposes of the EPBC Act, all of the bypass options have the potential for 'significant impacts' on the essential habitat of the above mentioned threatened species. As such, development of any bypass option would trigger referral under the EPBC and result in assessment and mitigation requirements similar to that experienced for other major road projects in sensitive environmental areas including the Tugun Bypass.

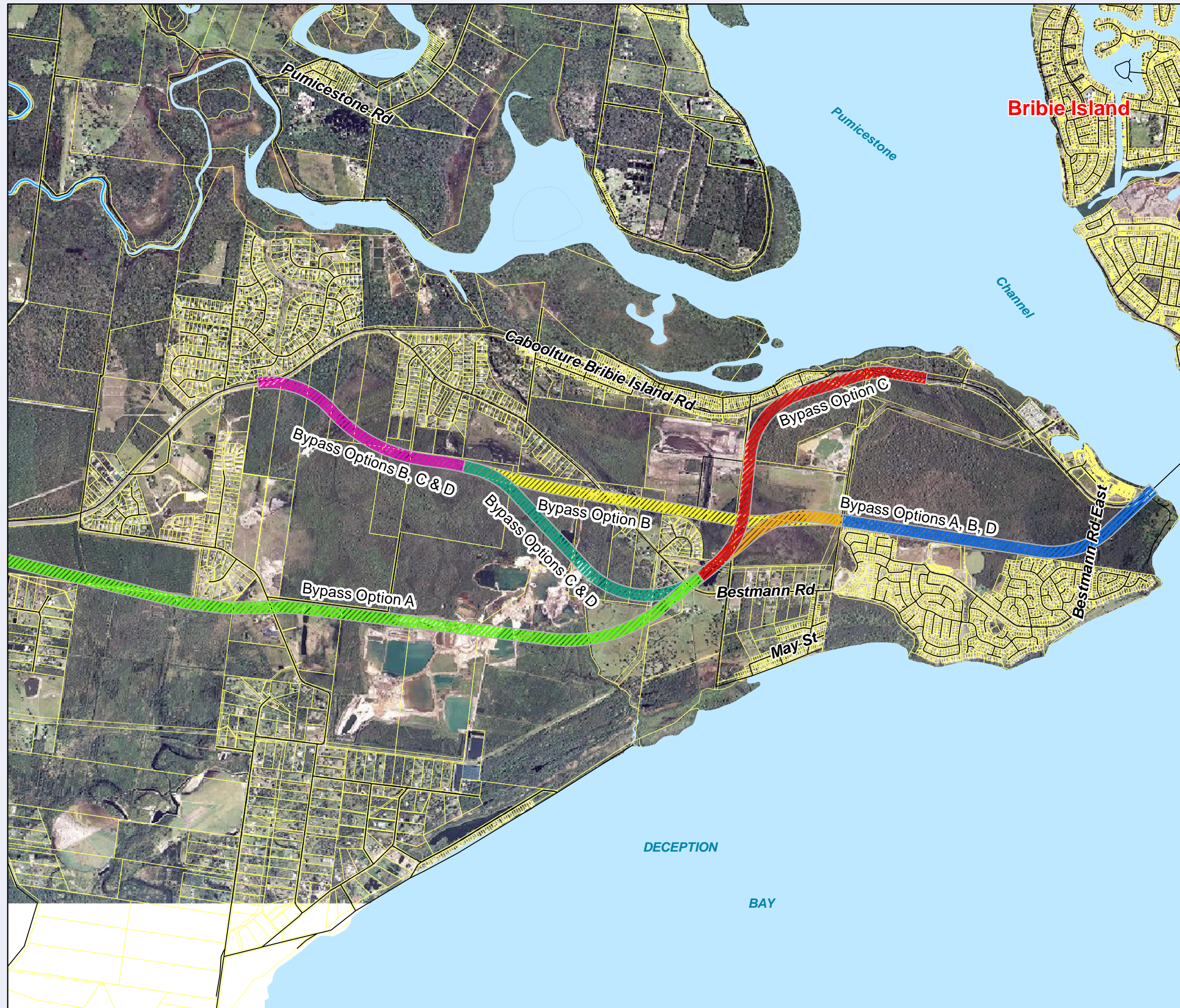
Therefore, the ecological impacts of the bypass options are considered to be such that they materially affect the feasibility of the remaining available alignments, particularly where a viable alternative exists (4 lane upgrade of existing road). As such, an upgrade of the existing road to 4 lanes as described in detail in section 5.5 is considered to be the preferred option.

According to the traffic volumes developed in the BIRPS, a 4 lane upgrade of the existing road is likely to have a design life beyond 2031. This is considered to be a conservative estimate given that the BIRPS did not consider a practical upper limit for development on Bribie Island. It is recommended therefore that a supplementary investigation is undertaken to revise these traffic numbers and provide a more accurate indication of the likely life of the 4 lane upgrade option beyond 2031.

Consideration should also be given to the potential for current land use planning on Bribie Island to change which would potentially result in a significant increase in the traffic volumes on Bribie Island Road. This scenario is considered unlikely given that it would rely on a significant departure from current State and Local government policy.






If this scenario were to occur, it is considered that bypass option A, or a variation thereof, may be able to be pursued in the future as large portions of the alignment are unlikely to be further constrained beyond what exists today. However, it should be noted that the pursuit of any such corridor would be subject to significant economic and environmental constraints, the extent of which have in this report been considered to limit the feasibility of such an option.

**MAP 1 - OVERVIEW
BRIBIE ISLAND ROAD -
TRANSPORT CORRIDOR**



Bribie Island

Bypass options

-  Bypass Options A, B, D
-  Bypass Option A
-  Bypass Options A, D
-  Bypass Option B
-  Bypass Options B, C, D
-  Bypass Option C
-  Bypass Options C, D

Data sources:

Roads, rivers- Copyright 2006, MapData Sciences
PTY LTD, PSMA
Cadastral boundaries- NRW, June, 2006
Aerial photography - Caboolture Shire Council, November 2006

NRW Disclaimer
Based on or contains data provided by the State of Queensland
Department of Natural Resources Mines and Water) [2004, 2006]. In
consideration of the State 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 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.
Data must not be used for direct marketing or be
used in breach of the privacy laws.

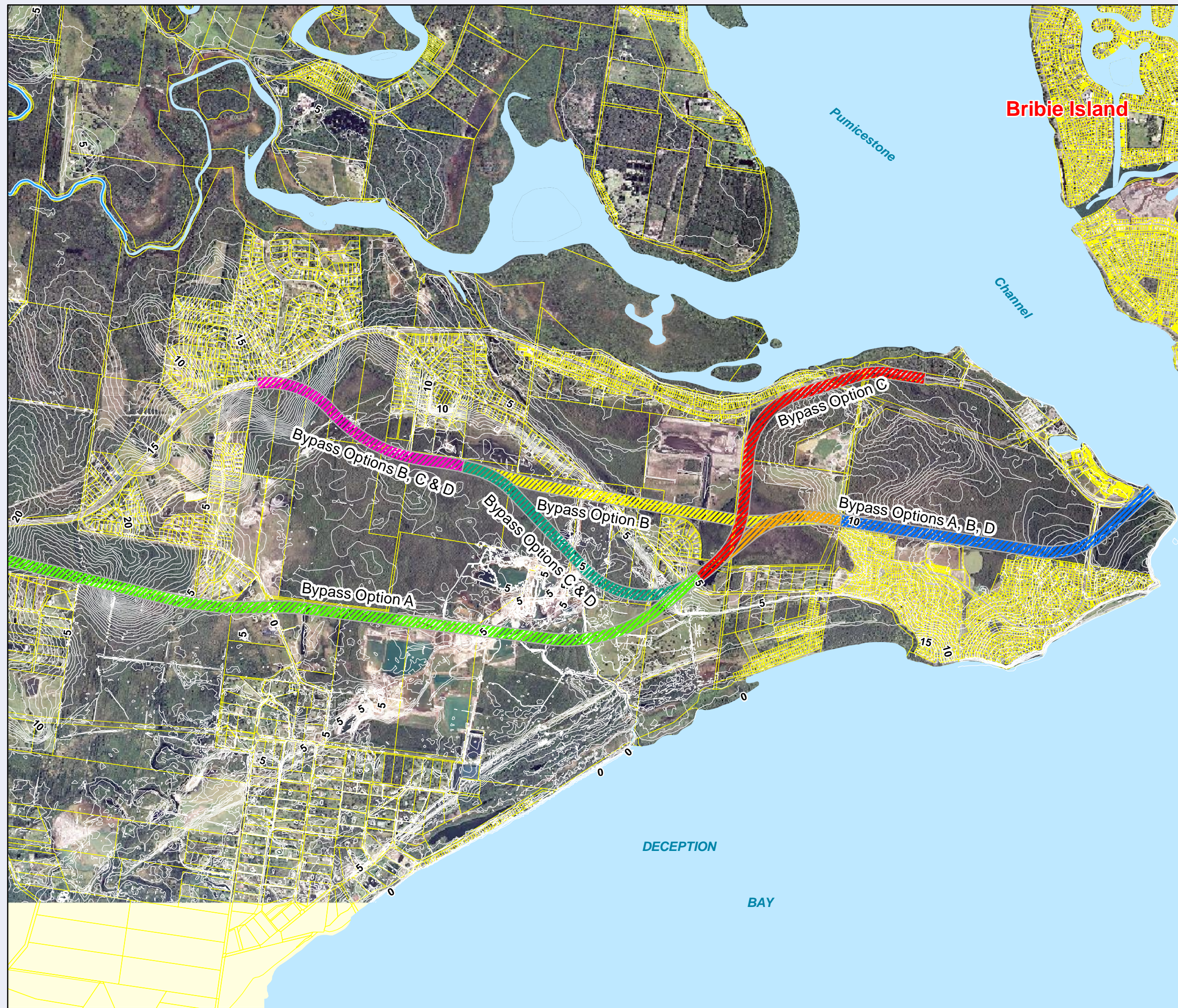
Map location: J:\mmp\10304406\Engineering\GIS\GISdata\Workspaces/
final_report\13_overview.mxd










Date created: 23 February 2007



MAP 2 - CONTOURS BRIBIE ISLAND ROAD - TRANSPORT CORRIDOR



Bypass options

-  Bypass Options A, B, D
-  Bypass Option A
-  Bypass Options A, D
-  Bypass Option B
-  Bypass Options B, C, D
-  Bypass Options C
-  Bypass Options C, D

Data sources:
 Roads, rivers- Copyright 2006, MapData Sciences
 PTY LTD, PSMA
 Contours, aerial photograph - Caboolture Shire Council, November 2006

Map location: J:\mmp\10304406\Engineering\GIS\GISdata\Workspaces/
 final_report\2_contours.mxd



Date created: 23 February 2007










**MAP 3 - PLANNING ZONES
BRIBIE ISLAND ROAD -
TRANSPORT CORRIDOR**



Bribie Island

Bypass options

-  Bypass Options A, B, D
-  Bypass Option A
-  Bypass Options A, D
-  Bypass Option B
-  Bypass Options B, C, D
-  Bypass Option C
-  Bypass Options C, D

Data sources:

Roads, rivers- Copyright 2006, MapData Sciences
PTY LTD, PSMA
Cadastral boundaries - NRW, June, 2006
Planning Zones, aerial photograph - Caboolture Shire Council,
November 2006

NRW Disclaimer

Based on or contains data provided by the State of Queensland
Department of Natural Resources Mines and Water) [2004, 2006]. In
consideration of the State 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 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.
Data must not be used for direct marketing or be
used in breach of the privacy laws.

Map location: J:\mmp\10304406\Engineering\GIS\GISdata\Workspaces/
final_report\3_planning_zones.mxd

1:30,000
(when printed at A3)











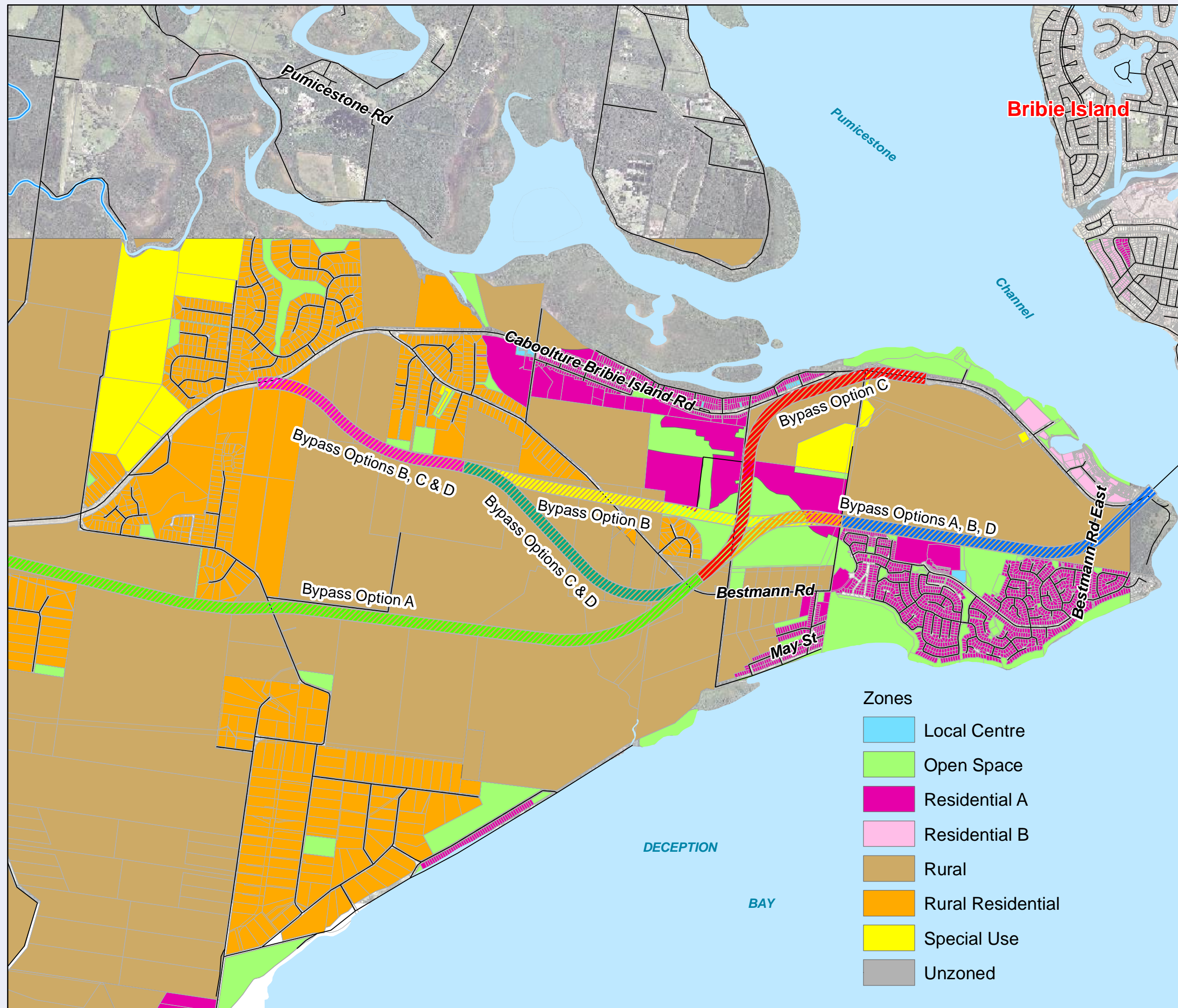
Date created: 23 February 2007



MGA94 Zone 55

Zones








-  Local Centre
-  Open Space
-  Residential A
-  Residential B
-  Rural
-  Rural Residential
-  Special Use
-  Unzoned



**MAP 4 - SEQ REGIONAL PLAN
BRIBIE ISLAND ROAD -
TRANSPORT CORRIDOR**



Bypass options

-  Bypass Options A, B, D
-  Bypass Option A
-  Bypass Options A, D
-  Bypass Option B
-  Bypass Options B, C, D
-  Bypass Option C
-  Bypass Options C, D

Data sources:

Roads, rivers - Copyright 2006, MapData Sciences
PTY LTD, PSMA
SEQ regional plan - Caboolture Shire Council, November 2006

NRW Disclaimer
Based on or contains data provided by the State of Queensland
Department of Natural Resources Mines and Water) [2004, 2006]. In
consideration of the State 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 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.
Data must not be used for direct marketing or be
used in breach of the privacy laws.

Map location: J:\mmp\10304406\Engineering\GIS\GISdata\Workspaces/
final_report\4_SEQ_regional_plan.mxd

1:30,000
(when printed at A3)





Date created: 23 February 2007

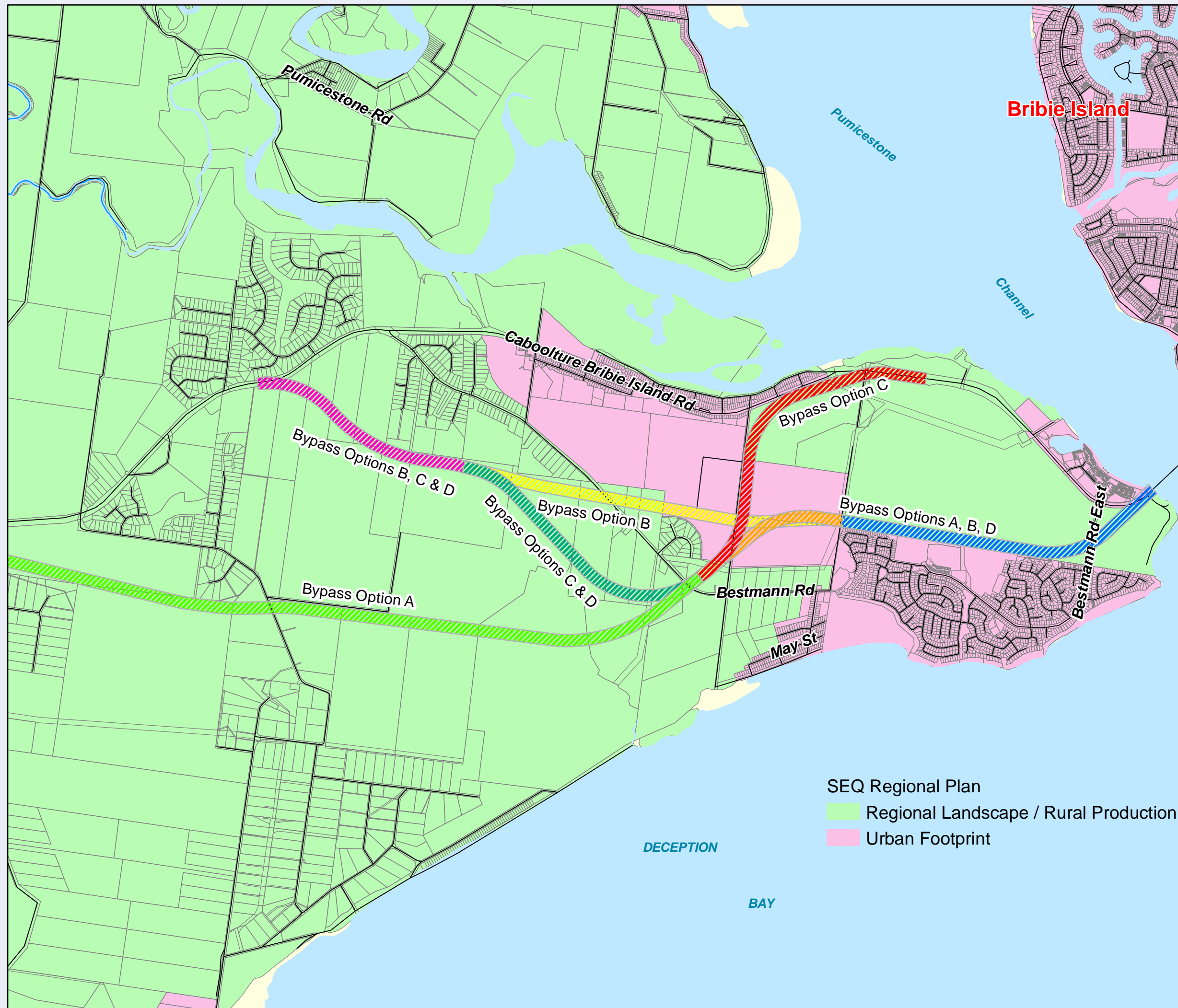


MGA94 Zone 55

SEQ Regional Plan

 Regional Landscape / Rural Production








 Urban Footprint



**MAP 5 - DEVELOPMENT APPLICATIONS - 1
BRIBIE ISLAND ROAD -
TRANSPORT CORRIDOR**



Bypass options

-  Bypass Options A, B, D
-  Bypass Option A
-  Bypass Options A, D
-  Bypass Option B
-  Bypass Options B, C, D
-  Bypass Option C
-  Bypass Options C, D

Data sources:

Roads, rivers- Copyright 2006, MapData Sciences
PTY LTD, PSMA
Cadastral boundaries- NRW, June, 2006
Development applications - Caboolture Shire Council, November 2006

NRW Disclaimer

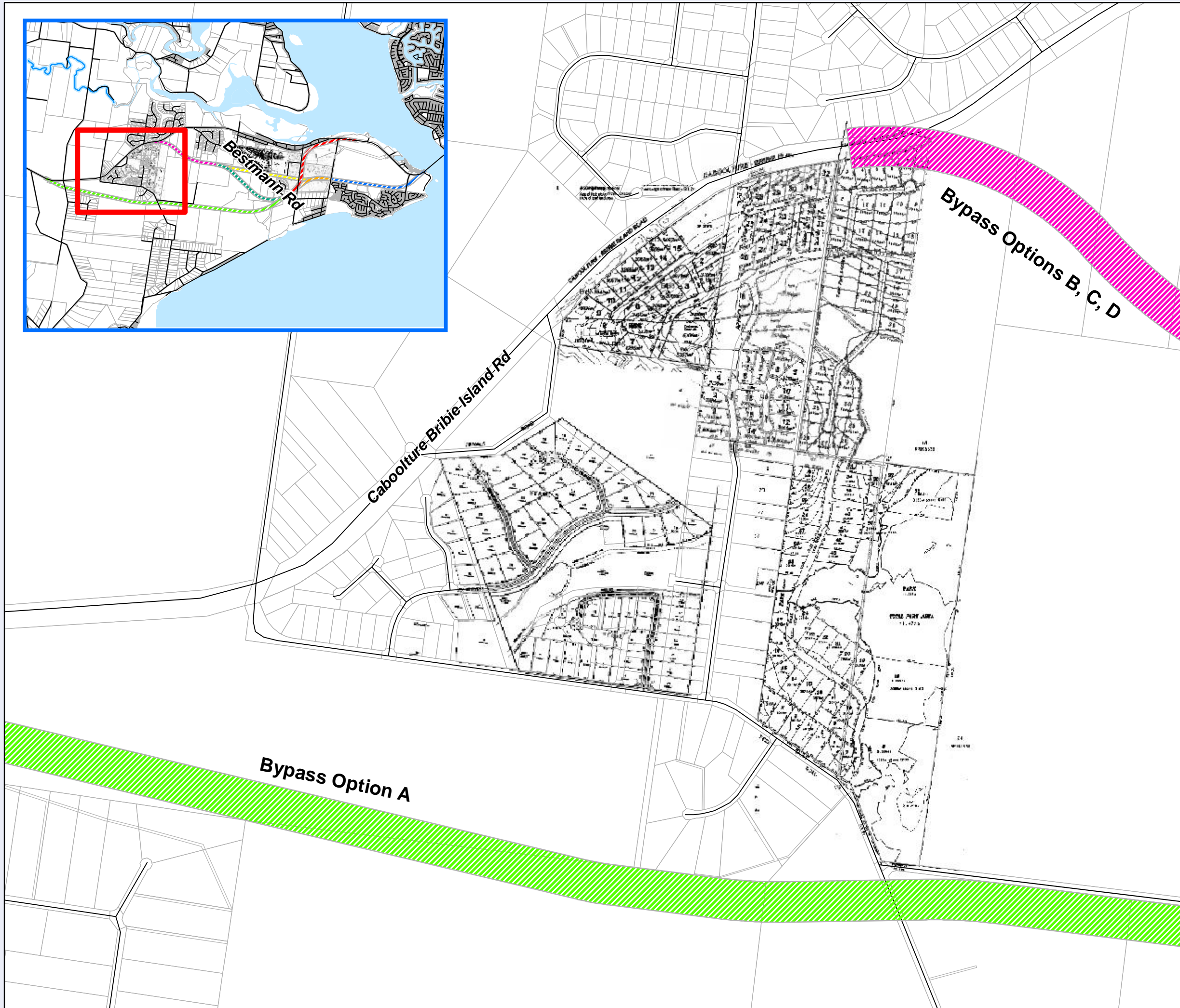
Based on or contains data provided by the State of Queensland
Department of Natural Resources Mines and Water) [2004, 2006]. In
consideration of the State permitting use of this data you
acknowledge and agree that the State gives no warranty in
relation to the data (including accuracy, reliability, completeness,
currency or suitability) and 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.
Data must not be used for direct marketing or be
used in breach of the privacy laws.

Map location: J:\mmp\10304406\Engineering\GIS\GISdata\Workspaces/
final_report\5_development_applications_a.mxd

1:9,000
(when printed at A3)










Date created: 23 February 2007



**MAP 6 - DEVELOPMENT APPLICATIONS - 2
BRIBIE ISLAND ROAD -
TRANSPORT CORRIDOR**



- Bypass options**
-  Bypass Options A, B, D
 -  Bypass Option A
 -  Bypass Options A, D
 -  Bypass Option B
 -  Bypass Options B, C, D
 -  Bypass Option C
 -  Bypass Options C, D

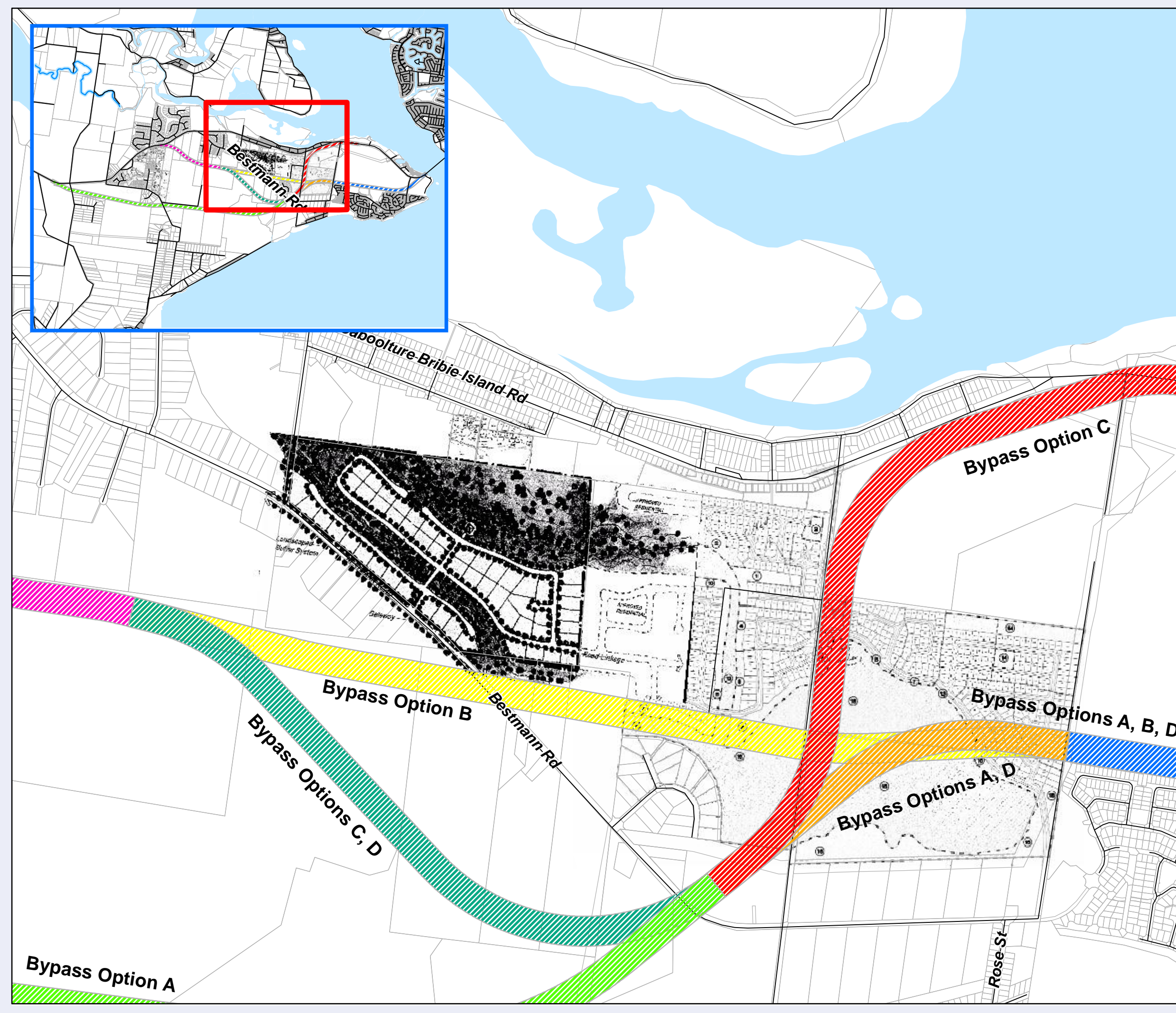
Data sources:
 Roads, rivers- Copyright 2006, MapData Sciences
 PTY LTD, PSMA
 Cadastral boundaries- NRW, June, 2006
 Development applications - Caboolture Shire Council, November 2006

NRW Disclaimer
 Based on or contains data provided by the State of Queensland
 Department of Natural Resources Mines and Water) [2004, 2006]. In
 consideration of the State 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 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.
 Data must not be used for direct marketing or be
 used in breach of the privacy laws.

Map location: J:\mmp\10304406\Engineering\GIS\GISdata\Workspaces/
 final_report\6_development_applications_a.mxd










Date created: 23 February 2007



MAP 7 - EXTRACTIVE RESOURCES AND ELECTRICITY INFRASTRUCTURE BRIBIE ISLAND ROAD - TRANSPORT CORRIDOR



Bypass options

-  Bypass Options A, B, D
-  Bypass Option A
-  Bypass Options A, D
-  Bypass Option B
-  Bypass Options B, C, D
-  Bypass Option C
-  Bypass Options C, D

Data sources:

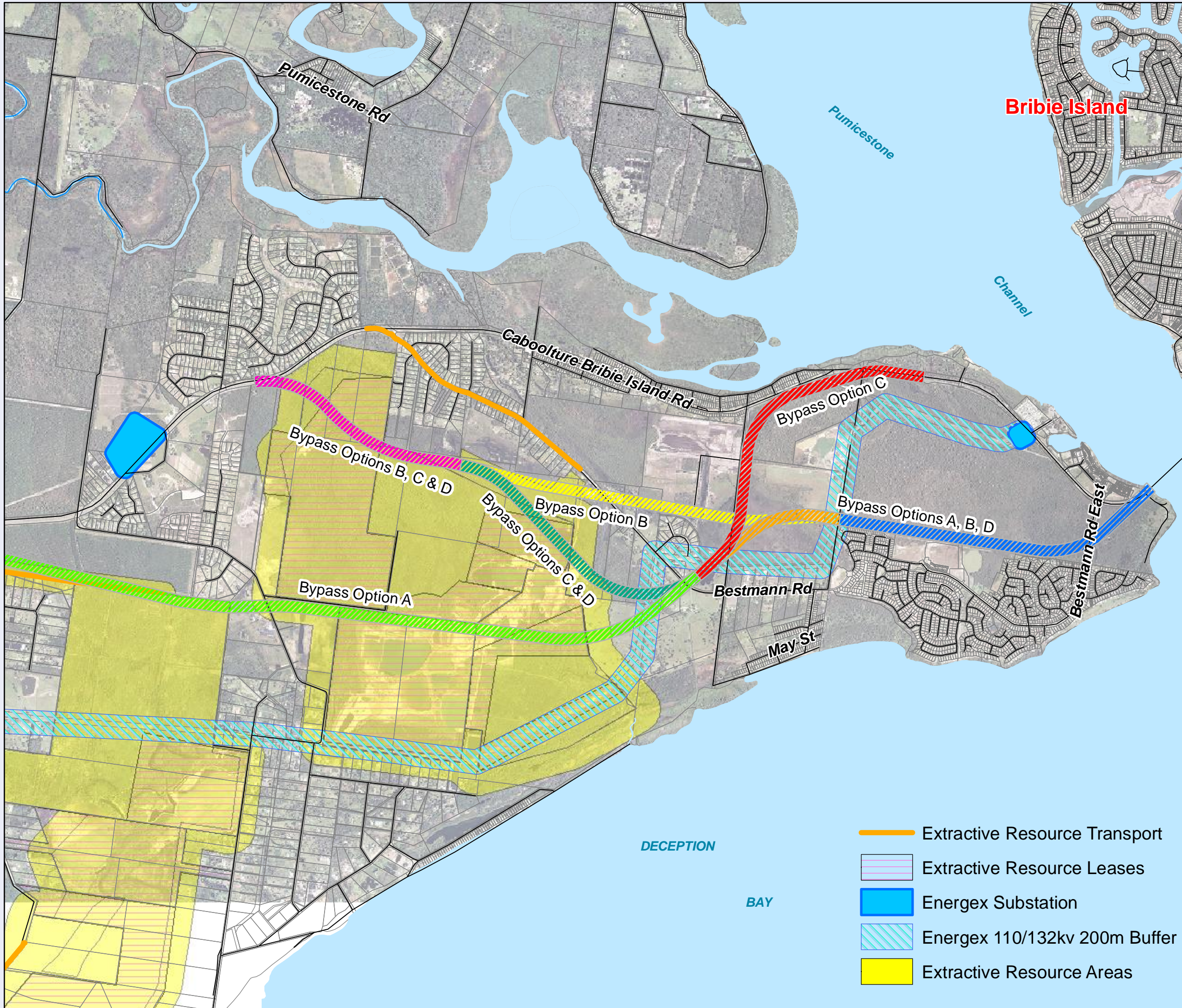
Roads, rivers- Copyright 2006, MapData Sciences PTY LTD, PSMA
 Cadastral boundaries, aerial photography - NRW, June, 2006
 Extractive resource data, Energex data - Caboolture Shire Council, 15 June, 2006


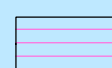
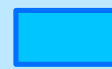


NRW Disclaimer
 Based on or contains data provided by the State of Queensland Department of Natural Resources Mines and Water) [2004, 2006]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and 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. Data must not be used for direct marketing or be used in breach of the privacy laws.

Map location: J:\mmp\10304406\Engineering\GIS\GISdata\Workspaces\final_report\7_extractive_electric_infra.mxd



Date created: 23 February 2007










-  Extractive Resource Transport
-  Extractive Resource Leases
-  Energex Substation
-  Energex 110/132kv 200m Buffer
-  Extractive Resource Areas

**MAP 8 - NATURE
CONSERVATION AREAS
BRIBIE ISLAND ROAD -
TRANSPORT CORRIDOR**



Bypass options

-  Bypass Options A, B, D
-  Bypass Option A
-  Bypass Options A, D
-  Bypass Option B
-  Bypass Options B, C, D
-  Bypass Option C
-  Bypass Options C, D

Data sources:
 Roads, rivers- Copyright 2006, MapData Sciences
 PTY LTD, PSMA
 Nature conservation areas - Caboolture Shire Council, November 2006

Map location: J:\mmp\10304406\Engineering\GIS\GISdata\Workspaces/
 final_report\8_nature_conservation.mxd

Nature Conservation Areas

-  100m Buffer
-  20m Buffer
-  Local
-  Regional
-  State
-  National Park










Date created: 23 February 2007



**MAP 9 - WATERWAYS AND WETLANDS
BRIBIE ISLAND ROAD -
TRANSPORT CORRIDOR**



Bypass options

-  Bypass Options A, B, D
-  Bypass Option A
-  Bypass Options A, D
-  Bypass Option B
-  Bypass Options B, C, D
-  Bypass Option C
-  Bypass Options C, D

Data sources:

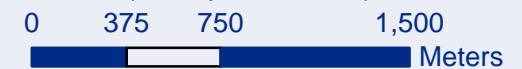
Roads, rivers- Copyright 2006, MapData Sciences
PTY LTD, PSMA
Waterways, wetlands, aerial photo - Caboolture
Shire Council, 15 June, 2006

NRW Disclaimer

Based on or contains data provided by the State of Queensland
Department of Natural Resources Mines and Water) [2004, 2006]. In
consideration of the State 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 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.
Data must not be used for direct marketing or be
used in breach of the privacy laws.

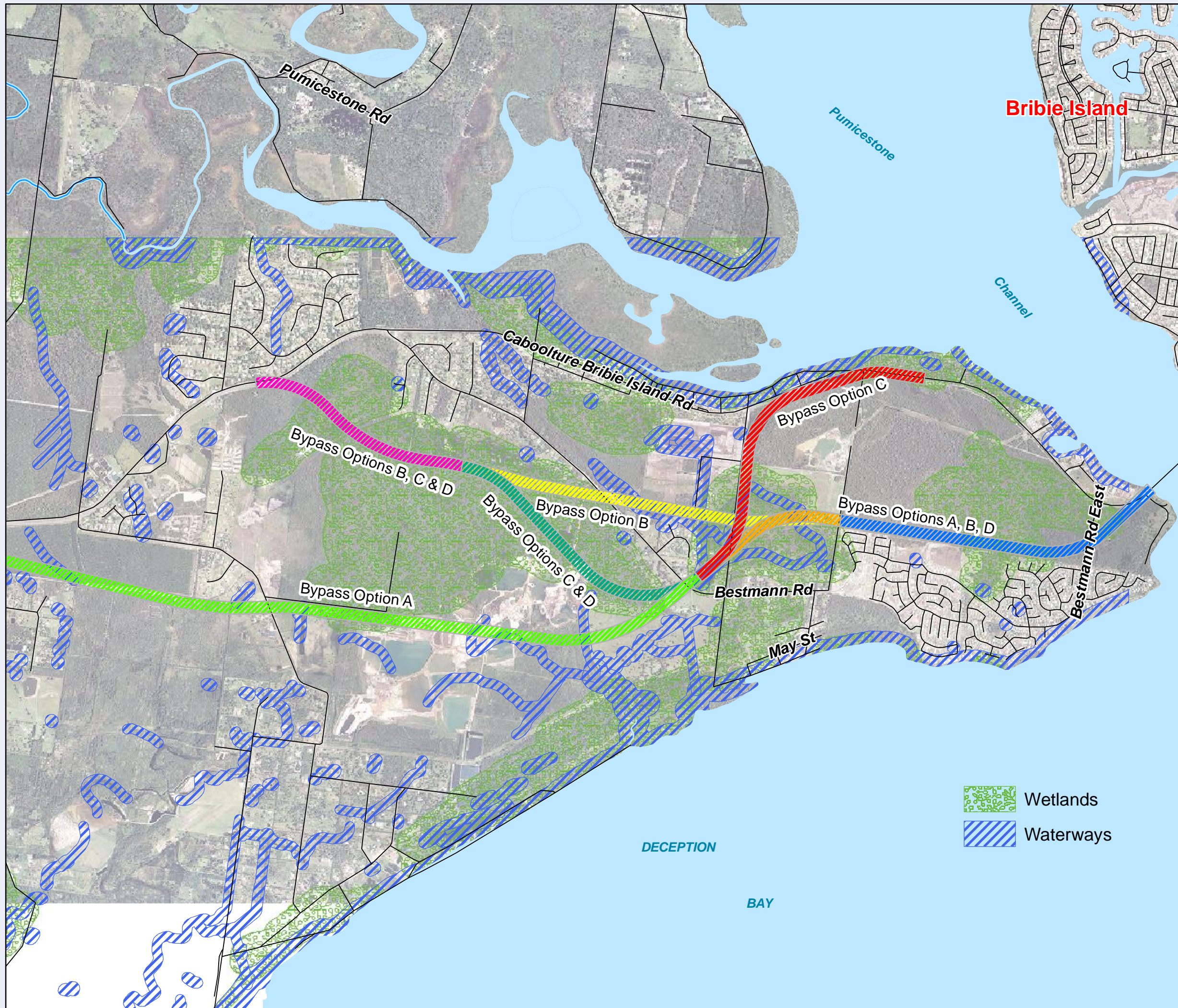
Map location: J:\mmp\10304406\Engineering\GIS\GISdata\Workspaces/
final_report\9_waterways_wetlands.mxd

1:30,000
(when printed at A3)



Date created: 23 February 2007








-  Wetlands
-  Waterways



**MAP 10 - ACID
SULFATE SOILS
BRIBIE ISLAND ROAD -
TRANSPORT CORRIDOR**



Bypass options

-  Bypass Options A, B, D
-  Bypass Option A
-  Bypass Options A, D
-  Bypass Option B
-  Bypass Options B, C, D
-  Bypass Option C
-  Bypass Options C, D

Data sources:

Roads, rivers - Copyright 2006, MapData Sciences
PTY LTD, PSMA
Acid sulfate soils - Caboolture Shire Council, November 2006

NRW Disclaimer
Based on or contains data provided by the State of Queensland
Department of Natural Resources Mines and Water) [2004, 2006]. In
consideration of the State 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 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.
Data must not be used for direct marketing or be
used in breach of the privacy laws.

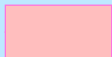
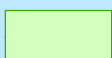
Map location: J:\mmp\10304406\Engineering\GIS\GISdata\Workspaces/
final_report\10_ASS.mxd

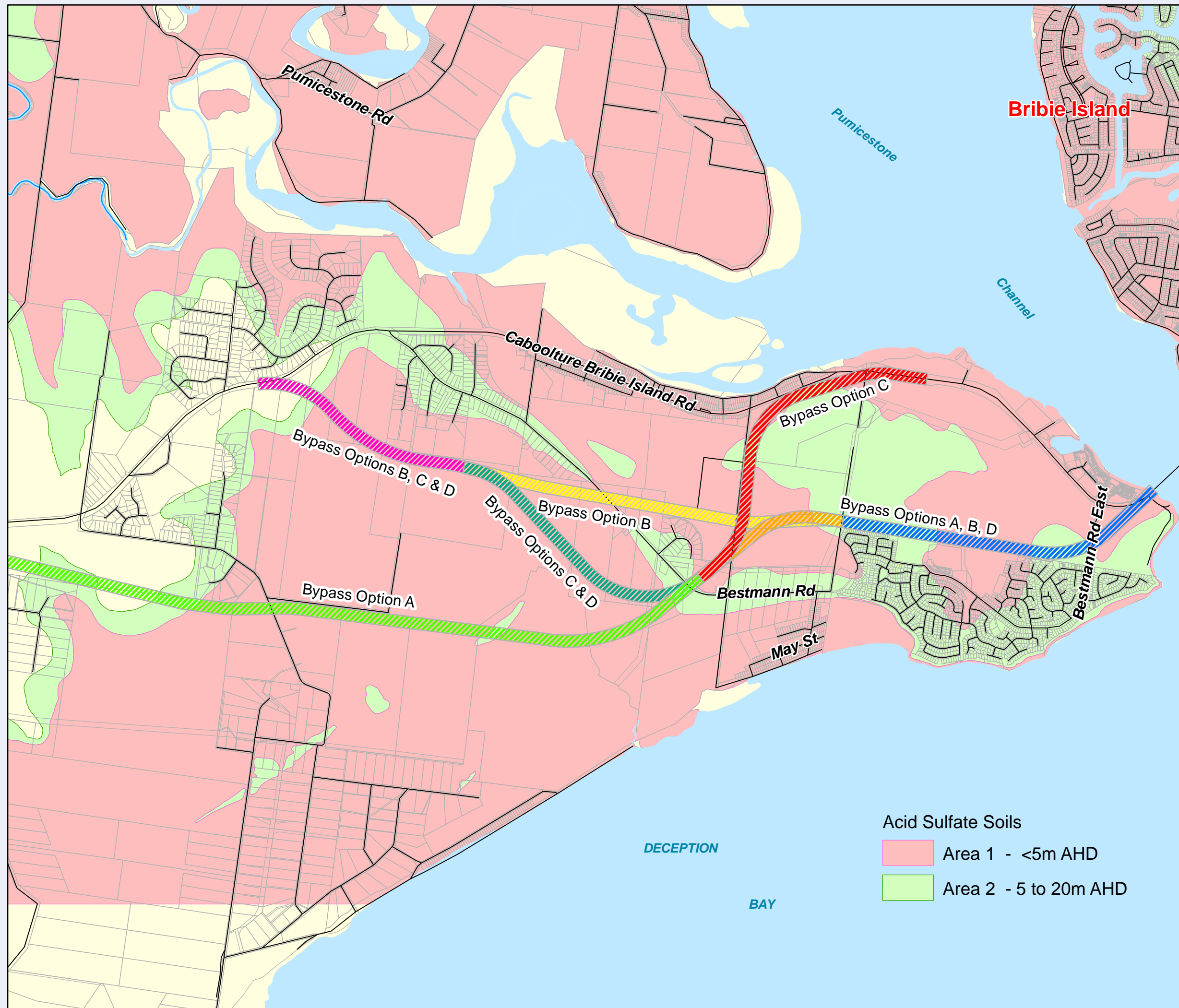
1:30,000
(when printed at A3)



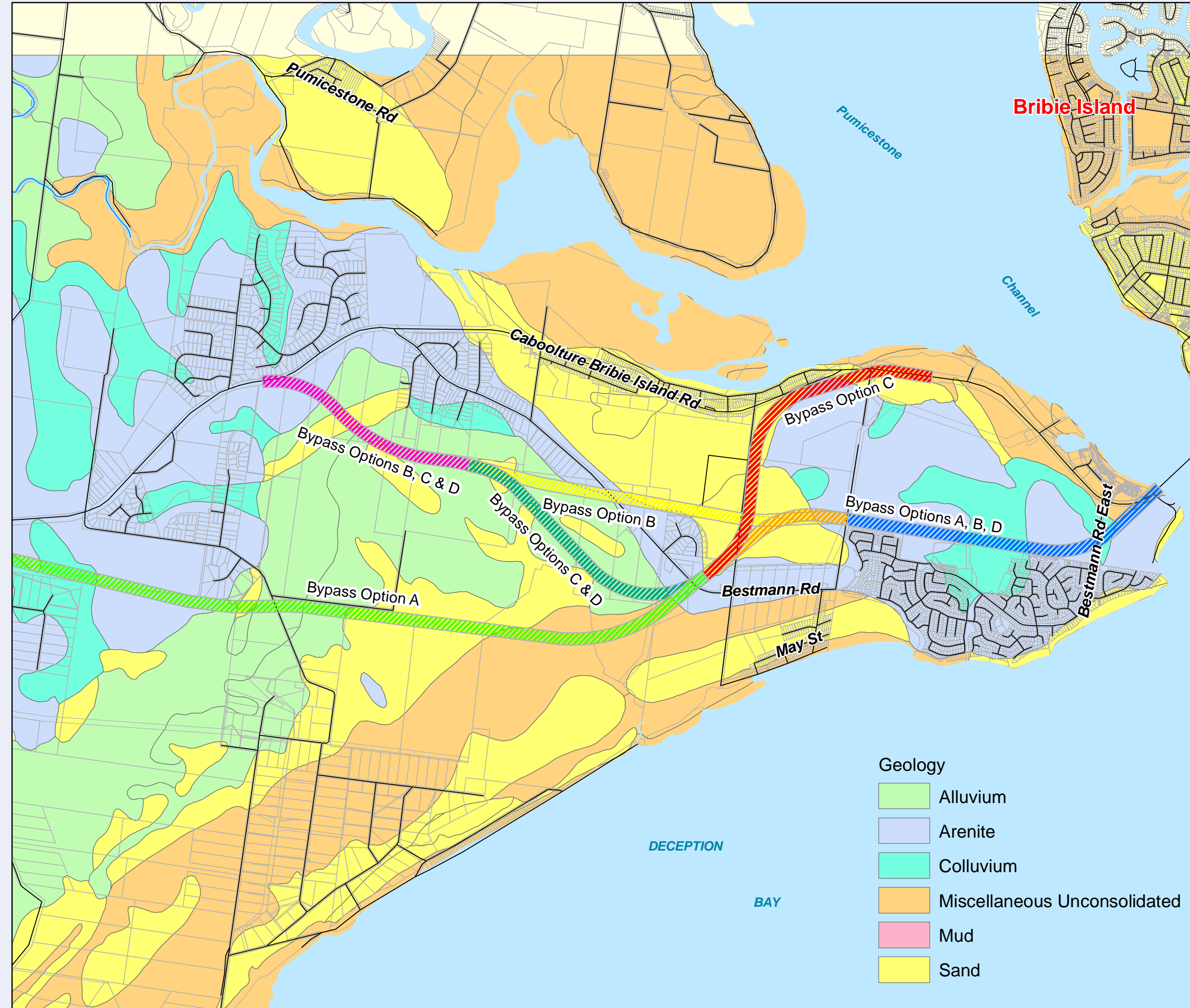
Date created: 23 February 2007








Acid Sulfate Soils

-  Area 1 - <5m AHD
-  Area 2 - 5 to 20m AHD



MAP 11 - GEOLOGY BRIBIE ISLAND ROAD - TRANSPORT CORRIDOR



- Bypass options**
-  Bypass Options A, B, D
 -  Bypass Option A
 -  Bypass Options A, D
 -  Bypass Option B
 -  Bypass Options B, C, D
 -  Bypass Option C
 -  Bypass Options C, D





Data sources:
 Roads, rivers- Copyright 2006, MapData Sciences PTY LTD, PSMA
 Geology - Geological Survey of Queensland, NRW, 2006

NRW Disclaimer
 Based on or contains data provided by the State of Queensland Department of Natural Resources Mines and Water) [2004, 2006]. In consideration of the State 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 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. Data must not be used for direct marketing or be used in breach of the privacy laws.

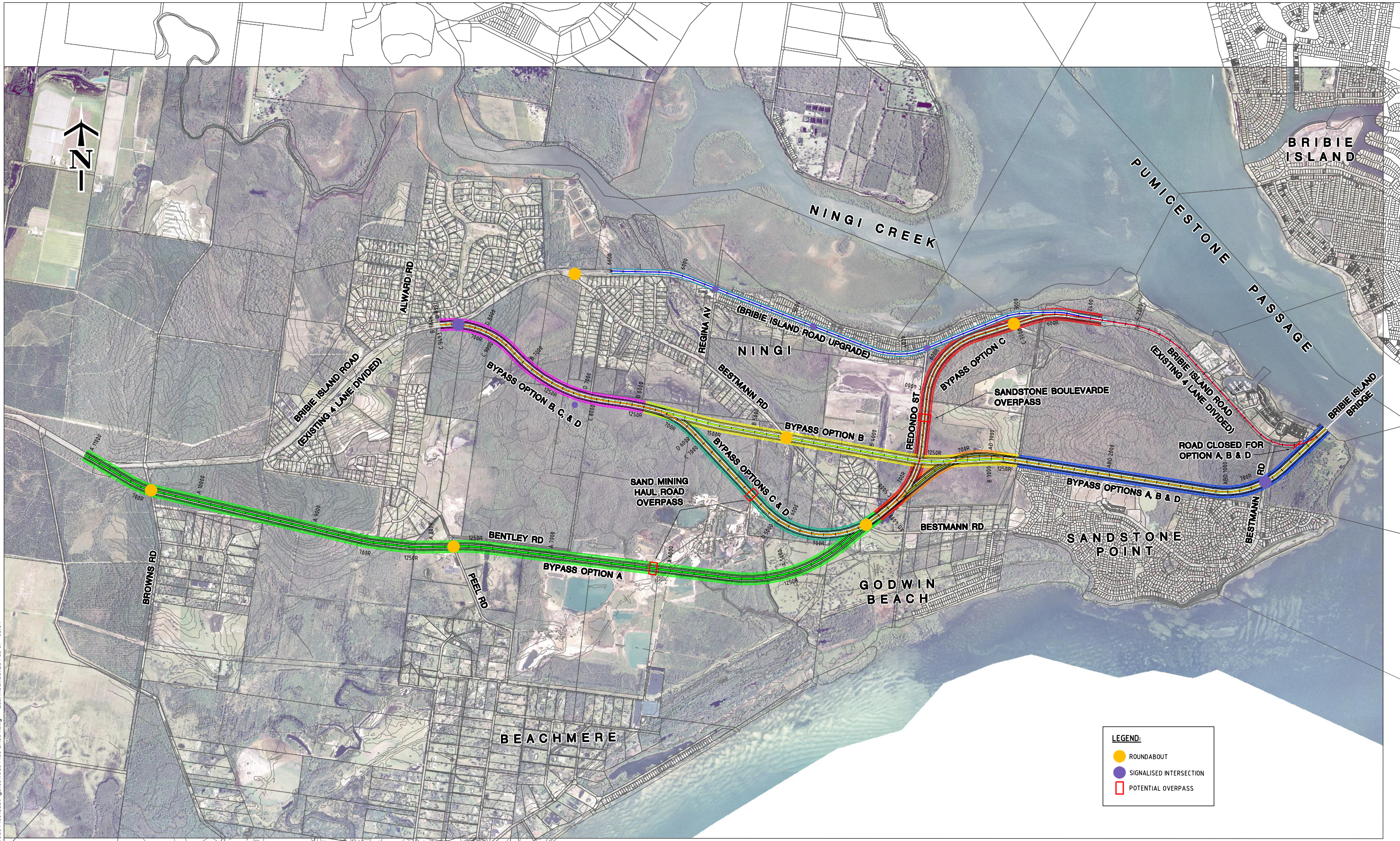
Map location: J:\mmp\10304406\Engineering\GIS\GISdata\Workspaces\final_report\11_geology.mxd



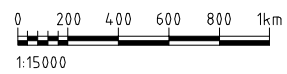
Date created: 23 February 2007

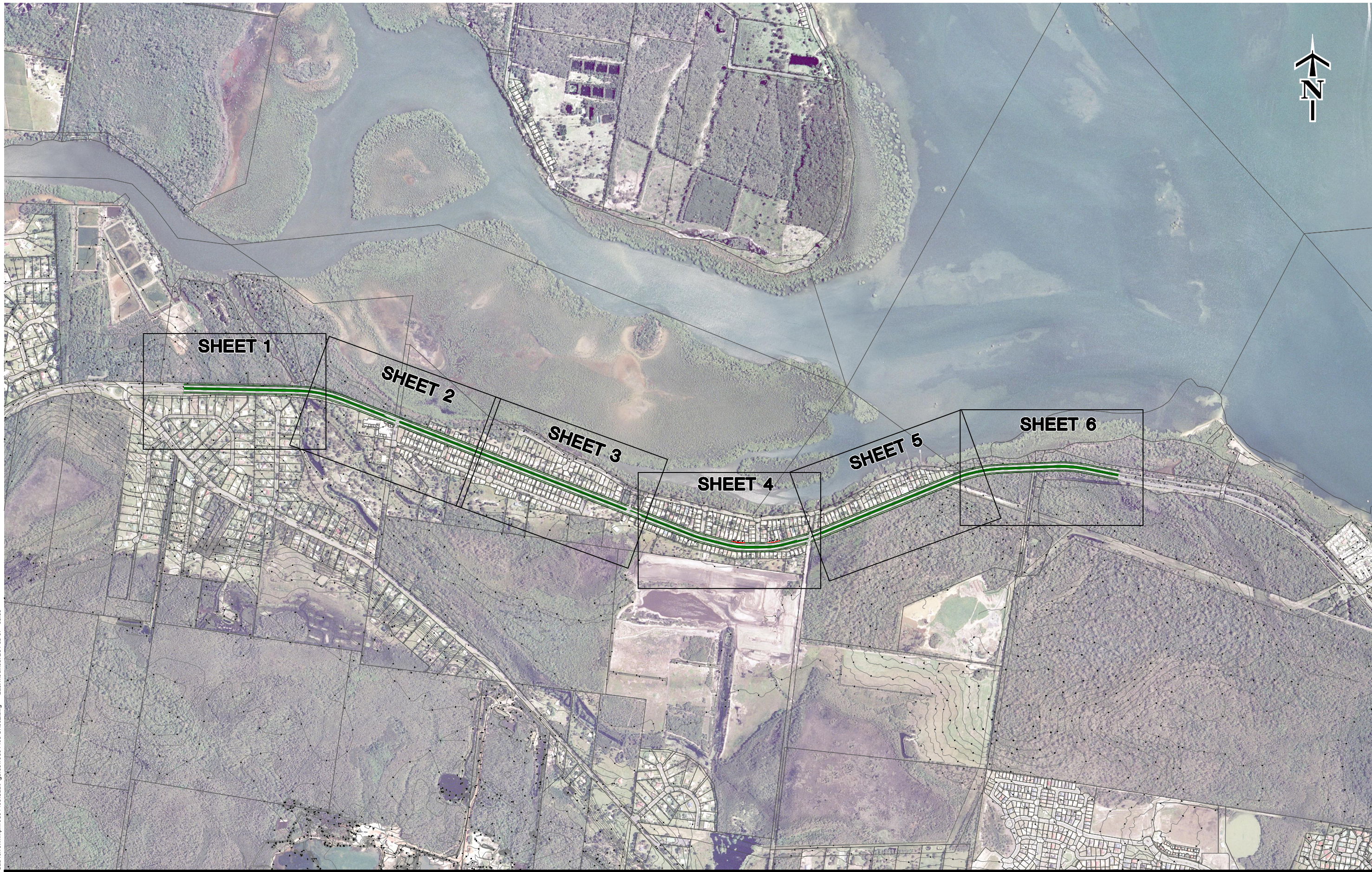
- Geology**
-  Alluvium
 -  Arenite
 -  Colluvium
 -  Miscellaneous Unconsolidated
 -  Mud
 -  Sand





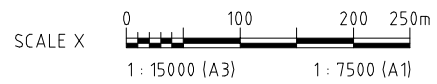
Cad ref: J:\hmgp\10304406\Cad\Figures\10304406-SK001.dwg Last modified: 23 Feb 07 - 08:34





Cad ref: J:\mmp\10304406\Cad\Figures\10304406-SK002.dwg Last modified: 23 Feb 07 - 08:35

10304406

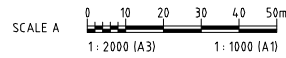


BRIBIE ISLAND ROAD - TRANSPORT CORRIDOR REVIEW
NINGI TO BRIBIE ISLAND BRIDGE
UPGRADE EXISTING ROAD - SITE PLAN
10304406-SK002



Cad ref.: J:\mmp\10304406\CadFigures\10304406-SK003.dwg Last modified: 23 Feb 07 - 09:36

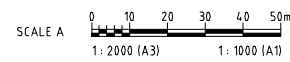
10304406





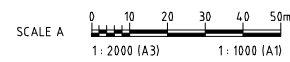
Cad ref.: J:\mmp\10304406\Cad\Figures\10304406-SK004.dwg Last modified: 23 Feb 07 - 08:36

10304406





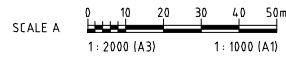
Cad ref: J:\mmp\10304406\Cad\Figures\10304406-SK005.dwg Last modified: 23 Feb 07 - 08:37





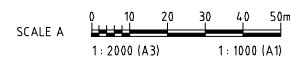
Cad ref.: J:\mmp\10304406\Cad\Figures\10304406-SK006.dwg Last modified: 23 Feb 07 - 09:38

10304406





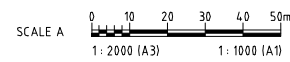
Cad ref.: J:\mmp\10304406\Cad\Figures\10304406-SK007.dwg Last modified: 23 Feb 07 - 08:38

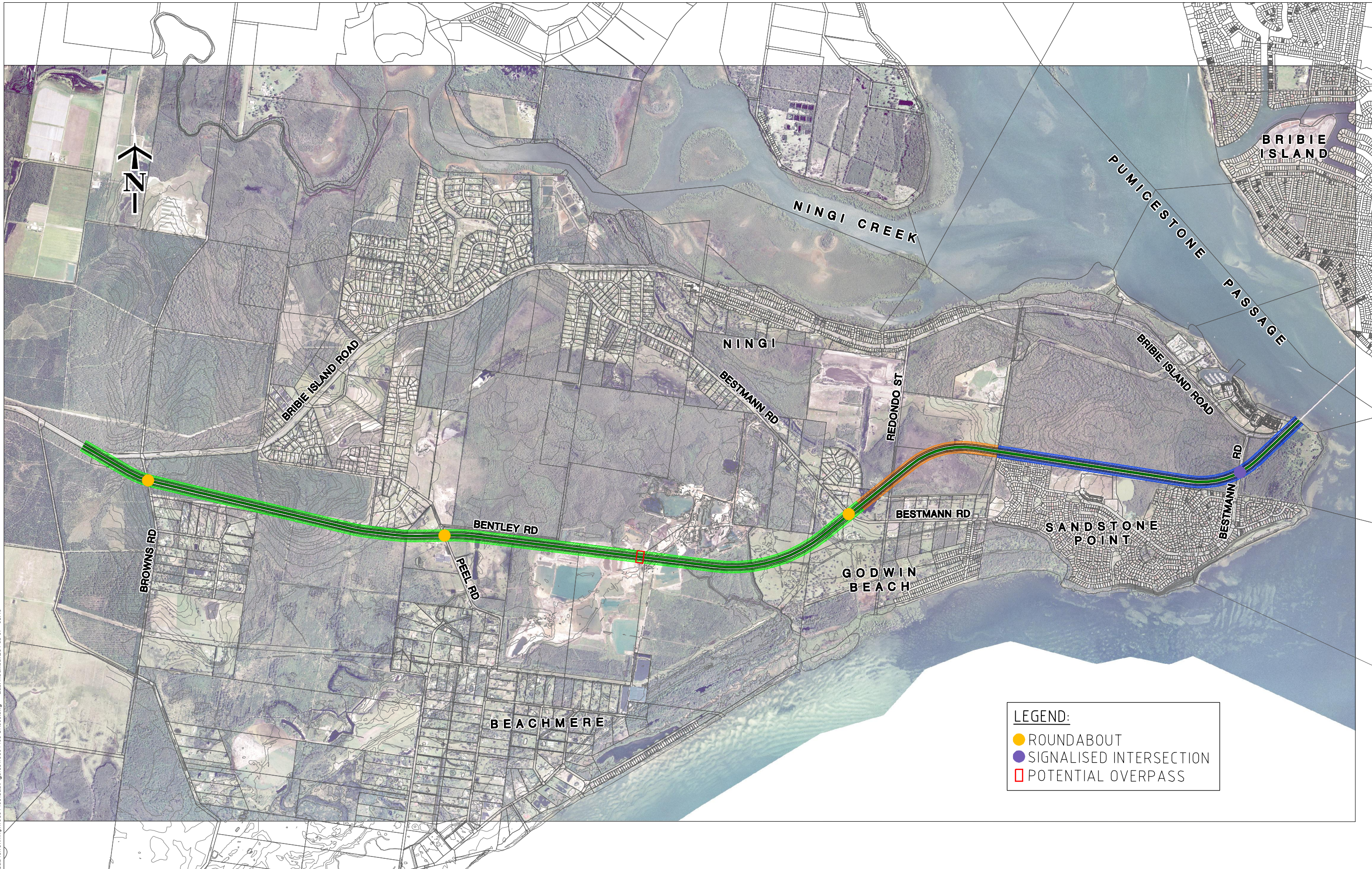




Cad ref: J:\mmp\10304406\CadFigures\10304406-SK008.dwg Last modified: 23 Feb 07 - 09:39

10304406

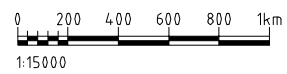


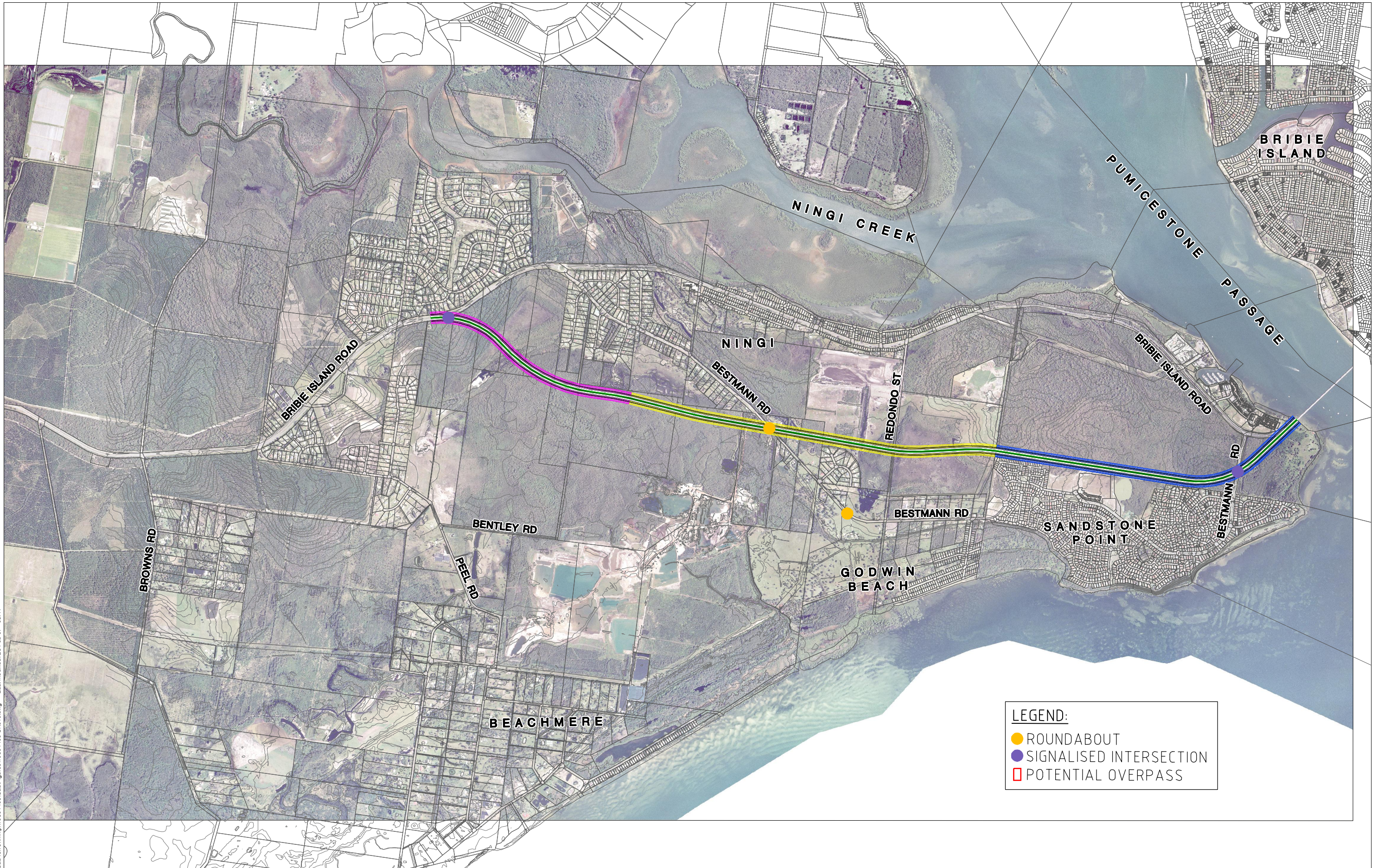


LEGEND:

- ROUNDABOUT
- SIGNALISED INTERSECTION
- POTENTIAL OVERPASS

Cad ref: J:\himg\10304406\Cad\Figures\10304406-SK009.dwg Last modified: 23 Feb 07 - 08:40

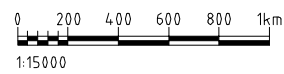


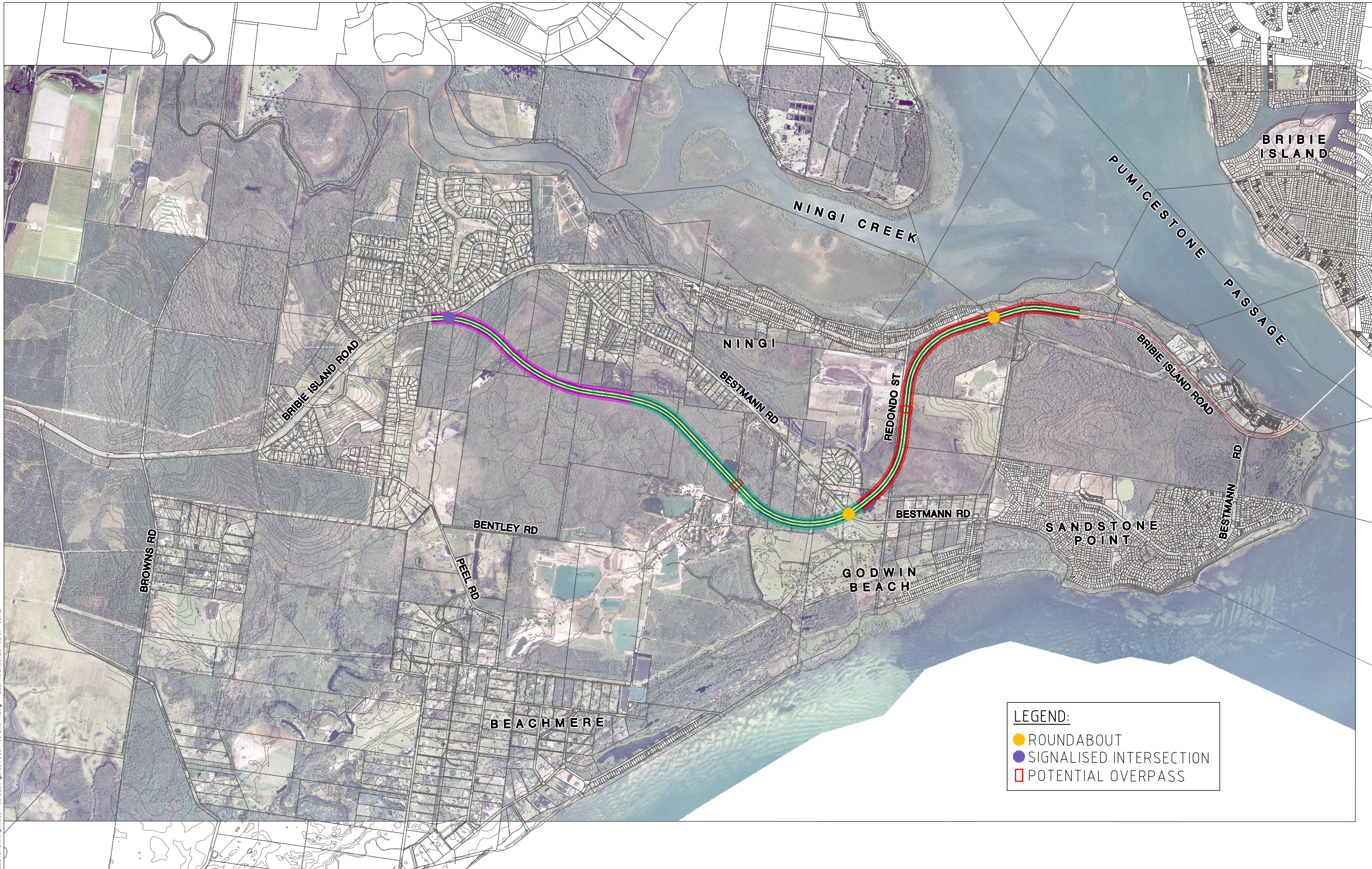


LEGEND:

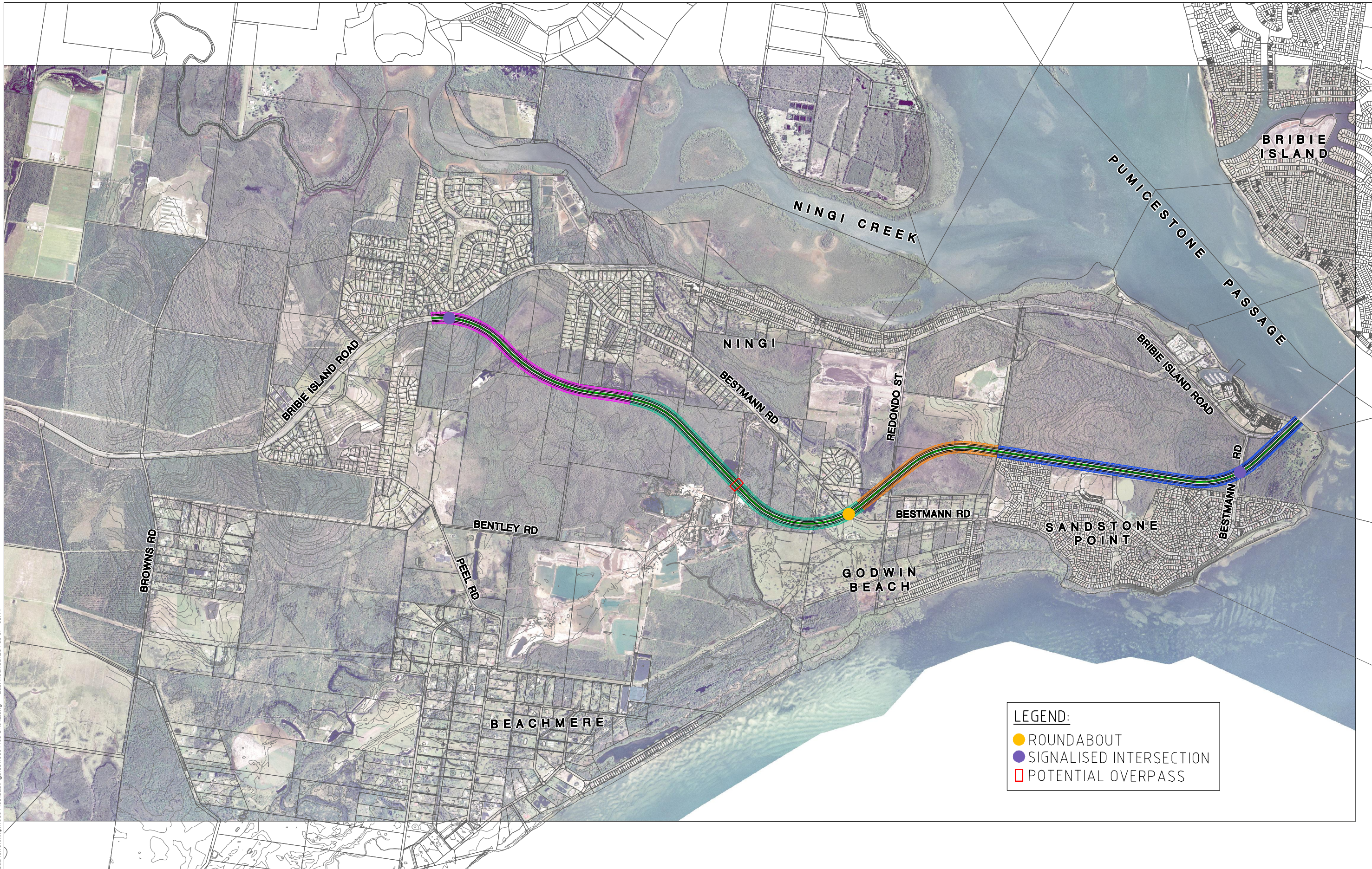
- ROUNDABOUT
- SIGNALISED INTERSECTION
- POTENTIAL OVERPASS

Cad ref: J:\hmgp\10304406\Cad\Figures\10304406-SK010.dwg Last modified: 23 Feb 07 - 08:41



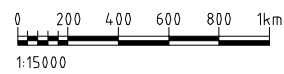


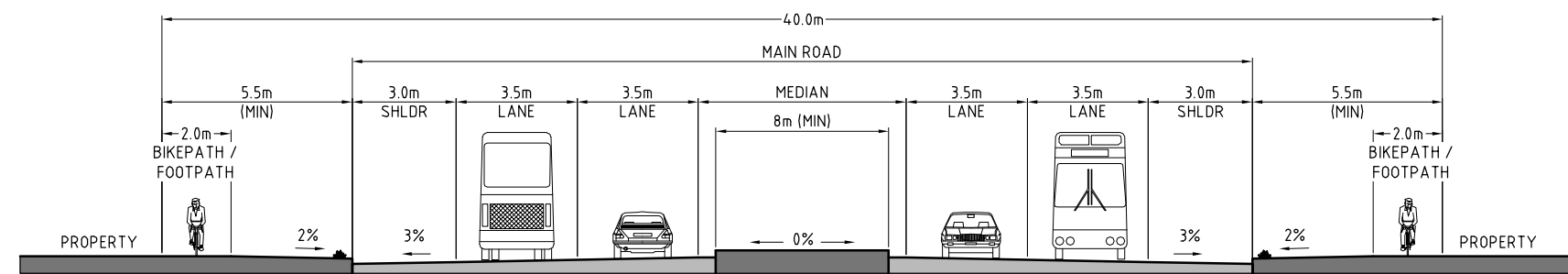
Cad ref: J:\himg\10304406\CadFigures\10304406-SK011.dwg Last modified: 23 Feb 07 - 08:42



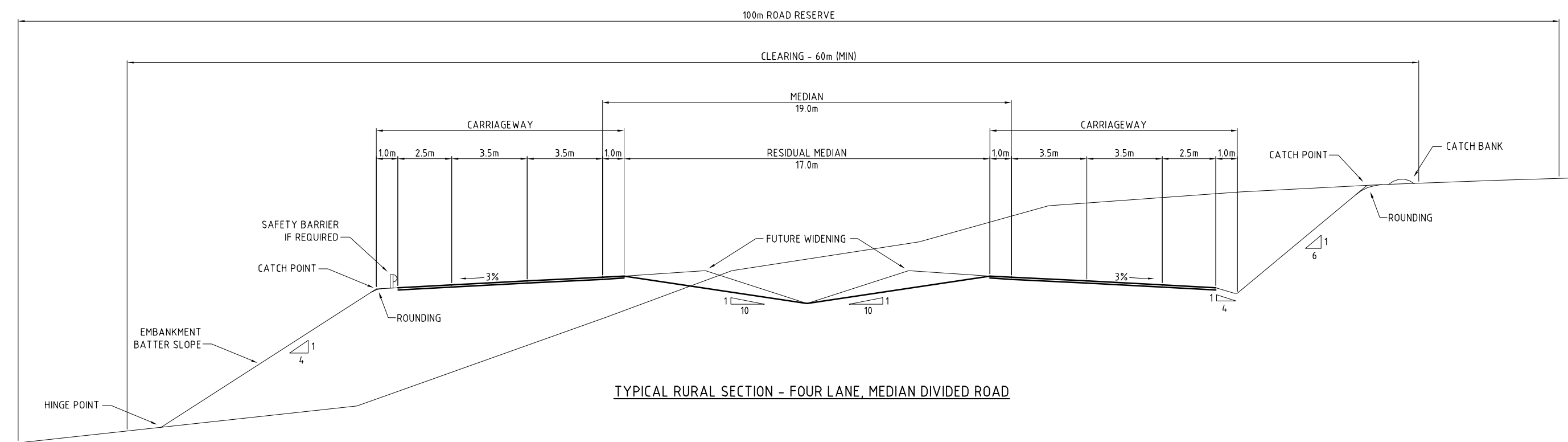
Cad ref: J:\himg\10304406\Cad\Figures\10304406-SK012.dwg Last modified: 23 Feb 07 - 08:44

LEGEND:
● ROUNDABOUT
● SIGNALISED INTERSECTION
□ POTENTIAL OVERPASS





TYPICAL URBAN SECTION - FOUR LANE, MEDIAN DIVIDED ROAD



TYPICAL RURAL SECTION - FOUR LANE, MEDIAN DIVIDED ROAD

Cad ref.: J:\mnp\10304406\Cad\Figures\10304406-SK013.dwg Last modified: 23 Feb 07 - 08:44



Bribie Island Road – Transport Corridor Review Ningi to Bribie Island Bridge

Desktop Flora and Fauna Review

Department of Main Roads (North Coast Hinterland)

6 March 2007

MAUNSELL | AECOM

Ningi to Bribie Island Bridge

Prepared for

Department of Main Roads (North Coast Hinterland)

Prepared by

Maunsell Australia Pty Ltd

12 Cribb Street, PO Box 1823, Milton QLD 4064, Australia
T +61 7 3858 6700 F +61 7 3858 6705 www.maunsell.com

ABN 20 093 846 925

6 March 2007

10304406

© Maunsell Australia Pty Ltd 2007

The information contained in this document produced by Maunsell Australia Pty Ltd is solely for the use of the Client identified on the cover sheet for the purpose for which it has been prepared and Maunsell Australia Pty Ltd undertakes no duty to or accepts any responsibility to any third party who may rely upon this document.

All rights reserved. No section or element of this document may be removed from this document, reproduced, electronically stored or transmitted in any form without the written permission of Maunsell Australia Pty Ltd.

Quality Information

Document Ningi to Bribie Island Bridge
Ref 10304406
Date 6 March 2007
Prepared by Jo Pringle, Richard Floyd
Reviewed by Jeremy Claridge, James Fjeldsoe

Draft for Client Review

Revision History

| Revision | Revision Date | Details | Authorised | |
|----------|---------------|-------------------------|---|-----------------|
| | | | Name/Position | Signature |
| A | 06/03/2007 | Draft for Client Review | Leo Hammett Director - Planning and Advisory Services | Original Signed |
| 0 | 06/03/2007 | Final issued to Client | Leo Hammett Director - Planning and Advisory Services | Original Signed |

Table of Contents

| | | |
|------------|--|----|
| Acronyms | | i |
| 1.0 | Introduction | 2 |
| 1.1 | Background | 2 |
| 1.2 | Description of Proposed Activity | 2 |
| 1.3 | Study Aims and Objectives | 2 |
| 1.4 | Study Area Description | 2 |
| 1.5 | Limitations | 4 |
| 1.6 | Previous Reports | 4 |
| 1.7 | Legislative and Regulatory Context | 4 |
| | 1.7.1 Commonwealth Legislation | 4 |
| | 1.7.2 Queensland Legislation | 5 |
| | 1.7.3 Local Requirements | 6 |
| 2.0 | Methodology | 7 |
| 2.1 | Background Data Collection and Review | 7 |
| 2.2 | Field Inspection | 7 |
| 3.0 | Existing Environment | 8 |
| 3.1 | Flora | 8 |
| | 3.1.1 Nature Conservation Areas | 11 |
| | 3.1.2 Flora of Conservation Significance | 13 |
| | 3.1.3 Introduced Species | 15 |
| 3.2 | Terrestrial and Aquatic Fauna | 16 |
| | 3.2.1 Database Searches | 16 |
| | 3.2.2 Species of Conservation Significance | 16 |
| | 3.2.3 Migratory Species | 17 |
| | 3.2.4 Aquatic Fauna | 17 |
| | 3.2.5 Habitat Assessment | 17 |
| | 3.2.6 Essential Habitat | 18 |
| 4.0 | Potential Impacts and Assessment | 19 |
| 4.1 | Assessment Criteria | 19 |
| 4.2 | Potential Impacts | 19 |
| | 4.2.1 Habitat fragmentation | 20 |
| | 4.2.2 Habitat removal or modification | 20 |
| | 4.2.3 Barrier effects | 21 |
| | 4.2.4 Road strike | 22 |
| 5.0 | Conclusions and Recommendations | 25 |
| 6.0 | References | 25 |
| Appendix A | Rare and Threatened Fauna Assessment | a |

List of Tables

| | | |
|---------|---|----|
| Table 1 | Plant species of conservation significance with potential to occur in the study area. | 13 |
| Table 2 | Invasive plant species recorded in the vicinity of the site | 15 |
| Table 3 | Threatened species occurring or likely to occur in the study area. | 16 |
| Table 4 | Migratory species (excluding marine occurring or likely to occur in the study area. | 17 |
| Table 5 | Assessment Criteria | 19 |
| Table 6 | Total Areas of Regional Ecosystem to be Cleared for Each Option (hectares) | 20 |
| Table 7 | Summary of Assessment of Impacts | 23 |

List of Figures

| | | |
|----------|---|----|
| Figure 1 | Study Area | 3 |
| Figure 2 | Declared Plant Status in Queensland (Natural Resources and Water) | 5 |
| Figure 3 | Regional Ecosystems of the Study Area | 10 |
| Figure 4 | State, Regional and Locally Significant Areas | 12 |

Acronyms

| | |
|----------|---|
| CAMBA | China Australia Migratory Bird Agreement |
| EPA | Environmental Protection Agency |
| EPBC Act | Environmental Protection and Biodiversity Conservation (1999) |
| JAMBA | Japan Australia Migratory Bird Agreement |
| MCU | Material Change of Use |
| MR | Main Roads |
| NC Act | Nature Conservation Act (1992) |
| RoL | Reconfiguration of a Lot |
| RE | Regional Ecosystem |
| REDD | Regional Ecosystem Description Database |
| VM Act | Vegetation Management Act (1999) |

1.0 Introduction

1.1 Background

Maunsell Australia Pty Ltd (Maunsell) have been commissioned by the Department of Main Roads (MR) to identify the environmental constraints with respect to potential upgrade options for the Caboolture – Bribie Island Road between Browns Road and the Bribie Island Bridge.

Several bypass options for Ningi were previously identified under the *Bribie Island Road Planning Study* (Cardno MBK, 2002) within the overall objective of identifying a strategy to deliver adequate service in the future and to improve the capacity and safety of Bribie Island road without unacceptable impact on the environment (Cardno MBK, 2002).

This report describes the existing ecology and ranks each potential road option against environmental assessment criteria to provide an overall level of ecological impact. Particular emphasis is placed on the likely occurrence of threatened ecological communities and species as listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (C'th) and *Nature Conservation Act 1992* (NC Act) (Qld) and regulations.

1.2 Description of Proposed Activity

As shown in Figure 1, a number of alternate bypass options for the township of Ningi are proposed as well as the upgrade of the existing Bribie Island Road. Each potential roadway will require a dedicated corridor of 100m reserve with actual road construction ranging in width from 50m (where on elevated structure) to 60 metres. For the purpose of this assessment, it is assumed construction activities will require clearing of the entire width of the corridor. The process by which these corridors were developed is outlined in Section 4 of the main report.

1.3 Study Aims and Objectives

The aim of this study is to examine ecological constraints and opportunities of the potential bypass options and existing road upgrade within the Ningi locality.

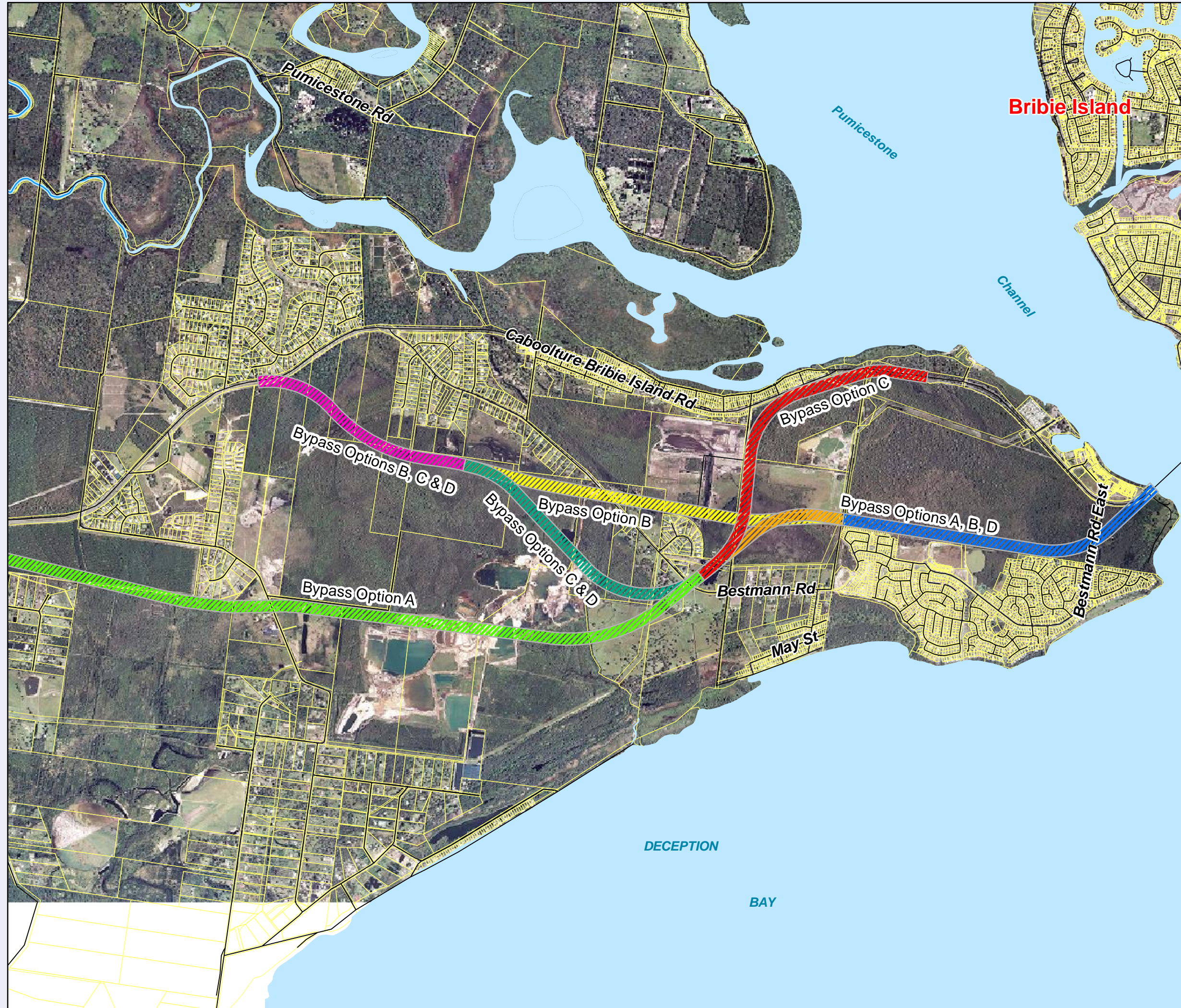
The specific objective is to conduct a desktop flora and fauna assessment to identify the known presence of regional ecosystems, threatened species or the habitat of threatened species within the study area. This assessment is to identify significant environmental issues with the potential to constrain the proposed options, according to their likely ecological impacts as a result of the construction and operation of each road option. Key ecological values assessed included threatened species, regional ecosystems, associated biodiversity and habitat values. Impacts on water quality, air quality, erosion and sedimentation have not been directly analysed.








1.4 Study Area Description

The study area, as originally defined in *The Bribie Island Road Planning Study* is located within Caboolture Shire and is bounded by Browns Road to the west, Ningi Creek to the north, Pumicestone Passage/Bribie Island to the west, and Moreton Bay to the south. Priority for the field inspection was given to areas of nature conservation significance that correspond with potential bypass opportunities. The study area is illustrated in Figure 1.

The study area comprises coastal lowlands, with the local geomorphology and soil fertility varying from well drained, sandy soils on the dune ridges to poorly drained clay, mud and peat soils in the seasonally and permanently inundated dune depressions. This supports extensive areas of remnant vegetation including *Melaleuca* woodland, wet and dry heathlands, sedgeland and mixed eucalypt communities.

**Figure 1
OVERVIEW**



- Bypass options**
-  Bypass Options A, B, D
 -  Bypass Option A
 -  Bypass Options A, D
 -  Bypass Option B
 -  Bypass Options B, C, D
 -  Bypass Option C
 -  Bypass Options C, D

Data sources:
 Roads, rivers- Copyright 2006, MapData Sciences PTY LTD, PSMA
 Cadastral boundaries- NRW, June, 2006
 Aerial photography - Caboolture Shire Council, November 2006

NRW Disclaimer
 Based on or contains data provided by the State of Queensland Department of Natural Resources Mines and Water) [2004, 2006]. In consideration of the State 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 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. Data must not be used for direct marketing or be used in breach of the privacy laws.

Map location: J:\mmp\10304406\Engineering\GIS\GISdata\Workspaces\final_report\1_overview.mxd



Date created: 23 February 2007



1.5 Limitations

This assessment has been conducted utilising desktop resources. The validity of the desktop results has not been verified through detailed field survey. A one-day inspection of study area was undertaken by Maunsell ecologists during the course of investigations; however, no formal survey work was undertaken due to limitations on property access.

1.6 Previous Reports

Two previous reports examine the options and feasibility of a bypass of Ningi township namely:

- *The Bribie Island Road Planning Study (Cardno MBK, 2002)*; and
- *The Bribie Island Road Planning Study Review of Environmental Factors (Planning) (Cardno MBK, 2002)*.

The Bribie Island Road Planning Study was initially commissioned by MR to develop an “upgrading strategy for the road and evaluate alternative routes to maximise traffic efficiency and residential amenity in Ningi”. *The Bribie Island Road Planning Study Review of Environmental Factors (Planning)* concentrated on the environmental characteristics that may be impacted by the options that were in development for *The Bribie Island Road Planning Study*.

Following an internal review of the studies recommendations, the then Minister for Transport and Main Roads announced that by-passing Ningi was considered an unviable option. It was decided that the preferred option was to progressively upgrade the existing Bribie Island Road alignment.

1.7 Legislative and Regulatory Context

Key legislation covering terrestrial and aquatic ecology are described below. Further information on approvals considered likely to be required as part of the delivery of the proposed road upgrade is outlined in the main report.

1.7.1 Commonwealth Legislation

The *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* prescribes the Commonwealth’s role in environmental assessment, biodiversity conservation and the management of protected areas. Under the provisions of the *EPBC Act*, actions that are likely to have significant impacts on a matter of national environmental significance are referred to as ‘controlled actions’ and cannot be undertaken without approval under the Act.

The Act currently identifies seven matters of national environmental significance:

- World Heritage properties;
- National heritage places;
- Wetlands of international importance (declared RAMSAR wetlands);
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mining).

1.7.2 Queensland Legislation

Vegetation Management Act 1999

The *Vegetation Management Act 1999 (VM Act)* regulates the clearing of mapped remnant vegetation on freehold and leasehold land in Queensland to prevent biodiversity loss, maintain ecological processes and to prohibit land degradation.

Nature Conservation Act 1992

The *Nature Conservation Act 1992 (NC Act)* provides for the conservation and management of Queensland's native plants and animals. The Act prohibits the taking or destruction without authorisation of certain listed flora and fauna species.

The *Nature Conservation (Wildlife) Regulation 2006* lists plants and animals considered *presumed extinct, endangered, vulnerable, rare and common*. It states the declared management intent for each class and the principles to be observed in any taking and use for each group.

The Act also provides for the protection of critical habitat considered essential for the conservation of a viable population of protected wildlife or community of native wildlife. This is irrespective of any special management considerations and protection required.

The conservation status of a threatened species or its habitat is described in this report in accordance with the provision of the *NC Act*. A permit may be required under the provisions of the *NC Act* for the removal of scheduled flora or fauna species

Land Protection (Pest and Stock Route Management) Act 2002

The *Land Protection (Pest and Stock Route Management) Act 2002* and the *Land Protection (Pest and Stock Route Management) Regulation 2003* provides for pest management in Queensland and includes both weeds and fire ants and graded in severity from Class 1-3 (refer Figure 2).

Figure 2 Declared Plant Status in Queensland (Natural Resources and Water)

| |
|---|
| <p>Class 1 pests are not commonly present in Queensland and, if introduced, would cause an adverse economic, environmental or social impact. Any Class 1 pest established in Queensland is subject to eradication from the state. Landowners must take reasonable steps to keep land free of Class 1 pests.</p> |
| <p>Class 2 pests are established in Queensland and have, or could have, an adverse economic, environmental or social impact. The management of these pests requires coordination and they are subject to programs led by local government, community or landowners. Landowners must take reasonable steps to keep land free of Class 2 pests.</p> |
| <p>Class 3 pests are established in Queensland and have, or could have, an adverse economic, environmental or social impact. The primary objective of Class 3 listing is to prevent sale, therefore preventing the spread of these pests into new areas.</p> |

Under the provisions of the *Land Protection Act 2002*, MR will have an obligation to control infestations of declared weed species adjacent to environmentally significant areas.

Fisheries Act 1994

The *Fisheries Act 1994* provides for the protection of all marine vegetation including mangrove communities. A permit would be required under the provisions of the *Fisheries Act 1994* for the removal of any marine plants.

Nature Conservation (Koala) Plan 2006

The EPA has developed a Koala Plan that may affect the types of development that can occur in koala habitat areas. The Koala Plan consists of the *Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016* and has been prepared under the *Nature Conservation Act 1992*.

The Koala Plan includes criteria for development assessment. These are referred to as the koala conservation criteria and are 'called up' by the *South East Queensland Regional Plan 2005 -2026*. The koala conservation criteria apply only in SE Queensland Koala Habitat Areas. Koala Habitat Areas consist of:

- Koala Conservation Areas;
- Koala Sustainability Areas; and
- Urban Koala Area.

The study area does not contain lands identified in the Nature Conservation (Koala) Plan (2006).

1.7.3 Local Requirements

Caboolture Shire Plan

The Caboolture Shire Planning Scheme (the Shire Plan) reflects the Shire's desired environmental outcomes including the protection of natural assets, such as Pumicestone Passage, waterways, wetlands, forests and the biodiversity they support from inappropriate development that could harm their ecological function or aesthetic appeal.

The Planning Scheme has a series of overlays, specifically a Koala Conservation Overlay and Nature Conservation Overlay (Volume 2, of the Caboolture Shire Plan).

In order for development to comply with the Nature Conservation and Koala Conservation Overlay Codes; it must support the following overall outcomes:

- a) The integrity, condition and function of Nature Conservation Areas are protected from the significant adverse impacts of development;
- b) Development is appropriately sited to retain Significant Vegetation and Wetlands;
- c) Ecological corridors are strengthened and improved to link Nature Conservation Area;
- d) Work results in minimal disturbance to the Nature Conservation Areas;
- e) Infrastructure is located so that Significant Vegetation and Wetlands remain undisturbed;
- f) Development in Koala Conservation Areas is sited and designed to minimise the adverse impacts on koalas and their habitats within that area; and
- g) The historic values of indigenous cultural heritage sites are maintained.

A development approval to clear vegetation is required if the land is covered by the Nature Conservation Overlay, Catchment Protection Overlay or the Koala Conservation Overlay. Overlays identify areas or places that constrain the use of land due to their environmental value or their adverse effects on development.

2.0 Methodology

2.1 Background Data Collection and Review

This assessment was largely based on desktop analysis using a combination of database searches, previous reports and aerial photography interpretation of the study area.

During the review, the following databases and mapping resources were consulted.

- Department of Environment and Heritage Protected Matters Search Tool;
- Queensland Environmental Protection Agency Regional Ecosystem Digital Database (REDD);
- Queensland Environmental Protection Agency Wildlife Online;
- Queensland Herbarium HERBRECS;
- Caboolture Shire Atlas of Natural Assets;
- Caboolture Shire Atlas of Natural Assets Riparian and Reserve Management Study;
- Caboolture Environmental Planning Study;
- The Habitat 2000 Wildlife Corridors Report; and
- The Caboolture Shire Planning Policy (Caboolture Shire Plan).

Aerial photographs were analysed to:

- Develop an appreciation of the distribution of vegetation and habitat in the study area;
- Identify and map dominant vegetation communities for incorporation into an appropriate GIS layer; and
- Gain a preliminary assessment of habitat and complexity.

2.2 Field Inspection

Site Inspection

An inspection was carried out on 23 November 2006. The aim of the inspection was to:

- Identify broad terrestrial and aquatic fauna assemblages (including pests);
- Identify dominant terrestrial flora species (including noxious and environmental weeds);
- Identify areas that may be of significant habitat value for native fauna;
- Determine priority and secondary fauna survey sites for targeted survey techniques; and
- Identify and locate broad threatened fauna species habitat.

Bird Survey

An opportunistic bird survey was conducted for a one day period throughout the study area as inspections were undertaken. Birds were identified from either direct observation or their calls.

Scat and pellet searches

Opportunistic searches for tracks and scats were conducted whilst undertaking inspection of the study area.

Aquatic survey

Aquatic fauna was observed (adjacent to Redondo Street approximately 500m north of Bestmann Road. Aquatic vertebrates, fish and micro-crustaceans were visually assessed and confirmed using a long-handled dip net. Samples were identified on site and native species were returned alive to the water body.

Amphibians were surveyed using general search methods and call recognition/comparison with known calls.

Opportunistic records

Records were kept of all fauna observations and call detections.

3.0 Existing Environment

3.1 Flora

Five vegetation communities have been identified within the study area. These communities are briefly described below and their distribution is shown in Figure 3. The proposed Bribie Island Road upgrade would potentially affect these communities.

Scribbly Gum Open Forest (12.5.3) - Endangered

Location: This community is mainly situated between Bestmann Road and Bribie Island Road, in the east of the study area, where two large fragments are present.

Floristics: This community is dominated by Scribbly Gum (*E. racemosa*), with occasional Pink Bloodwood (*Corymbia intermedia*) and Grey Ironbark (*E. siderophloia*) occurring.

Other co-existent species may include Red Mahogany (*E. resinifera*), Blackbutt (*E. pilularis*), Tallowwood (*E. microcorys*) and Rusty Gum (*Angophora leiocarpa*). Broad-leaved Paperbark (*Melaleuca quinquenervia*) is often a prominent feature of lower slopes, whilst Spotted Gum (*C. citriodora*) may occur in small patches.

Structure: This community is consistent with an open forest vegetation structure, based on a complex of remnant Tertiary surfaces.

Habitat Significance: This open forest community is of state conservational status within the study area and is listed as endangered under the *Vegetation Management Act 1999* (VM Act). Scribbly Gum Open Forest is likely to provide foraging resources for a range of endangered and significant fauna species. The age, size and density of trees will be a major determinant of habitat significance, as these factors affect the biodiversity within such a community.

Palustrine Wetland (12.3.6) – Not of Concern

Location: Two small areas of this community exist within the study area. One of these areas exists around the Ningi Recycling and Landfill Centre, off Bribie Island Road. The second area is found to the north Sandstone Point, beside Bestmann Road East.

Floristics: This woodland is dominated by Broad-leaved Paperbark (*M. quinquenervia*) and occasional Forest Red Gum (*E. tereticornis*) and Swamp Box (*L. suaveolens*).

Structure: This community is typical of coastal woodland found on Quaternary alluvial plains and drainage lines.

Habitat Significance: This community forms valuable habitat for terrestrial and aquatic fauna. Palustrine woodland is recognised by Caboolture Shire Council as being of regional conservational significance. This community is also likely to support small foraging mammals as well as migratory and nesting birds.

Paperbark Forest (12.3.5) – Not of Concern

Location: This vegetative community can be found throughout the study area. The largest area of Paperbark forest is situated on the land bordered by Bestmann Road to the east, Bribie Island to the north, Bentley Road to the south and Fauna Way to the west. Other significant fragments of this community exist to the north of Sandstone Point, to the west of Ningi and inland from Goodwin Beach.

Floristics: *Melaleuca quinquenervia* dominates this forest. The composition of the understorey depends on the duration of water logging with sedges and ferns, especially Swamp Water Fern (*Blechnum indicum*), in wetter microhabitats. Grasses and shrubs can be found in drier environments.

Other tree species may include Swamp Box (*Lophostemon suaveolens*), Swamp Mahogany (*E. robusta*), Blue Gum (*E. tereticornis*), Orange Gum (*E. bancroftii*), *C. intermedia* and White Bottlebrush (*Callistemon salignus*).

Structure: The structure is consistent with a forest community found on Quaternary alluvial plains in coastal areas.

Paperbark Forest (12.3.5) – Not of Concern (Cont'd)

Habitat Significance: This forest community is identified by Caboolture Shire Council as being of state conservational value. Further to this, paperbark forest is likely to provide foraging resources for a range of endangered and significant fauna species. The age, size and density of trees will be a major determinant of habitat significance, as these factors affect the biodiversity within such a community. The duration of water logging in the understorey will be a contributing factor to the fauna composition of this community.

Paperbark Open Forest (12.2.7) – Not of Concern

Location: This vegetative community can be found to the south of Ningi, with Regina Avenue to the west and Lakeside Crescent to the east.

Floristics: This community is dominated by Broad-leaved Paperbark (*M. quinquenervia*), although other species may include Orange Gum (*E. bancroftii*), Swamp Mahogany (*E. robusta*), Forest Red Gum (*E. tereticornis*), Pink Bloodwood (*C. intermedia*) and Swamp Box (*L. suaveolens*). A shrub layer may occur with frequent species including Black-mouth Bush (*Melastoma affine*) and Broad-leaved Banksia (*Banksia robur*).







Structure: The community structure is consistent with open forest occurring on Quaternary coastal dunes and seasonally waterlogged sand plains.

Habitat Significance: This community is identified by Caboolture Shire Council as containing a combination of state and regional conservational significance. Paperbark open forest is likely to provide foraging resources for a range of endangered and significant fauna species. The age, size and density of trees will be a major determinant of habitat significance, as these factors affect the biodiversity within such a community.

**FIGURE 3
REGIONAL ECOSYSTEMS
VERSION 5
ESSENTIAL HABITAT**



Bypass options

-  Bypass option A, B, D
-  Bypass option A
-  Bypass option A, D
-  Bypass option B
-  Bypass option B, C, D
-  Bypass option C
-  Bypass option C, D

Data sources:

Roads, rivers- Copyright 2006, MapData Sciences
 PTY LTD, PSMA
 Cadastral boundaries - NRMW, June, 2006
 Aerial photo - Caboolture Shire Council
 DCDB - NRW, June 2006
 Regional Ecosystem Version 5, Essential habitat - EPA, 2005

NRW Disclaimer

Based on or contains data provided by the State of Queensland Department of Natural Resources Mines and Water) [2004, 2006]. In consideration of the State 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 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. Data must not be used for direct marketing or be used in breach of the privacy laws.

EPA disclaimer

Whilst every care is taken to ensure the accuracy of this data, the EPA makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might incur as a result of the data being inaccurate or incomplete in any way and for any reason.

Map location: J:\mmp\10304406\Engineering\GIS\GISdata\Workspaces\final_report\3_RE_richard.mxd

1:30,000

(when printed at A3)

0 375 750 1,500



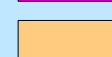

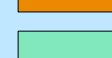
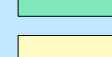

Meters

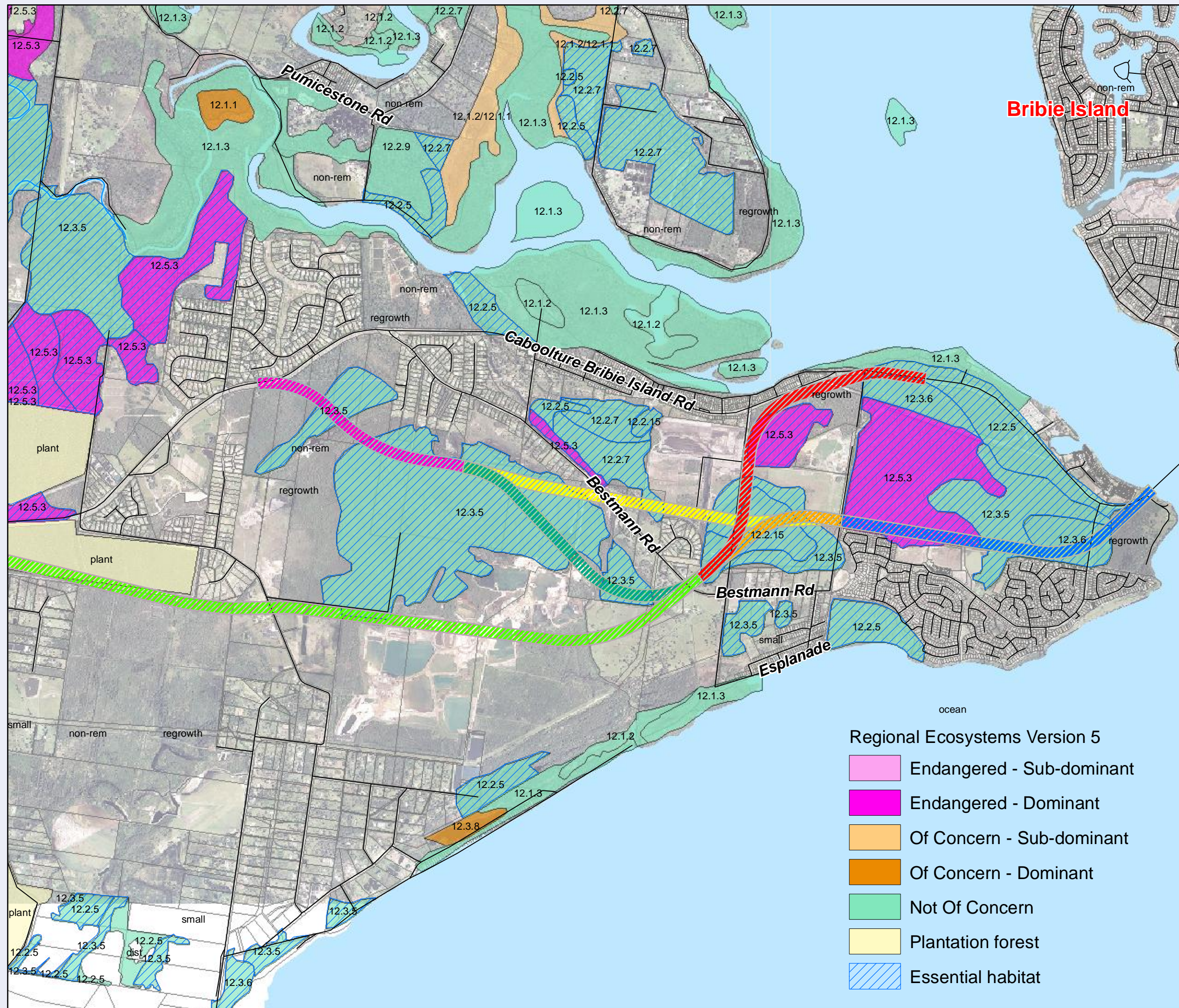
Date created: 7 March 2007



MGA94 Zone 55

Regional Ecosystems Version 5

-  Endangered - Sub-dominant
-  Endangered - Dominant
-  Of Concern - Sub-dominant
-  Of Concern - Dominant
-  Not Of Concern
-  Plantation forest
-  Essential habitat



Coastal Sedgeland (12.2.15) – Not of Concern

Location: Only one area of coastal sedgeland exists within the study area. This community can be found to the north of the Redondo St. – Bestmann Rd. junction.

Floristics: Coastal sedgeland consists largely of *Baumea* spp., Twigrush (*Lepironia articulata*), *Gahnia* spp. and *Eleocharis* spp. along associated water bodies.

Structure: These communities are typical of sedgelands occurring on Quaternary coastal dunes and beaches, as well as low coastal landscape where water collects from both overland flow and infiltration from adjoining sand dunes.

Habitat Significance: This community is listed as being of state conservational significance by Caboolture Shire Council. Further to this, Cardno MBK (2002) The maintenance of coastal sedgeland is crucial in providing habitat for species of conservational significance. Organisms particularly vulnerable to changes in drainage and water flow regimes in sedgeland communities include amphibians, fish, small mammals and migratory and nesting birds.

Vegetation within the study area has predominantly been cleared for agriculture, mining and residential development. As illustrated in Figure 3, a large patch of vegetation occurs in the eastern section of the study area and is dominated by endangered RE 12.5.3 and wetland RE 12.3.5 and 12.3.6. Further to this, Figure 3 illustrates a large area of *Melaleuca quinquenervia* open forest (12.3.5) and swampland dominated by *Baumea articulata* and *Lepironia articulata* (RE 12.2.15) as occurring in the central to western sections of the study area. The site is an important habitat to frog and bird species, and despite urban development adjacent to the wetland impacting on the condition of the site, road construction should avoid this area of permanent water where possible.

Any clearing of Endangered and/or Of Concern REs will require an approval for clearing for ongoing purposes from the Department of Natural Resources and Water (DNRW). This application must be prepared in accordance with the relevant code (Regional Vegetation Management Code for Ongoing Clearing Purposes: South East Queensland), and with a legally binding offset strategy.

3.1.1 Nature Conservation Areas

Nature Conservation Areas of State, Regional and Local significance are present within the study area (Figure 4).

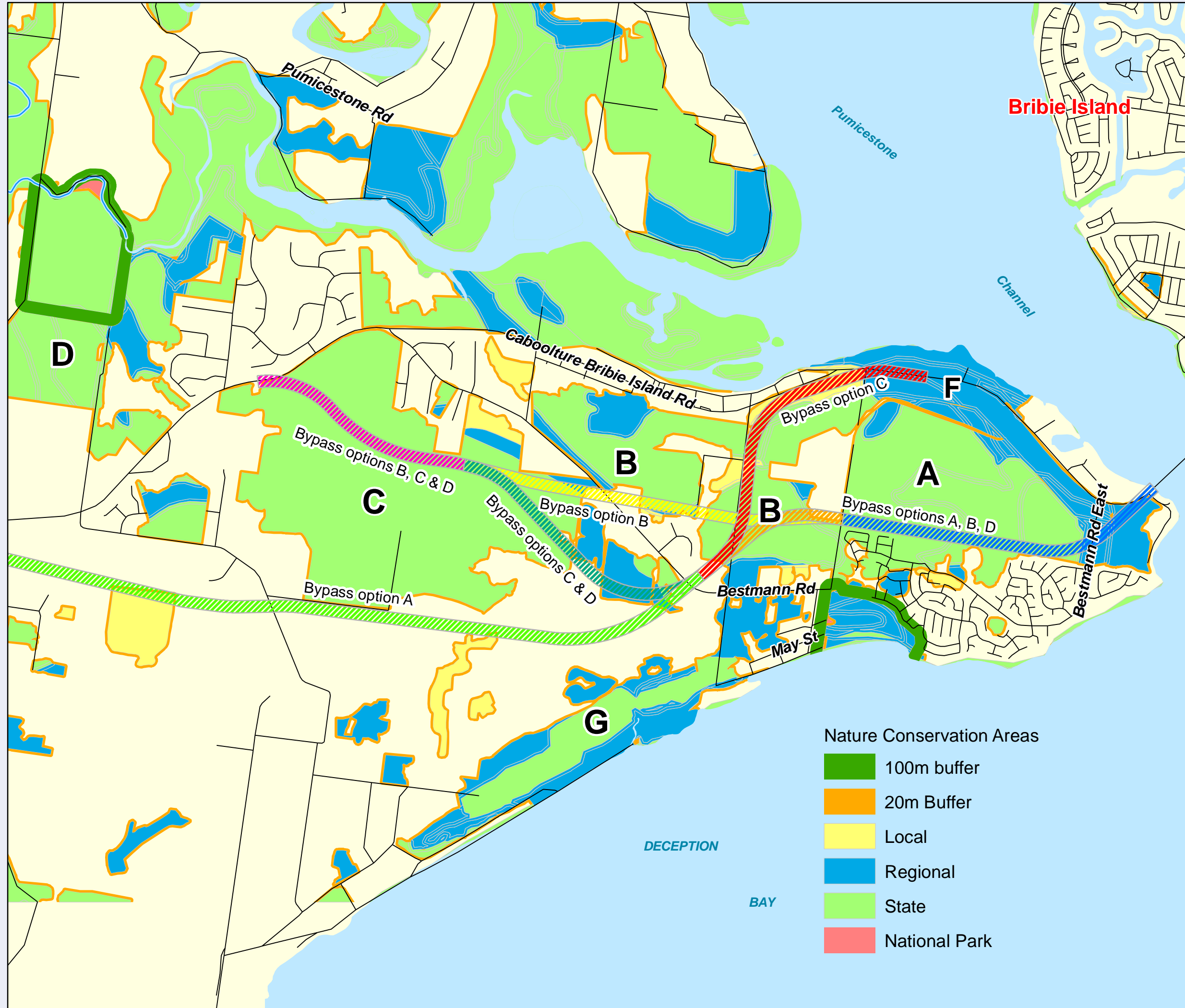
Nature Conservation Areas of State Significance

Major Conservation Areas of state significance include:

- The land between Bribie Island Road and Sandstone Point at Toorbul Point (Label A, Figure 4);
- The land and bodies of water between Bestmann Road and Bribie Island Road (Label B, Figure 4);
- The land bordered by Bestman Road to the east, Bribie Island Road to the north, Bentley Road to the south and Fauna Way to the west (Label C, Figure 4);
- The land bordered by Ningi Creek to the north, Wrenaus Way to the east, the northern boundary of the State Forest to the south and Volz Road to the west (Label D, Figure 4); and
- Tea Tree Swamp Lagoon, King John Creek and the land immediately surrounding them (Label E, Figure 4).

Several other fragments exist throughout the study area and are also illustrated in Figure 4.

**FIGURE 4
NATURE CONSERVATION
AREAS**



- Bypass options**
- Bypass option A, B, D
 - Bypass option A
 - Bypass option A, D
 - Bypass option B
 - Bypass option B, C, D
 - Bypass option C
 - Bypass option C, D

- Nature Conservation Areas**
- 100m buffer
 - 20m Buffer
 - Local
 - Regional
 - State
 - National Park

Data sources:
 Roads, rivers- Copyright 2006, MapData Sciences
 PTY LTD, PSMA
 Nature conservation areas - Caboolture Shire Council, November 2006

Map location: J:\mmp\10304406\Engineering\GIS\GISdata\Workspaces/
 final_report\10_nature_conservation_richard.mxd



Date created: 14 February 2007



Nature Conservation Areas of Regional Significance

Major Conservation Areas of regional significance include:

- Coastal regions at Toorbul Point (Label F, Figure 4)
- Coastal regions at Goodwin Beach (Label G, Figure 4)

Several other fragments exist throughout the study area (Figure 4).

Nature Conservation Areas of Local Significance

Fragments are present within the study area (Figure 4).

3.1.2 Flora of Conservation Significance

A search of the EPBC protected matters and EPA wildlife online databases identified eight listed threatened flora species that may be located in the areas impacted by the proposed bypass options (refer to Table 1). Queensland Herbarium records (HERBRECS) and field observations by Cardno MBK (2002) were also consulted.

Acacia baueri has been previously observed adjacent to the intersection of Bribie Island Road and Bestmanns Road and this is the only threatened plant species considered to have a likely presence within the study area. This decision is based on an assessment of the availability of suitable habitat and the presence or absence of associated vegetation communities. Species were ranked as having high, moderate or low likelihoods of occurrence. The definitions for each of these categories are:

- **High:** Species has been previously recorded within the study area.
- **Moderate:** Species has not been previously observed within the study area but their habitat is known to occur within the study area.
- **Low:** Species has not been previously observed within the study area and their habitat is not known to occur within the study area.

No threatened plant species were observed by Maunsell during the field inspection.

Table 1 Plant species of conservation significance with potential to occur in the study area.

| Scientific Name | Common Name | Conservation status | | Likelihood of Occurrence |
|------------------------------|-----------------------|---------------------|-------------------|--------------------------|
| | | QLD ¹ | C'th ² | |
| <i>Acacia attenuata</i> | - | - | V | Moderate |
| <i>Acacia baueri</i> | - | V | - | High |
| <i>Bosistoa selwynii</i> | Heart-leaved Bosistoa | - | V | Low |
| <i>Bosistoa transversa</i> | Three-leaved Bosistoa | - | V | Low |
| <i>Lilaeopsis brisbanica</i> | - | - | E | Low |
| <i>Macadamia ternifolia</i> | Bopple nut | V | V | Low |
| <i>Phaius australis</i> | Lesser Swamp-orchid | E | E | Moderate |
| <i>Phaius bernaysii</i> | - | - | E | Moderate |
| <i>Tecomanthe hillii</i> | Fraser Island creeper | R | - | Low |

¹ E - Endangered, V - Vulnerable, R - Rare, C - Common as listed under the Nature Conservation (Wildlife) Regulation 1994

² E - Endangered, V - Vulnerable as listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

Acacia attenuata

A. attenuata is endemic to south east Queensland. It occurs on sandplains not more than 30 km from the coast with a range along the coast of approximately 400 km from just north of Bundaberg to Burleigh on the Gold Coast. It occurs on flats, low rises and at the edge of wallum swamps. The soils are sandy and mostly poorly drained. *A. attenuata* has been recorded growing in shrublands with *Leptospermum whitei* and *Baeckea frutescens*, wallum with *Banksia aemula* and *Eucalyptus robusta*, woodlands with *Corymbia trachyphloia*, *Eucalyptus umbra* and *Banksia oblongifolia*, and open forests of *Eucalyptus umbra*, *E. racemosa* and *Melaleuca quinquenervia*. *A. attenuata* has also been recorded on roadsides and in areas previously cleared of natural vegetation. This species has a moderate likelihood of occurrence in the study area.

Acacia baueri

In Queensland *A. baueri* subsp. *baueri* is restricted to the coastal plain not more than 20 km from the coast with a range along the coast of approximately 320 km from just south of Bundaberg to Burleigh Heads on the Gold Coast. *A. baueri* subsp. *baueri* is restricted to the coastal lowlands mostly on infertile, often seasonally waterlogged sandy soils in heathlands, shrublands and low open woodlands. Other species most commonly recorded at the collection sites included: *Banksia aemula*, *Banksia serrata*, *Banksia oblongifolia*, *Eucalyptus racemosa* and *Eucalyptus umbra*.

This species has been recorded adjacent to the intersection of Bestmanns Road and the Bribie Island Road.

Lilaeopsis brisbanica

This species inhabits saline mud which is submerged at high tide. This species is known along the Caboolture River, Brisbane River and Moggill Creek which is a tributary of the Brisbane River.

This species is unlikely to be impacted by any of the proposed alignments.

Bosistoa selwynii* and *B. transversa

Bosistoa selwynii has been absorbed into *B. transversa* is listed as vulnerable under the EPBC Act. It is a small tree that is found in nutrient rich soils in moist locations and is fairly common in softwood scrubs.

It is unlikely that *Bosistoa selwynii* and *B. transversa* occur in the study area.

Macadamia ternifolia

Macadamia ternifolia is largely a sub-tropical rainforest species. The preferred habitat for this species has not been recorded in the local area.

It is unlikely that *Macadamia ternifolia* occurs in the study area.

Phaius australis

This species is confined to growing between the Atherton Tablelands, North Queensland, to the North Coast of NSW. Within this defined area, *P. australis* prefers wet and sandy coastal soils with good drainage.

This species has moderate potential of occurring in the wetland habitats present in the study area.

Phaius bernaysii

Similar to *P. australis*, this species is confined to swampy environments on islands along the Brisbane River, such as Bribie and Stradbroke Islands. This species has also been recorded on the rich sandy loams near Noosa Heads.

This species has moderate potential of occurring in the wetland habitats present in the study area.

Tecomanthe hillii

Species inhabits coastal rainforest communities. This species is known from Fraser Island and adjacent mainland areas of the Wide Bay district. It is unlikely that *Tecomanthe hillii* occurs in the study area as no rainforest vegetation is present.

This species is unlikely to be impacted by any of the proposed alignments.

3.1.3 Introduced Species

During the field inspection, six species of declared weed were observed that are listed under the Queensland *Land Protection (Pest and Stock Route Management) Act 2002*.

A further 20 environmental weeds were observed to be widespread within the road corridor. These are introduced plants which have become naturalised and have invaded natural ecosystems.

A list of declared and environmental weeds in the study area is presented in Table 2.

Table 2 Invasive plant species recorded in the vicinity of the site

| Scientific Name | Common Name | Status¹ |
|--------------------------------|---------------------|---------------------------|
| <i>Ageratum houstonianum</i> | blue billygoat weed | E |
| <i>Asparagus sprengeri</i> | asparagus fern | C3 |
| <i>Baccharis halimifolia</i> | groundsel bush | C2 |
| <i>Brachiaria mutica</i> | para grass | E |
| <i>Bryophyllum sp.</i> | mother of millions | E |
| <i>Senna septemtrionalis</i> | smooth senna | E |
| <i>Chloris gayana</i> | rhodes grass | E |
| <i>Cinnamomum baileyianum</i> | camphor laurel | C3 |
| <i>Cortaderia selloana</i> | pampas grass | E |
| <i>Euphorbia cyathophora</i> | painted spurge | E |
| <i>Ipomoea cairica</i> | morning glory | E |
| <i>Lantana camara</i> | common lantana | C3 & NES |
| <i>Leucaena sp.</i> | leucaena | E |
| <i>Oenothera drummondii</i> | beach primrose | E |
| <i>Opuntia sp.</i> | common prickly pear | C2 |
| <i>Passiflora suberosa</i> | corky passion vine | E |
| <i>Pinus elliottii</i> | slash pine | E |
| <i>Ricinis communis</i> | castor oil plant | E |
| <i>Schefflera actinophylla</i> | umbrella tree | E |
| <i>Schinus terebinthifolia</i> | broadleaved pepper | C3 |
| <i>Senna pendula</i> | Easter cassia | E |
| <i>Solanum mauritianum</i> | wild tobacco | E |
| <i>Solanum torvum</i> | devil's fig | E |
| <i>Tagetes minuta</i> | stinking roger | E |
| <i>Verbena bonariensis</i> | purple top | E |
| <i>Wedelia trilobata</i> | singapore daisy | E |

¹ E – Environmental weed, C2/3 – Declared weed class, NES –national environmental significance

These weed species were identified throughout the study area. Once a final alignment has been determined, it will be essential for a detailed floristic survey to be undertaken to determine the necessary treatments for control of these species.

3.2 Terrestrial and Aquatic Fauna

Previous studies of the area are limited and few records exist for threatened fauna species observed in Caboolture Shire. The absence of particular species from the available data, however, does not imply that the species does not occur within the specified area but rather that due to limited field surveys. Fauna trapping techniques would determine fauna assemblages that use the available habitat in addition to targeting fauna of conservation significance.

3.2.1 Database Searches

A total of 395 vertebrate species have been recorded within the study area. This includes 23 amphibians, 307 birds and 40 mammal species.

3.2.2 Species of Conservation Significance

A search of the EPBC protected matters and EPA wildlife online databases identified a total of 40 threatened fauna species previously recorded in the wider study area. Eight of these species are listed as 'endangered' and 14 species are listed as 'vulnerable' under the Commonwealth *EPBC Act 1999*.

Eleven marine species were also identified as occurring within or adjacent to the study area. These species were excluded from further analysis as they are highly unlikely to be impacted by the proposed road options.

To determine if these species are likely to occur in the study area, habitat requirements for each of the species were assessed against habitat identified within the study area (Appendix A). 17 significant species were identified with moderate to high likelihood of occurring. These species are listed in Table 3.

Table 3 Threatened species occurring or likely to occur in the study area.

| Scientific Name | Common Name | Conservation Status | |
|-----------------------------------|--|---------------------|-------------------|
| | | QLD ¹ | C'th ² |
| <i>Adelotus brevis</i> | tusked frog | V | - |
| <i>Crinia tinnula</i> | wallum froglet | V | - |
| <i>Litoria freycineti</i> | wallum rocketfrog | V | - |
| <i>Litoria olongburensis</i> | wallum sedgefrog | V | V |
| <i>Accipiter novaehollandiae</i> | grey goshawk | R | - |
| <i>Calyptorhynchus lathamii</i> | glossy black-cockatoo | V | - |
| <i>Ephippiorhynchus asiaticus</i> | black-necked stork | R | - |
| <i>Lophoictinia isura</i> | square tailed kite | R | - |
| <i>Numenius madagascariensis</i> | eastern curlew | - | R |
| <i>Rallus pectoralis</i> | Lewin's rail | R | - |
| <i>Rostratula australis</i> | Australian painted snipe | V | - |
| <i>Rostratula benghalensis</i> | painted snipe | V | V |
| <i>Xanthomyza phrygia</i> | regent honeyeater | E | E |
| <i>Phascolarctos cinereus</i> | koala (southeast Queensland bioregion) | - | V |
| <i>Pteropus poliocephalus</i> | grey-headed flying-fox | V | V |

| | | | |
|-------------------------------------|-----------------------|---|---|
| <i>Xeromys myoides</i> | false water-rat | V | V |
| <i>Argyreus hyperius inconstans</i> | Australian fritillary | - | E |

¹ E - Endangered, V - Vulnerable, R – Rare, C- Common as listed under the Nature Conservation (Wildlife) Regulation 1994

² E- Endangered, V - Vulnerable as listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

3.2.3 Migratory Species

19 migratory species of State and Commonwealth significance have been identified as potentially occurring within the study area (Table 4). It should be noted however, that two of these are migratory marine species and are therefore not likely to be impacted by the bypass proposal.

Table 4 Migratory species (excluding marine occurring or likely to occur in the study area.

| Scientific Name | Common Name | Conservation Status | |
|---|-------------------------------|---------------------|-----|
| | | QLD | Cth |
| <i>Arenaria interpres</i> | ruddy turnstone | C | M |
| <i>Calidris ferruginea</i> | curlew sandpiper | C | M |
| <i>Charadrius mongolus</i> | lesser sand plover | C | M |
| <i>Cyclopsitta diophthalma coxeni</i> | Coxen's fig-parrot | E | M |
| <i>Gallinago hardwickii</i> | Latham's snipe | C | M |
| <i>Haliaeetus leucogaster</i> | white-bellied sea-eagle | C | M |
| <i>Heteroselus brevipes</i> | grey-tailed tattler | C | M |
| <i>Hirundapus caudacutus</i> | white-throated needletail | C | M |
| <i>Limosa lapponica</i> | bar-tailed godwit | C | M |
| <i>Monarcha melanopsis</i> | black-faced monarch | C | M |
| <i>Monarcha trivirgatus</i> | spectacled monarch | C | M |
| <i>Myiagra cyanoleuca</i> | satin flycatcher | C | M |
| <i>Nettapus coromandelianus albidpennis</i> | Australian cotton pygmy-goose | C | M |
| <i>Numenius madagascariensis</i> | eastern curlew | R | M |
| <i>Numenius phaeopus</i> | whimbrel | C | M |
| <i>Pluvialis fulva</i> | Pacific golden plover | C | M |
| <i>Puffinus leucomelas</i> | streaked shearwater | C | M |
| <i>Rhipidura rufifrons</i> | rufous fantail | C | M |
| <i>Zenus cinereus</i> | terek sandpiper | C | M |

¹ E - Endangered, V - Vulnerable, R – Rare, C- Common as listed under the Nature Conservation (Wildlife) Regulation 1994

² E- Endangered, V – Vulnerable, M- Migratory as listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

The species listed in Table 3 and 4 have potential to occur throughout the study area and as a consequence, further field survey should be undertaken.

3.2.4 Aquatic Fauna

Database searches revealed that two species of fresh water bony fish of Commonwealth conservation significance, the Australian Lungfish and the Oxleyan Pygmy Perch, may occur in the study area. There is however, no suitable habitat for these species.

3.2.5 Habitat Assessment

The majority of fauna species select habitat based primarily on structural characteristics of vegetation communities rather than the composition of plant species (Barnett *et al.* 1978). One notable exception is the koala, which selects habitat based on the presence of particular tree species, which are suitable

for feeding. The method used for assessing koala habitat involved identification of tree species on site and scat searches to determine koala presence. Structural characteristics of vegetation communities include the height of the dominant layer, the number of distinctive layers and the density of vegetation.

Many specialised faunal groups may also rely upon the availability of water, the presence of particular tree or shrub species, or specific micro-climatic characteristics in order to survive. The current analysis sought to identify and assess the type and quality of habitats occurring in the study area.

Assessment of habitat types and quality is typically derived from a qualitative assessment of:

- dominant vegetation type;
- structural vegetation characteristics;
- presence/abundance of hollow-bearing trees;
- density of groundcover resources (eg. rocks, logs, vegetation and leaf litter);
- presence of foraging resources;
- presence/absence of permanent or ephemeral freshwater resources; and
- level of disturbance.

In this instance however, property access was not available and therefore the habitat assessment has been undertaken at the broadest level of Regional Ecosystem and roadside inspection. Once an alignment has been determined, it will then be possible to more accurately determine the habitat availability present along a proposed alignment.

Therefore, the current survey identified eight broad habitat types in the study area. The study area contains:

- Mangrove Forest
- Melaleuca Swamp Forest
- Open Forest
- Saltmarsh/Claypan
- Heathland
- Closed Forest
- Ecotonal Forest
- Pine Plantation

Many specialised faunal groups rely on the availability of resources, the presence of particular vegetation or specific micro-climatic conditions for survival. The eight RE's within the study area, with different dominant vegetation types and characteristics, will provide suitable habitat for a variety of different fauna species (as described in Section 3.1).

3.2.6 Essential Habitat

Essential Habitat is an area or location with essential resources for the maintenance of priority populations. Priority populations include flora and fauna that are:

- Currently listed as endangered/vulnerable/rare/culturally significant under State or Commonwealth legislation;
- Identified in various Action Plans as being of concern (Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Near Threatened and Conservation Dependent);
- Most transcontinental migrants listed under international agreements (e.g. CAMBA and JAMBA);
- At risk or of management concern within specific bioregions based on the written opinion of experts; or
- Of scientific interest as relictual, endemic or locally significant populations (e.g. flying fox camp) based on the written opinion of experts.

All vegetation in the study area has been mapped as remnant Essential Habitat comprising wetland ecosystems that are known to provide habitat for wallum sedge frog (*Litoria olongburensis*), wallum rocketfrog (*Litoria freycineti*) and wallum froglet (*Crinia tinnula*).

In addition to these amphibian species, essential habitat for koala (*Phascolarctos cinereus*) has also been identified within this locality. The study area is not, however, declared a Koala Conservation Area. Inspection of public lands was undertaken for koala or signs of koala during the ground truthing of the vegetation mapping. No evidence of koala activity was found during these preliminary investigations.

4.0 Potential Impacts and Assessment

4.1 Assessment Criteria

The following assessment criteria (Table 5) were used as a framework for assessing the degree of potential impacts (i.e. level of significance) for each option. The degree of potential impact can be assessed as "extreme", "high", "medium" or "low". Recommendations have been included for suitable mitigation measures to lessen or remove the impact. If beneficial impacts were identified, these were also noted.

Table 5 Assessment Criteria

| Degree of Potential Impact | Assessment Criteria |
|----------------------------|--|
| None | Such an impact would have no effects, or no perceptible effects, within the normal bounds of variation or within the margin of forecasting error. |
| Low | Such an impact would be of local concern that can generally be addressed through implementation of good practice measures during design and construction. |
| Medium | Such impacts would be of local significance. Mitigation measures should be considered during planning, design and construction to minimise environmental effects. |
| High | Such impacts would be of state or regional concern. Mitigation measures should be considered during planning, design and construction to minimise environmental effects. |
| Extreme | Such impacts would be of international, national, or state level concern. They could be "show-stoppers" that, if not able to be mitigated, could be of significant concern to the project proceeding. Even if mitigation measures are implemented, there will still be considerable social and / or environmental effects. |

4.2 Potential Impacts

The proposed upgrade of the existing alignment will occur within the existing, highly disturbed road corridor. There will be minor impact to remnant vegetation as a consequence of selecting this alignment.

Development of bypass options would result in the clearing of remnant vegetation to varying degrees. The clearing of native vegetation and habitat involves several processes that affect native flora and fauna assemblages. These include:

- Habitat fragmentation;
- Habitat removal and/or modification;

- Loss of individual species of conservation significance
- Barrier effects; and
- Road strike.

Each of these processes are discussed below in relation to the study area and the options as proposed.

4.2.1 Habitat fragmentation

Habitat fragmentation is the process whereby remaining habitat remnants are reduced in size and/or broken into smaller isolated remnants by land clearing or other intensive forms of land use.

Fragmentation resulting from clearing is likely to significantly reduce the effectiveness of the wildlife movement across the proposed transport corridor. The transport corridor is relatively intact and evidently supports a variety of fauna movement both within the corridor and between vegetation communities adjacent to the site.

4.2.2 Habitat removal or modification

Clearing of native vegetation from the study area would displace native fauna into adjacent areas of similar or better quality habitat, which are most likely already inhabited by other individuals of the same or different species. This displacement of individuals can place additional pressure on local fauna populations due to a sudden shortage of available foraging, roosting and/or nesting resources. A shortage of resources can lead to mortalities of displaced individuals, and may contribute to reduced rates of breeding success resulting in local population declines. Table 7 illustrates the total area of each regional ecosystem to be cleared as a result of each proposed option.

Table 6 Total Areas of Regional Ecosystem to be Cleared for Each Option (hectares)

| Regional Ecosystem | Option A | Option B | Option C | Option D | Existing Alignment |
|--------------------------|----------|----------|----------|----------|--------------------|
| 12.1.3 (Not of Concern) | - | - | 0.04 | - | 0 |
| 12.2.5 (Not of Concern) | - | 0.03 | 2.46 | 0.03 | 0 |
| 12.2.7 (Not of Concern) | - | - | - | - | 0 |
| 12.2.15 (Not of Concern) | 9.19 | 4.80 | 7.19 | 9.19 | 0 |
| 12.3.5 (Not of Concern) | 8.24 | 28.90 | 29.22 | 32.93 | 0 |
| 12.3.6 (Not of Concern) | - | 6.48 | 1.71 | 6.48 | 0 |
| 12.5.3 (Endangered) | 15.07 | 11.39 | 3.71 | 11.39 | 0 |
| Plantation | 10.34 | - | - | - | 0 |
| Regrowth/Non-remnant | 71.34 | 25.01 | 26.54 | 23.84 | 0 |

Options A, C and D will result in the clearing of over 10 hectares of “Endangered” regional ecosystem. Options B, C and D will require the clearing of in excess of 30 hectares of wetland regional ecosystems 12.3.5 and 12.3.6 which are regarded as significant wetlands under the *Vegetation Management Act 1999*. These wetland areas occur in close proximity to a Moreton Bay which is a RAMSAR wetland. Disturbance to a RAMSAR wetland is considered a Matter of National Significance and as a consequence would be considered a controlled action by the federal government.

Wallum sedge frog (*Litoria olongburensis*), wallum rocketfrog (*Litoria freycineti*) and wallum froglet (*Crinia tinnula*) have been recorded within the wetland areas and will subsequently be impacted by the proposed road options. The existing alignment is however expected to result in negligible impacts to the known distribution of these species in the study area as the existing roadway will be limiting the distribution of these species and as a consequence of any future upgrade of the existing roadway, it is expected that minimal additional impacts will result.

Habitat modification is a general term that covers a variety of impacting processes associated with human disturbance of natural ecosystems including:

- Edge effects;
- Alteration of nutrient levels;
- Alteration of water quality; and
- Alteration of hydrological regimes.

Areas of remnant vegetation have undergone minimal if any, historic clearing meaning that these areas have retained the conservation and biodiversity values typically required by many fauna species. Remnant vegetation in the western and eastern section of the study area is likely to provide foraging and roosting opportunities for the majority of species that are likely to occur in the study area.

Clearing associated with all proposed bypass options impacts this vegetation and would result in **high levels of impact**. The changes to vegetation and habitat characteristics could alter the species composition and abundance of fauna species in this area.

Upgrading of the existing alignment is likely to result in minimal to habitat removal or modification.

The proposed bypass options are likely to affect the sensitive ecological communities associated with Toorbul Point and wetland ecosystems throughout the study area. The removal of aquatic plants and disturbance associated with the construction and operation of all bypass alignments are likely to have a **high impact** on water quality and hydrological regimes.

Upgrading the existing alignment is likely to have minimal impacts upon sensitive ecological communities in the study area.

4.2.3 Barrier effects

A roadway may create a barrier to existing fauna movement patterns. This impact can however be potentially mitigated through detailed fauna survey to identify those species likely to be impacted by the barrier. It will then be possible, within the final road design, to incorporate appropriate fauna crossing points for those fauna species identified. No fauna corridors have been identified by DNR & W.

Upgrading the existing alignment will result in a minimal increase in the effect currently occurring from the existing alignment.

4.2.4 Road strike

Construction of bypass options is likely to result in an increase in native fauna road strike. This impact can, however, be mitigated through fencing, the strategic positioning of fauna underpasses or overpasses along an alignment. This aspect will need to be considered once a preferred alignment has been determined.

Road strike impacts associated with an upgrade of the existing Bribie Island Road is not likely to significantly increase as local fauna are generally acclimatised to the existing traffic levels in this location.

Table 7 Summary of Assessment of Impacts

This table assesses the potential impacts associated with the bypass options and upgrade option for the Bribie Island Road.

| Option | Habitat Fragmentation | Habitat Removal/ Modification | Loss of Significant Species | Barrier Effects | Road Strike | Overall Assessment |
|-----------------|--|---|--|---|---|--------------------|
| Option A | High State Significant Wetlands providing known habitat for federal and state listed species will be bisected by this option. | High <ul style="list-style-type: none"> 15.07 ha Endangered RE 12.5.3 will be cleared. 8.24 ha of Significant Wetlands 12.3.5 and 12.3.6 would be cleared. Habitat for Federal and State Significant Fauna Species would be cleared. | High <ul style="list-style-type: none"> Commonwealth listed threatened species are likely to be impacted. State listed threatened species are likely to be impacted. | Moderate Substantial areas of habitat will be bisected by this proposed alignment. | Moderate As habitat will be bisected by this proposed alignment, road strike is expected to be significant. Mitigative measures including directional fencing and fauna underpasses will mitigate this impact. | High |
| Option B | High State Significant Wetlands providing known habitat for federal and state listed species will be bisected by this option. | High <ul style="list-style-type: none"> 11.39ha of Endangered RE 12.5.3 would be cleared. 35.38 ha of Significant Wetlands 12.3.5 and 12.3.6 will be cleared. | High <ul style="list-style-type: none"> Commonwealth listed threatened species are likely to be impacted. State listed threatened species are likely to be impacted. | Moderate Substantial areas of habitat will be bisected by this proposed alignment. | Moderate As habitat will be bisected by this proposed alignment, road strike is expected to be significant. Mitigative measures including directional fencing and fauna underpasses will mitigate this impact. | High |
| Option C | High State Significant Wetlands providing known habitat for federal and state listed species will be bisected by this option. | High <ul style="list-style-type: none"> 3.71ha of Endangered RE 12.5.3 would be cleared. 30.93 ha of Significant Wetlands 12.3.5 and 12.3.6 would be cleared. 0.04ha of mangroves | High <ul style="list-style-type: none"> Commonwealth listed threatened species are likely to be impacted. State listed threatened species are likely to be impacted | Moderate Substantial areas of habitat will be bisected by this proposed alignment. | Moderate As habitat will be bisected by this proposed alignment, road strike is expected to be significant. Mitigative measures including directional fencing and fauna underpasses will mitigate this impact. | High |

| Option | Habitat Fragmentation | Habitat Removal/ Modification | Loss of Significant Species | Barrier Effects | Road Strike | Overall Assessment |
|-----------------------------------|--|--|--|---|---|--------------------|
| | | would be cleared. | | | | |
| Option D | High State Significant Wetlands providing known habitat for federal and state listed species will be bisected by this option. | High <ul style="list-style-type: none"> 11.39ha of Endangered RE 12.5.3 would be cleared. 39.41ha of Significant Wetlands 12.3.5 and 12.3.6 would be cleared | High Commonwealth listed threatened species would be impacted. | Moderate Substantial areas of habitat will be bisected by this proposed alignment. | Moderate As habitat will be bisected by this proposed alignment, road strike is expected to be significant. Mitigative measures including directional fencing and fauna underpasses will mitigate this impact. | High |
| Existing Alignment Upgrade | Low Upgrading of the existing alignment will not lead to further fragmentation. | Low Minor clearing will be required for the installation of this option. | Low <i>Acacia bauerii</i> may be impacted by this alignment. No other threatened species would be impacted. | Low Upgrading of the existing alignment will not lead to further barrier effects. | Low Locally occurring fauna are acclimatised to the existing traffic on the existing roadway. | Low |

5.0 Conclusions and Recommendations

The proposed realignment options of the Bribie Island Road will result in various impacts to the natural environment of the Ningi locality. Construction of the identified bypass options will have potential to:

- Impact upon a number of threatened species protected at the federal and state levels;
- Potentially impact upon significant regional ecosystems triggering requirements under the Vegetation Management Act 1999;
- Impact upon state significant wetlands; and
- Negatively impact upon the environmental value for nature conservation of the area. Detailed environmental field assessment is required to determine the extent of these impacts and recommend mitigation measures to avoid or minimise such impacts.

It is therefore recommended that as a suitable alternative exists, that alternative should be selected as the preferred option over the bypass options. In this instance, it is expected that the proposed upgrade of the existing alignment will have minimal ecological impacts upon the locality. Upgrading the existing alignment is not expected to significantly impact upon any threatened species. When compared to the proposed bypass options, it is likely that significant impacts will occur to threatened species listed at both the state and federal levels.

The proposed bypass options will result in large areas of habitat loss and will ultimately increase the habitat fragmentation occurring in the locality. This will be compounded by the barrier to fauna movement that each of the proposed bypass options will represent to local fauna. These impacts will further decrease the biodiversity of the Ningi area.

Further to this, the proposed bypass options will each impact on a wetland area north of Bestmann Road which is considered a State Significant wetland.

It is therefore apparent that the upgrade option will result in minimal impacts to the local biodiversity of the Ningi locality and as a consequence should be regarded as the preferred alignment.

6.0 References

Cropper, S (1993) Management of Endangered Plants, CSIRO Publications, Melbourne.

DEC (date unknown) Threatened Species Profiles. New South Wales Department of Environment and Conservation. Available at <http://threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx> (accessed 24 August 2006).

DPI&F (2003) Queensland lungfish (ceratodus) *Neoceratodus forsteri*. Queensland Department of Primary Industries and Fisheries. Available at <http://www2.dpi.qld.gov.au/fishweb/2609.html> (accessed 24 August 2006).

EPA (2002) Biodiversity Assessment and Mapping Methodology, v. 2.1. Biodiversity Planning Unit, Biodiversity Branch, Queensland Environmental Protection Agency, July 2002.

EPA (2006) The *Nature Conservation (Koala) Conservation Plan 2006 and Nature Conservation (Koala) Management Program 2006-2016*. Queensland Environmental Protection Agency, July 2006. Available at http://www.epa.qld.gov.au/nature_conservation/wildlife/koala_plan/nature_conservation_koala_conservation_plan_2006_and_management_program_2006_2016/ (accessed 14 February 2007).

EWB (2005) *Nationally threatened species and ecological communities: Swamp Tea-Tree (Melaleuca irbyana) Forest of South-East Queensland*. Australian Government Department of Environment and Water Resources (then Australian Government Department of Environment and Heritage). Available at <http://www.deh.gov.au/biodiversity/threatened/publications/swamp-tea-tree-forest.html> (accessed 30 November 2006).

Fairley, A. and Moore, P. (1989) *Native Plants of the Sydney District: An Identification Guide*. Kangaroo Press, Kenthurst, NSW.

Guymmer, G. (1987) Two new species of *Notelaea* Vent. (Oleaceae) from south-eastern Queensland. *Austrobaileya* 2(4): 339-343.

Halford, David (1998) Survey of Threatened Plant Species in South East Queensland Biogeographical Region. Department of Environment and Heritage. Available at http://www.affa.gov.au/corporate_docs/publications/pdf/forestry/rfa/qld/qld_se_eh113.pdf#search=%22Halford%2C%201998%20marsdenia%20coronata%22 (accessed 24 August 2006).

Maunsell Australia Pty Ltd (2005) *Purga Site Investigation Study*. Prepared for Department of State Development and Innovation, July 2005.

PlantNET (2006) New South Wales Flora Online. National Herbarium of New South Wales. <http://plantnet.rbgsyd.nsw.gov.au/search/simple.htm> (accessed 24 August 2006).

Qld EPA (2006) *Back From the Brink – Profiling Some of Our Threatened Species*. Queensland Environmental Protection Agency. Available at http://www.epa.qld.gov.au/publications/p01357aq.pdf/Bush_Telegraph_Winter_2006.pdf (accessed 29 November 2006).

Sattler, P. and Williams, R. (ed.s) (1999) *The Conservation Status of Queensland's Bioregional Ecosystems*. Queensland Government Environmental Protection Agency, Brisbane.

Saunders, M. (2001) *Recovery Plan for the Endangered Native Jute Species Corchorus cunninghamii F. Muell. In Queensland*. Australian Government Department of Environment and Heritage. Available at <http://www.deh.gov.au/biodiversity/threatened/publications/recovery/c-cunninghamii/index.html#download> (accessed 29 November 2006).

Simpson, K. and Day, N. (2004) *Field Guide to the Birds of Australia*. Penguin Books Ltd, Camberwell, Victoria.

Slater, P., Slater, P. and Slater, R. (1992) *The Slater Field Guide to Australian Birds*. Weldon Publishing, Smithfield, NSW.

Stanley, T.D. and Ross, E.M. (1989) *Flora of South-eastern Queensland (Vol. 3)*. Queensland Herbarium, Queensland Department of Primary Industries.

Stanley, T.D. and Ross, E.M. (1995) *Flora of South-eastern Queensland (Vol. 1)*. Queensland Herbarium, Queensland Department of Primary Industries.

Stanley, T.D. and Ross, E.M. (2002) *Flora of South-eastern Queensland (Vol. 2)*. Queensland Herbarium, Queensland Department of Primary Industries.

Strahan, R. (ed) (1995) *The Mammals of Australia*. Reed New Holland, Sydney.

Wilson, S. (2005) *A Field Guide to Reptiles of Queensland*. Reed New Holland Publishers (Australia) Pty Ltd, Sydney

| Species | Common Name | NC Act Status | EPBC Status | Preferred Habitat | Known Distribution | Reference | Likelihood of Occurrence |
|------------------------------|----------------------|---------------|-------------|---|---|---------------------|---|
| Amphibians | | | | | | | |
| <i>Adelotus brevis</i> | tusked frog | Vulnerable | - | Rainforest, wet sclerophyll and grazing country usually associated with water most frequently found under cover besides puddles, streams and besides ditches. | Running along the east coast from about Mackay in North Qld to about 200km south of Sydney NSW. | Robinson 1993 | Moderate – Habitat occurs in study area and one specimen having been recorded. |
| <i>Crinia tinnula</i> | wallum froglet | Vulnerable | - | Paperbarked Teatree swamps, acid surface water Wallum country. | Located along the East Coast from Maryborough in Qld to Sydney NSW. | Robinson 1993 | High – species known to occur in wetland habitats in the study area. |
| <i>Litoria freycineti</i> | wallum rocketfrog | Vulnerable | - | Heath and forest and temporary swamps. | Found along the East Coast from southern tip of Fraser Is. to about 200km south of Sydney. | Robinson 1993. | Moderate – Habitat occurs in study area and two specimens having been recorded. |
| <i>Litoria olongburensis</i> | wallum sedge frog | Vulnerable | Vulnerable | Along creeks and in marshy or swampy lowland habitats amongst emergent vegetation and reeds of the wallum. | Along the East Coast from Harvey Bay in Qld to about Coffs Harbour in NSW. | Robinson 1993 | Moderate – Habitat occurs in study area with one specimen having been recorded. |
| <i>Mixophyes iterates</i> | southern barred frog | Endangered | Endangered | Coastal riverine rainforests and upland areas. | Southern Queensland to central New South Wales. | Barker et al. 1995. | Low – no suitable habitat likely to occur in the area. |

| Species | Common Name | NC Act Status | EPBC Status | Preferred Habitat | Known Distribution | Reference | Likelihood of Occurrence |
|---------------------------------------|--|---------------|-------------|---|---|------------------------|---|
| Birds | | | | | | | |
| <i>Accipiter novaehollandiae</i> | grey goshawk | Rare | - | Open forests, woodlands and forested rivers. | Near-coastal Queensland through the Top end of Northern Territory and Western Australia. | Simpson and Day 1984 | Moderate – Habitat occurs in study area and two specimens having been recorded. |
| <i>Calyptorhynchus lathami</i> | glossy black cockatoo | Vulnerable | - | Open forest and semi-arid woodland, especially <i>Casuarina</i> . | Found around Mackay Qld; Eastern half of Qld from Fraser Is south to Vic Border; Kangaroo Is. SA. | Simpson and Day 1984 | Moderate – Habitat occurs in study area and one specimen having been recorded. |
| <i>Collocalia spodiopygius</i> | white-rumped swiftlet | Rare | - | Occurs over rainforest, cleared country, beaches and in gorges. Breeds in secluded caves and cavities between boulders, near sea on coastal islands or in gorges and hills. | Generally restricted to coastal north east Queensland and highland areas. | DEH | Low – no suitable habitat likely to occur in the study area. |
| <i>Cyclopsitta diophthalma coxeni</i> | Coxen's Fig-Parrot Double-eyed fig-parrot | Endangered | Endangered | Rainforest, gardens with soft fruit trees. | Occurs in S.E Qld and N.E NSW (300km radius around Brisbane) | Simpson and Day 1993 | Low – no suitable habitat likely to occur in the study area. |
| <i>Ephippiorhynchus asiaticus</i> | black-necked stork | Rare | - | River pools, swamps, intertidal flats. | N.E corner of NSW, Northern parts of NT and WA | Simpson and Day 1993). | High – species known to occur in wetland habitats in the study area. |
| <i>Erythrotriorchis radiatus</i> | red goshawk | Vulnerable | - | Prefers a mix of vegetation types with its habitat including tall open forest, woodland, lightly treed savannah and the edge of rainforest. | Occurs over eastern Queensland and across northern Australia | Simpson and Day 1993 | Low – limited habitat likely to occur in the areas likely to be impacted. |

| Species | Common Name | NC Act Status | EPBC Status | Preferred Habitat | Known Distribution | Reference | Likelihood of Occurrence |
|---------------------------------|-----------------------|---------------|-------------|--|---|-----------------------|---|
| <i>Esacus neglectus</i> | beach stone-curlew | Vulnerable | - | Reefs, beaches, coastal mudflats patchy distribution along the northern coastline. | Known from North West Cape in WA to Port Stephens in NSW. | Simpson and Day 1993. | Low – limited habitat likely to occur in the areas likely to be impacted. |
| <i>Geophaps scripta scripta</i> | squatter pigeon | Vulnerable | Vulnerable | Grassy woodlands and plains, preferring sandy areas and usually close to water. | Found from north Queensland to the North West Slopes of NSW and extending down to the Liverpool Plains and Dubbo. | Simpson and Day 1993. | Low – limited habitat likely to occur in the areas likely to be impacted. |
| <i>Haematopus fuliginosus</i> | Sooty Oystercatcher | Rare | - | Undisturbed tidally inundated rocks, occasionally on sandy spits and mudflats. | Along the entire East Coast and Tas, patchy distribution in SA, WA, NT. | Simpson and Day 1993 | Low – limited habitat likely to occur in the areas likely to be impacted. |
| <i>Lathamus discolor</i> | swift parrot | Endangered | Endangered | Drier open forests, woodlands, parks and gardens. | Predominately found in eastern Vic and Tas, north along east coast until Fraser Is. | Simpson and Day 1993 | Low – few recorded birds in the study area |
| <i>Lophoictinia isura</i> | Square-tailed Kite | Rare | - | Open forests, woodlands, riparian vegetation, rocky hills, and heathlands. | Found in all of Qld, NSW, Vic, and most of NT and western WA, very eastern edge of SA. | Simpson and Day 1993 | High – species known to occur in forest habitats in the study area. |
| <i>Macronectes giganteus</i> | Southern giant petrel | Endangered | Endangered | Oceanic. | Has a circumpolar pelagic range from Antarctica to approximately 20° S. | Simpson and Day 1993 | Low – limited habitat likely to occur in the areas likely to be impacted. |

| Species | Common Name | NC Act Status | EPBC Status | Preferred Habitat | Known Distribution | Reference | Likelihood of Occurrence |
|-------------------------------------|--------------------------|---------------|-------------|--|--|----------------------|---|
| <i>Macronectes halli</i> | Northern giant petrel | Vulnerable | Vulnerable | Oceanic. | Has a circumpolar pelagic distribution, predominantly in sub-Antarctic to Antarctic waters north of the Antarctic convergence, usually between 40-64°S in open oceans. | Simpson and Day 1993 | Low – limited habitat likely to occur in the areas likely to be impacted. |
| <i>Melithreptus gularis</i> | Black-chinned Honeyeater | Rare | - | Tall, dry eucalypt forests and woodland, riparian vegetation. | Located along Eastern and central Qld except tip of Cape York , N.E corner of NSW running through central Vic out to northern WA and central NT. | Simpson and Day 1993 | Low – limited habitat likely to occur in the areas likely to be impacted. |
| <i>Neophema pulchella</i> | turquoise parrot | Rare | - | Is an inhabitant of the steep, rocky ridges and gullies, rolling hills, valleys and river-flats and the nearby plains of the Great Dividing Range. | Endemic to eastern Australia. The species range extends from north-eastern Victoria, through NSW to the granite belt (eg. Stanthorpe district) of south-east Queensland. | Simpson and Day 1993 | Low – limited habitat likely to occur in the areas likely to be impacted. |
| <i>Numenius madagascariensis</i> | Eastern curlew | - | Rare | Estuaries, mudflats, mangroves and sandpits. | Located across all Australian Coastlines. | Simpson and Day 1993 | Low – limited habitat likely to occur in the areas likely to be impacted. |
| <i>Pterodroma neglecta neglecta</i> | Kermadec petrel | Vulnerable | - | Oceanic | Occurs in subtropical seas between 20 and 35°S. | Simpson and Day 1993 | Low – limited habitat likely to occur in the areas likely to be impacted. |

| Species | Common Name | NC Act Status | EPBC Status | Preferred Habitat | Known Distribution | Reference | Likelihood of Occurrence |
|----------------------------------|--------------------------|---------------|----------------------|---|--|----------------------|--|
| <i>Rallus pectoralis</i> | Lewins rail | Rare | - | Occurs mainly in freshwater wetlands, it uses a wide range of other habitat types, including brackish and saline wetlands. Dense fringing vegetation may be an important habitat component. | From south east Queensland to the Eyre Peninsular. | Simpson and Day 1993 | Moderate – Habitat occurs in study area and three specimens having been recorded. |
| <i>Numenius madagascariensis</i> | eastern curlew | Rare | Marine/ Migratory | Mainly coastal, sand spits, mudflats, waterways in saltmarsh, mangroves, occasionally fresh or brackish lakes. | South eastern Australia to north eastern Australia. | Simpson and Day 1993 | High – species known to occur in forest habitats in the study area. |
| <i>Rostratula pectoralis</i> | Australian painted snipe | Vulnerable | - | Found in shallow inland wetlands. | Victoria through to North Queensland. | Simpson and Day 1993 | Moderate – potential habitat occurs in the study area and known to occur within the species range. |
| <i>Rostratula benghalensis</i> | painted snipe | Vulnerable | Vulnerable | Found in shallow inland wetlands. | Victoria through to North Queensland | DEH | Moderate – Habitat occurs in study area and two specimens having been recorded. |
| <i>Sterna albifrons</i> | Little tern | - | Endangered | Coasts, sometimes inland watercourses. Birds breed on sandy beaches and sand spits. | Found along the coast from the North West Cape in WA north through Qld to Adelaide | Simpson and Day 1984 | Low – limited habitat likely to occur in the areas likely to be impacted. |

| Species | Common Name | NC Act Status | EPBC Status | Preferred Habitat | Known Distribution | Reference | Likelihood of Occurrence |
|------------------------------|-----------------------------|---------------|-------------|--|---|------------------------|--|
| <i>Thalassarche cauta</i> | shy albatross | Vulnerable | | Oceanic. | Along the East Coast. | Simpson and Day (1984) | Moderate - potential habitat occurs in the study area and within the species range |
| <i>Thalassarche impavida</i> | Campbell albatross | Vulnerable | - | Oceanic. | Along the East Coast. | Simpson and Day (1984) | Low – limited habitat likely to occur in the areas likely to be impacted. |
| <i>Turnix melanogaster</i> | Black-breasted button quail | Vulnerable | Vulnerable | Is restricted to rainforests and forests, mostly in areas with 770-1200 mm rainfall per annum. They also prefer drier low closed forests, particularly semi-evergreen vine thicket, low microphyll vine forest, araucarian microphyll vine forest and araucarian notophyll vine forest. They may also be found in low, dense acacia thickets and, in littoral area, in vegetation behind sand dunes. | The Black-breasted Button-quail is endemic to eastern Australia. It is restricted to coastal and near-coastal regions of south-eastern Queensland and north-eastern New South Wales. The main populations occur within south-east Queensland. | Simpson and Day (1984) | Low – limited habitat likely to occur in the areas likely to be impacted. |
| <i>Xanthomyza Phrygia</i> | regent honeyeater | Endangered | Endangered | Woodlands and open Eucalypt forests. | Occurs within 300 km of coastline from Brisbane to Adelaide | DEH | Moderate – Habitat occurs in study area and two specimens having been recorded. |

| Species | Common Name | NC Act Status | EPBC Status | Preferred Habitat | Known Distribution | Reference | Likelihood of Occurrence |
|---|------------------------|---------------|-------------|--|--|-----------------------------|--|
| Mammals | | | | | | | |
| <i>Chalinolobus dwyeri</i> | large-eared pied bat | Vulnerable | - | Roosts in caves, crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (<i>Hirundo ariel</i>), frequenting low to mid-elevation dry open forest and woodland close to these features. Found in well-timbered areas containing gullies | Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. | DEH | Low – limited habitat likely to occur in the areas likely to be impacted. |
| <i>Phascolarctos cinereus</i> | koala | - | Vulnerable | Wet and dry sclerophyll forest and woodland containing preferred food tree species. | East coast of Australia. | State Forests of NSW (1995) | Moderate - potential habitat occurs in the study area and within the species range |
| <i>Potorous tridactylus tridactylus</i> | long-nosed potoroo | Vulnerable | Vulnerable | Inhabits heaths and wet sclerophyll forests. | Near coastal from South East Queensland to Victoria and Tasmania. | DEC | Low – no suitable habitat likely to occur in the area |
| <i>Pteropus poliocephalus</i> | grey-headed flying-fox | Vulnerable | Vulnerable | Variety of habitats including rainforest, mangroves, paperbark swamps, wet and dry sclerophyll forests and cultivated areas. | East coast of Australia from Rockhampton (Qld) to western Victoria. | Churchill (1998) | Moderate - potential habitat occurs in the study area and within the species range |

| Species | Common Name | NC Act Status | EPBC Status | Preferred Habitat | Known Distribution | Reference | Likelihood of Occurrence |
|--------------------------------------|------------------------------|---------------|-------------|--|---|----------------|--|
| <i>Xeromys myoides</i> | false water rat | Vulnerable | Vulnerable | Variety of well-watered habitats including mangrove forests and freshwater lagoons. | Small discrete patches along Queensland coast and Northern Territory. | Strahan (1995) | Moderate - potential habitat occurs in the study area. |
| Reptiles | | | | | | | |
| <i>Coeranoscincus reticulatus</i> | Three-toed snake tooth skink | Vulnerable | Rare | Rainforest and occasionally moist eucalypt forest, on loamy or sandy soils. The Three-toed Snake-tooth Skink lives in loose soil, leaf litter and rotting logs. | Occurs in the coast and ranges from the Macleay valley in NSW to south-eastern Queensland. | DEH | Low – no suitable habitat likely to occur in the area |
| Insects | | | | | | | |
| <i>Argyreus hyperbius inconstans</i> | Australian Fritillary | - | Endangered | Collected from river estuaries or swampy coastal areas at or near sea level. Restricted to open, swampy, coastal areas where the larval food plant, <i>Viola betonicifolia</i> , grows as a small, insignificant ground herb in association with <i>Lomandra longifolia</i> (long leaved matrush) and the grass <i>Imperata cylindrica</i> (bladey grass). | Recorded in south-eastern Queensland and north-eastern New South Wales between Gympie and Port Macquarie. | DEH | Moderate - potential habitat occurs in the study area and within the species range |
| Aquatic Fauna | | | | | | | |
| <i>Neoceratodus forsteri</i> | Australian lungfish | Vulnerable | - | Normally found in still or slow flowing pools in river systems of south-eastern Queensland. | SE Queensland to NE NSW. | DEH | Low - no potential habitat occurs in the study area |
| <i>Nannoperca</i> | oxleyan | Vulnerable | Endangered | Occurs in coastal <i>Banksia</i> - | NE NSW to SE | DEH | Low - no potential |

| Species | Common Name | NC Act Status | EPBC Status | Preferred Habitat | Known Distribution | Reference | Likelihood of Occurrence |
|-----------------|--------------------|----------------------|--------------------|-------------------------------------|---------------------------|------------------|----------------------------------|
| <i>oxleyana</i> | pygmy perch | | | dominated heath or wallum habitats. | Queensland | | habitat occurs in the study area |