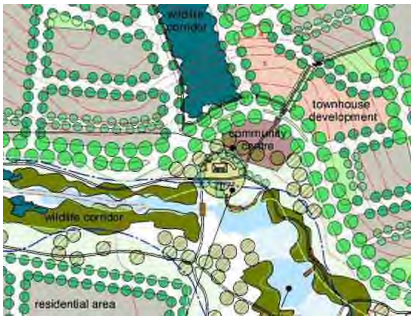
Proposed Subdivision

Coffs Harbour City Council

Rothwell Boys Pty Ltd

Lot 1 DP 725785

The Glades, Moonee Beach NSW



February 2018

Engineering Infrastructure Report

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1. Background

Resource Design and Management Pty Ltd (RDM) has been engaged to provide an engineering assessment and report to support the proposed development by Rothwell Boys Pty Ltd.

The proposed development entails the subdivision of the site to create 31 residential lots.

The development site comprises a portion of the property located within the approved residential subdivision known as The Glades Estate, formally described as Lot 1 DP 725785.

2. Site Context

2.1 Existing Site

The subject site comprises an area of approximately 16,800m^2 within the approved Glades Estate (MP 06_0143). The site is a portion of the residual lot created by the Glades Estate subdivision. The subject site is currently vegetated and treed.

Services and easements for services are located to the west of the site adjacent the Pacific Highway through the Glades Estate. The easements provide for trunk services (including electricity, telecommunications, water and sewer) for the Glades Estate and future residential developments to the south.

The site is bounded to the east and west by future residential lots of the Glades Estate, and to the north and south by future public reserve which falls to Moonee Creek to the north, and a minor tributary of Moonee Creek to the south.

The site falls from RL8.5m in the centre of the site and falls to the south to RL3.5m (an average gradient of 10%), and falls to the north to RL5.0m (an average gradient of2.5%). Existing stormwater runoff is directed to Moonee Creek to the north, and a natural watercourse to the south where it eventually contributes to the Moonee Creek system.

Figure 1: Subject Site

2.2 Proposed Development

The proposed development provides for a residential subdivision creating 31 residential lots with an average area of 560sq.m.

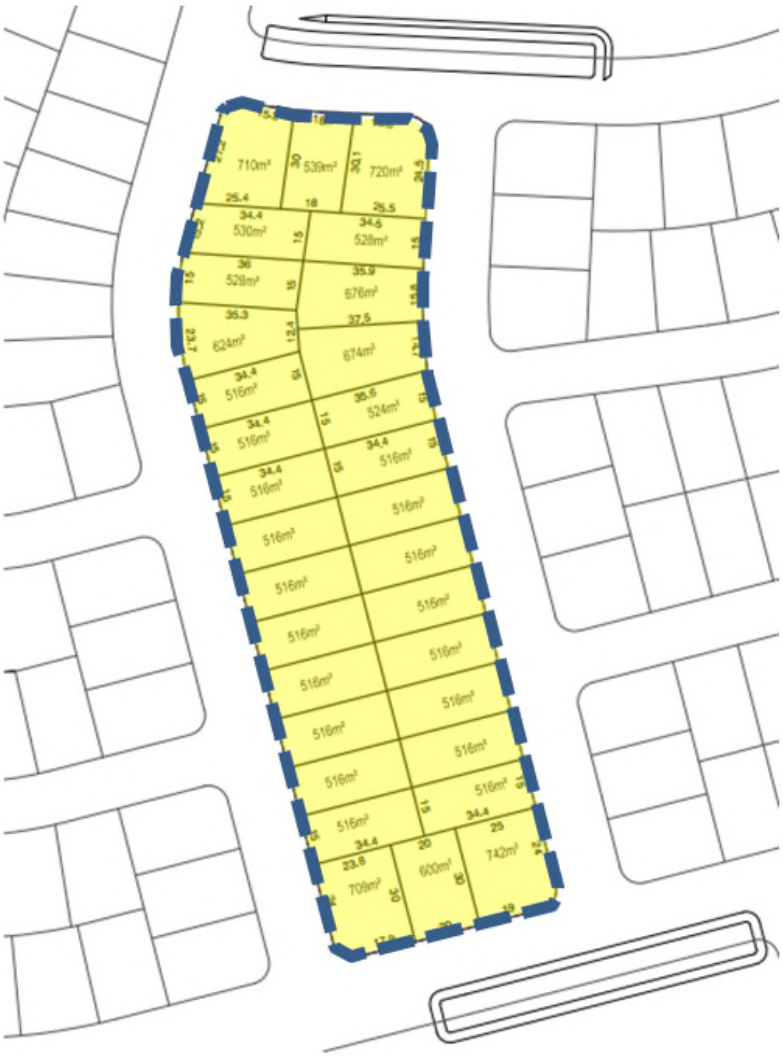


Figure 2: Site Plan

The proposed development comprises bulk earthworks, integration of the proposed lots with the surrounding road and footpath network approved for the Glades Estate, extension of the proposed Glades Estate Council water and sewer infrastructure to service the proposed residential lots, the provision of electricity and telecommunication infrastructure, and the integration of the proposed Glades Estate stormwater drainage network, including provision for stormwater detention and stormwater quality improvement.

The following section provides detail of the proposed engineering infrastructure required to adequately service the proposed development.

3. Infrastructure and Services

3.1 Traffic

The site will have vehicular access to the surrounding road network proposed by the Glades Estate development. The east and west roads (Road 5 and Road 9) will be a 7 metre wide formed Council road within a 20 metre wide road reserve. This conforms to Coffs Harbour City Council's (CHCC) classification of a local road. According to CHCC development specifications a designated local road can have a maximum traffic volume of 2,000 vehicles per day. Refer to Figure 3 below.

The road directly to the north of the site (Road 1) is considered a local road, however, due to this road being a perimeter road for bushfire fighting purposes, the road will be an 8metre wide formed Council road within a 20metre wide road reserve.

The road directly to the south of the site (Road 1) is considered a collector road, with a 9metre wide formed Council road within a 24metre wide road reserve.

Road Type	Max Traffic Volume (vpd)(1)	Max Speed(2) (km/h)	Carriageway Width (m)(3)		Parking Provision Within Road Reserve	Kerbing(4)	Footpath Required	Bicycle Path Required	Verge Width (each side)
			Min	Max					
Local Street	2,000	40	7.0	8.0	Carriage way	As above	1.2m wide(7)	No	Min 4.0m
Collector Street	6,000 (with access to lots)	50(8)	9.0 (10)	11.0	Carriage way or indented parking	Rollover 9.0m(9) SA 11.0m	1.2m wide both sides	No 1.0m gap in proturb for cyclist(10)	Min 4.0m(14)

NOTES:

(7) A minimum of one footpath on one side of the street to be constructed initially with provision to construct a second footpath if required by residents in the future.
(8) Reduced speeds are required at designated pedestrian/bicycle crossing. A speed of 20km/h is desirable, achieved by the road design principles outlined in AUS-SPEC.
(9) Barrier kerbing may be used if required for drainage purposes without reducing the carriageway width.

(10) On bus routes, 9.0m travelled way with 2.0m wide indented parking and bus bays defined by kerbed protuberances. Where bicycle way can be anticipated, a bicycle lane is required along the kerb. (14) Provide adequate road reserve width for widening of carriageway for future bus route if required.

Source CHCC AUS-SPEC 2008

Figure 3: Characteristics of Roads in Residential and Industrial Road Networks

Based on the NSW Roads and Maritime Service (RMS) Technical Direction – Guide to Traffic Generating Development, Updated Traffic Surveys (August 2013), residential dwellings generate 7.4 daily vehicle trips per dwelling, and 0.78 weekday peak hour trips per dwelling. Refer Figure 4.

Rates
Daily vehicle trips = 10.7 per dwelling in Sydney, 7.4 per dwelling in regional areas Weekday average evening peak hour vehicle trips = 0.99 per dwelling in Sydney (maximum 1.39), 0.78 per dwelling in regional areas (maximum 0.90). Weekday average morning peak hour vehicle trips = 0.95 per dwelling in Sydney (maximum 1.32), 0.71 per dwelling in regional areas (maximum 0.85). (The above rates do **not** include trips made internal to the subdivision, which may add up to an additional 25%).

Source RMS

Figure 4: Low Density Residential Dwellings

The proposed 31 residential dwellings will produce 230 vehicle movements per day, and 24 vehicle movements during peak hour.

The expected traffic generated by the residential development, combined with the vehicle usage generated by the Glades Estate, will not generate traffic volumes sufficient to warrant a change to the local / collector road designations. It is considered that the additional traffic volumes generated by the proposed development can be satisfactorily catered by the Glades Estate road network.

The proposed development does not propose any alteration to the approved Glades Estate layout. Intersections shall comply with Safe Intersection Sight Distance as per the approved Glades Estate intersection locations.

3.2 Road Network

The development proposes to provide a Council road network to service the proposed dwellings. The road will be a flexible pavement with an asphalt wearing course. The pavement thickness will be designed in accordance with Council requirements during the detailed design phase.

The proposed roads will be constructed to local road standard, being 7m wide carriageway within a 20m wide road reserve.

The perimeter road will have 8m wide carriageway within a 20m wide road reserve to comply with Planning for Bush Fire Protection requirements.

The collector road will have 9m wide carriageway within a 24m wide road reserve.

All roads will be 2-way, 3% crossfall with roll kerb and gutter on each side of the road.

The proposed road network will have a minimum longitudinal gradient of 0.5% and will not exceed 16%. Access gradients to each lot will not exceed 14%.

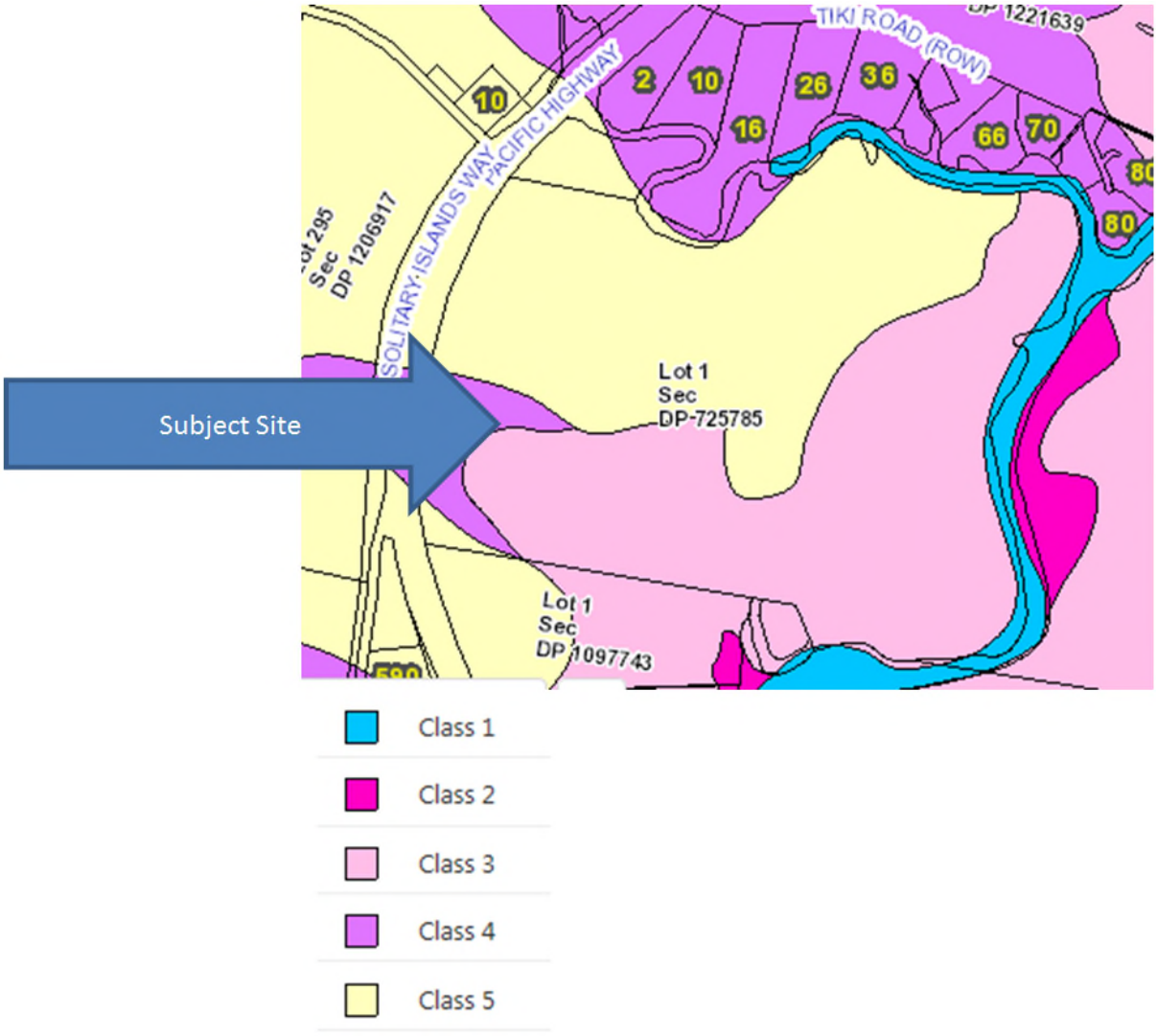
3.3 Footpaths and Cycleways

A proposed footpath and cycleway network exists within the surrounding road network approved as Major Project 06_0143. The proposed development will be serviced by the proposed path network within the immediately surrounding road network.

3.4 Earthworks

A geotechnical investigation will be undertaken to inform the detailed design of the proposed development. The investigation will inform the soil types, strengths, stability, or the presence of hard rock or groundwater levels present on the site. The geotechnical results will determine the road pavement type and thickness, and building foundation requirements.

The site is identified as having potential acid sulfate soils. Refer Figure 5 below.



Source CHCC Mapping

Figure 5: Acid Sulfate Soils

It is anticipated that an Acid Sulfate Management Plan will be required for the site. There is risk that site excavation services and utilities, roads, and building footings could expose acid sulfate soils. The Acid Sulfate Management Plan will include a remediation plan should acidic soils be disturbed.

The proposed 31 additional lot development has sought to provide an integrated balanced cut/fill within the entire Glades Estate site. Preliminary calculations suggest that a total cut of approximately 4,700m^3 is designed for a total fill of approximately 12,200m^3. This leaves a shortfall of 7,500m^3 which will be sourced from within the remainder of the Glades Estate development.

The proposed development will have a maximum cut depth of 1m and a maximum fill depth of 2.5m to ensure the final ground surface is above the Flood Planning Level. The lower lying area of the site will be at or above existing natural levels to minimise any impact by acidic soils and groundwater levels.

3.5 Trunk Water Supply

A trunk water main is proposed to be constructed within the proposed collector road from Bucca Road to the north, to connect to the constructed trunk water main in Moonee Creek Drive to the south. The size of the watermain is to be confirmed by Coffs Harbour City Council.

The proposed water trunk main will service the Glades Estate (including this development) and the remainder of the Moonee Urban Release Area to the south.

3.6 Trunk Sewer

The Glades Estate has proposed a number of sewer pump stations situated throughout the site to receive sewer from the estate. The pump stations will operate collectively to transfer sewer to the Sewage Reclamation Plant in Bucca Road.

The detailed design of the sewer pump stations and associated sewer rising mains will provide for the additional 31ET load generated by the development.

3.7 Water Reticulation

The approved Glades Estate development has made provision for a 100mm DIA water main located within all the roads surrounding the site. The development proposes to realign these water mains to provide efficiency of the overall design. The proposed modifications are minor and do not impact the functionality of the original design intent.

The development proposes to utilise these water mains for the provision of house services to each lot.

The water main and water services will be constructed in accordance with Coffs Harbour City Council requirements. Fire hydrants are to be installed to comply with Council requirements.

The proposed water reticulation for the development is shown below as Figure 6.

Figure 6: Proposed Water Reticulation

3.8 Sewer Reticulation

The development proposes to connect the internal site sewer to the approved Glades Estate sewer network. Minor redirection of the approved sewer layout will occur to provide for efficient sewer network design. The site is located adjacent to two proposed sewer pump stations affecting only minor localised increased loads to the sewer network.

Detailed design of the combined sewer network will ensure that appropriate pipe diameters and gradients are specified.

There is currently no existing recycled water reticulation in the vicinity of the site. The proposed development does not make provision for any future reticulated recycled water.

The proposed sewer reticulation for the development is shown below as Figure 7.

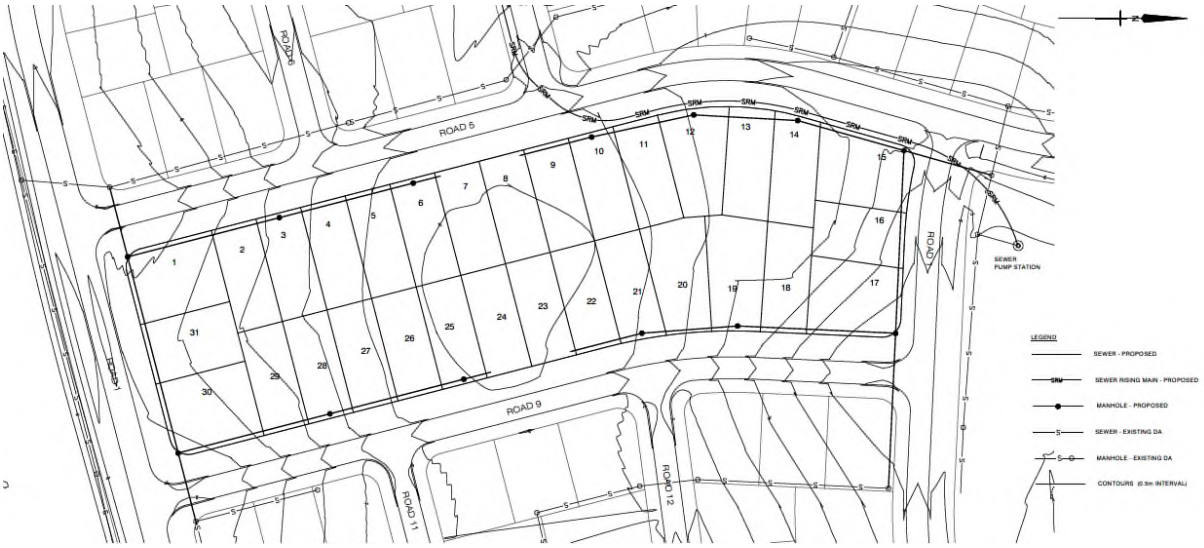


Figure 7: Proposed Sewer Reticulation

3.9 Electricity and Telecommunications

Electricity and telecommunications networks are required for the surrounding Glades Estate. Detail design of the electrical and telecommunications networks will determine the effects of additional loads on the existing systems, and any potential upgrades of existing infrastructure to cater for the additional loads.

4. Stormwater Management

4.1 Site Description

The subject site comprises an area of approximately 16,800m^2 within the approved Glades Estate (MP 06_0143). The site is a portion of the residual lot created by the Glades Estate subdivision. The subject site is currently vegetated and treed.

The site falls from RL8.5m in the centre of the site and falls to the south to RL3.5m (an average gradient of 10%), and falls to the north to RL5.0m (an average gradient of2.5%). Existing stormwater runoff is directed to Moonee Creek to the north, and a natural watercourse to the south where it eventually contributes to the Moonee Creek system.

Figure 8: Subject Site

4.2 Contributing Catchments

The site is located on a hill crest within the Glades Estate. The northern portion of the site falls north towards Moonee Creek, and the southern portion of the site falls to the south.

The surrounding Glades Estate road and drainage network directs stormwater away from the site. It is considered that there is no external catchment contributing to the site.

The landform of the proposed development directs runoff from the site to the surrounding road and drainage network, where, after treatment it is discharged to receiving waters.

4.3 Contributing Flows

Pre-development flows were determined using the kinematic wave equation.

Analysing the development site only, the catchment area of 16,800m^2 was determined to have an impervious area of 10%, flow length of 110m, assumed retardance of 0.35, and slope of 5%. Pre-developed flows for the development site were calculated as:

293L/s for 20%AEP, tc= 24minutes

686L/s for 1%AEP, tc= 19minutes

Post-development flows utilising the kinematic wave equation were determined as follows:

For the development site only, with 50% impervious area, flow length of 110m, assumed retardance of 0.21, and a slope of 3%, the post-developed flows for the development site are calculated as:

363L/s for 20%AEP, tc= 20minutes

861L/s for 1%AEP, tc= 15minutes

The assumed impervious area of 50% is consistent with an urban residential area for which this catchment is zoned.

The urbanisation of the site results in an approximate 25% increase to peak flow rates generated by the site. The detailed design of the stormwater drainage network will cater for urbanisation flows generated by the site and surrounding Glades Estate.

4.4 Stormwater Quantity and Detention

The site's location near to the catchment outlet suggests that site peak discharges occur on the rising limb of the hydrograph for the overall Moonee Creek catchment and that detention of flows from the site may adversely impact on the peak catchment flows by releasing water closer to the peak which would otherwise have been released earlier in the flood event. Consistent with the surrounding Glades Estate development, there is no stormwater detention system proposed for the site's generated stormwater discharge.

Detailed design of the proposed drainage network will include a detailed analysis of the existing drainage network to ensure that all council requirements with respect to urban drainage are met.

4.5 Flooding

The proposed 31 lot development is within the study area of the flooding Assessment prepared by Martens (2018) for the Glades Estate. The proposed development does not impact on the modelled flood terrain, and the lots are located above the Flood Planning Level (FPL) determined for the Glades Estate by the Martens report as shown on Drawing PS01-A050.

4.6 Proposed Drainage Network

A conceptual design for the proposed drainage network for the development has been prepared for the proposed site. The design intent is outlined below:

- The proposed road and western footpath are to convey overland flow designed to cater for 1%AEP storm events.
- All overland flow routes to comply with Council's velocity / depth requirements.
- Each dwelling will direct roof and surface water to the road kerb to be conveyed by the road drainage network.
- Each urban sub-catchment has had the impervious area calculated from the proposed site plan, and an assumed 250m^2 roof area. Generally, each dwelling catchment is between 40% to 50% impervious.
- Detail design of the stormwater system will consider sensitivity analysis of discharging to flood affected tailwater.

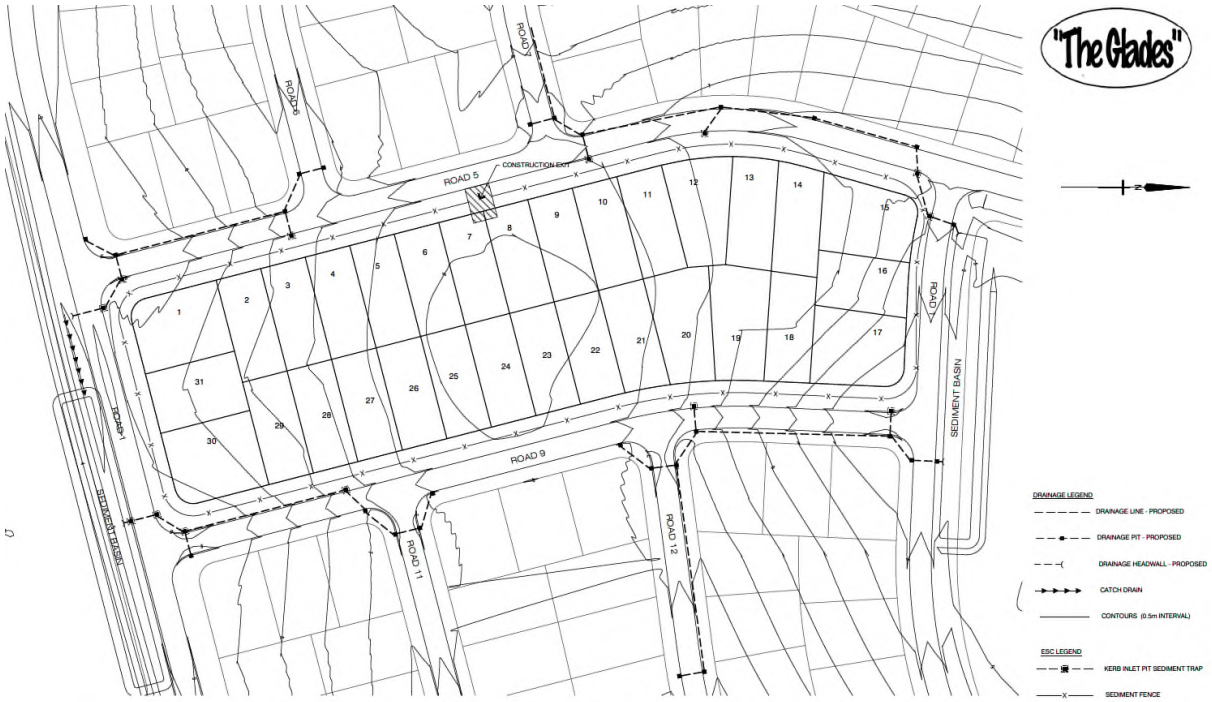


Figure 9: Proposed Drainage Network

4.7 Stormwater Quality

The Glades development proposes to construct bioswales around the perimeter of the development area to treat stormwater runoff to meet stormwater quality targets.

Coffs Harbour City Council's Water Sensitive Urban Design Policy has set objectives for the improvement of stormwater quality for new developments. The specified stormwater quality objectives are:

- 80% reduction in the average annual total suspended solids load
- 60% reduction in the average annual total phosphorus load
- 45% reduction in the average annual total nitrogen load
- 90% reduction in the average annual gross pollutant load

The urbanisation of the subject site will generate additional pollutant loads. A MUSIC model has been developed to determine the treatment measures necessary to meet Council's stormwater quality targets.

A bioretention system is proposed to augment the bioswales proposed for the surrounding Glades Estate. A 300m^2 bioretention basin was modelled by the MUSIC software to treat the generated stormwater pollutants by the subject site.

Coffs Harbour City Council MUSIC parameters were assigned to the model via the MUSIC-link portal. The MUSIC-link Validation Report is provided as an appendix to this report.

The MUSIC modelling results determined that a bioretention area of 300m^2 is required to satisfactorily address Council's stormwater quality targets. The additional 300m2 of bioretention area will be incorporated into the proposed bioswales during detail design of the stormwater system.

A screenshot of the MUSIC results is provided as Figure 10 below.

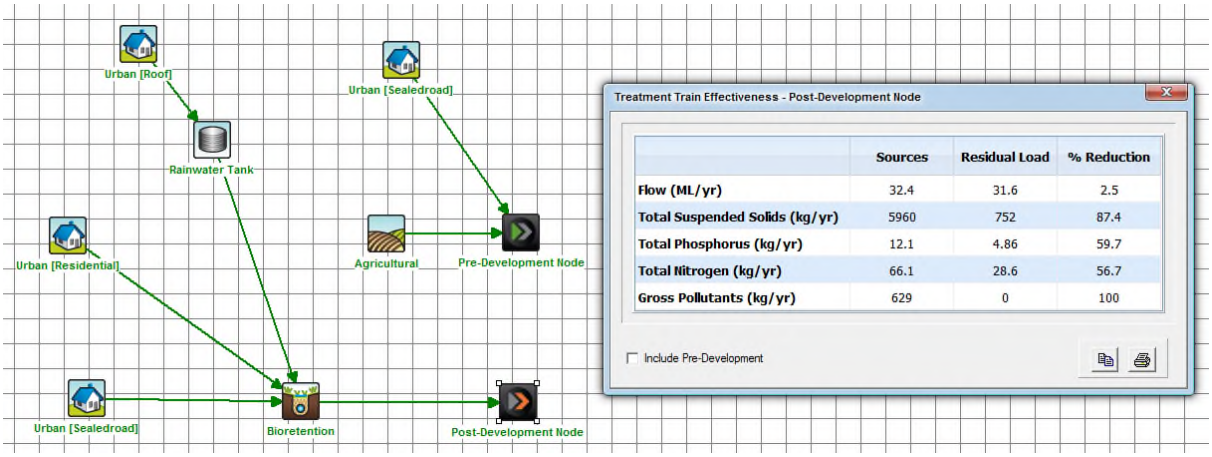


Figure 10: MUSIC Results

4.8 Soil and Water Management

Sediment and erosion control measures will be implemented during the construction phase in accordance with the principles and procedures outlined in with the Landcom document Soils and Construction, Managing Urban Stormwater (the Blue Book).

A concept Sediment Erosion Control Plan is provided with the Development Application documents. A detailed Sediment Erosion Control Plan will be submitted with the Construction Certificate documentation for Council approval. The final soil and water management plan, including the detailed sediment and erosion control plan, will assess and incorporate the following principles:

(i) assess the soil properties such as erosivity, groundwater, and acid sulphate potentials of the soils, and address issues where soil disturbance is likely to expose and/or exacerbate this problem;

(ii) plan for erosion and sediment control concurrently with engineering design and before earthworks begin, ensuring proper assessment of site constraints and integration of the various components;

(iii) minimise the area of soil disturbed and exposed to erosion;

(iv) conserve topsoil for later site rehabilitation/revegetation;

(v) control water flow from the top of, and through the development area, where possible diverting clean water away from the site;

(vi) rehabilitate disturbed lands quickly; and

(vii) maintain soil and water management measures appropriately during the construction phase.

Appendices

Annexure A ~ Engineering Drawings

Annexure B ~ MUSIC Validation Report