Site Analysis Report

Lot 900 Coronation Drive, Tannum Sands

Boyne Tannum Aquatic Recreation Centre Option Analysis

PREPARED FOR
GLADSTONE REGIONAL COUNCIL

REFERENCE NO: R2019066

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001	20 December 2019	Preliminary Draft for Council Review	Justine Latemore, Sophie St John Christina Johansson Megan Kraft Trisna Sudana	Stephen Whitaker
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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 1, being land located at Lot 900 Coronation Drive, Tannum Sands. 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 Lot 900 Coronation Drive, Tannum Sands and is more properly described as Lot 900 on SP152499. The site includes a land area of 99,250m^2 and has a road frontage to Coronation Drive to the south. Coronation Drive is an Urban Distributor road with limited direct access. Tannum Sands Road, with which Coronation Drive intersects, is a state-controlled road.

The site is presently vacant of improvements or land uses, with extensive mature vegetation present.

The site is located in an established residential area with notable features in the surrounding area including:

- Tannum Sands Shopping Centre, approximately 250 metres north-east of the site;
- Tannum Sands State School, approximately 250 metres north-west of the site; and
- Tannum Sands State High School, approximately 300 metres south-west of the site, which is accessed from the western end of Coronation Drive.

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. **Table 3-1** outlines the categories of development and assessment provided by the Planning Regulation that may be of relevance to the site and the proposed development.

Table 3-1 Assessable Development

Category of Development	Provision	Discussion
Prohibited Development	Operational Work, or a Material Change of Use involving Operational Work, that is the clearing of native vegetation that is not: ▪ for a relevant purpose under Section 22A of the VMA; or ▪ for exempt clearing work; or ▪ for Accepted Development under an Accepted Development Vegetation Clearing Code.	As discussed in Section 5.3 of this report, it is likely that the proposed development will involve exempt clearing work, however further detailed review is required.

Category of Development	Provision	Discussion
Assessable Development	Operational Work that is the clearing of native vegetation that is not: ▪ for exempt clearing work; or ▪ for Accepted Development under an Accepted Development Vegetation Clearing Code.	
Assessable Development	Operational Work that is constructing or raising waterway barrier works unless Accepted Development under Schedule 7 of the Planning Regulation.	The site includes a waterway mapped as a moderate waterway for waterway barrier works. Where development is undertaken within the vicinity of this waterway, Assessable Development may be triggered.

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 development application for the proposed development may trigger referral to the Department of State Development, Manufacturing, Infrastructure and Planning for vegetation clearing matters, pursuant to Schedule 10, Part 3, Division 4, Table 3 of the Planning Regulation.

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 Emerging Community Zone. The site is not located within a zone precinct. Surrounding land to the north and west is included in the Low Density Residential Zone whilst the north-west parcel bordering the site is included in the Special Purpose 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 3-2**.

Table 3-2 Applicable Overlays

Overlay	Designation
Acid Sulfate Soils Overlay	▪ Acid Sulphate Soils 0-5m AHD ▪ Acid Sulphate Soils 5-20m AHD
Biodiversity Overlay	▪ MSES Regulated Vegetation (intersecting a watercourse) ▪ MSES Wildlife Habitat
Building Heights and Frontages Overlay	▪ Heights
Bushfire Hazard Overlay	▪ Bushfire Prone Area – Medium Potential Bushfire Intensity ▪ Bushfire Prone Area – Potential Impact Buffer

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 3-3** are likely to be applicable.

Table 3-3 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 Emerging Community Zone is Assessable Development that is subject to Code Assessment.

> A Material Change of Use for Indoor Sport and Recreation in the Emerging Community 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.

Dependent on the applicable land use, the proposed development will be either Assessable Development that is subject to Code Assessment (where involving Outdoor Sport and Recreation) or Assessable Development that is subject to Impact Assessment (where involving Indoor Sport and Recreation). Where the proposed development involves both uses, it will be subject to the highest category of assessment and therefore be Assessable Development that is subject to Impact Assessment.

3.2.5 Key Development Parameters

The following codes of the planning scheme are identified as assessment benchmarks against which the proposed development may be assessed (subject to the design and siting of the development):

> Emerging Community Zone Code

> Development Design Code

> Landscaping Code

> Acid Sulfate Soils Overlay Code

> Biodiversity Overlay Code

> Bushfire Hazard Overlay Code

Where the proposed development is subject to Impact Assessment, it is noted that the entire planning scheme is an assessment benchmark for the development, meaning the Strategic Framework of the planning scheme is also to be considered.

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 3-4**.

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.

Table 3-4 Key Development Parameters

Parameter	Provision
Built Form	
Maximum Building Height	8.5 metres
Minimum Setbacks (Outdoor Sport and Recreation[1])	Where sharing a boundary with a residential premises or residential zone ▪ 6 metres for: – active outdoor use or sporting areas; – site access points; – car parking areas, and – servicing or outdoor storage areas. ▪ 15 metres for buildings.
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.
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.

[1] It is likely that similar setbacks would be appropriate for an Indoor Sport and Recreation use.

Parameter	Provision
Surface treatment	Manoeuvring, loading and unloading areas, and parking areas (car and bicycle) are impervious 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 1.5m 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	
Biodiversity	▪ Development locates outside of an area supporting MSES (Matters of State Environmental Significance). ▪ A buffer extending from the outside edge of an area of MSES is provided and has a minimum width of 50 metres.
Bushfire	▪ 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.

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. Dependent on the applicable land use, the required development application will be either Assessable Development that is subject to Code Assessment (where involving Outdoor Sport and Recreation) or Assessable Development that is subject to Impact Assessment (where involving Indoor Sport and Recreation). Where the proposed development involves both uses, it will be subject to the highest category of assessment and therefore be Assessable Development that is subject to Impact Assessment.

This development application may be required to be referred to the Department of State Development, Manufacturing, Infrastructure and Planning.

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. Further detail of this investigation is included in Chapter 7 of this report.

A total of five (5) boreholes were tested across the site and all showed the presence of shallow weathered rock with all boreholes being terminated by 1.75 metres deep.

The presence of rock will need to be considered in any master planning of the site and in estimates of costs for earthworks.

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.

Initial field testing as detailed in Section 7.3.6 of this report indicates potential ASS on site. An ASS Investigation/Management Plan would therefore 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.

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 minimal existing drainage infrastructure within the site. At present, stormwater will sheet flow via natural flow paths either to the gully and existing detention basin in the northern section of the site (shown in **Figure 4-1**) or to the table drain running along Coronation Drive to the south. Local drainage networks are present in the surrounding residential subdivisions. Currently the site is undeveloped with minimal impermeable areas.

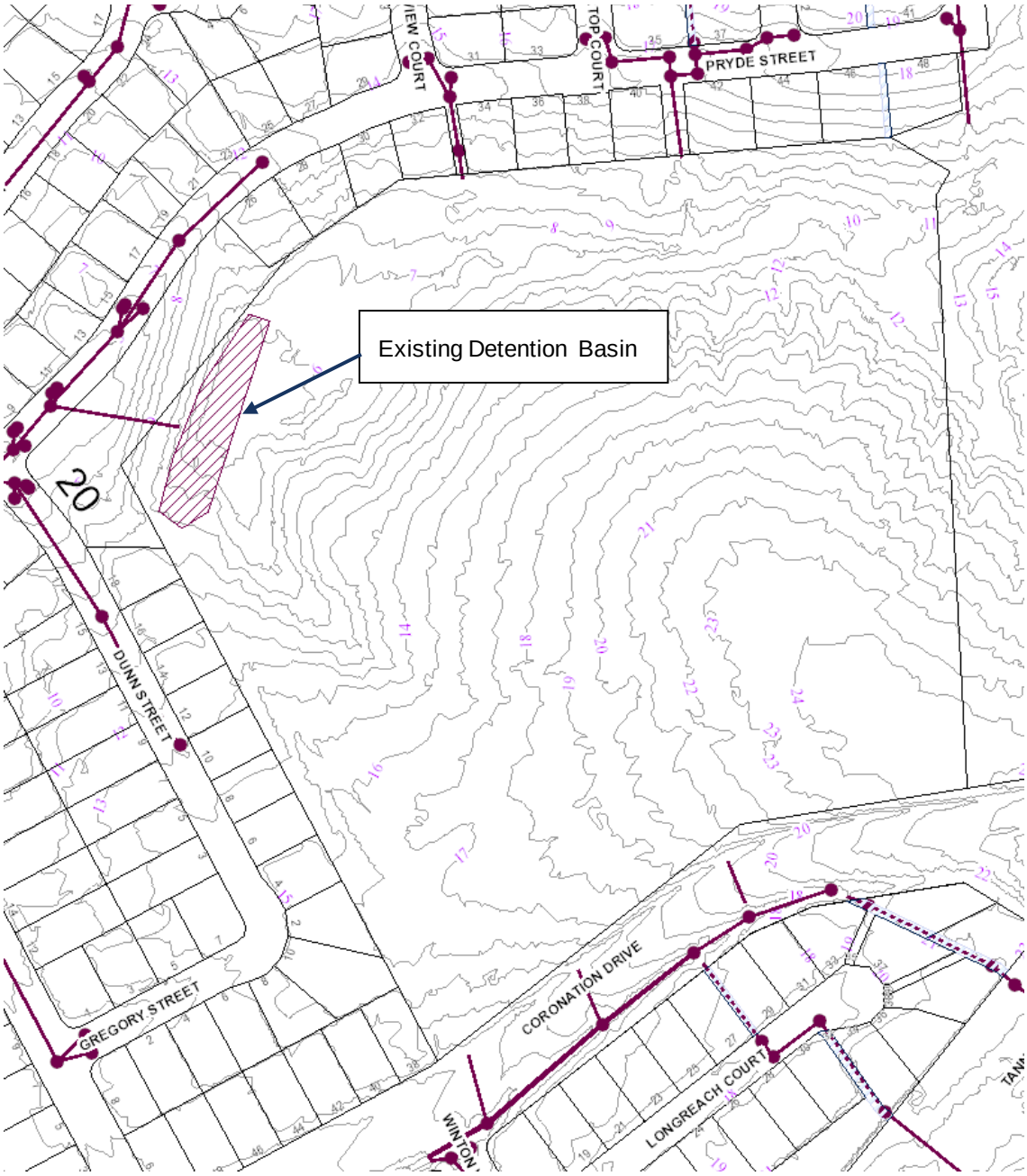

Figure 4-1 Existing Stormwater Infrastructure

4.2.2 Required 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).

It is expected that depending on the increase of impervious area across the site the following infrastructure would be required:

- Detention, either by increasing the capacity of the existing basin or construction of a new basin or underground storage (which could be used for irrigation or toilets etc);
- Stormwater quality treatment via bioretention basins/swales or proprietary products where suitable. 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 Pryde Street, north of the site, is subject to flooding from the Boyne River during Q100 flood events (see **Figure 4-2**). As the southern end of the site is the preferred location for the aquatic centre, there is low risk of river flooding.

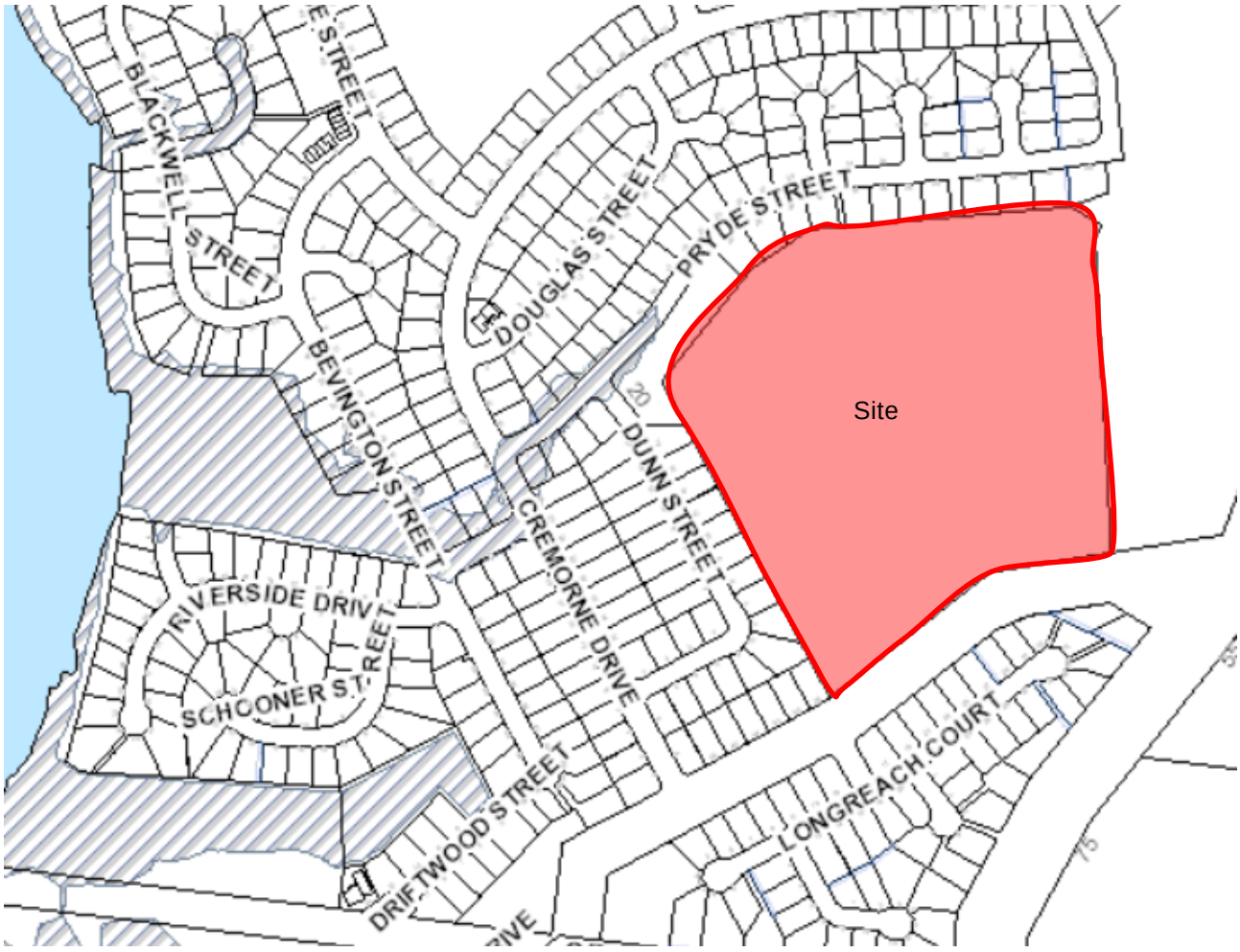

Figure 4-2 Boyne River Flood Levels

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 200mm line running along Coronation Drive, south of the site, as shown in **Figure 4-3**. This water main is supplied by the Broadacres reservoir which is located approximately 500 metres away. Council has advised (via email to Cardno dated 28 November 2019) that there is sufficient capacity in the existing network to supply the proposed use of the site.

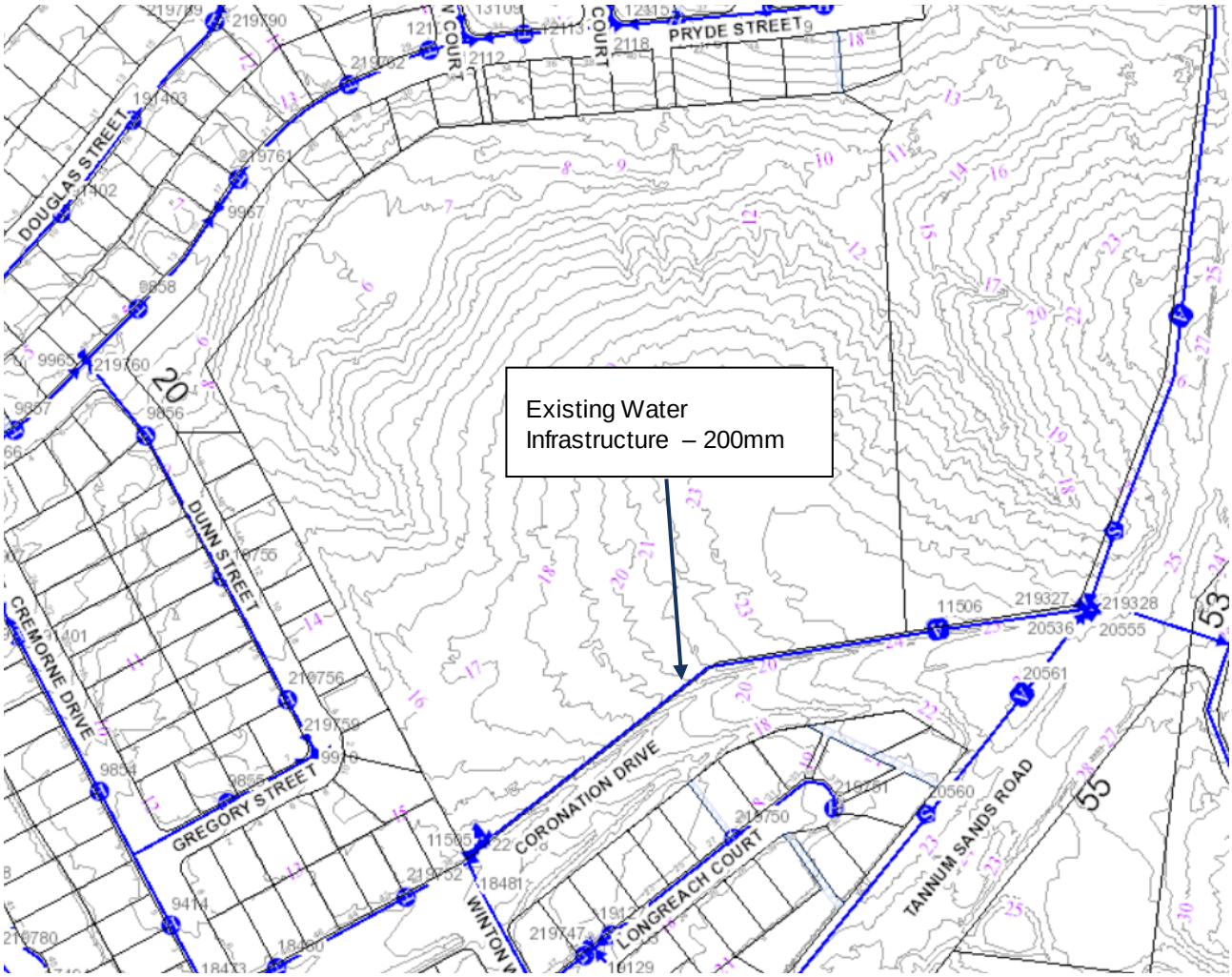

Figure 4-3 Existing Water Infrastructure

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 Netw ork.

4.4.3 Required Upgrades to Existing Treated Water Network

Council has provided preliminary advice that the existing network should have capacity to supply the proposed aquatic centre use.

The Boyne Tannum Benaraby Wurdong Water Supply Strategic Plan (GRC, 2010) has identified that trunk water mains are required to be constructed to supply the Broadacres Reservoir which is currently supplied by an existing pump station on Coronation Drive. Council has not indicated at this time that these works are required to enable to proposed development of the aquatic centre.

4.5 Wastewater Service Infrastructure

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

4.5.1 Existing Wastewater Infrastructure

There is currently no existing sewerage infrastructure within the site. The site is surrounded by existing infrastructure servicing nearby residential subdivisions which drain to the existing Sewerage Pump Station (SPS) on the corner of Langdon Street and Latrobe Street (SPS TAN 03), as shown in **Figure 4-4**.

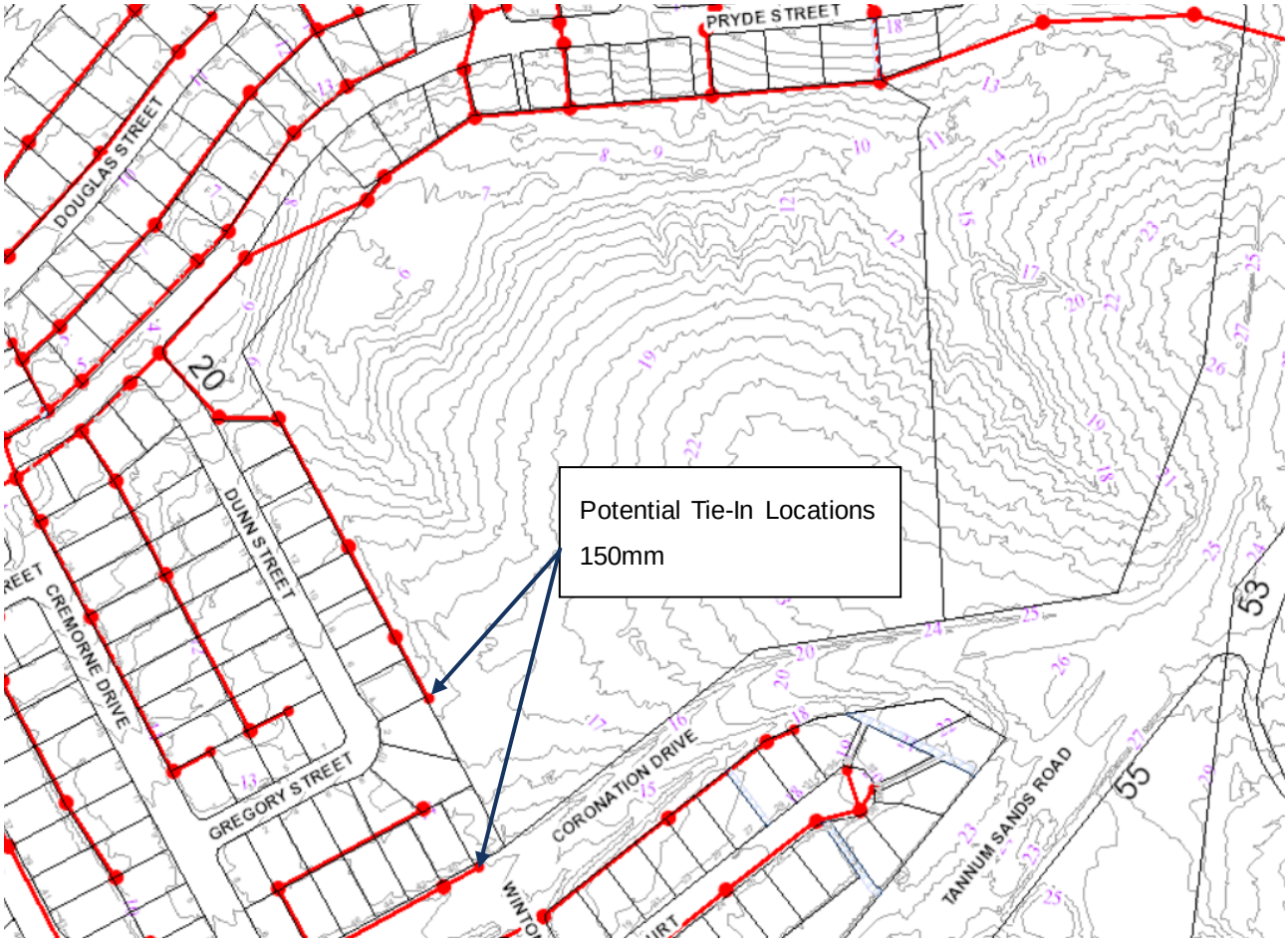

Figure 4-4 Existing Sewer Infrastructure

4.5.2 Proposed Sewer Network and Loading

Sewerage loadings in terms of EP are considered identical to water loadings for preliminary design purposes. **Table 4-2** 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

4.5.3 Required Upgrades to Existing Network

Depending on the final connection point to the existing network there will be a need to upgrade the downstream gravity mains from a 150mm diameter to a 225mm diameter. The potential upgrades are shown in **Figure 4-5**. Preliminary advice from Council has not indicated that any further upgrades to the network or downstream pump station are required.

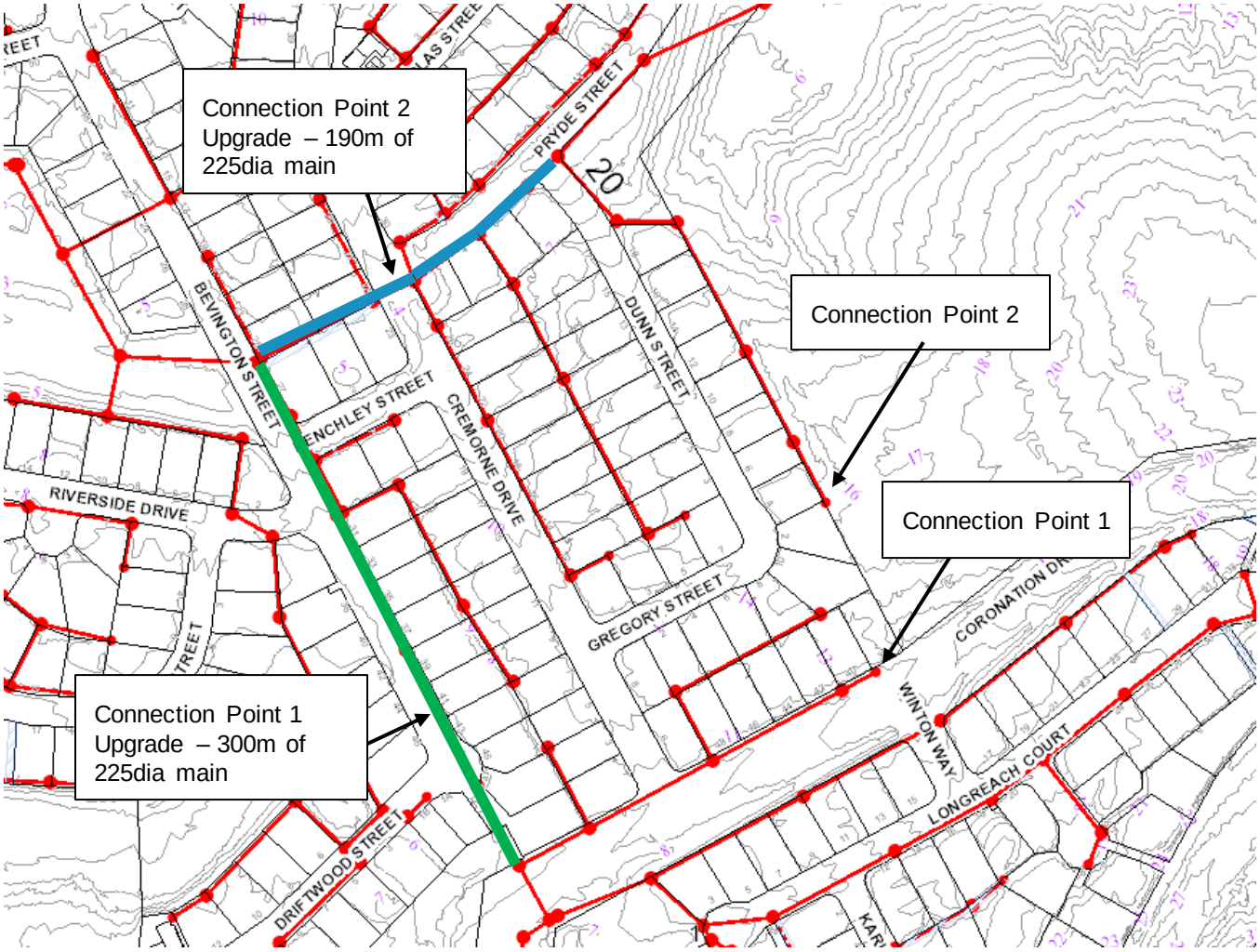

Figure 4-5 Existing Sewer Network Upgrades

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 Voltage power infrastructure running along Coronation Drive, south of the site, as shown in **Figure 4-6**.

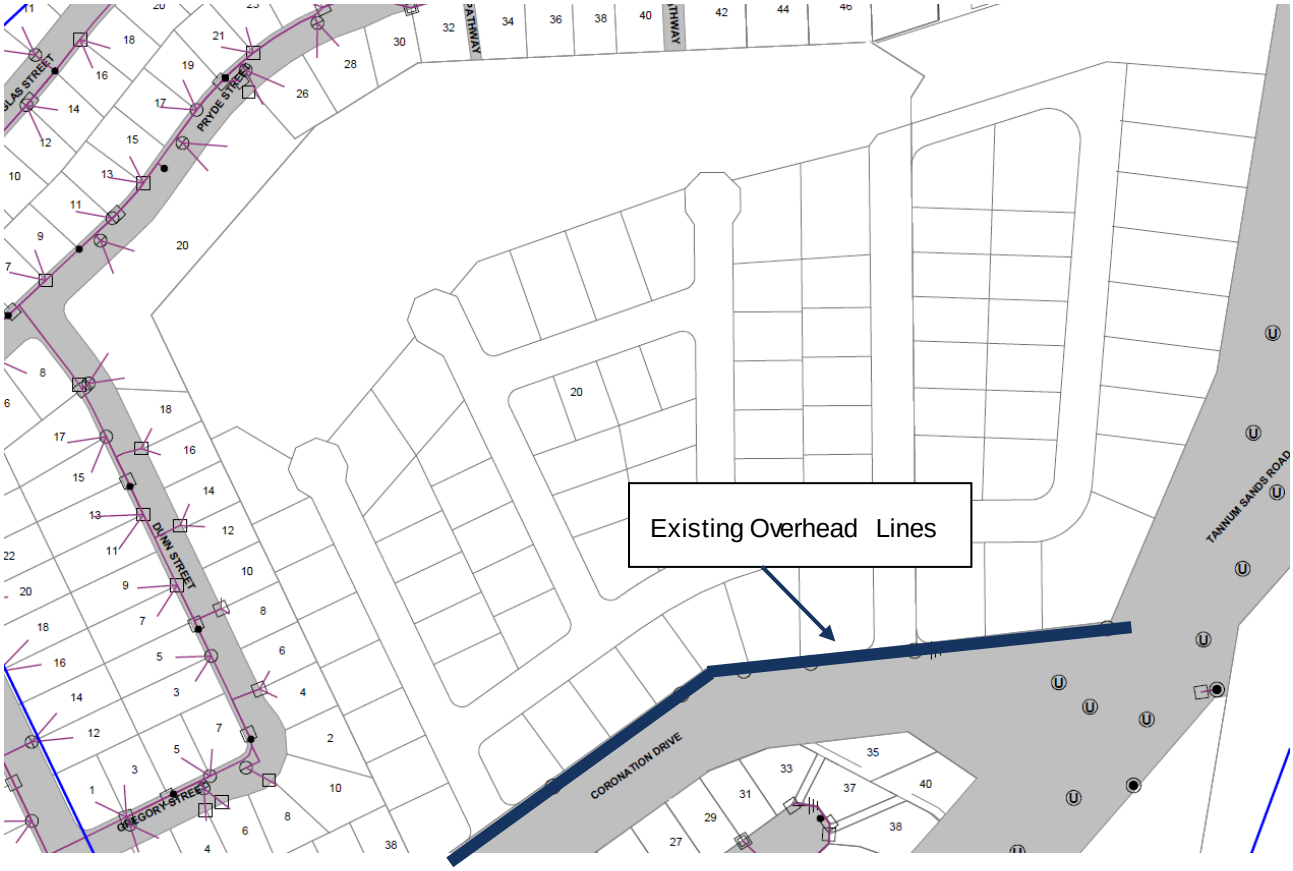

Figure 4-6 Existing Overhead Power

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, however 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, although there is NBN infrastructure in Dunn Street and Coronation Drive that can be extended to the site.

Mobile network coverage in the area is well serviced with 4G covering the entire site under the Telstra network as shown in **Figure 4-7**. Other network providers may vary.

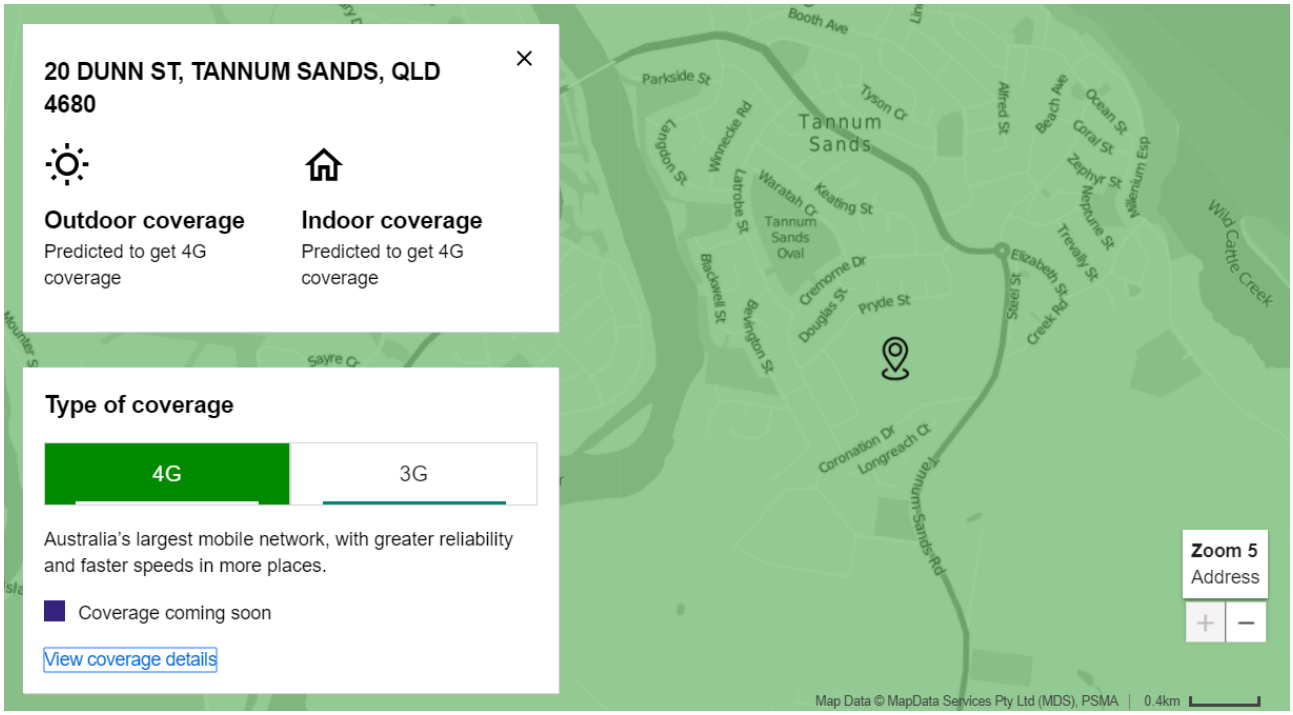

Figure 4-7 Telstra Mobile Network Coverage (Telstra, 2019)

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				
Sewer Gravity Upgrade (225mm)	300	m	$600.00	$180,000.00
Contingency	**30**	**%**	**-**	**$395,381.94**
Design	**5**	**%**	**-**	**$65,896.99**
			Total	**$1,779,218.73**

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	Lot 900 Coronation Drive, Tannum Sands
Coordinates	-23.955, 151.3677
Real Property Description	Lot 900 on SP152499
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	48
Listed Migratory Species	55

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 B (remnant) vegetation containing Least Concern RE 12.11.6;
- Category X (non-remnant) vegetation; and
- Essential habitat.

These mapping layers are shown in **Figure 5-1**.

Figure 5-1 Regulated Vegetation Mapping (Extract)

5.3.2 Legislative Requirements

Works associated with the project are unlikely to be able to comply with the 'accepted development vegetation clearing codes' and therefore an operational works approval for vegetation clearing will likely be required. As the site is located within the Emerging Community Zone by the planning scheme, any required clearing may be considered exempt clearing work under Schedule 21 of the *Planning Regulation 2017*. Exempt clearing work is Accepted Development. Whether any required clearing is Accepted Development is subject to further review and should be determined by the regulatory body at the time of application.

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. A species management program may be required for clearing fauna breeding places (e.g. hollow-bearing trees, nests, burrows).

5.7 Biodiversity

5.7.1 Desktop Assessment Results

The site is mapped as containing:

- MSES – Wildlife habitat; and
- MSES – Regulated vegetation (intersecting a watercourse).

These mapping layers are shown in **Figure 5-2**.

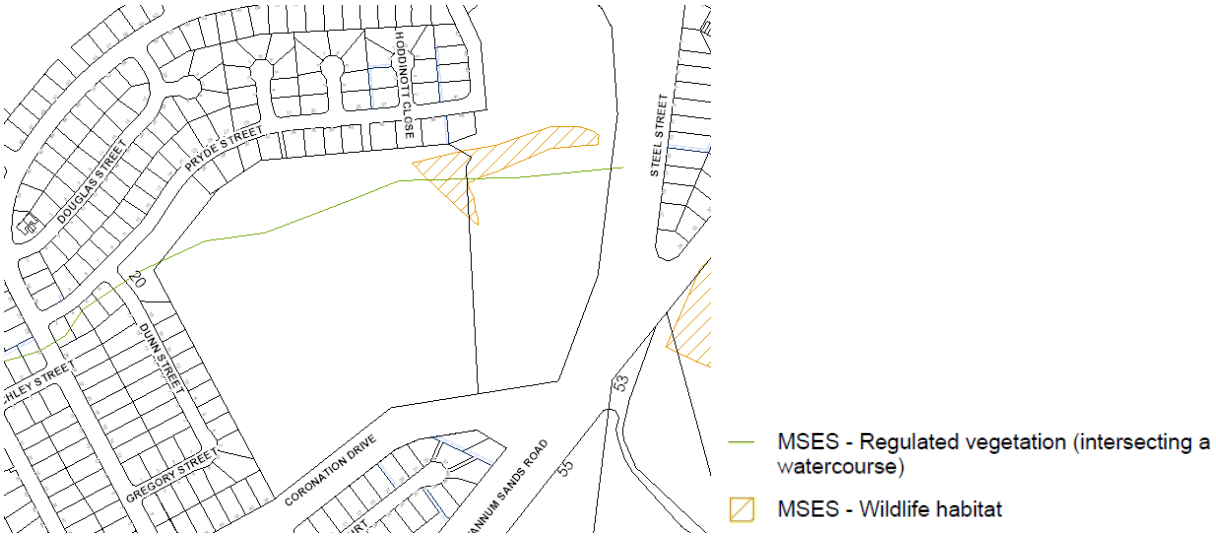

Figure 5-2 MSES Mapping (Extract)

5.7.2 Legislative Requirements

Where works are proposed within a mapped biodiversity area, the project will need to demonstrate compliance with the Biodiversity Overlay Code of the planning scheme.

5.8 Wetlands and Waterways

5.8.1 Desktop Assessment Results

The site is not mapped as supporting any wetlands.

The site is mapped as containing an Amber – Moderate Risk Waterway for waterway barrier works by the Department of Agriculture and Fisheries (DAF) Queensland waterways for waterway barrier works mapping. This mapping is shown in **Figure 5-3**.

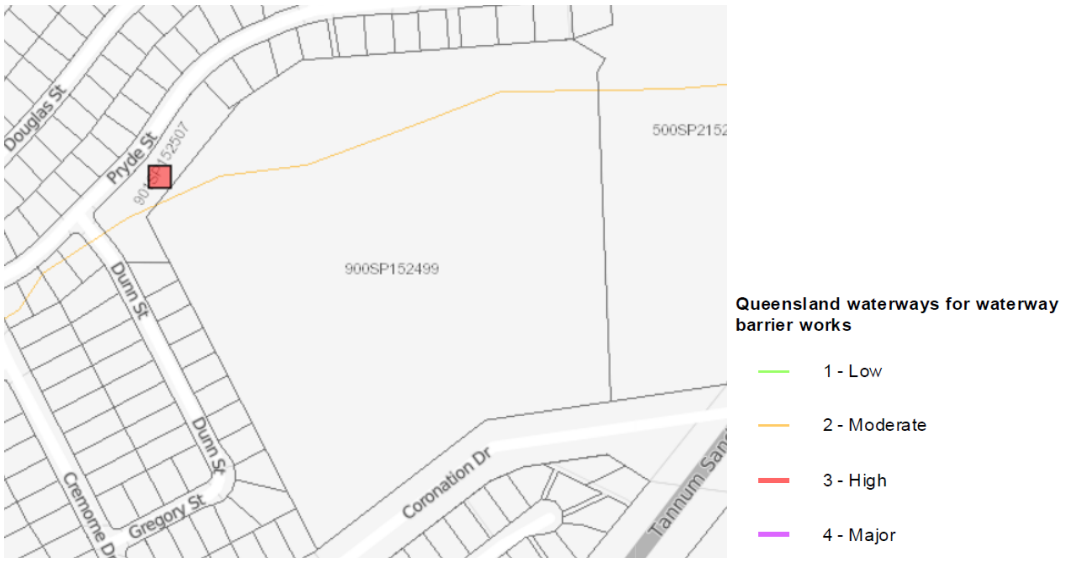

Figure 5-3 Waterway Barrier Works Mapping (Extract)

5.8.2 Legislative Requirements

Where works are required within the mapped waterway and cannot comply with the accepted development requirements for fisheries development, an operational works – waterway barrier works approval would be required.

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 5-4**.

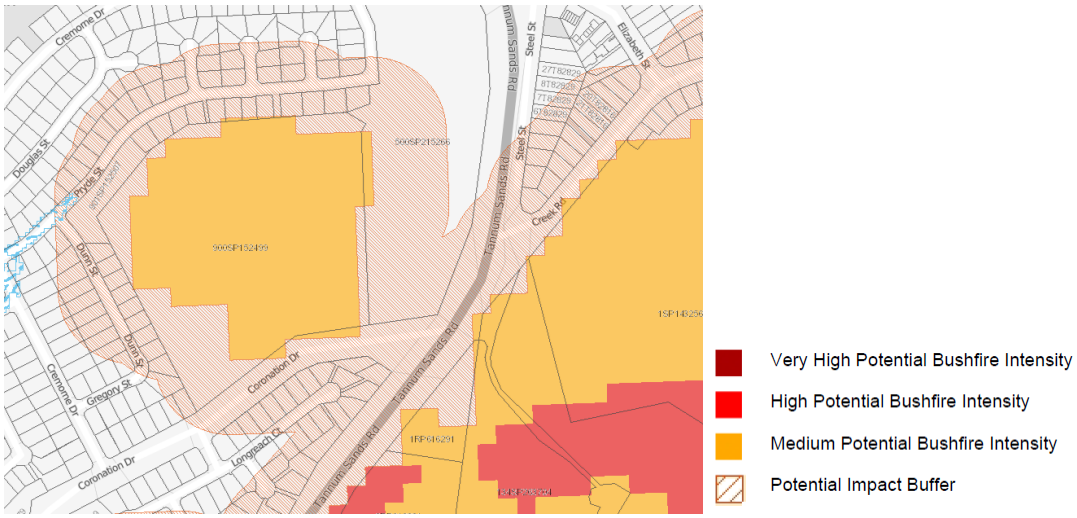

Figure 5-4 Bushfire Overlay mapping (Extract)

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 5-5**.

Figure 5-5 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 Chapter 7 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

The site is not mapped as an erosion prone area or a storm tide inundation area.

5.12 Cultural Heritage

5.12.1 Desktop Assessment Results

The Cultural Heritage Database and Register desktop search indicated no cultural heritage artefacts or points have been recorded within the search area.

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

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, and **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.

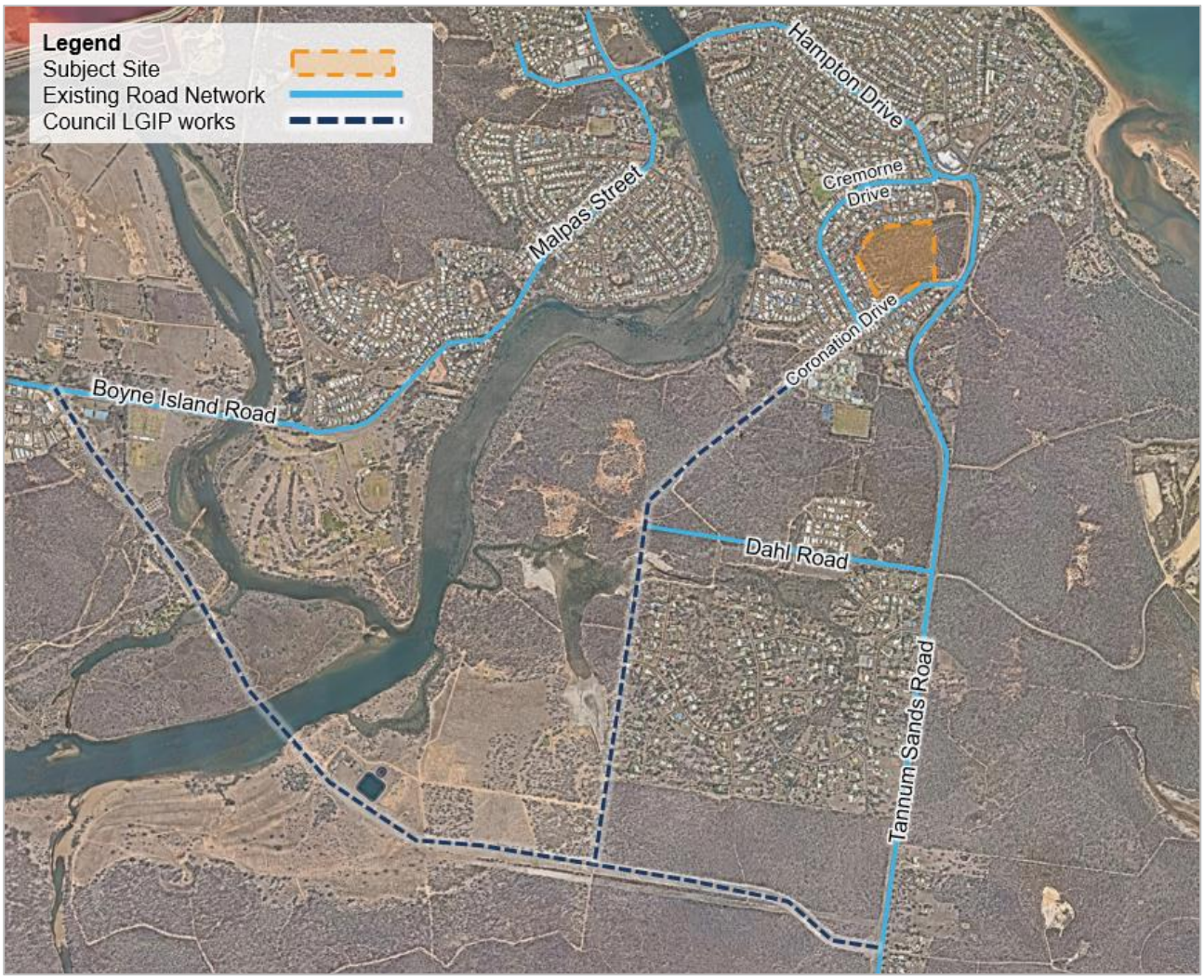

Figure 6-2 Surrounding Road Network and Council LGIP
Note the site boundary is indicative only. Source: Nearmap.

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.

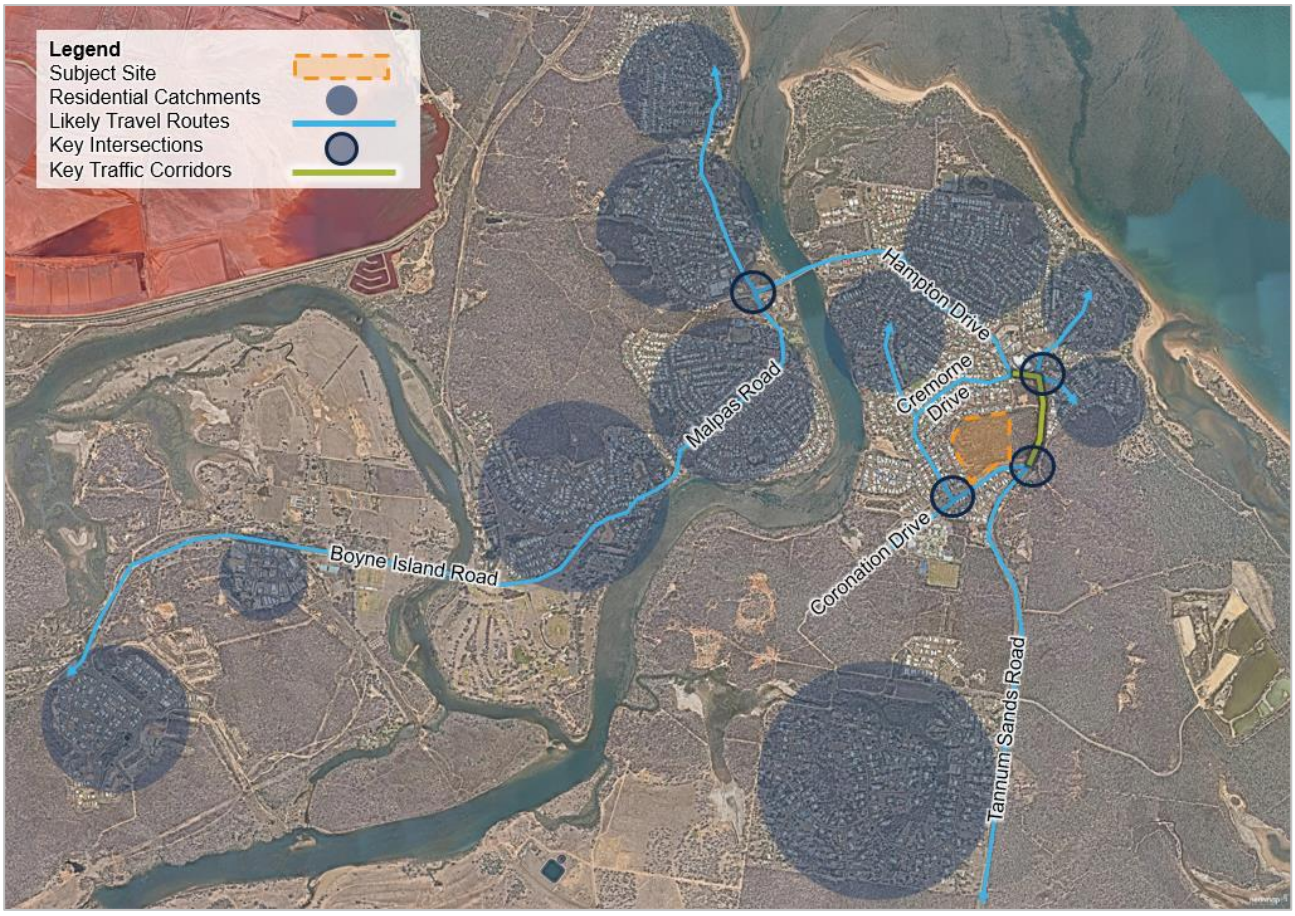

Figure 6-3 Surrounding catchments and travel routes to/from site
Note the site boundary is indicative only. Source: Nearmap.

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

- Coronation Drive / Cremone Drive intersection
- Tannum Sands Road / Coronation Drive intersection
- Tannum Sands Road / Hampton Drive roundabout
- Hampton Drive / Malpas Street intersection
- Tannum Sands Road between Coronation Drive and Hampton Drive
- Hampton Drive between Tannum Sands Road and Cremone Drive

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. **Table 6-2** 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 information.

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

Road Name	Traffic Lanes (bi-directional)	Road Hierarchy	Daily Capacity Threshold[1]	Traffic Data Available[2]
Coronation Drive	2	Urban 2 Lane Distributor	6,000vpd	No
Cremone Drive	2	Urban 2 Lane Distributor	6,000vpd	Yes

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 Coronation Drive along its southern boundary, with no existing driveways that provide vehicular access to the site.

Figure 6-4 Site Frontage

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

With direct frontage to only one road, primary vehicular access will have to be achieved via Coronation 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.

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 intersections with Winton Way and Cremone Drive (to the west), and Tannum Sands Road (to the east).

6.2.3 Sight Distance

A review of the sight visibility on Coronation 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 65 metres (for 60 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 151 metres (assuming 70km/h design speed).

With a slight curve alignment, and crest located approximately 100 metres west of Tannum Sands Road, the minimum sight distance requirements can be achieved in both directions, along the majority of the site frontage on Coronation Drive.

Figure 6-5 illustrates the preferred locations for the site to gain access, highlighting which locations will achieve 65 metres and 151 metres sight distance.

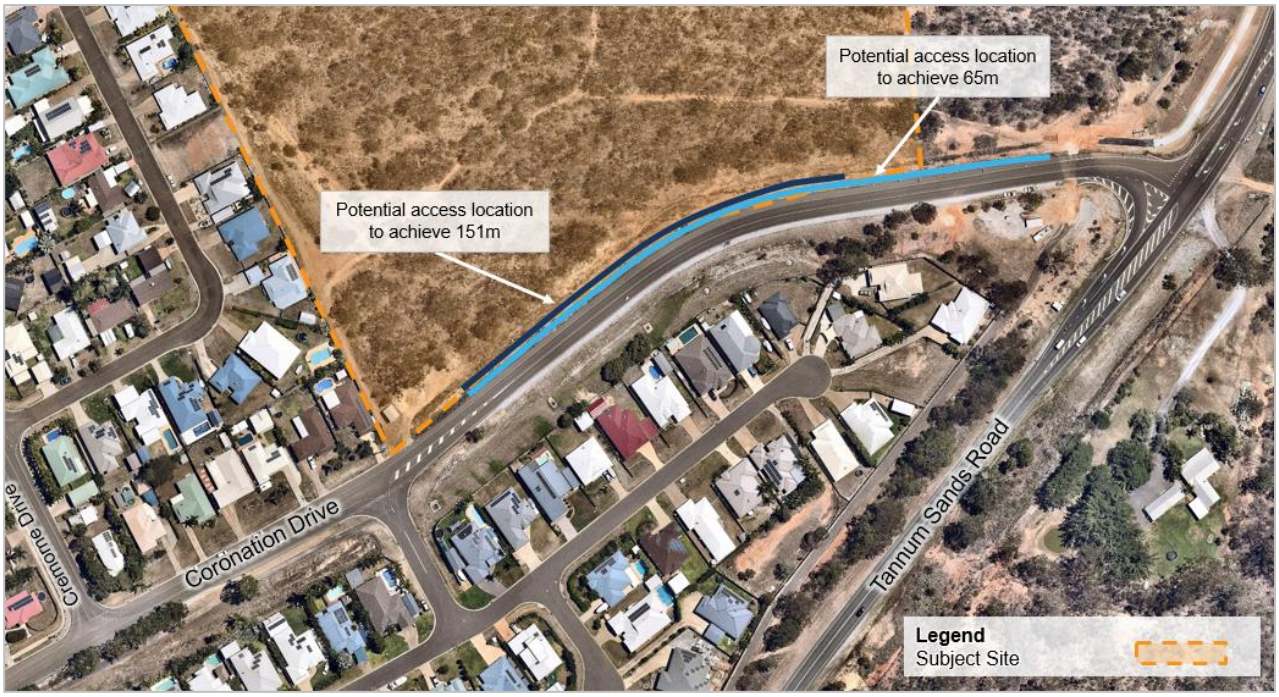

Figure 6-5 Potential access location to achieve sight distance
Note the site boundary is indicative only. Source: Nearmap.

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 in **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).

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.

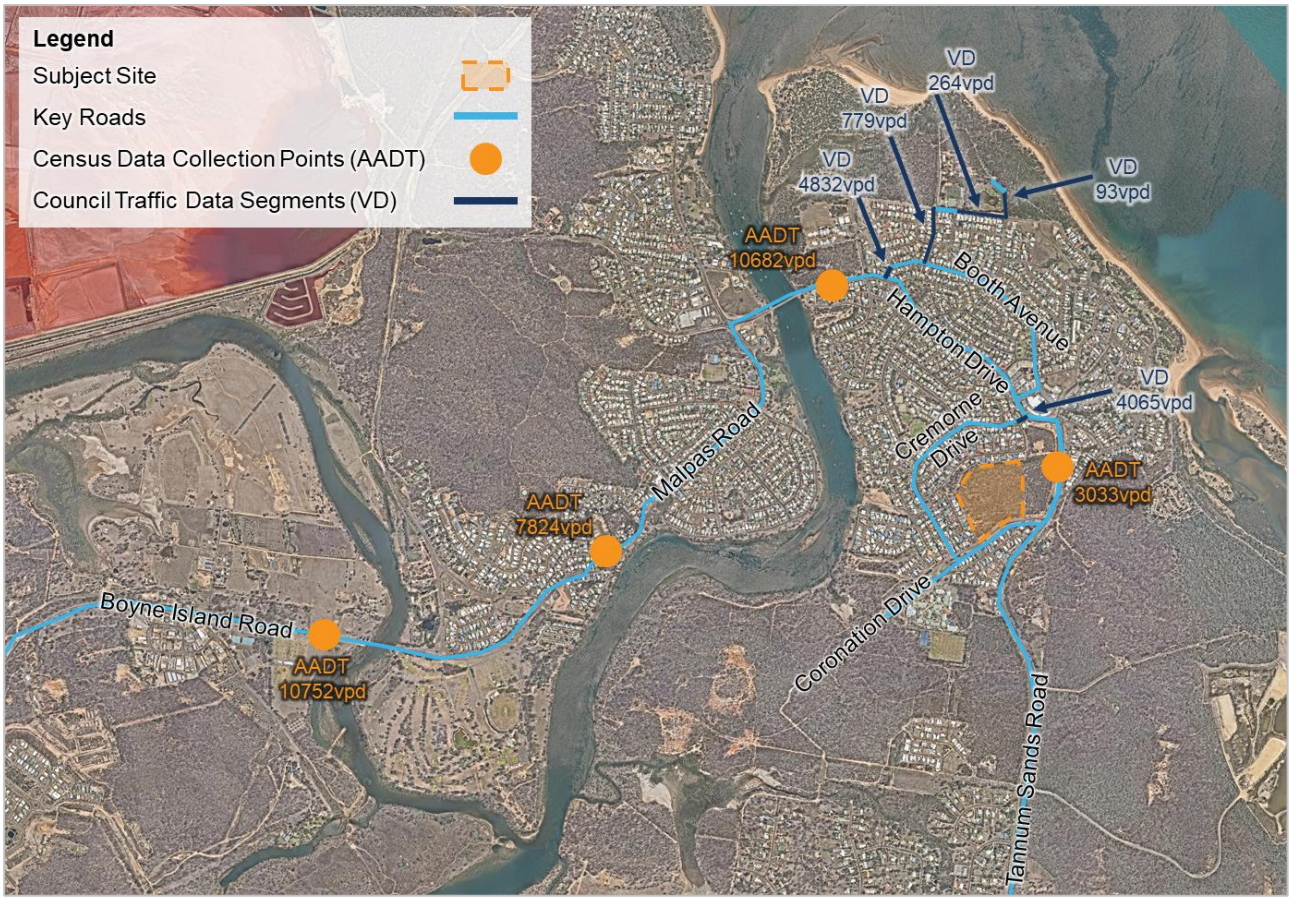

Figure 6-6 Available traffic data
Note the site boundary is indicative only. Source: Nearmap.

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 intersections and traffic corridors may experience an increase of traffic, and may require further investigations. These locations include the following:

- Coronation Drive / Cremone Drive intersection
- Tannum Sands Road / Coronation Drive intersection
- Tannum Sands Road / Hampton Drive roundabout
- Hampton Drive / Malpas Street intersection
- Tannum Sands Road between Coronation Drive and Hampton Drive
- Hampton Drive between Tannum Sands Road and Cremone Drive

Based on the virtual vehicle daily data provided by Council, Cremone Drive (between Hampton Drive and Pryde Street) is currently operating under its theoretical daily capacity threshold of 6,000vpd, as follows:

- Cremone Drive: 4,065vpd (2017) = available capacity of 1,935vpd

Furthermore, based on the TMR 2018 traffic census data, Tannum Sands Road and Hampton Drive are currently operating under their theoretical daily capacity thresholds of 18,000vpd, as follows:

- Tannum Sands Road: 3,033vpd (2018) = available capacity of 14,967vpd
- Hampton Drive: 10,682vpd (2018) = available capacity of 7,318vpd

On the basis of the above, there is available capacity on the key 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 Coronation Drive / Tannum Sands intersection, which is currently a priority controlled intersection. The next likely upgrade, if required, would be signalisation. This could be achieved with the provision of signal infrastructure on its current configuration.

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 Tannum Central shopping centre, this parking is intended for customer use only, and is located outside of the typically acceptable 400 metre radius walking catchment.

There is limited on-street parking around the site, comprising of formalised parking on Cremone Drive and informal parking on the minor streets connecting to Cremone Drive.

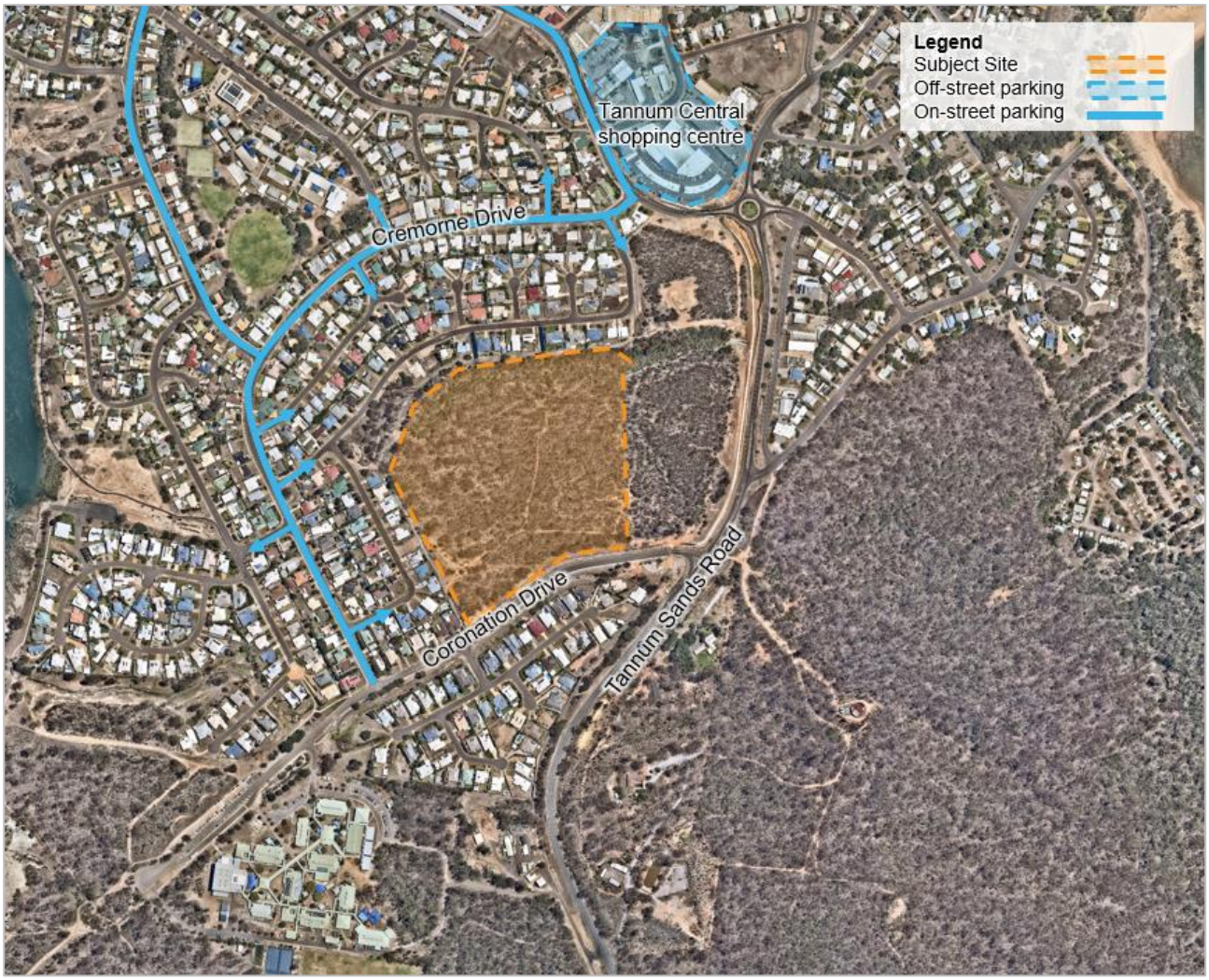

Figure 6-7 Available Car Parking Facilities
Note the site boundary is indicative only. Source: Nearmap.

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 in **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 have 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.

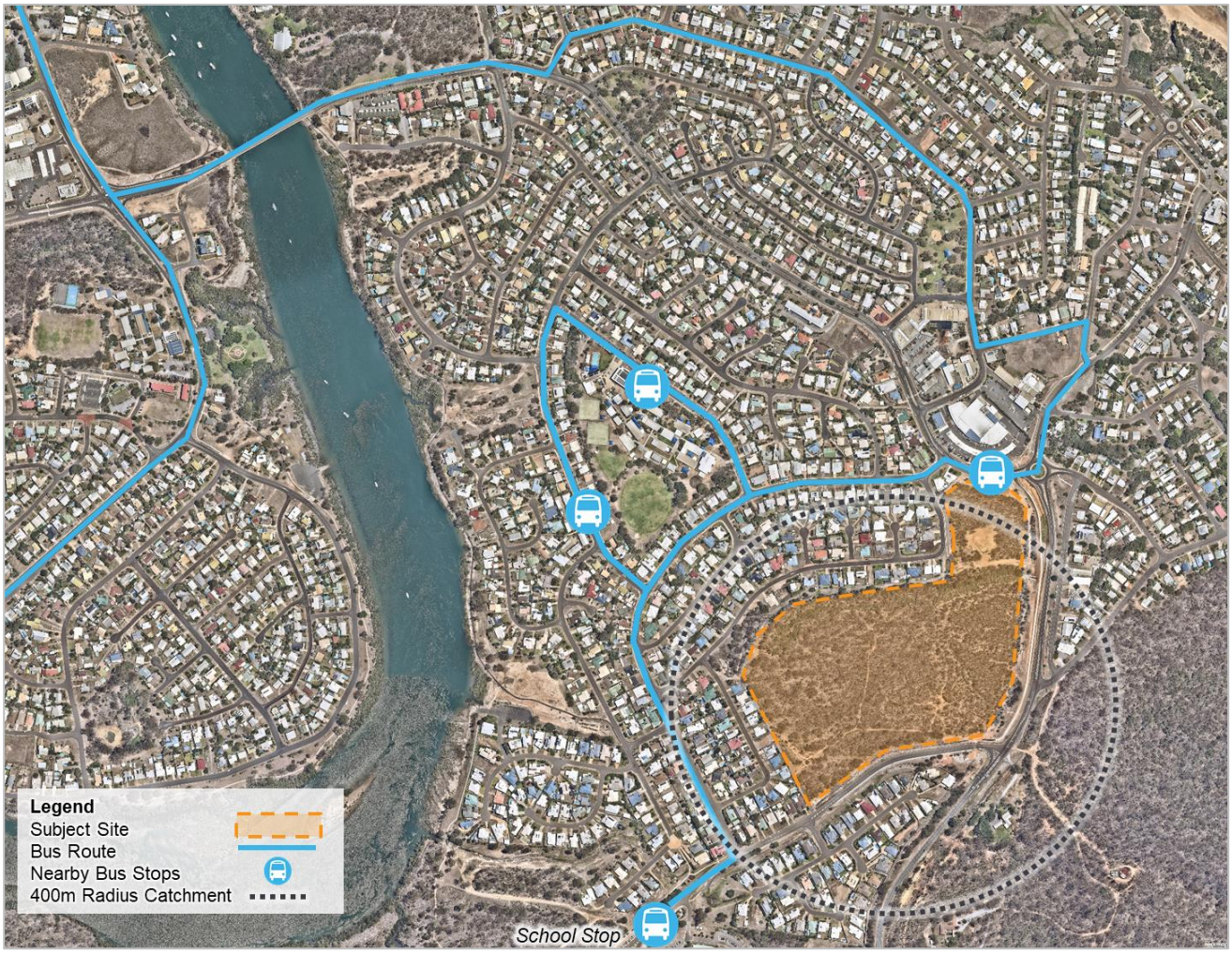

Figure 6-8 Public Transport Services

Note the site boundary is indicative only Source: Nearmap.

As shown in **Figure 6-8**, there are no bus stops located within the 400 metre radius catchment. As such, it is recommended to provide a bus stop closer to the site frontage on Coronation Drive.

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 is well-connected with pedestrian footpaths including Cremone Drive and Tannum Sands Road, which provides a connection to the Tannum Central shopping centre. However there are no pedestrian connections along the site frontage, therefore it is recommended to provide a pedestrian footpath along the site frontage on Coronation Drive to connect with the new footpaths on Tannum Sands Road.

Furthermore, there are no on-street cycling facilities within proximity to the site. Therefore, 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 primarily of Early Carboniferous residual soils and weathered rock, primarily recovered as clays, gravels and sands from the Shoalwater Formation, part of the Curtis Island Group. This is likely overlying quartzose sandstone, mudstone and localised quartz-muscovite-biotite schists (sourced from MapInfo). **Figure 7-1** shows the regional geology with approximate locations of the three potential aquatic centre sites shown in red.

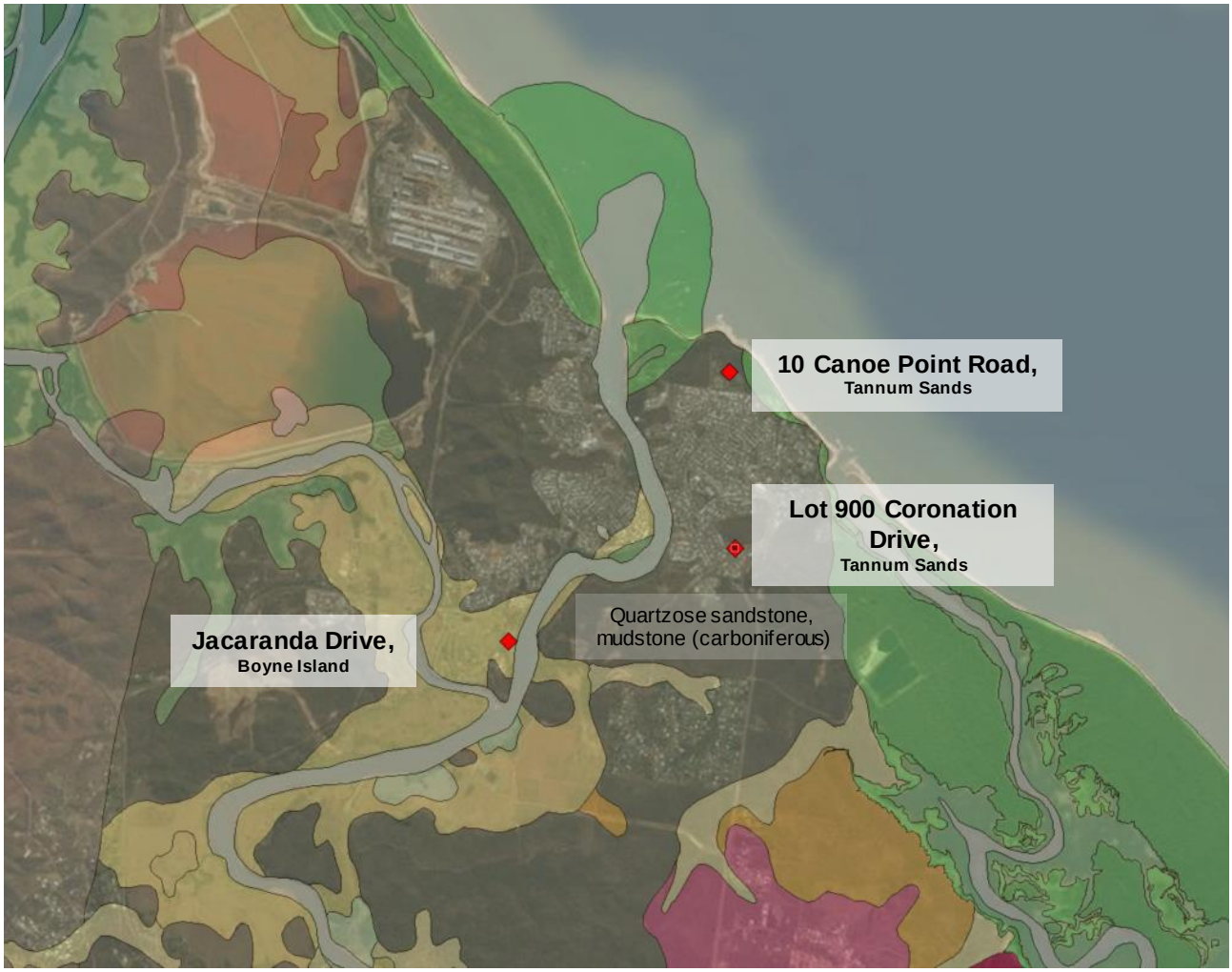

Figure 7-1 Regional Geology of Boyne Island and Tannum Sands (source MapInfo, Bing Maps)

7.1.2 Contaminated Land

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 900 on SP152499) as well as lots immediately adjacent to the site.

While the site in question is vacant (vegetated), the area surrounding the lot consists of low density residential dwellings. 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 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 encountered primarily consists of residual soils recovered as sandy clayey gravel and clayey gravelly sand. In BH05, at lower elevation, colluvium (recovered as sandy silt with gravel) was encountered from 0 metres to 0.7 metres. Extremely weathered rock was shallow in the ground profile, encountered from surface in BH02 and BH03 and from 0.5 metres to 1.4 metres below ground level in the remaining boreholes. The presence of this shallow weathered rock caused early termination due to auger refusal.

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 good throughout the year. The clay component of the subsurface materials may cause poor trafficability in wet weather, however the gravel component of the residual soil and extremely weathered rock should enable trafficability in adverse weather. 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 3 and 2 were found in BH01 and BH05, respectively. 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 of residual soil and colluvium is expected to be excavatable using standard construction machinery. Ripping may be required in the extremely weathered rock. If deeper excavation is required, beyond the termination depth of the investigation, more difficult ripping conditions may be expected.

7.3.4 Foundation Design

The presence of extremely weathered rock near the surface is likely to be suitable for shallow foundations for low-set buildings. An allowable bearing capacity of 100-150kPa is suitable for the assessed colluvium and residual soils, respectively.

7.3.5 Pavement Design

The pavement subgrade is likely to be in the residual soil profile where a CBR of 16% was found in the BH05 sample. Given that the CBR of the sample taken in extremely weathered rock in BH04 was 60%, 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 5-5**.

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 shallow weathered rock	▪ Excavatability of rock may require heavy machinery ▪ Limited information on the quality of rock at depth from investigation due to auger refusal	Careful siting of structures to complement the existing ground contours and thus avoid deep excavation.
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 Lot 900 Coronation Drive, Tannum Sands 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

stephen.whitaker@cardno.com.au

APPENDIX

A

CONSTRUCTION SCIENCES REPORT

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

Construction Sciences

3/12/2019

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
20 Dunn Street, Tannum Sands, QLD

At the request of Cardno, Construction Sciences conducted a geotechnical investigation for the proposed Aquatic Centre project located at 20 Dunn Street, Tannum Sands. 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 (BH1 to BH5) to a target 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	COLLUVIUM	RESIDUAL		WEATHERED ROCK	TD (m)	Termination Condition
	Sandy SILT with Gravel (ML)	Sandy Clayey GRAVEL (GC)	Clayey Gravelly SAND (SC)	XW		
BH1	-	0.0-1.4	-	1.4-TD	1.75	XW ROCK
BH2	-	-	-	0.0-TD	0.5	XW ROCK
BH3	-	-	-	0.0-TD	0.5	XW ROCK
BH4	-	0.0-0.5	-	0.0-TD	0.7	XW ROCK
BH5	0.0-0.7	-	0.7-1.2	1.2-TD	1.75	XW ROCK

NOTES:
1) TD - Termination Depth
2) XW - Extremely Weathered
3) 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, Atterberg Limits and Emerson Class
- 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 1	0.0-1.4	35	7.0	12	72	55	37	3
BH 5	0.0-0.7	24	5.0	8	88	80	52	3

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

Test Location	Profile Depth	pH_F	pH_{FOX}	pH Shift	Reaction
BH 1	0.00-0.25	7.3	3.8	3.5	3
	0.25-0.5	6.4	3.7	2.7	3
	0.50-0.75	5.8	3.6	2.2	3
	0.75-1.00	5.8	3.7	2.1	3
	1-1.25	5.5	3.9	1.6	3
	1.25-1.5	5.6	3.8	1.8	3
	1.5-1.75	5.3	3.9	1.4	3
BH 2	0.00-0.25	6.1	4.0	2.1	3
	0.25-0.5	6.4	3.9	2.5	3
BH 3	0.00-0.25	5.8	3.6	2.2	3
	0.25-0.5	5.8	3.2	2.6	3
BH 4	0.00-0.25	5.7	3.4	2.3	3
	0.25-0.5	5.6	3.6	2.0	3
	0.5-0.75	6.3	3.9	2.4	3
BH 5	0.00-0.25	5.8	2.6	3.2	3
	0.25-0.5	6.1	3.2	2.9	3
	0.50-0.75	6.2	3.7	2.5	3
	0.75-1.00	6.3	4.0	2.3	3
	1-1.25	6.3	4.2	2.1	3
	1.25-1.5	5.9	4.4	1.5	3
	1.5-1.75	6.4	4.4	2.0	3

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 4	0.0-0.5	2.11	8.0	60
BH 5	0.4-0.7	1.90	12.5	16

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 2) – Canoe Point Road

BOREHOLE NUMBER BH 1

Construction Sciences

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

PROJECT NUMBER 2128E/P/1080A **PROJECT LOCATION** 20 Dunn Street, Tannum Sands

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 (RESIDUAL) fine to coarse grained subangular to angular gravel, brown orange, fine to coarse grained sand, low plasticity fines, dry, very dense.	1 x DISTURBED SAMPLE	23 25+ REFUSAL
			1.0					
			1.5		XW	XW ROCK extremely weathered rock, brown orange mottle grey, excavated as Sandy Clayey Gravel.		
			2.0			BOREHOLE BH1 TERMINATED AT 1.75m - AUGER REFUSAL		
			2.5					
			3.0					
			3.5					
			4.0					
			4.5					
			5.0					
			5.5					

BOREHOLE NUMBER BH 2

Construction Sciences

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

PROJECT NUMBER 2128E/P/1080A **PROJECT LOCATION** 20 Dunn Street, Tannum Sands

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		XW	XW ROCK extremely weathered rock, brown orange mottle grey, excavated as Sandy Clayey Gravel.		25+ REFUSAL
						BOREHOLE BH2 TERMINATED AT 0.5m - AUGER REFUSAL		
			1.0					
			1.5					
			2.0					
			2.5					
			3.0					
			3.5					
			4.0					
			4.5					
			5.0					
			5.5					

BOREHOLE NUMBER BH 3

Construction Sciences

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

PROJECT NUMBER 2128E/P/1080A **PROJECT LOCATION** 20 Dunn Street, Tannum Sands

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		XW	XW ROCK extremely weathered rock, brown orange mottle grey, excavated as Sandy Clayey Gravel.		REFUSAL - HAMMER BOUNCING
						BOREHOLE BH3 TERMINATED AT 0.5m - AUGER REFUSAL		

1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5

BOREHOLE NUMBER BH 4

Construction Sciences

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

PROJECT NUMBER 2128E/P/1080A **PROJECT LOCATION** 20 Dunn Street, Tannum Sands

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 (RESIDUAL) fine to coarse grained subangular gravel, brown orange, fine to coarse grained sand, low plasticity fines, dry, very dense.	1x BULK SAMPLE	22 26+ REFUSAL
					XW	XW ROCK extremely weathered, brown grey, very low strength, excavated as Gravelly Silty Sand.		
			1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5			BOREHOLE BH4 TERMINATED AT 0.7m - AUGER REFUSAL		

BOREHOLE NUMBER BH 5

Construction Sciences

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

PROJECT NUMBER 2128E/P/1080A **PROJECT LOCATION** 20 Dunn Street, Tannum Sands

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		ML	Sandy SILT with Gravel (COLLUVIUM) low plasticity, grey, fine to coarse grained sand, friable, with fine grained subangular gravel, dry, hard.	1x DISTURBED SAMPLE, 1x BULK SAMPLE	12 10 15 18 19 23+ REFUSAL
			1.0		SC	Clayey Gravelly SAND (RESIDUAL) fine to coarse grained sand, grey brown, low plasticity fines, fine to medium coarse grained subangular to angular gravel, dry, very dense.	1x DISTURBED SAMPLE	
			1.5		XW	XW ROCK extremely weathered rock, brown orange mottle grey, excavated as Sandy Clayey Gravel.		
			2.0			BOREHOLE BH5 TERMINATED AT 1.75m - AUGER REFUSAL		
			2.5					
			3.0					
			3.5					
			4.0					
			4.5					
			5.0					
			5.5					

Construction Sciences

Construction Sciences Pty Ltd
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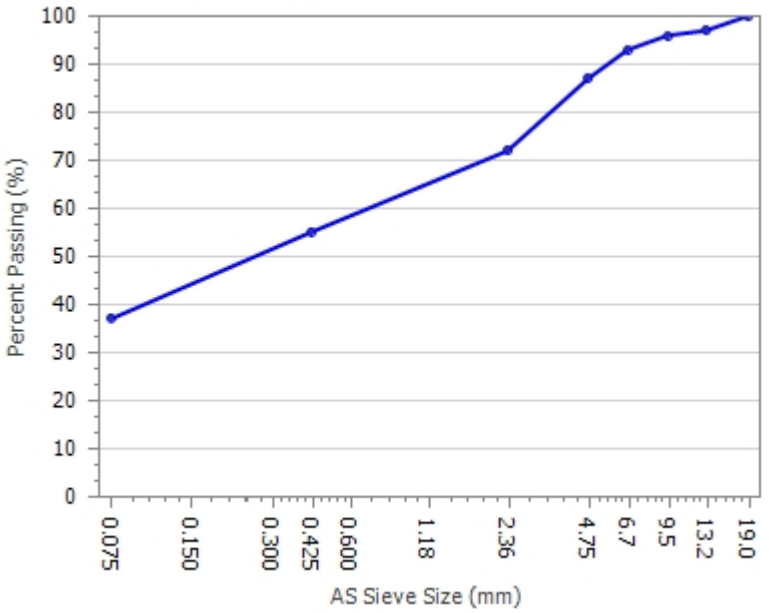
QUALITY OF MATERIALS REPORT

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 1 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/89155	Bore Hole No.	BH 1
Sampling Method	Tested As Received	Depth (m)	0.0-1.4m
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
19.0		**100**	
13.2		**97**	
9.5		**96**	
6.7		**93**	
4.75		**87**	
2.36		**72**	
0.425		**55**	
0.075		**37**	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum	**Result**	Specification Maximum	Test Result	Specification Minimum	**Result**	Specification Maximum
Liquid Limit (%)		**35**		0.075/0.425 Fines Ratio		**0.68**	
Plastic Limit (%)		**23**		Weighted PI (%)		**656.1**	
Plastic Index (%)		**12**		LS x 0.425 Ratio (%)		**382.7**	
Linear Shrinkage (%)		**7.0**		Linear Shrinkage Defects	-		

Remarks	Results apply to the sample/s as received.

NATA

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

Construction Sciences Pty Ltd
ABN: 74 128 806 735

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101 High Street,
North Rockhampton QLD 4701

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

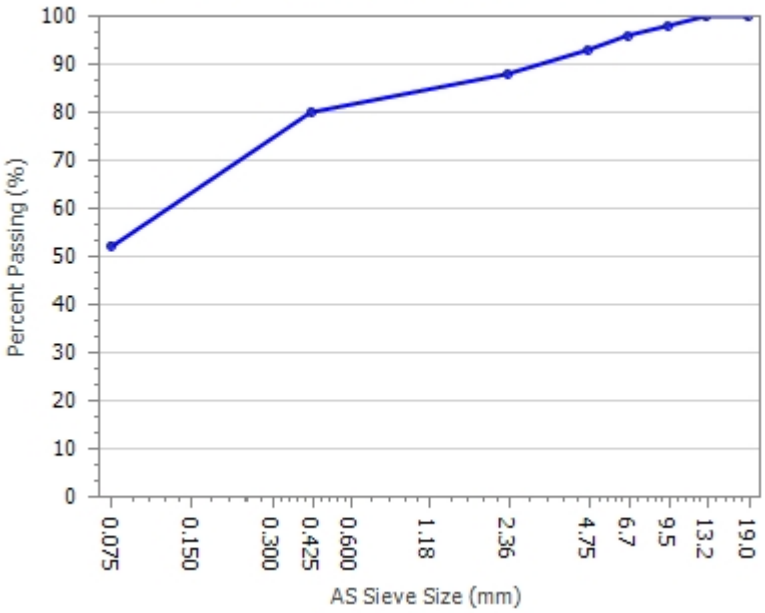
QUALITY OF MATERIALS REPORT

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 2 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/89156	Bore Hole No.	BH 5
Sampling Method	Tested As Received	Depth (m)	0.0-0.7m
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
19.0		**100**	
13.2		**100**	
9.5		**98**	
6.7		**96**	
4.75		**93**	
2.36		**88**	
0.425		**80**	
0.075		**52**	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum	**Result**	Specification Maximum	Test Result	Specification Minimum	**Result**	Specification Maximum
Liquid Limit (%)		**24**		0.075/0.425 Fines Ratio		**0.65**	
Plastic Limit (%)		**16**		Weighted PI (%)		**643.9**	
Plastic Index (%)		**8**		LS x 0.425 Ratio (%)		**402.5**	
Linear Shrinkage (%)		**5.0**		Linear Shrinkage Defects	-		

Remarks	Results apply to the sample/s as received.

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
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Accreditation Number: 1986
Corporate Site Number: 2128

Approved Signatory: Daniel Bryce
Form ID: W85Rep Rev 1

Construction Sciences

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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 1 of 2

Test Procedures:	AS1289.3.8.1

Sample Number	2128/S/89155	2128/S/89156	2128/S/89157	2128/S/89158
ID / Client ID	2128E/S/4355	2128E/S/4356	2128E/S/4357	2128E/S/4358
Lot Number	-	-	-	-
Date / Time Sampled	11/11/2019	11/11/2019	12/11/2019	12/11/2019
Date Tested	26/11/2019	26/11/2019	26/11/2019	26/11/2019
Material Source	Insitu	Insitu	Insitu	Insitu
Material Type	Insitu	Insitu	Insitu	Insitu
Sampling Method	Tested As Received	Tested As Received	Tested As Received	Tested As Received
Water Type	Distilled	Distilled	Distilled	Distilled
Water Temperature (C°)	23	23	23	23
Bore Hole No.	BH 1	BH 5	BH 7	BH 10
Depth (m)	0.0-1.4m	0.0-0.7m	0.5-1.6m	0.0-0.5m
Soil Description	-	-	-	-
Emerson Class Number	**3**	**2**	**2**	**5**

Remarks	Results apply to the sample/s as received.

NATA

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: W34Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
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Address:
8 Kingdon Street,
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Laboratory: **Gladstone Laboratory**
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Email: Gladstone@constructionsciences.net

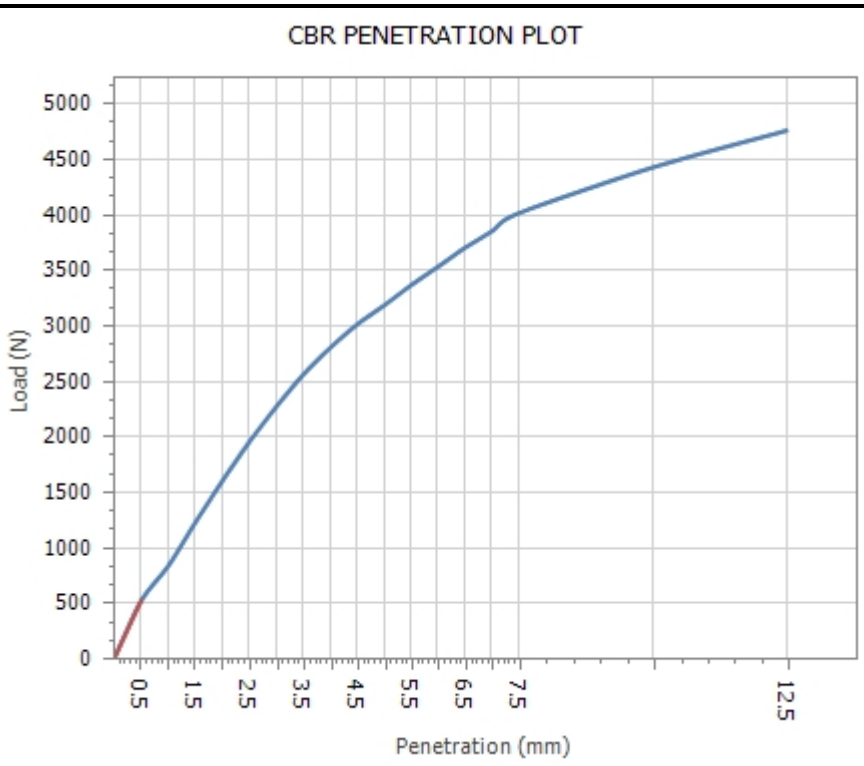
CALIFORNIA BEARING RATIO REPORT

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 4 of 6

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

Sample Number	4708/S/43612	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location	BH 5
Date Sampled	11/11/2019		0.4-0.7m
Sampled By	Nicole Bella		
Date Tested	18/11/2019		
Material Source	-	Material Limit Start	-
Material Type	-	Material Limit End	-
Client Reference	2128E/S/4346	Compactive Effort	Standard
Material Description	Brown Gravelly Sand		

Maximum Dry Density (t/m³):	1.90
Optimum Moisture Content (%):	12.5
Field Moisture Content (%):	5.9
Sample Percent Oversize (%)	0.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	100
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.89
Placement Dry Density Ratio (%):	100.0
Placement Moisture Content (%):	12.5
Placement Moisture Ratio (%):	101.5
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	4.5
Dry Density After Soak (t/m³):	1.89
Total Curing Time (hrs)	20
Liquid Limit Method	Estimation
Moisture (top 30mm) After Soak (%)	14.0
Moisture (remainder) After Soak (%)	13.7
CBR Swell (%):	0.0
Minimum CBR Specification (%):	-
CBR Value @ 5.0mm (%):	**16**



Remarks

NATA

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

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
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Laboratory: **Gladstone Laboratory**
Phone: 07 4972 6571
Fax: 07 4972 7048
Email: Gladstone@constructionsciences.net

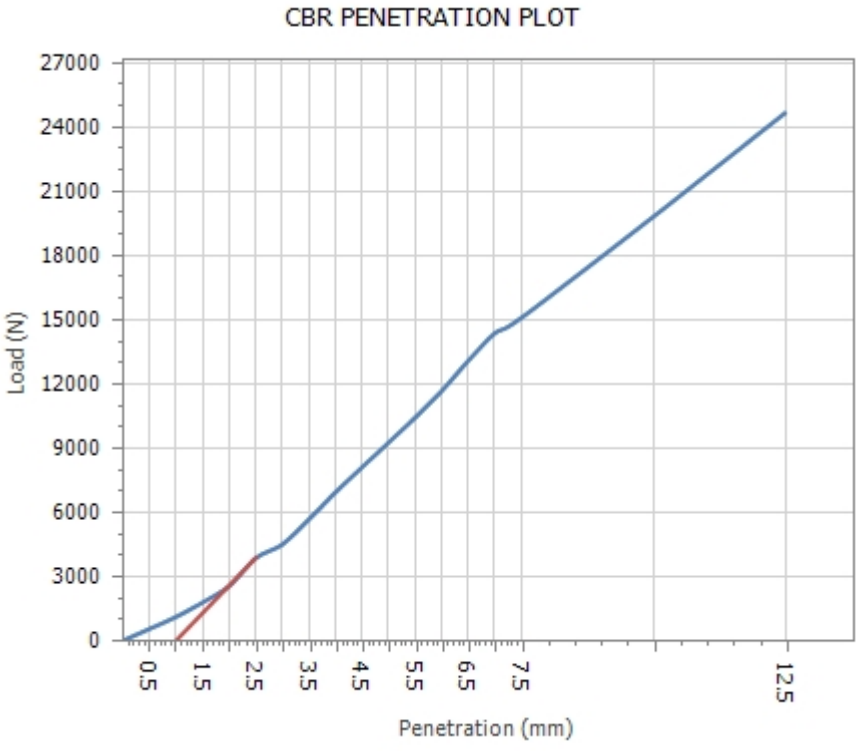
CALIFORNIA BEARING RATIO REPORT

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 5 of 6

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

Sample Number	4708/S/43613	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location	BH 4
Date Sampled	11/11/2019		0.0-0.5m
Sampled By	Nicole Bella		
Date Tested	18/11/2019		
Material Source	-	Material Limit Start	-
Material Type	-	Material Limit End	-
Client Reference	2128E/S/4347	Compactive Effort	Standard
Material Description	Gravelly Silt Brown		

Maximum Dry Density (t/m³):	2.11
Optimum Moisture Content (%):	8.0
Field Moisture Content (%):	2.5
Sample Percent Oversize (%)	0.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	100
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	2.11
Placement Dry Density Ratio (%):	100.0
Placement Moisture Content (%):	7.7
Placement Moisture Ratio (%):	97.5
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	4.5
Dry Density After Soak (t/m³):	2.11
Total Curing Time (hrs)	16
Liquid Limit Method	Estimation
Moisture (top 30mm) After Soak (%)	8.6
Moisture (remainder) After Soak (%)	7.9
CBR Swell (%):	0.0
Minimum CBR Specification (%):	-
CBR Value @ 5.0mm (%):	**60**



Remarks

NATA

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.

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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

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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

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^ = 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: 50573975 EMR Site Id: 04 December 2019
Cheque Number:
Client Reference:

This response relates to a search request received for the site:
Lot: 900 Plan: SP152499
20 DUNN ST
TANNUM SANDS

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