Site Analysis Report

Jacaranda Drive, Boyne Island

Boyne Tannum Aquatic Recreation Centre Option Analysis

PREPARED FOR
GLADSTONE REGIONAL COUNCIL

REFERENCE NO: R2019066

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1 Introduction

Cardno has been engaged by Gladstone Regional Council ('Council') to complete an options analysis of three (3) potential sites for the future Boyne Tannum Aquatic Recreation Centre ('the aquatic centre').

This report documents the initial analysis of Site 3, being land located at Jacaranda Drive, Boyne Island. The site is further discussed in **Chapter 2** of this report.

Cardno has completed a comprehensive technical analysis of the site, covering the following matters:

- town planning, as discussed in **Chapter 3** of this report;
- civil engineering, as discussed in **Chapter 4** of this report;
- environment, as discussed in **Chapter 5** of this report;
- traffic engineering, as discussed in **Chapter 6** of this report; and
- geotechnical engineering, as discussed in **Chapter 7** of this report.

The analysis documented in this report will be used to inform an options analysis of the three potential sites, with a view to recommending a preferred site to Council.

2 Site Details

The site is located at Jacaranda Drive, Boyne Island is more properly described as Lot 10 on SP171136. The site includes a land area of 54,830m^2 and has a road frontage to Jacaranda Drive to the west. Current access to the site is from an Urban Residential Access Place which is narrow with no sealed footpaths. Malpas Street, which Jacaranda Drive intersects with to the north of the site, is a state-controlled road.

The site is primarily vacant land which has been partly cleared, although areas of mature vegetation exist particularly in the north of the site. Part of the site is presently subject to use as part of the adjoining caravan park, which is primarily located on Lot 1 on RP619797.

The site is included within the far southern extent of Boyne Island with notable features in the surrounding area including:

- the Boyne Island Caravan Park to the immediate north of the site;
- an expansive area of land to the immediate west of the site which incorporates the Boyne Tannum Golf Club, the Boyne Tannum Bowls Club and sporting fields for football, AFL and cricket; and
- the Boyne River to the immediate east of the site.

The site is shown in **Figure 2-1** below.

Figure 2-1 The Site

3 Town Planning Review

The *Planning Act 2016* ("the Planning Act") is the statutory instrument for the State of Queensland under which development is regulated. Development under the Planning Act may be one of five types:

- Material Change of Use;
- Reconfiguring a Lot;
- Carrying Out Operational Work;
- Carrying Out Building Work; or
- Carrying Out Plumbing or Drainage Work.

The Planning Act provides that a categorising instrument, either the applicable local government planning scheme or the *Planning Regulation 2017* ('the Planning Regulation'), may categorise development into one of three categories of development:

- Accepted Development which does not require a Development Permit;
- Assessable Development, which requires a Development Permit; and
- Prohibited Development, for which a Development Permit cannot be given and for which a development application cannot be made.

A development application is required to be made under the Planning Act to seek a Development Permit. A development application is subject to one of two categories of assessment:

- Code Assessment: A Code Assessable development application is assessed against the town planning framework, including the relevant planning scheme codes, and is not subject to public notification.
- Impact Assessment: An Impact Assessable development application is assessed against the town planning framework, including the entire planning scheme (to the extent relevant). Such an application is subject to a statutory public notification period, during which members of the public can make submissions. A properly made submission provides a submitter with appeal rights in the Planning and Environment Court, where they can appeal a decision to approve a development application.

The purpose of the Planning Regulation is to prescribe matters provided for under the Planning Act, as well as to provide the mechanisms supporting operation and implementation of the Planning Act. It deals with practical matters such as State interest matters, referrals for development, categorisation of development and relevant assessment managers.

3.1 State Planning Matters

3.1.1 Assessable Development and Related Matters

Schedule 10 of the Planning Regulation categorises development. Based on available information it is considered that the Planning Regulation does not identity any categories of development relevant to the proposed development on this site.

The Planning Regulation, through Schedule 6, identifies instances where a planning scheme is not permitted to categorise development as Assessable Development. Section 8 of Schedule 6 provides that

> *"…operational work or plumbing or drainage work (including maintenance and repair work), if the work -*
>
> *(a) Is carried out by or for a public sector entity authorised under a State law to carry out the work; and*
>
> *(b) Is not development stated in section 26 of this schedule.*

In this instance the planning scheme is not permitted to make Operational Work Assessable Development where the work is undertaken by a public sector entity. It is likely that Council is considered a public sector entity, however it is noted that the term is not defined by the Planning Regulation. For the purposes of this town planning review it has been assumed that Council is considered a public sector entity and therefore the planning scheme is unable to regulate any Operational Work associated with the development.

3.1.2 Referral Triggers

Section 52(2) of the Planning Act and Section 22 and Schedules 9 and 10 of the Planning Regulation provide for the identification of the jurisdiction of referral agencies, to which a copy of a development application must be provided.

A review of the relevant provisions has not identified any referral requirements that are applicable to the proposed development on the site. Referral requirements should be confirmed at the time of the preparation of any required development application.

3.1.3 State Planning Policy

The State Planning Policy ('the SPP') was released on 2 December 2013 and replaced all previous State Planning Policies. The SPP has since been revised, with new versions released on 2 July 2014, 29 April 2016 and 3 July 2017.

The April 2016 version of the SPP is identified in the planning scheme as being appropriately integrated in the planning scheme. Whilst the planning scheme does not reflect the most recent version of the SPP (3 July 2017) it is not considered that the policy intent of the SPP has been sufficiently altered with respect to the site or the proposed development to warrant its specific consideration.

3.1.4 Regional Plan

The *Central Queensland Regional Plan 2013* ('the Regional Plan') is the regional plan that applies to the site. The Regional Plan is identified in the planning scheme as being appropriately integrated in the planning scheme. The Regional Plan is therefore not applicable to the assessment of a development application over the site.

3.2 Local Planning Matters

Section 3.2 of this report documents a review of relevant local planning matters, primarily involving a review of *Our Place Our Plan Gladstone Regional Council Planning Scheme Version 2* ('the planning scheme').

3.2.1 Zoning

The site is located within the Low Density Residential Zone. The site is not located within a zone precinct. Surrounding land to the north is also included in the Low Density Residential Zone whilst land to the south and west is within the Sport and Recreation Zone. **Figure 3-1** provides an extract of the planning scheme zone map for the site and surrounding area.

Figure 3-1 Zone Map

3.2.2 Overlays

The site is affected by the planning scheme overlays identified in **Table 3-1**.

Table 3-1 Applicable Overlays

Overlay	Designation
Acid Sulfate Soils Overlay	▪ Acid Sulphate Soils 0- 5m AHD ▪ Acid Sulphate Soils 5- 20m AHD
Bushfire Hazard Overlay	▪ Bushfire Prone Area – Medium Potential Bushfire Intensity ▪ Bushfire Prone Area – Potential Impact Buffer
Building Heights & Frontages	▪ Heights
Coastal Hazard Overlay	▪ Medium Storm Tide Inundation
Flood Hazard Overlay	▪ Boyne River Q100
Transport Overlay	▪ Transport Noise Corridor Category 1

3.2.3 Defined Land Uses (Material Change of Use)

Having regard to Cardno's understanding of the proposed development, the land use definitions from the planning scheme stated in **Table 3-2** are likely to be applicable.

Table 3-2 Applicable Planning Scheme Use Definitions

Planning Scheme Use	Definition	Examples
Outdoor Sport and Recreation	Premises used for a recreation or sport activity that is carried on outside a building and requires areas of open space and may include ancillary works necessary for safety and sustainability. The use may include ancillary food and drink outlet(s) and the provision of ancillary facilities or amenities conducted indoors such as changing rooms and storage facilities.	▪ Driving Range ▪ Golf Course ▪ Swimming Pool ▪ Tennis Court ▪ Football Ground ▪ Cricket Oval
Indoor Sport and Recreation	Premises used for leisure, sport or recreation conducted wholly or mainly indoors.	▪ Amusement Parlour ▪ Bowling Alley ▪ Gymnasium ▪ Squash Courts ▪ Enclosed Tennis Courts

For the purposes of this town planning review it has been assumed that any other land uses components, such as (but not limited to) cafes or shops, will be ancillary to the primary use and as such not form a separately defined use.

3.2.4 Categories of Development and Assessment

The following provisions of the planning scheme identify categories of development and assessment that are relevant to the site and the proposed development:

> A Material Change of Use for Outdoor Sport and Recreation in the Low Density Residential Zone is Assessable Development that is subject to Impact Assessment.

> A Material Change of Use for Indoor Sport and Recreation in the Low Density Residential Zone is Assessable Development that is subject to Impact Assessment.

The overlays applicable to the site do not alter the applicable category of development or assessment.

The proposed development, irrespective of whether it involves one or both uses, will be Assessable Development that is subject to Impact Assessment.

3.2.5 Key Development Parameters

As the proposed development would be subject to Impact Assessment, it is noted that the entire planning scheme is an assessment benchmark for the development. The following planning scheme codes are considered relevant to the proposed development:

- Low Density Residential Zone Code
- Development Design Code
- Landscaping Code
- Acid Sulfate Soils Overlay Code
- Bushfire Hazard Overlay Code
- Coastal Hazard Overlay Code
- Flood Hazard Overlay Code

Cardno has completed a review of these planning scheme codes to identify key development parameters relevant to the proposed development. These key development parameters are summarised in **Table 3-3**. These key development parameters are based on the Acceptable Outcomes of the applicable codes. Alternatives to the Acceptable Outcomes may be proposed where it can be demonstrated that those alternatives comply with the corresponding Performance Outcomes.

The provided listing of key development parameters is not intended to be exhaustive and only identifies matters that are considered to be of substantial influence on the siting and design of the proposed development. A comprehensive review of any proposal against the applicable planning scheme codes should be completed to confirm the level of compliance that is achieved.

With regard to the planning scheme codes, it is noted that as the proposal is subject to Impact Assessment the relevant codes do not generally anticipate the uses proposed and subsequently the available key development parameters that can be taken from the relevant codes is limited. In some instances key development parameters have been provided from the Low Density Residnetial Zone Code, which has been generally drafted anticipating residential uses, meaning the provided parameters may not be appropriate for a sport and recreation use as is proposed. It is recommended that site specific design requirements be developed, which may be informed from other parts of the planning scheme (such as other zone codes or the strategic framework).

Table 3-3 Key Development Parameters

Parameter	Provision
Built Form	
Maximum Building Height	8.5 metres and 2 storeys
Maximum Site Cover	50%
Landscaping	
Boundaries (Outdoor Sport and Recreation)	Where sharing a boundary with a residential premises or residential zone, the boundary is improved with a: ▪ minimum 1.8 metres high solid screen fence; or ▪ landscaped buffer area consisting of dense screen planting of a minimum 3 metres width.
Landscape treatments	▪ A minimum of 50% of landscaped areas are to be covered in soft landscaping (turf areas and planting beds), with at least 25% of that area being planting. ▪ Shade trees are located within car parks at the rate of 1 tree per 6 car spaces.
Landscape species	Selected tree species within communal recreation areas are to provide at least 30% shade coverage within 5–10 years of planting.
Street trees	Street trees are provided at the rate whichever is the lesser of: ▪ one street tree per lot frontage or one tree per 10 linear metres of road frontage; or ▪ a minimum of 1 tree per 400m^2 of site area.

Parameter	Provision
Traffic and Transport	
Car Parking Supply	▪ Outdoor Sport and Recreation: 1 space per 20m^2 gross floor area, or 1 space per 5 spectators able to be seated; or 4 spaces per court or lane. ▪ Indoor Sport and Recreation: 1 space per 20m^2 gross floor area, or 1 space per 5 spectators able to be seated, or 4 spaces per court or lane, whichever is the greater.
Bicycle Parking Supply	▪ Outdoor Sport and Recreation: 1 space per 400m^2 gross floor area (minimum 6 spaces) ▪ Indoor Sport and Recreation: 1 space per 400m^2 gross floor area (minimum 4 spaces)
Design standard	Manoeuvring, loading and unloading areas, and parking areas (car and bicycle) are designed in accordance with the Engineering Design Planning Scheme Policy and AS2890 as amended.
End of Trip Facilities	End of trip facilities, in accordance with the requirements of the Queensland Development Code.
Access Driveways	▪ Access driveways allow vehicles to enter and exit the site in a forward gear.
Surface treatment	Manoeuvring, loading and unloading areas, and parking areas (car and bicycle) are imperviously sealed using concrete or asphalt bitumen
Footpaths	Footpaths are: ▪ provided to the full road frontage; ▪ designed in accordance with the Engineering Design Planning Scheme Policy; and ▪ connected to the existing footpath network.
Pedestrian access	Pedestrian access steps, escalators, ramps and lifts are: ▪ located wholly within the site, ▪ setback a minimum of 1.5 metres from the front boundary, and ▪ compliant with the *Disability Discrimination Act 1992*.
Engineering	
Flooding	Development does not result in an increase in flood level flow velocity or flood duration on upstream, downstream or adjacent properties.
Wastewater	Development does not discharge wastewater into any waterways.
Earthworks	▪ Earthworks are to be wholly located within the site. ▪ The top and toe of any batter slope is to be a minimum of 0.9 metres from any site boundary. ▪ Excavating and filling is not to exceed 1 metre. ▪ Batter slopes have a maximum grade of 1 vertical to 4 horizontal.
Overlays	
Acid Sulfate Soils	▪ The disturbance of acid sulfate soils is avoided or appropriately managed (as detailed in the Acid Sulfate Soils Overlay Code).
Bushfire Hazard	▪ Development maintains the safety of people and property by not exposing them to an unacceptable risk from bushfire (Performance Outcome). ▪ The water supply network has a minimum sustained pressure and flow of at least 10L per second at 200kPa.
Coastal Hazard	▪ Floor levels on non-habitable rooms (other than Class 10 buildings) are above the medium storm tide inundation level, or allow for the flow through of coastal waters on the ground floor. ▪ Any components of infrastructure that are likely to fail to function or may result in contamination when inundated by coastal waters (e. electrical switchgear and motors, water supply pipeline air valves) are: – located above the defined storm tide event level, or – designed and constructed to prevent coastal water intrusion/infiltration.

Parameter	Provision
	▪ Infrastructure and building foundations are designed and constructed to resist hydrodynamic forces as a result of storm tide inundation (Performance Outcome).
Flood Hazard	▪ Development: – does not occur on land within a flood hazard area; or – a site specific flood hazard assessment demonstrates that risks associated with the development can be mitigated to an acceptable or tolerable level. ▪ Development has direct access to land above the DFE by an evacuation route that is either above the DFE or has a confirmed low or medium flood hazard rating. Evacuation routes do not include a high or extreme flood hazard area. ▪ Signage is provided on site (regardless of whether the land is public or private ownership) indicating the position and path of all safe evacuation routes off the site. ▪ The floor level of non-residential buildings (other than Class 10 buildings) is above DFE or allows for the flow through of floodwaters on the ground floor.

3.2.6 Approval Requirements

On the basis of the review documented within this chapter, it is considered that a development application will be required to be made to Gladstone Regional Council seeking a Development Permit for a Material Change of Use. This development application will be subject to Impact Assessment, meaning a statutory public notification period will apply. Based on available information it is considered unlikely the proposed development will be required to be referred to any agency.

4 Civil Engineering Review

This Chapter of the report provides a review of relevant civil engineering matters to the development of the site and summarises any servicing capacity constraints.

The services considered as part of this review are:

- water and sewer;
- electricity;
- gas;
- communications; and
- stormwater drainage.

Cardno has provided findings and recommendations in this report regarding the future infrastructure and servicing requirements that are needed to accommodate the development.

The investigations and preparation of this report have largely been based on preliminary advice from the various service authorities. The information is current as of December 2019 and is subject to change.

4.1 Site and Earthworks

4.1.1 Earthworks

Site preparation and civil construction of the aquatic centre will involve the following key components;

- Site clearing of shrubs and trees. Reference should be made to Chapters 5 and 7 of this report to understand any likely environmental or geotechnical restrictions for these works;
- Topsoil strip and stockpiling for respread. This material may need to ameliorate to improve suitability for future surface respread such as landscaping, however is unsuitable for general cut/fill activities;
- Using a balanced bulk earthworks design approach and appropriate grades, the design road and pad levels will be achieved through the civil earthworks stage of construction; and
- If retaining structures are to be installed they will be constructed utilising clean granular fill behind the wall complete with drain pipes for release of water pressure.

4.1.2 Ground Conditions

A geotechnical investigation has been conducted on site by Construction Sciences in November 2019 and comprised the advancing of five (5) boreholes (BH11 to BH15) each to a target depth of five (5) metres.

Based on the Construction Sciences report (**Appendix A**), the subsurface profile consists of topsoil to a depth of 0.2 metres overlying alluvial sandy silt or clayey sand in the northern and southern areas of the site, generally from 0.2 metres to 5.0 metres (total depth). Fill of unknown origin comprising gravelly sandy clayey mixtures was encountered from surface levels in the central area of the site (at the location of BH14) to approximately two (2) metres depth, overlying sandy clay to 2.9 metres depth and then silty sands and clayey sands to five (5) metres depth. No rock was encountered in the locations of the boreholes.

4.1.3 Acid Sulphate Soils

Acid Sulphate Soils (ASS) are naturally occurring soils that contain iron sulphide minerals and are in an undisturbed state below the water table. When the soils are excavated or exposed to air, the sulphides react with oxygen to form sulphuric acid. Care and treatment must be undertaken when carrying out construction in areas with ASS.

Field screening test results indicated a high likelihood of encountering potential ASS in alluvial materials from 0.0 – 5.0m below ground levels (results for fill materials suggest ASS is not present). Therefore, further ASS intrusive investigation and management will be required.

4.1.4 Groundwater Levels

No groundwater was encountered in any of the test pits during the geotechnical investigation.

4.2 Drainage

Council is the local authority regulating the collection of stormwater drainage in the local Boyne Island and Tannum Sands area. The Capricorn Municipal Development Guidelines (CMDG) is the governing guideline for the design and management of stormwater at this site.

4.2.1 Existing Stormwater Infrastructure

There is currently no existing stormwater drainage infrastructure within the site. At present, stormwater will sheet flow via natural flow paths to the gully on the western section of the site which then flows both north and south to the Boyne River. This is shown in the contour map provided as **Figure 4-1**. There are no local drainage networks present in the surrounding area that can be easily connected to. As the current site is under developed there are few impermeable areas.

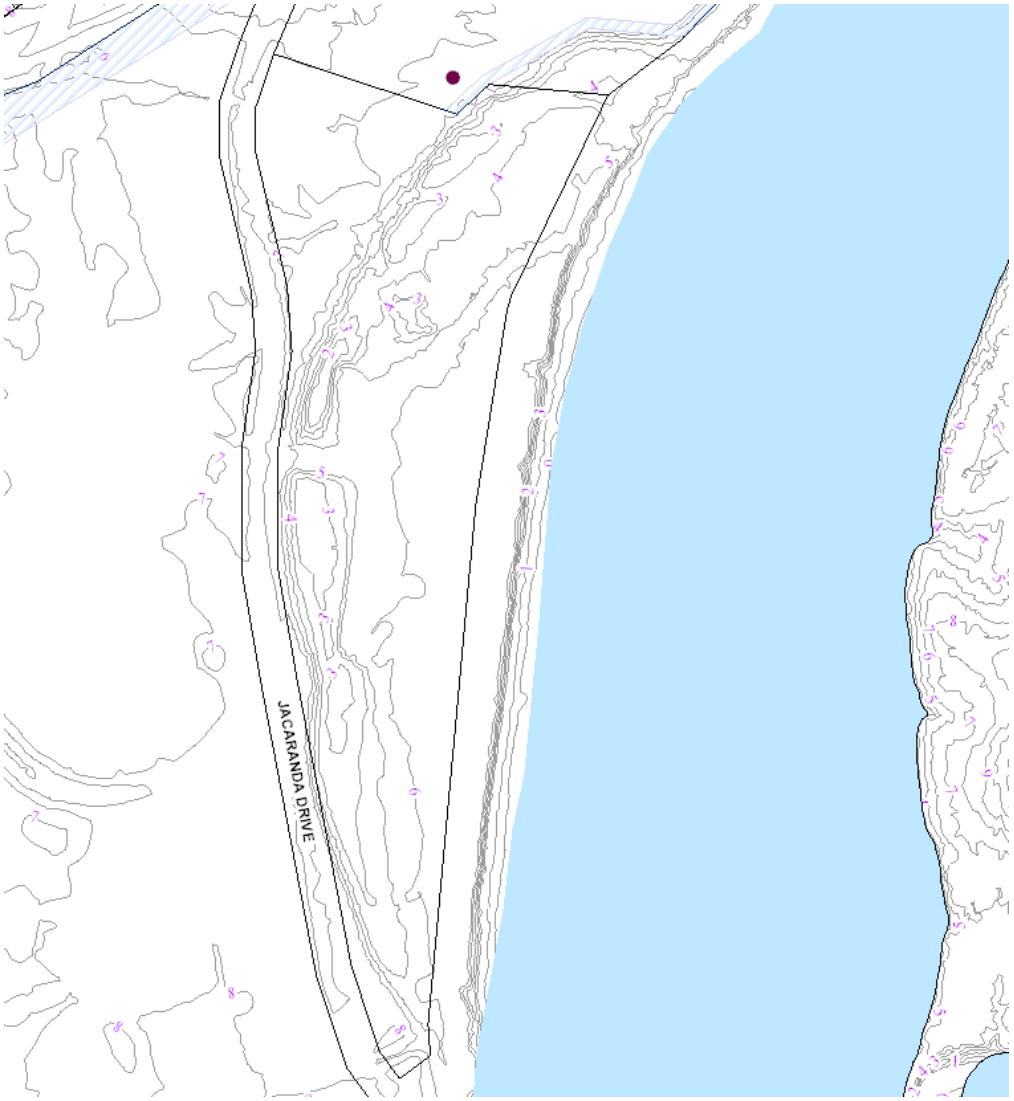

Figure 4-1 Contour map (1 metre)

4.2.2 Required Stormwater Infrastructure

Internal stormwater drainage is required to be provided in accordance with the CMDG. The guideline stipulates the detention / retention system must be designed to achieve the following minimum requirements:

- No increase in pre-development flood levels on adjoining land (upstream or downstream) where such an increase would cause damage to, or adversely affect either the “value” or “potential use” of the land.

> No increase in peak discharges immediately downstream of the development for all storm durations and for the following ARIs up to and including a 1 in 100 year ARI storm event (ARI = 1 yr, 2 yr, 5 yr, 10 yr, 20 yr, 50 yr and 100 yr).

The site is located directly adjacent to the Boyne River and as such does not have any downstream or upstream properties that would be impacted by increased stormwater runoff. Due to the location of the site, Council may not require the construction of stormwater detention for larger events.

There will still be the requirement for construction of stormwater quality treatment for the site and it is proposed that bioretention basins and swales are used across the site. This will have the additional benefit of managing the increased stormwater flows for minor events. Approximately 2% of the developed site area should be allowed for treatment by bioretention basins.

4.3 Flood Immunity

4.3.1 Flood Immunity

Council's online mapping indicates that a large proportion of the site is subject to flooding from the Boyne River during Q100 flood events, as shown in **Figure 4-2**. Significant filling of the site would be required to establish a building pad above this level. A flood study is recommended to determine the impact on adjacent properties caused by this filling.

Figure 4-2 Boyne River Flood Extent

4.4 Water Service Infrastructure

Council is the authority regulating the supply and distribution of treated water reticulation in the local Boyne Island and Tannum Sands area. The CMDG is the governing guideline for the design and management of reticulated water at this site.

4.4.1 Existing Treated Water Infrastructure

Council's online mapping indicates there is an existing 100mm line running along Jacaranda Drive and entering the site from the western side, as shown in **Figure 4-3**. Council has advised (email dated 28/11/2019) that there is sufficient capacity in the existing network to supply the proposed use of the site but the property connection will need to be to the existing 150dia main located at the north of the site.

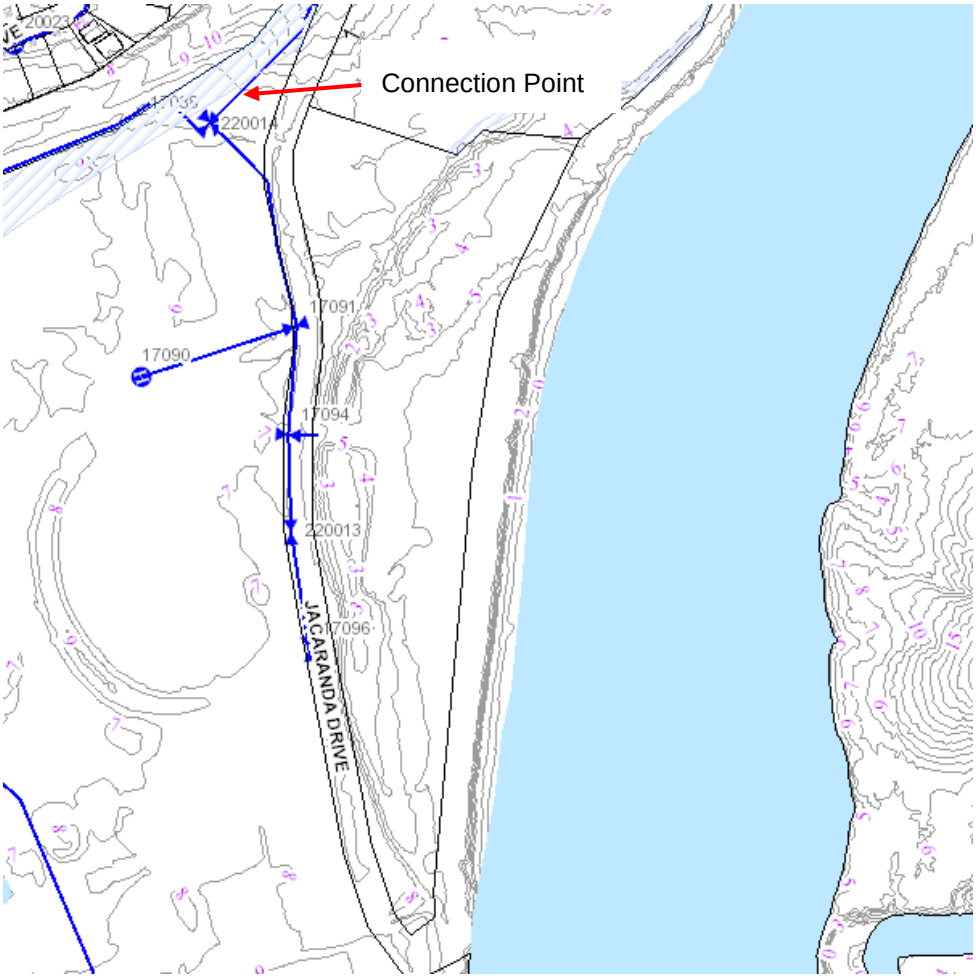

Figure 4-3 Existing Water Infrastructure

4.4.2 Proposed Treated Water Network and Loading

In order to determine the internal water main sizing (and any potential external water main upgrades), the number of equivalent persons (EP) must be determined. The number of equivalent persons (EP) for the site has been determined in accordance with the CMDG as shown in **Table 4-1**.

Table 4-1 Development Water Loading

Area (ha) Note 1	Assumed loading (EP/ha) Note 2	Development EP	Assumed Loading (L/EP/day) Note 2	Average day demand (kL/day)
1.5	56	~ 84	558	46.9

Note 1: Allotment area only – excludes road reserve, balance of land titles, open space etc. Area is approximate
Note 2: cmdg.com.au, D11 Water Supply Network.

4.4.3 Required Upgrades to Existing Treated Water Network

Council has advised at this time that no upgrades will be required to the external network to support the proposed development.

4.5 Wastewater Service Infrastructure

Council is the authority regulating the distribution and treatment for sewer reticulation in the local Boyne Island and Tannum Sands area.

4.5.1 Existing Wastewater Infrastructure

An existing sewer main is located within the site, as shown in **Figure 4-4**. The first length of sewer is 150dia that then steps up to 225dia within site boundaries. It is feasible to connect in to this infrastructure without upgrades. Depending on the site layout extension of the sewer mains internally may be required.

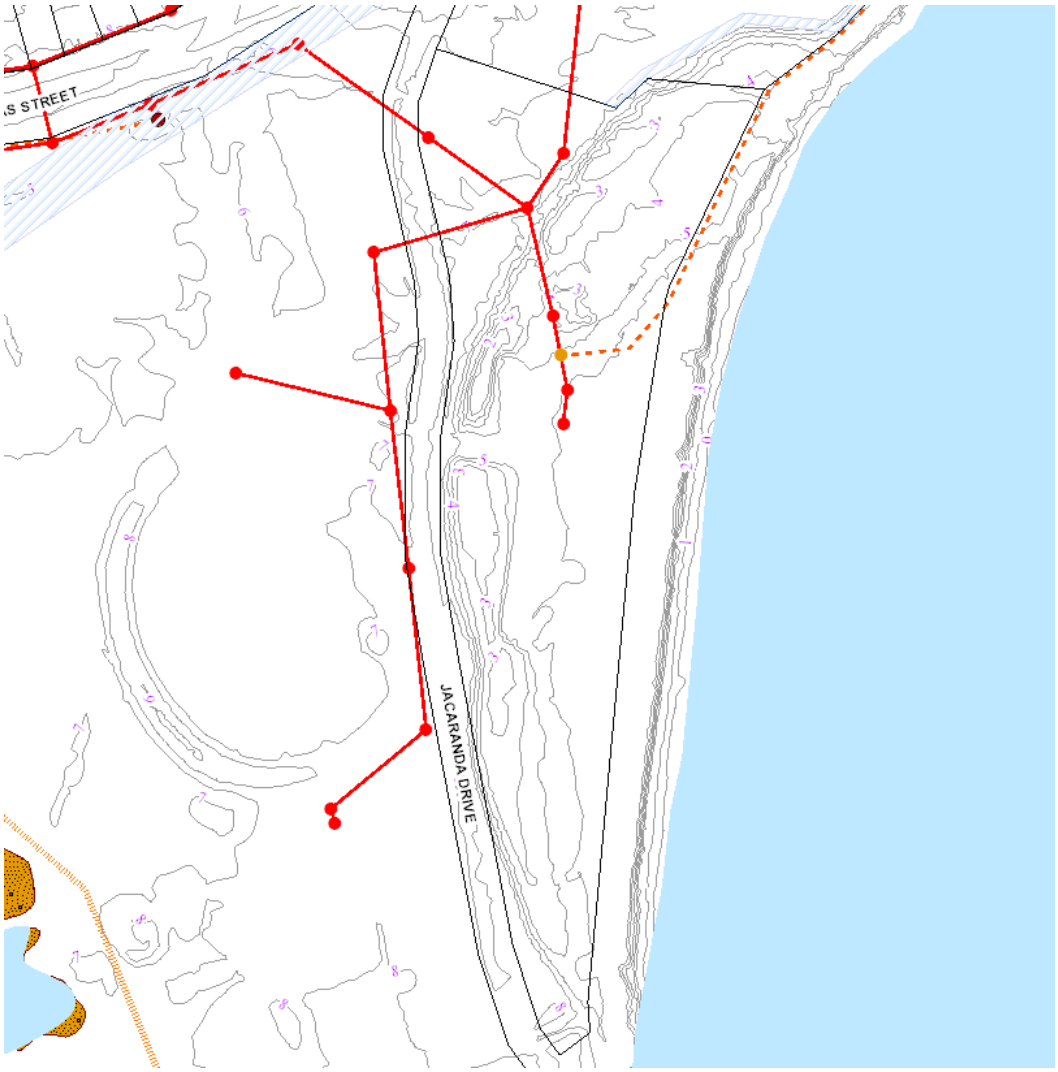

Figure 4-4 Existing Sewer Infrastructure

4.5.2 Proposed Sewer Network and Loading

Sewerage loadings in terms of EP are considered identical to water loadings for preliminary design purposes. The following table outlines the anticipated wastewater flows for the recreational properties in the proposed development. It can be seen the total wastewater flow for the development is approximately 18.9kL/d.

Table 4-2 Development Sewer Loading

Area (ha) Note 1	Development EP	Assumed loading (L/EP/d) Note 2	Development Load kL/d
1.5	~ 84	225	~ 18.9

Note 1: Allotment area only – excludes road reserve, balance of land titles, open space etc. Area is approximate.
Note 2: CMDG, D12 Sewerage System Design Guidelines

4.6 Electricity Infrastructure

Energy Queensland (EQ), formally Ergon Energy, owns and operates all electrical supply network assets within the development area and therefore all new electrical supply equipment and cables will need to be installed in accordance with EQ requirements and AS3000 specifications and standards and Council Engineering Standards and Drawings.

4.6.1 Existing Power Network

Power distribution is managed by EQ. Data obtained from EQ via DBYD indicates that the area has existing High and Low Voltage power infrastructure servicing the site as shown in **Figure 4-5**.

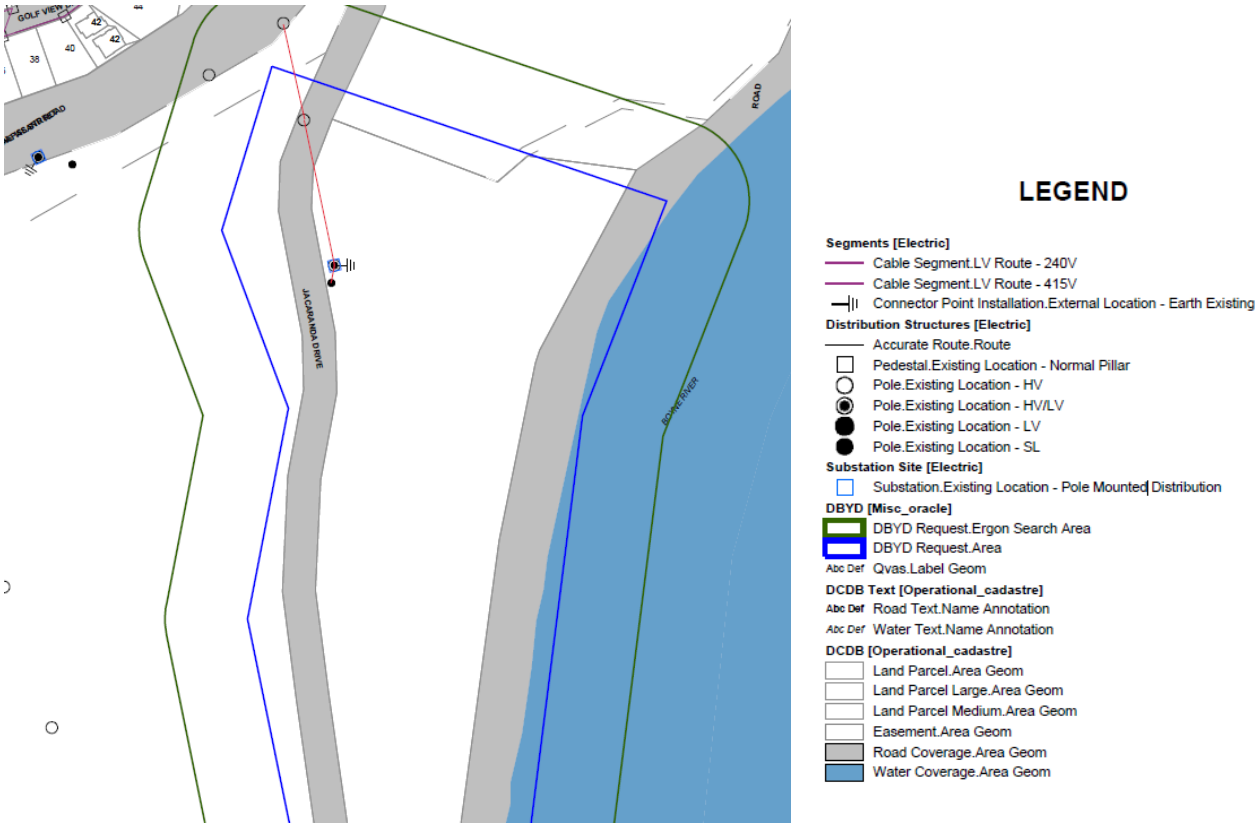

Figure 4-5 Electricity Infrastructure

4.6.2 Service Capacity

Consultation with EQ is required to determine if the existing infrastructure is sufficient to support the Aquatic Centre. The nearby overhead lines provide a high voltage of 11kV, therefore it is likely additional infrastructure will be required.

4.6.3 Required Infrastructure

It is expected that the existing high voltage power lines will be sufficient, but a transformer may be required to service the site. An allowance for a pad mounted transformer has been made in the estimate of cost.

Internally a Main Switchboard Room will be required in line with step-down transformer and distribution boards for specific facilities. As this infrastructure will be common across all facilities no additional allowance has been made in the estimate of cost at this time.

4.7 Gas Network Infrastructure

APA Group is the main service provider regulating the production, storage and distribution of gas for the site. A review of Dial Before You Dig information shows that there is no existing gas services in the vicinity of the site. A reticulated gas supply is not considered necessary to support the aquatic centre. Off-grid facilities can be provided for cooking or other activities if required.

4.8 Communications Network

There is currently no Telstra or NBN infrastructure traversing the site (see **Figure 4-6** and **Figure 4-7**), although there is NBN infrastructure located directly to the north of the site that can be extended to service the proposed development.

Mobile network coverage in the area is well serviced with 4G covering the entire site under the Telstra network. Other network providers may vary.

Figure 4-6 NBN DBYD

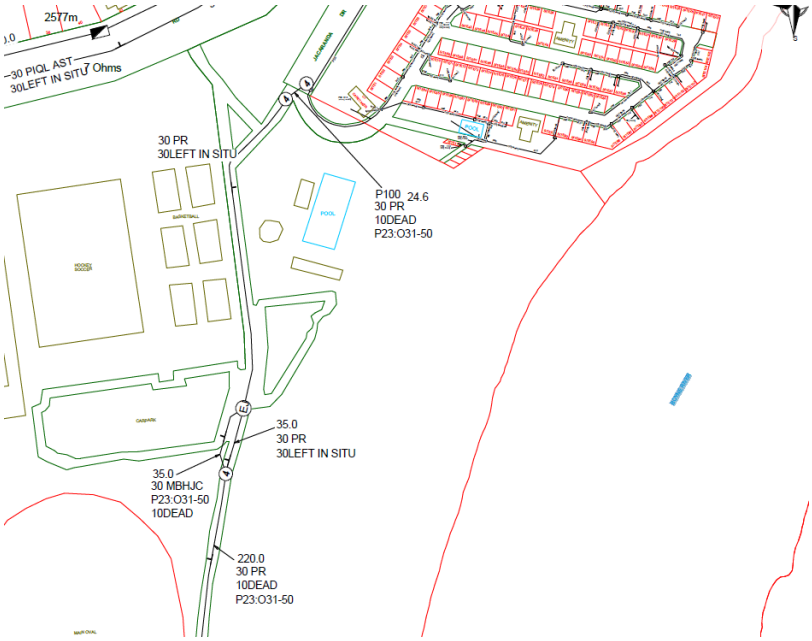

Figure 4-7 Telstra DBYD

4.9 Cost Estimate

The following cost estimate (Table 4-3) is for the construction of the Boyne Tannum Aquatic Recreation Centre and associated works at the site.

The estimated costs are preliminary and for initial feasibility analysis only. The estimates of construction costs are based on average contract rates for similar works within the Boyne Island and Tannum Sands area.

No allowance has been made in the cost estimate for the following items:

- Land and holding costs;
- Selling, marketing, management and legal fees;
- Rates and taxes;
- Building development;
- Treatment for Acid Sulphate Soils, ASS mapping in the area indicates that the risk of this is high; or
- Landscaping treatments.

Costs are based on preliminary and informal advice from relevant approving authorities and may be subject to change once formal submission is made.

Whilst every care has been taken in preparing the estimate, Government regulations, labour and equipment availability and site conditions unknown to Cardno at the time of writing may materially affect the final costs.

Table 4-3 Cost Estimate

Action	Quantity	Unit	Rates	Amount
Earthworks				
Site Stripping (1mm)	1031.5	m^2	$2.00	$2,063.00
Bulk Earthworks (cut/fill)	10315	m^3	$30.00	$309,450.00
Swimming Pool Cut (50m)	2000	m^3	$35.00	$70,000.00
Swimming Pool Cut (25m)	1300	m^3	$35.00	$45,500.00
Slide Area	91	m^3	$35.00	$3,185.00
Car Park				
Carpark (including earthworks)	4804	m^2	$115.45	$554,621.80
Stormwater				
Detention Basin Cut	200	m^3	$35.00	$7,000.00
Stormwater Treatment	96.08	m^2	$1,500.00	$144,120.00
Water				
Connection to Water Network	Allowance	-	-	$2,000.00
Sewer				
Connection to Sewer Network	Allowance	-	-	$2,000.00
Contingency	**30**	**%**	**-**	**$341,981.94**
Design	**5**	**%**	**-**	**$56,996.99**
			Total	**$1,538,918,73**

5 Environmental Review

An environmental desktop analysis was completed to collect available and contemporary information on the known/likely ecological and cultural heritage values of the site and immediate surrounds. The following readily accessible Commonwealth, State and Local government desktop databases and mapping instruments were reviewed:

- the Commonwealth Protected Matters Search Tool to identify Matters of National Environmental Significance (MNES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- the Regulated Vegetation Management Map (RV Map) prepared by the Department of Natural Resources, Mines and Energy (DNRME) pursuant to the *Vegetation Management Act 1999* (VM Act);
- the Protected Plants Flora Survey Trigger Map pursuant to the *Nature Conservation Act 1992* (NC act);
- the Atlas of Living Australia (ALA) Database to identify any known records of threatened or locally significant plants or animals;
- the Department of Environment and Science (DES) Wildlife online databases;
- the Development Application (DA) Mapping System to identify development assessment triggers and referrals and interpret the State Development Assessment Provisions (SDAP);
- the Interactive Mapping Tool associated with the *Our Place Our Plan Gladstone Regional Council Planning Scheme Version* 2 (the planning scheme);
- The Cultural Heritage Database and Register to determine the presence of any cultural heritage sites; and
- Aerial imagery sourced from Queensland Globe and Google Earth.

All searches were conducted using either the real property description or the coordinates of the approximate centre of the site, each with a three (3) kilometre search radius as specified below in Table 5-1.

Table 5-1 Desktop Search Location

Parameter	Value
Address	Jacaranda Drive, Boyne Island
Coordinates	-23.96417, 151.34583
Real Property Description	Lot 10 on SP171136
Buffer	3 kilometres

5.2 Commonwealth EPBC MNES

5.2.1 Desktop Assessment Results

Table 5-2 identifies the MNES that are recorded by the PMST within the search area.

Table 5-2 MNES Desktop Assessment Results

Parameter	Search Area
World Heritage Properties	1
National Heritage Places	1
Wetland of International importance	None
GBR Marine Park	None
Commonwealth Marine Park	None
Listed Threatened Ecological Communities	5
Listed Threatened Species	42
Listed Migratory Species	48

5.2.2 Legislative Requirements

A site inspection will be required to verify on-the-ground constraints.

If MNES are detected an EPBC Self-assessment would be required to determine whether or not the project would constitute a significant impact.

5.3 Regulated Vegetation

5.3.1 Desktop Assessment Results

The site is mapped as containing Category X (non-remnant) vegetation, as shown in **Figure 5-1**.

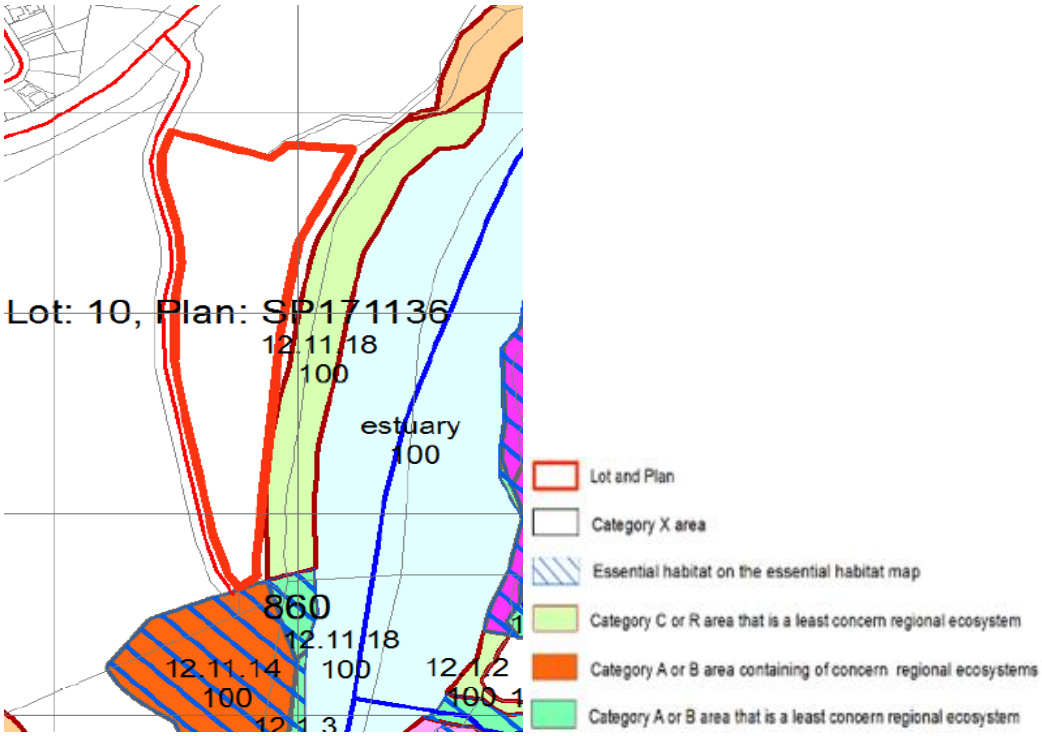

Figure 5-1 Regulated Vegetation Mapping (Extract)

5.3.2 Legislative Requirements

Clearing within Category X vegetation is likely to be considered accepted development.

5.4 Coastal Management District

The site is not within a Coastal management district.

5.5 Protected Plants

5.5.1 Desktop Assessment Results

The site is not mapped within a high risk area on the protected flora trigger map. No protected flora species are recorded by the Wildlife Online search tool within the search area.

5.5.2 Legislative Requirements

A flora survey in accordance with the Flora Survey Guidelines - Protected Plants *Nature Conservation Act 1992* is not required for the site.

A site inspection is required to determine the presence / absence of threatened flora species.

5.6 Fauna

5.6.1 Desktop Assessment Results

No flying fox camps are mapped within the search area on the National Flying Fox viewer.

The Wildlife Online tool identifies records for eight threatened species within the search area.

5.6.2 Legislative Requirements

Fauna assessment and / or breeding places assessment will be required prior to clearing to identify potential animal breeding places for fauna species listed under the NC Act. Where fauna breeding places (e.g. hollow-bearing trees, nests, burrows) are required to be cleared a species management program would be required.

5.7 Biodiversity

The site is not mapped as containing any MSES features.

5.8 Wetlands and Waterways

The site is not mapped as supporting any wetlands.

5.9 Bushfire

5.9.1 Desktop Assessment Results

The site is mapped as 'Medium Potential Bushfire Intensity' risk by the Bushfire Overlay of the planning scheme. An extract of the planning scheme mapping is provided as **Figure 5-2**.

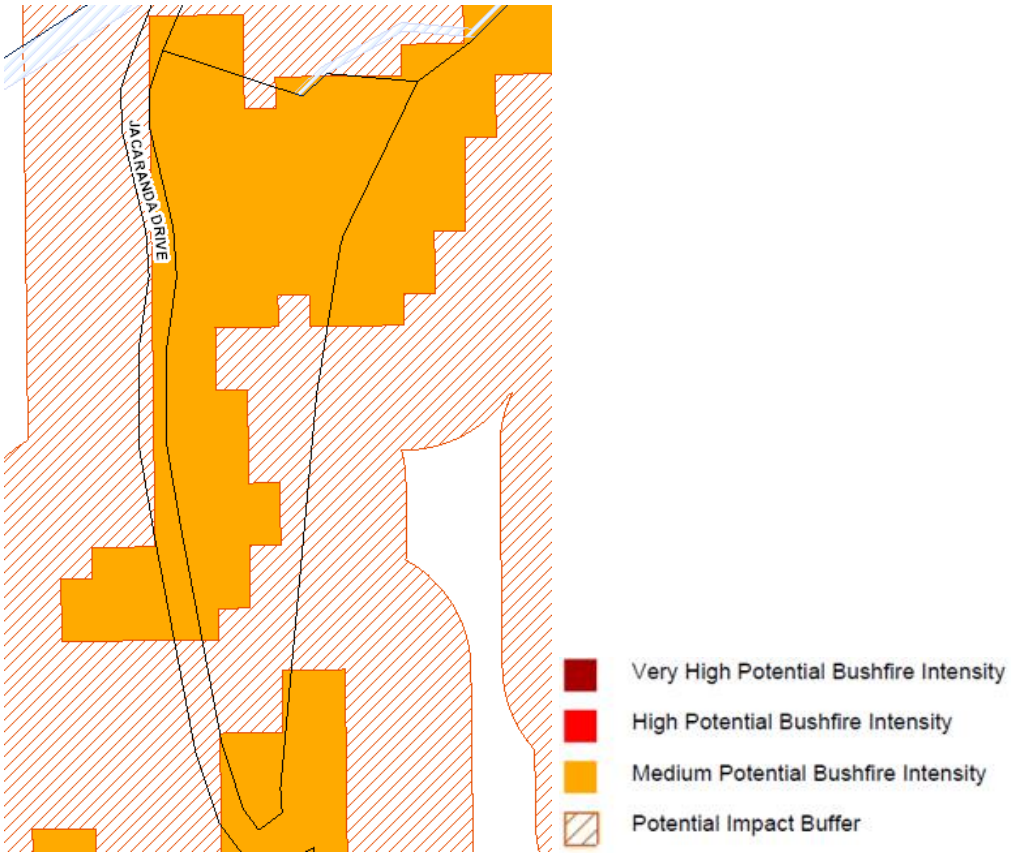

Figure 5-2 Bushfire Overlay mapping (Extract)

5.9.2 Legislative Requirements

The project will need to demonstrate compliance with the Bushfire Overlay Code of the planning scheme.

Development within vegetation categorised as Medium Potential Bushfire Intensity will require setbacks from vegetation.

Buildings will need to comply with the AS3959 construction of buildings in bushfire-prone areas code. These limitations will depend on how much vegetation is retained.

5.10 Soil and Land

5.10.1 Desktop Assessment Results

The site is mapped as including land at 0-5 metres AHD and 5-20 metres AHD which may contain Acid Sulphate Soils (ASS), as shown in **Figure 5-3**.

Figure 5-3 Acid Sulphate Soils Overlay mapping (Extract)

5.10.2 Legislative Requirements

Given the site potentially supports ASS, geotechnical investigation may be required to determine presence of ASS. Further discussion of geotechnical site conditions is provided in Chapter7 of this report.

Works will need to demonstrate compliance with the Acid Sulphate Soils Overlay Code of the planning scheme.

5.11 Coastal Area – Storm Tide and Erosion

5.11.1 Desktop Assessment Results

The site is mapped as containing a Medium Storm Tide Inundation Zone, as shown in **Figure 5-4**.

The site is not mapped as an erosion prone area.

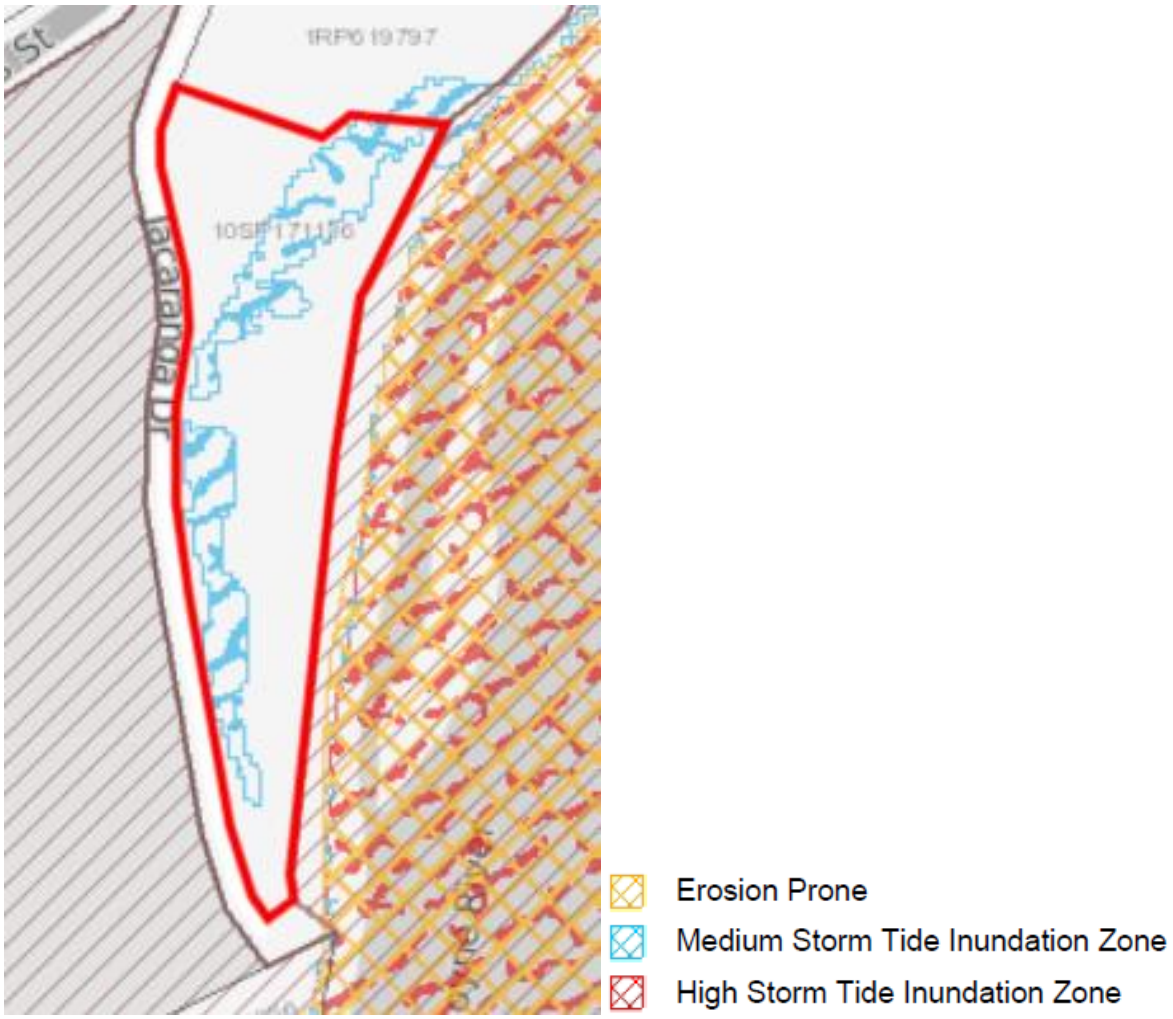

Figure 5-4 Coastal Hazard mapping (Extract)

5.11.2 Legislative Requirements

Works within the storm tide inundation zone must be designed for safe operations during and following a one in 100 year average recurrence interval storm event.

5.12 Cultural Heritage

5.12.1 Desktop Assessment Results

The Cultural Heritage Database and Register desktop search indicates that two cultural heritage artefacts points have been recorded within the search area, being shell middens along the east coast, as shown in **Figure 5-5**.

The site is not mapped as containing any heritage points by the planning scheme or the DA mapping System.

Figure 5-5 Cultural Heritage mapping (Extract)

5.12.2 Legislative Requirements

Any works on the site will need to comply with the Cultural Heritage Duty of Care Guidelines.

6 Traffic Engineering Review

The following traffic-related attributes have been addressed in this chapter:

- surrounding road network and key travel routes;
- site accessibility;
- potential traffic impact;
- car parking availability and demand;
- servicing requirements;
- public transport connectivity; and
- active transport connectivity.

6.1 Surrounding Road Network

Figure 6-1 illustrates the local context of the site, where **Figure 6-2** illustrates the broader road network in the vicinity of the site, highlighting Council's Local Government Infrastructure Plan (LGIP) trunk works.

Figure 6-1 Local site context and road hierarchy

Note the site boundary is indicative only. Source: Nearmap.

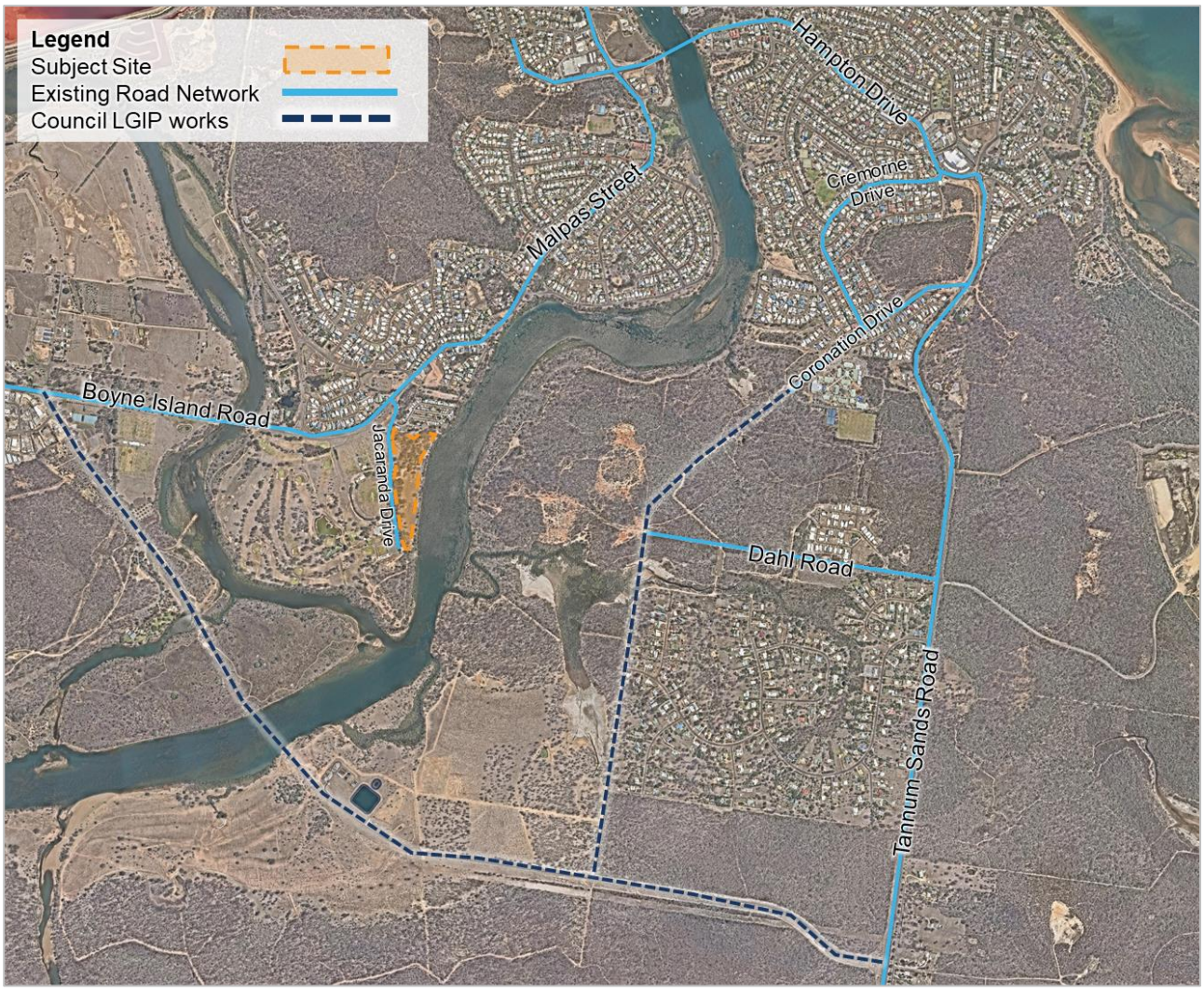

Figure 6-2 Surrounding road network and Council LGIP

Note the site boundary is indicative only. Source: Nearmap.

As shown in **Figure 6-2**, the LGIP trunk works introduce a new route for vehicles to travel between Coronation Drive, Boyne Island Road and Tannum Sands Road, which creates a bypass for vehicles to avoid travelling along Hampton Drive.

Furthermore, it has been assumed that the proposed development will service the immediate suburbs, including Tannum Sands and Boyne Island. Therefore, Cardno has undertaken a high level review of the surrounding road network and residential catchments, in order to identify the likely travel routes to/from the site.

The purpose of this review is to understand which corridors and intersections may experience an increase in traffic, with the inclusion of the proposed development, which can inform where potential mitigation measures may be required.

Figure 6-3 highlights these likely travel routes to/from the site.

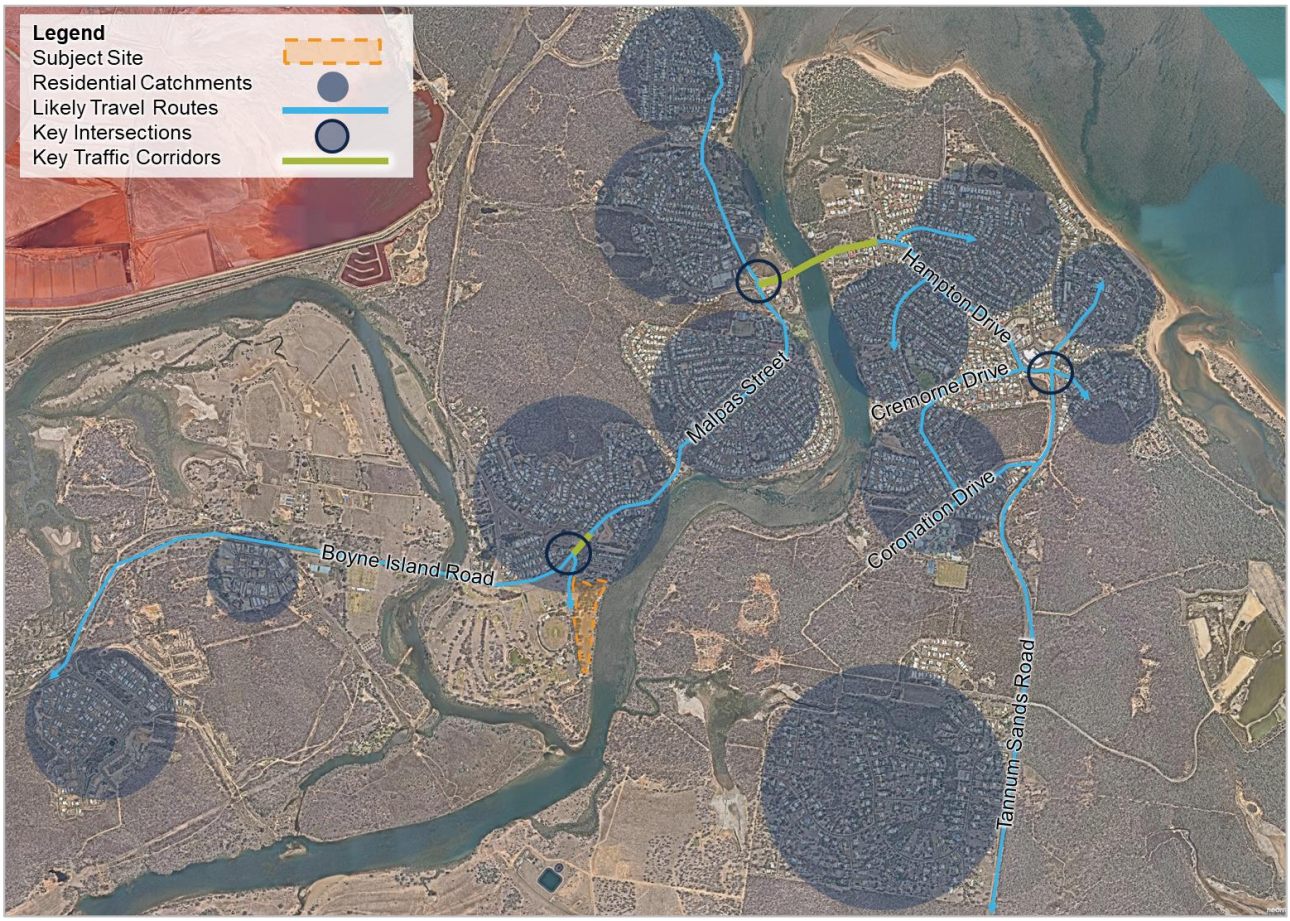

Figure 6-3 Surrounding catchments and travel routes to/from the site

Note the site boundary is indicative only. Source: Nearmap.

As shown in **Figure 6-3**, the following intersections and roads have been identified as key interests:

- Malpas Street / Jacaranda Drive intersection
- Hampton Drive / Malpas Street intersection
- Hampton Drive / Tannum Sands Road roundabout
- Malpas Street (between McLeod Street and Jacaranda Drive)
- Hampton Drive (between Malpas Street and Langdon Street)

Table 6-1 provides a summary of the state-controlled road network surrounding the site, identifying the theoretical capacity thresholds as guidance for planning purposes. It is noted that future committed / planned upgrades have not been considered for capacity calculations. The 2018 traffic census data for Queensland state-controlled roads has been referenced to obtain the existing daily traffic volumes on the roads surrounding the site.

Table 6-1 Road Characteristics – Existing Situation (State controlled)

Road Name	Traffic Lanes (bi-directional)	Hierarchy	Existing Daily Volume	Daily Capacity Threshold[1]
Tannum Sands Road	2	State-controlled Road	3,033vpd	18,000vpd
Hampton Drive	2	State-controlled Road	10,682vpd	18,000vpd
Malpas Street	2	State-controlled Road	7,824vpd	18,000vpd
Boyne Island Road	2	State-controlled Road	10,752vpd	18,000vpd

1. Theoretical capacity thresholds, based on 900 vph/lane (Austroads) or 9,000 vpd/lane.

Furthermore, **Table 6-2** provides a summary of the immediate local road network surrounding the site. The table includes the following characteristics:

- road hierarchy in accordance with the Gladstone Regional Council Planning Scheme (version 2);
- theoretical daily capacity thresholds, in accordance with the traffic carrying function identified in Table 1 of the Road Hierarchy Council Policy (P-2014/31 version 4 dated 30/05/2016); and
- publically available traffic data information.

Table 6-2 Road Characteristics – Existing Situation (Council controlled)

Road Name	Traffic Lanes (bi-directional)	Hierarchy	Daily Capacity Threshold[1]	Traffic Data Available[2]
Jacaranda Drive	2	Residential Access Place	150vpd	No

1. Theoretical capacity thresholds in accordance with Table 1 of Road Hierarchy Council Policy (P-2014/31).

2. Based on data readily available on public websites (i.e. PD Online), and from Council.

6.2 Site Accessibility

As shown in **Figure 6-4**, the site has direct road frontage to Jacaranda Drive along its western boundary, with no existing driveways that provide vehicular access to the site.

With direct frontage to only one road, primary vehicular access will have to be achieved via Jacaranda Drive via new driveway crossovers. Given the length of road frontage, there is potential for multiple access points, ensuring adequate sight distance and intersection spacing is achieved, as outlined below.

Figure 6-4 Site Frontage

Note the site boundary is indicative only. Source: Nearmap.

6.2.2 Access Spacing

In accordance with Queensland Streets, minimum spacing of 60 metres (same side) and 40 metres (opposite side) should be provided between the proposed access driveways and adjacent features, including the existing accesses for the sporting fields and Boyne Tannum Bowls Club car park.

6.2.3 Sight Distance

A review of the sight visibility on Jacaranda Drive has been undertaken, to inform acceptable locations where the proposed site can gain access.

In accordance with Australian Standards 2890.1 (AS2890.1), the minimum sight distance requirements at an access driveway is 35 metres (for 40 km/h posted speed). However, as a conservative requirement, Austroads Guide to Road Design Part 4A indicates a minimum sight distance at an intersection is 90 metres (assuming 50km/h design speed).

With a slight curve alignment, and relatively flat terrain, the minimum sight distance requirements can be achieved in both directions, along the majority of the site frontage on Jacaranda Drive. Although it should be noted that landscaping may require maintenance to maintain sight distance requirements.

Figure 6-5 illustrates the preferred locations for the site to gain access, highlighting which locations will achieve 35 metres and 90 metres sight distance.

Figure 6-5 Potential access location to achieve sight distance

Note the site boundary is indicative only. Source: Nearmap.

6.3 Potential Traffic Impact

Discussions with Council and Department of Transport and Main Roads (TMR) have informed the following traffic assumptions and characteristics for the proposed development:

- The proposed development will have the same trading hours and programs as the Gladstone Aquatic Centre.
- The annual visitor count for the Gladstone Aquatic Centre has been used as a basis for the potential visitor count for the proposed development.
- Mode of transportation is dependent on the swim program and events, however visitors are likely to travel via private vehicles, coach buses (larger groups, i.e. school and teams), walking and cycling.
- The following traffic data has been provided for the road locations illustrated on **Figure 6-6**:
  - 2018 AADT data for Tannum Sands Road, Hamptons Drive, and Malpas Street.
  - 2017 bi-directional traffic data (real count and virtual count) for Cremone Drive, Booth Avenue (north end), Caledon Street, the Oaks Road, and Canoe Point Road (east end).

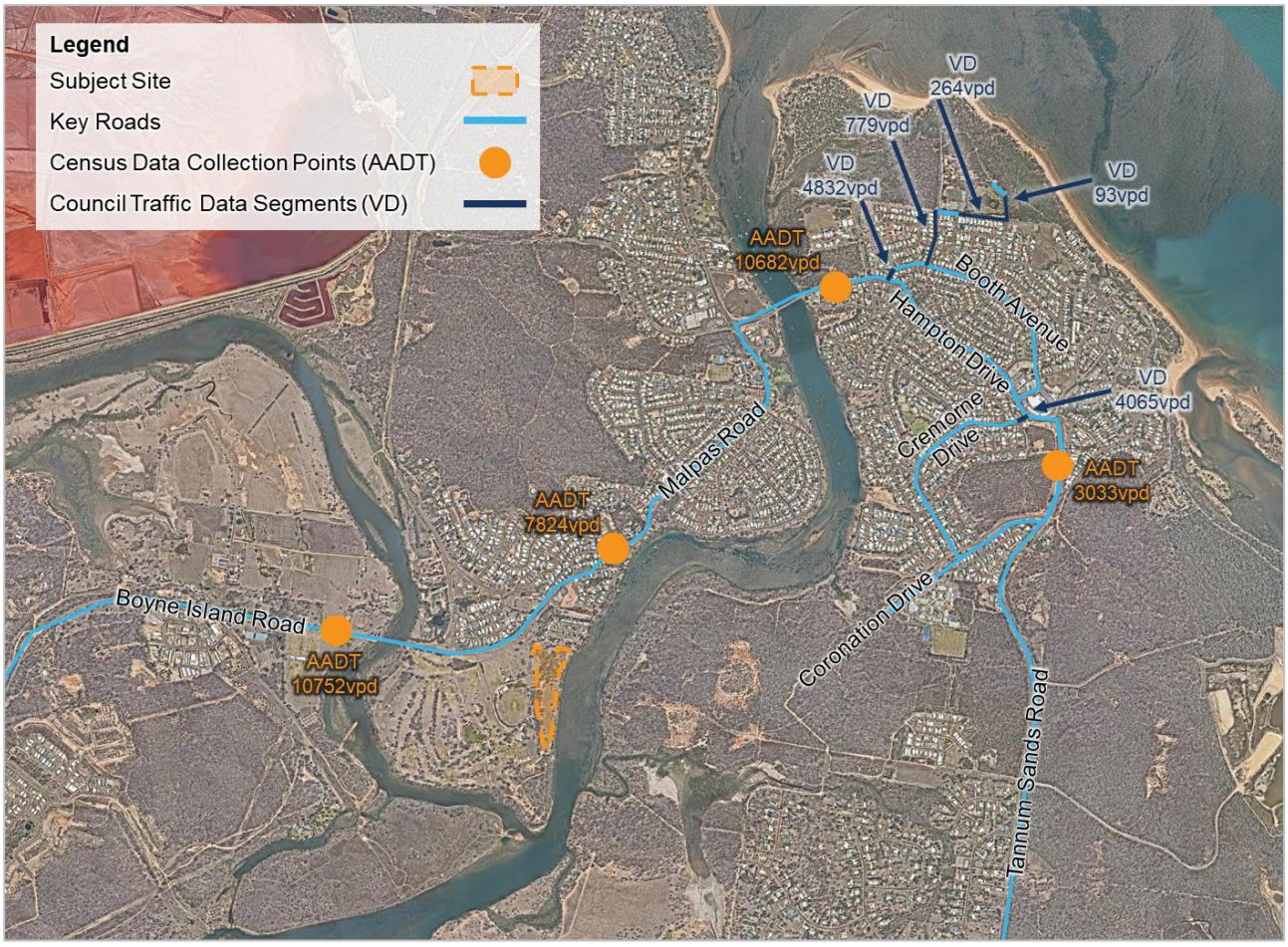

Figure 6-6 Available traffic data (displayed in vehicles per day, vpd)

Note the site boundary is indicative only. Source: NEarmap.

While the above information provides some insight into the potential operation of the proposed development, the development is still considered to be at preliminary stages. Therefore for the purpose of this options analysis, the potential traffic impact of the proposed development has been evaluated at a high level for due diligence purposes. Further investigations and analysis should be undertaken at the detailed design stage, once a site is confirmed.

Using first principles, Cardno has undertaken a high level transport infrastructure review of the likely travel routes to/from the site (as shown on **Figure 6-3**), to achieve an indicative representation of the potential upgrades on the surrounding road network, in response to the proposed development.

This high level review has informed which traffic corridors and intersections may experience an increase of traffic, and may require further investigations. These locations include the following:

- Malpas Street / Jacaranda Drive intersection
- Hampton Drive / Malpas Street intersection
- Hampton Drive / Tannum Sands Road roundabout
- Malpas Street (between McLeod Street and Jacaranda Drive)
- Hampton Drive (between Malpas Street and Langdon Street)

Based on the TMR 2018 traffic census data, Malpas Street and Hampton Drive are currently operating under their theoretical daily capacity thresholds of 18,000vpd, as follows:

- Malpas Street: 7,824vpd (2018) = available capacity of 10,176vpd
- Hampton Drive: 10,682vpd (2018) = available capacity of 7,318vpd

On the basis of the above, there is available capacity up to approximately 7,300vpd on the key state-controlled corridors to accommodate additional traffic generated by the proposed development.

In regards to the key intersection capacities, turning movement counts were not available, therefore it is recommended that a detailed traffic assessment is undertaken to verify the potential mitigation measures, at the detailed design stage.

However, any upgrades associated with the proposed development are likely to be at the Jacaranda Drive / Malpas Street intersection, which is currently a priority controlled intersection. If required, the next likely upgrade would be to investigate auxiliary turn lanes on Malpas Street, in order to minimise the impact of turning vehicles on the through movements.

6.4 Car Parking Provision

Given the development is still considered to be at preliminary stages, for the purpose of this options analysis, the car parking provision for the proposed development has been investigated at a high level for due diligence purposes. Further investigations and analysis should be undertaken at the detailed design stage, once a site is confirmed.

To gain an understanding of the existing car parking options within proximity to the site, Cardno has undertaken a review of the publically available car parks and on-street car parking.

While the nearest car park is located at the Boyne Tannum Bowls Club, this parking is intended for customer use only. However, given it is located within the typically acceptable 400 metre radius walking catchment to the site, there is potential for this car park to provide additional car parking for the development, during special events. It should be noted that there no formal walking facilities along Jacaranda Road between the site and the car park.

There is limited on-street parking around the site, comprising of formalised parking on McLeod Street and and Malpas Street, with informal parking on the minor streets connecting to these roads.

Figure 6-7 Available Car Parking Facilities

Note the site boundary is indicative only. Source: Nearmap.

As shown in **Figure 6-7**, there are limited car parking alternatives within proximity to the site. Therefore, it is recommended that adequate car parking be provided on-site in accordance with the following parking rates (as per the Gladstone Planning Scheme SC6.10 Vehicle Parking Rates), and consideration of car parking at similar development sites.

- Indoor Sport and Recreation: 1 space per 20m^2 gross floor area, or 1 space per 5 spectators able to be seated, or 4 spaces per court or lane, whichever is the greater.
- Outdoor Sport and Recreation: 1 space per 20m^2 gross floor area, or 1 space per 5 spectators able to be seated, or 4 spaces per court or lane

Additionally, Cardno has investigated the car parking supply at aquatic centres located within similar areas of Queensland, and have at least 8 swimming lanes (25m or 50m), as follows:

- Gladstone Aquatic Centre (8 lanes – 50m)
- Hervey Bay Aquatic Centre (8 lanes – 50m)
- Rockhampton 2nd World War Memorial Aquatic Centre (8 lanes – 25m)
- Mackay Aquatic and Recreation Complex (10 lanes – 50m)
- Gympie Aquatic Recreation Centre (8 lanes – 50m)
- Noosa Aquatic Centre (10 lanes – 50m and 8 lanes – 25m)

Table 6-3 summarises the car parking supply at the above sites.

Table 6-3 Car parking supply at similar development sites

Similar Site	Swimming Lanes	Car Parking (spaces)			
		Standard	People with Disability (PWD)	Other	Total
Gladstone Aquatic Centre	8 – 50m	94	5	-	**99**
Hervey Bay Aquatic Centre	8 – 50m	58	4	65 informal	**127**
Rockhampton 2nd World War Memorial Aquatic Centre	8 – 25m	85	6	-	**91**
Mackay Aquatic & Recreation Complex	10 – 50m	98	4	-	**102**
Gympie Aquatic Recreation Centre	8 – 50m	54	4	-	**58**
Noosa Aquatic Centre	10 – 50m / 8 – 25m	76	3	59 informal	**138**
Average	**-**	**78**	**4**	**-**	**103**

Note: The car parking supply has been counted using aerial imagery, therefore represents an approximate number.

As shown on **Table 6-3**, an average car parking supply of 103 spaces is provided by the existing aquatic centres, with consideration of the additional informal car parking at Hervey Bay and Noosa. Whereas when the informal car parking is excluded, an average of 82 spaces has been identified.

On the basis of above, a car parking provision between 82 spaces and 103 spaces is considered to be acceptable for the proposed development.

6.5 Servicing Requirements

The service vehicle requirements associated with the proposed development has been investigated, with consideration of typical servicing needs and development-specific needs.

It is likely that large groups will travel to the site for sporting competitions and events, therefore the proposed development will have to be designed to accommodate coach buses, in addition to the standard refuse collection vehicles.

On the basis of the above, the following development features should be designed such that the largest service vehicle can safely and efficiently access / manoeuvre through the site.

- Access driveway crossover (refer to Capricorn Municipal Development Guidelines)
- Circulation roads, parking aisles, and allocated parking spaces (refer AS2890.1)
- Drop-off / pick-up area (for coach buses)
- Loading/unloading area (for refuse collection)

Given the preliminary stages of the proposed development, swept path analysis should be undertaken at the detailed design stage to confirm the suitability of the abovementioned development features.

6.6 Public Transport Connectivity

Figure 6-8 illustrates the broader public transport network surrounding the site, including the closest bus stops.

Figure 6-8 Public Transport Services

Note the site boundary is indicative only Source: Nearmap.

As shown in **Figure 6-8,** the bus stops on Malpas Street are located within the 400 metre radius catchment, measured from the northern end of the site.

While the westbound bus stop is closer than the eastbound, both bus stops are considered to be adequate to service the proposed development. To ensure a safe walking environment, it is recommended that pedestrian connections and crossings are provided between the site and bus stops.

6.7 Active Transport Connectivity

Figure 6-9 illustrates the on and off-street active transport facilities surrounding the site.

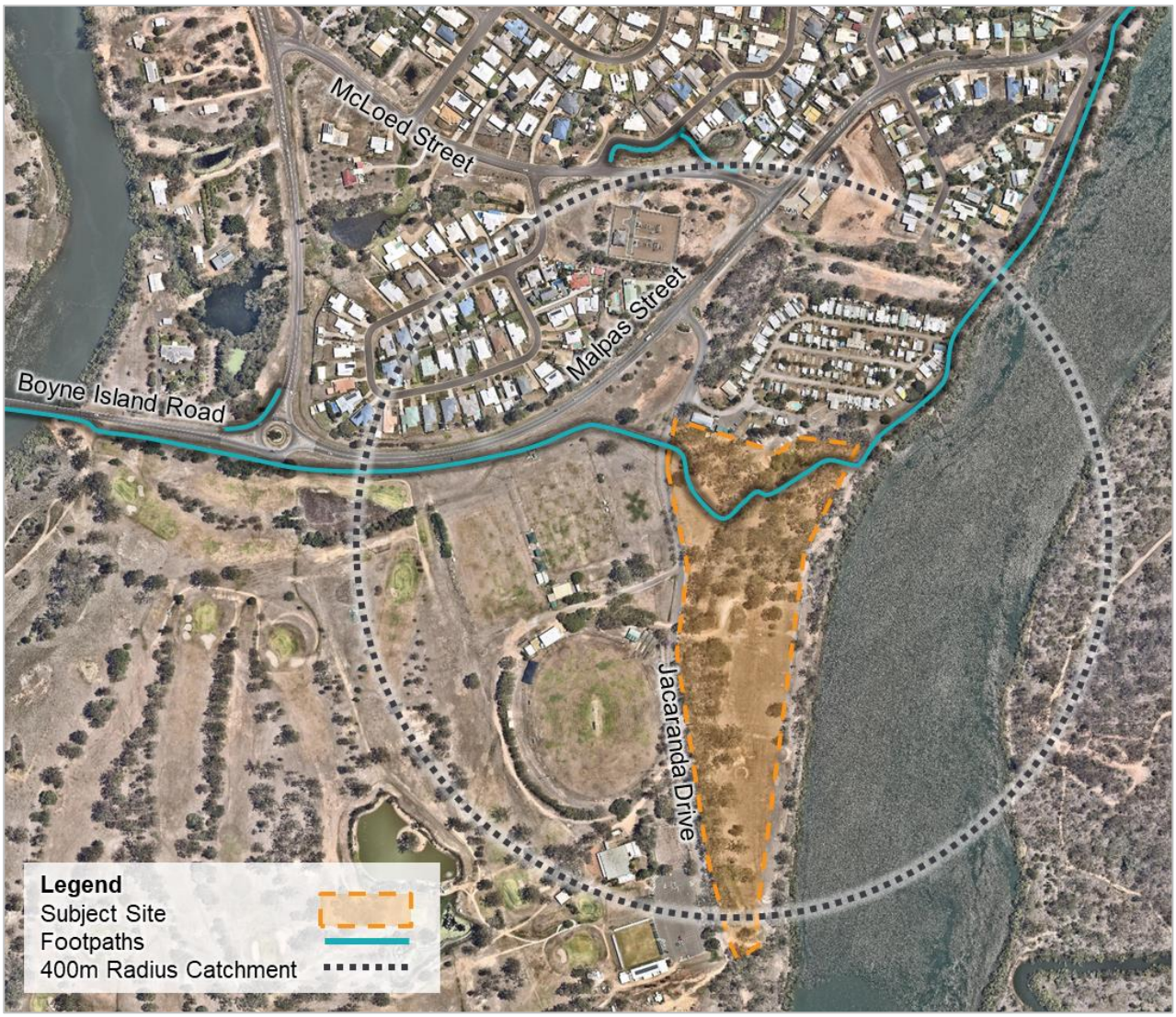

Figure 6-9 Active Transport Connections

Note the site boundary is indicative only Source: Nearmap.

As shown in **Figure 6-9**, the local area has pedestrian footpaths on Boyne Island Road and Malpas Street to the west, which pass through the site, and continue along the river to the north. Given there are no footpaths on Jacaranda Drive, it is recommended to provide a pedestrian connection along the site frontage, or internally on-site, to connect with the existing footpaths.

Furthermore, consideration should be made to safe pedestrian connections between the site and the existing bus stops on Malpas Street.

With no cycling facilities located within proximity to the site, it has been assumed that cyclists will share the footpaths.

7 Geotechnical Engineering Review

7.1 Site Conditions

7.1.1 Regional Geology

The site is comprised of Quaternary aged clays, silts and gravels of the Fitzroy River flood plain alluvium. This is likely overlying Early Carboniferous residual soils and weathered rock, primarily recovered as clays, gravels and sands from the Shoalwater Formation, part of the Curtis Island Group. Additionally, quartzose sandstone, mudstone and localised quartz-muscovite-biotite schists are likely the likely bedrock material (sourced from MapInfo). **Figure 7-1** shows the regional geology with approximate locations of the three (3) potential aquatic centre sites shown in red.

Figure 7-1 Regional Geology of Boyne Island and Tannum Sands (source MapInfo, Bing Maps)

7.1.2 Contaminated Lands

The Department of Environment and Science (DES) maintains and manages two registers, the Environmental Management Register (EMR) and the Contaminated Land Register (CLR).

The EMR is a land use planning and management register and records land that has been used for a 'Notifiable Activity' or 'Hazardous Contaminant', and land that has been contaminated by hazardous contaminants over time which pose or are suspected to pose a risk to human health and the environment based on their history. The CLR is a register of 'known risk' sites which have been scientifically proven to be contaminated and actions are required to either remediate or mange the site to reduce the risk of causing harm to human health and environment.

A desktop investigation was conducted to identify any potential contamination risks for the site (Lot 10 on SP171136) as well as the area immediately adjacent to the site. A Google street view assessment showed that there was no evidence of suspicious infrastructure that are typically associated with contamination (e.g. electrical infrastructure, fuel stations, laundromats, etc.).

An EMR / CLR search of the lot was conducted (refer to **Appendix B**) and the search found that the site is not included on the EMR or the CLR. While the search did not account for historical searches and is limited in nature, there appears to be a low risk for potential contaminated land.

7.2 Field Investigation

A field investigation was carried out by Construction Sciences on 11 November 2019 and comprised the advancing of five (5) boreholes (BH11 to BH15) each to a target depth of five (5) metres. Borehole locations were selected to target structures depicted on concept designs made available at the time of investigation. Their factual report, containing laboratory results and borehole logs is presented in **Appendix A**.

Based on the Construction Sciences report, the subsurface profile consists of topsoil to a depth of 0.2 metres overlying alluvial sandy silt or clayey sand in the northern and southern areas of the site, generally from 0.2 metres to five (5) metres (total depth). Fill of unknown origin comprising gravelly sandy clayey mixtures was encountered from surface levels in the central area of the site (at the location of BH14) to approximately two (2) metres depth, overlying sandy clay to 2.9 metres depth and then silty sands and clayey sands to five (5) metres depth.

7.3 Engineering Assessment

The engineering assessment presented herein has been based on the material succession presented in the boreholes, laboratory test data and site walk-over survey. Expected building sizes and loads have not been supplied, therefore generalised values have been assumed.

It is understood that the aquatic centre facilities will consist of:

- Swimming pool (25 metres or 50 metres in length);
- Building infrastructure (assumed to be low set buildings, maximum of two (2) storeys); and
- Associated car park and access pavements.

The following sections present our findings from review of the Construction Sciences report.

7.3.1 Trafficability

The trafficability of the site should be fair to poor throughout the year. The clay component of subsurface materials in the central area of the site (particularly near the location of BH14) may cause poor trafficability in wet weather, however this should be offset by the gravel component of the overlying fill. Should material of the subgrade become poor, a working platform may be required to traverse low-laying areas on site.

7.3.2 Erosion

From the Emerson Class laboratory report appended to the Construction Sciences report (**Appendix A**), an Emerson Class number of 2 was found in both BH12 and BH14 samples. This indicates that the soil has high potential to be dispersive. The detailed design may need to take this into consideration and an erosion control and management plan may need to be developed.

7.3.3 Excavatability

The near surface material comprising alluvium and fill is expected to be excavatable using standard construction machinery. If deeper excavation is required beyond the termination depth of the investigation, more difficult ripping conditions may be expected. Based on the field investigation and testing, it is estimated that the excavatability of subsurface soil materials in the top five (5) metres would range from Class 1 to Class 3.

7.3.4 Foundation Design

The presence of medium dense to dense silty sands near the surface in most boreholes is likely to be suitable for shallow foundations for low-set buildings. Dense/very stiff gravel-clay-sand fill mixtures were encountered to two (2) metres below ground level in BH14. An allowable bearing capacity of 100-150kPa is considered suitable for the assessed alluvium and fill materials.

7.3.5 Pavement Design

The pavement subgrade is likely to be in the alluvium soil profile where a CBR of 17% and 20% were found in the BH12 and BH15 samples, respectively. The CBR of the soil across the site is likely to be in excess of CBR 10%. A design subgrade of 10% may be adopted for preliminary pavement design.

7.3.6 Acid Sulphate Soils

Section 5.10.1 of this report identifies the manner in which ASS Overlay mapping applies to the site. The site is mapped as including land at 0-5 metres AHD and 5-20 metres AHD which may contain Acid Sulphate Soils (ASS), as shown in **Figure 5-3**.

Initial field screening test results showed a drop in pH and strong reactions, indicating Potential ASS is likely to be present across the site despite the site's elevation being above five (5) metres AHD. A detailed ASS Investigation and Management Plan, conducted to Queensland Acid Sulphate Soil Technical Manual standards, will therefore be required under the Queensland State Planning Policy 2017 and the Gladstone Regional Council Planning Scheme Overlay Code 8.2.1 to delineate areas/severity of ASS on site and provide appropriate management strategies for disturbance. Managing ASS will also provide greater assurance in the durability design of subsurface steel and concrete assets; specify exposure classification, concrete grade and reinforcement coverage; and prevent acidic runoff from leaving the site.

7.4 Discussion

Based on the geotechnical investigation and assessment documented in this chapter, the site is considered suitable from a geotechnical perspective for the proposed development provided the items raised in the preceding sections are considered during detailed design.

Table 7-1 presents the risks and opportunities that have been identified towards the design and construction of the aquatic centre facilities.

Table 7-1 Risks and Opportunities

Item	Risk/ Opportunity	Proposed Action
Presence of PASS	Acidification of soils, corrosion of underground structures, acidic runoff	▪ ASS Investigation and Management Plan ▪ Treatment of excavated ASS with lime to neutralise acid-producing potential

8 Conclusion

This report documents the technical analysis of land located at Jacaranda Drive, Boyne Island by Cardno, as a potential location for the future Boyne Tannum Aquatic Recreation Centre. The analysis completed has considered town planning, civil engineering, environment, traffic engineering and geotechnical engineering matters.

The site has been identified as one of three potential locations for the Boyne Tannum Aquatic Recreation Centre and the findings of this analysis are intended to be used to inform an options analysis of all three sites, to allow Council to select a preferred location for the aquatic centre.

Should you have any queries in relation to this report, please do not hesitate to contact the undersigned.

Yours faithfully,

STEPHEN WHITAKER

Senior Planner, Technical Lead – Planning

07 3369 9822

07 3310 2454

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APPENDIX

A

CONSTRUCTION SCIENCES REPORT

Our Reference: 2128E.P.1080C
Contact: Poka Kilaverave

Construction Sciences

4/12/2019

Construction Sciences Pty Ltd
ABN 74 128 806 735

101 High Street
North Rockhampton
QLD 4701

Phone: (07) 49280044
Fax: (07) 49261286

www.constructionsciences.net

Cardno (QLD) Pty Ltd
PO Box 5495
Gladstone QLD 4680

Email: Kerrod.giles@cardno.com.au

Dear Kerrod,

Proposed Boyne/Tannum Aquatic Centre Feasibility Study
Jacaranda Drive, Boyne Island, QLD

At the request of Cardno, Construction Sciences conducted a geotechnical investigation for the proposed Aquatic Centre project located at Jacaranda Drive, Boyne Island. The area of investigation and the location of boreholes have been shown on the Site Investigation Location Plan included at the rear of this letter report.

The fieldwork was undertaken on the 11th November 2019 and comprised the advancing of five boreholes (5) boreholes (BH11 to BH15) to a depth of 5.0m or prior refusal on competent rock.

The subsurface profile was logged in general accordance with AS1726 “Geotechnical Site Investigations”.

Bulk and disturbed samples were recovered during the field work and returned to our NATA accredited Rockhampton laboratory.

For details of the strata encountered at each test location, the logs are included at the rear of this letter. A summary of this information is detailed in Table 1 below.

Table 1: Summary of Subsurface Strata

All depths in metres.

Location	TOPSOIL		FILL			ALLUVIUM						TD (m)	Termination Condition
	Silty SAND (SM)	Sandy SILT (ML)	Sandy Clayey GRAVEL (GC)	Gravelly Clayey SAND (SC)	Sandy CLAY (CI)	Sandy SILT (ML)	Clayey SAND (SC)	Silty SAND (SM)	Sandy CLAY (CI)	Sandy CLAY (CI/CH)	CLAY (CH)		
BH11	0.0-0.2	-	-	-	-	0.2-1.1	1.1-3.3	-	-	3.3-4.5	4.5-TD	5.0	
BH12	-	0.0-0.2	-	-	-	0.2-1.0 2.8-3.4	1.0-2.8 3.4-TD	-	-	-	-	5.0	ALLUVIUM
BH13	0.0-0.2	-	-	-	-	-	-	0.2-TD	-	-	-	5.0	ALLUVIUM
BH14	-	-	0.0-0.2	0.2-0.5	0.5-2.0	-	4.5-TD	2.9-4.5	2.0-2.9	-	-	5.0	ALLUVIUM
BH15	0.0-0.2	-	-	-	-	-	-	0.2-TD	-	-	-	5.0	ALLUVIUM

NOTES:

1) TD - Termination Depth
2) All depths were measured from the existing surface level at the time of the investigation.

No groundwater was encountered in any of the test pits during the investigation.

Laboratory Results

Selected samples recovered from the test sites were tested to determine the following;

- Particle Size and Atterberg Limits
- Acid Sulphate Soils Screening
- California Bearing Ratio

The following table detail the samples tested and results obtained.

Table 2: Particle Size, Atterberg Limit and Emerson Class Test Results

Sample Location	Sample Depth (m)	Liquid Limit %	Linear Shrinkage %	Plasticity Index %	% Passing As Sieve (mm)			Emerson Class Number
					2.36	0.425	0.075	
BH 12	0.2-1.2	20	1	3	99	94	41	2
BH 14	0.5-2.0	43	14	29	98	96	77	2

Table 3: Acid Sulphate Soils Field Assessment
Field pH and pH(fox)

Test Location	Profile Depth	pH_F	pH_{FOX}	pH Shift	Reaction
BH 11	0.00-0.25	6.7	3.8	2.9	4
	0.25-0.5	6.9	3.6	3.3	3
	0.50-0.75	7.1	3.8	3.3	3
	0.75-1.00	7.1	4.3	2.8	3
	1.0-1.25	7.4	4.6	2.8	3
	1.25-1.5	7.4	4.9	2.5	3
	1.5-1.75	7.4	4.7	2.7	3
	1.75-2.0	7.8	5.0	2.8	3
	2.0-2.25	7.5	5.1	2.4	3
	2.25-2.5	7.5	5.2	2.3	3
	2.5-3.0	6.9	5.5	1.4	4
	3.0-3.5	6.8	5.2	1.6	4
	3.5-4.0	6.7	5.6	1.1	4
	4.0-4.5	7.1	5.7	1.4	4
	4.5-5.0	7.3	5.8	2.5	4
BH 12	0.00-0.25	6.8	3.7	3.1	4
	0.25-0.5	6.7	3.3	3.4	4
	0.5-0.75	6.4	3.6	2.8	3
	0.75-1.0	6.6	3.6	3.0	3
	1.0-1.25	6.8	4.3	2.5	3
	1.25-1.5	6.9	4.3	2.6	3
	1.5-1.75	7.0	4.2	2.8	3
	1.75-2.0	7.5	4.9	2.6	3
	2.0-2.25	7.3	4.9	2.4	3
	2.25-2.5	7.9	5.0	2.9	4
	2.5-3.0	7.8	5.8	2.0	4
	3.0-3.5	7.9	6.5	1.4	4
	3.5-4.0	7.9	7.8	0.1	4
	4.0-4.5	8.2	8.1	0.1	4
	4.5-5.0	8.0	8.2	-0.2	4
BH 13	0.00-0.25	7.3	4.8	2.5	4
	0.25-0.5	7.5	4.7	2.8	3
	0.5-0.75	7.4	4.8	2.6	3
	0.75-1.0	7.4	4.8	2.6	4
	1.0-1.25	7.2	4.8	2.4	4
	1.25-1.5	7.6	4.9	2.7	4
	1.5-1.75	7.5	4.8	2.7	4
	1.75-2.0	7.5	4.8	2.7	4
	2.0-2.25	7.4	4.7	2.7	4
	2.25-2.5	7.6	4.7	2.9	4
	2.5-3.0	7.8	4.8	3.0	4
	3.0-3.5	7.9	4.9	3.0	4

	3.5-4.0	7.8	4.7	3.1	4
	4.0-4.5	7.9	4.8	3.1	4
	4.5-5.0	7.8	4.7	3.1	4
BH 14	0.00-0.25	9.3	8.7	0.6	4
	0.25-0.5	9.3	9.0	0.3	4
	0.5-0.75	9.4	9.4	0.0	4
	0.75-1.0	9.5	8.4	1.1	4
	1.0-1.25	9.3	8.5	0.8	4
	1.25-1.5	9.5	9.0	0.5	4
	1.5-1.75	8.9	8.8	0.1	4
	1.75-2.0	9.2	8.5	0.7	4
	2.0-2.25	9.2	8.7	0.5	4
	2.25-2.5	9.1	8.2	0.9	4
	2.5-3.0	7.6	3.9	3.7	4
	3.0-3.5	7.4	3.9	3.5	3
	3.5-4.0	7.5	4.1	3.4	3
	4.0-4.5	8.1	4.0	4.1	3
	4.5-5.0	7.5	3.9	3.6	3
BH 15	0.00-0.25	6.7	3.3	3.4	4
	0.25-0.5	6.4	3.1	3.3	4
	0.5-0.75	6.6	3.3	3.3	3
	0.75-1.0	6.6	3.3	3.3	3
	1.0-1.25	6.9	3.5	3.4	2
	1.25-1.5	6.9	3.6	3.3	2
	1.5-1.75	7.1	4.0	3.1	2
	1.75-2.0	7.6	4.3	3.3	1
	2.0-2.25	7.5	4.2	3.3	1
	2.25-2.5	7.6	4.3	3.3	2
	2.5-3.0	7.9	4.6	3.3	2
	3.0-3.5	7.9	4.9	3.0	2
	3.5-4.0	7.8	4.9	2.9	2
	4.0-4.5	8.1	4.9	3.2	2
	4.5-5.0	8.1	4.9	3.2	2

Note

1. Slight
2. Moderate
3. Strong
4. Extreme

Table 3: California Bearing Ratio (CBR) – 4 Day Soaked Samples

Sample Location	Sample Depth (m)	Maximum Dry Density (t/m^3)	Optimum Moisture Content (%)	CBR Value
BH 12	0.2-0.6	1.74	10.5	17
BH 15	0.2-0.6	1.78	11.0	20

We trust that this information is helpful. Please contact our office with any queries or if further information is required.

Yours faithfully,

Poka Kilaverave
Geotechnical Engineer
For Construction Sciences
Enc: Site Plan, Borehole Logs, Laboratory Test Results

Proposed Boyne Tannum Aquatic Centre (Location 3) – Jacaranda Drive

BOREHOLE NUMBER BH 11

Construction Sciences

CLIENT Cardno QLD Pty Ltd **PROJECT NAME** Proposed Boyne/Tannum Aquatic Centre Feasibility Stud

PROJECT NUMBER 2128E/P/1080C **PROJECT LOCATION** Jacaranda Drive, Boyne Island

DATE STARTED 11/11/19 **COMPLETED** 11/11/19 **R.L. SURFACE** **DATUM**

DRILLING CONTRACTOR Construction Sciences **SLOPE** 90° **BEARING** ---

EQUIPMENT Quick Drill **HOLE LOCATION** As Marked on Site Plan in Appendix A

HOLE SIZE 100mm **LOGGED BY** PK **CHECKED BY** PK

NOTES E: 331612, N: 7348923

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Auger					SM	Silty SAND (TOPSOIL) fine to coarse grained sand, brown grey, low plasticity fines, dry, medium dense.		12
					ML	Sandy SILT/Silty SAND (ALLUVIUM) low plasticity, brown grey, fine to coarse grained sand, dry, medium dense to dense.		20
			0.5					22
			1.0					26
								REFUSAL
					SC	Clayey SAND (ALLUVIUM) fine to coarse grained sand, brown, low plasticity fines, dry, dense.	1x DISTURBED SAMPLE	
			1.5					
			2.0			increase in fines content	1x DISTURBED SAMPLE	
			2.5					
					SC	Clayey SAND/Sandy CLAY (ALLUVIUM) fine to coarse grained sand, brown, low to medium plasticity fines, moist, dense.	1x DISTURBED SAMPLE	
			3.0					
					CI/CH	Sandy CLAY medium to high plasticity, dark brown, fine to coarse grained sand, moist, very stiff.	1x DISTURBED SAMPLE	
			3.5					
			4.0					
			4.5		CH	CLAY high plasticity, dark brown/grey, moist, very stiff.	1x DISTURBED SAMPLE	
			5.0					
			5.5			BOREHOLE BH11 TERMINATED AT 5.0m		

BOREHOLE NUMBER BH 12

Construction Sciences

CLIENT Cardno QLD Pty Ltd **PROJECT NAME** Proposed Boyne/Tannum Aquatic Centre Feasibility Stud

PROJECT NUMBER 2128E/P/1080C **PROJECT LOCATION** Jacaranda Drive, Boyne Island

DATE STARTED 11/11/19 **COMPLETED** 11/11/19 **R.L. SURFACE** **DATUM**

DRILLING CONTRACTOR Construction Sciences **SLOPE** 90° **BEARING** ---

EQUIPMENT Quick Drill **HOLE LOCATION** As Marked on Site Plan in Appendix A

HOLE SIZE 100mm **LOGGED BY** PK **CHECKED BY** PK

NOTES E: 331632, N: 7348838

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Auger					ML	Sandy SILT (TOPSOIL) low plasticity, brown grey, fine to coarse grained sand, dry, with rootlets, very stiff.		10
					ML	Sandy SILT (ALLUVIUM) low plasticity, brown grey, fine to coarse grained sand, friable/powdery, dry, hard.	1x BULK SAMPLE, 1x DISTURBED SAMPLE	12 18 20 23 25+
			0.5					REFUSAL
			1.0		SC	Clayey SAND (ALLUVIUM) fine to coarse grained sand, brown orange, low plasticity fines, dry to moist, dense.		
			1.5				1x DISTURBED SAMPLE	
			2.0					
			2.5					
			3.0		ML	Sandy SILT (ALLUVIUM) low plasticity, brown, fine grained sand, friable/powdery, dry.	1x DISTURBED SAMPLE	
			3.5		SC	Clayey SAND (ALLUVIUM) fine to coarse grained sand, brown, low to medium plasticity, moist, dense.		
			4.0				1x DISTURBED SAMPLE	
			4.5					
			5.0		SC	Sandy CLAY/Clayey SAND (ALLUVIUM) fine to coarse grained sand, brown mottle grey, low to medium plasticity, moist, dry, very stiff to hard.	1x DISTURBED SAMPLE	
			5.5			BOREHOLE BH12 TERMINATED AT 5.0m		

BOREHOLE NUMBER BH 13

Construction Sciences

CLIENT Cardno QLD Pty Ltd **PROJECT NAME** Proposed Boyne/Tannum Aquatic Centre Feasibility Stud

PROJECT NUMBER 2128E/P/1080C **PROJECT LOCATION** Jacaranda Drive, Boyne Island

DATE STARTED 11/11/19 **COMPLETED** 11/11/19 **R.L. SURFACE** **DATUM**

DRILLING CONTRACTOR Construction Sciences **SLOPE** 90° **BEARING** ---

EQUIPMENT Quick Drill **HOLE LOCATION** As Marked on Site Plan in Appendix A

HOLE SIZE 100mm **LOGGED BY** PK **CHECKED BY** PK

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Auger					SM	Silty SAND (TOPSOIL) fine to coarse grained sand, brown grey, low plasticity fines, dry, with rootlets, medium dense.		12 15
			0.5		SM	Silty SAND (ALLUVIUM) fine to coarse grained sand, brown, low plasticity fines, dry, medium dense to dense.		20 23 25+ REFUSAL
			1.0				1x DISTURBED SAMPLE	
			1.5					
			2.0		SM	Silty SAND (ALLUVIUM) fine to coarse grained sand, brown, low plasticity fines, moist, medium dense to dense.		
			2.5					
			3.0				1x DISTURBED SAMPLE	
			3.5					
			4.0					
			4.5		SM/SP	Silty SAND with Gravel (ALLUVIUM) fine to coarse grained sand, dark brown, low plasticity fines, with fine to medium coarse grained subrounded to rounded gravel, moist, very dense.		
			5.0			BOREHOLE BH13 TERMINATED AT 5.0m		
			5.5					

BOREHOLE NUMBER BH 14

Construction Sciences

CLIENT Cardno QLD Pty Ltd **PROJECT NAME** Proposed Boyne/Tannum Aquatic Centre Feasibility Stud

PROJECT NUMBER 2128E/P/1080C **PROJECT LOCATION** Jacaranda Drive, Boyne Island

DATE STARTED 11/11/19 **COMPLETED** 11/11/19 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR Construction Sciences **SLOPE** 90° **BEARING** ---

EQUIPMENT Quick Drill **HOLE LOCATION** As Marked on Site Plan in Appendix A

HOLE SIZE 100mm **LOGGED BY** PK **CHECKED BY** PK

NOTES _____

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Auger			0.5		GC	Sandy Clayey GRAVEL (FILL) fine to coarse grained rounded gravel, brown mottle grey, fine to coarse grained sand, low plasticity fines, dry, dense.		12
					SC	Gravelly Clayey SAND (FILL) fine to coarse grained sand, brown, fine to medium coarse grained rounded gravel, low to medium plasticity fines, dry to moist, dense.		17 15 20 19
			1.0		CI	Sandy CLAY with Gravel (FILL) medium plasticity, dark brown, fine to coarse grained sand, dry to moist, very stiff.	1x DISTURBED SAMPLE	22 24+ REFUSAL
			1.5				1x DISTURBED SAMPLE	
			2.0					
			2.5		CI	Sandy CLAY/Clayey SAND (ALLUVIUM) medium plasticity, dark brown, fine to coarse grained sand, moist, very stiff.	1x DISTURBED SAMPLE	
			3.0		SM	Silty SAND (ALLUVIUM) fine to coarse grained sand, brown orange, low plasticity fines, dry, dense.		
			3.5				1x DISTURBED SAMPLE	
			4.0					
			4.5		SC	Clayey SAND (ALLUVIUM) fine to coarse grained sand, dark brown, medium plasticity fines, moist, dense.		
			5.0			BOREHOLE BH14 TERMINATED AT 5.0m		
			5.5					

BOREHOLE NUMBER BH 15

Construction Sciences

CLIENT Cardno QLD Pty Ltd **PROJECT NAME** Proposed Boyne/Tannum Aquatic Centre Feasibility Stud

PROJECT NUMBER 2128E/P/1080C **PROJECT LOCATION** Jacaranda Drive, Boyne Island

DATE STARTED 11/11/19 **COMPLETED** 11/11/19 **R.L. SURFACE** **DATUM**

DRILLING CONTRACTOR Construction Sciences **SLOPE** 90° **BEARING** ---

EQUIPMENT Quick Drill **HOLE LOCATION** As Marked on Site Plan in Appendix A

HOLE SIZE 100mm **LOGGED BY** PK **CHECKED BY** PK

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Auger			0.0		SM	Silty SAND (TOPSOIL) low plasticity, grey, fine to coarse grained sand, dry, medium dense to dense.		12 14
			0.5		SM	Silty SAND (ALLUVIUM) fine to coarse grained sand, brown grey, low plasticity fines, dry, dense.	1x BULK SAMPLE	15 18 23 25+ REFUSAL
			1.0					
			1.5		SM	Silty SAND (ALLUVIUM) fine to coarse grained sand, brown, low plasticity fines, moist, dense.		
			2.0					
			2.5					
			3.0				1x DISTURBED SAMPLE	
			3.5					
			4.0					
			4.5					
			5.0			BOREHOLE BH15 TERMINATED AT 5.0m		
			5.5					

Construction Sciences

Construction Sciences Pty Ltd
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Laboratory: **Rockhampton Laboratory**
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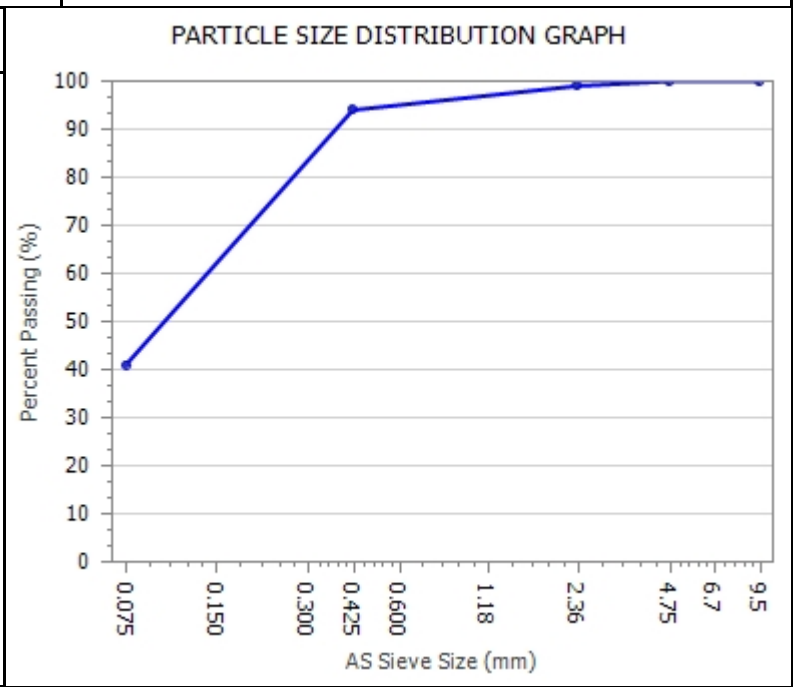
QUALITY OF MATERIALS REPORT

Client:	CONSTRUCTION SCIENCES - RTON ENG	Report Number:	2128/R/49555-1
Client Address:	ROCKHAMPTON, 101 High Street, North Rockhampton	Project Number:	2135/P/415
Project:	General Testing - Engineering	Lot Number:	
Location:	North Rockhampton	Internal Test Request:	2128/T/20917
Component:	CARDNO (QLD) PTY LTD	Client Reference/s:	2128E/CC/522 - 2128E/P/1080
Area Description:	Boyne / Tannum Aquatic Recreation Centre	Report Date / Page:	29/11/2019 Page 5 of 6

Test Procedures	AS1289.3.6.1, AS1289.3.9.2, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.2		
Sample Number	2128/S/89159	Bore Hole No.	BH 12
Sampling Method	Tested As Received	Depth (m)	0.2-1.0m
Date Sampled	11/11/2019		
Sampled By	Client Sampled		
Date Tested	18/11/2019	Material Source	Insitu
Att. Drying Method	Oven Dried	Material Type	Insitu
Atterberg Preparation	Dry Sieved	Material Description	-

AS Sieve (mm)	Specification Minimum	**Percent Passing (%)**	Specification Maximum
9.5		**100**	
4.75		**100**	
2.36		**99**	
0.425		**94**	
0.075		**41**	



Test Result	Specification Minimum	**Result**	Specification Maximum	Test Result	Specification Minimum	**Result**	Specification Maximum
Liquid Limit (%)		**20**		0.075/0.425 Fines Ratio		**0.43**	
Plastic Limit (%)		**17**		Weighted PI (%)		**283.4**	
Cone Plasticity Index (%)		**3**		LS x 0.425 Ratio (%)		**94.5**	
Linear Shrinkage (%)		**1.0**		Linear Shrinkage Defects	-		

Remarks: Results apply to the sample/s as received.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025 - Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 2128

Approved Signatory: Daniel Bryce
Form ID: W85Rep Rev 1

Construction Sciences

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ABN: 74 128 806 735

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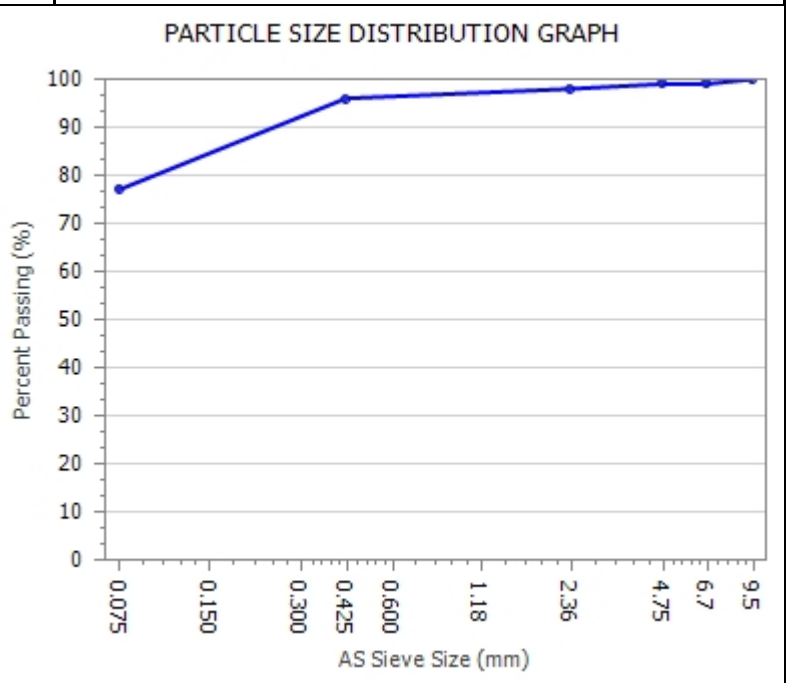
Laboratory: **Rockhampton Laboratory**
Phone: 07 4928 0044
Fax: 07 4926 1286
Email: Rockhampton@constructionsciences.net

QUALITY OF MATERIALS REPORT

Client:	CONSTRUCTION SCIENCES - RTON ENG	Report Number:	2128/R/49555-1
Client Address:	ROCKHAMPTON, 101 High Street, North Rockhampton	Project Number:	2135/P/415
Project:	General Testing - Engineering	Lot Number:	
Location:	North Rockhampton	Internal Test Request:	2128/T/20917
Component:	CARDNO (QLD) PTY LTD	Client Reference/s:	2128E/CC/522 - 2128E/P/1080
Area Description:	Boyne / Tannum Aquatic Recreation Centre	Report Date / Page:	29/11/2019 Page 6 of 6

Test Procedures	AS1289.3.6.1, AS1289.3.1.2, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	2128/S/89160	Bore Hole No.	BH 14
Sampling Method	Tested As Received	Depth (m)	0.5-2.0m
Date Sampled	11/11/2019		
Sampled By	Client Sampled		
Date Tested	14/11/2019	Material Source	Insitu
Att. Drying Method	Air Dried	Material Type	Insitu
Atterberg Preparation	Dry Sieved	Material Description	-

AS Sieve (mm)	Specification Minimum	**Percent Passing (%)**	Specification Maximum
9.5		**100**	
6.7		**99**	
4.75		**99**	
2.36		**98**	
0.425		**96**	
0.075		**77**	



Test Result	Specification Minimum	**Result**	Specification Maximum	Test Result	Specification Minimum	**Result**	Specification Maximum
Liquid Limit (%)		**43**		0.075/0.425 Fines Ratio		**0.81**	
Plastic Limit (%)		**14**		Weighted PI (%)		**2772.8**	
Plastic Index (%)		**29**		LS x 0.425 Ratio (%)		**1338.6**	
Linear Shrinkage (%)		**14.0**		Linear Shrinkage Defects	Curling		

Remarks	Results apply to the sample/s as received.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation Number: 1986
Corporate Site Number: 2128

Approved Signatory: Daniel Bryce
Form ID: W85Rep Rev 1

Construction Sciences

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North Rockhampton QLD 4701

Laboratory: **Rockhampton Laboratory**
Phone: 07 4928 0044
Fax: 07 4926 1286
Email: Rockhampton@constructionsciences.net

EMERSON CLASS NUMBER REPORT

Client:	CONSTRUCTION SCIENCES - RTON ENG	Report Number:	2128/R/49556-1
Client Address:	ROCKHAMPTON, 101 High Street, North Rockhampton	Project Number:	2135/P/415
Project:	General Testing - Engineering	Lot Number:	
Location:	North Rockhampton	Internal Test Request:	2128/T/20917
Component:	CARDNO (QLD) PTY LTD	Client Reference/s:	2128E/CC/522 - 2128E/P/1080
Area Description:	Boyne / Tannum Aquatic Recreation Centre	Report Date / Page:	29/11/2019 Page 2 of 2

Test Procedures:	AS1289.3.8.1

Sample Number	2128/S/89159	2128/S/89160		
ID / Client ID	2128E/S/4359	2128E/S/4360		
Lot Number	-	-		
Date / Time Sampled	11/11/2019	11/11/2019		
Date Tested	26/11/2019	26/11/2019		
Material Source	Insitu	Insitu		
Material Type	Insitu	Insitu		
Sampling Method	Tested As Received	Tested As Received		
Water Type	Distilled	Distilled		
Water Temperature (C°)	23	23		
Bore Hole No.	BH 12	BH 14		
Depth (m)	0.2-1.0m	0.5-2.0m		
Soil Description	-	-		
Emerson Class Number	**2**	**2**		

Remarks	Results apply to the sample/s as received.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025 - Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 2128

Approved Signatory: Daniel Bryce
Form ID: W34Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
8 Kingdon Street,
Gladstone QLD 4680

Laboratory: **Gladstone Laboratory**
Phone: 07 4972 6571
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Email: Gladstone@constructionsciences.net

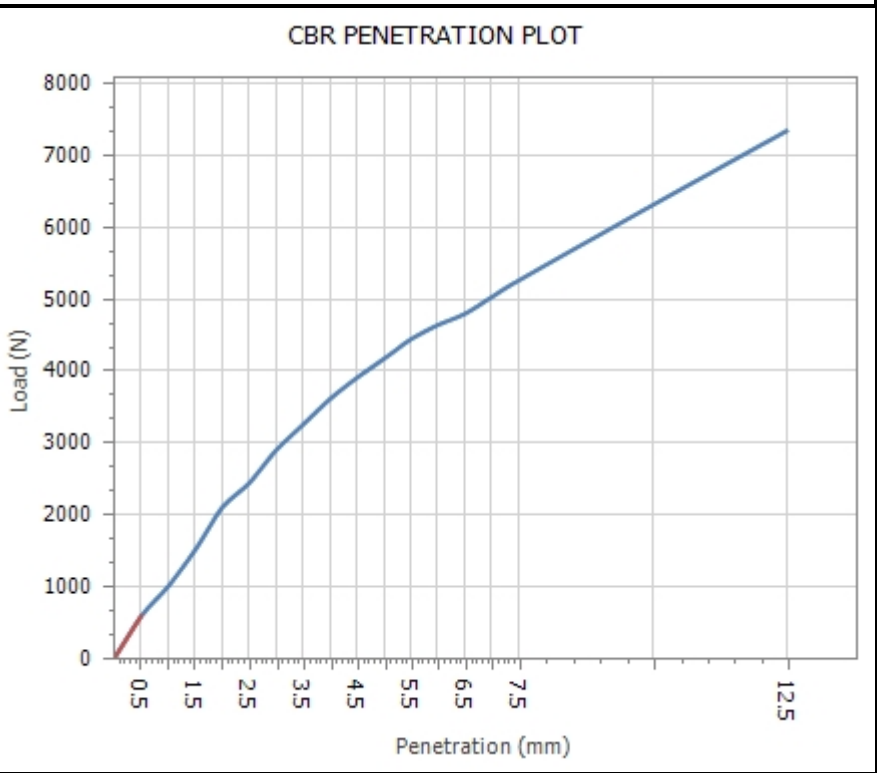
CALIFORNIA BEARING RATIO REPORT

Client:	Construction Sciences Rockhampton Engineering	Report Number:	4708/R/17480-1
Client Address:	101 High Street, North Rockhampton	Project Number:	4708/P/566
Project:	Rockhampton Engineering Projects	Lot Number:	
Location:	Gladstone Region	Internal Test Request:	4708/T/9536
Supplied To:	n/a	Client Reference/s:	
Area Description:		Report Date / Page:	25/11/2019 Page 1 of 6

Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1

Sample Number	4708/S/43609	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location	BH 15
Date Sampled	11/11/2019		0.2-0.6m
Sampled By	Nicole Bella		
Date Tested	18/11/2019		
Material Source	-	Material Limit Start	-
Material Type	-	Material Limit End	-
Client Reference	2128E/S/4343	Compactive Effort	Standard
Material Description	Brown Silty Sand		

Maximum Dry Density (t/m³):	1.78
Optimum Moisture Content (%):	11.0
Field Moisture Content (%):	4.6
Sample Percent Oversize (%)	0.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	100
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.77
Placement Dry Density Ratio (%):	99.5
Placement Moisture Content (%):	11.2
Placement Moisture Ratio (%):	103.0
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	4.5
Dry Density After Soak (t/m³):	1.77
Total Curing Time (hrs)	19
Liquid Limit Method	Estimation
Moisture (top 30mm) After Soak (%)	15.6
Moisture (remainder) After Soak (%)	15.0
CBR Swell (%):	0.0
Minimum CBR Specification (%):	-
CBR Value @ 5.0mm (%):	**20**



Remarks

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation Number: 1986
Corporate Site Number: 4708

Approved Signatory: Zacharey Locke
Form ID: W2ASRep Rev2

Construction Sciences

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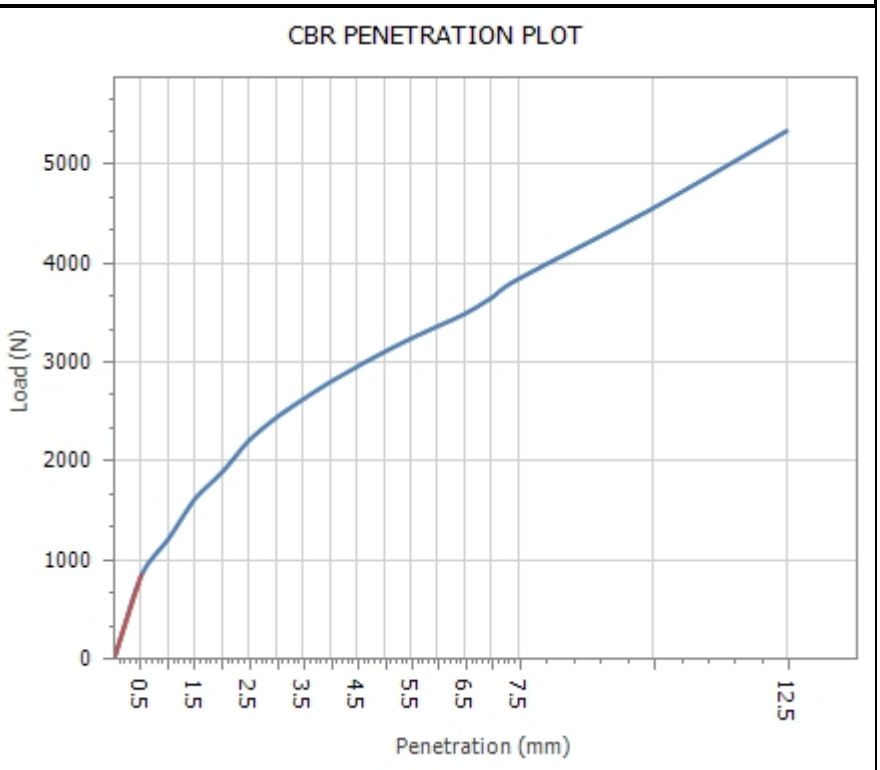
CALIFORNIA BEARING RATIO REPORT

Client:	Construction Sciences Rockhampton Engineering	Report Number:	4708/R/17480-1
Client Address:	101 High Street, North Rockhampton	Project Number:	4708/P/566
Project:	Rockhampton Engineering Projects	Lot Number:	
Location:	Gladstone Region	Internal Test Request:	4708/T/9536
Supplied To:	n/a	Client Reference/s:	
Area Description:		Report Date / Page:	25/11/2019 Page 3 of 6

Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1

Sample Number	4708/S/43611	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location	BH 12
Date Sampled	11/11/2019		0.2-0.6m
Sampled By	Nicole Bella		
Date Tested	18/11/2019		
Material Source	-	Material Limit Start	-
Material Type	-	Material Limit End	-
Client Reference	2128E/S/4345	Compactive Effort	Standard
Material Description	Gravelly Sandy Silt Brown		

Maximum Dry Density (t/m³):	1.74
Optimum Moisture Content (%):	10.5
Field Moisture Content (%):	4.5
Sample Percent Oversize (%)	0.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	100
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.74
Placement Dry Density Ratio (%):	99.5
Placement Moisture Content (%):	10.9
Placement Moisture Ratio (%):	103.0
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	4.5
Dry Density After Soak (t/m³):	1.73
Total Curing Time (hrs)	n/a
Liquid Limit Method	Estimation
Moisture (top 30mm) After Soak (%)	15.2
Moisture (remainder) After Soak (%)	16.1
CBR Swell (%):	0.0
Minimum CBR Specification (%):	-
CBR Value @ 2.5mm (%):	**17**



Remarks

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation Number: 1986
Corporate Site Number: 4708

Approved Signatory: Zacharey Locke
Form ID: W2ASRep Rev2

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1930107**	Page	: 1 of 19
Client	: **CONSTRUCTION SCIENCES PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: NICOLE BELLA	Contact	: Jenny Bevan
Address	: 101 HIGH STREET NORTH ROCKHAMPTON QLD 4701	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8657
Project	: Aquatic Centre	Date Samples Received	: 13-Nov-2019 11:40
Order number	: 2128E|P|1080	Date Analysis Commenced	: 22-Nov-2019
C-O-C number	: ----	Issue Date	: 22-Nov-2019 16:54
Sampler	: NICOLE BELLA		
Site	: ----		
Quote number	: EN/024/18		
No. of samples received	: 84		
No. of samples analysed	: 84		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ASS: EA003 (NATA Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH5 0.0-0.25	BH5 0.25-0.5	BH5 0.5-0.75	BH5 0.75-1.0	BH5 1.0-1.25
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930107-001	EB1930107-002	EB1930107-003	EB1930107-004	EB1930107-005
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**5.8**	**6.1**	**6.2**	**6.3**	**6.3**
pH (Fox)	----	0.1	pH Unit	**2.6**	**3.2**	**3.7**	**4.0**	**4.2**
Reaction Rate	----	1	Reaction Unit	**3**	**3**	**3**	**3**	**3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH5 1.25-1.5	BH5 1.5-1.75	BH3 0.0-0.25	BH3 0.25-0.5	BH2 0.0-0.25
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930107-006	EB1930107-007	EB1930107-008	EB1930107-009	EB1930107-010
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**5.9**	**6.4**	**5.8**	**5.8**	**6.1**
pH (Fox)	----	0.1	pH Unit	**4.4**	**4.4**	**3.6**	**3.2**	**4.0**
Reaction Rate	----	1	Reaction Unit	**3**	**3**	**3**	**3**	**3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH2 0.25-0.5	BH1 0.0-0.25	BH1 0.25-0.5	BH1 0.5-0.75	BH1 0.75-1.0
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930107-011	EB1930107-012	EB1930107-013	EB1930107-014	EB1930107-015
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**6.4**	**7.3**	**6.4**	**5.8**	**5.8**
pH (Fox)	----	0.1	pH Unit	**3.9**	**3.8**	**3.7**	**3.6**	**3.7**
Reaction Rate	----	1	Reaction Unit	**3**	**3**	**3**	**3**	**3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH1 1.0-1.25	BH1 1.25-1.5	BH1 1.5-1.75	BH4 0.0-0.25	BH4 0.25-0.5
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930107-016	EB1930107-017	EB1930107-018	EB1930107-019	EB1930107-020
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**5.5**	**5.6**	**5.3**	**5.7**	**5.6**
pH (Fox)	----	0.1	pH Unit	**3.9**	**3.8**	**3.9**	**3.4**	**3.6**
Reaction Rate	----	1	Reaction Unit	**3**	**3**	**3**	**3**	**3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH4 0.5-0.75	BH11 0.0-0.25	BH11 0.25-0.5	BH11 0.5-0.75	BH11 0.75-1.0
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930107-021	EB1930107-022	EB1930107-023	EB1930107-024	EB1930107-025
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**6.3**	**6.7**	**6.9**	**7.1**	**7.1**
pH (Fox)	----	0.1	pH Unit	**3.9**	**3.8**	**3.6**	**3.8**	**4.3**
Reaction Rate	----	1	Reaction Unit	**3**	**4**	**3**	**3**	**3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH11 1.0-1.25	BH11 1.25-1.5	BH11 1.5-1.75	BH11 1.75-2.0	BH11 2.0-2.25
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930107-026	EB1930107-027	EB1930107-028	EB1930107-029	EB1930107-030
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**7.4**	**7.4**	**7.4**	**7.8**	**7.5**
pH (Fox)	----	0.1	pH Unit	**4.6**	**4.9**	**4.7**	**5.0**	**5.1**
Reaction Rate	----	1	Reaction Unit	**3**	**3**	**3**	**3**	**3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH11 2.25-2.5	BH11 2.5-3.0	BH11 3.0-3.5	BH11 3.5-4.0	BH11 4.0-4.5
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930107-031	EB1930107-032	EB1930107-033	EB1930107-034	EB1930107-035
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**7.5**	**6.9**	**6.8**	**6.7**	**7.1**
pH (Fox)	----	0.1	pH Unit	**5.2**	**5.5**	**5.2**	**5.6**	**5.7**
Reaction Rate	----	1	Reaction Unit	**3**	**4**	**4**	**4**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH11 4.5-5.0	BH12 0.0-0.25	BH12 0.25-0.5	BH12 0.5-0.75	BH12 0.75-1.0
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930107-036	EB1930107-037	EB1930107-038	EB1930107-039	EB1930107-040
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**7.3**	**6.8**	**6.7**	**6.4**	**6.6**
pH (Fox)	----	0.1	pH Unit	**5.8**	**3.7**	**3.3**	**3.6**	**3.6**
Reaction Rate	----	1	Reaction Unit	**4**	**4**	**4**	**3**	**3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH12 1.0-1.25	BH12 1.25-1.5	BH12 1.5-1.75	BH12 1.75-2.0	BH12 2.0-2.25
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930107-041	EB1930107-042	EB1930107-043	EB1930107-044	EB1930107-045
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**6.8**	**6.9**	**7.0**	**7.5**	**7.3**
pH (Fox)	----	0.1	pH Unit	**4.3**	**4.3**	**4.2**	**4.9**	**4.9**
Reaction Rate	----	1	Reaction Unit	**3**	**3**	**3**	**3**	**3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH12 2.25-2.5	BH12 2.5-3.0	BH12 3.0-3.5	BH12 3.5-4.0	BH12 4.0-4.5
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930107-046	EB1930107-047	EB1930107-048	EB1930107-049	EB1930107-050
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**7.9**	**7.8**	**7.9**	**7.9**	**8.2**
pH (Fox)	----	0.1	pH Unit	**5.0**	**5.8**	**6.5**	**7.8**	**8.1**
Reaction Rate	----	1	Reaction Unit	**4**	**4**	**4**	**4**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH12 4.5-5.0	BH13 0.0-0.25	BH13 0.25-0.5	BH13 0.5-0.75	BH13 0.75-1.0
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930107-051	EB1930107-052	EB1930107-053	EB1930107-054	EB1930107-055
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**8.0**	**7.3**	**7.5**	**7.4**	**7.4**
pH (Fox)	----	0.1	pH Unit	**8.2**	**4.8**	**4.7**	**4.8**	**4.8**
Reaction Rate	----	1	Reaction Unit	**4**	**4**	**3**	**3**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH13 1.0-1.25	BH13 1.25-1.5	BH13 1.5-1.75	BH13 1.75-2.0	BH13 2.0-2.25
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930107-056	EB1930107-057	EB1930107-058	EB1930107-059	EB1930107-060
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**7.2**	**7.6**	**7.5**	**7.5**	**7.4**
pH (Fox)	----	0.1	pH Unit	**4.8**	**4.9**	**4.8**	**4.8**	**4.7**
Reaction Rate	----	1	Reaction Unit	**4**	**4**	**4**	**4**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH13 2.25-2.5	BH13 2.5-3.0	BH13 3.0-3.5	BH13 3.5-4.0	BH13 4.0-4.5
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930107-061	EB1930107-062	EB1930107-063	EB1930107-064	EB1930107-065
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**7.6**	**7.8**	**7.9**	**7.8**	**7.9**
pH (Fox)	----	0.1	pH Unit	**4.7**	**4.8**	**4.9**	**4.7**	**4.8**
Reaction Rate	----	1	Reaction Unit	**4**	**4**	**4**	**4**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH13 4.5-5.0	BH14 0.0-0.25	BH14 0.25-0.5	BH14 0.5-0.75	BH14 0.75-1.0
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930107-066	EB1930107-067	EB1930107-068	EB1930107-069	EB1930107-070
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**7.8**	**9.3**	**9.3**	**9.4**	**9.5**
pH (Fox)	----	0.1	pH Unit	**4.7**	**8.7**	**9.0**	**9.4**	**8.4**
Reaction Rate	----	1	Reaction Unit	**4**	**4**	**4**	**4**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH14 1.0-1.25	BH14 1.25-1.5	BH14 1.5-1.75	BH14 1.75-2.0	BH14 2.0-2.25
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930107-071	EB1930107-072	EB1930107-073	EB1930107-074	EB1930107-075
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**9.3**	**9.5**	**8.9**	**9.2**	**9.2**
pH (Fox)	----	0.1	pH Unit	**8.5**	**9.0**	**8.8**	**8.5**	**8.7**
Reaction Rate	----	1	Reaction Unit	**4**	**4**	**4**	**4**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH14 2.25-2.5	BH14 2.5-3.0	BH14 3.0-3.5	BH14 3.5-4.0	BH14 4.0-4.5
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930107-076	EB1930107-077	EB1930107-078	EB1930107-079	EB1930107-080
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**9.1**	**7.6**	**7.4**	**7.5**	**8.1**
pH (Fox)	----	0.1	pH Unit	**8.2**	**3.9**	**3.9**	**4.1**	**4.0**
Reaction Rate	----	1	Reaction Unit	**4**	**4**	**3**	**3**	**3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH14 4.5-5.0	BH15 0.0-0.25	BH15 0.25-0.5	BH15 0.5-0.75	----
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	----
Compound	CAS Number	LOR	Unit	EB1930107-081	EB1930107-082	EB1930107-083	EB1930107-084	--------
				Result	Result	Result	Result	----
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**7.5**	**6.7**	**6.4**	**6.6**	**----**
pH (Fox)	----	0.1	pH Unit	**3.9**	**3.3**	**3.1**	**3.3**	**----**
Reaction Rate	----	1	Reaction Unit	**3**	**4**	**4**	**3**	**----**

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1930108**	Page	: 1 of 13
Client	: **CONSTRUCTION SCIENCES PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: NICOLE BELLA	Contact	: Jenny Bevan
Address	: 101 HIGH STREET NORTH ROCKHAMPTON QLD 4701	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8657
Project	: Aquatic Centre	Date Samples Received	: 13-Nov-2019 11:40
Order number	: 2128E|P|1080	Date Analysis Commenced	: 20-Nov-2019
C-O-C number	: ----	Issue Date	: 21-Nov-2019 17:21
Sampler	: NICOLE BELLA		
Site	: ----		
Quote number	: EN/024/18		
No. of samples received	: 55		
No. of samples analysed	: 55		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ASS: EA003 (NATA Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH15@0.75-1.0	BH15@1.0-1.25	BH15@1.25-1.5	BH15@1.5-1.75	BH15@1.75-2.0
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930108-001	EB1930108-002	EB1930108-003	EB1930108-004	EB1930108-005
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**6.6**	**6.9**	**6.9**	**7.1**	**7.6**
pH (Fox)	----	0.1	pH Unit	**3.3**	**3.5**	**3.6**	**4.0**	**4.3**
Reaction Rate	----	1	Reaction Unit	**2**	**2**	**2**	**2**	**1**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH15@2.0-2.25	BH15@2.25-2.5	BH15@2.5-3.0	BH15@3.0-3.5	BH15@3.5-4.0
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930108-006	EB1930108-007	EB1930108-008	EB1930108-009	EB1930108-010
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**7.5**	**7.6**	**7.9**	**7.9**	**7.8**
pH (Fox)	----	0.1	pH Unit	**4.2**	**4.3**	**4.6**	**4.9**	**4.9**
Reaction Rate	----	1	Reaction Unit	**1**	**2**	**2**	**2**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH15@4.0-4.5	BH15@4.5-5.0	BH6@0.0-0.25	BH6@0.25-0.5	BH6@0.5-0.75
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930108-011	EB1930108-012	EB1930108-013	EB1930108-014	EB1930108-015
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**8.1**	**8.1**	**8.0**	**7.6**	**6.2**
pH (Fox)	----	0.1	pH Unit	**4.9**	**4.9**	**4.8**	**4.6**	**4.0**
Reaction Rate	----	1	Reaction Unit	**2**	**2**	**3**	**3**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH6@0.75-1.0	BH6@1.0-1.25	BH6@1.25-1.5	BH6@1.5-1.75	BH6@1.75-2.0
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930108-016	EB1930108-017	EB1930108-018	EB1930108-019	EB1930108-020
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**5.6**	**5.5**	**5.6**	**5.4**	**5.9**
pH (Fox)	----	0.1	pH Unit	**3.8**	**3.6**	**3.6**	**3.5**	**4.1**
Reaction Rate	----	1	Reaction Unit	**2**	**2**	**2**	**2**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH8@0.0-0.25	BH8@0.25-0.5	BH8@0.5-0.75	BH8@0.75-1.0	BH8@1.0-1.25
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930108-021	EB1930108-022	EB1930108-023	EB1930108-024	EB1930108-025
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**7.0**	**7.1**	**6.7**	**5.6**	**5.6**
pH (Fox)	----	0.1	pH Unit	**3.6**	**3.2**	**3.9**	**3.7**	**3.8**
Reaction Rate	----	1	Reaction Unit	**3**	**3**	**2**	**2**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH8@1.25-1.5	BH8@1.5-1.75	BH8@1.75-2.0	BH8@2.0-2.25	BH8@2.25-2.5
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930108-026	EB1930108-027	EB1930108-028	EB1930108-029	EB1930108-030
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**5.7**	**5.5**	**5.6**	**5.8**	**6.0**
pH (Fox)	----	0.1	pH Unit	**3.6**	**3.5**	**3.6**	**3.7**	**4.0**
Reaction Rate	----	1	Reaction Unit	**2**	**2**	**2**	**1**	**1**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH8@2.5-3.0	BH8@3.0-3.5	BH8@3.5-4.0	BH8@4.0-4.5	BH8@4.5-5.0
			Client sampling date / time	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00	11-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930108-031	EB1930108-032	EB1930108-033	EB1930108-034	EB1930108-035
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**5.8**	**5.9**	**6.1**	**6.1**	**6.2**
pH (Fox)	----	0.1	pH Unit	**4.1**	**4.0**	**4.2**	**4.2**	**4.3**
Reaction Rate	----	1	Reaction Unit	**1**	**1**	**1**	**1**	**1**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH7@0.0-0.25	BH7@0.25-0.5	BH7@0.5-0.75	BH7@0.75-1.0	BH7@1.0-1.25
			Client sampling date / time	12-Nov-2019 00:00	12-Nov-2019 00:00	12-Nov-2019 00:00	12-Nov-2019 00:00	12-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930108-036	EB1930108-037	EB1930108-038	EB1930108-039	EB1930108-040
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**7.8**	**7.2**	**7.0**	**7.0**	**6.8**
pH (Fox)	----	0.1	pH Unit	**4.6**	**4.5**	**3.6**	**3.8**	**4.1**
Reaction Rate	----	1	Reaction Unit	**3**	**3**	**3**	**3**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH7@1.25-1.4	BH9@0.0-0.25	BH9@0.25-0.5	BH9@0.5-0.75	BH9@0.75-1.0
			Client sampling date / time	12-Nov-2019 00:00	12-Nov-2019 00:00	12-Nov-2019 00:00	12-Nov-2019 00:00	12-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930108-041	EB1930108-042	EB1930108-043	EB1930108-044	EB1930108-045
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**6.8**	**7.2**	**6.9**	**6.6**	**6.6**
pH (Fox)	----	0.1	pH Unit	**4.1**	**3.6**	**3.5**	**4.0**	**4.5**
Reaction Rate	----	1	Reaction Unit	**2**	**3**	**3**	**3**	**3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH10@0.0-0.25	BH10@0.25-0.5	BH10@0.5-0.75	BH10@0.75-1.0	BH10@1.0-1.25
			Client sampling date / time	12-Nov-2019 00:00	12-Nov-2019 00:00	12-Nov-2019 00:00	12-Nov-2019 00:00	12-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930108-046	EB1930108-047	EB1930108-048	EB1930108-049	EB1930108-050
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**6.2**	**6.1**	**5.8**	**5.5**	**5.3**
pH (Fox)	----	0.1	pH Unit	**2.8**	**3.0**	**3.0**	**3.1**	**2.7**
Reaction Rate	----	1	Reaction Unit	**3**	**3**	**3**	**3**	**3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH10@1.25-1.5	BH10@1.5-1.75	BH10@1.75-2.0	BH10@2.0-2.25	BH10@2.25-2.5
			Client sampling date / time	12-Nov-2019 00:00	12-Nov-2019 00:00	12-Nov-2019 00:00	12-Nov-2019 00:00	12-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1930108-051	EB1930108-052	EB1930108-053	EB1930108-054	EB1930108-055
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**5.1**	**4.9**	**4.8**	**4.9**	**5.0**
pH (Fox)	----	0.1	pH Unit	**2.8**	**2.9**	**2.9**	**2.9**	**3.1**
Reaction Rate	----	1	Reaction Unit	**3**	**2**	**2**	**2**	**2**

APPENDIX

B

SITE SEARCHES

Department of Environment and Science (DES)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.des.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Trisna Sudana
Level 11
515 St Pauls Tce
Fortitude Valley QLD 4006

Transaction ID: 50573974 EMR Site Id: 04 December 2019
Cheque Number:
Client Reference:

This response relates to a search request received for the site:
Lot: 10 Plan: SP171136
JACARANDA DR
BOYNE ISLAND

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if DES has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if DES has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority