Newton Denny Chapelle
SURVEYORS PLANNERS ENGINEERS

ATTACHMENT 6

Engineering Services Report

Newton Denny Chapelle

• JOHN NEWTON B. Surv; M.I.S. Aust. • TONY DENNY B. Surv; (Hons); M.I.S. Aust. • DAMIAN CHAPELLE BTP. CPP

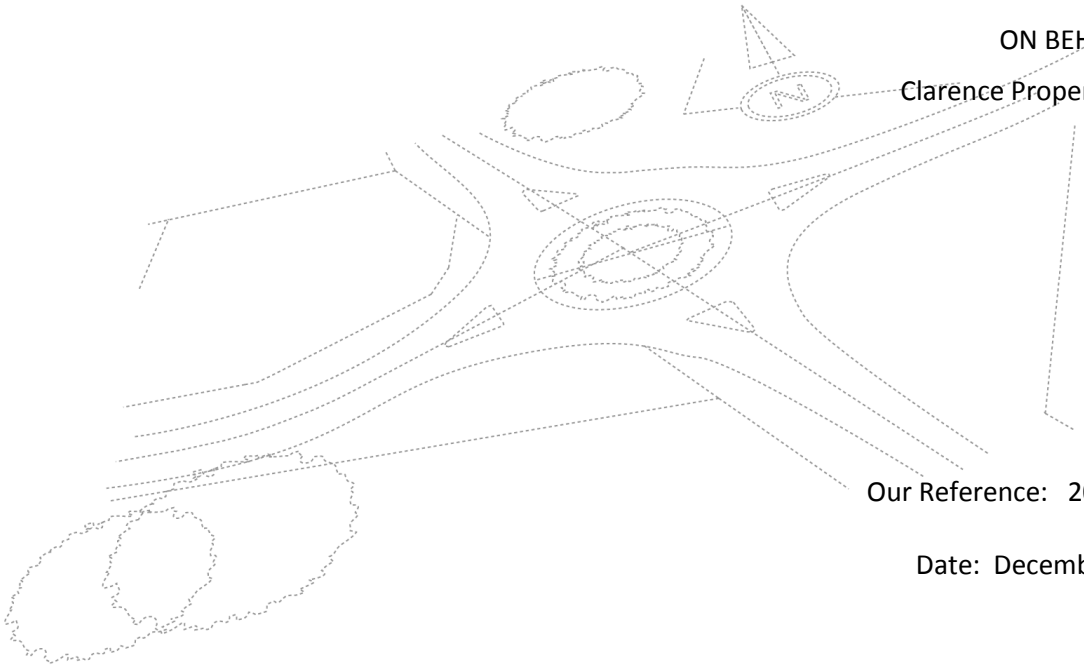
Engineering Services Report

Modification To Concept Approval for
Casuarina Town Centre

At
Lot 15 DP1198266
Casuarina

ON BEHALF OF:

Clarence Property Trust



Our Reference: 2013/054

Date: December 2015

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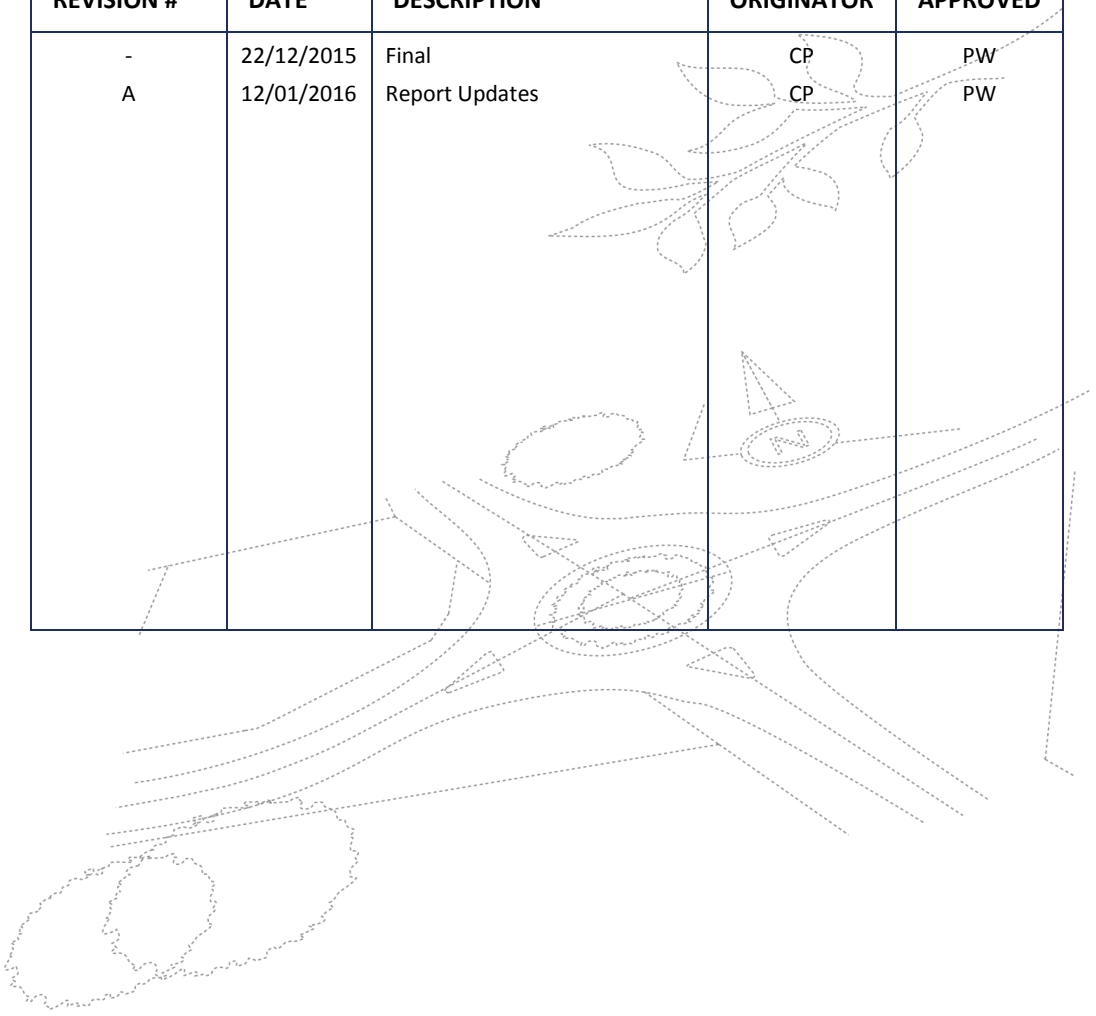
Revision History

REVISION #	DATE	DESCRIPTION	ORIGINATOR	APPROVED
-	22/12/2015	Final	CP	PW
A	12/01/2016	Report Updates	CP	PW



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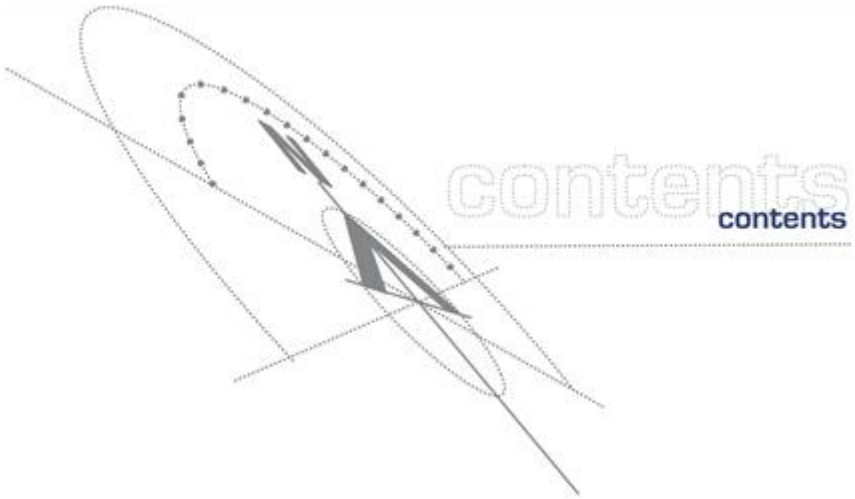

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Appendices

Appendix A **Concept Engineering Plans:**

Drawing No	Rev	Name of Plan	Date
BE001	Rev A	Bulk Earthworks Plan	December 15
C001	Rev A	Public Parking Count (Roads Plan)	December 15
C002	Rev A	Road Hierarchy and Pavement Width Plan	December 15
C003	Rev A	Master Services Plan	December 15
C004	Rev A	Longsection of Grand Parade	December 15
E001	Rev A	Sediment and Erosion Control Plan	December 15
8491-909	Rev C	Cardno Drawing – Public Parking	23/01/2009

Appendix B **Stormwater Management and Piping of Swale**

- Casuarina Town Centre, East West Drainage Scheme
- SWINF01 – Infiltration Equivalency Catchment Plan - Rev B

Appendix C **Acid Sulfate Management Plan**

Appendix D **Engineering Calculation Sheets**

- Gravity Model Calculations

1 Introduction

1.1 Purpose

Newton Denny Chapelle (NDC) has been instructed by Clarence Property (Proponent) to submit a request to the Minister for Planning & Environment to further modify the Concept Approval and Project Approval (MP 06_0258) for the Casuarina Town Centre, pursuant to the provisions of Section 75W of the Environmental Planning and Assessment Act 1979 (the Act).

The primary purpose of this report is to provide engineering design detail on stormwater amendments, trip generation and proposed road function / hierarchy, general earthwork requirements and key utility servicing alignment. The key elements being addressed include:

- Filling & piping of the existing swale and the inclusion of a green buffer zone;
- Comparative assessment of stormwater infiltration requirements
- Traffic generation proposed by the modified lot layout incorporating the built form density;
- Retention of cycleway access to the foreshore;
- Relocation of trunk sewer main clear of building allotments and
- Assessment of the bulk earthworks requirements to achieve the desired finished profile.

1.2 Reference Documents

The following documents have been used in the preparation of this plan:

- NSW Government Department of Planning and Environment, *Project Approval 06_0258 Casuarina Town Centre*, Casuarina
- Cardno, *Radiation Validation and Remediation Report – Casuarina Town Centre*, March 2014 721754
- D.T Morand, *Soil Landscapes of the Murwillumbah – Tweed Heads*, 1996
- Cardno, *Report on Engineering & Environmental Matters, Development Application for Town Centre Site,* Version 2 – June 2008
- Cardno, *Technical Memorandum 2, Casuarina Town Centre, East West Drainage Scheme Options,* Dated 14 July 2015
- Bitzios - *Casuarina Town Centre Detailed Design Phase Traffic Assessment 2012*

2 Site Description

2.1 Site Location

The proposed development is located within the area defined as the Casuarina Town Centre in the Casuarina Beach Development Concept Plan. Primary access to the site is from Casuarina Way via Blue Horizon Drive and a new connection constructed at the roundabout with Grand Parade. The site consists of Lot 15 DP1198266 and is approximately 8.93Ha in size (refer Figure 2-1).

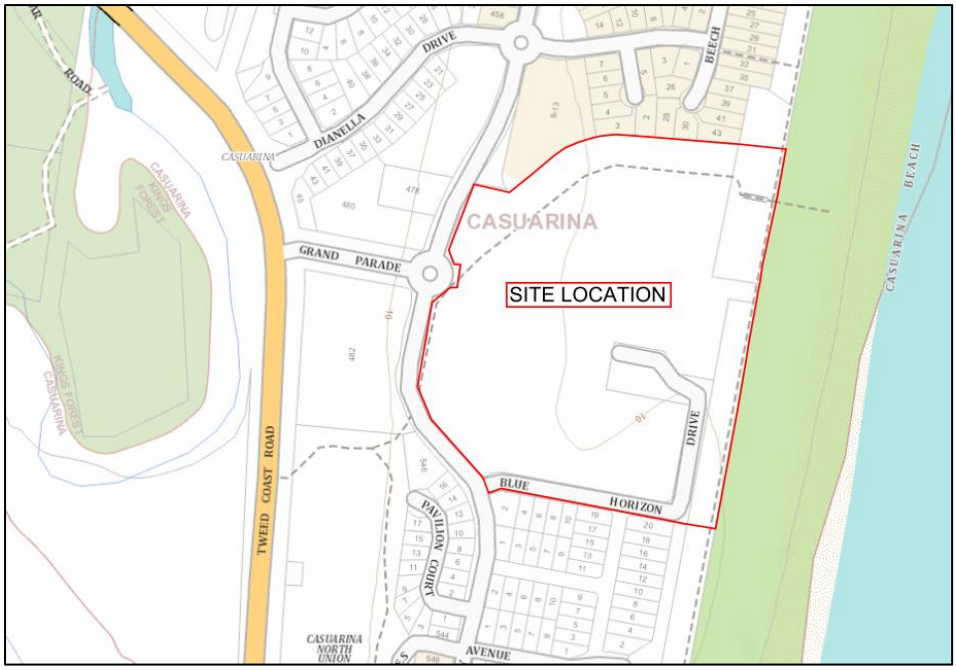

Figure 2-1 - Site Location

2.2 Existing Site Conditions

The development is located between Casuarina Way (western boundary) and the Casuarina Beach dunal system (eastern boundary). The Casuarina Town Centre site is bounded by residential developments on both the northern and southern boundaries.

Figure 2-2 - Development Site (Looking North)

The area has been the site of previous sand mining activities in the late 20th century and has been cleared of vegetation as part of the development approval. Blue Horizon Drive along the southern boundary of the site and the beach access carpark have already been constructed under approval Part 3A 06-258-Mod 3. Figure 2-2 shows an aerial of the these facilities. The site contains an existing stormwater easement along the northern boundary conveying flows within a stormwater swale in an east to west direction across the site.

2.3 Description of Proposed Development

The proposed Casuarina Town Centre is a mixed residential and retail development as conceptually shown in Figure 2-3 below. The proposal comprises 82 conventional residential lots, 7 medium density lots (nominal concept of 234 dwelling units) and 3200m² GFA of retail floor space. There will be a further 81 on-street parking bays added to the existing supply, thereby almost doubling public street parking to 170 spaces. A public reserve area shall also be provided. Refer to the town planning report for more specific details of the proposed Casuarina Town Centre development.

Figure 2-3 – Concept View of Proposed Casuarina Town Centre Development (Source: RPS)

3 Bulk Earthworks

The site has been cleared of vegetation as part of the construction undertaken via the Part 3A 06-258-Mod 3 approval. The soil profile has been identified as very disturbed sand (Bogangar type - *Morland, 1996*) to which previous sand mining activities are known to have occurred on the site and a radiation assessment had been undertaken (*Cardno, 2014*).

Bulk earthworks will be conducted to reshape the site such that typically the finished surface will fall towards the coastal foreshore. This is to maximise discharge of stormwater to this area for treatment as per previous concept plan strategies. In addition to the material won onsite, an existing stockpile of material from previous stages of the development is located adjacent to the western side of the Beach Carpark. This material will be used onsite for backfilling of the existing drainage swale that will be replaced with underground pipe culverts. Refer to Section 5 in this report for a detailed stormwater assessment.

Preliminary design calculates that the expected works across site will require 90,000m^3 of cut and 63,230m^3 of fill. This results in a excess net 26,830m^3 of material that will be disposed of offsite. Refer to **Appendix A – DWG BE001 - Bulk Earthworks Plan** showing indicative finished surface profiles and retaining wall locations.

The final levels across the site shall vary between RL6.5m along the southern boundary to RL9m along the central portion of Grand Parade. Small retaining wall structures (nominal 1m high) are

required throughout the development to maintain the design levels nominated by the urban designer in the vicinity of medium density buildings and the retail areas. More extensive retaining walls are required in the vicinity of proposed Lot 92 so as to direct stormwater infiltration and overland flow paths into the 100yr ARI pipe network. Given the existing swale levels are in the vicinity of RL3.5m and with current surface levels at the northern boundary at RL7.5m, the retaining wall will need to be of a structural blockwork type with heights up to 4m required and mandatory permanent safety fencing installed.

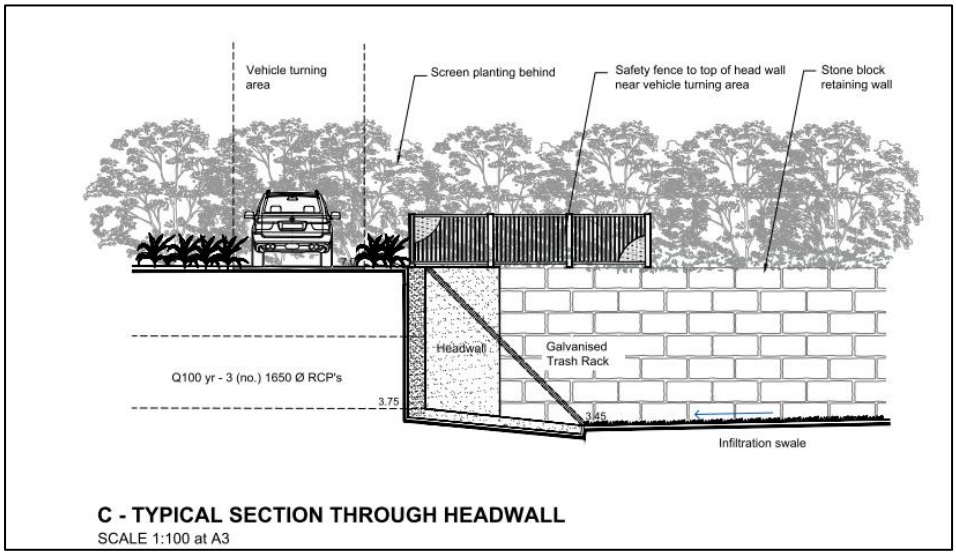

Figure 3-1 Concept Details of Retaining Wall At Transition From Swale To Pipework

3.1 Radiation

An investigation undertaken by Cardno (*Radiation Validation and Remediation Report – May 2014*) has identified an area (Area 1) within the site that requires remediation. Cardno identifies previous sand mining activities as the likely source of the radioactive material.

Figure 3-2: Area 1 - Radiation Remediation Area (Source: Cardno)

Remediation of this area will be undertaken by onsite mixing in accordance with the process outlined in the *Cardno Remediation Action Plan.* Public owned assets including the new sewer trunk

main and stormwater culverts will be over excavated and remediated to a depth of 2m below the asset in this remediation area.

3.2 Acid Sulfate Soils

The site has been identified as containing Potential Acid Sulfate Soils (PASS) in the Tweed Shire Council planning and land use mapping. The site is noted as Class 4 soils where works beyond 2m from natural surface level require investigation.

Figure 3-3 - Acid Sulfate Soil Mapping (Source: Tweed Shire Council)

Previous PASS investigations indicate that the site is not anticipated to have any substantial acid sulfate mobilisation issues as groundwater (at approximately 1m AHD) will generally not be affected by the majority of the proposed civil works. Limited disturbance of deeper soils are expected in relation to the construction of the sewer trunk main, which shows works will be required down to RL 0.6m AHD. Works proposed in this area shall be considered to have ASS potential and are to be conducted in accordance with the previous concept planning approved *Cardno Acid Sulfate Management Plan* (**Appendix C**). This will typically require the Contractor to appropriately test potential ASS material in accordance with ASSMAC Manual, particularly if ground water is likely to occur. ASS material will be appropriately dosed with Agricultural Lime where encountered and tested at the rate of 1 test per 1,000m^3 for compliance.

4 Road Configuration and Function

Connection to the existing road network for the proposed development will be primarily provided by access from Casuarina Way via an existing roundabout stub already built for this purpose. This primary connection (known as Grand Parade) will give direct access to the on-street parking fronting the shop top housing precinct and also leads to the Icon building and primary beach car parking area.

A minor secondary access to Casuarina Way will be via the existing Blue Horizon Drive, which will form a local street loop that in turn connects to Grand Parade. Blue Horizon Drive shall provide direct residential access to those housing lots south of the Town Centre, whilst at the same time allowing an alternative (but slightly more lengthy) access to the beach parking area.

The balance of the local road network consists of residential access streets and laneways for rear loaded access to specific areas.

4.1 Road Hierarchy

The proposed road networks consists of a conventional grid style configuration to which the following road classifications and pavement widths are tabulated below and are also shown within **Appendix A - DWG C002: Road Hierarchy and Pavement Width Plan.**

Table 4-1 - Road Classification and Pavement Width

Road Name	Street Type	Pavement Width / Reserve Width
Grand Parade	Local Street with on Street Angled Parking	9.5m / 29m
Road A	Access Street	7.5m / 14.5m to 22.25m
Road B	Access Street	7.5m / 14.5m to 22.25m
Road C	Access Street	7.5m / 14.5m
Laneways	Access Laneways (Rear Access Only)	6.0m / 6.5m
Casuarina Way (Exist)	Major Collector	11 m / 23m & variable
Blue Horizon Drive (Exist)	Local Street	7.0m / 19m

4.2 Trip Generation

An assessment of the trip generation potential of the development has been undertaken utilising the following generation rates.

Table 4-2 - Trip Generation Potential

Land Use	Daily Trip Rate (/unit)	Quantity	Total Trips Generated (per day)
Residential Lots	6.5 trips/lot	82 Lots	533
Medium Density Units	3.9 trips/unit	248 Units	967
Retail	200 per centre + 2.8 trips / 100m² GFA	3200 m²	490
Public Car Parking	225% x Number of Spaces	172 Spaces	387
		TOTAL:	**2,377**

In adopting a simplistic gravity model for the new proposal, it was calculated that the highest traffic volumes on the local residential streets would be 56vph and 8vph on the residential laneways.

Table 4-3 - Traffic Design Volumes

Road Name	Vehicle Trips Per Day	Vehicle Trips Peak Hour
Grand Parade	1813	272
Road A	315	48
Road B	373	56
Road C	224	34
Laneways	51	8
Blue Horizon Drive (Exist)	565	85

Previous design assessments of the roundabout performance at Grand Parade / Casuarina Way (*Bitzios Consulting – Casuarina Town Centre Detailed Design Phase Traffic Assessment 2012)* were based upon a peak hour generation of 270vph from the Town Centre precinct (referred to in past reports as The Boulevard (East)). This compares favourably with this modified proposal, whereby a peak of 272vph is calculated (refer **Appendix D**) – thereby consistent with past design parameters.

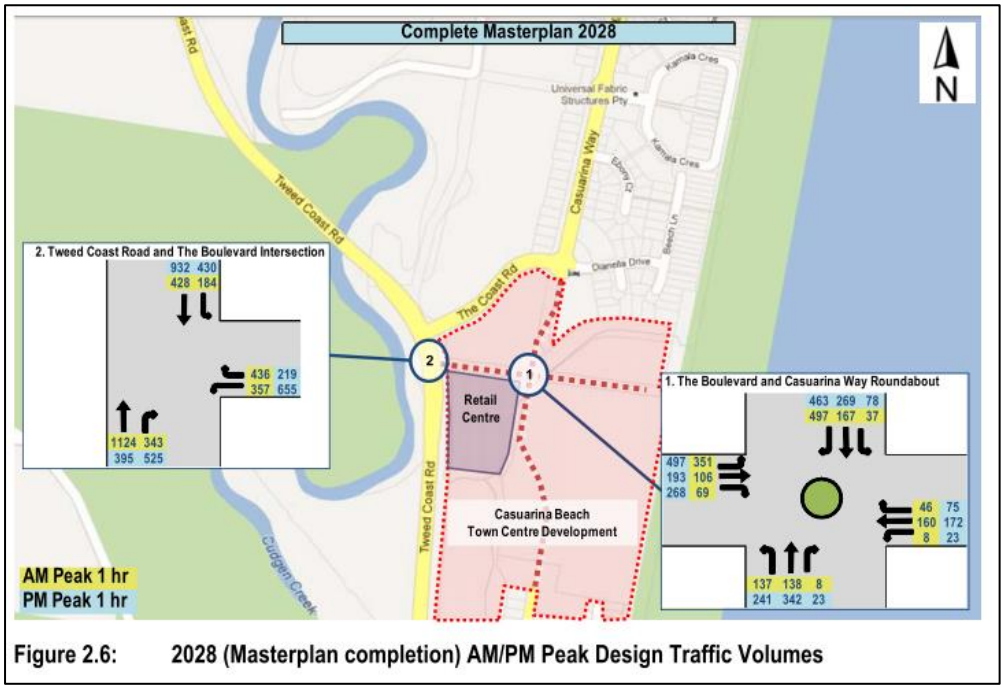

Figure 4-1 - Extract - Casuarina Town Centre Detailed Design Phase Traffic Assessment (Bitzios 2012)

4.3 Intersection Performance

A key design element of the modified proposal is the use of four-way intersections as nominated within the *Casuarina Beach Urban Design Statement (RPS Dec 2015).* The gravity model traffic generation assessment has found that Grand Parade is the primary travel path with upwards of 1,813vpd and is clearly the higher order road when compared to the inter connecting residential streets – which range between 224vpd to 373vpd.

A review of *Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis* advises within Section 6.1.1 that detailed intersection analysis is not required where total intersection trips are less than 400 vph on the major road (refer Figure 4-2). Based upon these details, it can be seen that the intersection trip activity is low (ie ample spare capacity) to which it can then be followed that road users would be readily able to safely navigate turning movements from the lower order side streets onto Grand Parade with comparable ease.

6.1.1 Unsignalised Intersections with Minor Roads

At unsignalised intersections with minor roads where there are relatively low volumes of cross and turning traffic, capacity considerations are usually not significant, and capacity analysis is unnecessary. Table 6.1 sets out details of intersection volumes below which capacity analysis is unnecessary.

While flaring for capacity is not required at intersections with traffic volumes below those shown in Table 6.1, separate lanes for left or right-turning vehicles may be provided on the major road for improved safety.

Table 6.1: Intersection volumes below which capacity analysis is unnecessary

Type of road	Light cross and turning volumes maximum design hour volumes vehicles per hour (two way)		
Two-lane major road	400	500	650
Cross road	250	200	100
Four-lane major road	1000	1500	2000
Cross road	100	50	25

Figure 4-2 -Extract - Austroads - Guide to Traffic Management Part 3: Traffic Studies and Analysis

In keeping with regulatory road rule requirements, it is mandatory that GIVE WAY signage and associated line marking will be required on Road A, B and C intersection legs that connect to Grand Parade.

4.4 Public Parking Spaces

Public parking spaces have been provided at a rate of 300 cars spaces per kilometre of beach frontage in accordance with previous planning provisions to which a breakdown of locational details are shown in **Appendix A – DWG C001 Public Parking Count**.

A total of 172 public car parking spaces will ultimately be provided within a 200m setback distance of the beach front reserve, of which 89 spaces are currently built and a further 83 spaces will be installed with this proposal. This public car parking proposal is consistent with the required quantum of 172 spaces as nominated on past Cardno concept plan approval. Refer **Appendix A - Cardno Drawing 8491-909 Rev C** for previous approval plan details.

5 Stormwater Management

Stormwater management proposed for the site seeks to substitute a major stormwater pipe network in lieu of the existing deep swale that traverses the site as shown in following Figure 5-1. In addition, the development shall provide the same quantum of infiltration areas as previously nominated in past concept approval documentation submitted by Cardno (2008), albeit these areas are in differing locations.

Figure 5-1 - Existing File Photograph of Swale At Northern End Of Town Centre Precinct

5.1 Proposed Piping of Swale System

The piping of the swale has been nominated as a design solution in previous concept approval documentation (06 0258 Mod 1), however detailed pipe alignments and flow calculation parameters had yet to be finalised with the local government authority (Tweed Shire Council).

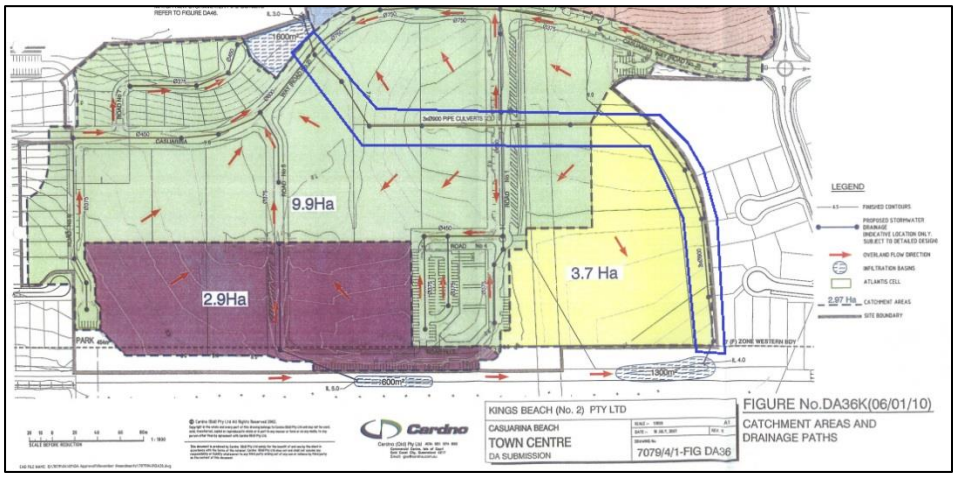

Figure 5-2 - Extract – Cardno Figure No DA36K – Piping Alignment Shown in BLUE of 3 x 900dia pipes

Newton Denny Chapelle have had correspondence and meetings with Tweed Shire Council technical officers commencing in September 2013 through to August 2015 (Messer's Schwartz and Twohill) so as to refine the design requirements deemed necessary in piping the swale given that its primary function is to convey stormwater to the west in extreme events up to and including the 100yr ARI storm. Tweed Shire Council's design requirements are best summarised below in an extract from correspondence dated 18 February 2015.

Design criteria adopted by Cardno:

- 100 year ARI capacity
- 50% blockage factor at inlet
- Coastal swale overtops towards the beach at RL 5.56m AHD. Lowest level of fronting property is RL 5.92m AHD.
- Maximum ponded water level at inlet set at 5.50m AHD (no increased discharge to beach, 0.42m freeboard to properties)
- Development Design Specification D5 requires 500mm freeboard to floor level of adjacent structures

These design criteria are acceptable, however D5.04 Design Rainfall Data requires that the design of major systems a factor of safety of 1.2 shall be applied to design rainfall intensities to properly account for blockages, obstructions, loss of cross section over time, and potential impacts of climate change. This needs to be increased to 1.5 if angle of deflection of the major drain alignment exceeds 45 degrees. This should be avoidable if considered in alignment design. The design must be amended to accommodate the specified FoS. Note that this requirement has come into force since the Cardno report was written (December 2013).

Figure 5-3 - Extract - Tweed Shire Council Letter 18 February 2015 as to Design Criteria

A design investigation has been updated in July 2015 by *Cardno* (refer **Appendix B: Technical Memorandum 2 Casuarina Town Centre East West Drainage Scheme Options**) to replace the existing Casuarina Town Centre east-west swale with a piped drainage system incorporating the latest design parameters as nominated by Tweed Shire Council. Modelling has been undertaken by Cardno in the XP-STORM modelling package to appropriately size the proposed drainage system. The drainage system shall consist of three x 1650mm diameter pipes. Modelling by Cardno has determined that the proposed system is sufficient to cater for the rainfall intensity increase to 120% of the ARI 100 year event.

5.2 Stormwater Infiltration Requirements

The proposed stormwater system aims to maximise water recycling and minimise the pollutant contamination loading entering Cudgen Creek and the Pacific Ocean. *Cardno* (2008) has undertaken studies of previous development on the southern Kingscliff coastal strip and its effect on the existing freshwater aquafer under the Cudgen Peninsula. It is noted that the infiltration basins located across the site mimic the natural pre-development behaviour whereby the majority of rainfall is infiltrated into the ground. Consultation was had with Tweed Shire Council's technical officer (Mr Twohill) in relation to the infiltration design outcomes required, given the proposed removal of the swale reduces the available infiltration areas. Council have advised that an appropriate outcome would be for the retention of the same quantum of infiltration areas, given that the entire Casuarina catchment areas were dependent upon a gross area to be provided. Should the project wish to provide less, extensive re-modelling of both existing and new development areas would be required. Accordingly, reference to *Drg SK7079/1-24 Rev B Infiltration Basin Configuration Draining To Controlled Outlet No 11* was made by Council, thereby 4,110m^2 of infiltration is required. Refer to extract of Drg SK7079/1-24 Rev B below.

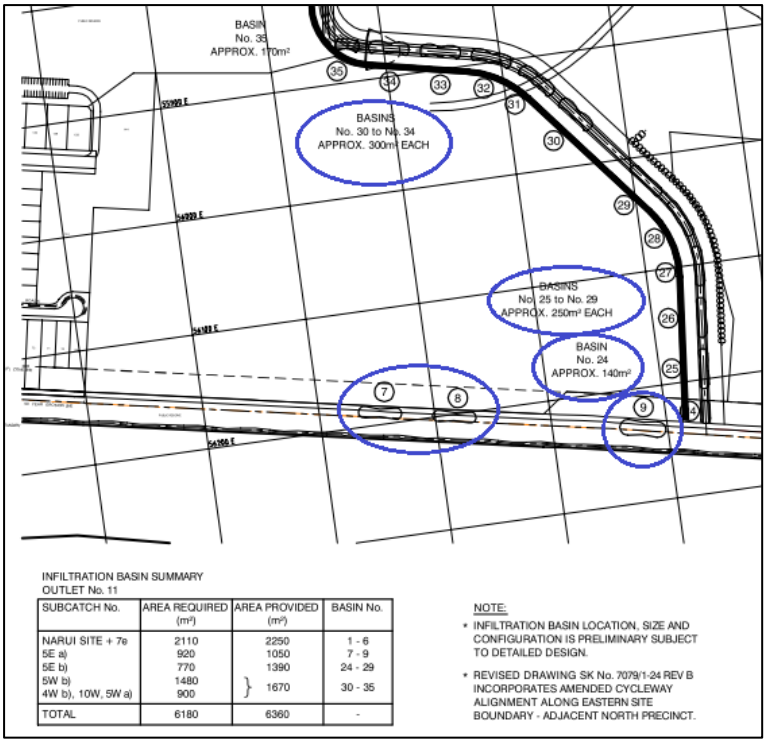

Figure 5-4 - Extract - Drg SK7079/1-24 Rev B Infiltration Basin Configuration (With 4,110m^2 Shown in BLUE)

The development has been designed to incorporate a total infiltration area of 4,110m^2 as shown per **Appendix B – DWG SWINF01 – Infiltration Equivalency Catchment Plan**

6 Sewer Services

All lots will be provided with a gravity sewer connection. An existing 300mm gravity trunk main servicing the adjacent northern development currently traverses the site. This existing service will be relocated adjacent to the stormwater culverts running from the north eastern corner west across site before discharging into the existing trunk sewer system on the western side of Casuarina Way. It is proposed that the new trunk sewer line is constructed and commissioned before a live change-over of the existing trunk main. After completion of the changeover the redundant main will be decommissioned and removed from site.

The design depth of the proposed trunk main generally varies between 3m to 7.2m below the finished design surface. As the new main follows the existing drainage swale it is proposed that the new line will be installed prior to the commencement of backfilling activates. It is anticipated that a maximum excavation depth of 4.2m from the existing surface will be required for construction.

The gravity sewer reticulation system will be provided for all lots and connected at three locations to the existing sewer reticulation network. Two connections will join directly into the new trunk main with the remaining gravity reticulation system servicing Lots 1-35 & 50 connecting into the existing network at the south western corner of the site. Reconnection of the Santai resort to the sewer trunk main will be provided.

Additional over excavation for the construction of the sewer trunk main and reticulation network will be required in the north eastern corner of the site identified as area 1 in the Cardno *Radiation Validation and Remediation Report*. Excavation and remediation in this area will be in accordance with Section 3.1 and the *Cardno Remediation Action Plan.*

7 Potable Water Reticulation

A conventional potable water reticulation network will be provided for the development. A hydraulic investigation of the water supply infrastructure servicing the Town Centre development has been previously undertaken by Cardno for past concept approvals. The previous hydraulic model had determined that there is sufficient capacity within the Tweed Shire Reticulation network for an expected 550ET demand (as compared to 240 ET for this proposal). Section 64 contributions will be paid in accordance with Tweed Shire Council Development Servicing Plan for Water Supply Services

8 Sediment and Erosion Control Plan

During construction sediment and erosion control measures (including staging of works) will be installed to ensure the loss of soil from the site is minimised. Refer to **Appendix A – DWG E001 Sediment and Erosion Control Plan** for the proposed site control measures. Temporary sediment and erosion control measures such as silt fencing are the responsibility of the Contractor and will be installed prior to construction.

9 Public Transport and Pedestrian Access

The development is connected to the Tweed Shire Cycleway network. The Cycleway runs along the eastern boundary of the site and provides an off-road connection as far north as Coolangatta and south to Pottsville. Additional connections to the adjacent footpath network along Casuarina way and Blue Horizon Drive will also be provided as part of the development. An additional east/west Cycleway connection (2.5m wide) along the northern boundary of the site will be installed as part of the swale remediation works. This will provide a link between the Tweed Shire cycleway to the Casuarina Way.

A footpath network is to be provided to all local access streets within the development excepting for laneways. This forms a strong local pedestrian network that forms interconnections from the cycleway through to Grand Parade. The pedestrian network also connects to Casuarina Way whereby Surfside Buslines currently services the Casuarina area. Surfside route 603 runs along Casuarina Way and departs hourly 7 days a week. The development provides four pedestrian connection points to Casuarina Way with all lots within a safe five minute walk of the existing bus route.

10 Conclusion

This report demonstrates that the proposed development infrastructure is generally in alignment with previous design concepts and approvals for the site. Variations to previous design concepts surrounding the stormwater swale and sewer relocation has been discussed in detail.

Hydraulic modelling by Cardno has shown that replacement of the existing drainage swale with three 1650mm diameter stormwater pipes is sufficient to convey 120% of the 100 year ARI storm event. Relocation of the sewer trunk main to align with the stormwater system is also possible.

The expected traffic generated by the development has been assessed with traffic volumes in alignment with previous traffic predictions. It is noted that detailed intersection designs are not necessary as the peak hourly capacity requirements are below the Austroad recommendations.

Other design elements such as:

- Bulk Earthworks
- Public Transport and Pedestrian Access
- Potable Water
- Stormwater Management
- Radiation, and
- Acid Sulfate Soils

Have been considered as part of this Engineering Assessment. The proposed development is consistent with previous approval conditions, Tweed Shire Council requirements and are consistent with the adjacent surrounding developments.