Cardno
Shaping the Future

REPORT ON ENGINEERING & ENVIRONMENTAL MATTERS

DEVELOPMENT APPLICATION FOR TOWN CENTRE SITE

June 2008
Job No. 7079/4

Kings Beach (No. 2) Pty Ltd

Cardno (Qld) Pty Ltd

ABN 57 051 074 992

Commercial Centre

Isle of Capri, Gold Coast

Queensland 4217 Australia

Telephone: 07 5539 9333

Facsimile: 07 5538 4647

International: +61 7 5539 9333

gco@cardno.com.au

www.cardno.com.au

Document Control

Version	Date	Author		Reviewer	
		Name	Initials	Name	Initials
2	June 2008	Trevor Johnson	TJ	Aiden Cunningham	AC

REPORT ON ENGINEERING & ENVIRONMENTAL MATTERS

DEVELOPMENT APPLICATION FOR TOWN CENTRE SITE

TABLE OF CONTENTS

APPENDICES

EXECUTIVE SUMMARY

Kings Beach No 2 Pty Ltd is the owner and developer of the Casuarina Beach development at South Kingscliff in Tweed Shire. Commencing in 1998, development in Casuarina has proceeded in accordance with the Stage 1 Kings Beach approval and subsequent detailed town planning applications for each Precinct.

The latest stage of the development is the Town Centre site, lying between Central and North Precincts. The Town Centre site was recognized in the Stage 1 approval as that part of the total site where significant multi-dwelling residential, commercial and retail development would take place as the project took shape over a number of years. The population growth which has occurred in Casuarina since development commenced means that the Town Centre is now a viable development opportunity.

The Town Centre site has remained essentially undeveloped while the remainder of Casuarina took shape around it. As part of an agreement with the NSW National Parks and Wildlife Services for the Stage 1 approval, the Town Centre was required to be kept in a natural vegetated condition until June 2003 so as to provide Banksia fodder for the common blossom bat. NPWS has subsequently given its permission to allow clearing of this site.

Engineering development activities will therefore include:

- Clearing of vegetation
- Stockpiling of mulch (no topsoil exists on the site)
- Carrying out of earthworks to reshape the site for drainage and urban development purposes
- Construction and installation of engineering infrastructure such as roads, drainage, water quality controls, water supply, sewerage, power and telecommunications.

Adequate design of these components requires detailed consideration of a number of issues, including bushfire potential, contamination (the site was extensively sand mined in the past), acid sulfate soils, water quality and drainage management, sustainability (through total water cycle management), ecology and heritage values.

This report addresses each of these issues in detail, demonstrating that there are no engineering impediments to the development of the site in the manner proposed. In addition, the drawings attached to the report show how engineering infrastructure can be successfully provided to the site.

Stage 1 of the Town Centre development will involve all physical works required to develop the site, as well as the provision of all infrastructure needed to service the ultimate population of the site, with the exception of water supply and sewerage connections to those individual allotments which will not be created as part of Stage 1.

1. INTRODUCTION

Kings Beach No 2 Pty Ltd is the owner and developer of the Casuarina Beach urban development project in the South Kingscliff area.

A number of previous stages of this project have been developed in accordance with the Stage 1 Master Plan, which was approved by Council in 1998 as Consent No S96/135. Approval is currently being sought in respect of a Concept Plan for the Town Centre site, which will have a mixture of retail, commercial and residential land uses.

The Stage 1 Consent approval subdivided the overall Kings Beach site into 14 lots, subject to compliance with conditions requiring provision of infrastructure and various items of environmental management. Future subdivision within each of these Master Lots relies upon approval of further development applications, taking into account all relevant issues.

In particular, condition 40 of the Stage 1 approval required the applicant to plant at least 8,600 Banksia integrifolia trees, to compensate for the future loss of vegetation over the urbanised part of the site. Up to a further 5,400 trees were required as subsequent development was approved on each of the Master Lots.

Subsequently, the approval for Stage 2 of the development identified two areas where clearing of native vegetation was to be deferred. Condition 86 states:

vi. In respect of the commercial area, clearing may commence within four years from 1 June 1999, in accordance with an agreed biological timeframe provided that adequate mitigation measures can be demonstrated to NPWS and Tweed Shire Council.

An identical condition (83(v)) was included in the approval for Stage 6 of the Casuarina development. The Town Centre site is identified as the commercial area in those Conditions. The adequate mitigation measures are those outlined in the Stage 1 and Stage 2 approvals.

Conditions 40 and 41 of the Stage 1 approval (Consent No S96/135) is as follows:

40 The applicant shall plant a total of not fewer than 8600 Banksia integrifolia as part of the Stage 1 works. To avoid the potential for a Banksia monoculture, the numbers of Banksias proposed for replanting shall include a proportion of other relevant flowering species depending on the location for replanting. The other relevant species shall be of a type that provides for a food source for the Queensland Blossom Bat. Approximately 20% of the planting shall comprise other relevant flowering species. The said planting shall:

- *i be completed no later than 30 June 1999*
- *ii be planted within Lot 8 as shown on the Subdivision Plan and on the Richtech land in the areas identified in the Amelioration Plan*
- *iii not be planted in areas identified as being within SEPP14 wetlands (as they currently exist or as proposed to be included by the Minister as at the date of this consent) without the approval of the Department of Urban Affairs and Planning.*
- *iv comprises tube stock produced from local provenance or from good quality seed which has had not less than 4 months growth in grow tubes.*

41(a) Any development application with respect to any of the Management Lots shall provide for the planting of not fewer than the number of Banksia integrifolia shown in the Table hereunder against each such lot and totalling not less than 5400 stems provided that those numbers shall be

reduced so that they total the difference between 14000 and the total number of stems planted pursuant to condition 40 (where they total more than 8600).....

In effect, these conditions required the planting of at least 14000 Banksia integrifolia seedlings across the entire Casuarina site, including existing open space areas and the Richtech land to the north of Casuarina in the area known as Seaside City.

Condition 47 of the approval noted the following:

47 ***No approval shall be granted for development of any Management Lots unless the monitoring reports referred to in Condition 46 are sufficient to satisfy the Director of Development Services based upon advice from the National Parks and Wildlife Services that the plants are maturing in accordance with the programme set out in the Vegetation Management Plan. Each subsequent development application will detail the locations, timing and methodology of any further plantings proposed in accordance with Condition 42 above.***

Compliance with these conditions is addressed in Section 8 of this report. On 11 November 2003, the Land and Environment Court (No 10686 of 1997) replaced Condition 47 with a new condition, reflecting the agreement by Tweed Shire Council and the National Parks and Wildlife Services that plantings completed up until that date were generally acceptable. Provided that a number of relatively minor requirements were complied with (planting of an additional 3,000 Banksias, fencing of compensatory planting areas and fertilisation and irrigation of new planted areas), the issuance of subdivision certificates for Stages 6B and the Town Centre was approved subject to the lodgement of a $200,000 bond with Council.

All of these requirements have been satisfied.

Based on the condition imposed in Stage 2 as noted above, clearing and development of the Town Centre site can therefore take place at anytime after 1 June 2003 (4 years from the date of approval) without further reference to the Department of Environment and Conservation.

It is noted that the other deferred area, namely Stage 6B, was approved for development in 2003 by NPWS and has subsequently been cleared and developed. A copy of a letter dated 16 April 2003 from NPWS in this regard is attached in Appendix D. It states:

NPWS acknowledges the previous agreement for the clearing of this site to commence after 1 June 2003

There should be no doubt, therefore, that the Town Centre site can now be cleared.

In other respects, the site is zoned appropriately for urban subdivision under the terms of Council's Local Environmental Plan, and is already served by urban infrastructure provided for earlier stages of the Casuarina Beach development, specifically the Central and Northern Precincts.

2. DETAILS OF THIS APPLICATION

2.1 General

The subject land is described as Lot 223 on DP 1048494 and contains a total area of 19.03 hectares. The location of the land is shown on the attached figures.

The site has a frontage to the Coast Road, and is bordered by existing developed areas of Casuarina to the north and south. It has a 2(e) zoning designation in Council's Local Environmental Plan, apart from the eastern frontage of the site which is zoned 7(f).

This application is for approval of a Concept Plan over the site, and will confer no development rights without the approval of subsequent development applications. In overview, the Concept Plan contemplates carrying out of the following works:

- Clearing of vegetation on the Town Centre site, Lot 223 on DP 1048494, and the carrying out of bulk earthworks to reflect the desired ultimate development landform.
- The filling in of the drainage swale which commences at the north-eastern boundary of the site and bisects it before discharging to the existing culverts in the Coast Road described as Outlet 11 in previous studies. Within lot 223, the swale will be replaced by underground stormwater pipe drainage before discharging back to the existing drainage system at the northern end of the playing field area, and thence to Outlet 11.
- The construction of the northern "missing link" in Casuarina Way, extending from Steelwood Lane at the southern end to the Dianella Drive roundabout at the north.
- The physical closure of Dianella Drive by cul-de-sac at its western end, and the construction of the Town Centre Main Street, which will connect the Coast Road to Casuarina Way and effectively replace Dianella Drive as a connection to existing and future northern stages of Casuarina.
- The provision of all urban infrastructures to the site, namely water supply, sewerage, electricity and telecommunications. It is noted that external infrastructure, with the exception of sewerage, has been previously sized and provided to accommodate development on this site.
- The reconstruction of the cycle way / walkway along the coastal frontage of the site, and the redevelopment of this area of open space to comply with the design intent applied to the remainder of Casuarina. It is noted that this area is mostly within public ownership. However, this is no different to the other stages of Casuarina, where permission was granted to carry out works in public lands that were considered to be primarily of community benefit. We expect the same criteria to apply in this case.
- The eventual subdivision of the site into a number of individual lots, as shown on the Concept Plan.

While approval of the Concept Plan will not trigger any immediate works, this engineering report has been prepared to demonstrate that any such works can reasonably proceed without excessive cost and/or environmental impact.

2.2 Stage 1 Works

The Stage 1 works for the site will consist of all of the items listed in Section 2.1. Consequently, Stage 1 will produce all of the earthworks, roadworks and infrastructure needed to service the site.

One of the significant elements required for Stage 1 will be the physical closure of Dianella Drive at its western end, and the associated construction of the Town Centre Main Street to replace the east-west connection between Casuarina Way and the Coast Road. The intersections of Dianella Drive and the Town Centre Main Street with the Coast Road are too close together to be concurrently acceptable from a traffic engineering point of view. Consequently, it is proposed to close Dianella Drive by construction of a cul-de-sac and vehicle barrier at its western end

The developer owns all allotments on both sides of Dianella Drive. It is noted that Council will be required to give permission to the cul-de-sac, as it is the owner of the road. It is also noted that Dianella Drive will not actually be "closed", in that the road reserve connection to the Coast Road will remain. However, a physical barrier will be placed at the end of the new cul-de-sac to prevent access to and from the Coast Road at this point.

All of the engineering works listed in this report and the associated drawings will be undertaken in Stage 1.

3. EARTHWORKS AND CLEARING

The site will be cleared of vegetation, and then reshaped to achieve the desired development outcome. It is noted that, unlike the developed parts of Casuarina, the eastern part of Lot 223 remains essentially in the same condition as it was when sand-mining finished in the early 1970s. The works proposed on Lot 223 are compatible and consistent with previous earthworks activity undertaken on the wider Casuarina project.

The finished surface contours for the site are shown on figure DA24. All disturbed surfaces will be grassed and stabilised immediately on completion.

It is noted that the earthworks phase will also cover the filling in of the existing east-west drainage swale which bisects the site, with the eventual replacement of the drainage capacity of that system by an underground stormwater drainage pipe system.

Completion of earthworks to the levels currently shown on figure DA24 will require the importation of approximately 40,000 m^3 of material. Additional fill material is to be sourced locally. We note with further earthworks calculations over the Casuarina Development site, It is most likely that fill material may be obtained north of the Town Centre site and Dianella Drive from the undeveloped Northwest Precinct of Casuarina. This material will be brought to site by road transport.

A detailed Earthworks Management Plan has been completed and is included herein as Appendix G.

4. ROADWORKS

The Concept Plan anticipates the construction of Casuarina Way, from Steelwood Lane through to the existing roundabout at Dianella Drive. The planned alignment of the Casuarina Way, and all other roads within the site, is shown on figure DA23, with preliminary design details of long-sections shown on figures DA28 to DA33. The road reserve width (20 m) and cross section proposed are identical to that previously used for all existing sections of Casuarina Way.

The construction of this section of Casuarina Way will improve internal traffic movements, and reduce loading on the Coast Road. It has been an integral component of the overall planning for Casuarina since the original development approval, and is entirely consistent with the Concept Plan adopted at that time.

Construction of the road will require significant earthworks to be undertaken, so as to achieve satisfactory vertical alignment.

5. BUSHFIRE

The construction process on this site will involve the clearing and removal of vegetation from the entire site. The site is bounded to the west by the Coast Road, and to existing developed sections of Casuarina to the north and south. Consequently, the only part of the site which is potentially subject to bushfire attack is the eastern boundary, adjacent to the approximately 60 m wide strip of dune vegetation which fronts the entire Casuarina site.

As part of the approval for Stage 1 of the Casuarina development, a Public Reserve (Lot 13 on DP1014470) was created over the dunal vegetation and the area immediately west of it. The cycleway/walkway which runs along the entire frontage of the Casuarina site is located within this Lot, part of which was landscaped by the developer and is maintained by Council as a low fire hazard area. The minimum width of this Public Reserve east of the Town Centre site is 30 m, although only the western-most 12 m is maintained in the manner required.

The 7f zone for coastal erosion protection sits astride the current eastern boundary of the Town Centre site, occupying the western-most 10 m of the Public Reserve, and the eastern-most 20 m of the proposed allotments. As part of the development plans for the site, it is intended to dedicate a further 13.5 m of this 20 m as Public Reserve, with the remaining 6.5 m retained as private open space within the lots. In conjunction with the existing 12 m of cleared land on the boundary, the maintained area will therefore eventually consist of 25.5 m of Public Open Space and 6.5 m of private open space. This total width of 32 m will be maintained as a fuel-free zone.

The requirements for Asset Protection Zones (APZ) in urban developments are presented in the document "Planning for Bush Fire Protection 2006", issued by the NSW Rural Fire Service. According to Appendix A2 of that document, and Table A2.5, the minimum APZ width for residential subdivision purposes for all vegetation types is no greater than 20 m in FDI 80 areas. According to Table A2.3, the Tweed area is classed as FDI 80.

Consequently, the separation distance of 32 m easily achieves compliance with the standard, and bush fire risk can be managed appropriately. The cycleway/walkway to be provided along the eastern boundary of the Town Centre site will provide the majority of the bushfire Asset Protection Zone.

6. INFRASTRUCTURE

6.1 Engineering Infrastructure

In respect of water supply, 150 mm diameter mains already exist in Casuarina Way at the southern and northern boundaries of the site. Due to the current Town Centre densities a connection to the existing 150 mm diameter main at the northern end is being upgraded to a 250 mm diameter main. A 250 mm diameter main will therefore be constructed along the proposed road alignment of Casuarina Way up to the road entrance of Lot 1. The remaining section of Casuarina Way will be serviced with a 150 mm diameter main. A stub connection will be provided into each lot from these mains. A detailed network analysis of the existing and proposed systems was undertaken by Cardno, and the results of this investigation are given in Appendix A. Adequate water supply capacity is available to meet the proposed demands from the ultimate Town Centre development.

In respect of sewerage reticulation, an existing sewer main runs from the south-eastern corner of the Northern Precinct along the drainage swale to Pump Station No 2 on the Coast Road. The alignment of this main is shown on drawing no's 7079/1/50-159 to 162, which are attached in Appendix A. This sewer will be relocated along the new Casuarina Way road alignment as a consequence of the development of Lot 223. The new location of the sewer is shown on figure DA37.

The development of the Town Centre site will require upgrading of the pumps in Pump Station No 2, and the installation of additional rising main capacity in the Tweed Coast Road. The requirement for upgrading has been previously investigated in detail, and is the subject of an agreement between Cardno and Tweed Shire Council in terms of timing of the works, and responsibility for installation.

As part of the SALT development, the most downstream section of the existing rising main in the Tweed Coast Road (from the intersection with Cudgen Road to the Treatment Plant) was replaced with a 375 mm diameter pipeline. This correlates with the first stage of the ultimate upgrading requirements agreed with Council, and provides sufficient capacity in this section of the pipeline for current and future development proposals within Casuarina. However, it will be necessary to upgrade or duplicate other sections of the pipeline to accommodate sewage flows from the approved (and currently under construction) Cotton Beach development in the South Precinct as well as this current proposal.

In particular, it will be required to duplicate the existing 225 mm diameter rising main from Pump Station No 2 to the proposed Kings Forest connection (RM1), as well as constructing at least part of a 375 mm diameter main from this point towards the Cudgen Road intersection point. The actual extent of additional works required will be determined in conjunction with Council.

A copy of the final Cardno report to Council in regard to the required ultimate and preliminary upgrading is attached in Appendix A. Any subsequent development applications over this site will therefore need to be appropriately conditioned to ensure that adequate external infrastructure is called up and provided at the correct time.

Internal sewerage and water supply reticulation layouts are shown on figures DA37 and DA38 respectively.

Sewerage and water reticulation have been sized on the basis of the expected population which will eventually occupy the Town Centre site. It is noted that, while this population number may be greater than previously anticipated for this specific area, the overall population for Casuarina remains less than the 5,600 persons referred to in the Stage 1 Consent Approval. Hence, the overall sewerage planning for Casuarina, and the relevant agreements reached with Council, remain unaffected by an increase from one precinct alone.

Electricity and telecommunications services are available in the Coast Road adjoining the site, and this infrastructure has previously been sized to accommodate all planned development within the South Kingscliff precinct. Application will be made to the relevant service providers at the appropriate time for connection to these external systems. In respect of waste collection, the site will be serviced by either Tweed Shire Council, or private service providers, depending upon the specific requirements of each individual business or residence.

6.2 Beach Access

It is proposed to revise the location of one existing beach access, so as to reach alignment and proximity with the frontage park proposed to be located in the north-eastern section of the Town Centre site. The existing beach access immediately north of the park area will be removed and rehabilitated by revegetation. The new beach access shown on Figure No's 1.0, 2.0 and 3.0 will then be provided.

This information is provided for reference purposes only at this time, since a separate application will need to be lodged to enable its construction to take place.

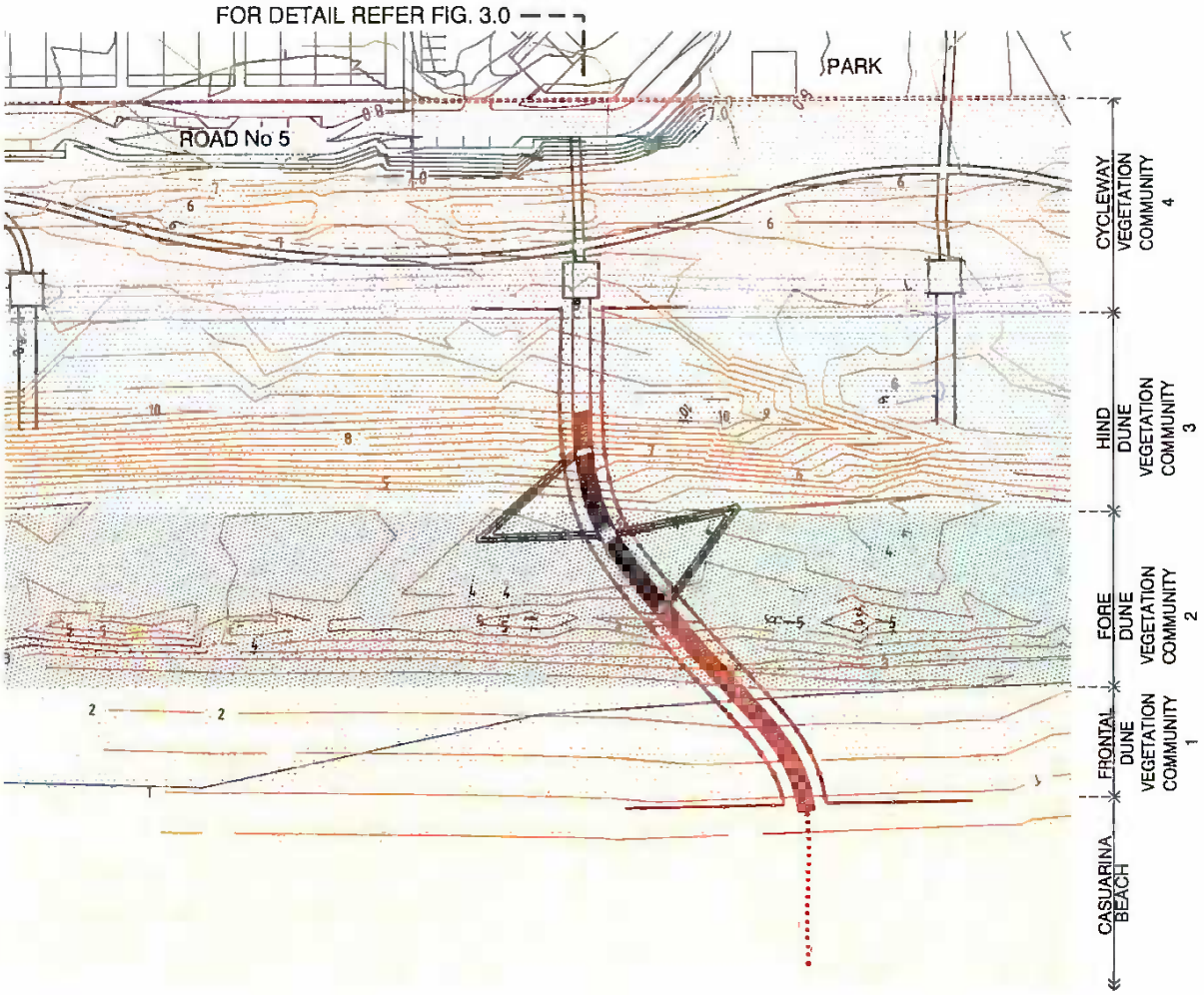
Cardno (Qld) Pty Ltd ACN 051 074 992
Commercial Centre, Isle of Capri
Gold Coast City, Queensland 4217
Email: gco@cardno.com.au

AutoCAD Filename : G:\7079\04\05\FIGURES\707904005-FIG 1-2-3.dwg

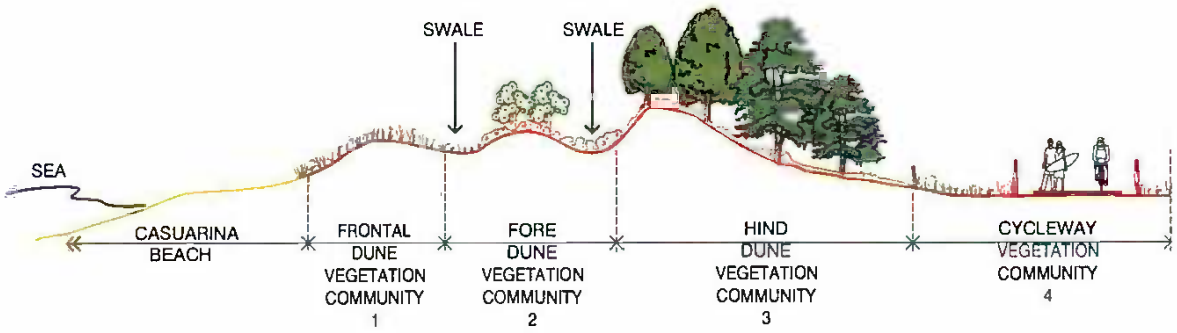
FIGURE No. 1.0

SITE LOCATION & AERIAL PHOTOGRAPH

KINGS BEACH (No. 2) PTY LTD	
CASUARINA BEACH TOWN CENTRE ECOLOGICAL ASSESSMENT AND DUNE VEGETATION MANAGEMENT PLAN	SCALE :- NOT TO SCALE DATE :- 05/02/2008 REV. JOB No 7079/04/005



PLAN
SCALE 1 :1500



VEGETATION COMMUNITY SECTION
NOT TO SCALE

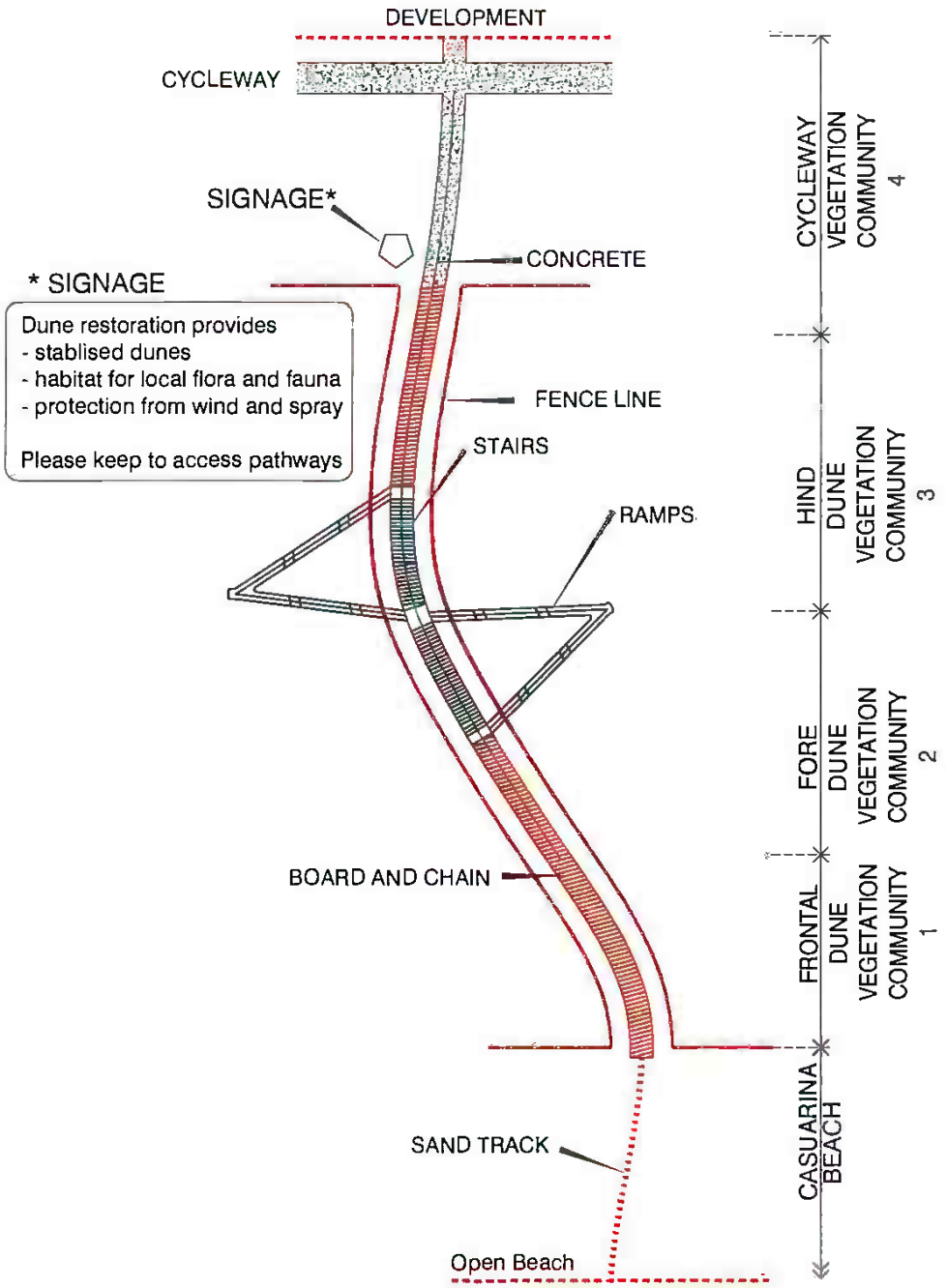
0 50 100m
1 : 1,500
SCALE BEFORE REDUCTION

FIGURE No. 2.0
VEGETATION COMMUNITIES

Cardno (Qld) Pty Ltd ACN: 051 074 992
Commercial Centre, Isle of Capri
Gold Coast City, Queensland 4217
Email: gca@cardno.com.au

AutoCAD Filename : G:\7079\04\05\FIGURES\7079040O5-FIG 1-2 -3.dwg

KINGS BEACH (No. 2) PTY LTD	
CASUARINA BEACH TOWN CENTRE ECOLOGICAL ASSESSMENT AND DUNE VEGETATION MANAGEMENT PLAN	SCALE :- AS SHOWN DATE - 05/02/2008 REV. JOB No 7079/04/005



INDICATIVE BEACH ACCESS TRACK DESIGN

SCALE 1 : 500

10 0 20 m.

1 : 500

FIGURE No. 3.0

INDICATIVE BEACH ACCESS TRACK DESIGN

Cardno

Cardno (Qld) Pty Ltd ACN: 051 074 992
Commercial Centre, Isle of Capri
Gold Coast City, Queensland 4217
Email: gco@cardno.com.au

AutoCAD Filename = G:\7079\04\05\FIGURES\707904005-FIG 1 2 -3.dwg

KINGS BEACH (No. 2) PTY LTD	
CASUARINA BEACH TOWN CENTRE ECOLOGICAL ASSESSMENT AND DUNE VEGETATION MANAGEMENT PLAN	SCALE :- AS SHOWN DATE :- 05/02/2008 REV JOB No 7079/04/005

7. EROSION & SEDIMENT CONTROL PLAN

An Erosion and Sediment Control Plan (ESCP) has been prepared in accordance with Council guidelines, and is attached hereto as Appendix B.

8. ENVIRONMENTAL ISSUES

8.1 Ecological Assessment

Ecological issues on the entire Casuarina site were considered in detail in the original Stage 1 Consent Approval issued by the Land and Environment Court, as outlined in Section 1 above. To reiterate that information, condition 40 of the Consent Approval required the applicant to plant at least 8,600 Banksia integrifolia trees, to compensate for the future loss of vegetation over the urbanised part of the site. Up to a further 5,400 trees were required as subsequent development was approved on each of the Master Lots.

The requirement to plant these additional trees was related to satisfactorily ameliorating the impact of development on the Common Blossom Bat, which was the only threatened fauna species considered likely to occur on the site. These bats are nectarivorous, and forage on the inflorescences of the Banksia tree species found generally on the Casuarina site. However, it has been determined that the site provides no roosting facility for the bats, indicating that clearing of the site will not be problematic if Banksia numbers are maintained by replanting in the local area.

Conditions 40 and 41 of the Stage 1 approval (Consent No S96/135) are as follows:

40 The applicant shall plant a total of not fewer than 8600 Banksia integrifolia as part of the Stage 1 works. To avoid the potential for a Banksia monoculture, the numbers of Banksias proposed for replanting shall include a proportion of other relevant flowering species depending on the location for replanting. The other relevant species shall be of a type that provides for a food source for the Queensland Blossom Bat. Approximately 20% of the planting shall comprise other relevant flowering species. The said planting shall:

- *i be completed no later than 30 June 1999*
- *ii be planted within Lot 8 as shown on the Subdivision Plan and on the Richtech land in the areas identified in the Amelioration Plan*
- *iii not be planted in areas identified as being within SEPP14 wetlands (as they currently exist or as proposed to be included by the Minister as at the date of this consent) without the approval of the Department of Urban Affairs and Planning.*
- *iv comprise tube stock produced from local provenance or from good quality seed which has had not less than 4 months growth in grow tubes.*

41(a) Any development application with respect to any of the Management Lots shall provide for the planting of not fewer than the number of Banksia integrifolia shown in the Table hereunder against each such lot and totalling not less than 5400 stems provided that those numbers shall be reduced so that they total the difference between 14000 and the total number of stems planted pursuant to condition 40 (where they total more than 8600).....

41(d) Where an application is made for consent to the development of a Management Lot within 8 years of the completion of the planting referred to in Condition 40, the applicant for such consent shall be required, prior to

such a consent being granted, to satisfy the National Parks and Wildlife Service that the removal of any Queensland Blossom Bat foraging resource from that Management Lot will not unduly reduce the total productive inflorescences referred to in (c) above or that such removal may proceed notwithstanding any such reduction.

In effect, these conditions required the planting of at least 14000 Banksia integrifolia seedlings across the entire Casuarina site, including existing open space areas and the Richtech land to the north of Casuarina in the area known as Seaside City.

Condition 47 of the approval noted the following:

47 ***No approval shall be granted for development of any Management Lots unless the monitoring reports referred to in Condition 46 are sufficient to satisfy the Director of Development Services based upon advice from the National Parks and Wildlife Services that the plants are maturing in accordance with the programme set out in the Vegetation Management Plan. Each subsequent development application will detail the locations, timing and methodology of any further plantings proposed in accordance with Condition 42 above.***

Compliance with these conditions is addressed in Section 8 and Appendix D of this report..

The requirements of the Stage 1 Consent Approval were mitigated to some extent by subsequent conditions imposed on later development applications. The approval for Stage 2 of the development identified two areas where clearing of native vegetation was to be deferred so as to maintain feed stock until replantings were considered to be effective. These two areas were the Town Centre site (referred to as the commercial area in the approval) and an area now known as the Sands in the north-west of the Casuarina development. Condition 86 of that approval states:

v. ***In respect of the north-western area, as identified in the Gunninah report, clearing is to be deferred for a period of four years from 1 June 1999, or al alternative biological timeframe to be agreed between the applicant, NPWS and Tweed Shire Council.***

vi. ***In respect of the commercial area, clearing may commence within four years from 1 June 1999, in accordance with an agreed biological timeframe provided that adequate mitigation measures can be demonstrated to NPWS and Tweed Shire Council.***

Similar or identical conditions are generally included in the approvals granted for Stages 3, 4, 5, and 6 on Casuarina. These conditions have been interpreted as follows:

- Clearing of both the Town Centre site and the North-west Precinct could take place anytime after 1 June 2003.
- Clearing of the North-west Precinct could not occur prior to that date.
- Clearing of the Town Centre site could occur prior to that date provided that the mitigation measures referred to in the Stage 1 and Stage 2 approvals were successfully implemented.

On 11 November 2003, the Land and Environment Court (No 10686 of 1997) replaced Condition 47 with a new condition, reflecting the agreement by Tweed Shire Council and the National Parks and Wildlife Services that plantings completed up until that date were generally acceptable. A copy of the Court Order is contained in Appendix D. The attached letters (also in Appendix D) dated 26 April 2003 from Casuarina to the NPWS, and dated 7 August 2003 from NPWS to Tweed Shire Council outline the conditions of specifics of the agreement.

Provided that a number of relatively minor requirements were complied with (planting of an additional 3,000 Banksias, fencing of compensatory planting areas and fertilisation and irrigation of new planted areas), the issuance of subdivision certificates for Stages 6B and the Town Centre was approved subject to the lodgement of a $200,000 bond with Council.

All of these requirements have been satisfied.

Based on the condition imposed in Stage 2 as noted above, clearing and development of the Town Centre site can therefore take place at anytime after 1 June 2003 (4 years from the date of approval) without further reference to the Department of Environment and Conservation.

It is noted that the other deferred area, namely Stage 6B, was approved for development in 2003 by NPWS and has subsequently been cleared and developed. A copy of a letter dated 16 April 2003 from NPWS in this regard is attached in Appendix D. It states:

> ***NPWS acknowledges the previous agreement for the clearing of this site to commence after 1 June 2003***

There should be no doubt, therefore, that the Town Centre site can now be cleared, and that the only threatened fauna species identified as utilising the site will not be adversely affected by any works.

However, in order to provide further guidance on this matter, a detailed report on flora and fauna matters relevant to this site was prepared by Cardno in 2005, and is attached as Appendix C. The principal findings of that report are:

- Vegetation on the site has been significantly impacted upon by sand mining, and rehabilitation activities undertaken since the cessation of mining. The western part of the site was totally cleared during Coast Road construction activities, and now supports introduced grasses and minor regenerating shrubland. The eastern part of the site, which was also totally cleared during mining activities, is dominated by Coastal Banksia, Coast Tea-tree and Coastal Oak, with an understorey of lantana and bitou bush.

- There are no threatened flora species present within the proposed Town Centre site. The area does not support habitat or vegetation communities of relevance to any threatened plant species known to occur in the general locality. In particular, there are no rainforest or wetland habitats present.

- Threatened fauna species which are likely to occur in the area are limited to the highly mobile megachiropteran and microchiropteran bats. The Coast Banksia stands provide winter foraging resources for the Common Blossom Bat, the Black Flying Fox and the Grey-headed Flying Fox. However, the extent of this resource within the site constitutes only a very small part of the available foraging resource for individuals of these species within the locality. As noted above, the question of the impact of any clearing and development works on bat species has already been addressed in detail, and effectively signed off by the NPWS. The site is generally not suitable for other threatened species which are known to occur locally, including koala, the glossy black cockatoo and a number of wading and wetland bird species.

- An eight part test, in accordance with the then Section 5A of the Environmental Planning & Assessment Act, was carried out in respect of potential impacts of development on these bat species. It has been concluded that "a significant effect" is not likely to be imposed on "any threatened species, populations or ecological communities, or their habitats" as a consequence of the proposed works.

- As a consequence of the disturbed nature of the site, and the limited extent of suitable natural habitats and resources in the general locality, the proposed development is not regarded as having the potential for adverse impacts of concern on the natural environment.

It is noted that NSW legislation in relation to threatened species, populations and ecological communities has been amended and expanded since the ecological assessment was completed. Under Section 94 of the Threatened Species Conservation Act, the following must now be determined when considering whether an action will have a significant effect:

(3) The following factors must be taken into account in making a determination under this section:

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the risk of extinction,

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

This is now referred to as the seven-part test, in comparison to the previous eight-part test which was used in the ecological assessment in Appendix C. The Common Blossom Bat which is identified as a threatened species in the TSC Act has been the subject of a significant amount of previous investigation on this site, as well as the agreements reached between NPWS and the developer. We contend that this information clearly demonstrates that the proposed works are compliant with the requirements of the seven-part test for this species.

It is not our intention at this stage to commission further detailed site investigations into the flora and fauna present on this site. The updated information within the schedules to the Threatened Species Conservation Act has been checked, and it has been determined that there is little likelihood of any of the listed flora and fauna species, or ecological communities, being present on this site.

We note that this application will be placed on exhibition, providing ample opportunity for relevant Government agencies such as NPWS and the Department of Environment and Climate Change to make comment which can be dealt with on a case by case basis.

8.2 Banksia Amelioration Program

The Casuarina Beach (formerly Kings Beach) Banksia Amelioration Program has been in place for a period of approximately seven years. This program was required for compliance with relevant conditions of the Stage 1 development approval granted over the site, particularly in respect of replacing individuals of a number of species removed from the urbanised part of the site during the construction process.

A detailed report on the current performance of the program is attached as Appendix D, and can be summarised in the following table.

Species	Originally Planted	Losses to Date	Remaining Total
Banksia integrifolia	12,200	1,285	10,915
Banksia aemula	400	90	310
Callistemon pachypyllus	500	401	99
Callistemon salignus	500	406	94
Eucalyptus robusta	300	276	24
Eucalyptus teretecornis	100	92	8
Melaleuca quinquinerva	1000	495	505
TOTAL	**15,000**	**3,045**	**11,955**

The remaining trees on site are all considered viable, and have consolidated significantly since the date of original planting. Further losses are expected to be minimal.

In addition, 2,398 banksias have been planted on the Casuarina Beach development site itself, in compliance with condition 89(ii) of the Stage 6 approval, and other similar conditions for the previous development approvals. Butler and Webb Pty Ltd, landscape architects, have reviewed the growth performance of these plants, and have generally found that there has been excellent growth and minimal losses.

Lastly, in excess of 20,000 Banksias have been planted within Lot 500 as part of the Dune Management Plan on the eastern boundary of the site. Many of these specimens have now reached more than 4 m in height, and support considerable numbers of inflorescences.

The attached plan and associated photographs show the locations of the plants listed above, and some illustration of their existing condition as at 2002.

In April 2003, a further report on the provision of compensatory habitat for the common blossom bat was prepared by Gunninah Environmental Consultants. This report is also included in Appendix D.

9. CONTAMINATION

The Town Centre site is located between the Central and Northern Precincts in Casuarina. Previous investigations have determined the presence of radioactive sand in this general area, and this has been the subject of detailed assessment prior to release of the allotments in the Northern Precinct.

The radiation source in this area has been identified as an ilmenite spoil dump located close to the beach in the Northern Precinct. All radioactive material found during site investigations on the entire Casuarina site has been determined to originate from this source, with minor distribution occurring over the Northern Precinct during the construction phase. The ilmenite dump is centred over the eastern end of the existing drainage swale which forms the southern boundary of the Northern Precinct.

Limited investigations were carried out in the Town Centre area during the detailed radiation assessment for the Northern Precinct. The report for the North Precinct, including the results for the Town Centre site, is attached in Appendix E. These investigations consisted of the drilling of a bore (BH9) with down-hole monitoring of gamma radiation, as well as surface measurements along the southern edge of the swale, and through the existing cleared area west of the ridge. No surface monitoring was undertaken on the eastern part of the site because of thick vegetation which currently exists in that area.

The overall down-hole monitoring analysis shows that BH9 is likely to represent the southern edge of the ilmenite dump area. This information is presented on the attached Figures 1 and 2, reproduced from the detailed reports prepared for Council for the Northern Precinct in 2001 and 2002. Apart from minor gamma radiation counts at the surface, the only radiation present in BH9 is minor-range count information at depths in excess of 4.5 m.

Similarly, surface radiation monitoring (see attached SK No 18) showed that radiation levels at the top of the swale, along its southern boundary, are all below 0.4 µGray per hour, while those in the swale do not exceed 0.95 µGray per hour.

The NSW Department of Health has set the following action level criteria for the clean up and disposal of radioactive residues from mineral sands:

1.1 For dwellings, schools (including playground), businesses, factories, etc. where occupancies by the same individuals occur regularly on a day by day basis, the remedial action level should be 0.7 µG/hr for all points at 1 metre above the area of concern on the property.

1.2 For other areas, where occupancies are for a few hours per week by the same individuals or by differing individuals and for garden areas, the remedial action level should be 1.0 µG/hr for all points at 1 metre above the lowest surface of the area.

1.3 For roads, paths, and other areas with intermittent occupancy, the remedial action level should be 2.5 µG/hr for all points at 1 metre above the surface of the areas.

1.4 All values quoted above should include a value for normal natural background of 0.1 µG/hr.

The radiation levels recorded on site therefore indicate that there is no risk to health from this site. Nevertheless, it is acknowledged that further detailed site investigations, including surface assessment, should be undertaken before any works take place in the area or permanent occupation occurs. It is appropriate that this investigation take place after vegetation clearance has occurred, in a similar manner to previous approvals issued by Tweed Shire Council for developments in the South Kingscliff precinct.

10. ACID SULFATE SOILS

An Acid Sulfate Soils Management Plan has been prepared for the site, and is attached in Appendix F.

An Acid Sulfate Soils Investigation was undertaken by Sinclair Knight Merz in 1998 prior to the issue of the Stage 1 approval. A total of five boreholes and test pits were excavated within the area which is the subject of the current application, namely DP-5, BH2, AS-L, AS-A and BH4 running progressively from east to west. The locations of these sites are shown on the attached Figure 3 prepared by SKM. Dealing with each in turn, the following comments can be made

DP-5 Clean sand present over the full depth of 14.6 m, with maximum measured POS (percentage oxidisable sulphur) of 0.001%. It is noted that the ASSMAC limit for investigation is 0.03% S.

BH2 Clean sand present over the full depth of 10.0 m. Site testing gave nil result to PASS material, and samples were not subject to POCAS testing.

AS-L Clean sand present over the full depth of 4.45 m. PASS material present at depth within the profile, with a maximum of 74 mole/tonne of H^+ ion. This is equivalent to about 0.12% sulphur, and would require a minimal liming rate of about 5 kg of $CaCO_3$ per tonne of soil.

AS-A Clean sand present over the depth of 2 m. Groundwater encountered at 1.5 m depth. PASS material present at depth within the profile, with a maximum of 38 mole/tonne of H^+ ion. This is equivalent to about 0.06% sulphur, and would require a minimal liming rate of about 3 kg of $CaCO_3$ per tonne of soil.

BH4 Silty sand and sand present over full depth of 5.0 m. Groundwater encountered at depth of 1.5 m. PASS material present at surface and depth within the profile. Maximum sulfidic acidity of 32 mole/tonne of H^+ ion found at surface, equivalent to 0.05% sulphur, which would require a minimal liming rate of 2.5 kg of $CaCO_3$ per tonne of soil.

All of the investigation sites which disclosed PASS material are on the western side of the site, in the area where ground levels are at, or slightly below 5.0 m AHD. The eastern part of the site has existing surface levels consistently above 10.0 m AHD. The minimum final surface level for that part of the site east of Casuarina Way will be about 7.0 m AHD. Given that acid sulfate soils are rarely found at levels above 5.0 m AHD, and the results of the site investigation, it seems very unlikely that any PASS materials will be disturbed during the construction phase on this part of the site. Douglas Partners, which completed earlier Acid Sulfate Soils Investigation of the site in 1995 and 1997, determined that the eastern part of the site was located in a sandy terrain unit known as Qs_1, with virtually no acid sulfate potential down to the minimum level of excavation which was about 2.0 m AHD.

The liming rates calculated for the investigation sites on the western side of Lot 223 are all low, and present no issue in respect of management. Based on the results, an Acid Sulfate Soils Management Plan (ASSMP) has been prepared, and all material disturbed on the western part of the site below 5.0 m AHD will be treated as PASS until confirmed otherwise.

11. CLIMATE CHANGE ISSUES

As a result of the recent decision in *Walker v Minister for Planning* [2007] NSWLEC 741, it has been determined that the Minister, in determining the potential impact of a project, is bound to consider the effects of climate change.

The principal issue on this site in respect of climate change is the potential for sea level rises to occur. This is turn will lead to increased erosion impacts, and affect the location of the 50 year erosion line and the 7(f) zone area.

These matters have been addressed in detail in the Tweed Coastline Hazard Management Study completed by WBM Oceanics for Tweed Shire Council in October 2007. The study specifically takes into account the likely effects of sea level rise on shoreline recession, as noted in the following extract from the executive summary of the report:

> ***Climate Change and Sea Level Rise***
>
> *Climate change associated with the enhanced Greenhouse Effect has the potential to influence shoreline recession through a rise in mean sea level and changes to the prevailing wind/wave climate. The latest estimates of global mean sea level rise have been derived from IPCC (1996) with the best estimates for the years 2050 and 2100, relative to 1990, being 0.2m and 0.5m respectively.*
>
> *The assessed range of calculated best-estimate shoreline recession distances, based on the Brunn Rule, for beaches in the study area is 10 to 25m respectively for the above years. There is still considerable debate and research with respect to future sea level rise and the impacts due to the related issue of storminess and changes to the prevailing wave climate. The derived values should be reviewed as more information comes to hand.*

It is further noted that the 2007 version of the study, including the above allowances for sea level rise, predicts lesser erosion setback requirements than are currently adopted in Council's LEP. That is, if the latest WBM findings were reflected in the LEP, the 50 year erosion line and the western boundary of the 7(f) zone would both move seawards in comparison to the currently designated positions. It is noted that these current positions have been used in the siting of allotments and buildings, thereby ensuring that the proposed development actually has a higher level of erosion protection than called for by the LEP, even taking into account the effect of climate change and sea level rise.

Cardno Lawson Treloar has recently undertaken a coastal hazards assessment for the Sandon Point Development near Wollongong in NSW, following refusal of a development application by the Land and Environment Court, NSW. For that work cognisance of the NSW Governments flooding policy was partially relevant. Additionally, as well as storm erosion hazard, it was important to assess the ocean inundation hazard. Finally, it was necessary to consider the range of possible climate change outcomes, not just the mean results alone.

WBM discuss climate change generally in their Section 4.10. A good general discussion is provided. Their Table 4.4 provides a realistic range for low, best estimate and high estimates for future sea level rise. Note that the reference to IPCC (1996) will now be out of date and that IPCC (2007) is current. Nevertheless, the MSL parameters presented by WBM are slightly conservative and can be considered appropriate. The NSW Government has recently released a guideline document for climate change scenarios which should be considered in floodplain risk management (DECC, 2007). This document is increasingly becoming the basis for investigating potential sea-level rise impacts along the NSW coast.

WBM then describe how the 'best estimate' MSL parameter values were applied in the 'Bruun Rule' to estimate possible future shoreline recession.

In terms of other climate change issues, WBM conclude that there is insufficient reliable information to develop a study program for that matter. On the basis of McInnes et al (2007), we agree with that position.

WBM (2007) presents coastal erosion hazard extents for Kingscliff. The hazard extents include outcomes from a detailed investigation of long-term shoreline change in the area. The variability of long-term shoreline recession rates is addressed through the presentation of minimum,' best-estimate', and maximum erosion hazard extents for 50 and 100-year planning periods. For each planning period, mid range sea-level rise scenarios have been included in the erosion hazard extent. A sensitivity investigation applying low and high range sea-level rise scenarios to the WBM (2007) erosion hazard extents should be considered.

The design water levels (storm tide), leaving aside shoreline wave set-up, adopted by WBM are 1.24, 1.30 and 1.35m AHD at the 20, 50 and 100-years ARI, see their Table 4.3, and are based on a storm tide study undertaken for the Gold Coast by James Cook University in 1977. Hence these levels are not site specific. Also, at this location, it is likely that east coast low systems will cause slightly higher storm tides, at least up to 100-years ARI. Australian National Tide Tables show that (HAT - MSL) is 1.0m at Gold Coast Seaway and 1.1m at Kingscliff. Hence it is likely that the adopted storm tide levels are perhaps 0.1m too low for Kingscliff. In overall terms, however, and given that WBM estimated that the 7(f) zone line could move significantly east of the position which has been maintained by Council, the effect of this change would not have affected the outcome of the study.

It can be safely concluded that the information upon which Council has relied to set the position of the 7(f) zone line adequately accounts for climate change effects.

12. TOTAL WATER CYCLE MANAGEMENT

In keeping with Tweed Shire Council's Engineering Guidelines, the engineering design standards to be applied to the Town Centre development will strongly incorporate Water Sensitive Urban Design (WSUD) principles. Cardno has been paramount in implementing WSUD in Tweed through its involvement in a number of major development projects in the Shire.

These projects include previous stages of Casuarina and SALT, where innovative stormwater management practices were developed specifically for the unique nature of the South Kingscliff coastal strip. In particular, stormwater management on these sites involves capture and retention of virtually all runoff from the site, which provides a sustainable resource for recycling, as well as substantially reducing contaminant loads in Cudgen Creek and the Pacific Ocean. Substantial effort was expended during the approval and design phases of these projects to ensure optimal outcomes. The success of the stormwater systems since implementation, as acknowledged by Council engineering officers, is a reflection of this effort.

The use of infiltration basins throughout Casuarina and SALT directs a significant amount of stormwater to the existing freshwater aquifer underlying the site. Water from this aquifer has been used extensively for irrigation on the two sites, as well as for sewer make-up purposes. The effect of this reuse has been that no potable water from Council's municipal system has been required for either broad scale management of public open space or for maintenance of make-up flows in the sewerage system.

In the sewerage system alone, the potable water saving in the initial stages of Casuarina was 100 ML per year by reusing stormwater for pumping make-up purposes.

The capture and storage of stormwater runoff in natural aquifer systems is a well-recognised and highly economic way of maintaining an available non-potable water source on site. In many situations, this technique is not available because of difficulties such as the absence of a suitable aquifer system, or the inability to achieve an efficient injection process. However, in this case, the aquifer underlying the Cudgen peninsula (i.e. between the Pacific Ocean and Cudgen Creek) is recognised as a state resource by New South Wales, and is ideal for the continued storage of runoff.

It should be noted that the establishment of infiltration basins over the site simply replicates the behaviour of the pre-developed area, where the overwhelming majority of rainfall occurring on the site was infiltrated into the ground whence it flowed out to east (Pacific Ocean) and west (Cudgen Creek) as the groundwater level increased. Urbanisation of a catchment leads to increased stormwater runoff and decreased infiltration as a result of the creation of increased impervious area such as roads and roofs. The infiltration basins have been sized to accommodate the 3 month design event from the local catchment, which means that more than 90% of the rainfall occurring on the site is captured and diverted to infiltration. This is comparable with the pre-development condition.

Water quality monitoring carried out on previous stages of Casuarina and SALT has demonstrated that the quality of water in the aquifer has remained unaffected by the infiltration system. The stormwater solution proposed for the Town Centre site has been approved by both Council and the Department of Natural Resources on all previous stages.

It is noted that detailed numerical modelling using the MODFLOW program was undertaken in respect of the SALT development, where the construction process had the potential to cause adverse impacts on the quality of the aquifer. It was found, and confirmed by monitoring, that neither the construction process, nor the removal of a relatively small volume of water for irrigation and sewer make-up purposes, caused any significant change to either the quality or volume of water in the aquifer. This modelling showed that a volume of water many times greater than that extracted for anthropogenic purposes was lost by outflow from the system every day.

In respect of reuse, there is also potential for the use of individual rain water tanks for house and other development sites in the Town Centre. This practice is, of course, already available to all residents.

It should be noted that the Casuarina project was awarded the National Award for Excellence from the International Erosion Control Association for its stormwater management systems. Recently, Council's Director of Planning Services has publicly acknowledged the value of these systems in Casuarina and SALT, especially in respect of performance during the recent flooding events. At this time, no stormwater was discharged from the site to Cudgen Creek, with all runoff successfully infiltrated without damage on site. The water entering the aquifer in this way is therefore available to all residents of Casuarina and SALT, as well as Council, to reduce reliance on Council's municipal systems.

Cardno has a very strong track record in the introduction of WSUD in development projects, and is committed to ensuring that the outcomes on the Town Centre site comply with Best Management Practice.

13. DRAINAGE AND WATER QUALITY MANAGEMENT

13.1 General

The existing frontal and east-west swales on this site contain infiltration basins which were sized to accommodate any future development of this precinct. However, the redevelopment of the site will remove the east-west swale, and modify the frontal swale. The recon touring of the site will also alter the drainage patterns in a way which was not envisaged at the time that the original hydraulic and water quality analyses were undertaken.

The major implications of these changes are as follows:

- The filling of the east-west swale will remove a number of small infiltration basins which were sized to accommodate the low level (i.e. 3 month average recurrence interval) developed stormwater runoff from Lot 223, as well as part of the previously developed Northern Precinct. However, the redevelopment of the frontal swale will enable additional infiltration capacity to be provided in this location to compensate for the loss.

- The reshaping of the site will direct all flow on the site away from the frontal swale, and to the west (i.e. towards Casuarina Way and the Coast Road) and north. The drainage paths for the finished site are shown on figure DA24. This represents a departure from previous design practice on Casuarina, where the eastern parts of the site drained initially to the frontal swale, and then west to Cudgen Creek. The lack of available filling material on Lot 223 prevents such an outcome from being achieved.

- The finished site will be divided into four catchments, as shown on figure DA36. The south-eastern catchment, representing the majority of the site, will drain to the west, to an infiltration basin to be constructed at the south-eastern corner of the supermarket site. This basin requires a surface area of 1,600 m^2 and will be a maximum of 0.5 m deep. It is proposed that this basin will be dedicated as open space to Council.

- The north-eastern catchment, i.e. that part of the site north of the Town Centre Main Street and east of the newly constructed section of Casuarina Way, will drain northwards to the boundary of the site (and towards the previous alignment of the east-west swale. There is sufficient open space available within this site to accommodate the required 600 m^2 area of infiltration at a maximum depth of 0.3 m. These basins will form part of the resort to be constructed on this site, and will remain in private ownership.

- The north-western catchment, i.e. that part of the site north of the Town Centre Main Street and west of Casuarina Way, will drain to its south-western corner, and into an infiltration basin with an area of 300 m^2 and a maximum depth of 0.3 m. This basin is proposed to be dedicated as public open space to Council.

- The south-western catchment, i.e. the supermarket site, will drain to its south-western corner, and thence into the unreconstructed part of the east-west swale which will be retained in the playing field area. The swale has sufficient capacity to handle the runoff from this site without overtopping. Consequently, no discharge from the supermarket site or any other area will be directed onto the playing fields. Prior to draining out, low flows from the car park areas will be directed to grass infiltration swales for treatment of car park surface runoff. Higher flows will be directed into a stormwater pipe system located under the grassed infiltration swales and directed to the Atlantis cells prior to discharge to the existing swale at the south west corner. All roof water will be discharged directly to the Atlantis cells.

- Approximately 100 m^2 of infiltration area will be required to handle the 3 month design runoff, and this infiltration system will be located within the supermarket site and will remain the responsibility of the supermarket operator.

The design procedure for sizing the infiltration basins noted above is identical to that used on all other Casuarina sites, i.e. a maximum infiltration rate of 12 m/day, and basins sized with a factor of safety of 2. All open basins will consist of bare sand vegetated sparsely with dune grasses and spinifex, similar to the existing basins present on the site.

13.2 East-West Swale

The remaining element of the stormwater management system on this site is the replacement of the existing overland flow swale with underground stormwater drainage pipes. This swale lies within a Drainage Easement, and was not dedicated as Drainage Reserve because of its temporary nature. The land upon which the easement was placed remains as private property in the ownership of Kings Beach No 2 Pty Ltd.

The drainage design premise within the Casuarina Development has generally been to carry stormwater runoff to the frontal swale which runs along the entire length of the site, with flow in excess of infiltration capacity to be then directed westwards to the Coast Road. This western discharge occurs in two locations, namely the east-west swale between the Town Centre and the Northern Precinct (which is designed to carry developed runoff from those two areas) and the Central Park in Central Precinct, which is designed to carry developed runoff from the Southern and Central Precincts.

During the development of the Northern Precinct, the east-west swale was constructed as a temporary channel to convey stormwater from those two sites to drainage outlet 11, and subsequently to Cudgen Creek. The location of the drainage outlet, now represented by a culvert beneath the Coast Road, is shown on figure DA36. It can be appreciated that, at the time of that construction and subsequently, the Town Centre site, including the drainage swale, has remained in an undeveloped state.

As a consequence of the change to the drainage catchments on the Town Centre site which will result from the reshaping of the land, the peak rate of flow being delivered to the swale reduces significantly. By utilizing the existing flood storage capacity in the frontal swale for North Precinct and the Town Centre, the peak rate of discharge can be further reduced, to the point where the open channel can be replaced by a relatively minor drainage system.

The need for an open channel to carry the overland flow has therefore been obviated by a change in design, and the value and residential amenity of the site to be created dictates that a piped solution is significantly preferable. While the filling of the swale will remove a number of minor infiltration basins which were located along its length, these can be more than adequately replaced by the creation of similar infiltration systems in the frontal swale. It is noted that the existing cycle way/walkway located along the frontage of the site was also a temporary structure, provided solely to allow connection between the North and Central Precincts. Reconstruction of the cycle way in this area to a standard similar to that present in developed parts of Casuarina will allow installation of additional infiltration capacity without any adverse impact on public amenity. It is likely that the majority of the required basins will actually be sited in 7(f) zone areas which will be dedicated as Open Space following completion of the project.

It is noted that the southern overflow system in Casuarina was designed coincident with the Central Park, and only operates during storm events with Average Recurrence Intervals in excess of 5 years. The operation of this system has caused no concerns with the use, management or maintenance of the park facilities, and there is no doubt that Central Park is a much more aesthetically pleasing feature than the current east-west swale.

If the swale was retained in its current condition, it would also form a substantial barrier to movement in the north-south direction. Its removal and replacement with an open space corridor will provide significantly improved pedestrian and bicycle access from Northern Precinct residences when the Town Centre becomes operational.

Detailed hydraulic analysis has been undertaken to assess the likely performance of the replacement pipe system for the east-west swale. It has been determined that a pipe installation equivalent to 4 x 900 mm diameter pipes will be sufficient to carry the required 10 year Average Recurrence Interval (ARI) design runoff from the Town Centre site and the Northern Precinct. The analysis demonstrates that the maximum depth of ponding which will occur at the culvert inlet at the northern end of the frontal swale will be less than 900 mm for this event, i.e. equivalent to the diameter of the pipe. For larger events, the frontal swale will act as a storage basin attenuating the peak rate of discharge to be taken by the pipe system. The maximum depth of inundation at the intake point will be about 1.5 m for the 100 year ARI event.

It is noted that these depths are consistent with those that would be experienced in the frontal swale for the South Precinct under similar hydrologic conditions. Provided that the cycle way/walkway is sited above the peak flood level, which is achievable, the risk to open space users during this extreme event is considered small, particularly given that the maximum velocity of flow in the swale will be of the order of only 0.3 m/s.

14. HERITAGE

This site, in common with the entire South Kingscliff coastal strip, has been subject to very significant land surface disturbance in the past. A study of historical aerial photography and other site history information has determined that extensive sand mining took place over the subject site between 1956 and 1975, with the result that no pre-existing surface information now remains.

During the construction of the SALT site approximately 2 km to the north of the proposed Town Centre development, the Tweed Byron Local Aboriginal Land Council was consulted in respect of the archaeological values of the area. The following comment was made by the Land Council:

> **Sandmining has disturbed/destroyed Aboriginal cultural heritage since the 1940s. Due to the disturbance and years of sand mining of this property we were unable to determine whether there were any Aboriginal artefacts on this area, therefore the Tweed Byron Local Aboriginal Land Council has no objection to development of this property.**

It is expected that a similar finding would apply to this area. Further, it is noted that archaeological investigations completed as part of the Stage 1 Consent Approval of the Casuarina development did not disclose the presence of any sites or artefacts of relevance to either indigenous or European settlement heritage considerations. In addition, no such sites or artefacts have been identified during the development of either Casuarina or SALT.

It is therefore considered that it is extremely unlikely that any remnants of either Aboriginal or European cultural value exist on the site. Nevertheless, a relevant component will be incorporated in the construction Environmental Management Plan (Appendix B) to ensure that if any artefacts are uncovered during excavation and construction these will be brought to the attention of the Sites Officer of the Tweed Byron Local Land Council for investigation.

15. CONSULTATION

The Casuarina consulting team has met frequently and regularly with Government Departments, Tweed Shire Council and other regulatory agencies in the period since the Stage 1 Consent Approval was issued by the Land and Environment Court in 1999. Following that decision, a number of meetings were held with Tweed Shire Council planning and engineering staff prior to the lodgement of further Development Applications for each stage of the project.

The Development Application for Stage 2 of the development (Southern Precinct) was lodged with Council in early 2000. Following that lodgement, the consulting team entered into long discussions and negotiations with Council in respect of the form and detail of the development. Issues which were discussed and agreed at that time included:

- Approval by Council of the water quality management regime proposed for the site, primarily involving the use of Gross Pollutant Traps to handle stormwater runoff from parking and other hardstand areas, and infiltration basins located in the frontal open space swales on the eastern boundary of the site. Relevant parameters for the management of stormwater runoff, such as catchment areas, acceptable infiltration rates and on-site infiltration capacity, were discussed and agreed.

- Approval of the hydraulic (flooding) regime proposed for the site, whereby flow on the eastern part of the site was directed towards the frontal swales, and then carried along the swale before being discharged westwards eventually to Cudgen Creek. The overall drainage solution for the site was discussed in detail and agreed.

- Approval by Council of the form and type of cycleway to the provided in the frontal swale system.

- Approval by Council of the road hierarchy to be adopted throughout Casuarina.

- Approval by Council of the plan to provide sewerage and water supply services to all future stages of Casuarina.

These meetings were an invaluable part of the process, enabling the underlying principles of the development to be established and agreed at the very start of the development process. Subsequent meetings were held with Council in relation to each later stage of the development, but were significantly reduced in scope because of the general agreements reached. All engineering infrastructure provision issues were agreed as part of the Stage 2 approval, producing a streamlined outcome for later applications.

Meetings were also held at this time with officers of the then Department of Land and Water Conservation (DLWC) and its successors, the Department of Infrastructure, Planning and Natural Resources (DIPNR) and the Department of Planning (DoP). Discussions at that time centred on two principal areas - firstly, the impact of development on Lot 500, and secondly, DIPNR's concurrence role in the 7f erosion protection zone which runs along the entire frontage of the Casuarina site. These meetings were also successful and the outcomes have been used to guide development outcomes on the site since that time.

The Department also had a substantial role to play in respect of the approval and implementation of the Dune Management Plan, which sought to rehabilitate areas on the dunal system east of Casuarina so as to maintain adequate protection against both wind and water erosion. The Department of Lands was also involved in this process.

Discussions with the National Parks and Wildlife Service (NPWS) and the Environmental Protection Authority (EPA) had also been held prior to the issuing of the Stage 1 approval, relating specifically to the potential clearing of vegetation on the site and the impacts on the common blossom bat. Subsequent discussions were held with those authorities, and their successor, the Department of Environment and Climate Change, in relation to management and approval of environmental issues relating to the site, including dust management during construction.

Agreement was reached with NPWS (Mr Gary Davey) in or about 2003 that resulted in their agreement that lands known as the Town Centre (the subject land) and the North West Precinct could then be cleared of vegetation. This agreement was based upon the earlier provision of compensatory planting and the payment of the sum of $200,000.00 towards the revegetation of other areas nearby. Discussions were also held with the Department of Fisheries in respect of potential water quality impacts resulting from discharge of stormwater to Cudgen Creek.

Discussions were also held with the Rural Fire Services Authority in Sydney originally with Mr Graeme Douglas and then others. Agreements were reached in terms of the widths of asset protection zone in respect of all lands adjoining the coastal walkway / cycleway and approvals have since issued in line with agreements reached. Further meetings were held with Tweed Shire Council (administrators and officers) on the 22nd January 2008 and on 1st April 2008 at which the nature and extent of the subject application was presented and discussed.

In all cases, agreement was reached in relation to proposed actions, and the development of Casuarina has proceeded in accordance with these agreements since that time.

It is considered that substantial and on-going consultation has taken place with Tweed Shire Council and relevant Government Departments and Agencies since the Casuarina development project commenced.

16. DIRECTOR GENERAL'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

By letter dated 17 January 2007, the Department of Planning provided DGRs for the environmental assessment of the project for a Concept Plan. In terms of the matters considered in this engineering report, the following requirements are applicable:

Water Cycle Management and Watercourses
Address potential impacts on the water quality of both surface and groundwater.
Address and outline measures for Integrated Water Cycle Management (including stormwater) based on Water Sensitive Urban Design Principles, including impacts on the surrounding environment.

5.0 Hazard Management and Mitigation

5.1 Address the requirements of Planning for Bushfire Protection 2001 (or relevant policy).

5.2 Identify any contamination on site (particularly the presence of radioactive sands) and, if necessary, appropriate mitigation measures in accordance with the provisions of SEPP 55 – Remediation of Land.

5.3 Identify the presence and extent of acid sulfate soils on the site and, if necessary, appropriate mitigation measures.

6.0 Infrastructure

6.1 Address existing capacity and requirements of the development for sewerage, water, electricity, telecommunications, waste disposal and gas in consultation with relevant agencies

7.0 Flora and Fauna

7.1 Outline measures for the conservation of flora and fauna and their habitats within the meaning of the Threatened Species Conservation Act 1995, in particular, the Common Blossom Bat habitat identified within and adjacent to the site.

7.2 Consider impacts of clearing on native vegetation.

8.0 Heritage

8.1 Identify whether the site has any significance to Aboriginal cultural heritage and identify appropriate measures to preserve any significance (refer to draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation and Interim Community Consultation Requirements for Applicants).

8.2 Identify any other items of European heritage significance and provide measures for conservation of such items.

Each of the required items has been addressed in detail in the preceding sections.

17. CONCLUSIONS

The following issues have been considered in detail in respect of the proposed development of this site:

- Earthworks and clearing
- Ecological issues
- Roads and access
- Bushfire
- Infrastructure
- Stormwater drainage
- Erosion and sediment control
- Drainage
- Water quality
- Acid sulfate soils
- Water Cycle Management
- Contamination
- Heritage
- Consultation
- Climate Change
- Compliance with previous development approvals

It has been determined that adequate design and construction management will ensure that any impacts on the existing environment can be satisfactorily ameliorated.

The development will comply with:

- Tweed shire Council's development control plans, regulations and standards.
- Public Works Department design guidelines for sewer.
- Department of Housing guidelines for soil and water management.
- Environmental Protection Authority draft guidelines for managing urban stormwater.

The site will be developed to complement surrounding and adjacent developments.

It can be concluded that there are no reasons why the development application should not be approved.

APPENDIX A

SEWERAGE AND WATER SUPPLY PLANNING INFORMATION

Cardno MBK
Engineering the Future

Our Ref 7083/01 :tj

Contact Dr Trevor Johnson

18 September 2003

FAXED 22.9.2003

The General Manager
Tweed Shire Council
PO Box 816
MURWILLUMBAH NSW 2484

By Facsimile: 02 6670 2483

Attention: Mr Michael Rayner

Dear Sir

CASUARINA DEVELOPMENT PRECINCT
REGIONAL SEWERAGE UPGRADE PLANNING

I refer to our discussions earlier this year in relation to the upgrading of the sewerage system from the Casuarina precinct to the Chinderah Treatment Plant. We have now completed a detailed analysis of the current system, and determined an appropriate staged upgrade path for this system. We believe that this upgrade path represents the most economic way to proceed with the augmentation of the system to accommodate planned future development.

In this regard, the following development areas have been considered in this analysis:

- Casuarina Beach
- Kings Forest
- SALT
- Seaside City
- Lot 490

You should note that, with the exception of Lot 490 which remains under Council guardianship, we now provide relevant consulting services to all of the existing and planned developments listed above. We have permission from each of the developers to negotiate a successful outcome for the sewerage upgrade requirements. This provides a major benefit to Council, in that it need deal only with Cardno MBK in resolving the entire precinct sewerage matter.

In determining the upgrades required, we have reviewed the Kingscliff Sewerage Strategy Study – An Analysis of the Sewerage Catchment of the Kingscliff Sewage Treatment Plant, prepared by Council in February 2002. I have adopted the pump station and rising main nomenclature adopted in that report, so that comparisons between that document and our current report can be easily made.

Cardno MBK (Qld) Pty Ltd
ABN 57 051 074 992

A member of the Cardno group of companies

5 Gardner Close Milton Q 4064
PO Box 388 Toowong
Queensland 4066 Australia
Telephone: 07 3369 9822
Facsimile: 07 3369 9722
International: +61 7 3369 9822
Email: cardno@cardno.com.au
Web: www.cardno.com.au

Cardno MBK Offices:
- Brisbane 07 3369 9822
- Sydney 02 9496 7700
- Gold Coast 07 5539 9333
- Sunshine Coast 07 5443 2555
- Townsville 07 4772 1166
- Hervey Bay 07 4124 5455
- Central Coast 02 4323 2558
- Port Moresby + 675 325 2322
- Philippines+ 632 635 5343
- Indonesia + 62 21 831 0361
- Sri Lanka + 94 94155
- Portland, USA + 1 888 554 5022

Cardno Willing Offices:
- Sydney 02 9496 7799
- Darwin 08 8981 3613
- Port Moresby + 675 325 4606

Cardno BLH Office:
Castle Hill, Sydney 02 9894 6577

Cardno CCS Office:
- Cairns 07 4033 2995

I note that the Council report envisages a number of parallel rising mains to service the various developments, with separate infrastructure supplied by each developer between its site and the treatment plant. While this concept provides a clean solution, in that there is no conflict in relation to the use or cost of shared mains, it is inefficient overall, and would lead to significantly higher operating costs for Council when it accepts the individual systems.

Given our position as consultant for all relevant developers, we are confident that a more cost-effective solution can be derived to suit all parties. This may involve developer construction of some infrastructure, with recovery of costs from headworks offsets.

1. Tweed Shire Council Pipeline and Pump Station Nomenclature

The following descriptors for various pump stations in the existing or proposed sewerage system are used by Council in the Kingscliff Sewerage report:

Table 1
Casuarina Precinct Pump Stations

Name	Description	Catchment Area
PS4025	Casuarina sub-regional pump station, previously designated as PS2 in Casuarina planning	Casuarina
PS4023	Kings Forest regional pump station	Kings Forest
PS4030	SALT sub-regional pump station	SALT and Seaside City
PS4032	South Kingscliff Gateway pump station	Lot 490
PS4008	Cudgen pump station on Chinderah Road	Cudgen

Rising mains from each pump station to the treatment plant are described by the same number as the pump station, as follows:

- SRM4025 Rising main from Casuarina (PS4025)
- SRM4023 Rising main from Kings Forest (PS4023)
- SRM4030 Rising main from SALT (PS4030)
- SRM4032 Rising main from Lot 490 (PS4032)
- SRM4008 Rising main from Cudgen (PS4008)

As noted above, the thrust of the Council report is that each pump station will deliver to the treatment plant via its own rising main. We believe that it will be significantly more efficient to adopt a staged development program, as per the following analysis.

2. Existing Conditions

The current sewerage system consists of the 225 mm diameter main installed by Casuarina, which runs from PS4025 along Old Bogangar Road and Chinderah Road to PS4008. Flow at that point is diverted into Council's existing 150 mm diameter main which runs from PS4008 to the treatment plant. A standpipe has been installed at the high point near the intersection of Old Bogangar Road and Cudgen Road to reduce the flow rate in the pipe system under normal flow conditions, and prevent motor overload. Under wet weather conditions, the system is pressurised over its entire length, and operates as a rising main.

The overall capacity of the present system is governed by the 150 mm diameter main downstream of PS4008. While the system is sufficient to handle the approved sections of Casuarina (totalling 394 ET), any increases will require augmentation or replacement of the final section of pipeline.

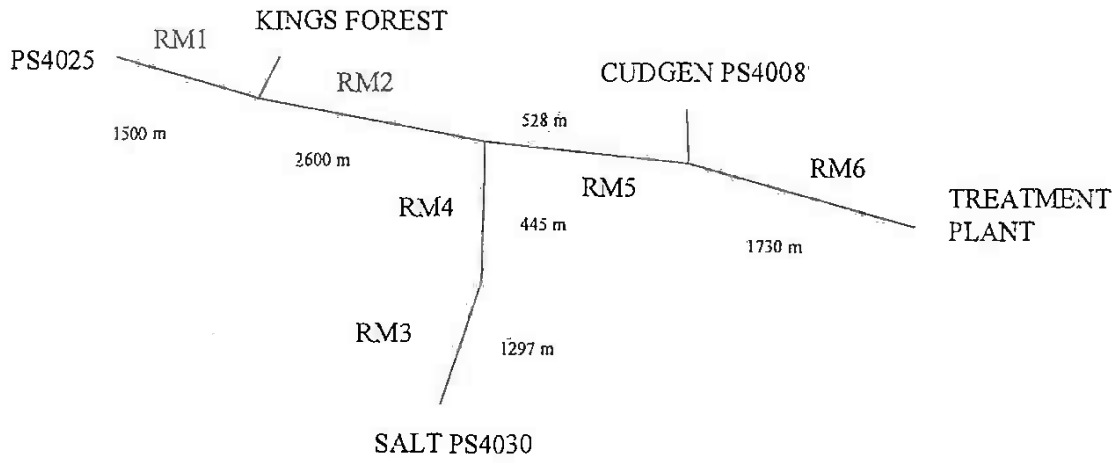
3. Ultimate Conditions

Based on information supplied by each of our clients, as well as agreements reached with Council, the ultimate populations of each development have been determined to be as follows. It is noted that these values are in some instances different from those used by Council in the Kingscliff study. However, they are based on the most up-to-date information from each developer, and are therefore considered to be more reliable.

Table 2
Ultimate Populations for Each Development Site

Development	Ultimate Population (ET)
Casuarina	1,540
SALT	908
Seaside City	330
Lot 490	400
Kings Forest	4,000

Pipe lengths for the ultimate system, on the assumption that the treatment plant is in its current position, are given in the following not-to-scale sketch. It is also assumed in this analysis that the South Kingscliff Gateway pump station (PS4032) will not be required, and that the SALT pump station (PS4030) will handle flows from Lot 490 as well as from SALT and Seaside City.



It is apparent that the rising main descriptions used by Council can not be applied in this case, and the simple epithets RM1 to RM6 have been used in the analysis as shown on the sketch. It is noted that existing mains RM1, RM2 and RM5 constitute the 225 mm diameter main installed for Casuarina.

Based on the ET values listed above in Table 2, the following flow rates have been calculated for each pump station, based on the requirements of Council's DCP16 and the PWD Sewage Design Manual. It has been further assumed in this analysis that the flow from the Cudgen pump station PS4008 will be accommodated via a separate rising main, in accordance with the Kingscliff study. In the first instance, this will be achieved simply by maintaining the existing 150 mm diameter rising main which connects PS4008 to the treatment plant. Flow from Casuarina will therefore no longer utilise this line when upgrading occurs.

Table 3
Pump Station Ultimate Flows

Pump Station	Ultimate Population (ET)	ADWF (L/s)	r	PDWF (L/s)	SF (L/s)	PWWF (L/s)
Casuarina 4025	1,540	13.6	2.2	29.4	89.3	118.7
Kings Forest 4023	4,000	35.2	1.9	68.3	232.0	300.3
SALT 4030	1,638	14.4	2.2	31.1	95.0	126.1

Design flow rates for each rising main can therefore be calculated as follows:

Table 4
Rising Main Ultimate Flows

Rising Main	From	Peak Flow Rate (L/s)
RM1	PS4025 to PS4023	118.7
RM2	PS4023 to Standpipe	419.1
RM3	PS4030 to High Point	126.1
RM4	High Point to Standpipe	126.1
RM5	Standpipe to PS4008	545.1
RM6	PS4008 to Treatment Plant	545.1

The following ultimate main sizes have therefore been optimally determined, based on maintaining the use of the existing 225 mm diameter Casuarina main, and adopting a staging strategy which will be explained in the next section.

Table 5
Rising Main Ultimate Pipe Sizes

Rising Main	Peak Flow Rate (L/s)	Ultimate Pipe Sizing
RM1	118.7	2/225 mm diameter
RM2	382.4	2/225 mm diameter + 375 mm diameter
RM3	126.1	2/225 mm diameter
RM4	126.1	300 mm diameter
RM5	508.5	2/225 mm diameter + 375 mm diameter
RM6	508.5	2/375 mm diameter

4. Staging

Staging of the proposed sewerage system is a complex matter, because of the different timings involved with each separate development. In several instances, ie for Kings Forest, Seaside City and Lot 490, relevant development approvals may be several years away, and it is clearly impossible to predict with any accuracy when and how the different developments will come on line. The key to any overall planning strategy will therefore be to build flexibility into the implementation of the system, particularly by considering staging using multiple parallel mains.

At present, there are current or pending development approvals for two of the sites listed above. SALT received planning approval from Council in April 2003. Stage 1 of the project is currently under design, and will yield 300 residential lots and 493 resort apartments, which will in turn produce 596 ET.

Casuarina lodged a Development Application for the North-west precinct in early 2003, which is currently under review by DIPNR. A further Development Application for part of the site between the southern and central precincts was also lodged in this time period. Both Casuarina sites together will generate about 256 ET, which, together with the existing 394 ET in Casuarina, will produce a total demand of 650 ET.

Consequently, the expected total sewerage loadings for Casuarina and SALT by the end of 2004 will be:

- Casuarina 650 ET
- SALT 596 ET

The corresponding PWWF values are 51.6 and 47.5 L/s respectively. On the basis of current information, it is not expected that any development approvals will be in place for the remaining developments sites within this same time frame.

Under this scenario, the only upgrade required to the existing Casuarina pipeline is to exclude PS4008 and the existing 150 mm diameter RM6 from the Casuarina system, and install a replacement 375 mm diameter main from PS4008 to the treatment plant.

Under normal conditions, this main will flow under gravity conditions, only pressurising and flowing as a rising main when significant wet weather flows occur. It is very unlikely that there will be any septicity issues associated with this change.

A similar scenario will operate in RM4, with a switch between gravity and pressure flow occurring as the flow rate increases during wet weather. The mains sizing required to meet 2004 conditions will therefore be as shown in the table on the next page.

Table 6
Rising Main Current Stage Pipe Sizing

Rising Main	Peak Flow Rate (L/s)	Staged Pipe Sizing
RM1	51.6	1/225 mm diameter
RM2	51.6	1/225 mm diameter
RM3	47.5	1/225 mm diameter
RM4	47.5	300 mm diameter
RM5	99.1	1/225 mm diameter
RM6	99.1	1/375 mm diameter

This presents a simple, and very cost-effective solution. It enables both Casuarina and SALT to satisfy sewerage demands for their current respective development applications, while ensuring an upgrade path which is entirely consistent with ultimate development planning for the Casuarina precinct. Under this scenario, the duty points for PS4025 and PS4030 would be approximately as follows under full pressurised conditions:

- Casuarina PS4025 51.6 L/s @ 64.0 m
- SALT PS4030 47.5 L/s @ 36.3 m

Specific upgrade requirements beyond the current stages of development are impossible to determine, since they are highly dependent upon the timing and quantum of development approvals granted for Kings Forest, Seaside City and Lot 490. However, the proposed ultimate system enables a high degree of flexibility to be built into the final solution.

For example, one possible, although very unlikely, scenario, is that Casuarina and SALT could reach full development before any other development comes on line. Under these conditions, the peak flow rates from each area would be 118.7 and 126.1 L/s respectively. These flows could be adequately carried by the following solution:

Table 7
Rising Main Interim Stage Pipe Sizing

Rising Main	Peak Flow Rate (L/s)	Staged Pipe Sizing
RM1	118.7	2/225 mm diameter
RM2	118.7	2/225 mm diameter
RM3	126.1	2/225 mm diameter
RM4	126.1	300 mm diameter
RM5	244.8	1/225 mm diameter + 375 mm diameter
RM6	244.8	1/375 mm diameter

The requisite duty points would be:

- Casuarina PS4025 118.7 L/s @ 82.0 m
- SALT PS4030 126.1 L/s @ 55.0 m

A major benefit of this upgrade system is that mains RM5 and RM6 will operate as gravity mains for normal flow conditions for all cases. It should be noted that there is also one substantial difference between the proposed solution, and that derived by Council in the Kingscliff Sewerage Study. The proposed solution requires multiple parallel pipelines operating in unison as a single system. By contrast, Council's solution requires operation of multiple individual systems.

It can also be noted that the provision of 1/375 mm diameter main in the place of the current 150 mm diameter RM6 provides a very significant amount of upgrade capacity. Since this system will normally operate as a gravity main, there are no detrimental impacts which would be associated with the normal provision of an oversized rising main. When pressurised flow does occur, the significant amount of wet weather dilution at this time will prevent any problems.

6. Current Upgrade Requirements

In order to facilitate the current SALT and Casuarina development approvals/applications, it will be required that RM6, running from PS4008 to the treatment plant, be augmented by a 375 mm diameter pipeline. Obviously, there is also the requirement to construct the first stage of RM3 (1/225 mm diameter line), and RM4 (1/300 mm diameter line), so as to connect SALT to the existing Casuarina main at the intersection of Old Bogangar and Cudgen Roads.

7. Section 64 Infrastructure Contributions

It is our view that all of the works outlined in the ultimate solution above constitute infrastructure which should rightly be offset against the relevant components of the Section 64 plan. The multiple pipeline approach addresses concerns which have previously been raised in respect of potential septicity, and is therefore an appropriate design method for the ultimate case scenario.

In addition, this approach allows the retention and continued use of the existing 225 mm diameter Casuarina main in a cost-effective way. It is noted that construction of this pipeline, and associated PS4025, did not attract any headworks rebates or credits. Utilisation of this system therefore provides a cost benefit to the community and Council, in comparison to what would be required if it was abandoned, and all works were undertaken in accordance with, and attracted headworks credits from, the Section 64 plan.

It is therefore proposed that the following construction responsibility and funding scheme be adopted for the current upgrade requirements:

- SALT will construct the ultimate 2/225 mm and 1/300 mm diameter mains to extend from the SALT site to Old Bogangar Roads, including the underbore beneath Cudgen Creek. All pipeline costs will be offset against the relevant Section 64 contributions for sewage transport infrastructure. Only 1/225 mm diameter main will be operational for the first stage of the development, with the second to be sealed until required.

- SALT will construct PS4030, sized to accommodate the design flows from SALT, Seaside City and Lot 490. The cost of the structure, and associated electrical controls, will be offset against the relevant Section 64 contributions for sewage transport infrastructure.

- SALT will install a pump set in PS4030 to meet planned stage 1 requirements. The cost of this pump set will not be a headworks credit unless it can be demonstrated that it will form part of the ultimate sewerage solution.

- A makeup water system, involving extraction of groundwater, will be required during the initial stages of development, so as to supplement actual sewage flows. The cost of these works will not be a headworks credit.

- It is not expected that any oxygen injection system will be required to facilitate the SALT development. However, if it is determined that such a system is required, it will be provided by the developer and there will be no offset against headworks.

8. Conclusions

The ultimate sewerage scheme outlined in Section 3 and Table 5 above represents an optimal approach to the delivery of services to the existing and proposed developments at Casuarina, SALT, Seaside City, Lot 490 and Kings Forest.

The proposed scheme allows for flexible augmentation of the existing system, so as to accommodate different timing and development planning for the sites mentioned. In addition, it addresses the requirements in relation to potential septicity by providing smaller lines for the initial stages of each development.

It is our view that all of the pipeline works should be undertaken by the relevant developers, either singly or in concert, with the cost of the works offset against infrastructure contributions that would otherwise be payable in respect of Council's Section 64 plan.

I trust that the information which has been provided is clear. If required, we can provide an Excel spreadsheet which sets out the calculations supporting the flow rate, pump head and pipeline sizing analyses presented above. After you and your technical staff have had an opportunity to review the data provided, I believe that it would be helpful if we could have a workshop in Council's offices to refine the overall solution.

If we can provide any further assistance in this matter, please do not hesitate to contact the undersigned.

Yours faithfully

Dr Trevor Johnson
Director
for **Cardno MBK**

cc: Steve Coote GCO
Robbie Marshall GCO
Steve Macrae 5593 1233
Steve Pink 3221 7202
Frank Wilson 3849 2960

Please Quote Council Ref: DW951444

Your Ref No:

For Enquiries Please Contact: Ms Alexandra Abedrabbo

Telephone Direct (02) 6670 2484

I01s32

03 February 2004

Cardno MBK
Commercial Centre
Isle of Capri
GOLD COAST QLD 4217

Dear Sir

Regional Sewerage Upgrade Planning for the Casuarina, Kings Forest, Salt, Seaside City and Lot 490 Developments and Associated Section 64 Contributions

I refer to your letter dated 18 September 2003 and advise that the proposed upgrade strategy as detailed is acceptable in principle. Before Council can adopt the proposed strategy a detailed conceptual design should be prepared. This conceptual design should provide detailed analysis of the current system, interim system and ultimate system including:

- Pump sizing, taking into consideration pump performance at SPS 4025 and SPS 4030 and future Kings Forest pumping station when pumping in parallel during wet weather;
- All necessary upgrades to the current infrastructure system to accommodate ultimate system requirements (i.e. electrical cabling, pump and well size, roof slab openings etc);
- Location and details of the valve chamber at the point of connection of the Salt main to the Casuarina main. (Please note that the chamber will need to be constructed in the current stage in its ultimate configuration to allow for future staged connections).

I would like to bring to your attention the following inaccuracies in your Report. Reference to the current duty point at SPS 4030 SALT as 47.5l/sec @ 36.3m rather than the approved duty of 70l/sec @ 49m head. Because SPS 4030 is currently under construction the review of the SPS 4030 design in light of the proposed system will need to be conducted as soon as possible. The review should include modelling of SPS 4030 and SPS 4025 and future Kings Forest pumping station performance in parallel operation for current, interim and ultimate stages. It should be clarified at what stage generator installation would be required. Also, it should be noted that SPS 4025 at Casuarina has an existing duty point of approximately 71l/sec @ 60m head not 51.6l/sec @ 64m as stated in your Report.

Council disagrees with Cardno MBK's view that all works outlined in the ultimate solution of the Report constitute infrastructure which should be offset against the conveyancing component of the Section 64 Contribution Plan.

.../2

VALLEY OF CONTRASTS
CIVIC AND CULTURAL CENTRE, MURWILLUMBAH
P.O.BOX 816, MURWILLUMBAH, N.S.W. 2484
TELEPHONE: (02) 6670 2400 FAX: (02) 6670 2429
PLEASE ADDRESS ALL COMMUNICATIONS TO THE GENERAL MANAGER
ABN 90 178 732 496
www.tweed.nsw.gov.au

UPGRADE TO INTERIM SYSTEM

- Salt to construct the ultimate 2 x 225mm and 300mm diameter mains from the Salt development to Old Bogangar Road, including Cudgen Creek crossing and valve pit at the point of connection to 225mm diameter Casuarina main. Council will pay the marginal difference in the construction cost of the above infrastructure required to service areas other than the Salt development.
- Salt to construct the sewerage pumping station 4030 at Salt in its ultimate configuration including electrical works required for ultimate development and future generator connection.
- Council to pay the marginal difference in the construction cost of the sewerage pumping station required to service Seaside City and Lot 490.
- Seaside City to pay for the third pump which will be required to upgrade the pumping station mechanical capacity to ultimate requirements and install a generator at the time of connection to the Salt sewerage system.
- Council will meet the cost of the extension from the existing 225mm diameter rising main downstream of the Cudgen pumping station to the sewage treatment plant and Chinderah. This main will be extended as a 375mm diameter pipe. Council is currently undertaking design of this rising main. Commissioning of the rising main is expected sometime in October.

UPGRADE TO ULTIMATE SYSTEM

- Council will meet the cost of all ultimate upgrade requirements from the regional sewerage pumping station at Kings Forest to the existing sewerage treatment plant as required to meet the development demand. Council will also meet the cost of relocation of the rising mains to the new sewerage treatment plant site when completed.

The estimated cost of Council's share of the proposed works is $7.28M. The conveyancing component of the head works charges from the proposed development (development yield as estimated in the above mentioned report) 7.28M.

A full Section 64 Contribution is required. This arrangement is consistent with previous advice given to all developers and is consistent with Salt development consent conditions.

I trust this advice clarifies Council's position on this matter.

Yours faithfully

Mike Rayner
Director
<u>ENGINEERING SERVICES</u>

Our Ref 7083/03 :tj

Contact Dr Trevor Johnson

3 March 2004

FAXED

By Facsimile: 02 6672 7513

The General Manager
Tweed Shire Council
PO Box 816
MURWILLUMBAH NSW 2484

Attention: Ms Alexandra Abedrabbo

Dear Alex

SALT DEVELOPMENT
EXTERNAL SEWER WORKS IN CHINDERAH ROAD

I refer to our recent meeting at your offices in relation to this matter, and your relevant letter to our Gold Coast office of 3rd February 2004. I have reviewed the design information which was previously sent to you (my letter dated 18th September 2003) and have derived the same upgrading sizes that you recommended at the meeting.

Using the same mains descriptions has in my letter of 18th September, the ultimate configuration will therefore consist of the following, which I understand is identical to Council's requirements.

Table 5
Rising Main Ultimate Pipe Sizes

Rising Main	Description	Ultimate Pipe Sizing
RM1	Casuarina to Kings Forest	2/225 mm diameter
RM2	Kings Forest to Cudgen Hill	2/375 mm diameter
RM3	SALT to Cudgen Road	2/225 mm diameter
RM4	Cudgen Road to Cudgen Hill	300 mm diameter
RM5	Cudgen Hill to PS 4008	2/375 mm diameter
RM6	PS 4008 to Treatment Plant	2/375 mm diameter

I also note your requirements that the system from Kings Forest be designed to operate stand-alone. The design for this system will include cross-connections between the parallel 375 mm diameter mains, so that operational flexibility is maintained as much as possible.

Cardno MBK
Engineering the Future

Cardno MBK (Qld) Pty Ltd
ABN 57 051 074 992

A member of the Cardno group of companies

5 Gardner Close Milton Q 4064
PO Box 388 Toowong
Queensland 4066 Australia
Telephone: 07 3369 9822
Facsimile: 07 3369 9722
International: +61 7 3369 9822
Email: cardno@cardno.com.au
Web: www.cardno.com.au

Cardno MBK Offices:
- Brisbane 07 3369 9822
- Sydney 02 9496 7700
- Gold Coast 07 5539 9333
- Sunshine Coast 07 5443 2555
- Townsville 07 4772 1166
- Hervey Bay 07 4124 5455
- Central Coast 02 4323 2558

Port Moresby + 675 325 2322
Philippines + 632 635 5343
Indonesia + 62 21 831 0361
Sri Lanka + 94 94155
Portland, USA + 1 888 554 5022

Cardno Willing Offices:
- Sydney 02 9496 7799

Darwin 08 8981 3613
Port Moresby + 675 325 4606

Cardno BLH Office:
Castle Hill, Sydney 02 9894 6577

Cardno CCS Office:
- Cairns 07 4033 2995

In regard to the requirements for the SALT development, the 2/225 mm and 300 mm diameter mains between the new SALT regional pump station and the intersection of Cudgen Road and Old Bogangar Road have already been approved and are under construction. The remaining item in the sewerage system for SALT is therefore the construction of a single 375 mm diameter main (RM5 and RM6) between this intersection and the treatment plant.

On the basis of the agreement with Mike Rayner, I note that general sewage transfer charges will not be payable, since all relevant works will be undertaken by the applicant. I further note that Council intends to relocate the treatment plant to the southern side of Chinderah Road at some time in the future. I understand that the implication of this will be that section 64 contributions will be payable by the developers to fund the additional connection costs at that time.

My calculations show that the 375 mm diameter main will also provide sufficient additional capacity to cater for the latest development applications for Casuarina (Lot 54 and North West Precinct) which have been lodged with DIPNR for approval. We will be separately negotiating with Casuarina in regard to the financial implications of this, and Council will be informed when we have reached agreement.

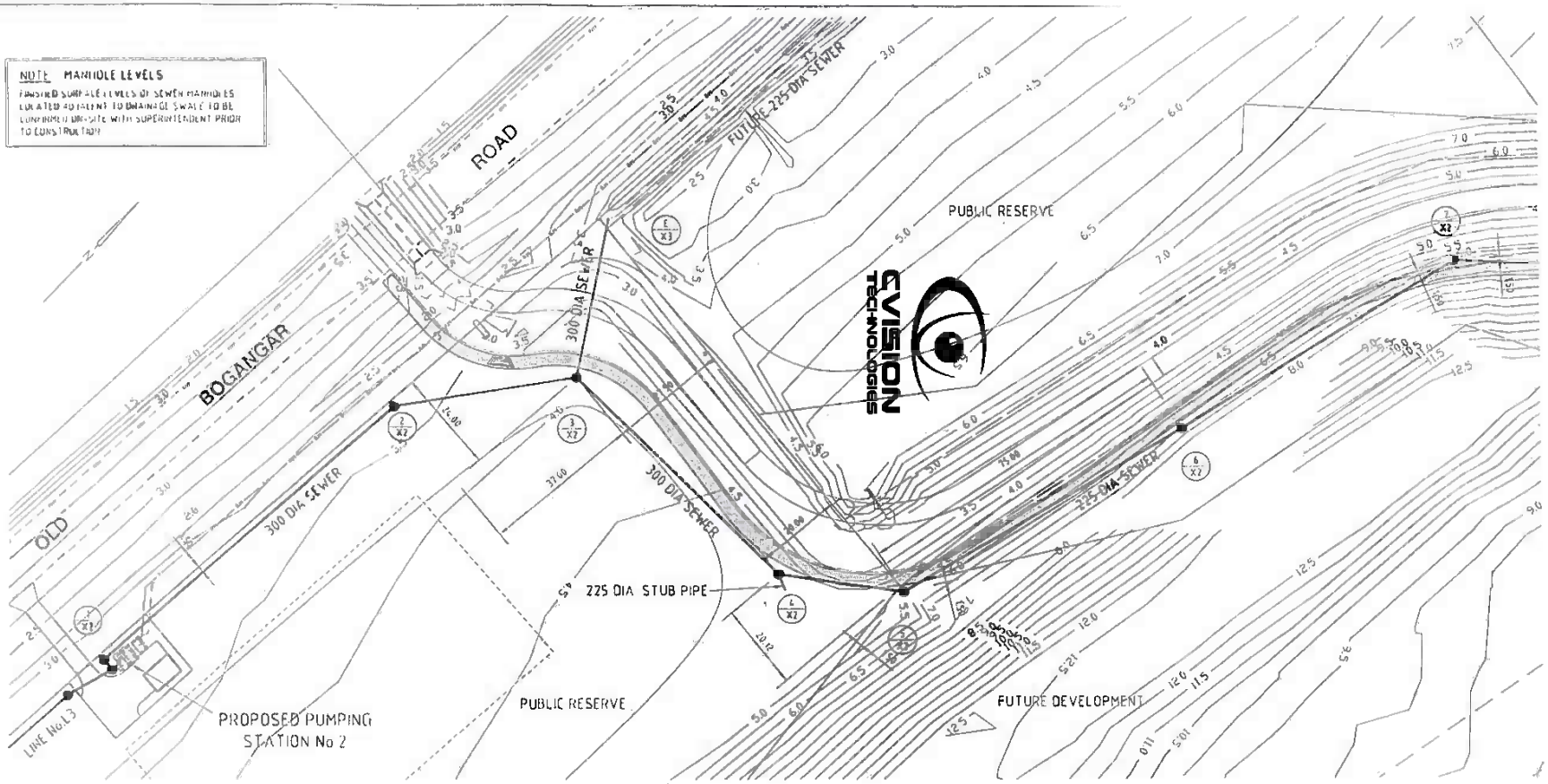
Design, approval and construction of the 375 mm diameter main from the Cudgen Road intersection are now important issues for the SALT project. We intend to commence design of this pipeline within the next couple of days, since detailed survey is now available. I assume, on the basis of our previous discussions, that the information presented above accords with your understanding of the agreed process. Members of my design team will contact you in the next few days to confirm this, and to also discuss specific design requirements that you might have.

I trust that this information is clear. If any clarification is required, please do not hesitate to contact me.

Yours sincerely

Dr Trevor Johnson
Director
for Cardno MBK

cc: Robbie Marshall GCO



PLAN
1:500

NOTE EASEMENTS OVER SEWERS
ALL SEWERS LOCATED IN PRIVATE PROPERTY TO BE CONTAINED WITHIN AN EASEMENT OF 10 METRES MIN WIDTH UNLESS NOTED OTHERWISE

NOTE MANHOLE COVERS
ALL SEWER MANHOLE COVERS LOCATED ALONG DRAINAGE SWALE TO BE MACHINE FINISHED TO ENABLE A "GAS TIGHT" CONNECTION TO MANHOLE ENTRY

LEGEND

- EXTERNAL SEWER MAIN
- SEWER MAIN AND MANHOLE
- HOUSE CONNECTION
- SEWER MANHOLE NUMBER / LINE NUMBER
- PROPOSED STORMWATER

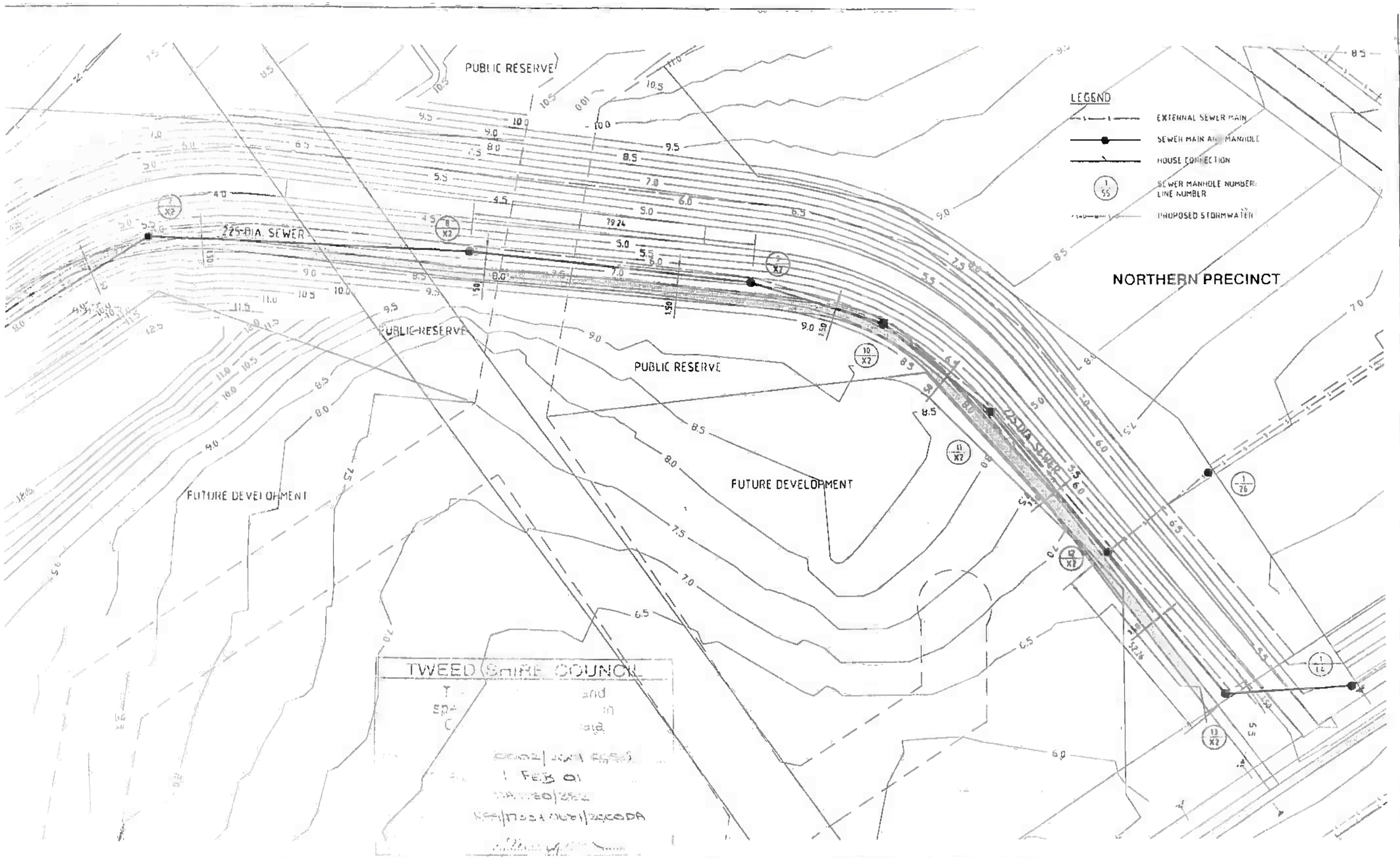
SEWERAGE RETICULATION NOTES

1. UNLESS NOTED OTHERWISE THE SEWER ALIGNMENT SHALL BE 1.5m GENERALLY FROM THE FRONT AND SIDE PROPERTY BOUNDARIES WITHIN THE ALLOTMENTS AND 1.0m FROM THE REAR BOUNDARY OF THE ALLOTMENT
2. ALL PIPES AND FITTINGS SHALL BE UPVC CLASS SEN UNLESS NOTED OTHERWISE.
3. THE MINIMUM CLEAR COVER TO ALL PIPEWORK SHALL BE 1.0m
4. ALL CONNECTIONS TO LIVE SEWERS TO BE CARRIED OUT UNDER SUPERVISION OF TWEED SHIRE COUNCIL AT THE DEVELOPER'S COST
5. ALL CONSTRUCTION SHALL BE IN COMPLIANCE WITH TWEED SHIRE COUNCIL REQUIREMENTS, N.S.W.P.W.D STANDARD DRAWINGS AND SPECIFICATIONS AND AS 3500
6. MANHOLE TYPES AND DROPS ARE AS DETAILED ON N.S.W.P.W.D DWG No S1.5008
7. SEWER MANHOLES TO BE FINISHED 25mm ABOVE FINISHED SURFACE LEVEL
8. SIDELINES SHALL BE AS DETAILED ON N.S.W.P.W.D DWG S1.5030 WITH THE FOLLOWING EXCEPTIONS
   a) NOTE 1 - ALL SIDELINES SHALL BE 150Ø
   b) NOTE 14 a) - A MAXIMUM OF 2 SIDELINES ARE PERMITTED ON A RISER TO SERVE ADJACENT PROPERTIES
   NOTE 14 d) - ONLY ONE CONNECTION IS PERMITTED TO EACH SIDELINE
   c) SQUARE TEES FOR RISERS ARE REPLACED BY Y JUNCTIONS AND ARE ALWAYS CONCRETE ENCASED
9. FOR SEWER LONGITUDINAL SECTIONS, REFER TO DWG Nos 7079/1/50-161 AND 162
10. SIDELINES AND STANDARD JUNCTIONS ARE AS DETAILED ON N.S.W.P.W.D DWG No S1.5030
   - TYPE A: TO SEWERS AT DEPTHS LESS THAN 2.00m
   - TYPE B: TO SEWERS AT DEPTHS GREATER THAN 2.00m

10 5 0 10 20 30 40m 1:500
SCALE BEFORE REDUCTION

TWEED SHIRE COUNCIL

			A1	DATUM: A.H.D.	Cardno MBK	CONSOLIDATED PROPERTIES GROUP PTY LTD
						CASUARINA BEACH DEVELOPMENT EXTERNAL SEWERAGE WORKS LINE No.X2 - PUMP STN. No 2 TO MH.//X2 LAYOUT PLAN
						7079/1/50-159 A



NOTE: MANHOLE LEVELS
FINISHED SURFACE LEVELS OF SEWER MANHOLES LOCATED ADJACENT TO DRAINAGE SWALE TO BE CONFIRMED ON SITE WITH SUPERINTENDENT PRIOR TO CONSTRUCTION.

NOTE: EASEMENTS OVER SEWERS
ALL SEWERS LOCATED IN PRIVATE PROPERTY TO BE CONTAINED WITHIN AN EASEMENT OF 3.0 METRES MIN WIDTH UNLESS NOTED OTHERWISE.

NOTE: MANHOLE COVERS
ALL SEWER MANHOLE COVERS LOCATED ALONG DRAINAGE SWALE TO BE MACHINE FINISHED TO ENABLE A "GAS TIGHT" CONNECTION TO MANHOLE ENTRY.

SCALE BEFORE REDUCTION 1:500

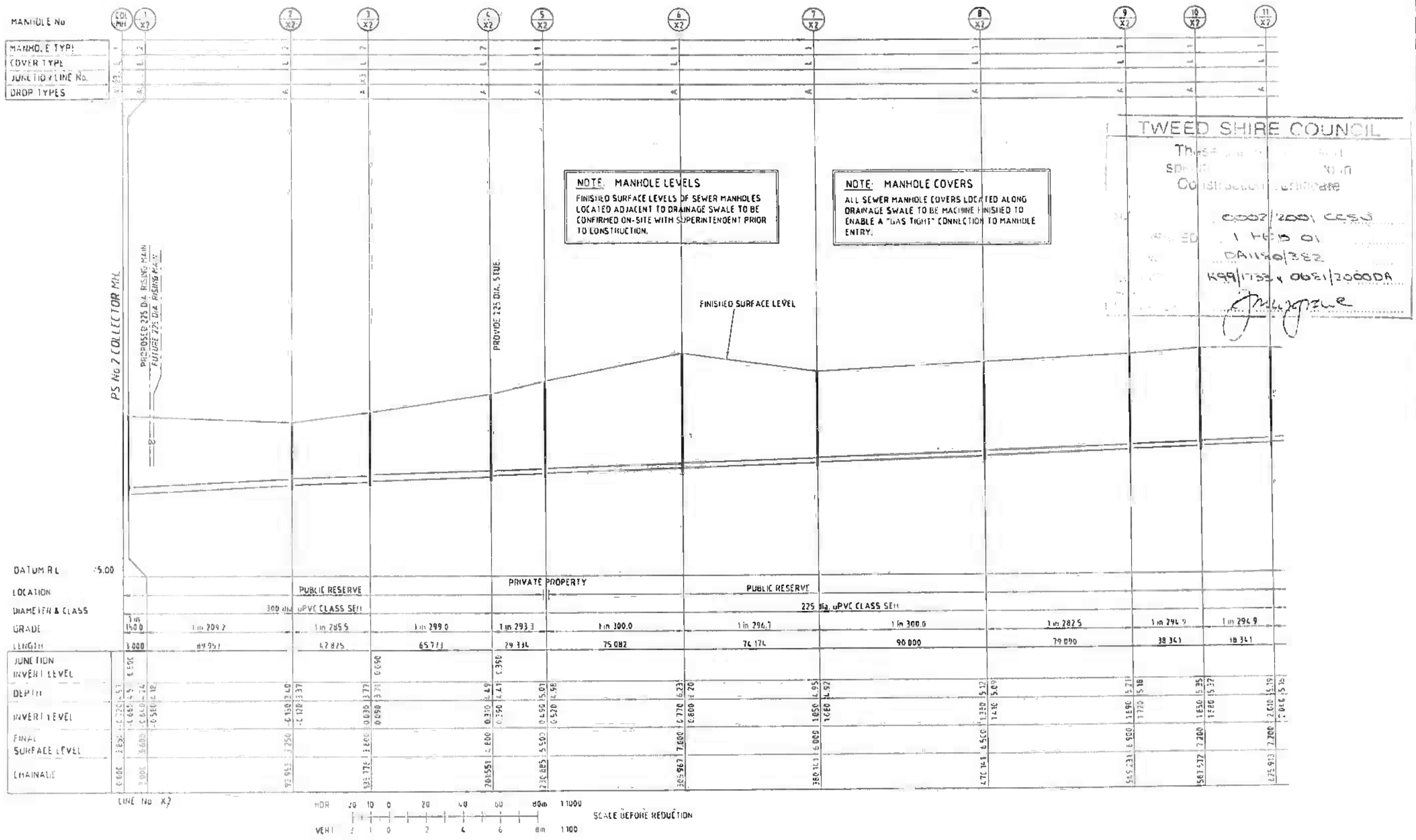
A | REVISED TO COUNCIL

A1 | DATUM A.H.D.

Cardno MBK
Cardno MBK (Qld) Pty Ltd

CONSOLIDATED PROPERTIES GROUP PTY LTD
CASUARINA BEACH DEVELOPMENT
EXTERNAL SEWERAGE WORKS
LINE No.X2 - MH.7/X2 TO MH.1/14
LAYOUT PLAN

7079/1/50-160 | A



A1 DATUM: A.H.D.

Cardno MBK

Cardno MBK (Qld) Pty Ltd

CONSOLIDATED PROPERTIES GROUP PTY LTD
CASUARINA BEACH DEVELOPMENT
EXTERNAL SEWERAGE WORKS
LINE No.X2 - PUMP STN. No 2 TO MH.11/X2
LONGITUDINAL SECTION

7079/1/50-161 A

MANHOLE No.	11/X2	12/X2	13/X2	1/L4
MANHOLE TYPE			1 2	2
COVER TYPE			1	1
JUNCTION LINE No		32E		
DROP TYPES	A		A	A

JOINS NORTH PRECINCT INTERNAL SEWER

DATUM R.L. -5.00

	11/X2 – 12/X2	12/X2 – 13/X2	13/X2 – 1/L4
LOCATION		PUBLIC RESERVE	
DIAMETER & CLASS		225 dia uPVC CLASS SEH	
GRADE	1 in 283.5	1 in 283.5	1 in 290.8
LENGTH	51.022	51.022	34.895

	11/X2	12/X2	13/X2	1/L4
JUNCTION INVERT LEVEL		2.300		
DEPTH	5.15 / 5.18	4.38 / 4.55	4.17 / 4.13	2.11 / 2.08
INVERT LEVEL	2.010 / 2.040	2.220 / 2.250	2.430 / 2.470	2.550 / 2.620
FINAL SURFACE LEVEL	7.200	6.600	6.600	4.700
CHAINAGE	625.913	676.935	727.957	762.848

LINE No X2

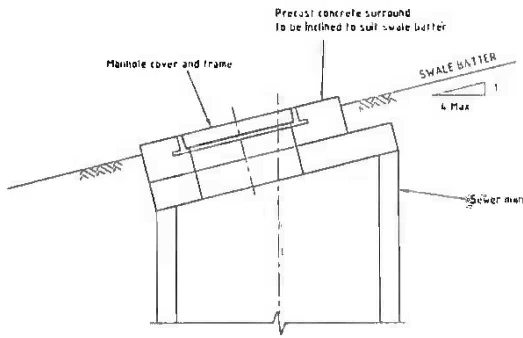
HOR. 20 10 0 20 40 60 80m 1:1000

VERT. 2 1 0 2 4 6 8m 1:100

SCALE BEFORE REDUCTION

NOTE: MANHOLE COVERS
ALL SEWER MANHOLE COVERS LOCATED ALONG DRAINAGE SWALE TO BE MACHINE FINISHED TO ENABLE A "GAS TIGHT" CONNECTION TO MANHOLE ENTRY.

NOTE: MANHOLE LEVELS
FINISHED SURFACE LEVELS OF SEWER MANHOLES LOCATED ADJACENT TO DRAINAGE SWALE TO BE CONFIRMED ON-SITE WITH SUPERINTENDENT PRIOR TO CONSTRUCTION



TYPICAL MANHOLE SECTION
N.T.S

TWEED SHIRE COUNCIL

A1 DATUM: A.H.D.

Cardno MBK

Cardno MBK (Qld) Pty Ltd

CONSOLIDATED PROPERTIES GROUP PTY LTD
CASUARINA BEACH DEVELOPMENT
EXTERNAL SEWERAGE WORKS
LINE No.X2 - MH.11/X2 TO MH.1/L4
LONGITUDINAL SECTION

7079/1/50-162 A

Cardno
Shaping the Future

WATER SUPPLY REPORT

Casuarina Town Centre

12th June 2008
Job No. 7079/4- 2

Kings Beach (No.3) Pty Ltd

Cardno (Qld) Pty Ltd

ABN 57 051 074 992

Commercial Centre

Isle of Capri, Gold Coast

Queensland 4217 Australia

Telephone: 07 5539 9333

Facsimile: 07 5538 4647

International: +61 7 5539 9333

gco@cardno.com.au

www.cardno.com.au

Document Control

Version	Date	Author		Reviewer	
		Name	Initials	Name	Initials
2	12th June 2008	S Walter	SW	A Cunningham	AC
1	13 August 2007	S Walter	SW	A Cunningham	AC

CASUARINA TOWN CENTRE

CASUARINA BEACH

WATER SUPPLY REPORT

TABLE OF CONTENTS

1.0 INTRODUCTION

Cardno were commissioned to undertake a hydraulic assessment to determine the adequacy of the water supply infrastructure proposed for the Casuarina Town Centre Development located on Casuarina Way, Casuarina Beach. The town centre consists of approximately 56 allotments ranging in size from 450m^2 up to 2.1ha. The intended uses of the lots include standard residential, medium density, retail and commercial.

The development is located within the existing Casuarina Beach development and covers approximately 19ha.

A water analysis of the site will be required to confirm the proposed system adequately meets the council's water supply requirements for such a development. The area is currently serviced by Tweed Shire Council's water reticulation system. This stage of the development will provide a link between the existing Central Precinct and Northern Precinct of the Casuarina Beach Development along Casuarina Way.

The preliminary network layout consists of a main running through the centre of the site along Casuarina Way, joining into the existing networks to the north and south of the development. The northern section of the main is 250mm in diameter, between the proposed shopping centre (lot 1) and the existing 450mm diameter main to the north of the site. This reduces to a 150mm main through the southern portion of the site. The existing connection point at the northern end of the site is a 150mm diameter stub from the existing 450mm diameter trunk main. It is proposed to connect the 250mm main to the existing 150mm dia stub. 100mm and 150mm diameter reticulation lines will run off the main in Casuarina Way to service the remaining portion of the development.

2.0 DESIGN CRITERIA

The design criteria adopted for TSC's Development Design Specification D11, Water Supply (June 2004).

Unit Consumption – Peak Instantaneous Demands

- Up to 1000 Tenements PID = 0.15 L/s/ET
- Over 1000 Tenements PID = 0.10 L/s/ET

Fire Fighting

Fire Flow (Residential Buildings) = 11 L/s
Fire Flow (Commercial Buildings) = 22 L/s

Minimum allowable residual pressure during fire flow and PID = 12 m

Residential Pressures

- Minimum allowable pressure = 22 m
- Maximum allowable pressure = 80 m

Hazen-Williams Coefficient

The following Hazen Williams Roughness Coefficients were adopted for this study assuming all pipes were made of DICL.

Nominal Diameter (mm)	Roughness Coefficient (C)
100-150	100
>150-250	110
>250 <450	120

Existing pressure conditions (Obtained from Council)

The following water reticulation hydraulic grade lines (HGL's) were obtained from Council for the points to the north and south of the proposed development. The HGL's allow for future development and a 3DMD scenario, so allow for the worst expected case within the network. The HGL to the north and south of the site are 58.3m and 61.5m AHD respectively.

3.0 DEVELOPMENT POPULATION AND FLOW

The population and flow projections for the water supply investigation were developed from the total number of proposed allotments in the development, as well as an allowance for the park areas shown in the lot layout.

The total number of equivalent tenements is 843 ET giving a potential equivalent population of 5661 EP. **Appendix A** shows the number of tenements serviced by each node, along with the estimated population and expected demand. A peak instantaneous demand of 0.1L/s/ET was adopted for the analysis as the Casuarina Beach development exceeds 1000 ET's.

4.0 WATER NETWORK ANALYSIS

A H2ONET water network modelling analysis has been carried out for the proposed internal reticulation of the development. Using the initial Hydraulic Grade Lines (HGL's) of 61.5m AHD for the southern connection and 58.3m AHD for the northern connection, the residual pressures at all lots under normal use were above the 20 metres required. The water reticulation analysis results for the pressures at each junction are shown in **Appendix B**. Node J74 returned the lowest expected pressure with 45.49m of head. This node represents the largest of the medium density areas and is also the greatest distance from the main water reticulation running through the site.

The fire flow analysis was carried out to determine whether the proposed system could provide the required 11L/s and 22 L/s flow volumes to the residential and commercial areas respectively and throughout the reticulation system. The model was re-run after applying a fire flow to nodes at the extremities of the network and at all expected commercial locations. The minimum residual pressure was 45.49 metres of pressure head at node J74. As mentioned previously, node J74 represents one of the medium density areas located on the higher, eastern portions of the site. With the addition of fire flow (22L/s) to the existing flows, it was found that the head losses observed when using a smaller 100mm diameter pipeline were minimal and the proposed reticulation system can adequately service the lot.

The full results from the analyses are provided in **Appendix B**, with the water reticulation layout and node numbering system included in Sketch No. 31 in **Appendix C**.

5.0 CONCLUSION

Based on the analysis of the site undertaken with the water reticulation modelling software H2Onet, the site can be adequately serviced to the level required by the Tweed Shire Council by the existing water reticulation network.

APPENDIX A

LOT INFORMATION AND DEMAND DATA

Cardno

Town Centre, Casuarina Beach

Demand Data

Occupancy		3.2	EP
Maximum Hour		900	L/EP/day
	=	0.0208	L/EP/s
Max Day Max Month		2.25	times average day
	=	0.0469	L/EP/s
	=	0.1000	L/ET/s

Node	Approx RL	No of Units (ET's)	EP's per Dwelling	EP	Demand (l/s)
J10	7.75	2.0	3.2	6.4	0.20
J12	8	40.4	3.2	129.28	4.04
J14	8.25	53.6	3.2	171.52	5.36
J18	7.5				
J20	6	11.0	3.2	35.2	1.10
J22	5.5	7.0	3.2	22.4	0.70
J24	6.75				
J26	6.75	56.0	2.2	123.2	5.60
J28	6.75	28.8	3.2	92.16	2.88
J30	7.2	64.0	3.2	204.8	6.40
J32	7.25	32.8	3.2	104.96	3.28
J34	6.5	37.6	3.2	120.32	3.76
J36	6.5	24.5	4.2	102.9	2.45
J38	7.5				
J40	8	163.2	6.2	1011.8	16.32
J50	7.75				
J52	7.9	140.0	8.2	1148	14.00
J54	7.25	36.8	9.2	338.56	3.68
J62	8	28.8	10.2	293.76	2.88
J64	11.5				
J66	8				
J68	9	48.8	13.2	644.16	
J70	5.25	6.0	14.2	85.2	0.60
J72	4.75	6.0	15.2	91.2	0.60
J74	8.25	28.0	16.2	453.6	2.80
J76	7.25	28.0	17.2	481.6	2.80

Lot Information

APPENDIX B

ANALYSIS RESULTS

APPENDIX B
Town Centre, Casuarina Beach - Water Reticulation Report
Water Reticulation - Junction Report

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (m)	Fire-Flow Demand (L/s)	Residual Pressure (m)
J10	0.2	7.8	61.19	53.44		
J12	4.0	8.0	60.42	52.42		
J14	5.4	8.3	60.07	51.82	22	38.23
J18	0.0	7.5	60.51	53.01		
J20	1.1	6.0	60.45	54.45		
J22	0.7	5.5	60.44	54.94	11	50.69
J24	0.0	6.8	57.99	51.24		
J26	5.6	6.8	55.92	49.17		
J28	2.9	6.8	55.30	48.55		
J30	6.4	7.2	53.92	46.72		
J32	3.3	7.3	53.86	46.61	22	37.26
J34	3.8	6.5	57.74	51.24		
J36	2.5	6.5	57.70	51.20	22	50.39
J38	0.0	7.5	57.70	50.20		
J40	16.3	8.0	54.78	46.78		
J50	0.0	7.8	53.78	46.03	0	46.03
J52	14.0	7.9	53.59	45.69	22	38.77
J54	3.7	7.3	53.75	46.50	22	39.37
J62	2.9	8.0	57.82	49.82	22	49.22
J64	0.0	11.5	58.27	46.77		
J66	0.0	8.0	57.71	49.71		
J68	4.9	9.0	57.53	48.53	0	48.53
J70	0.6	5.3	57.67	52.42		
J72	0.6	4.8	57.67	52.92	11	45.05
J74	2.8	8.3	53.74	45.49	22	36.61
J76	2.8	7.3	59.16	51.91		

APPENDIX B

Town Centre, Casuarina Beach - Water Reticulation Report

Water Reticulation - Pipe Report

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
P1102	J10	J12	50.1	112.9	100.00	9.40	0.94	0.77	15.3
P1104	J12	J14	65.2	112.9	100.00	5.36	0.54	0.35	5.4
P1108	J10	J18	27.9	164.6	100.00	32.44	1.52	0.67	24.17
P1110	J18	J20	91.3	112.9	100.00	1.80	0.18	0.07	0.72
P1112	J20	J22	58.0	112.9	100.00	0.70	0.07	0.01	0.12
P1114	J24	J76	64.5	164.6	100.00	-27.84	1.31	1.17	18.21
P1116	J24	J26	34.5	112.9	100.00	19.61	1.96	2.06	59.7
P1118	J26	J28	19.6	112.9	100.00	14.01	1.40	0.63	32.02
P1120	J28	J30	65.8	112.9	100.00	11.13	1.11	1.37	20.91
P1122	J30	J32	15.8	112.9	100.00	4.73	0.47	0.07	4.28
P1126	J34	J24	127.4	164.6	100.00	-8.23	0.39	0.24	1.91
P1128	J34	J36	65.4	164.6	100.00	4.47	0.21	0.04	0.62
P1130	J36	J38	118.8	265.7	110.00	2.02	0.04	0.00	0.01
P1132	J38	J40	102.9	164.6	100.00	35.35	1.66	2.92	28.34
P1142	J40	J50	111.4	164.6	100.00	19.03	0.89	1.00	9
P1144	J50	J52	36.8	164.6	100.00	14.00	0.66	0.19	5.1
P1146	J50	J54	72.6	164.6	100.00	3.68	0.17	0.03	0.43
P1156	J38	J62	57.6	265.7	110.00	-33.33	0.60	0.12	2.07
P1158	J62	J64	188.4	265.7	110.00	-36.21	0.65	0.45	2.41
P1160	J64	J66	82.9	112.9	100.00	6.08	0.61	0.57	6.83
P1162	J66	J68	39.9	112.9	100.00	4.88	0.49	0.18	4.54
P1164	J66	J70	99.6	112.9	100.00	1.20	0.12	0.03	0.34
P1166	J70	J72	95.8	112.9	100.00	0.60	0.06	0.01	0.09
P1168	T5002	J64	8.1	265.7	110.00	42.29	0.76	0.03	3.21
P1174	T5004	J10	8.0	164.6	100.00	42.04	1.98	0.31	39.07
P1176	J50	J74	92.5	112.9	100.00	1.35	0.14	0.04	0.42
P1178	J74	J32	225.3	112	100.00	-1.45	0.15	0.11	0.5
P1180	J76	J18	62.3	164.6	100.00	-30.64	1.44	1.35	21.75

APPENDIX C

NETWORK LAYOUT AND LABELLING

20 10 0 20 40 60 80m
SCALE BEFORE REDUCTION 1:1000

Cardno (Qld) Pty Ltd ACN 051 074 092
Commercial Centre, Isle of Capri
Gold Coast City, Queensland 4217
Email: gc@cardno.com.au

CAD FILE NAME: G:\7079\04\01\Sketch\7079401_SK31.dwg

KINGS BEACH (No. 2) PTY LTD	
CASUARINA BEACH	SCALE :- 1:2000 A1
TOWN CENTRE	DATE :- 10 JULY, 2007 REV A
DA SUBMISSION	DRAWING No. 7079/4/1-SK31

SKETCH No.31 (12/06/08)
WATER ANALYSIS SETOUT PLAN

APPENDIX B

ENVIRONMENTAL MANAGEMENT PLAN

ENVIRONMENTAL MANAGEMENT PLAN
CASUARINA TOWN CENTRE

TABLE OF CONTENTS

APPENDICES

1. INTRODUCTION

It is proposed to develop the subject site for the purposes of constructing an mixed use development, comprising residential, commercial and retail components.

This Environmental Management Plan (EMP) provides the environmental management requirements for the construction of the proposed development.

The EMP provides performance criteria that are to be met so that the impacts of the works on the physical and social environment are minimised. In particular, the EMP provides mechanisms whereby the environmental performance associated with the works can be measured and if required, provides procedures where agreed corrective actions are implemented.

2. PREAMBLE TO THE ENVIRONMENTAL MANAGEMENT PLAN

2.1 Terminology

The term **Principal** refers to Kings Beach No 2 Pty Ltd.

The term **Contractor** refers to the party or company performing construction works relating to the proposed development and includes all employees of the Contractor and sub-contractors.

The term **Consultant** refers to the civil and/or environmental engineering consultant employed by the Principal.

The term **Works** refers to all matters associated with the construction of the proposed development.

The term **DECC** refers to the Department of Environment and Climate Change

The term **EMP** refers to the Environmental Management Plan.

The term **Act** refers to the Protection of the Environment Operations Act 1997.

2.2 Program and Contractual Obligations

The EMP covers the construction phase of the works which is defined as the period from the commencement of works to the substantial completion of the works. The Contractor is generally responsible for ensuring that the provisions of the EMP are met, with the exception of certain planning or design issues, which are explicitly noted throughout the EMP as being the responsibility of the Principal or the Consultant.

The Contractor shall ensure that all persons who are to be employed or sub-contracted for the works shall be trained as to their individual responsibilities as set out in this EMP, including the following.

General Environmental Duty – whereby a person in the performance of their duties shall not do so in a manner which will cause, or is likely to cause, environmental harm unless the person takes all reasonable and practical measures to prevent or minimise the harm.

Duty to Notify Environmental Harm – whereby if a person in the performance of their duties becomes aware that serious or material environmental harm is caused or threatened then the person must contact the Contractor whereupon the Contractor must immediately notify the Principal and/or DECC.

Compliance with the EMP – whereby a person in the performance of their duties shall do so in a manner that ensures that the provisions of this EMP are complied with.

2.3 Non-Compliance with the EMP and Corrective Action Requirements

The Contractor shall assume responsibility for implementation of this EMP during the construction phase. Where the Contractor becomes aware of a site or operational condition that does not comply with stated performance indicator(s) of this EMP, there is a requirement for corrective action. A Corrective Action Request (CAR) form is to be completed and authorised where appropriate in general compliance with the example CAR form provided in Appendix A of this EMP. The Contractor is also required to maintain a register of CARs, which shall demonstrate that appropriate actions have been completed within a suitable timeframe.

Any CAR registered in accordance with this EMP shall be provided to the Principal, any State or Commonwealth Government Department, any statutory authority or other person, consensually or as lawfully required.

In some instances, further investigation or monitoring may be required to establish whether the Contractor has failed to adequately implement the EMP, or has failed to comply with relevant legislation, guidelines and statutes. In these instances, an independent party such as the Consultant shall carry out the investigation or monitoring. If it is established that the cause for non-compliance with the stated performance indicator(s) has arisen from the Contractor's actions or omissions, then the costs of the monitoring shall be deducted from payments to the Contractor and paid to the Consultant, otherwise the costs of the monitoring shall be obtained from the Principal and paid to the Consultant.

ELEMENT 1 – PREPARATION OF A WORKS MANAGEMENT PLAN

RATIONALE

It is the Contractor's responsibility to determine how the works will be conducted in compliance with this EMP and this determination is to be reported to the Principal.

POLICY

To prepare a works plan that complies with all elements and requirements of this EMP.

MANAGEMENT STRATEGY

The works site shall be maintained so that environmental harm or nuisance shall not be caused during construction of the proposed development.

TASKS / ACTIONS

The Contractor shall prepare a draft works plan prior to conducting any activities associated with the physical construction of the proposed development. This will include a traffic management plan to address potential impacts of construction on vehicular and pedestrian movements in the vicinity of the site. However, it is noted that the works will not require movement of trucks or other construction equipment off of the site, other than to bring fill and construction materials to the work place.

The draft works plan is to contain the following elements:

1. Community Awareness.
2. Air Quality.
3. Noise Emission.
4. Erosion and Sedimentation Control.
5. Stormwater Quality.
6. Traffic Management
7. Waste Management.

The draft works plan is to be provided to the Principal. The Contractor is to have due regard for comments made by the Principal and/or the Consultant prior to the preparation of the final works plan.

The Principal is to issue its approval of the Contractor's draft works plan to the Contractor prior to the Contractor conducting any works.

PERFORMANCE INDICATORS

Compliance with the elements of this EMP.

No situations where CARs are to be prepared and actioned.

FREQUENCY / DEADLINE

Implementation is to be ongoing for the duration of the works.

REPORTING AND REVIEW

Reporting to the Principal upon requirement to complete a CAR and the actions taken in respect of the CAR.

CORRECTIVE ACTION

Non-conformance with the works plan shall be documented and a corrective action request (CAR) issued. All CARs shall be included in the CAR Register to be kept under the provisions of this EMP.

The Contractor shall implement the corrective action as required within the agreed time frame noted on the CAR.

ELEMENT 2 – COMMUNITY AWARENESS

RATIONALE

Construction of the proposed development will involve the use of powered mechanical equipment that has the potential to impact upon land users adjacent to the site.

POLICY

To minimise the impact of the works on the identified community.

MANAGEMENT STRATEGY

Ensure that persons that may be affected by the works are aware of the nature and duration of the proposed works and proposed works program.

Conduct the works in compliance with the elements of the EMP.

TASKS / ACTIONS

The Contractor is to address the issue of community awareness in its draft works plan required under Element 1 of this EMP.

The Contractor is to ensure that all management strategies detailed in the final works plan are complied with at all times during the conduct of the works.

The Contractor shall advise local residents (occupants of all dwellings that adjacent to the site) of the proposed works and proposed works program. The Contractor shall provide means to advise residents and landowners in advance of works that may impact upon them and provide a representative point of contact to receive questions or concerns from community members.

The Contractor shall comply with the elements of this EMP that relate to the protection of residential amenity.

PERFORMANCE INDICATORS

Compliance with the elements of this EMP.

No situations where a community complaint causes CARs to be prepared and actioned.

FREQUENCY / DEADLINE

Implementation is to be ongoing for the duration of the works.

REPORTING AND REVIEW

Reporting to the Principal upon requirement to complete a CAR and the actions taken in respect of the CAR.

CORRECTIVE ACTION

Non-conformance with the works plan shall be documented and a corrective action request (CAR) issued. All CARs shall be included in the CAR Register to be kept under the provisions of this EMP.

The Contractor shall implement the corrective action as required within the agreed time frame noted on the CAR.

ELEMENT 3 – AIR QUALITY

RATIONALE

Construction of the proposed development will involve the use of powered mechanical equipment for excavation and movement of earth material to achieve the required landform for the proposed development, with subsequent storage and replacement of excavated earth material. The bulk handling of this material has the potential to create air impurity emissions by release of dust as suspended then deposited particulate matter. Odours from the construction site may also be released from the plant and machinery used on site.

POLICY

To comply with the Act, Council By-Laws and health and safety requirements.

To minimise the emission of air impurities and odours associated with the works.

To comply with the stated performance indicators for air impurity levels in the locality of the works.

MANAGEMENT STRATEGY

Conduct the works in such a manner that all reasonable and practical measures are utilised to minimise the emission of air impurities and odours.

TASKS / ACTIONS

The Contractor is to address the issue of air impurity emission in its draft works plan required under Element 1 of this EMP.

The Contractor is to ensure that all management strategies detailed in the final works plan are complied with at all times during the conduct of the works.

Dust control measures shall be used on all processes that have the potential to generate dust.

Windbreak screens shall be employed where considered necessary between working areas and abutting residential areas. Oil must not be used for the suppression of dust. The use of recycled water treated to an appropriate level shall be considered for the suppression of dust.

Earthworks

Earthworks shall be managed to control dust. Specific control measures may include, but may not be limited to the following.

- Completion of vegetation clearing in stages, in order to minimise the area of open ground exposed at any one time.
- Early stabilisation and revegetation of any cut or filled areas and slope works using, for example, wood chip layers.
- Watering of all exposed areas as required.
- Provision of windbreaks and silt fences as required.

Stockpiles

Stockpiles shall be managed to control dust. Specific control measures may include, but may not be limited to the following.

- Minimisation and stabilisation of stockpile areas.
- Maintenance of stockpiles within designated areas and prevention of spread of stockpile material into adjacent areas.
- Creation of no more stockpiles than is necessary, and removal of all stockpiles upon completion of works at the site.
- Provision of windbreaks and silt fences as required.

Odours

All materials (eg. paints) or processes (eg. painting) that generate fumes or odours shall be properly stored and used with efficient equipment to established procedures.

Fumes

All equipment shall be efficient, operated in accordance with established operating procedures and maintained to minimise exhaust emissions. Engines shall not be left idling needlessly.

All vehicles and plant shall be properly maintained so as to ensure that emission levels are less than the limits defined by relevant Commonwealth Department of Transport and Regional Services Federal Office of Road Safety Australian Design Rules:

- ADR30 Diesel Engine Exhaust Smoke Emissions
- ADR36 Exhaust Emission Control for Heavy Duty Vehicles
- ADR37 Emission Control for Light Vehicles
- ADR70 Exhaust Emission Control for Diesel Engine Vehicles

PERFORMANCE INDICATORS

No complaint relating to excessive emission of air impurities or odours from the works site from any person.

In the event that a complaint relating to air impurity or odour emissions from the works site is received, then the Contractor is required to instigate procedures as specified through the preparation and action of the CAR.

If through the CAR process it is determined that on the balance of probabilities the Contractor's actions have brought about the complaint regarding air impurities, then monitoring of suspended particulate matter at the complainants' premises is required. A measured concentration of particulate matter exceeding the limits specified in the below table is the trigger for initiation of corrective action.

Air Quality Criteria

Parameter	Maximum Acceptable Concentration
Annual, 24 hour averaged dust concentration, total suspended particulate	90 $\mu g/m^3$
Annual, 24 hour averaged dust concentration, as PM_{10}	50 $\mu g/m^3$
24 hour average dust concentration, as PM_{10}	150 $\mu g/m^3$
Visibility	20 km
Average dust deposition rate	120 $mg/m^2/day$

Note: PM_{10} is suspended particulate matter less than 10 microns in aerodynamic diameter.

FREQUENCY / DEADLINE

Implementation is to be ongoing for the duration of the works.

REPORTING AND REVIEW

Reporting to the Principal upon requirement to complete a CAR and the actions taken in respect of the CAR.

CORRECTIVE ACTION

Should a complaint relating to excessive emission of air impurities from the works site be received the following corrective actions are to be implemented.

- Identification of the source(s) of the excessive emission of air impurities;
- Implementation of appropriate mitigation measures as determined by the Principal and Consultant in consultation with the Contractor; and
- Relevant validation monitoring of air impurity concentrations at nominated locations.

The Contractor shall implement the corrective action(s) as required within the agreed time frame noted on the CAR.

ELEMENT 4 – NOISE EMISSION

RATIONALE

Construction of the proposed development will involve the use of powered mechanical equipment. This equipment is to be operated at the site adjacent to neighbouring residential areas.

Appropriate management measures are required to ensure the noise produced at the site during the works does not result in annoyance or disturbance at the closest noise sensitive place.

POLICY

To control noise generated by construction activities and to minimise the impact of noise to ensure acceptable levels of amenity for the local community.

MANAGEMENT STRATEGY

To comply with the Act, Council By-Laws and recognised noise criteria as contained in Environmental Guidelines.

TASKS / ACTIONS

The Contractor is to address the issue of noise emission in its draft works plan required under Element 1 of this EMP.

The Contractor is to ensure that all management strategies detailed in the final works plan are complied with at all times during the conduct of the works.

All noise generating mobile and stationary plant and equipment, and processes shall be controlled to minimise noise emission in accordance with AS 2436: *Guide to Noise Control on Construction, Maintenance and Demolition Sites*. In particular, all powered mechanical equipment shall be fitted with effective exhaust mufflers.

Working hours at the site shall be limited to between 7.00am and 7.00pm Monday to Saturday and 8.00am to 6.00pm Sundays and Public Holidays.

All vehicles entering or leaving the site or used at the site shall be operated and maintained in a manner which ensures that the noise levels produced by the vehicles are within the limits of the Commonwealth Department of Transport and Regional Services Federal Office of Road Safety Australian Design Rule *ADR28- External Noise of Motor Vehicles*.

In the event of the adjusted noise level for a single noise source or activity exceeding the background noise level by more than 10 dB(A), consideration shall be given to restricting the times during which the activity can take place to a number of separate hours each day. Persons affected by the noise shall be consulted with regard to suitable hours and advised of the agreed operations schedule.

PERFORMANCE INDICATORS

The works shall be carried out by such practicable means necessary to prevent the emission of noise that constitutes *"unreasonable"* or *"intrusive"* noise.

FREQUENCY / DEADLINE

Implementation is to be ongoing for the duration of the works.

REPORTING AND REVIEW

Reporting to the Principal upon requirement to complete a CAR and the actions taken in respect of the CAR.

CORRECTIVE ACTION

Should a complaint relating to excessive emission of noise from the works site be received the following corrective actions are to be implemented.

- Identification of the source(s) of the excessive emission of noise;
- Implementation of appropriate mitigation measures as determined by the Principal and Consultant in consultation with the Contractor; and
- Relevant validation monitoring of noise levels as a result of the works at nominated locations.

The Contractor shall implement the corrective action(s) as required within the agreed time frame noted on the CAR.

ELEMENT 5 – EROSION AND SEDIMENTATION CONTROL

RATIONALE

Construction of the proposed development will involve excavation of soils and alteration of landform at the site. Excavated areas and stockpiles are to be protected from erosion and at the completion of the works the ground surface is to be rendered stable to ensure erosion and sedimentation of receiving waters does not occur as a result of the works.

POLICY

To minimise the risk of soil erosion associated with the works.

MANAGEMENT STRATEGY

Use of best available technology for prevention of erosion or release of contaminants to waters.

Stabilise the works site upon completion of earthworks at the site so that the risk of erosion of the ground surface is minimised.

TASKS / ACTIONS

The Contractor is to address the issue of erosion and sedimentation control in its draft works plan required under Element 1 of this EMP.

The Contractor is to ensure that all management strategies detailed in the final works plan are complied with at all times during the conduct of the works.

A site specific Erosion and Sediment Control Plan has been been developed for the site as part of the detailed design phase. All measures specified in the Erosion and Sediment Control Plan shall be adhered to at all times during the works.

Measures shall be implemented in accordance with the requirements of the Soil Erosion and Sediment Control Guidelines, Institute of Engineers Australia and the erosion and sediment control plan. Such measures may include, but may not be limited to the following.

1. The use of sediment fences around all areas of bare earth over the site during the works.
2. The use of sediment retention basins where significant areas of bare earth are exposed.
3. The use of a designated site office area with a gravel pad base for vehicles entering and leaving the works site.
4. The use of stormwater diversion and transportation infrastructure over the site.

PERFORMANCE INDICATORS

No transport of erodable material from the works site to public roadways or watercourses.

FREQUENCY / DEADLINE

Implementation is to be ongoing for the duration of the works.

REPORTING AND REVIEW

Reporting to the Principal upon requirement to complete a CAR and the actions taken in respect of the CAR.

CORRECTIVE ACTION

Should there be non-compliance with the stated performance indicator the following corrective actions are to be implemented.

- Identification of the cause of the non-compliance;
- Implementation of appropriate mitigation measures as determined by the Principal and Consultant in consultation with the Contractor; and
- Relevant validation monitoring to confirm that the nominated corrective actions have been effective.

The Contractor shall implement the corrective action(s) as required within the agreed time frame noted on the CAR.

ELEMENT 6 – STORMWATER QUALITY

RATIONALE

Construction of the proposed development will involve excavation of soils and the alteration of landform at the site.

Stormwater coming in contact with this material has the potential to transport sediment and/or other contaminants to natural drainage lines and receiving waters adjacent to the site.

POLICY

To ensure that the existing qualities of the receiving surface and ground waters in the locality of the works are not adversely affected by activities associated with the works.

MANAGEMENT STRATEGY

To minimise the risk of any release of contaminants originating from the site entering surface and ground waters in the locality of the site.

TASKS / ACTIONS

The Contractor is to address the issue of stormwater quality in its draft works plan required under Element 1 of this EMP.

The Contractor is to ensure that all management strategies detailed in the final works plan are complied with at all times during the conduct of the works.

The Contractor shall provide temporary control measures as required during the course of the works to prevent soil erosion, scouring, sediment transport and deposition. Suitable temporary control measures are identified in the Soil Erosion and Sediment Control Guidelines [Institution of Engineers, Australia, 1995]. Further details are contained in the *Stormwater Management Plan* prepared for the site.

All chemicals and other materials stored at the site shall be in an appropriately covered and bunded area away from any identified stormwater drainage paths to prevent contamination of stormwater runoff from the site.

PERFORMANCE INDICATORS

Any waters being discharged from the works site are to comply with the following quality characteristics.

Water Quality Parameter	Release Criteria
Suspended Solids	< 50 mg/L
pH	6.5 to 8.5
Oil and Grease	No visible film No detectable odour
Floating Matter	None visible

FREQUENCY / DEADLINE

Implementation is to be ongoing for the duration of the works.

REPORTING AND REVIEW

Reporting to the Principal upon requirement to complete a CAR and the actions taken in respect of the CAR.

CORRECTIVE ACTION

Should there be non-compliance with the stated performance indicator the following corrective actions are to be implemented.

- Identification of the cause of the non-compliance;
- Implementation of appropriate mitigation measures as determined by the Principal and Consultant in consultation with the Contractor; and
- Relevant validation monitoring to confirm that the nominated corrective actions have been effective.

The Contractor shall implement the corrective action(s) as required within the agreed time frame noted on the CAR.

ELEMENT 7 – WASTE MANAGEMENT

RATIONALE	Waste management at the works site is to focus on appropriate methods to prevent, treat and dispose of waste materials generated as a result of the works.
POLICY	To ensure that all materials used to conduct the works do not cause unlawful environmental harm. To ensure that no waste material is released from the site in an uncontrolled manner.
MANAGEMENT STRATEGY	To carry out appropriate tasks and actions throughout the duration of the works to comply with the stated objective.
TASKS / ACTIONS	The Contractor is to address the issue of waste management in the draft works plan required under Element 1 of this EMP. The Contractor is to ensure that all management strategies detailed in the final works plan are complied with at all times during the conduct of the works. The Contractor shall provide appropriate methods for the collection and lawful disposal of any wastes produced at the site during the works. Solid wastes shall be stored in suitable refuse containers to prevent contamination of stormwater. Waste containers shall be located in convenient areas over the site. Hazardous materials shall not be disposed of into general waste bins. Licensed waste removal contractors shall be employed to remove any hazardous wastes produced and stored on the site. Waste shall not be incinerated on site. General waste shall only be disposed of to a licensed waste transfer station or waste disposal facility. Any flammable or combustible liquids as defined by Australian Standard AS1940 involved with the works are to be stored and handled in accordance therewith.
PERFORMANCE INDICATORS	No waste of any type to be released from the works site in an uncontrolled manner.
FREQUENCY / DEADLINE	Implementation is to be ongoing for the duration of the works.
REPORTING AND REVIEW	Reporting to the Principal upon requirement to complete a CAR and the actions taken in respect of the CAR.

CORRECTIVE ACTION

Should there be non-compliance with the stated performance indicator the following corrective actions are to be implemented.

- Identification of the cause of the non-compliance;
- Implementation of appropriate mitigation measures as determined by the Principal and Consultant in consultation with the Contractor; and
- Relevant validation monitoring to confirm that the nominated corrective actions have been effective.

The Contractor shall implement the corrective action(s) as required within the agreed time frame noted on the CAR.

APPENDIX A

Sample Corrective Action Request Form

CORRECTIVE ACTION REQUEST

Report no; .....

Date; .....

DETAILS OF NON-CONFORMANCE: Inspected by:
DETAILS OF PROPOSED ACTION Passed to Principal (as applicable):y/n Date: Reply required by:
CONSULTANT/PRINCIPAL ADVICE (as required): Date action required by (if applicable): Signed (by Principal or Principal's representative): Date:
AUTHORITY TO PROCEED Sign: Date:
ACTION CARRIED OUT Sign: Date:
ELEMENT RE-INSPECTED BY Sign: Date:
COPY ISSUED TO PRINCIPAL Date: Sign:

Cardno
Shaping the Future

PROPOSED CASUARINA BEACH TOWN CENTRE
RESIDUE LOT 243, CASUARINA

Erosion & Sediment Control Plan
Revision C

CVISION
TECHNOLOGIES

January 2008
Job No. 7079/4-5

Kings Beach (No.2) Pty Ltd

Cardno (Qld) Pty Ltd

ABN 57 051 074 992

Commercial Centre

Isle of Capri, Gold Coast

Queensland 4217 Australia

Telephone: 07 5539 9333

Facsimile: 07 5538 4647

International: +61 7 5539 9333

gco@cardno.com.au

www.cardno.com.au

Document Control

Version	Date	Author		Reviewer	
		Name	Initials	Name	Initials
1	January 2008	Carlo de Byl	CD	Rod Barry	

PROPOSED CASUARINA BEACH TOWN CENTRE
RESIDUE LOT 243, CASUARINA
EROSION & SEDIMENT CONTROL PLAN

TABLE OF CONTENTS

APPENDICES

1. INTRODUCTION

1.1 Purpose

This Erosion and Sediment Control Plan (ESCP) has been prepared on behalf of Kings Beach (No.2) Pty Ltd for the proposed Casuarina Beach Town Centre development on Residue Lot 243, Casuarina (the subject site).

The aim of the management plan is to provide detailed policies, performance criteria and procedures to minimise the impact of construction activities on the physical and social environment. In particular, the ESCP provides monitoring and reporting mechanisms whereby the performance of the system can be measured, and ensure that agreed corrective actions are implemented in a timely manner if problems occur.

1.2 Implementation

The ESCP has been prepared in accordance with Tweed Shire Council's (TSC) '*Tweed Urban Stormwater Quality Management Plan*' and Development Design Specification '*D7-Stormwater Quality*' and good local engineering and environmental practice.

2. EROSION AND SEDIMENT CONTROL PLAN (ESCP) CONSTRUCTION PHASE

All construction activities are to be carried out in accordance with this Erosion and Sediment Control Plan (ESCP). Refer to Elements 1 and 2 of this ESCP and to Tweed Shire Council Development Design Specification *'D7 - Stormwater Quality'* and its Annexure A - '*Code of Practice for Soil and Water Management on Construction Works*', to minimise the impact the development has on the surrounding environment. The site conditions relevant to the ESCP are described below:

2.1 Site Layout

The proposed Casuarina Beach Town Centre development is located between the central and northern precincts of Casuarina Beach. The site is bordered by residential allotments to the north and south, the Pacific Ocean to the east and Old Bogangar Road to the west. The site is divided by a drainage easement that runs from Old Bogangar Road through to the north-east of the proposed Town Centre development site. Cardno Figure No. DA27 shows the existing contours and features of the development site.

The proposed works will involve the clearing and mulching of existing vegetation on-site, the re-profiling of existing ground levels, the filling and re-alignment of the existing drainage channel and construction of a linking road between the northern and central precincts of the Casuarina Beach development.

2.2 Vegetation Layout

The existing vegetation on site consists mainly of regrowth Bitou bush, Banksia and Casuarina trees of varying size, as the site was previously cleared for adjacent sand mining activities.

- All vegetation on the site that is selected to be removed is to be mulched / chipped and reused / applied to cleared areas during the bulk earthworks. All disturbed regions will be reinstated progressively.
- Clearing shall be limited to 2 metres from the edge of any essential construction activity.
- Emphasis shall be placed on source control of erosion by retaining vegetation for as long as practical and revegetating disturbed areas as soon as possible.
- The final rehabilitation or landscaping program is to be scheduled so that a duration of less then 20 working days will elapse from final land shaping to permanent rehabilitation.
- All reasonable care shall be taken to protect other vegetation from damage during construction. This will involve clearly marking trees to remain, avoiding compaction of ground or filling within the dripline of trees to remain. Clearly delineate the area of disturbance and keep all vehicles and building materials within that area. Limit the number of access points to the site and clearly restrict access to "no go" areas using fencing and signage in accordance with Annexure A of TSC *'Development Design Specification D7 Section D7.A3 Clearing Vegetation, Soil Disturbance'*.
- No vegetation is to be removed prior to approval from Council to start work, and the approved erosion and sediment control measures are in place.
- Prior to commencement of substantial civil works and after the installation of the required erosion and sediment control measures, a site meeting shall be held to determine the adequacy of compliance with the ESCP and associated documents and control measures to the satisfaction of the consent authority.

2.3 Soil Properties

The soils on the proposed development site are primarily sandy coarse soils. Based on the revised Universal Soil Loss Equation the estimated soil loss rate for the site has been calculated at 125-210 tonnes/ha/yr (R=8000, K=0.03, LS=0.78-1.31, P=0.8, C=1.0), and the soil on-site classified as SOIL LOSS CLASS 1 (0-250 tonnes/ha/yr).

Sedimentation basins are proposed to be installed and maintained during the construction phase of the project. All catch drains / perimeter bunds diverting flows to the sedimentation basins shall have check dams installed at regular intervals where necessary. Exposed batters shall have sediment filter fencing lining the toe of batter where appropriate and shall be stabilised upon completion of vegetation clearing. Given the level of bulk earthworks proposed and the high infiltration capabilities of sand we believe the sediment control systems proposed on site should contain and dissipate potential soil loss.

2.4 Drainage

Site runoff during construction will be controlled by the devices shown on Cardno Figure No.DA27, Tweed Shire Council Standard Drawings S.D.501(B) and S.D.502(B), and Cardno Standard Drawing S5/6-20. Proposed devices include sedimentation basins, sediment filter fencing and catch drains / perimeter bunds. Shakedown / stabilised access devices will be located at the entrance / exits to the site in accordance with the superintendent's instructions.

The proposed devices are to be installed prior to construction and maintained until completion of construction or as long as practical.

Existing contours show the proposed development site east of the existing drainage channel generally grades north towards the north-east corner of the site, with runoff from this catchment area currently discharging into the drainage channel. It is proposed to fill the existing drainage channel and re-profile this eastern area to redirect the majority of the development area runoff west towards the link road between the northern and central precincts. A reduced catchment area will continue to discharge runoff north-east towards the existing beach side swale system. It is proposed to replace the existing drainage channel with a pipe culvert system to convey runoff from the existing beach side swale system west towards Old Bogangar Road.

The existing area west of the current drainage channel generally grades west towards Old Bogangar Road. For this catchment area it is proposed to maintain a similar grading profile that will continue to direct runoff towards Old Bogangar Road.

To reduce re-suspension of suspended solids and scour the catch drains are to have rock check dams installed if necessary.

The perimeter of the site will be protected by the use of sediment filter fences and perimeter bunds to ensure there is no uncontrolled discharge off site.

The location of site storage, carparking and temporary site office facilities shall be determined on site. Access shall only be from the designated entry / exit access points to the development site.

3. EROSION AND SEDIMENT CONTROL PLAN - ELEMENTS

The ESCP comprises of a number of elements related to construction activities across the site.

Should the Contractor need to revise this ESCP to suit constructions techniques or site constraints, the details are to be forwarded to Cardno and Tweed Shire Council for approval.

All works are to be carried out in accordance with the following elements.

3.1 Element 1: Construction Water Quality

Policy: To minimise the impact of construction activity on water quality within water bodies external to the site, and to protect the biological integrity of the downstream aquatic ecosystem.

Performance Objectives: To avoid detrimental impact on the water quality and aquatic environment of the downstream catchment, as a result of the discharge of contaminated stormwater runoff.

To comply with the *Environmental Planning and Assessment Act* and Tweed Shire Council's *Tweed Urban Stormwater Quality Management Plan* and Development Design Specification *D7 - Stormwater Quality*.

Water discharged off site is to have a suspended solids concentration of 50 mg/L or less and a pH between 6.5 and 8.5.

Control Measures: All erosion and sediment controls must be operated in accordance with the ESCP and maintained to be fully operational at all times. Worn, damaged or otherwise defective materials and components are to be repaired, refurbished or replaced as they become ineffective for their design purpose.

All contaminated surface runoff shall be directed to a treatment device to prevent sediment transport from the site. As a minimum the Contractor shall provide temporary erosion control measures as detailed on Cardno Figure No.DA27, to prevent soil erosion, scouring, sediment transport and deposition. Temporary control measures include:

- temporary sedimentation basins;
- temporary sediment filter fences;
- controls on amount of open ground;
- stabilisation of stockpiles;
- catch drains / perimeter bunds;
- check dams.

The control devices listed above and shown on the mentioned sketches are the minimum requirements. The Contractor shall install whatever measures are considered necessary to minimise the impact of construction activities on the surrounding environment.

Any stockpiles of topsoil and / or fill will be located as far away as possible from dwellings and other buildings near the site and will have perimeter sediment filter fencing installed.

Any chemicals (including lime) or fuel / oil stored on site shall be stored under cover in a bunded area or placed sufficiently above ground level to preclude contamination of surface water. The only potential source of contamination of surface water is to be due to erosion of ground surfaces.

Permanent stormwater treatment measures shall be provided as soon as possible after completion of each construction area.

All sediment control structures must be operated and maintained in an effective operational condition. These structures must not be allowed to accumulate sediment volumes in excess of 70% sediment storage design capacity. Where sedimentation basins are used a marker shall be placed within the basin to show the level above which the design capacity occurs. Materials removed from sediment retention devices must be disposed of in a manner approved by Council that does not cause pollution.

Monitoring: Regular on site monitoring of discharge water quality shall be required. Such monitoring, to be undertaken by the Contractor, shall include:

Parameter	Frequency	Reporting
pH	During controlled discharge events from sedimentation basins and monthly in primary sediment ponds.	Non complying test results are to be notified immediately to the developer.
Suspended Solids	During discharge event (defined as >25mm in any 24 hour period) and monthly in primary sediment ponds.	Non complying test results are to be notified within 24 hours to the developer.

A self auditing program must be developed for the site. A site inspection must be undertaken by the contractor:

- at least each week
- immediately before site closure
- immediately following rainfall events that cause runoff.

The self audit must be undertaken systematically on site (e.g. walking anticlockwise from main entrance) and recording:

- installation / removal of any erosion and sediment control device
- the condition of each device employed (particularly outlet devices), noting whether it is likely to continue in an effective condition until the next self audit
- circumstances contributing to damage to any devices, accidental or otherwise
- storage capacity available in pollution control structures
- time, date, volume and type of any additional flocculants
- the volumes of sediment removed from sediment retention systems, where applicable, and the site where sediment is disposed

- maintenance or repair requirements (if any) for each device
- circumstances contributing to the damage to device
- repairs affected on erosion and pollution control devices

Signed, completed self audits, original test results, weekly and other result sheets shall be kept on site and are to be available on request to Council officers and other relevant statutory authorities. All records are to be maintained in a form suitable for Council submission.

Corrective Action:

Non compliance with this Erosion and Sediment Control Plan, approved drawings and conditions of consent must be dealt with immediately. If there is a breach or infringement of the plan or conditions, action will be taken consistent with the nature and seriousness of the breach or infringement. Action may include:

- re-establish control structures if they have failed;
- more intensive implementation of erosion control measures in accordance with the NSW Department of Housing document: *'Managing Urban Stormwater - Soils and Construction (1998)'*;
- issue of "stop work notice";
- a fine under the provisions of the Protection of the Environment Operations Act 1997;
- notice to comply pending re-inspection of the site.

Standard responses to Non Compliance

The following responses are required by the Contractor to non complying monitoring test results:

Indicator	Response	Comments
pH too low <6.5	• If possible stop discharge and store runoff on site • Lime dose to restore to acceptable pH before further discharge • Notify Council's Environmental and Health Services Unit of non compliant discharge (within 24 hours)	Reporting as shown in monitoring.
pH too high >8.5	• If possible stop discharge and store runoff on site • Dilute with other water until pH in acceptable range • Re-test for compliance before further discharge	
Suspended Solids / Non-filterable Residue (NFR) >50mg/Litre	Identify if non compliance is due to storm event greater than design storm of control devices. If so accept non compliance. If not then:- • If possible stop discharge and store runoff on site • Use flocculation agents to lower NFR or • Pump contaminated water over grassed filter strips or buffer areas to lower NFR • Identify (by inspection and/or analysis) if non compliance is due to damage or ineffectiveness of erosion and sediment control devices. Repair or redesign/replace if necessary (or required by Council) to ensure future compliance.	Non compliance may occur by design in > 3 month event (deemed to be 40% of the one year ARI event).

3.2 Element 2: Dust Management

Policy: To minimise dust emission onsite.

Performance Objectives: To achieve air quality standards through the control of the movement of dust offsite from the site works.

Control Measures: The minimisation of the movement of dust offsite will be achieved through the following onsite practices:

- The pre-clearing of land will be minimised. No vegetation stripping / clearing will occur in situations of high wind.
- All permanent bunds and reshaped areas will be revegetated as quickly as possible.
- Stockpiling onsite will be minimised where possible.
- A water cart will be available at all times.

Monitoring: Visual monitoring will be undertaken throughout the construction phase. The Contractor is to ensure any dust production is kept to a minimum and action taken on any complaints received.

Reporting: The Contractor shall maintain a daily record of site conditions and the dust management measures implemented. Complaints by residents are to be recorded in a complaints register.

Dust problems will be identified by site monitoring.

Corrective Action: Depending on the source of the dust the following measures will be implemented:

- Apply water sprays to vegetation;
- Dampen exposed areas;
- Ensure all loaded trucks are covered;
- Increase number of water trucks in operation;
- Cease operations during periods of extreme winds.

APPENDIX A

Sediment Loss Calculations

Cardno

REVISED UNIVERSAL SOIL LOSS EQUATION

PROJECT:- Casuarina Town Centre
Catchment B - Basins SB 1A & 1B
JOB No:- 7079/04-01

DESIGNER:- CD
DATE:- July 2007

SEDIMENT STORAGE ZONE VOLUME

A = R.K.LS.P.C

Where		Description		Value	
A	=	Computed soil loss (tonnes/ha/yr)			
S	=	2 Year ARI, 6 Hour Storm Event	=	16.00	*mm/h*
R	=	Rainfall Erosivity Factor	=	8000	*(Appendix B - 'The Blue Book')*
or	=	$164.74\ (1.1177)^{S}\ S^{0.6444}$	=	5833.62	*(use if no chart exists)*
				INPUT	
R	=	from above	=	8000	
K	=	Soil Erodibility Factor	=	0.03	
LS	=	Slope Length / Gradient Factor	=	0.78	*From Table A1*
P	=	Erosion Control Practice Factor	=	0.80	*From Table A2*
C	=	Ground Cover	=	1.00	*From Table A3 or A4*
A Soil Loss	=	124.80 (tonnes/ha/yr)			
V Volume	=	96 (m^3/ha/yr)			
		Disturbed Surface Area (ha)	=	13.01	*Ha.*
		Computed soil loss	=	1248.96	*m^3/yr*
		Sediment Storage Zone Volume	=	312.00	*m^3 Assuming regeneration after 3 Months*

SEDIMENT BASIN VOLUME - Type C Soils

Qtc,3mth = 3mth x(0.00278xC10xF1xI1yr,tcx A) (m^3/s)

Qtc,3mth	=	Flow rate for 3 month ARI STORM event			
3mth factor	=	0.4 for T.S.C. or 0.5 for G.C.C.C.	=	0.40	
C10	=	Runoff coefficient for ARI storm event	=	0.70	*Qudm Manual*
F1	=	Frequency factor for 1 year	=	0.67	*TSC DDS D5*
A	=	Catchment Area of the Basin Ha.	=	13.01	*Ha.*
I1yr,tc	=	Average rainfall intensity for 1 year storm event Tc=35min	=	56.80	*mm/hr*

Qtc,3mth = 0.39 m^3 / s Settling Zone Volume

Vel Settling	=	Particle settling velocities under ideal conditions	=	0.007	Table 6.2 p 6-15
Basin Surface Area	=	Qtc,3mth / Vel settling	=	55.06	m^2
Depth of Basin	=	Basin Depth, min. 0.6 m	=	0.60	*m*
Settline Zone Volume	=	Basin Surface Area x Depth	=	33.03	m^3

TOTAL BASIN VOLUME = Settling Zone Volume + Sediment Storage Zone Volume
= 345.03 m^3
≈ 345 m^3

BASIN VOLUME PER HECTARE ≈ 27 m^3

Using a ratio of 1:3, pond size ≈ 14 x 42 m

Cardno

REVISED UNIVERSAL SOIL LOSS EQUATION

PROJECT:- Casuarina Town Centre
Catchment D - Basin SB 2
JOB No:- 7079/04-01

DESIGNER:- CD
DATE:- July 2007

SEDIMENT STORAGE ZONE VOLUME

A = R.K.LS.P.C

Where		Description		Value	
A		= Computed soil loss (tonnes/ha/yr)			
S		= 2 Year ARI, 6 Hour Storm Event	=	16.00	mm/h
R		= Rainfall Erosivity Factor	=	8000	(Appendix B - 'The Blue Book')
or		= 164.74 (1.1177) ^{S} S $^{0.6444}$	=	5833.62	(use if no chart exists)
				INPUT	
R		= from above	=	8000	
K		= Soil Erodibility Factor	=	0.03	
LS		= Slope Length / Gradient Factor	=	1.11	From Table A1
P		= Erosion Control Practice Factor	=	0.80	From Table A2
C		= Ground Cover	=	1.00	From Table A3 or A4
A	Soil Loss	= 177.60 (tonnes/ha/yr)			
V	Volume	= 137 (m^3/ha/yr)			
		Disturbed Surface Area (ha)	=	1.50	Ha
		Computed soil loss	=	205.50	m^3/yr
		Sediment Storage Zone Volume	=	51.00	m^3 Assuming regeneration after 3 Months

SEDIMENT BASIN VOLUME - Type C Soils

Qtc,3mth = 3mth x(0.00278xC10xF1xI1yr,tcx A) ($m^{3/s}$)

Qtc,3mth	= Flow rate for 3 month ARI STORM event			
3mth factor	= 0.4 for T.S.C. or 0.5 for G.C.C.C.	=	0.40	
C10	= Runoff coefficient for ARI storm event	=	0.70	Qudm Manual
F1	= Frequency factor for 1 year	=	0.67	TSC DDS D5
A	= Catchment Area of the Basin Ha.	=	1.50	Ha.
I1yr,tc	= Average rainfall intensity for 1 year storm event Tc=15min	=	86.50	mm/hr

Qtc,3mth = 0.07 m^3 / s Settling Zone Volume

Vel Settling	= Particle settling velocities under ideal conditions	=	0.007	Table 6.2 p 6-15
Basin Surface Area	= Qtc,3mth / Vel settling	=	9.67	m^2
Depth of Basin	= Basin Depth, min. 0.6 m	=	0.60	m
Settline Zone Volume	= Basin Surface Area x Depth	=	5.80	m^3

TOTAL BASIN VOLUME = Settling Zone Volume + Sediment Storage Zone Volume
= 56.80 m^3
= 57 m^3

BASIN VOLUME PER HECTARE = 38 m^3

Using a ratio of 1:3, pond size = 6 x 17 m

REVISED UNIVERSAL SOIL LOSS EQUATION

PROJECT:- Casuarina Town Centre
Catchment G - Basin SB 3
JOB No:- 7079/04-01

DESIGNER:- CD
DATE:- July 2007

SEDIMENT STORAGE ZONE VOLUME

A = R.K.LS.P.C

Where	*Description*	*Value*	
A	= Computed soil loss (tonnes/ha/yr)		
S	= 2 Year ARI, 6 Hour Storm Event	= 16.00	*mm/h*
R	= Rainfall Erosivity Factor	= 8000	*(Appendix B - 'The Blue Book')*
or	= 164.74 (1.1177) ^{S} S $^{0.6444}$	= 5833.62	*(use if no chart exists)*
		INPUT	
R	= from above	= 8000	
K	= Soil Erodibility Factor	= 0.03	
LS	= Slope Length / Gradient Factor	= 1.31	*From Table A1*
P	= Erosion Control Practice Factor	= 0.80	*From Table A2*
C	= Ground Cover	= 1.00	*From Table A3 or A4*
A Soil Loss	= 209.60 (tonnes/ha/yr)		
V Volume	= 162 (m^3/ha/yr)		
	Disturbed Surface Area (ha)	= 2.48	*Ha.*
	Computed soil loss	= 401.76	m^3/yr
	Sediment Storage Zone Volume	= 100.00	m^3 *Assuming regeneration after 3 Months*

SEDIMENT BASIN VOLUME - Type C Soils

Qtc,3mth = 3mth x(0.00278xC10xF1xI1yr,tcx A) ($m^{3/s}$)

Qtc,3mth	= Flow rate for 3 month ARI STORM event		
3mth factor	= 0.4 for T.S.C. or 0.5 for G.C.C.C.	= 0.40	
C10	= Runoff coefficient for ARI storm event	= 0.70	*Qudm Manual*
F1	= Frequency factor for 1 year	= 0.67	*TSC DDS D5*
A	= Catchment Area of the Basin Ha.	= 2.48	*Ha.*
I1yr,tc	= Average rainfall intensity for 1 year storm event Tc=12min	= 94.60	*mm/hr*
	=		
Qtc,3mth	= 0.12 m^3 / s Settling Zone Volume		
Vel Settling	= Particle setting velocities under ideal conditions	= 0.007	Table 6.2 p 6-15
Basin Surface Area	= Qtc,3mth / Vel settling	= 17.48	m^2
Depth of Basin	= Basin Depth, min. 0.6 m	= 0.60	*m*
Settline Zone Volume	= Basin Surface Area x Depth	= 10.49	m^3

TOTAL BASIN VOLUME = Settling Zone Volume + Sediment Storage Zone Volume
= 110.49 m^3
= 110 m^3

BASIN VOLUME PER HECTARE = 45 m^3

Using a ratio of 1:3, pond size = 8 x 24 m

APPENDIX B

Drawings & Sketches

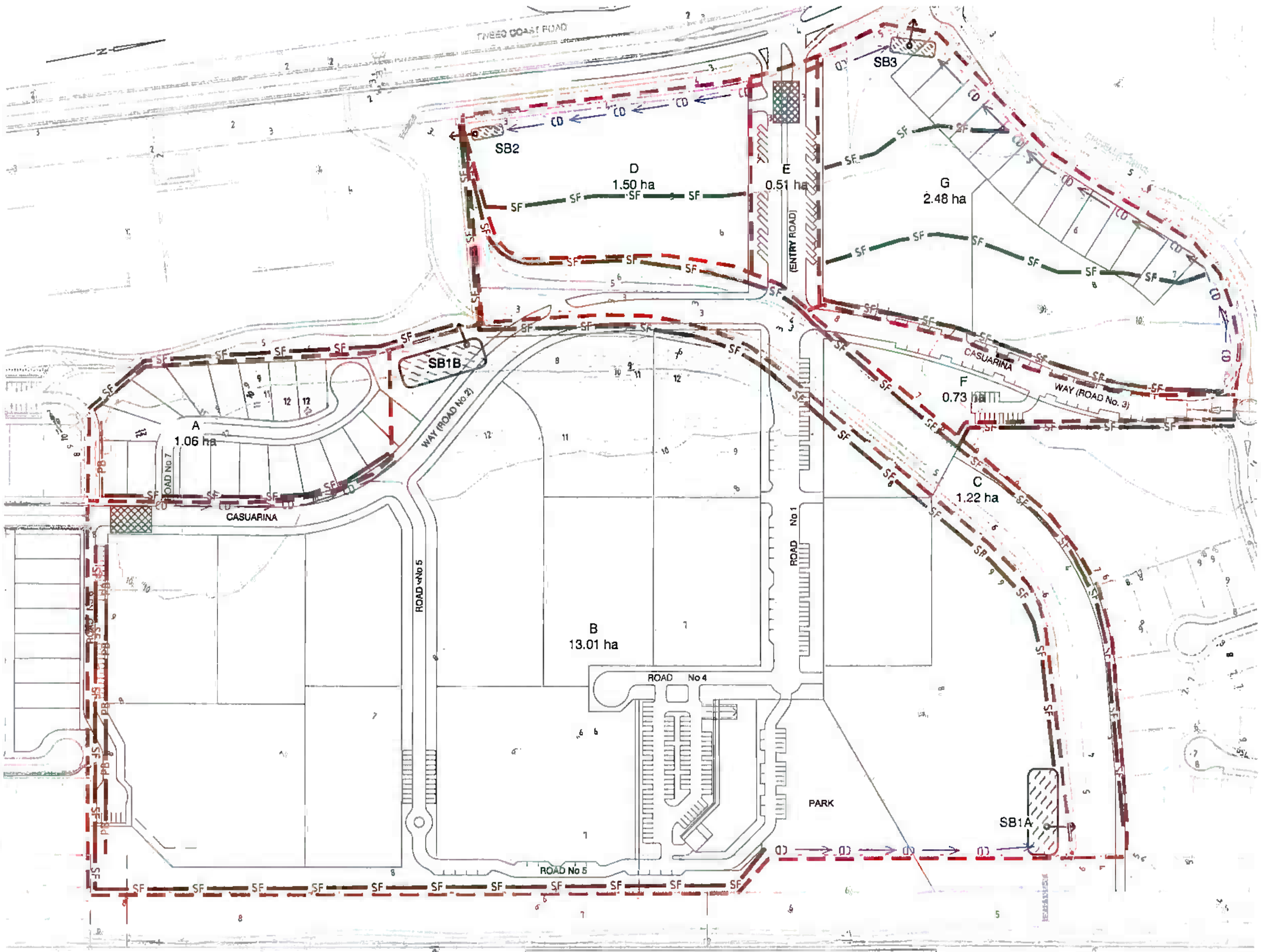
Cardno Figure No. DA27 Erosion & Sediment Control Layout Plan
Cardno Drawing No. S5/6-20 Sediment & Erosion Control Details
TSC Std Drg No. SD. 501 Rev B Erosion & Siltation Prevention Devices
TSC Std Drg No. SD. 502 Rev B Erosion & Siltation Prevention Devices

SEDIMENT BASIN SIZES

BASIN NUMBER	MINIMUM BASIN SIZE (m)
SB1A	14 x 42 x 0.6
SB1B	14 x 42 x 0.6
SB2	6 x 17 x 0.6
SB3	8 x 24 x 0.6

NOTES:

1. EROSION AND SEDIMENT CONTROL MEASURES TO BE INSTALLED AND MODIFIED TO SUIT THE LANDFORM AT THE TIME
2. IT IS EXPECTED THAT RUNOFF WITHIN SEDIMENT BASINS WILL INFILTRATE THROUGH THE SAND FILTER MEDIA.
3. SEDIMENT BASIN SB1A TO BE RELOCATED TO POSITION OF BASIN SB1B AS GRADING OF CATCHMENT VARIES DURING BULK EARTHWORKS
4. TSC's DEVELOPMENT DESIGN SPECIFICATION D7 ANNEXURE A - "CODE OF PRACTICE FOR SOIL AND WATER MANAGEMENT ON CONSTRUCTION WORKS," SECTION D7 A7 SEDIMENT CONTROL CONDITION 7.2 STATES: "SEDIMENT BASIN(S) MUST BE CONSTRUCTED WHERE THE AREA TO BE DEVELOPED EXCEEDS 1 HECTARE. WHERE IT IS LESS THEN 1 HECTARE, OTHER SEDIMENT CONTROL DEVICES MAY BE ACCEPTED" THEREFORE FOR CATCHMENT AREAS OF GENERALLY 1 HECTARE OR LESS EROSION CONTROL DEVICES OTHER THAN SEDIMENTATION BASINS HAVE BEEN UTILISED



LEGEND:

SB3	TEMPORARY SEDIMENT BASIN
	SEDIMENT BASIN DISCHARGE ARRANGEMENT (REFER CARDNO STD DRG S5/6-20)
— 55 —	EXISTING CONTOURS
— SF —	SEDIMENT FILTER FENCE (REFER TSC STD DRG S D.501 REV B)
— PB —	PERIMETER BUND (REFER CARDNO STD DRG S5/6-20)
→ CD —	CATCH DRAIN (REFER CARDNO STD DRG S5/6-20)
	STABILISED SITE ACCESS (REFER CARDNO STD DRG S5/6-20)
E 0.51 ha	PRELIMINARY BULK EARTHWORKS CATCHMENT AREA

20 10 0 20 40 60 80 1:1000

SCALE BEFORE REDUCTION

CAD FILE NAME G:\7079\04\01\DA Approval\7079040DA39.dwg

Cardno (Qld) Pty Ltd ABN 051 074 992

KINGS BEACH (No. 2) PTY LTD

CASUARINA BEACH

TOWN CENTRE

DA SUBMISSION

SCALE: 1:1,000 A3

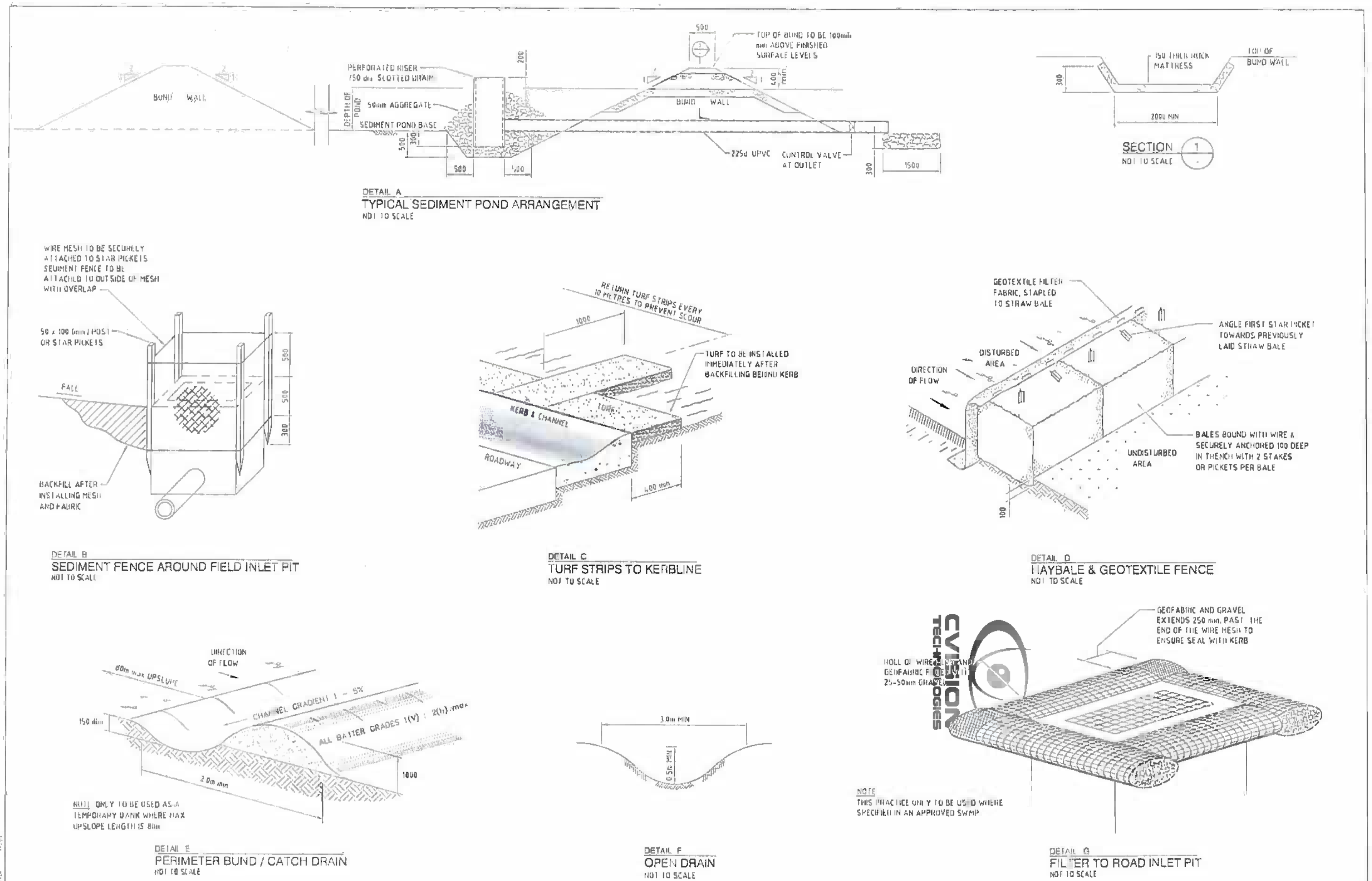
DATE: 10 JULY, 2007 REV. F

DRAWING No

7079/4/1-FIG DA27

FIGURE No.DA27F(17/02/08)

EROSION & SEDIMENT CONTROL LAYOUT PLAN



DETAIL A
TYPICAL SEDIMENT POND ARRANGEMENT
NOT TO SCALE

DETAIL B
SEDIMENT FENCE AROUND FIELD INLET PIT
NOT TO SCALE

DETAIL C
TURF STRIPS TO KERBLINE
NOT TO SCALE

DETAIL D
HAYBALE & GEOTEXTILE FENCE
NOT TO SCALE

DETAIL E
PERIMETER BUND / CATCH DRAIN
NOT TO SCALE

DETAIL F
OPEN DRAIN
NOT TO SCALE

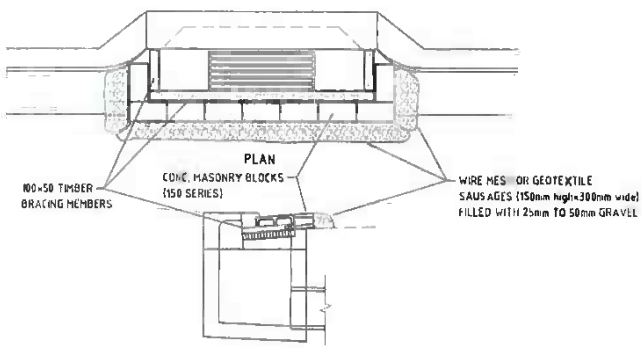
DETAIL G
FILTER TO ROAD INLET PIT
NOT TO SCALE

A1 DATUM: A.H.D.

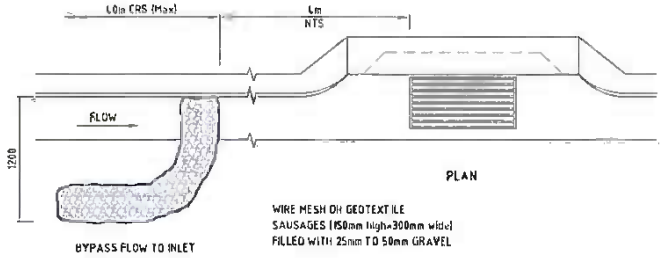
Cardno

Cardno (Qld) Pty Ltd

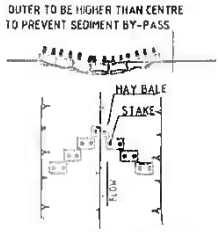
CARDNO GOLD COAST OFFICE
STANDARD DRAWING - TWEED SHIRE COUNCIL
SEDIMENT & EROSION CONTROL DETAILS
DATE JUNE 2007
S5/6-20



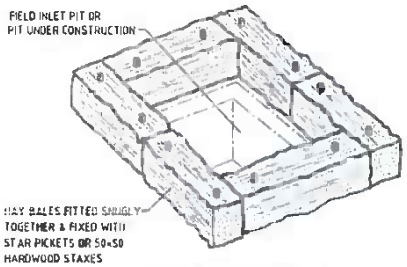
MESH & GRAVEL INLET FILTER-SAG GULLY
NOT TO SCALE



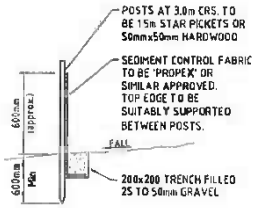
MESH & GRAVEL INLET FILTER-GRADE GULLY
NOT TO SCALE



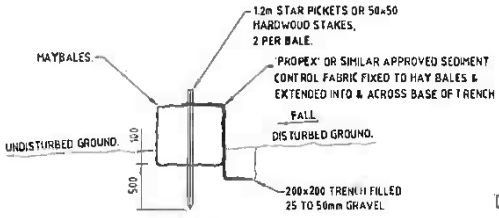
SEDIMENT CONTROL FOR OPEN CHANNELS
REFER ALSO TO HAY BALE FIXING DETAIL
N.T.S.

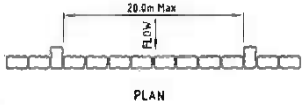


HAY BALE PIT SURROUND
REFER ALSO TO HAY BALE FIXING DETAIL
NOT TO SCALE



TEMPORARY SILTATION CONTROL FENCE
N.T.S.





HAY BALE FIXING DETAIL
N.T.S.

EROSION & SILTATION PREVENTION NOTES

1. CONSTRUCTION WORKS ARE TO BE MANAGED SUCH THAT AREAS OUTSIDE THE SCOPE OF WORKS REMAIN UNDISTURBED WHERE POSSIBLE
2. ALL SILTATION & EROSION CONTROL DEVICES SHALL BE INSTALLED PRIOR TO THE COMMENCEMENT OF ANY EXCAVATION WORKS (THE EXTENT OF THE DEVICES MAY BE VARIED FROM THAT SHOWN ON THE DESIGN PLANS TO SUIT STAGED CONSTRUCTION
3. THE DEVICES SHALL BE MAINTAINED IN PLACE UNTIL ALL WORKS ARE COMPLETED & TURF OR GRASSING HAS BECOME ESTABLISHED
4. DURING CONSTRUCTION, ALL STORMWATER PITS SHALL BE PROTECTED USING HAY BALE PIT SURROUNDS WHICH SHALL BE MAINTAINED IN PLACE UNTIL CONSTRUCTION OF LINTEL/GRATE COMMENCES.
5. FOLLOWING COMPLETION OF LINTEL/GRATE, GULLYS ARE TO BE PROTECTED USING MESH & GRAVEL INLET FILTER, WHICH SHALL BE MAINTAINED IN PLACE UNTIL ALL UPSTREAM WORKS ARE COMPLETED & ESTABLISHED
6. ALL BATTERS & REINSTATEMENT WORKS ADJACENT NEW CONSTRUCTION WORKS SHALL BE CARRIED OUT AS SOON AS POSSIBLE AFTER COMPLETION
7. ALL DISTURBED AREAS & BATTERS SHALL BE TURFED OR GRASSED AS SOON AS PRACTICAL AFTER REINSTATEMENT
8. PROVIDE HAY BALE BARRIERS ADJACENT THE OUTLET OF ALL STORMWATER DRAINS FOR THE DURATION OF CONSTRUCTION & ESTABLISHMENT
9. ALL DEVICES SHALL BE INSPECTED REGULARLY AND AFTER ALL SIGNIFICANT STORM EVENTS & CLEANED, REPAIRED OR REPLACED AS REQUIRED
10. SAFETY ISSUES MUST BE CONSIDERED AT ALL TIMES. INCORPORATE TRAFFIC CONTROL DEVICES WHERE REQUIRED.

ISSUE	AMENDMENT DETAILS	INITIALS	DATE
D	DRAWINGS ADOPTED FOR ISSUE TO PUBLIC	R.A.E.	6.2004
A	RE-ISSUED	R.A.E.	6.2004

TWEED SHIRE COUNCIL
DESIGN UNIT
COUNCIL OFFICES, TUMBULGUM ROAD, MURWILLUMBAH, NEW SOUTH WALES, 2484
PHONE (02) 66702400
FAX (02) 66727313
WEBSITE www.tweed.nsw.gov.au

DESIGN ENGINEER				DATE	6.2003
DESIGN MANAGER				DATE	6.2003
DESIGNED	R.A.E.	6.2004	DESIGN NO.		
DRAWN	R.A.E.	6.2004	SURVEY NO.		
CHECKED	G.B.	6.2004	REDUCTION RATIO		
HORIZONTAL DATUM		MGA	COORDS ADOPTED		PM
VERTICAL DATUM		AHD			

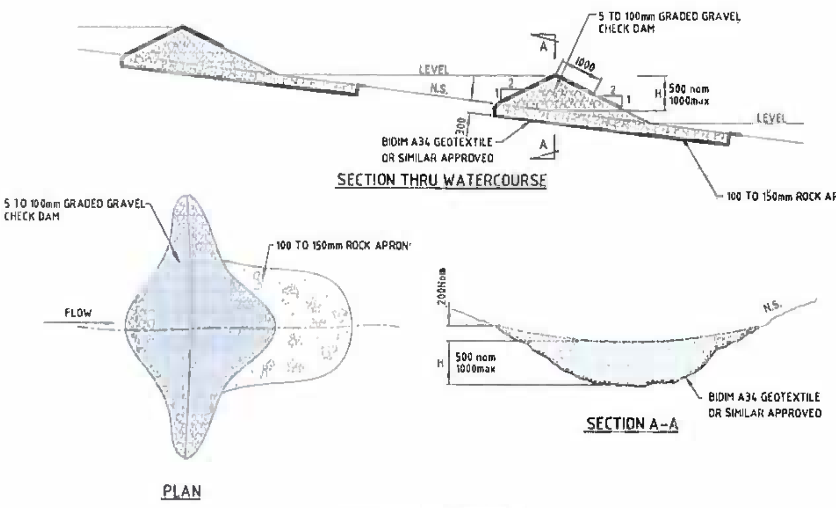
PROJECT: EROSION CONTROL STANDARDS

DRAWING NUMBER: S.D.501

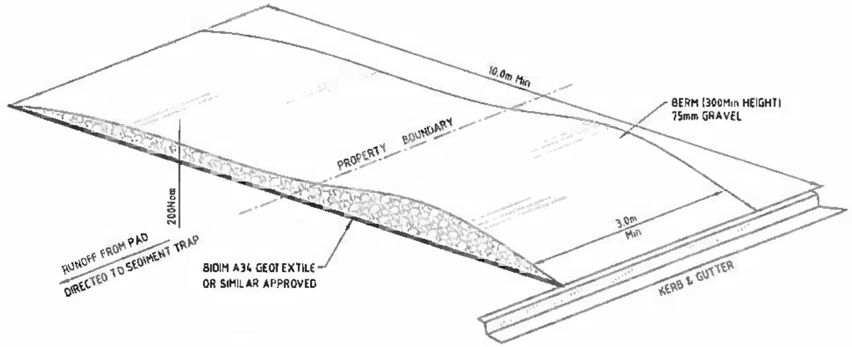
PLAN TITLE: EROSION & SILTATION PREVENTION DEVICES SHEET 1

SHEET 1 OF 1 SHEETS
ISSUE A B

ACAD FILE: N:_TSC STANDARD DRAWINGS\S D DRAWINGS\S500 EROSION CONTROLS\S D 501.dwg



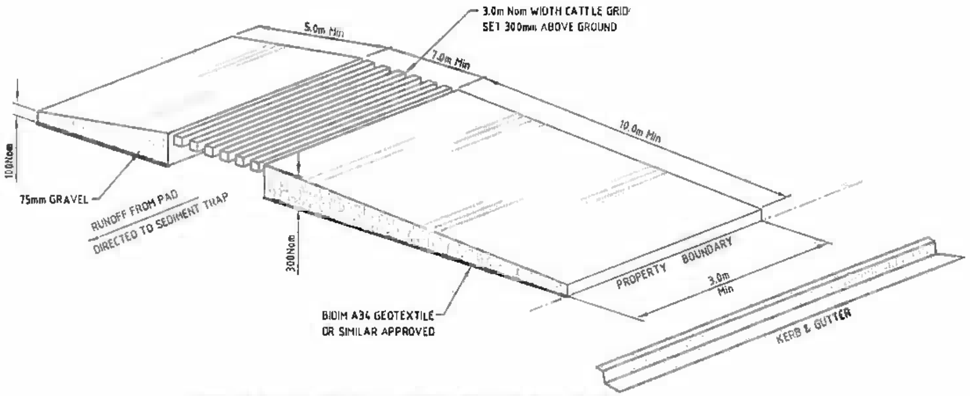
CHECK DAMS FLOW CONTROL
NOT TO SCALE



TEMPORARY CONSTRUCTION ACCESS SEDIMENT TRAP TYPE 1
NOT TO SCALE
NOTE. WHEEL WASH OR SPRAY MAY BE REQUIRED DURING WET WEATHER
GRAVEL SHALL BE CLEANED/REMOVED WHEN THE EXPOSED HEIGHT
OF THE GRAVEL IS LESS THAN 30mm

EROSION & SILTATION PREVENTION NOTES

1. CONSTRUCTION WORKS ARE TO BE MANAGED SUCH THAT AREAS OUTSIDE THE SCOPE OF WORKS REMAIN UNDISTURBED WHERE POSSIBLE
2. ALL SILTATION & EROSION CONTROL DEVICES SHALL BE INSTALLED PRIOR TO THE COMMENCEMENT OF ANY EXCAVATION WORKS (THE EXTENT OF THE DEVICES MAY BE VARIED FTOM THAT SHOWN ON THE DESIGN PLANS TO SUIT STAGED CONSTRUCTION
3. THE DEVICES SHALL BE MAINTAINED IN PLACE UNTIL ALL WORKS ARE COMPLETED & TURF OR GRASSING HAS BECOME ESTABLISHED
4. ALL BATTERS & REINSTATEMENT WORKS ADJACENT NEW CONSTRUCTION WORKS SHALL BE CARRIED OUT AS SOON AS POSSIBLE AFTER COMPLETION
5. ALL DISTURBED AREAS & BATTERS SHALL BE TURFED OR GRASSED AS SOON AS PRACTICAL AFTER REINSTATEMENT
6. ALL DEVICES SHALL BE INSPECTED REGULARLY AND AFTER ALL SIGNIFICANT STORM EVENTS & CLEANED, REPAIRED OR REPLACED AS REQUIRED
7. ADJACENT RUNOFF SHALL BE DIVERTED AWAY FROM CONSTUCTION ACCESS
8. SAFETY ISSUES MUST BE CONSIDERED AT ALL TIMES INCORPORATE TRAFFIC CONTROL DEVICES WHERE REQUIRED.



TEMPORARY CONSTRUCTION ACCESS SEDIMENT TRAP TYPE 2
NOT TO SCALE
NOTE. WHEEL WASH OR SPRAY MAY BE REQUIRED DURING WET WEATHER

ISSUE	AMENDMENT DETAILS	INITIALS	DATE
B	DRAWINGS ADOPTED FOR ISSUE TO PUBLIC	R.A.E.	5.2004
A	RE-ISSUED	R.A.E.	4.2004

TWEED SHIRE COUNCIL
DESIGN UNIT
COUNCIL OFFICES TUMBULGUM ROAD, MURWILLUMBAH, NEW SOUTH WALES, 2484
PHONE MURWILLUMBAH 02 66702400
FAX MURWILLUMBAH 02 66727513
WEBSITE www.tweed.nsw.gov.au

DESIGN ENGINEER — DATE 6.2003
DESIGN MANAGER — DATE 6.2003

DESIGNED	R.A.E.	2.2004	DESIGN	NO.
DRAWN	R.A.E.	2.2004	SURVEY	NO.
CHECKED	W.B.	5.2004	REDUCTION RATIO	
HORIZONTAL DATUM	MGA	COORDS ADOPTED		
VERTICAL DATUM	AHD			

PROJECT: EROSION CONTROL STANDARDS

PLAN TITLE: EROSION & SILTATION PREVENTION DEVICES SHEET 2

DRAWING NUMBER: S.D.502

SHEET 1 OF 1 SHEETS
ISSUE A B

ACAD FILE: N:\..._TSC STANDARD DRAWINGS\SD DRAWINGS\500EROSION CONTROL\SD502.dwg

APPENDIX C

ECOLOGICAL ASSESSMENT REPORT TOWN CENTRE

Cardno

Engineering the Future

ECOLOGICAL ASSESSMENT REPORT

CASUARINA BEACH TOWN CENTRE

Kings Beach No 3 Pty Ltd

Cardno (Qld) Pty Ltd
ABN 57 051 074 992

Level 1, 5 Gardner Close, Milton QLD 4064
PO Box 388, Toowong QLD 4066 Australia

Telephone: 07 3369 9822
Facsimile: 07 3369 9722
International: +61 73369 9822

September 2005
Job No. 7079/04

Cardno (Qld) Pty Ltd

ABN 57 051 074 992

5 Gardner Close Milton Q 4064

PO Box 388 Toowong

Queensland 4066 Australia

Telephone: 07 3369 9822

Facsimile: 07 3369 9722

International: +61 7 3369 9822

Email: cardno@cardno.com.au

Web: www.cardno.com.au

Document Control

Revision	Date	Author		Reviewer	
		Name	Initials	Name	Initials
0	September 2005	John Delaney		Dr T Johnson	

CASUARINA BEACH TOWN CENTRE
ECOLOGICAL ASSESSMENT REPORT

TABLE OF CONTENTS

LIST OF FIGURES

1.0 INTRODUCTION

This report has been prepared by Cardno (Qld) Pty Ltd ("Cardno"), on behalf of Kings Beach No 3 Pty Ltd, and provides an assessment of the ecological values of land that is to be developed as the Casuarina Beach Town Centre in accordance with the approved Master Plan for the Casuarina Beach development. The land the subject of this report is encompasses an area of approximately 16 hectares and is identified in the approved Master Plan as the "commercial area".

This report provides details of the floristic structure and composition of the site's vegetation and its associated fauna habitat values. This report also provides:

- an Eight Part Test, in accordance with Section 5A of the *Environmental Planning and Assessment Act 1979* ("*EP&A Act*"), to determine whether the propose development of the site is likely to have a significant effect on any threatened species, populations or ecological communities or their habitats; and

- an assessment of the likely impacts of the development upon the natural environment in accordance with the requirements of Section 79C of the EP&A Act.

The Casuarina Beach development area has been the subject of extensive flora and fauna surveys and assessments as part of the process of obtaining development approvals for the Master Plan (i.e. Gunninah 1996 a, b, c, 1997, 2000 and 2002). This assessment report relies on information from these previous investigations complemented by a supplementary site investigations carried out in January 2005.

2.0 SITE DESCRIPTION

The Casuarina Beach development area is land located between Cudgen Creek and Kings Beach, south of Kingscliff in northeast NSW. The majority of the Casuarina Beach development area was mined for mineral sands until the early 1970's and the existing vegetation communities have been modified by this disturbance regime.

The location and extent of the site that would be affected by the construction of Casuarina Beach Town Centre are illustrated in Figure No. DA21 and Figure No. DA39. The Town Centre site encompasses approximately 15 hectares of land centrally located within the Casuarina Beach development area.

3.0 VEGETATION DESCRIPTION

The dominant vegetation type at the Town Centre site is comprised of a coastal shrubland, dominated by Coastal Banksia (*Banksia integrifolia* subsp. *integrifolia),* Coast Tea-tree (*Leptospermum laevigatum*), Wattles (*Acacia spp*) and Coastal Oak (*Casuarina equisetifolia* subsp. *inana)* in the canopy layer, with an understorey dominated in places by Lantana (*Lantana camara*) and the exotic Bitou Bush (*Chrysanthemoides monilifera* subsp. *rotunda).* This vegetation types occupies the majority of the site and has regenerated, both naturally and as a result of post mining rehabilitation efforts, since the late 1960s. The balance of the site is comprised of areas of significant post mining disturbance that are primarily vegetated with introduced grasses and regenerating shrubland.

No significant flora species, pursuant to either the NSW *Threatened Species Conservation Act 1995* ("*TSC Act*") or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* ("*EPBC Act*") have been recorded at the site. Threatened flora species that have previously been recorded in the site locality include *Acronychia littoralis, Cryptocarya foetida, Randia moorei* and *Syzygium moorei* are all associated with littoral or sub-tropical rainforest communities that do not occur at the Town Centre site.

Bitou Bush, which forms dense monotypic stands that suppress the recruitment of native species, is listed as a *"Noxious Weed"* for the Far North Coast County Council on the *Noxious Weeds Act 1993 (NSW).*

4.0 FAUNA HABITAT VALUES

The site generally provides resources for fauna species that require low open habitats with limited groundcover or disturbed habitats. The absence of old growth hollow bearing trees limits the site's habitat values for native tree hollow dependent species and the site does not provide any habitat resources for wetland dependent species. The most common fauna species that occur include insectivorous and nectarivorous bird species such as silvereyes, finches, fairy wrens, scrub wrens, honeyeaters and wattlebirds which feed on Leptospermum, Acacia, Banksia and Bitou.

Several threatened fauna species are known to occur within site locality. In respect of such species its is noted that the site:

- does not contain any areas of suitable habitat for wetland or riparian dependent species such as the Australasian Bittern (*Botaurus poicilloptilus*), Black Bittern (*Ixobrychus flavicollis*), Black-necked Stork (*Ephippiorhynchus asiaticus*), Mangrove Honeyeater (*Lichenostomus fasciogularis*), Pied Oystercatcher (*Haematopus longirostris*) or Osprey (*Pandion haliaetus*);

- does not contain any areas of suitable habitat, including forage trees, for the Koala (*Phascolarctos cinereus*);

- contains a small number of food trees (i.e. *Allocasuarina* spp.) that may occasionally be exploited by the Glossy Black Cockatoo (*Calyptorhynchus lathami*), but does not contain any substantial areas of same nor any suitable nesting sites; and

- contains seasonally available feeding resources for flying foxes (i.e. *Pteropus alecto* and *P. poliocephalus*) and Common Blossom Bat (*Syconycteris australis*) primarily in the form of nectar produced by species such as the Coast Banksia, but does not provide any roosting habitats.

The contribution that the Coastal Banksia contained within the Town Centre site make towards the availability of foraging resources for habitat for flying foxes (i.e. *Pteropus alecto* and *P. poliocephalus*) and Common Blossom Bat (*Syconycteris australis)* was recognised in the planning approvals granted for the Casuarina Beach development. In this respect the Town Centre site encompasses one of two "Banksia Deferred Areas" in respect of which vegetation clearance associated with development works was to be deferred for a period of four (4) years from 1 July 1999. The intent of deferment of vegetation clearance within the "Banksia Deferred Areas" was to allow an appropriate period for the establishment of Banksia plantings that were to be carried out throughout the Casuarina Beach development area as a compensatory measure for the loss of

Banksia as a result of development works. Monitoring of Coastal Banksia plantings, which were commenced in 1998 as part of the Casuarina Beach development, indicated that by 2002 such plantings were "well established, and many beginning to provide winter foraging resources for the Common Blossom Bat and other nectarivorous species" (Gunninah Environmental Consultants, 2002).

In summary the vegetation that occurs at the site does not provide core habitat for any of the threatened species that are known to occur in the locality. The Coast Banksia is the only notable resource that is available for threatened fauna species such as the Common Blossom Bat, Grey-headed Flying Fox and Back Flying Fox. However the Coast Banksia within the Town Centre site comprises a relatively small proportion of the available forage resource that has been retained or established, in specific anticipation of the eventual loss of Coast Banksia from areas such as the Town Centre site, within the Casuarina Beach development area.

5.0 PROPOSED DEVELOPMENT

Kings Beach No 3 Pty Ltd proposes development of the Casuarina Beach Town Centre in accordance with the approved Master Plan for the Casuarina Beach development. The development of the Town Centre will involve the clearance of vegetation from the subject area and subsequent re-profiling of the land.

The general layout of the plan of development for the Town Centre is illustrated in Figure No. DA39.

6.0 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

With reference to the ecological characteristics and values of the site and the nature of he proposed development, this section of the report provides:

- an Eight Part Test, in accordance with Section 5A of the *Environmental Planning and Assessment Act 1979* ("*EP&A Act*"), to determine whether the propose development of the site is likely to have a significant effect on any threatened species, populations or ecological communities or their habitats; and
- an assessment of the likely impacts of the development upon the natural environment in accordance with the requirements of Section 79C of the *EP&A Act*.

6.1 Section 5A Assessment

Section 5A of the NSW *EP&A Act* provides for an eight part test to determine whether a proposed development is likely to have a significant effect on threatened species, populations or ecological communities, or their habitats. An eight part test for the Casuarina Beach Town Centre development is presented below.

1. **In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.**

No threatened flora species have been recorded at the Town Centre site and the site does not contain suitable habitat for threatened flora species that have been previously recorded in the site locality.

The Town Centre site provides very limited resources for the suite of threatened fauna species known to occur in the site locality, with the exception of foraging resources for species such as the Common Blossom Bat, Grey-headed Flying Fox and Back Flying Fox. The foraging resources for these species are primarily comprised of the blossoms of the Coastal Banksia, which is a common component of the site's vegetation. In isolation the site could not sustain a viable local population of any of these species. Rather the site makes a contribution to the total availability of foraging resources that are available, to local populations of these species, within and adjacent to the Casuarina Beach development area.

Specific measures have been taken as part of the Casuarina Beach development to preserve and establish foraging resources for threatened fauna reliant upon species such as the Coastal Banksia in anticipation of the eventual development of the Town Centre site. In this respect the loss of forage resources for threatened fauna species reliant upon species such as the Coastal Banksia would not disrupt the life cycle of any threatened fauna species such that a viable local population of the species is likely to be placed at risk of extinction.

2. **In the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.**

The Town Centre site does not support any "endangered populations" and, as such, development of the site would not disrupt the life cycle of any species that constitutes an endangered population such that the viability of the population is likely to be significantly compromised.

3. **In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.**

The affected area does not support any threatened populations or ecological communities.

The development of the Town Centre site would affect approximately 10 hectares of modified costal scrub that provides some foraging resources for threatened species such as the Common Blossom Bat, Grey-headed Flying Fox and Back Flying Fox. As noted previously substantial areas of habitat for these species occur within the site locality and specific measures have been taken as part of the Casuarina Beach development to retain and re-establish foraging resources for species such as the Common Blossom Bat, Grey-headed Flying Fox and Back Flying Fox in anticipation of the eventual development of the Town Centre site and associated reduction in the availability of foraging resources for such species.

In respect of the above the proposed development would not have any discernible influence upon the regional distribution of the habitat of a threatened species, population or ecological community nor would a significant area of known habitat be modified or removed.

4. Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

The only threatened species that potentially utilise the site are highly mobile species with relatively extensive home ranges. In addition the Town Centre site is currently surrounded by infrastructure forming part of the Casuarina Beach development and does not provide, nor form part of, any linkage system connecting external areas of habitat for threatened species, populations or ecological communities.

Development of the Town Centre site would not result in an area of known habitat becoming isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

5. Whether critical habitat will be affected.

The Town Centre site does not contain any "critical habitat" for threatened species, populations or ecological communities that is currently declared within NSW.

6. Whether a threatened species, population of ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Suitable areas of habitat for threatened species have been reserved as part of the Casuarina Beach development to compliment existing conservation reserves in the site locality. The Town Centre site does not contain any areas that would be suitable for inclusion in the region's conservation reserves (or other similar protected areas) for the purpose of improving the representation of threatened species, populations or ecological communities, or their habitats, within conservation reserves.

7. Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The *TSC Act* defines a "threatening process" as "*a process that threatens, or may have the capability to threatened, the survival or evolutionary development of species, populations or ecological communities*". *Schedule 3* of the *TSC Act* recognises the following "*key threatening process*" that are of potential relevance to the development of the Casuarina Beach Town Centre:

- "*clearing of native vegetation*"; and
- "*Invasion of native plant communities by Chrysanthemoides monilifera {Bitou Bush}*"

In respect of these threatening processes it is relevant to note that:

- whilst the development of the Town Centre will require the clearance of vegetation from the site, this vegetation has established on the site via a combination of active post-mining revegetation and natural regeneration processes, and is not true native vegetation in terms of its species composition and structure;

- the implications of vegetation clearance upon native wildlife species, populations and communities are negligible for the reasons specified previously; and

- Bitou Bush is a common component of the site's vegetation and development of the Town Centre will result in the removal of this species from the site, with an associated reduction in the potential for the site to act as a source of propagules for the establishment of Bitou Bush on adjacent land.

In summary the development of the Town Centre site does not constitute a process that would threaten, or have the capability to threatened, the survival or evolutionary development of any species, populations or ecological communities.

8. **Whether any threatened species, population or ecological community is at the limit of its known distribution.**

No threatened species, population or ecological community that could be potentially affected by development of the Town Centre site is at the limit of their known distribution, except in as far as the adjacent coastline represents the eastern limit of terrestrial species and communities. The development of the Town Centre site would not result in any contraction in the distribution of threatened fauna such as the Common Blossom Bat, Grey-headed Flying Fox or Back Flying Fox.

Conclusion

This eight part test has been completed, in accordance with the requirements of Section 5A of the *EP&A Act,* in respect of the potential impact of the Town Centre development upon threatened species, populations or ecological communities, or their habitats. The conclusion of this assessment is that the Town Centre development would not have, nor be likely to have, a significant impact upon any threatened species, populations or ecological communities, or their habitats. As such there is no requirement for the preparation of a Species Impact Statement for the Casuarina Beach Town Centre development.

7.0 BIBLIOGRAPHY

Gunninah. 1996a. *Kings Beach Development, Tweed Shire, NSW. Species Impact Statement.* Gunninah Environmental Consultants, Crows Nest, NSW.

Gunninah. 1996b. *Kings Beach Development, Tweed Shire, NSW. Flora and Fauna Report.* Gunninah Environmental Consultants, Crows Nest, NSW.

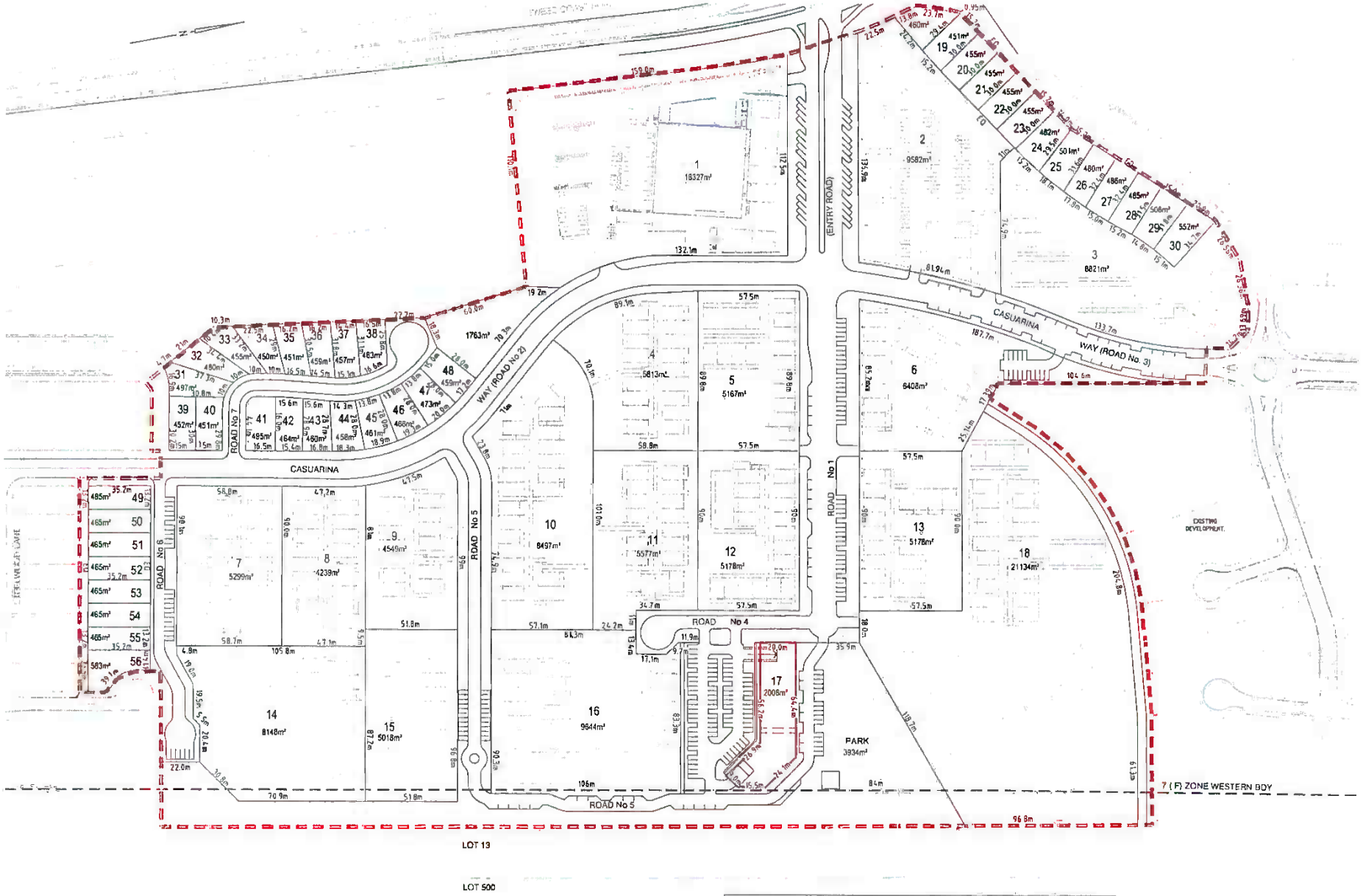
Gunninah. 1996a. Kings Beach Development, Tweed Shire, NSW. Species Impact Statement. Gunninah Environmental Consultants, Crows Nest, NSW.

Gunninah. 1996a. Kings Beach Development, Tweed Shire, NSW. Species Impact Statement. Gunninah Environmental Consultants, Crows Nest, NSW.

FIGURES

Figure No. DA21 **Aerial Photograph (2005) of the subject land**

Figure No. DA39 **Subdivision Plan**



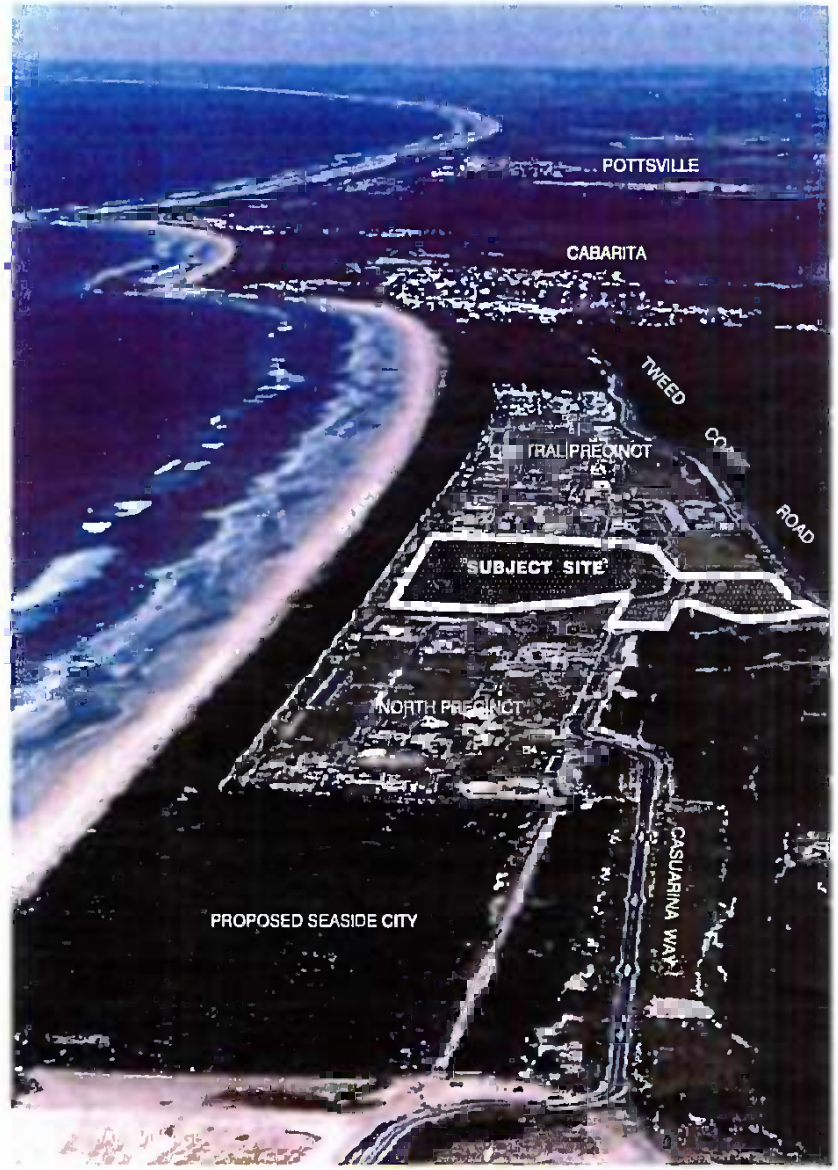
SCALE BEFORE REDUCTION

Cardno
Cardno (Qld) Pty Ltd ACN: 051 074 893
Commercial Centre, Isle of Capri
Gold Coast City, Queensland 4217
Email: gc@cardno.com.au

KINGS BEACH (No. 2) PTY LTD		
CASUARINA BEACH TOWN CENTRE DA SUBMISSION	SCALE - 1:1000	A1
	DATE :- 10 OCTOBER, 2003	REV. E
	DRAWING No. 7079/4/1-FIG DA39	

FIGURE No.DA39E(17/02/08)

SUBDIVISION
LAYOUT PLAN



Cardno (Qld) Pty Ltd

KINGS BEACH (No. 2) PTY LTD	
CASUARINA BEACH TOWN CENTRE DA SUBMISSION	SCALE – NOT TO SCALE A1 DATE – 10 JUL 7, 2007 REV 0 DRAWING No 7079/4/1-FIG DA21

FIGURE No.DA21D(24/01/08)

SUBJECT LAND
AIR PHOTO 2005

APPENDIX D

CASUARINA BEACH
BANKSIA AMELIORATION PROGRAM

REPORT No. 4

CASUARINA BEACH BANKSIA AMELIORATION PROGRAM

REPORT NO. 4

Prepared for

Consolidated Properties Pty. Ltd.

by

Project X

07-03-02

Casuarina Beach Banksia Amelioration Program

Report no. 4
Photo Records
Monitoring Schedules

07-03-02

1:00 GENERALLY
Current Inspection Date:- 01-03-2002
Last Inspection Date:- 13-06-2000

The Casuarina Beach Banksia Amelioration Program (formerly Kings Beach) has been in place for a period of approx. 3 years.

The Plantings were established utilising methods which would see the plants survive and prosper under the existing harsh environmental conditions without the aid of artificial stimuli (heavy fertilisation and irrigation).

Since that time the plantings have consolidated and progressed at various rates.

Some planted specimens of Banksia integrifolia have been noted to have reached 1.5 metres in height and were seen bearing blossoms during an impromptu visit last winter. Specimens of other species have been noted to have reached 2 mtrs.

Many specimens however continue to grow more slowly although most exhibit good colour and are producing new growth. It is worthy of note that even the smallest plants are very difficult to dislodge from the ground, having formed extensive root systems.

Peripheral species to the Program such as Eucalypts and Melaleucas have been reduced in numbers dramatically through the effects of browsing by local fauna.

2:00 PESTS
The BANKSIA INTEGRIFOLIA plantings continue to host naturally occurring leaf miners and tip borers which have slowed growth in many instances. This has however allowed stem callipers to develop and most trees have stems which are exceptionally thick for their size and support the plants well.

3:00 MAINTENANCE
Maintenance procedures were last carried out during winter 2000. The tasks carried out included Bitou reduction, fertilising and remarking of plants.

The implementation of a regular maintenance regime would be beneficial to the existing Banksia plantings. It is considered critical that the fire breaks in Area 2 are well maintained to protect the large number Banksia integrifolia plants which exist in that area.

4:00 PLANT LOSSES AND REPLANTINGS
Plant losses among the Banksia integrifolia plantings remain modest at approx.10%.

Other species have experienced heavier losses of approx. 63% due to dry conditions and heavy browsing from the local fauna population.

Total losses for the overall combined plantings is approx. 20%.

It should be noted that a section of Area 4 was affected by a small bushfire which destroyed approx. 125 Banksia integrifolia plants, this represents a significant percantage of Banksia losses overall.

No replantings have been established since the previous report.

See TABLE 4:01 overleaf.

Project X 07-03-02

Casuarina Beach Banksia Amelioration Program

Report no. 4

07-03-02

TABLE 4:01 **EXISTING PLANT QUANTITIES / LOSSES**

SPECIES	Planted	Area 1	Area 2	Area 3	Area 4	Area 5	Total
Banksia integrifolia	12200	2968	6032	50	200	2950	
Losses to date		39	248	19	145	834	
Existing total		2929	5784	31	55	2116	10915
Banksia aemula	400			350		50	
Losses to date				76		14	
Existing total				274		36	310
Callistemon pachyphyllus	500			300	125	75	
Losses to date				224	117	60	
Existing total				76	8	15	99
Callistemon salignus	500			300	140	60	
Losses to date				225	134	47	
Existing total				75	6	13	94
Eucalyptus robusta	300			300			
Losses to date				276			
Existing total				24			24
Eucalyptus teretecornis	100				100		
Losses to date					92		
Existing total					8		8
Melaleuca quinquinerva	1000			950		50	
Losses to date				448		47	
Existing total				502		3	505
TOTALS	15000						11955

Note: Conditions encountered on site, including the loss of plant marker stakes, has created difficulties providing definitive plant quantities and losses. Considerable effort was expended to obtain the data shown in Table 4:01 which, although approximate, we believe forms an accurate profile of the existing plantings.

Project X *07-03-02*

Casuarina Beach Banksia Amelioration Program

Report no. 4

07-03-02

5:00 SUMMARY

Although considerable variation in growth rates has occurred a substantial basis for the achievement of the Program's goals has been effected.

The Program's existing plantings have become well established with the formation of extensive root systems. It is anticipated therefore, that the growth rates shown by the most successful plants will be achieved across a wider range of specimens in the immediate future.

However the forces of natural selection will always be determinate under the existing conditions. The implementation of a regular maintenance regime will provide more consistent and predictable rates of growth.

Area 1 and Area 5, because of their accessibility and open aspect provide the best opportunity to enhance the growing conditions for the plantings through the provision of drip irrigation and mulching in to create a more cultivated environment.

Areas 2, 3 and 4 remain in a reasonably natural state and provide an opportunity for the continued establishment of plantings under the more natural conditions.

6:00 GENERAL MAINTENANCE RECOMMENDATIONS

1. Re-establish fire breaks.

2. Control the proliferation of Bitou, Leptospermum and other invasive weeds in all areas.

3. Establish whether or not any elemental deficiencies exist within soils or plant tissues by comparative testing.

4. Fertilise all existing plants applying a low P, NPK fertiliser with trace elements at rates established through testing.

5. Re-establish plant markers.

6. Spray infected plants to remove borers.

7:00 REPLANTING RECOMMENDATIONS

The replanting, provision of drip irrigation and mulching to all plants within Areas 4 and 5, coupled with regular weed control measures will provide conditions conducive to faster growth rates and an increased ability to produce inflorescence.

1. Re-establish plantings within AREA 1 - 39 plants.

2. Re-establish plantings within AREA 5 - 834 plants.

3. Provide drip irrigation fertiliser and mulch to new and existing Banksia integrifolia plantings within AREA 1 and AREA 5.

The implementation of irrigation and mulching works to Areas 1 and 5 coupled with a regular maintenance regime will provide 5918 Banksia integrifolia plants with vastly improved growing conditions. Under these new conditions, and in consideration that some specimens have already borne inflorescence, it would be reasonable to assume that flowering on at least 30% of plants would take place during the winter of 2003. The balance of plants would then come into flower sporadically over the following growing seasons as conditions and plant growth allow.

Project X *07-03-02*

Casuarina Beach Banksia Amelioration Program

Report no. 4

07-03-02

8:00 PHOTO RECORDS and MONITORING DATA

SAMPLE TABLE 8:01 **MONITORING SCHEDULE**

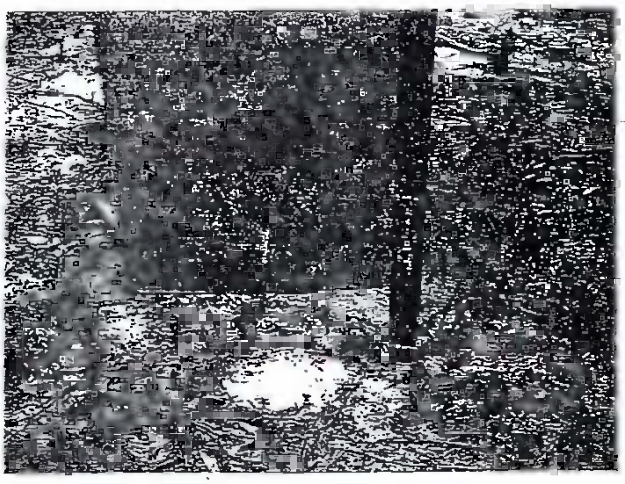
Area 1 Species	Data	No. 1	No.2	No.3	No.4	No.5	No.6	No.7	No.8
Banksia integrifolia	Height	150	400	450	-	250	/	350	1100
	Spread	110	550	450	-	600	/	400	1000
	Caliper	10	25	15	-	20	/	25	40
	Comment				-		/		

NOTES:

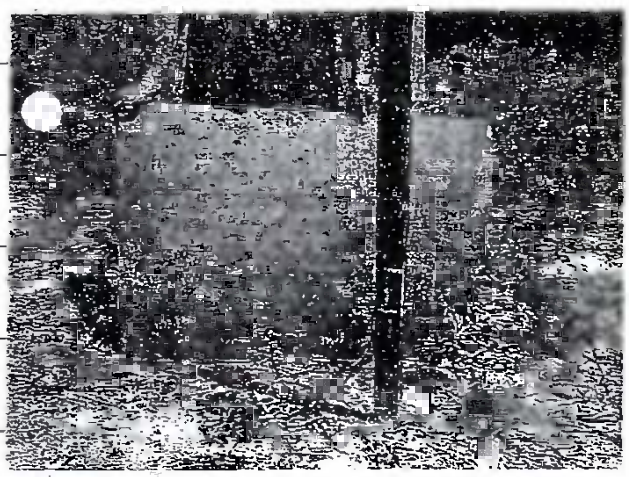
1. Dashes in columns represent markers which could not be located therefore no data collected.
2. Slashes in columns represent plants which have perished.
3. All measurements are shown in millimetres.
4. Height and Spread measurements have generally been rounded to the nearest 50mm.
5. Caliper measurements have been rounded to the nearest 5mm.

Project X *07-03-02*

1/8 height 310 spread 350 caliper 10



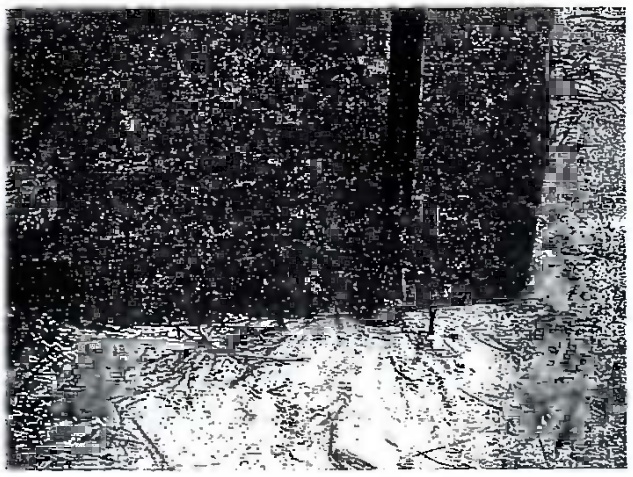
1/9 height 450 spread 340 caliper 15



1/11 height 420 spread 650 caliper 20

1/12 height 1250 spread 800 caliper 35

1/13 height 155 spread 125 caliper 10



1/14 new shoot

Photos - Area 1

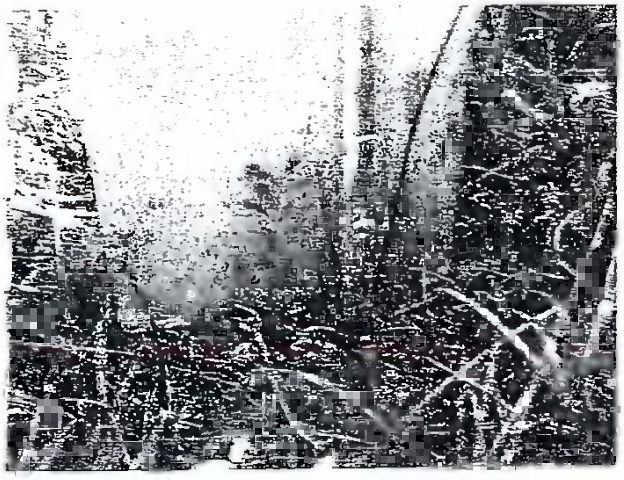
1/15 height 350 spread 310 caliper 10

TABLE 8:01 **MONITORING SCHEDULE** 7- 3 -2002

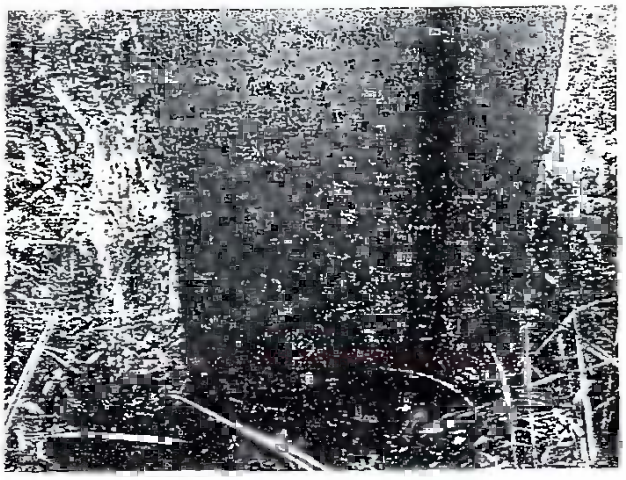
Area 1 Species	Data	No. 1	No.2	No.3	No.4	No.5	No.6	No.7	No.8
nksia integrifolia	Height	150	400	450	-	250	250	350	1100
	Spread	110	550	450	-	600	300	400	1000
	Caliper	10	25	15	-	20	10	25	40
	Comment								
	Data	No.9	No.10	No.11	No.12	No.13	No.14	No.15	No.16
	Height	1100	600	1100	900	1200	1100	125	1200
	Spread	900	750	1050	900	600	900	100	700
	Caliper	35	30	40	35	35	35	10	35
	Comment								
	Data	No.17	No.18	No.19	No.20	No.21	No.22	No.23	No.24
	Height	125	310	200	600	600	100	250	-
	Spread	250	300	300	400	500	100	260	-
	Caliper	10	15	15	20	20	10	10	-
	Comment								
	Data	No.25	No.26	No.27	No.28	No.29	No.30	No.31	No.32
	Height	reshoot	350	170	210	600	/	600	200
	Spread		350	125	200	450	/	900	200
	Caliper		20	5	15	20	/	30	10
	Comment								
	Data	No.33	No.34	No.35	No.36	No.37	No.38	No.39	No.40
	Height	400	325	350	600	175	-	80	170
	Spread	390	300	350	300	170	-	90	160
	Caliper	15	15	15	25	10	-	5	10
	Comment								
	Data	No. 41	No.42	No.43	No.44	No.45	No.46	No.47	No.48
	Height	500	600	-	-	500	-	115	1000
	Spread	400	500	-	-	600	-	110	300
	Caliper	15	115	-	-	20	-	5	15
	Comment								
	Data	No.49	No.50	No.51	No.52	No.53	No.54	No.55	No.56
	Height	600	255	-	-	300	350	450	350
	Spread	600	250	-	-	250	400	450	500	
	Caliper	20	15	-	-	10	15	20	15
	Comment								
	Data	No.57	No.58	No.59	No.60	No.61	No.62	No.63	No.64
	Height	200	250	-	800	500	-	300	500
	Spread	100	400	-	600	500	-	400	500
	Caliper	10	15	-	20	15	-	15	30
	Comment								

TABLE 8:01 MONITORING SCHEDULE 7-3-200

Area 1 Species	Data	No.65	No.66	No.67	No.68	No.69	No.70	No.71	No.72
Banksia integrifolia	Height	500	250	700	250	400	1500	-	400
	Spread	500	750	800	300	500	1500	-	300
	Caliper	20	15	30	15	25	40	-	15
	Comment								
	Data	No.73	No.74	No.75	No.76	No.77	No.78	No.79	No.80
	Height	600	350	300	-	300	380	160	300
	Spread	500	250	200	-	300	250	230	150
	Caliper	15	20	15	-	15	10	5	10
	Comment								
	Data	No.81	No.82	No.83	No.84	No.85	No.86	No.87	No.88
	Height	600	-	250	250	600	-	1050	500
	Spread	300	-	300	250	650	-	500	600
	Caliper	10	-	10	15	20	-	25	15
	Comment								
	Data	No.89	No.90	No.91	No.92	No.93	No.94	No.95	No.96
	Height	1200	350	600	250	170	500	500	-
	Spread	600	450	500	450	200	500	400	-
	Caliper	25	20	25	15	10	20	20	-
	Comment								



2/1 height 300 spread 150 caliper 10

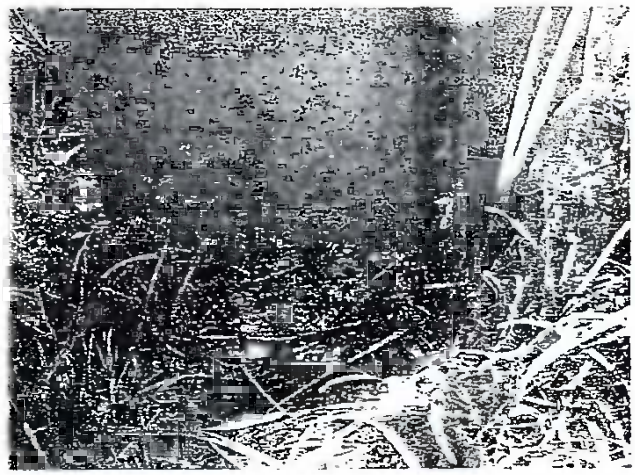


2/2 height 275 spread 225 caliper 10

2/3 height 250 spread 225 caliper 10

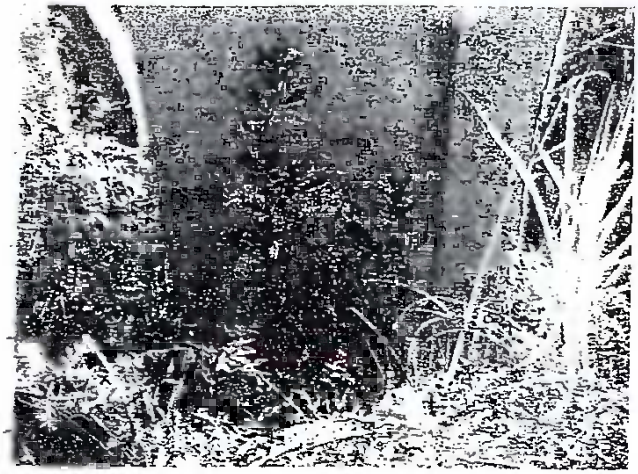
2/4 height 215 spread 300 caliper 10

2/5 height 225 spread 250 caliper 10



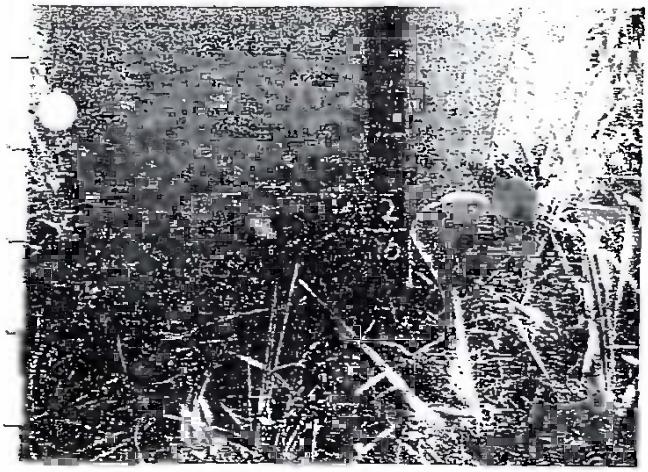
2/7 new shoot

Photos - Area 2



2/8 height 550 spread 420 caliper 15

2/9 height 225 spread 250 caliper 10



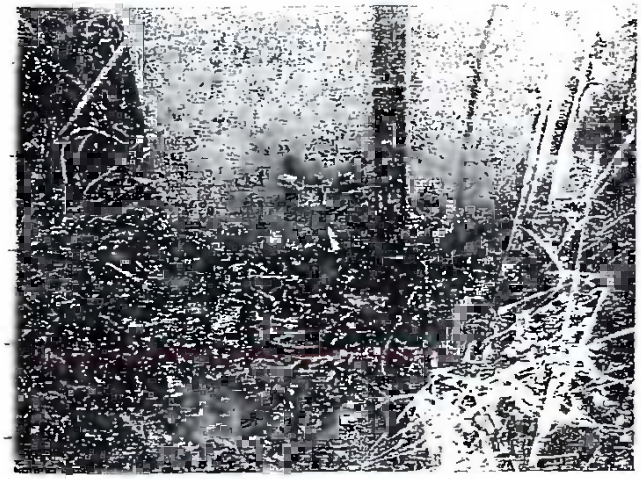
2/10 height 320 spread 250 caliper 15

2/11 height 450 spread 420 caliper 15

2/12 height 225 spread 150 caliper 10

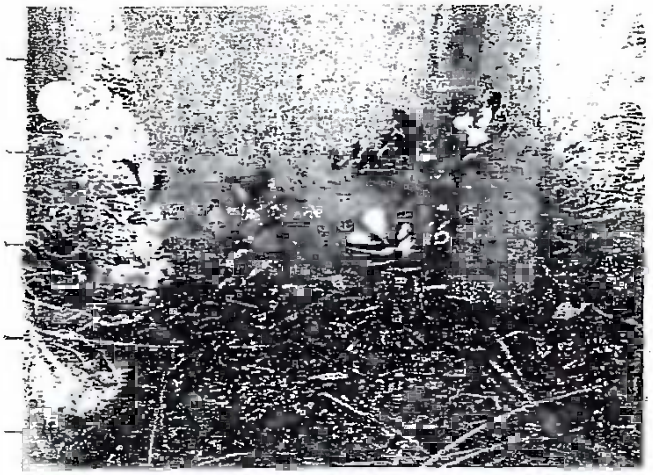
2/13 height 325 spread 240 caliper 15

Photos - Area 2

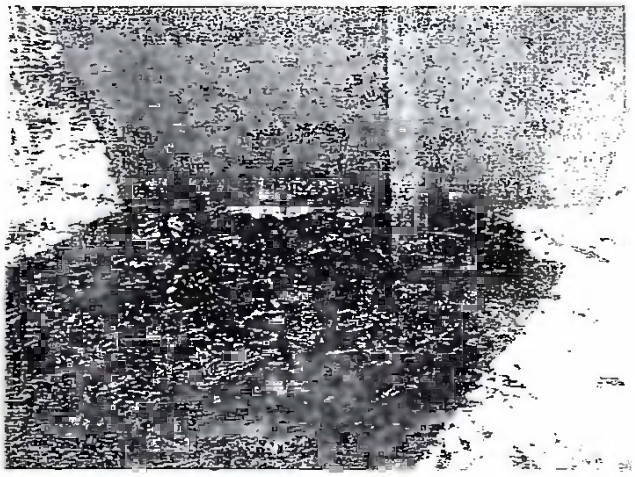


2/14 height 220 spread 150 caliper 10

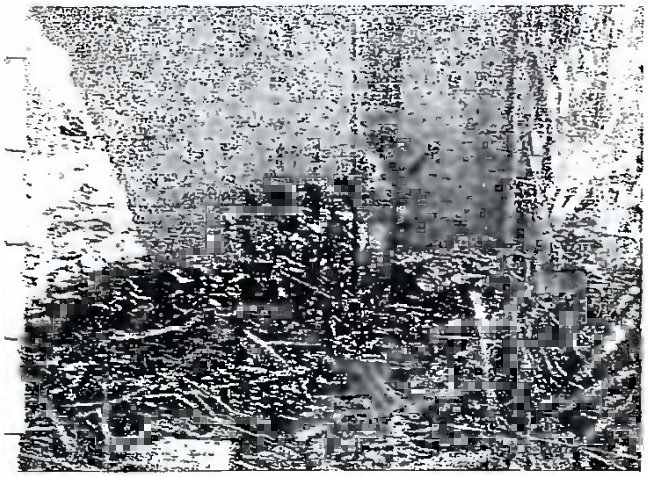
2/15 height 225 spread 125 caliper 10



2/16 height 375 spread 450 caliper 20



2/17 height 125 spread 300 caliper 20



2/18 height 300 spread 300 caliper 15

2/19 height 210 spread 350 caliper 15

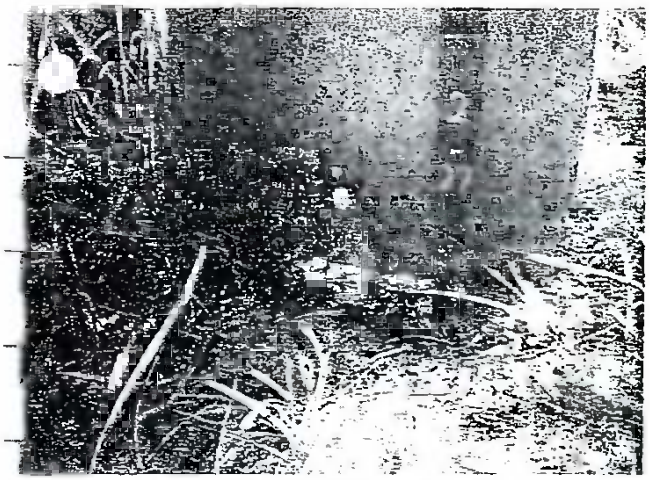
Photos - Area 2

2/21 height 175 spread 200 caliper 10

2/23 height 200 spread 200 caliper 10

2/24 height 450 spread 225 caliper 15

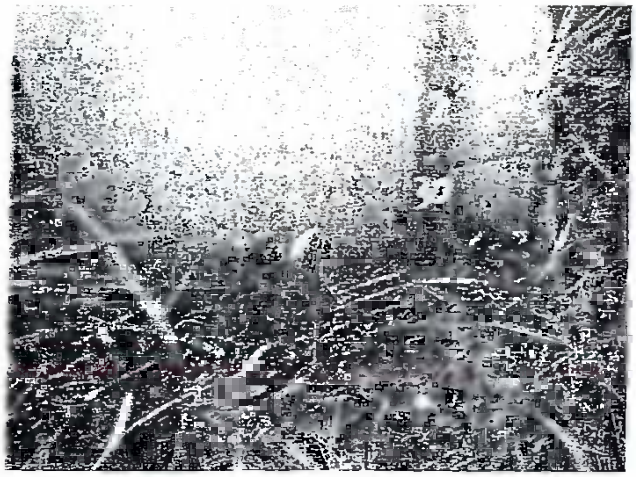
2/25 height 210 spread 200 caliper 10



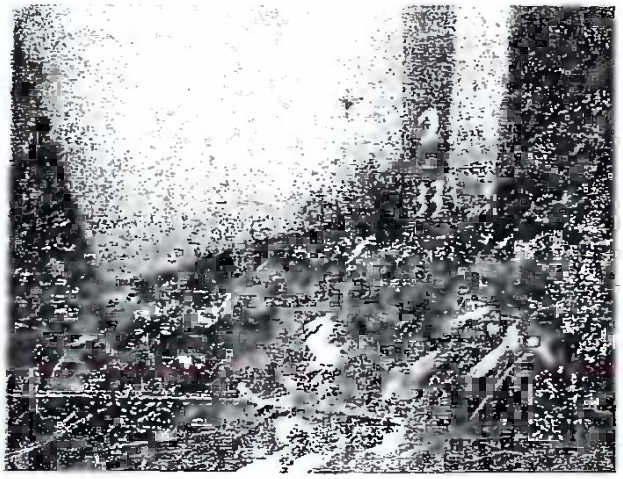
2/27 height 225 spread 200 caliper 10

2/29 height 125 spread 125 caliper 5

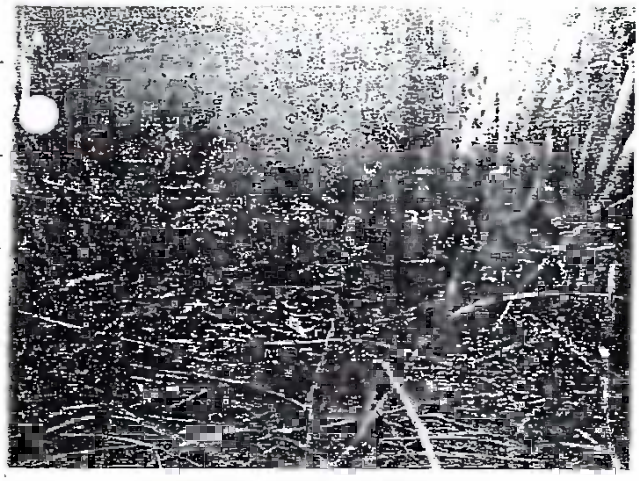
Photos - Area 2



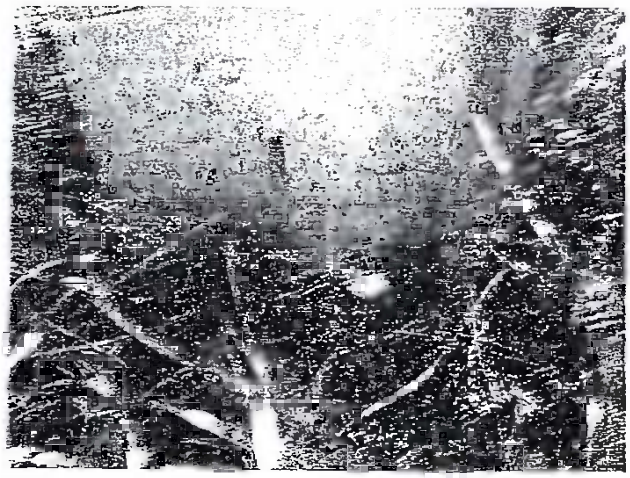
2/30 height 150 spread 125 caliper 5



2/33 height 110 spread 75 caliper 5



2/34 height 410 spread 400 caliper 15



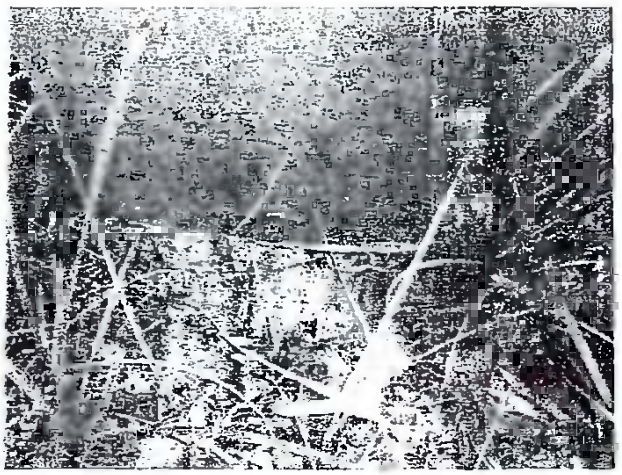
2/35 height 260 spread 250 caliper 10

2/36 new shoot

2/37 height 450 spread 250 caliper 15

Photos - Area 2

2/38 height 200 spread 150 caliper 5



2/39 height 110 spread 110 caliper 5

2/40 height 640 spread 620 caliper 25

2/41 height 500 spread 230 caliper 15

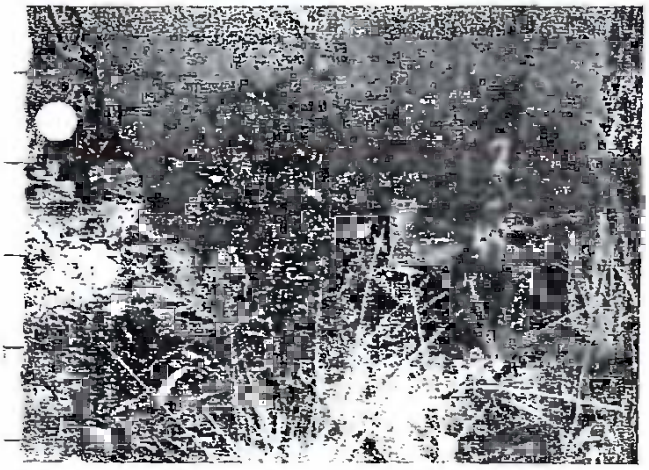
2/42 height 320 spread 350 caliper 10

2/43 height 425 spread 490 caliper 20

Photos - Area 2

2/47 height 290 spread 175 caliper 10

2/48 height 310 spread 500 caliper 20



2/49 height 425 spread 500 caliper 15

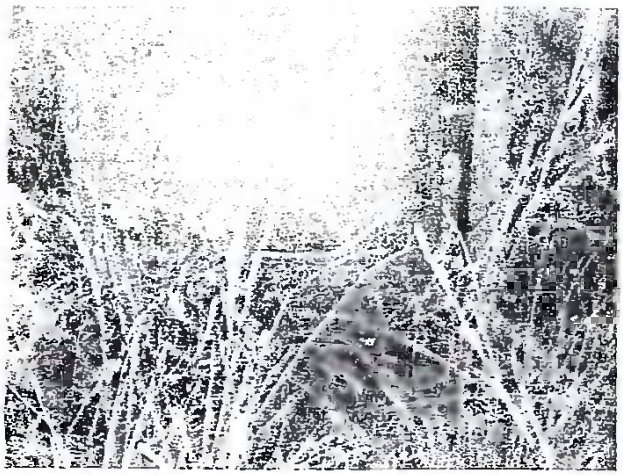
TABLE 8:01 **MONITORING SCHEDULE** 7- 3 -2002

Area 2 Species	Data	No.140	No.141	No.142	No.143	No.144	No.145	No.146	No.147
nksia integrifolia	Height	-	-	-	-	-	-	-	500
	Spread	-	-	-	-	-	-	-	350
	Caliper	-	-	-	-	-	-	-	15
	Comment	-	-	-	-	-	-	-	
	Data	No.148	No.149	No.150	No.151	No.152	No.153	No.154	No.155
	Height	225	/	-	100	300	200	175	-
	Spread	150	/	-	100	200	200	150	-
	Caliper	10	/	-	10	10	10	10	-
	Comment		/	-					-
	Data	No.156	No.157	No.158	No.159	No.160	No.161	No.162	No.163
	Height	-	150	/	/	300	200	500	250
	Spread	-	100	/	/	250	175	400	180
	Caliper	-	5	/	/	10	10	15	10
	Comment	-		/	/				
	Data	No.164	No.165	No.166	No.167	No.168	No.169	No.170	No.171
	Height	250	400	175	-	-	-	250	400
	Spread	200	400	80	-	-	-	300	250
	Caliper	10	15	5	-	-	-	10	10
	Comment				-	-	-		
	Data	No.172	No.173	No.174	No.175	No.176	No.177	No.178	No.179
	Height	/	-	-	360	400	250	300	600
	Spread	/	-	-	175	250	300	200	150
	Caliper	/	-	-	10	15	10	10	10
	Comment	/	-	-					
	Data	No.180	No.181	No.182	No.183	No.184	No.185	No.186	No.187
	Height	-	-	-	-	200	450	150	250
	Spread	-	-	-	-	100	320	125	230
	Caliper	-	-	-	-	10	10	5	10
	Comment	-	-	-	-				
	Data	No.188	No.189	No.190	No.191	No.192	No.193	No.194	No.195
	Height	600	600	300	600	220	150	300	600
	Spread	600	500	400	600	310	70	350	600
	Caliper	15	15	10	15	5	5	10	15
	Comment								
	Data	No.196	No.197	No.198	No.199	No.200	No.201	No.202	No.203
	Height	200	250	/	600	500	250	350	300
	Spread	250	220	/	500	500	175	250	300
	Caliper	10	10	/	10	10	10	10	10
	Comment			/					

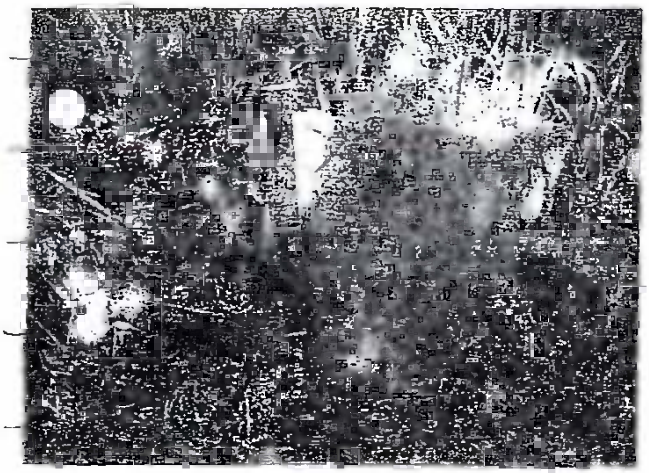
TABLE 8:01 **MONITORING SCHEDULE** 7-3-200

Area 2 Species	Data	No.204	No.205	No.206	No.207	No.208	No.209	No.210	No.211
nksia integrifolia	Height	-	400	255	400	500	500	205	300
	Spread	-	600	175	500	300	300	200	300
	Caliper	-	15	5	10	10	15	10	15
	Comment	-							
	Data	No.212	No.213	No.214	No.215	No.216	No.217	No.218	No.219
	Height	165	300	-	170	190	/	-	-
	Spread	90	200	-	40	105	/	-	-
	Caliper	5	10	-	5	5	/	-	-
	Comment			-			/	-	-
	Data	No.220	No.221	No.222	No.223	No.224	No.225	No.226	No.227
	Height	-	-	165	175	/	155	250	-
	Spread	-	-	105	150	/	170	250	-
	Caliper	-	-	5	10	/	10	10	-
	Comment	-	-			/			-
	Data	No.228	No.229	No.230	No.231	No.232	No.233	No.234	No.235
	Height	300	155	-	-	180	175	-	250
	Spread	300	120	-	-	100	100	-	250
	Caliper	10	5	-	-	5	10	-	10
	Comment			-	-			-	
	Data	No.236	No.237	No.238	No.239	No.240	No.241	No.242	No.243
	Height	-	-	300	-	250	/	280	/
	Spread	-	-	250	-	105	/	160	/
	Caliper	-	-	10	-	10	/	10	/
	Comment	-	-		-		/		/
	Data	No.244	No.245	No.246	No.247	No.248	No.249	No.250	No.251
	Height	500	-	150	250	300	260	150	-
	Spread	250	-	90	200	400	200	100	-
	Caliper	10	-	5	10	15	5	5	-
	Comment		-						-

3/1ba height 350 spread 360 caliper 15



3/2ba height 350 spread 450 caliper 20



3/5cs height 1100 spread 400 caliper 10

3/6cp height 450 spread 160 caliper 10

3/7m height 550 spread 140 caliper 10

3/8m height 375 spread 240 caliper 10

Photos - Area 3

3/9cs height 850 spread 225 caliper 10

3/11b height 250 spread 140 caliper 10

3/12b height 180 spread 120 caliper 10

TABLE 8:01 MONITORING SCHEDULE 7-3-200

Area 3 Species	Data	No.97	No.98	No.99	No.100	No.103	No.104	No.105	No.106
C ilistemon salignus	Height	-	-	-	/	-	-	-	-
	Soread	-	-	-	/	-	-	-	-
	Caliper	-	-	-	/	-	-	-	-
	Comment	-	-	-	/	-	-	-	-
M elaleuca quinquinerva	**Data**	No.101	No.102	No.107	No.108	No.109	No.110	No.111	No.117
	Height	-	/	/	/	500	/	-	/
	Spread	-	/	/	/	150	/	-	/
	Caliper	-	/	/	/	10	/	-	/
	Comment	-	/	/	/		/	-	/
	Data	No.118	No.119	No.120	No.131				
	Height	450	-	/	-				
	Spread	150	-	/	-				
	Caliper	10	-	/	-				
	Comment		-	/	-				
Callistemon pachypyllus	**Data**	No.112	No.113	No.114	No.115	No.116			
	Height	-	-	/	-	300			
	Spread	-	-	/	-	200			
	Caliper	-	-	/	-	5			
	Comment	-	-	/	-				
B nksia integrifolia	**Data**	No.121	No.122	No.123	No.124	No.125	No.128	No.129	
	Height	/	/	/	300	130	/	-	
	Spread	/	/	/	250	160	/	-	
	Caliper	/	/	/	15	5	/	-	
	Comment	/	/	/			/	-	
banksia aemula	**Data**	No.126	No.127	No.130	No.137	No.138	No.139		
	Height	500	300	325	/	500	-		
	Spread	250	400	350	/	350	-		
	Caliper	15	15	15	/	10	-		
	Comment				/		-		
E calyptus robusta	**Data**	No.132	No.133	No.134	No.136				
	Height	/	/	/	/				
	Spread	/	/	/	/				
	Caliper	/	/	/	/				
	Comment	/	/	/	/				

I/1b height 225 spread 210 caliper 10

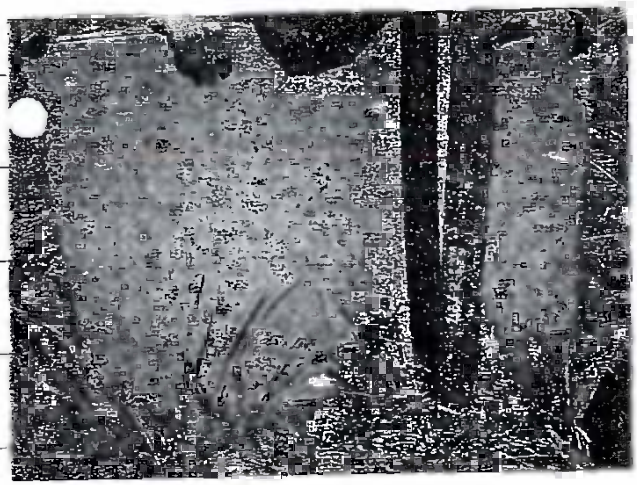
4/2et height 850 spread 150 caliper 10

TABLE 8:01 MONITORING SCHEDULE 7- 3 -200

Area 4 Species	Data	No.252	No.253	No.254	No.255	No.256	No.257	No.258	No.260
E nksia integrifolia	Height	-	-	/	-	500	/	-	-
(e affected area)	Spread	-	-	/	-	500	/	-	-
	Caliper	-	-	/	-	10	/	-	-
	Comment	-	-	/	-		/	-	
	Data	No.262	No.270	No.271	No.272	No.273			
	Height	-	/	/	/	/			
	Spread	-	/	/	/	/			
	Caliper	-	/	/	/	/			
	Comment	-	/	/	/	/			
E calyptus teretecornis	**Data**	No.259	No.261	No.263	No.264				
	Height	250	-	-	1000				
	Spread	100	-	-	300				
	Caliper	5	-	-	10				
	Comment		-	-					
Callistemon salignus	**Data**	No.265	No.268	No.269					
	Height	-	-	-					
	Spread	-	-	-					
	Caliper	-	-	-					
	Comment	-	-	-					
C listemon pachyphyllus	**Data**	No.266	No.267	No.274					
	Height	-	-	-					
	Spread	-	-	-					
	Caliper	-	-	-					
	Comment	-	-	-					

5/1 height 310 spread 290 caliper 15

5/2 height 280 spread 310 caliper 15



5/3 height 240 spread 150 caliper 10

5/1 height 225 spread 250 caliper 10

5/7 height 210 spread 350 caliper 15

5/8 height 50 spread 50 caliper 5

Photos - Area 5

5/9 height 110 spread 100 caliper 5

5/10 height 150 spread 140 caliper 5

5/11 height 100 spread 100 caliper 5

5/14 height 200 spread 250 caliper 5

5/19 height 110 spread 200 caliper 5

5/20 height 220 spread 250 caliper 15

Photos - Area 5

TABLE 8:01 **MONITORING SCHEDULE** 7- 3 -2002

Area 5 Species	Data	No.276	No.277	No.279	No.281	No.282	No.284	No.285	No.286
B nksia integrifolia	Height	400	300	100	-	-	300	150	250
	Spread	220	300	60	-	-	400	100	200
	Caliper	15	15	5	-	-	10	5	15
	Comment				-	-			
	Data	No.287	No.288	No.291	No.295	No.296	No.297	No.298	No.299
	Height	100	130	250	-	130	200	-	-
	Spread	150	140	300	-	135	150	-	-
	Caliper	5	10	15	-	10	10	-	-
	Comment				-			-	-
	Data	No.300	No.301	No.302	No.303	No.304	No.305	No.306	No.307
	Height	170	100	250	-	155	/	-	/
	Spread	150	145	250	-	140	/	-	/
	Caliper	5	5	10	-	5	/	-	/
	Comment				-		/	-	/
	Data	No.308	No.309	No.310	No.311	No.312	No.313	No.314	No.315
	Height	/	150	150	200	170	/	-	-
	Spread	/	130	110	200	125	/	-	-
	Caliper	/	5	5	10	5	/	-	-
	Comment	/					/	-	-
	Data	No.316	No.317	No.318	No.319				
	Height	100	150	150	100				
	Spread	140	130	140	300				
	Caliper	5	5	5	10				
	Comment								
C. emon salignus	**Data**	No.275	No.278	No.280					
	Height	-	/	-					
	Spread	-	/	-					
	Caliper	-	/	-					
	Comment	-	/	-					
Callistemon pachyphyllus	**Data**	No.289							
	Height	-							
	Spread	-							
	Caliper	-							
	Comment	-							
Banksia aemula	**Data**	No.283	No.290	No.292	No.294				
	Height	-	300	120	-				
	Spread	-	250	130	-				
	Caliper	-	15	10	-				
	Comment	-			-				

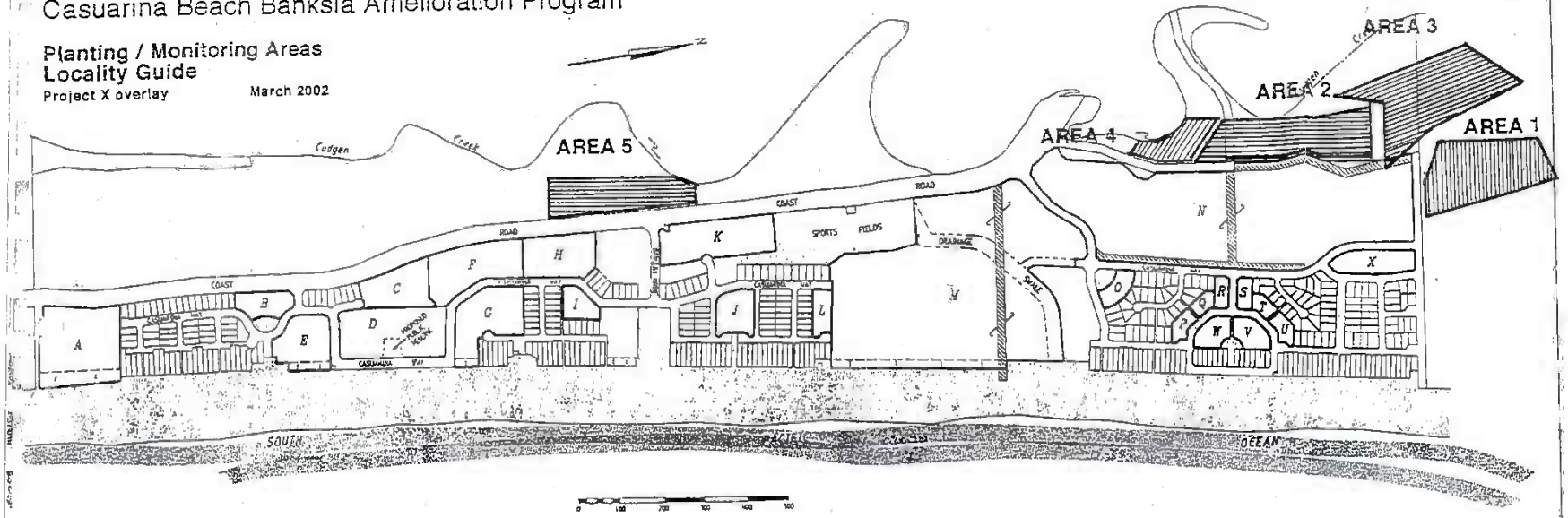
TABLE 8:01 MONITORING SCHEDULE 7- 3 -200

Area 5 Species	Data	No.320							
lalaleuca quinquinerva	Height	-							
	Spread	-							
	Caliper	-							
	Comment	-							

Casuarina Beach Banksia Amelioration Program

Planting / Monitoring Areas
Locality Guide

Project X overlay March 2002



SCHEDULE OF LOTS

No	AREA	DESCRIPTION	
A	3.537ha	Lot 1 DP1027531	(Affected by 7(f) Zone "z")
B	8009m2	Lot 19 DP1027531	
C	1.485ha	Lot 29 DP1027531	
D	3ha	Part Lot 30 DP1027531	(Includes proposed Public Reserve of 1981m2)
E	1.633ha	Lot 31 DP1027531	(Affected by 7(f) Zone "z")
F	2.345ha	Part Lot 54 DP1030322	
G	2.202ha	Part Lot 54 DP1030322	(Affected by 7(f) Zone "z")
H	1.779ha	Part Lot 54 DP1030322	
I	5728m2	Lot 55 DP1030322	
J	9314m2	Lot 145 DP1030322	
K	2.508ha	Part Lot 146 DP1030322	
L	5046m2	Part Lot 144 DP1030322	
M	20.5ha	Lot 181 DP1031933	(Includes Road hatched of 8999m2)
		& Part Lot 144 DP1030322	(Affected by 7(f) Zone "z")

SCHEDULE OF LOTS

No	AREA	DESCRIPTION	
N	19.34ha	Part Lot 113 DP1031933	(Includes Road hatched of 2.124ha)
O	4515m2	Lot 169 DP1031933	
P	3096m2	Lot 171 DP1031933	
Q	2372m2	Lot 172 DP1031933	
R	2725m2	Lot 173 DP1031933	
S	2731m2	Lot 174 DP1031933	
T	2339m2	Lot 175 DP1031933	
U	3095m2	Lot 176 DP1031933	
V	5347m2	Lot 177 DP1031933	
W	5394m2	Lot 178 DP1031933	
X	1.073ha	Part Lot 113 DP1031933	

WARNING NOTES

Lots D, F, G, H, K, L, M, N & X have not been created as individual lots as shown on this plan.

The final form of these lots is dependent upon Council approval, final survey and road closures. The areas and dimensions of these lots may vary.

Drainage easements and service easements have been omitted for clarity.

These notes form an integral part of this plan.

GOVT AREA: TWEED SHIRE

LOCALITY: KINGSCLIFF

Scale at A1: 1 : 10000

DWG No: A993/5A

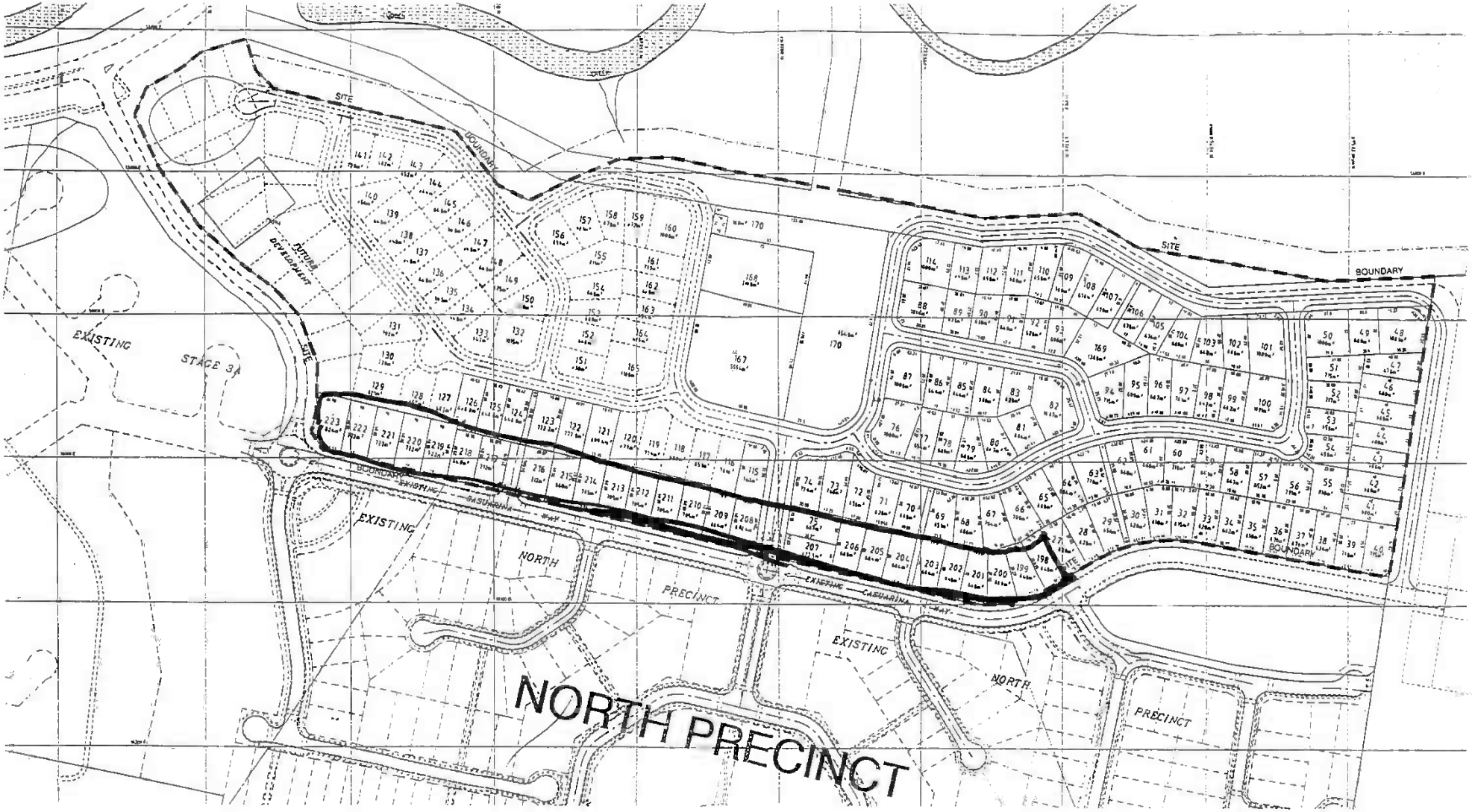
ASPECT north

Advanced Surveying Planning Engineering Consultancy

North Point Building
2A Carrington Street
LISMORE NSW 2480
Tel (02) 6622 1177
Fax (02) 6621 7664
email:info@aspectnorth.com.au

CASUARINA BEACH

DEVELOPMENT LOTS



Stage 6B
Plan

CURRENT

FILE COPY

7 August 2003

Mr D Broyd
Director - Development Services
Tweed Shire Council
PO Box 816
MURWILLUMBAH NSW 2484

NSW NATIONAL PARKS AND WILDLIFE SERVICE
ABN 30 841 387 271

Our Reference: DOC03/11065.aeb.02/3795
Your reference:

Dear Mr Broyd,

CASUARINA BEACH DEVELOPMENT – CONSENT CONDITIONS ISSUED BY THE LAND AND ENVIRONMENT COURT ON 17 DECEMBER 1998

I refer to the meeting held on the 4 April 2003 between Consolidated Properties, Tweed Shire Council and the National Parks and Wildlife Service (NPWS). At that meeting, a proposed rehabilitation program was outlined by Consolidated Properties for a number of areas in the vicinity of Casuarina Beach.

The rehabilitation program was proposed to enable the development of the Banksia deferred areas to proceed and to compensate for the loss of Common Blossom Bat habitat on the site. Following further discussions, a rehabilitation program was agreed to in principle. The elements of the program include:

1. Compensatory plantings of Coastal Banksia (*Banksia integrifolia*) and other food trees for the Common Blossom Bat in areas within the Cudgen Nature Reserve.
2. Compensatory plantings in areas to the north-west of the deferred areas at Casuarina Beach.
3. Provision of funding of $200 000 to cover works in points 1 and 2 above.
4. Remediation/rehabilitation works on the Banksias planted some three and a half years ago (Land and Environment Court Consent Condition No 46). It is noted that the allocation of funds for these works must be in addition to the funds allocated to points 1 and 2.

Given that the above works have been incorporated into amended consent conditions, it is considered that these works would compensate for the loss of Common Blossom Bat habitat in the deferred areas. Consequently, it is agreed that Stage 6B (26 lot residential subdivision within the Northwest Precinct) may be cleared. Additionally, it is agreed that the remainder of the Northwest Precinct and Town Centre may be cleared. These agreements

Conservation Programs and Planning Division
Northern Directorate
GIO House
24 Moonee Street
Coffs Harbour NSW 2450 Australia
Locked Bag 914
Coffs Harbour NSW 2450 Australia
Tel: (02) 6651 5946
Fax: (02) 6651 6187

Head Office
43 Bridge Street
P.O. Box 1967
Hurstville NSW 2220 Australia
Tel: (02) 9585 6444
Fax: (02) 9585 6555
www.npws.nsw.gov.au

are made on the provision that the clearing works for the Northwest Precinct and Town Centre shall not be undertaken prior to 1 September 2003 (end of winter).

In view of the above, Tweed Shire Council is therefore advised that the NPWS is satisfied that Condition 41(d) of the Land and Environment Court conditions for the above development has been met.

If you require any further information please contact me on 6659 8230.

Yours faithfully.

GARY DAVEY
Manager Conservation Programs and Planning Division
For the Director-General

Casuarina BEACH

New Oceanfront Township

25th April 2003

NSW National Parks & Wildlife Service
Conservation Programs & Planning Division
Northern Directorate
Locked Bag 914
COFFS HARBOUR NSW 2450

WITHOUT PREJUDICE

For Attention Gary Davey

Dear Gary

Re: DEFERRED AREA AT CASUARINA BEACH

We refer to the above and note the contents of your letter of the 16th April 2003.

We appreciate your response to the urgency of the matter and advise that we generally support the outcome as provided by you in your letter. We wish to confirm and advise as follows:

1. All arrangements allow for the clearing of the deferred area known as North West Precinct at the end of winter save that the area known as Stage 6B may be cleared upon the issue of a Development Consent for Stage 6B (forthwith).

2. A Development Consent (Consent Order) be handed to the court on the 23rd April 2003. That consent contain a condition that the NPWS receive the sum of $200,000 from the applicant for amelioration works.

3. NPWS advise Council that it is satisfied pursuant to Condition 41 (D) of the Stage 1 Consent – that stage 6B may be cleared upon issue of the Development Consent and that the balance of the North West Precinct may be cleared following the 31st August 2003.

4. NPWS confirming that there is no impediment to the clearing of the Town Center site as and from 1st June 2003.

Developer: Casuarina Beach Project (No.1) Pty Ltd ACN 089 134 971
Address: Level 13, 344 Queen Street, Brisbane Q 4000 Australia
Telephone: 07 3221 8258
Facsimile: 07 3221 7202
Email: [illegible]
Website: [illegible]

5. That the sum of $200,000 includes the cost of the compensatory plantings and rehabilitation works referred to in Items 1,2, and 3 of your letter dated 16th April 2003.

We advise that we would be in a position to pay the sum of $200,000 or bond within 14 days of the issue of the Deferred Development Consent for Stage 6B.

Would you please confirm the above as satisfactory as soon as possible?

Yours faithfully,

PETER MACGREGOR
Consultant

PS. Can Council's lawyers and our lawyers to arrange conditions of consent for consent order.

16 April 2003

Mr Peter MacGregor
Advisor
Consolidated Properties
GPO Box 358
BRISBANE QLD 4001

[our ref]

Our Reference:
Your reference:

NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE

ABN 30 641 387 271

WITHOUT PREJUDICE

Dear Mr MacGregor

DEFERRED AREA AT CASUARINA BEACH.

Thank you for your facsimile in response to my letter of earlier today. I appreciate your prompt reply.

In relation to the five points in your letter I provide the following advice. The points below correspond to those in your letter:

1. NPWS agrees with this proposal. Stage 6B may be cleared upon the issue of a relevant development consent. The remainder of the North West precinct may be cleared following the end of winter (as from 1 September 2003).
2. The sum of $200,000 is endorsed. For audit and transparency purposes, it is appropriate that only those monies that will be expended on NPWS lands be transferred to NPWS. The remainder should be transferred to another party, possibly Council with its concurrence. It may be preferable that the funds be allocated between projects based on an agreed revegetation/rehabilitation plan. I suggest that these matters be resolved in the future. In the interim, if Council is amenable, the monies could be transferred to it.
3. NPWS agrees to advise Council that it is satisfied that Condition 41(D) has been met.
4. NPWS acknowledges the previous agreement for the clearing of this site to commence after 1 June 2003. NPWS asks that the clearing be delayed, if practicable, over winter to protect feeding resources. Nonetheless, NPWS acknowledges that clearing may commence after 1 June 2003. It is understood that this may require an amendment under s96 of the *Environmental Planning and Assessment Act*.
5. The sum of $200,000 covers the matters in points 1 and 2 in my letter dated 16 April 2003, not point 3. It is the view of NPWS that the matters in point 3 are subject to a current Land and Environment Court condition and, as such, should already be subject to implementation. I apologise if this was not clear from my earlier correspondence.

Conservation
Programs and
Planning Division
Northern Directorate
GIO House
24 Moonee Street
Coffs Harbour NSW
2450 Australia
Locked Bag 914
Coffs Harbour NSW
2450 Australia
Tel: (02) 6651 5946
Fax: (02) 6651 6187

Head Office
43 Bridge Street
P.O. Box 1967
Hurstville NSW
2220 Australia
Tel: (02) 9585 6444
Fax: (02) 9585 6555
www.npws.nsw.gov.au

I trust that this addresses the issues raised in your facsimile. Your cooperation over these matters is appreciated.

Please do not hesitate to contact me if you require any further information. I may be contacted on 02 6659 8230 or 0402 149 300.

Yours faithfully

GARY DAVEY
Manager, CPPD
Northern Directorate

for DIRECTOR-GENERAL

Casuarina Beach Project

Compensatory Habitat for The Common Blossom Bat

April 2003

Project Team:

F Dominic Fanning
Julie Faine
Dug Leonard

In collaboration with:
Hayes Environmental

Gunninah Environmental Consultants
PO Box 513 Crows Nest NSW 2065
ph: 02 - 9906 5436 fax: 02 - 9906 7770 email: gecon@gunninah.com.au

CASUARINA BEACH PROJECT

COMPENSATORY HABITAT
for
The COMMON BLOSSOM BAT

April 2003

1 INTRODUCTION

1.1 General

This *Report* addresses opportunities for the provision of compensatory habitat, particularly plantings of Coast Banksia and the generation of littoral rainforest at Casuarina Beach, to provide habitat for the Common Blossom Bat *Syconycteris australis*. The establishment of further compensatory habitat for Common Blossom Bats, as documented in this *Report*, is in response to the recent and/or imminent lodgement of *Development Applications* for several remaining portions of the Casuarina Beach Estate, south of Kingscliff in northeastern NSW.

The compensatory habitat provisions currently in place have arisen out of discussions, negotiations and investigations conducted over a long period at Casuarina Beach (since 1994). The opportunities identified within this *Report* take into account:

the existing plantings of foraging resources for the Common Blossom Bat;

data on the Blossom Bat population and its habits in the Casuarina Beach area; and

the opportunities provided by and constraints imposed by development requirements on Casuarina Beach and associated activities in the vicinity.

1.2 History

Development of the subject land at Casuarina Beach has been the subject of a development consent granted by the NSW Land & Environment Court in 1998. That consent imposed a number of conditions *inter alia* for the provision of habitat and resources for the Common Blossom Bat.

A population of the Common Blossom Bat was known to occur on the subject land and in the vicinity utilising rainforest vegetation in the vicinity of the Wollumbin Scout Camp (on the eastern side of Cudgen Lake to the south of the site) and foraging on a range of nectar-producing plants within a home range of approximately 2-4km. The Casuarina Beach site (which had been entirely cleared and mined for heavy minerals in the 1960s and 1970s) contained regrowth stands of the Coast Banksia *Banksia integrifolia*, which (along with a number of other plant species), provides a winter-foraging resource for the Common Blossom Bat.

The conditions of consent for the Casuarina Beach project included *inter alia*:

the planting of approximately 15,000 Coast Banksias and other relevant plant species as a future foraging resource to replace the stems of Coast Banksia to be removed for the whole of the development. Those 'compensatory plantings' were located on lands to be retained and conserved to the west and northwest of the Casuarina Beach development area;

the planting of Coast Banksias within the Casuarina Beach project itself over the 8 management lots; and

the deferral of development in two portions of the Casuarina Beach site for a period of 4 years (in the case of the Town Centre site) or some other period agreed by NPWS, Gunninah and the applicant (in the case of the Northwest Precinct).

The latter measure (the deferment of development of the Northwest Precinct and the Town Centre within the Casuarina Beach site) was the result of negotiations and discussions between Tweed Shire Council (TSC), the NSW National Parks & Wildlife Service (NPWS) and the then applicant for the project. The four year period concludes on the 30th of June 2003, and there has been no other agreed timeframe.

The issue of the Common Blossom Bat and its foraging resources have been addressed in a number of previous *Reports* and documents, commencing with the original *Flora & Fauna Assessment Report* prepared by Gunninah Environmental Consultants (Gunninah 1995) and the *Species Impact Statement* (SIS) prepared for the project (Gunninah 1996). Other relevant documents include *Reports* prepared by Dr Bradley Law and Dr Greg Richards regarding the Casuarina Beach site and the detailed analysis of foraging resources for the Common Blossom Bat prepared by F Dominic Fanning (Gunninah 1999).

1.3 Current Applications

Two *Development Applications* (DAs) have been submitted recently to TSC for development activities on the Casuarina Beach site. An application for development of the eastern part of the Northwest Precinct (Stage 6B) has been lodged with TSC, and a DA has also been lodged for development of the balance of the Northwest Precinct.

Development Applications have also been prepared for the Town Centre (which was one of the deferred areas agreed in early 2000) and for Lot 54 (which has already been cleared of all vegetation and has been entirely modified by earthworks and levelling).

Whilst other DAs will be lodged over ensuing years for development activities on portions of the Casuarina Beach site, there are no other remaining areas of vegetation containing Coast Banksias for which the applicant will be lodging *Development Applications*. The three relevant DAs which pertain to the 'deferred' areas on the Casuarina Beach site are:

Stage 6B (the eastern part of the Northwest Precinct);

the balance of the Northwest Precinct; and

the Town Centre site.

2 CIRCUMSTANCES

The various investigations and *Reports* with respect to Common Blossom Bats and their foraging resources in the Casuarina Beach area, including the specialist *Reports* prepared by Dr Greg Richards and Dr Bradley Law, and the detailed documentation prepared by Dominic Fanning (Gunninah 1999), have concluded that:

roosting habitat and resources for Common Blossom Bats in the vicinity is limited, and currently known roosting habitat is confined to rainforest in the Wollumbin Scout Camp site (near Cudgen Lake);

the local population of the Common Blossom Bat at this location is approximately 200 individuals (based on the location and extent of roosting and foraging habitat, and the normal foraging range of the Bats); and

the distribution and abundance of Coast Banksias is not a limiting factor for the population of Common Blossom Bats at this location, given the array of the winter-foraging plant species available and their extent in the locality (Gunninah 2000).

These issues have been canvassed at some length in the earlier *Report* for resources for the Common Bat at Casuarina Beach (Gunninah 1999), and in various *Reports* and discussions involving the NPWS, Dr Bradley Law, Dr Richards and others.

The compensatory activities for Common Blossom Bats which had been accepted by all parties in the negotiated outcome in early 2000 include:

the planting of 15,000 Coast Banksias and other species in the conserved lands to the west of the approved Casuarina Beach Estate development;

the planting of 300 Banksias within each management lot (to a total of 2,400) throughout the Casuarina Beach Estate; and

the deferral of development activities in the Northwest Precinct and Town Centre for a period of 4 years or (in the case of the Northwest Precinct) some period other than 4 years if agreed by NPWS, Council and the applicant.

Development activities on the Casuarina Beach site and along the major foredune regeneration project to its immediate east, have, included the provision of additional resources (in terms of Coast Banksias) for the Common Blossom Bat. Of particular relevance in this regard is:

the planting of a total of 2,454 Coast Banksias throughout the Casuarina Beach project site; and

the planting of a total of approximately 20,000 Coast Banksia within the foredune rehabilitation area (Lot 500) on the eastern side of the Casuarina Beach Estate site. Those plantings have included 5,937 individuals in 2000-2001, 11,402 individuals in 2001-2002, and 2,907 individuals in 2002-2003. It should be noted that there is at least a 70% success rate with those plantings of the Coast Banksia, and that many of the specimens planted in 2001-2002 have reached a height of up to 4 metres and support considerable numbers of inflorescences.

The additional resource of 20,000 Coast Banksia which have been planted on the coastal dune, and which have achieved a high level of success, exceed the original requirement for 'compensatory' plantings (of 15,000 individuals including other species). An additional 7,021 Coast Banksia are to be planted in the foredune area over the next twelve months.

In total, therefore, there have been approximately 38,000 Coast Banksias planted in the vicinity of Casuarina Beach since the project achieved development consent from the Land & Environment Court, and a futher 7,000 are to be planted. That resource considerable exceeds that which was originally required to satisfy the development consent, and is substantially greater than that which was removed.

The availability of a range of other winter-foraging plant species for the Common Blossom Bat is of particular relevance. As documented in detail in the Gunninah 1999 *Report*, there are several other native tree species which provide winter-foraging resources for the Common Blossom Bat, including the Large-leaved Paperbark, *Banksia erciifolia* and *B. robur*, and several eucalypts. The extent of those resources in the general locality was also addressed in the Gunninah 2000 *Report*, with extensive stands of the Large-leaved Paperbark present around Cudgen Lake and elsewhere in the locality. The presence of these resources supplements the stands of Coast Banksia in the locality, and reduces the potential dependence of the Common Blossom Bat on the Coast Banksia resources.

The 'compensatory plantings' which were undertaken as part of the consent conditions have generally not proved particularly successful. Whilst many of the plants in the northernmost

area (immediately to the north of the Casuarina Beach Estate site) have prospered and are producing inflorescences, the majority of those in the various plantings sites to the immediate west of the Casuarina Beach Estate have either failed or have remained in a stunted condition. Many of those plantings do not currently support inflorescences. As indicated below, however, there is an opportunity to rehabilitate those plantings by a program of active maintenance and management.

3 OPPORTUNITIES

Opportunities to provide further Coast Banksia resources for Common Blossom Bats in the vicinity of the Casuarina Beach Estate have been identified as a means of facilitating consent to development of the remaining portions of the Estate while concomitantly providing resources to enhance the survival of and to increase the population of Common Blossom Bats. Identification of these opportunities has involved consideration of:

the poor success rate of the original 'compensatory plantings' and the need for maintenance of these supplementary resources provided for the bats;

the provision of an additional 27,000 Coast Banksias in the foredune rehabilitation program, which were not contemplated at the time of development consent;

the opportunity for rehabilitation of parts of Cudgen Nature Reserve and for the provision of long-term resources for Common Blossom Bats in that locality; and

the shortage of Littoral Rainforest suitable for roosting in the vicinity of the Casuarina Beach site (as discussed in the Gunninah 2000 *Report*).

Three principal opportunities for the provision of further 'compensatory' plantings are available in the vicinity of the Casuarina Beach Estate site:

the provision of supplementary habitat and the enhancement of resources for the Common Blossom Bat within the area of Cudgen Nature Reserve to the immediate south of the site (the area bound by the Casuarina Beach Estate, the Coast Road, the beach and the village of Cabarita). The proposal is for the removal of dense stands of Bitou Bush and Coastal Tea-tree and their replacement by stands of Coast Banksia in the eastern part of the Cudgen Nature Reserve, and the provision of littoral rainforest (to provide additional roosting habitat) in the western part. Details of the proposed rehabilitation program within the Cudgen Nature Reserve are provided within the *Report* prepared by Aspect North, dated April 2003;

enhancement and remediation of the existing 'compensatory' plantings where the success rate and vigour of individual plants has been less than ideal. Measures proposed in these areas include the application of fertiliser and supplementary watering (if necessary), and protection of the plantings from browsing by the use of fencing or plant guards; and

the provision of supplementary plantings of Coast Banksia within the conservation land to the immediate west of Northwest Precinct. There are moderate areas of disturbed and degraded introduced grassland at this location, which would provide a substantial additional opportunity for the planting of Coast Banksias both for the rehabilitation of vegetation generally and for the provision of additional winter-foraging resources for the Common Blossom Bat.

4 CONCLUSIONS

The provision of supplementary or 'compensatory habitat' for the Common Blossom Bat which has been undertaken to date in association with the Casuarina Beach Estate development has included:

- the planting of 15,000 Coast Banksias (and other species) in 'compensatory plantings' on conserved lands, and the planting of 2,454 Coast Banksias within the Estate;
- the deferral of development activities in two portions of the Estate (the Town Centre and Northwest Precinct); and
- the planting of in excess of 20,000 Coast Banksias within the foredune rehabilitation area (with an additional 7,000 to be planted over the current 12 month period).

Relevant considerations include:

- the poor success of the initial 'compensatory plantings' except for those in the northernmost area; and
- the high levels of success of Coast Banksia plantings within the foredune area and the inflorescences contained thereon which provide foraging resources for Common Blossom Bats.

To facilitate development of the remainder of the Casuarina Beach Estate site, and to ensure the provision of resources for the Common Blossom Bat at this location, further 'compensatory habitat' is proposed, including:

- the rehabilitation of part of Cudgen Nature Reserve to the immediate south of the Casuarina Beach Estate site by the removal of Bitou Bush and Coastal Tea-tree and their replacement by stands of Coast Banksias (for foraging) and littoral rainforest (for roosting);
- remediation of the initial 'compensatory plantings' by the application of fertiliser and water as necessary and by fencing or protecting plantings from browsing; and
- the provision of an additional area of 'compensatory plantings' within the conserved lands along Cudgen Creek to the immediate west of the Northwest Precinct in an area of introduced grassland and disturbance.

The additional opportunities identified above are intended to further supplement resources and habitat for Common Blossom Bats in the vicinity of the Casuarina Beach Estate site. It is considered that this approach will both ensure the long-term survival of the existing Common Blossom Bat population at this locality, and will facilitate an increase in the size of that population.

In the Land and Environment Court of New South Wales

No. 10686 of 1997

Cardno MBK Pty Ltd

Applicant

Tweed Shire Council

Respondent

Order

The Court orders, by consent, that:

1. Condition 47 of the consent granted on 16 December 1998 by Talbot J pursuant to s 91AB of the Environmental Planning and Assessment Act 1979 for the subdivision of Lot 13 DP 1031933 Casuarina Way, South Kingscliff into fourteen lots subject to conditions, be deleted and substituted with the following:-

47. In order to make provision for any possible impact arising out of the removal of the Common Blossom Bat forage and resources resulting from the development of management lots:-

(a) the applicant shall remediate and rehabilitate at its own expense the planting of Banksias made prior to 2002 pursuant to conditions 40, 41, 42 and 46 and bear the costs of same and conduct such remediation and rehabilitation by:-

(i) replacing any plantings which have not survived with new seedlings ("compensatory plantings") to a maximum of 3,000 new seedlings;

(ii) fence the whole area containing the compensatory plantings with steel mesh fencing to exclude herbivores or use growth tubes for individual plantings within the compensatory plantings;

(iii) provide fertilizer for each of the new plantings, as well as the established seedlings, (using Osmocote or another slow release fertilizer);

(iv) water the plantings when necessary

using a water tanker when cumulative rainfall in any 21 day period is less than 20 millimetres in the Tweed Shire area; and

(i) the remediation and rehabilitation works above described in Item (i) – (iii) are to be completed prior to the issue of a subdivision certificate relating to the subdivision of the areas referred to as Stage 6B, in the North-West Precinct, or the Town Centre (as defined in the attached map);

(b) In addition to the plantings referred to in paragraph (a) above, the applicant shall plant 1,000 well established 1-3 metre high Coast Banksias (as many as possible being approximately 3 metres in height subject to availability) in the areas of disturbed grassland in the conservation area to the west of the North-West Precinct with such plants to be maintained in respect of water and fertilized as detailed in the previous subparagraph. The location of these plantings are to be approved by the Director of Development Services of Tweed Shire Council in consultation with the Department of Environment & Conservation prior to the commencement of planting works. The planting of the said Coast Banksia is to be completed prior to the issue of the Subdivision Certificate for the areas known as Stage 6B, the North-West Precinct or the Town Centre as defined on the attached map;

(c) In addition, the applicant shall, prior to the issue of a Construction Certificate in respect of Stage 6B of the North-West Precinct or Town Centre (as defined in the attached map) give notice in writing to the Manger of Conservation Programs and Planning Division of New South Wales National Parks and Wildlife Service ("NPWS"), northern directorate of the making of the application for a Construction Certificate and shall pay to Tweed Shire Council at the time of making such application the sum of $200,000 to be held by the Tweed Shire Council in trust for the purposes of revegetation works within the Cudgen Nature Reserve and environmental protection lands under Council's control on the Casuarina Beach Estate.

Ordered: **11 November 2003**

By the Court

P Green

Registrar

APPENDIX E

RADIATION REPORT NORTH PRECINCT