

4 August 2021

TANTABIDDI BOATING FACILITY, NORTH WEST CAPE, WA

FACTUAL GEOTECHNICAL INVESTIGATION REPORT

Department of Transport PER2020-0495AG Rev1

PER2020-0495AG				
Date	Revision	Comments		
30 June 2021	0	Draft Issued for Client Review and Comment		
4 August 2021	1	Final for Issue		

Table of Contents

1	INT	rroduction	1
	1.1 1.2	Scope Project Description Objectives and Scope of Work	1
		LDWORK	
		General	2
	2.2 <i>2.2</i> .	Methodologies	2 2
	2.3	Boreholes	2
		 Drilling and Environmental Considerations Determination of Seabed Levels and Setting Out of Boreholes 	
3	LAE	BORATORY TESTING	6
4	SAI	MPLING BIAS	6
5	CLC	OSURE	6
6	REI	FERENCES	7

Drawings

Drawing 1 – Site Investigation Plan

Drawings 2 to 4 - Cross Sections A to C

Appendices

Appendix A - Operational Photos

Appendix B - Borehole Logs and Photographs

Appendix C - Daily Site Records

Appendix D – Lawful Authority and Disturbance Approval System (DAS)

Appendix E - Marine Fauna Observer Record Sheets

Appendix F – Laboratory Test Results and Results Summary Matrix

1 INTRODUCTION

1.1 Scope

CMW Geosciences Pty Ltd (CMW) was authorised by Department of Transport (DoT), by way of a signed Letter of Acceptance (Panel DOT 404017, Contract No. DOT404017c143) dated 12 March 2021. The scope of work and associated terms and conditions of the engagement were detailed in the CMW tender dated 8 December 2020. Clarifications to the scope were conducted via subsequent email and confirmed in the Contract.

The scope of this report is to provide factual information on the soil and rock conditions that were encountered at the proposed Tantabiddi Boating Facility development site.

1.2 Project Description

The proposed development is based on a revised concept plan and is still to be confirmed. At this stage, the proposed Tantabiddi Boating Facility development is based on a concept plan consisting of a 6-lane boat ramp, passenger loading floating jetty, service jetty and associated landside infrastructure. The development may include either floating mooring pens for the charter industry or dinghy pens to access their charter vessels located on swing moorings to the west of the proposed facility. The exact location of the facility is yet to be confirmed and as such the proposed boreholes covers an area which reflects this position. The development will include the following:

The development will include the following:

- Breakwaters and revetments surrounding the marine infrastructure;
- A six lane boat ramp;
- Service Jetty;
- Passenger loading floating jetty;
- An Entrance Channel, dredged from the existing seabed level to RL-2.65m CD, and the dredging of a basin to RL-2.65m CD; and
- · Car and trailer parking facilities.

The revised concept plan and infrastructure is superimposed on some of the Drawings that form part of this report.

Elevations in this report in the following sections are in metres Australian Height Datum (AHD). CMW have been advised that 0 m AHD is 1.01 m above the local Tantabiddi Chart Datum.

1.3 Objectives and Scope of Work

The objectives of the geotechnical investigations are to provide information to support:

- Confirmation of the geotechnical conditions within the entrance channel alignment and the protected basin;
- Assessment of dredge conditions and suitability of dredge spoil for use as fill in the proposed car/trailer parking area and other areas of fill needed for this development;
- Confirmation of the geotechnical stability of the breakwaters and revetments.

Coordinates for all proposed borehole locations were provided by the DoT and surveyed by CMW Geosciences. Actual coordinates are recorded on borehole logs which in all cases are within 5 m of the proposed location.

CMW Geosciences Ref. PER2020-0495AG Rev1

2 FIELDWORK

2.1 General

The following sections detail the fieldwork that was undertaken. Operational photographs of the fieldwork undertaken is presented in Appendix A. All fieldwork was carried out under the supervision of Engineering Geologists and Geotechnical Engineers from CMW in accordance with AS1726:2017, Geotechnical Site Investigations. The scope of fieldwork completed included the following:

Drilling of 10 diamond cored marine boreholes, denoted BH01 to BH04, BH08, BH10 to BH13 and BH16, to target depths of either 7.0m or 3.0m below Chart Datum (CD), with boreholes drilled up to 7.5m depth below seabed level. Operational photographs are provided for reference in Appendix A. The boreholes were advanced using HQ3 triple tube coring with Standard Penetration Tests (SPT's) conducted at 1.5m intervals where deemed appropriate in soil. Engineering logs, associated field testing and photographs of the core trays are presented in Appendix B;

The approximate locations of the respective investigation locations referred to above are indicated on the Site Investigation Location Plan (Figure 1). Test locations and sea level elevations were measured using a differential GPS to an accuracy of sub-decimetre. Water depth measurement s were made to obtain seabed elevations in order to ensure boreholes were drilled to the required termination elevation. All test locations were selected by the DoT. To avoid seabed disturbance for environmental reasons, the rig was not move multiple times to be exactly on the proposed location. Instead it was driven directly to the desired location in a single operation. This resulted in less accurate positioning of the mast of the rig over the borehole position, but in all instances the actual borehole position was within 5 metres of the proposed location.

2.2 Methodologies

2.2.1 Fieldwork Direction

CMW directed and managed the following field work activities:

- · Daily pre-start meetings and checks;
- Assessing access and positioning to each of the borehole locations in consultation with TAMS and where required the Department for Biodiversity, Conservation and Attractions (DBCA) and commercial owner/ operators;
- Providing Marine Observation duties during seabed drilling operations;
- Confirmation of site survey to mark proposed test locations;
- Drilling activities, confirming all HSE requirements were complied with;
- Logging of the soil and rock materials encountered in the boreholes in accordance with AS 1726:2017; and
- Direction of in situ tests and sampling, including Standard Penetration Tests (SPT's).

2.3 Boreholes

A total of ten (10) boreholes were drilled to target depths of up to 7.50m below seabed level over the period 7 to 13 May 2021. The borehole locations are shown on Drawing 1. The boreholes required the use of modified subsea HQ3 diamond core drilling rig drilled by TAMS, CMW's subcontractor. The boreholes were advanced using HQ3 diamond coring techniques with Standard Penetration Tests (SPT) carried out where deemed appropriate. The drilling rig is capable of working on land, partially submerged, as was the case for intertidal borehole locations and fully submerged for intertidal

boreholes towards highwater and for the boreholes located in deeper water. The driller operates the rig, using diving equipment when the rig is submerged below water.

HQ3 drilling involves advancing a diamond impregnated drill bit attached to a drill stem and connected to a rotary drill. The diamond bit comprises industrial grade diamonds embedded within a soft metallic matrix (usually tungsten and cobalt). Water and muds are injected into the drill pipe during the drilling process to flush the cuttings created by the bit and to reduce heat produced at the drill head. Drill runs were advanced to a maximum length of 1.5m with core recovered using a triple-tube wire-line system. This system involves extracting the core barrel without the need to remove the drill casing. Run lengths were reduced in selected materials to increase core recovery for sampling.

A variety of measures were adopted throughout the drilling campaign to help achieve optimal core/sample recovery from the boreholes. These measures included:

- Shortening of core runs to 1.00m and slowing drilling progress to ensure adequate drilling time to assist in recovering good quality core samples;
- Adjusting feed pressure and rotation speed; and
- Utilising "half finger" and "full fingers" core catchers as required.

The techniques used throughout the drilling campaign were continuously monitored and refined to maximise total core recovery and are detailed in the daily site records in Appendix C.

The Standard Penetration Test (SPT) is an *in situ* dynamic penetration test undertaken through the drill casing to provide an indication of the soil density/consistency as well as to recover a disturbed sample for logging. The SPT cone has an outside diameter of 50.8mm and an inside diameter of 35mm. It is lowered to the base of the borehole and then driven into the ground as a result of a slide hammer weight. The hammer weight is 63.5kg and falls a distance of 760mm. Blow counts are measured every 150mm of penetration with the total test length being 450mm. The sum of the second two increments is the "N-value", which is used to correlate an *in situ* relative density/shear strength (consistency). The SPTs were carried out in accordance with AS1289.6.3.1-2004. It should be noted that one SPT test was carried out with the SPT hammer underwater. At this location associated energy losses would occur and account should be taken when interpreting the SPT N value.

No correction has been made to recorded SPT values presented on borehole logs. SPT hammer energy losses over and above those recorded for SPT values when the SPT hammer is out of the water would occur when the SPT hammer is wholly submerged; this occurred for the following SPT test:

BH08 (0.5m)

The energy losses purely due to the buoyant weight of the steel hammer amount to approximately 13% and a further 20% is estimated due to energy losses from hydrodynamic drag. Assuming a 60% efficient SPT hammer is operated in air the same hammer would be only approximately 40% energy efficient when operated in seawater. A correction factor Co of approximately 0.6 to 0.7 needs to be applied to correct SPTs conducted with a submersed SPT hammer to an equivalent N_{60} value.

Relative density/ consistency descriptions on the borehole logs have been derived after applying the energy loss correction factor and considering the effective overburden pressure at the depth of the test.

CMW's Geotechnical Site Manager (Principal Engineering Geologist) was present throughout the drilling programme to direct, log, photograph, package and bag samples.

Operational photos of the drilling campaign are shown in Appendix A. Final borehole logs with associated field testing and photographs are presented in Appendix B along with a list of relevant notes and abbreviations used on the logs.

Note that all soil and rock descriptions are described in accordance with Australian Standard AS1726.

A summary of the marine boreholes is presented in Table 1 below. Note borehole numbers are not consecutive. There are no boreholes BH5, BH6, BH7, BH9, BH14 or BH15.

Table 1: Summary of Marine Boreholes					
Borehole Number	Easting GDA2020	Northing GDA2020	Target Termination Depth (m below CD)	Actual Termination Depth (m below CD)	Depth of BH below seabed (m)
BH01	807136.1	7573581.7	7.00	7.73	7.50
BH02	807186.8	7573708.0	7.00	7.30	7.00
BH03	807249.8	7573679.0	7.00	7.32	7.00
BH04	807339.9	7573855.3	3.00	3.33	3.00
BH08	807579.0	7573978.9	3.00	3.56	3.00
BH10	807257.4	7574115.2	3.00	3.89	1.50
BH11	807197.4	7574299.6	3.00	3.50	1.50
BH12	807086.2	7573682.8	3.00	3.89	3.20
BH13	807288.6	7573779.0	3.00	3.69	3.10
BH16	807273.3	7573875.6	3.00	4.09	3.00

2.3.1 Drilling and Environmental Considerations

All drilling works were carried out within the Ningaloo Marine Park and as such were subject to the conditions detailed in the following Lawful Authority and Disturbance Approval System (DAS) issued by the Department of Biodiversity, Conservation and Attractions (DBCA) in consultation with the DoT and CMW:

- Lawful Authority to Undertake Core Sampling for Geotechnical Surveys issued 5th May 2021; and
- DAS Approval of Proposal Tantabiddi Boating Facility Geotechnical Investigations P000916 TO UNDERTAKE DISTURBANCE ACTIVITY IN Pilbara – Exmouth issued 4th May 2021.

The following management actions were undertaken during the fieldwork to comply with these conditions:

- 1. Mitigation of potential impact to limestone pavement substrate (i.e. the seabed):
 - a. Prior to the deployment of the 3-point anchor spread to the multicat AMS Boss at its approved mooring location, the AMS1 dive team confirmed that clump weight locations comprised sand only and not coral features. Divers confirmed that clump weights were founded in sand pockets on the seabed. Similarly, divers checked the sea floor for the drill support vessel Charlie Bill prior to deployment of anchors.

- b. Pre-plan access routes prior to tracking of the rig on the seabed to avoid high-value seabed features (e.g. coral) review map data and use of a snorkeller scouting ahead of the rig as it tracks along the seabed.
- c. Utilise rubber tracks on subsea drill rig (standard on TAMS' model).
- d. Rubber tyres were strapped to the underside of the Charlie Bill drill support vessel in the event of the punt touching the seabed bottom in the closest nearshore/ intertidal areas at low tide (this eventuality did not occur during the fieldwork period).
- e. The leading blade at the front of the rig was wrapped in rope to prevent damage to the sea floor at each borehole site when used to steady the rig as the mast is erected. Similarly, the metal mast plate that normally contacts the sea floor had a piece of timber attached to it to prevent damage to the seabed.
- f. Locate subsea rig to only within +/ 5m of borehole locations to avoid unnecessary slewing of rig tracks on limestone pavement which might occur if micro-positioning by slewing using the tracks was undertaken.
- g. Photograph all locations before and after tracking to assess damage to limestone pavement (if any) and to provide a documented record of the impact of the geotechnical survey.
- 2. Mitigation of potential impact to marine fauna:
 - a. CMW's Geotechnical Site Manager undertook competency training as an approved Marine Fauna Observer (MFO) prior to mobilisation to Exmouth.
 - b. Specifically, the MFO training was geared towards observations being undertaken during periods where subsea SPT testing was completed as agreed by the DoT and in consultation with the DBCA during development of the DAS prior to site mobilisation.
 - c. CMW's Geotechnical Site Manager undertook the duties of MFO during fieldwork and monitored threshold distances to stop work if fauna was observed. The management practices recommended in the SA guidelines "Underwater Piling Noise Guidelines" was adopted with the option available to suspend drilling works if marine fauna came within the threshold distances specified in the guidelines during subsea SPT testing.

The Lawful Authority and DAS are reproduced in Appendix D and the Marine Fauna Observer sheets completed during the subsea SPT testing are included as Appendix E.

2.3.2 Determination of Seabed Levels and Setting Out of Boreholes

Prior to fieldwork commencing the DoT supplied CMW with seabed levels inferred at the proposed location of each borehole based on a hydrographic survey of the area commissioned by the DoT in July 2020. During fieldwork CMW took water depth soundings and utilising tide tables derived a seabed level to check for gross differences in the anticipated levels which may have affected scheduled drill depths. Target drill depths were confirmed on site prior to drilling at each borehole location. The DoT subsequently provided CMW with the latest hydrographic survey data from April 2021. Seabed levels noted on the Daily Site Records were subsequently adjusted following receipt of this data from the hydrographic survey. These seabed levels were adopted to derive final borehole termination depths shown in Table 1.

Borehole positions were confirmed on site with initial GPS positioning by TAMS' R1 Trimble differential GPS equipment and confirmed by CMW's Stonex S70G RTK and PPK differential GPS accurate to within +/- 20mm horizontally.

3 LABORATORY TESTING

A programme of soil and rock laboratory testing was carried out on representative soil and rock samples generally in accordance with the requirements of the latest edition of AS1289 (where applicable). Testing was carried out on soil samples selected by CMW and carried out by or under the direction of Western Geotechnical & Laboratory Services Pty Ltd (WGL), a NATA registered laboratory. WGL engaged Tri-lab (Queensland) and E-Precision Laboratory (NATA accredited) to carry out selected tests within the program. A summary of the number and type of laboratory tests scheduled, and the test method adopted is presented in Table 2 below. The test certificates and a Results Summary Matrix are provided in Appendix F.

Table 2: Summary of Soil Laboratory Testing					
Laboratory Test	Quantity	Australian Standard			
Particle Size Distribution (PSD)	2	AS1289.3.6.1			
Calcium Carbonate Content	6	WA915.1			
Quartz Content	2	ASTM D6855			
Cerchar Abrasivity	2	ASTM D7625			
Unconfined Compressive Strength	8	AS4133.4.2.1			
Point Load Index	20	AS4133.4.1			
All test methods NATA Accredited	·	•			

4 SAMPLING BIAS

Consideration must be given to the unavoidable bias that exists from the rock sampling process. In order to undertake laboratory testing, adequate samples must be retrieved from the recovered rock core. These samples must have specific dimensions and must also be high enough strength to withstand the sampling, transport and preparation requirements for the testing. Because of this, the laboratory testing results may ultimately display an overall overestimation of the broader strength of the unit and other characteristics. Laboratory test results must not be used in isolation and must be used in conjunction with the engineering log associated with them. This is particularly important given the variable nature of the material encountered.

There was insufficient testing undertaken to establish a correlation between I₅₅₀ and UCS.

5 CLOSURE

The findings contained within this report are the result of limited discrete investigations conducted in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances can it be considered that these findings represent the actual state of the ground conditions away from our investigation locations.

If the ground conditions encountered during construction are significantly different from those described in this report and on which the conclusions and recommendations were based, then we must be notified immediately.

This factual report has been prepared for use by the Department of Transport in relation to the Tantabiddi Boating Facility, North West Cape, WA in accordance with generally accepted consulting

practice. No other warranty, expressed or implied, is made as to the professional advice included in this report. Use of this report by parties other than the Department of Transport and their respective consultants and contractors is at their risk as it may not contain sufficient information for any other purposes.

For and on behalf of CMW Geosciences Pty Ltd

Tim Robinson

Principal Engineering Geologist

Matthew Tutton

Senior Principal Geotechnical Engineer

Distribution: 1 copy to DoT (electronic)

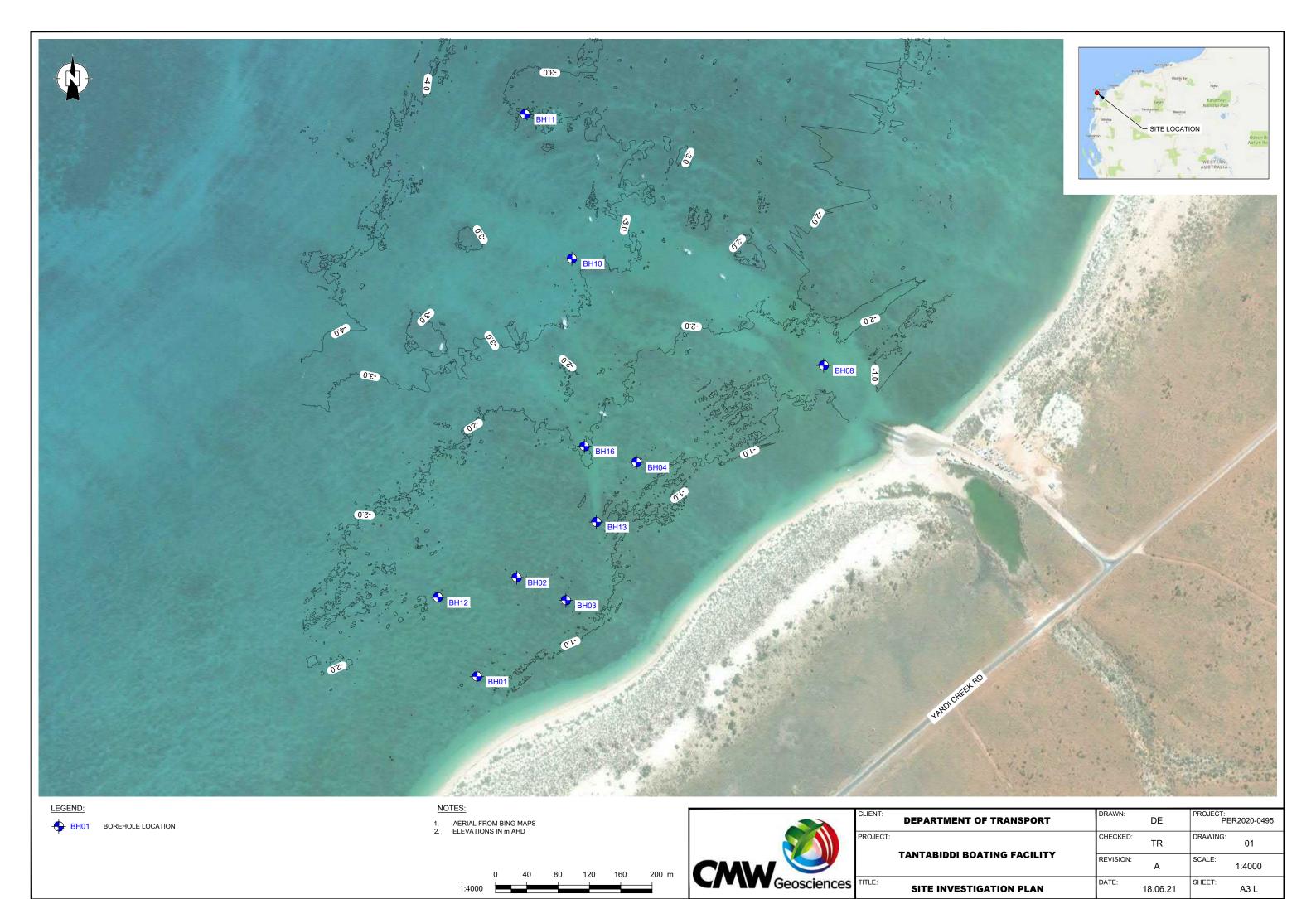
Original held by CMW Geosciences Pty Ltd

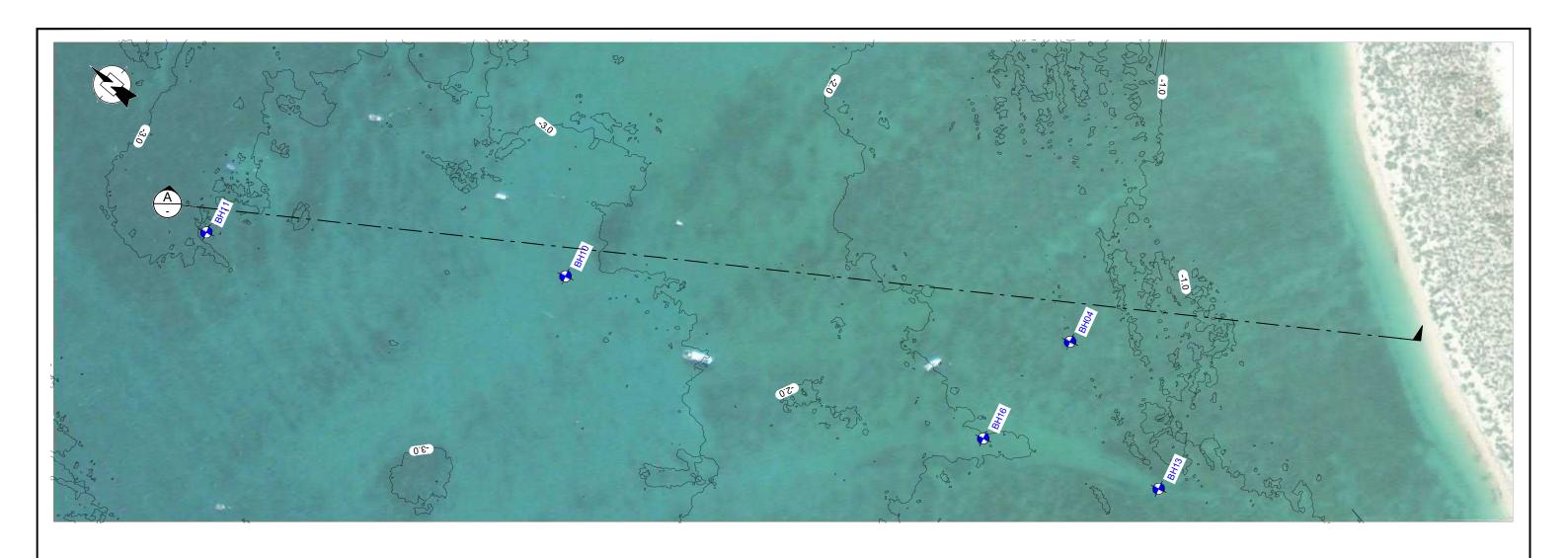


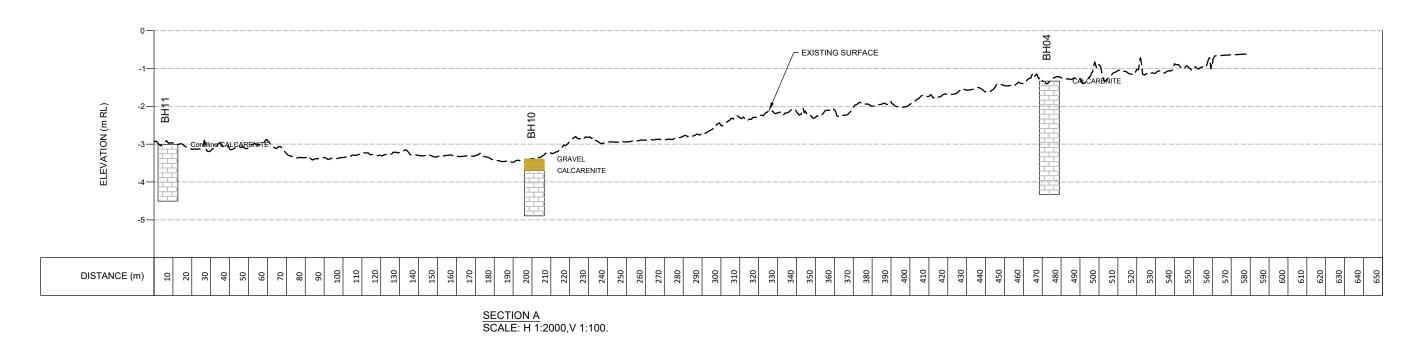
6 REFERENCES

- AS 1289, Methods of testing soils for engineering purposes, Standards Australia, Sydney
- AS 1726, Geotechnical Site Investigations, Standards Australia, Sydney, 2017
- Clark, A.R. and Walker, B.F.: A proposed scheme for the classification and nomenclature for use in the engineering description of Middle Eastern sedimentary rocks. Géotechnique Vol.27, March 1977.
- Government of South Australia: Underwater Piling Noise Guidelines. Version 1, November 2012.

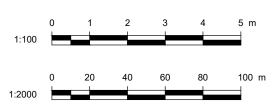
Drawings







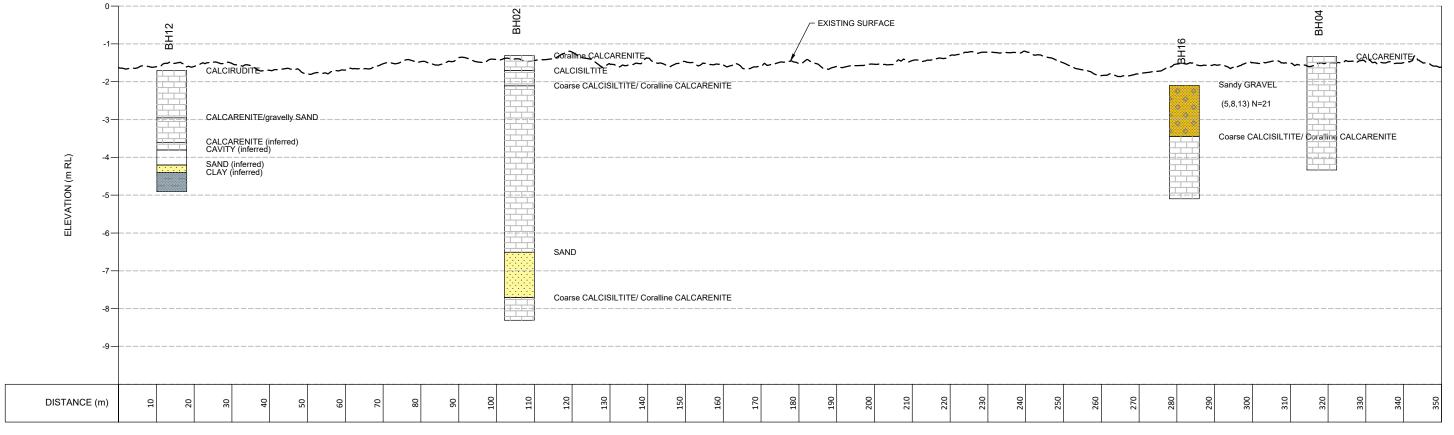
- AERIAL FROM BING MAPS
 ELEVATIONS IN m AHD
 BOREHOLES ARE OFFSET AND PROJECTED ON TO SECTION LINE





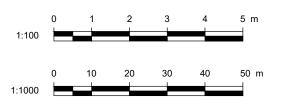
CLIENT:	DEPARTMENT OF TRANSPORT	DRAWN:	DE	PROJECT	: PER2020-0495
PROJECT:	TANTARIRRI ROATING FACILITY	CHECKED:	TR	DRAWING	9: 02
	TANTABIDDI BOATING FACILITY		Α	SCALE:	AS SHOWN
TITLE:	GEOTECHNICAL SECTION A	DATE:	18.06.21	SHEET:	A3 L





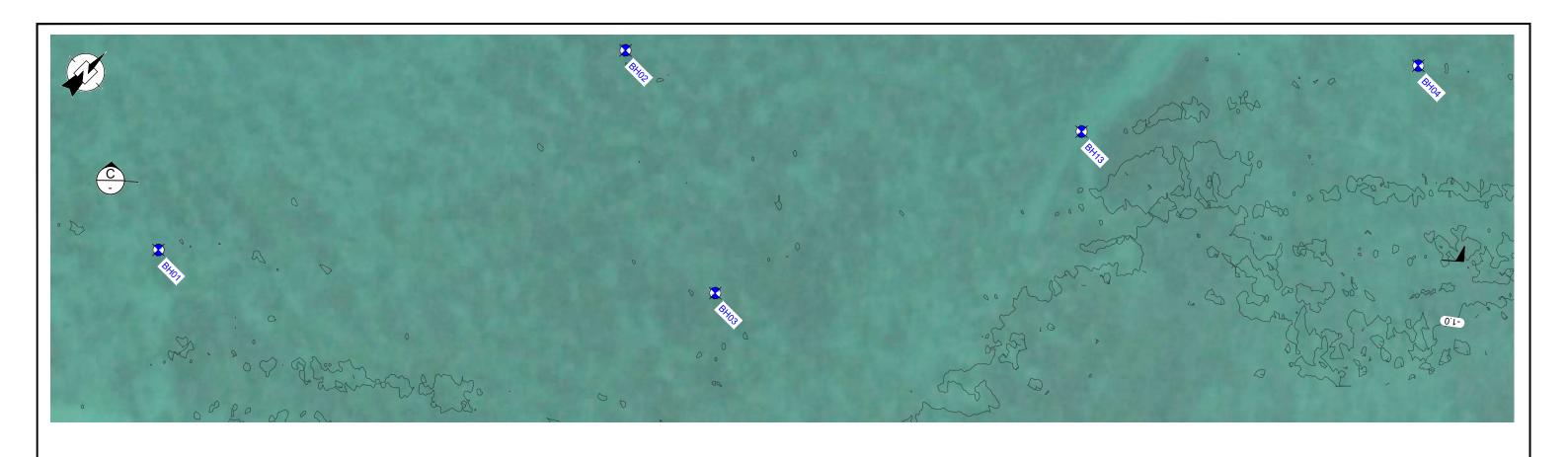
<u>SECTION B</u> SCALE: H 1:1000,V 1:100.

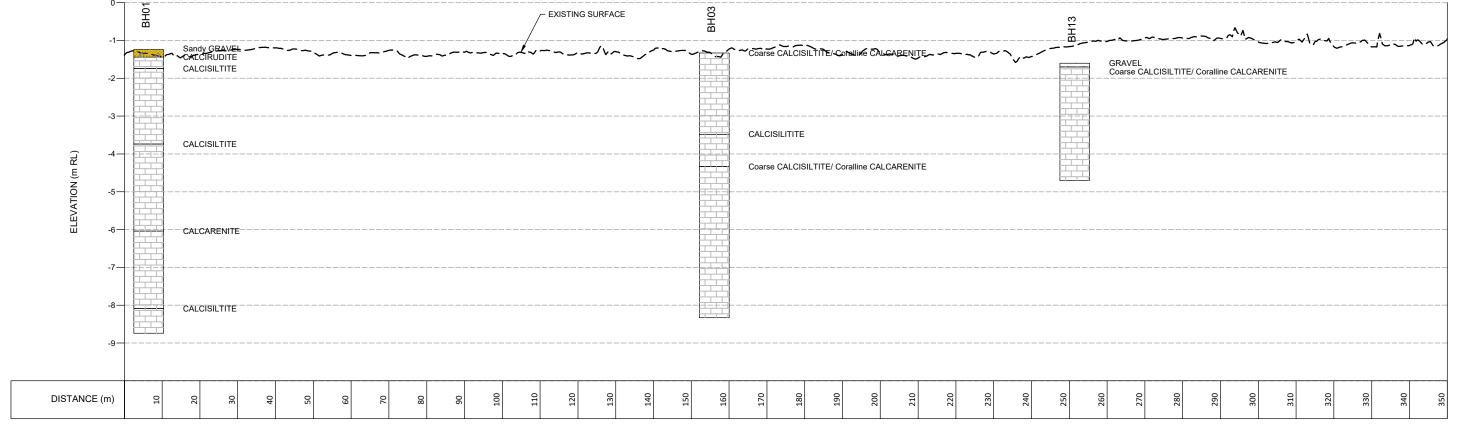
- AERIAL FROM BING MAPS
 ELEVATIONS IN m AHD
 BOREHOLES ARE OFFSET AND PROJECTED ON TO SECTION LINE





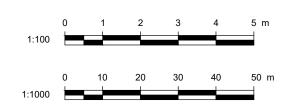
DEPARTMENT OF TRANSPORT	DRAWN:	DE	PROJECT: PER2020-0495
PROJECT:	CHECKED:	TR	DRAWING: 03
TANTABIDDI BOATING FACILITY	REVISION:	Α	SCALE: AS SHOWN
GEOTECHNICAL SECTION B	DATE:	18.06.21	SHEET: A3 L





<u>SECTION C</u> SCALE: H 1:1000,V 1:100.

- AERIAL FROM BING MAPS
 ELEVATIONS IN m AHD
 BOREHOLES ARE OFFSET AND PROJECTED ON TO SECTION LINE





CLIENT:	DEPARTMENT OF TRANSPORT	DRAWN:	DE	PROJECT: PER2020-049	95
PROJECT:	TANTARIRRI ROATING FACILITY	CHECKED:	TR	DRAWING: 04	
	TANTABIDDI BOATING FACILITY		Α	SCALE: AS SHOW	N
TITLE:	GEOTECHNICAL SECTION C	DATE:	18.06.21	SHEET: A3 L	

Appendix A Operational Photos

Appendix A Slide 1

TANTABIDDI BOATING FACILITY- GEOTECHNICAL INVESTIGATION

Marine Drilling Operations at Tantabiddi Boating Facility site, Western Cape, WA – 7th to 13th May 2021



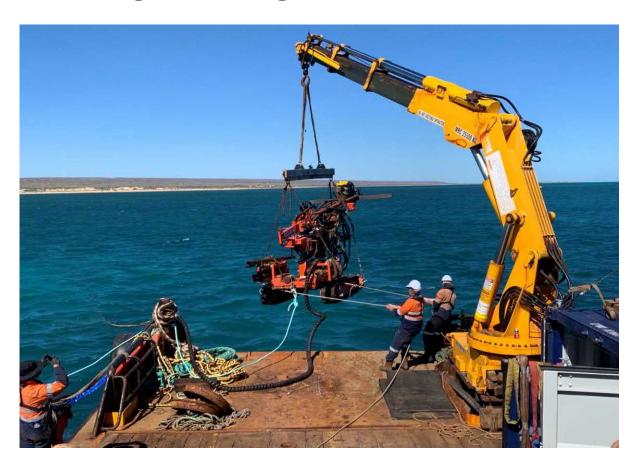


TAMS Diver Support Vessel AMS1 with Drill Support Vessel Charlie Bill in foreground.

Preparation of equipment prior to commencement of drilling operations.



Subsea HQ3 Drill Rig overboarding from the TAMS Multicat AMS Boss





Clump weights on deck of Multicat AMS Boss awaiting to be deployment in 3 point anchor spread at DBCA approved location.

Dive team visually confirmed clump weight anchor locations prior to deployment





Subsea drill rig tracking between BH02 and BH03 with snorkeller checking route ahead of rig.

Timber on metal plate visible at base of mast





Mast erected at position of BH13 in advance of drilling; note timber at base of mast to protect seabed.





Note rope on front blade of subsea drilling rig to prevent abrasion of the sea bed





Subsea drilling rig set-up in position and prepared for coring. Note typical seabed conditions: thin sandy veneer and seaweed.



Diver/ driller recovering core barrel from subsea rig at BH12.





Rear view of subsea rig – note faint impression of rubber track in sandy substrate at lower left.



Calcisitite (fine grained limestone) following extrusion from core barrel being prepared for logging by CMW geologist.



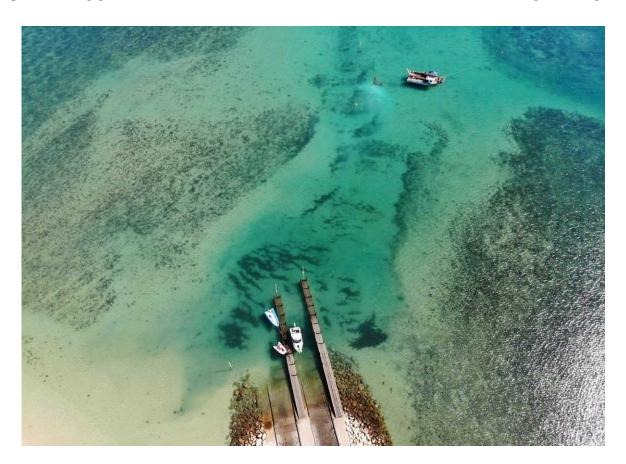


TAMS tender watching / directing commercial and pleasure boat traffic as drilling rig is tracked on to position opposite existing boat ramp at BH08.





Aerial view of setup at BH08 opposite existing boat ramp with rig operations underway and support vessels AMS1 and Charlie Bill anchored in 3 point spread.



Aerial close up of operations at BH08 with support vessels AMS1 and Charlie Bill in attendance.

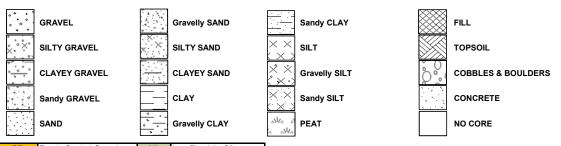




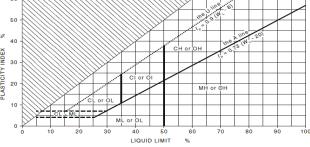
Appendix B Borehole Logs and Photographs

Explanatory Notes – Soil Description





GP	Poorly Graded Gravel	ML	Low Plasticity Silt
GW	Well Graded Gravel	MH	High Plasticity Silt
GM	Silty Gravel	CL	Low Plasticity Clay
GC	Clayey Gravel	CI	Medium Plasticity Clay
SP	Poorly Graded Sand	CH	High Plasticity Clay
SW	Well Graded Sand	OL	Organic Soils (LP)
SM	Silty Sand	ОН	Organic Soils (HP)
SC	Clayey Sand	PT	Peat
	Fill		Cobbles & Boulders



WATER				
•	Groundwater (Strike)	∇	Groundwater (rise)	

CLASSIFICATION AND INFERRED STRATIGRAPHY

Particle Size					
Major Division	Sub Division	Particle Size			
Boulders		> 200 mm			
Cobb	63 to 200 mm				
	Coarse	19 to 63 mm			
Gravel	Medium	6.7 to 19 mm			
	Fine	2.36 to 6.7 mm			
	Coarse	0.6 to 2.36 mm			
Sand	Medium	0.21 to 0.6 mm			
	Fine	0.075 to 0.21 mm			
Sil	Silt				
Cla	Clay				

(Less than 35% Particles < 0.075mm) trace trace	RMS FOR CLAYS/SILTS (More than 35% Particles < 0.075mm)
sand/gravel = <15% san clay/silt = <5%	
clay/silt = <5%	е
,	d/gravel = <15%
with with	
sand/gravel = >15%, <30% san	d/gravel = >15%, <30%
clay/silt = >5%, <12%	
Sandy / Gravelly >30%	
Clayey / Silty >12%	andy / Gravelly >30%

MOISTURE CONDITION	(Cohesionless Soils)
--------------------	----------------------

Symbol	Term	Description
D	Dry	Looks and feels dry. Cohesionless and free- running.
М	Moist	No free water on remoulding. Soil feels cool, darkened in colour. Soil tends to cohere.
w	Wet	Free water on remoulding. Soil feels cool, darkened in colour. Soil tends to cohere.

MOISTURE CONDITION (Cohesive Soils)

Symbol	Term	Description
<pl< th=""><th>Dry</th><th>Looks and feels dry. Hard and friable or powdery, well dry of the plastic limit</th></pl<>	Dry	Looks and feels dry. Hard and friable or powdery, well dry of the plastic limit
≈PL	Moist	Soil feels cool, darkened in colour. Soil can be moulded. Near plastic limit.
>PL	Wet	Soils feels cool, darkened in colour. Usually weakened and free water forms when remoulding. Wet of plastic limit.

DENSITY (Cohesionless Soils)

Sym.	Term	Density Index (%)	SPT 'N'
VL	Very Loose	Less than 15	0 to 4
L	Loose	15 to 35	4 to 10
MD	Medium Dense	35 to 65	10 to 30
D	Dense	65 to 85	30 to 50
VD	Very Dense	Above 85	Above 50

STIFFNESS (Cohesive Soils)

Sym.	Term	Undrained Shear Strength
vs	Very Soft	0 to 12 kPa
s	Soft	12 to 25 kPa
F	Firm	25 to 50 kPa
St	Stiff	50 to 100 kPa
VSt	Very Stiff	100 to 200 kPa

SAMPLING AND LABORATORY / INSITU TESTING RESULTS

В	Bulk Disturbed Sample	U	Undisturbed Push-in Sample	CBR	California Bearing Ratio
BLK	Block Sample	W	Water Sample	ucs	Unconfined Compressive Strength
С	Core Sample	LL	Liquid Limit	PLI	Point Load Index
ES	Environmental Soil Sample	PI	Plasticity Index	N	SPT-N Value
Р	Piston Sample	LS	Linear Shrinkage		

DRILLING/EXCAVATION METHOD

AC	Air Core	HA	Hand Auger	RC	Rotary Cored
ADH	Hollow Auger Drilling	HQ	Rotary Core 63.5mm	RO	Rotary Open Hole
AD/V	Auger with V-Bit	HQ3	Rotary Core 61.1mm	SPT	Standard Penetration Test
AD/T	Auger with TC-Bit	PQ3	Rotary Drill 83mm	TP	Test Pit
DPP	Direct Push Probe	PT	Push Tube	W	Wash Bore

Explanatory Notes – Rock Description



MUDSTONE

XXX
XXX
SILTSTONE

XXX
XXX
SANDSTONE

LIMESTONE
CHALK
BRECCIA

CONGLOMERATE

+ + IGNEOUS

METAMORPHIC



	ROCK MATERIAL STRENGTH					
Symbol	Term	Uniaxial Compressive Strength - UCS (MPa)	Point Load Index - I _{s(50)} (MPa) - GUIDE ONLY	Field Guide		
EL	Extremely Low	Less than 0.6	Less than 0.03	Easily remoulded by hand to a material with soil properties (logged as soil).		
VL	Very Low	0.6 to 2	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 3 cm thick can be broken by finger pressure.		
L	Low	2 to 6	0.1 to 0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150 mm long 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.		
М	Medium	6 to 20	0.3 to 1	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.		
Н	High	20 to 60	1 to 3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.		
VH	Very High	60 to 200	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.		
EH	Extremely High	More than 200	More than 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.		

	WEATHERING CLASSIFICATION			
Symbol	nbol Term Definition			
RS	Residual Soil	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.		
xw	Extremely weathered rock	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.		
HW (or DW)	Highly Weathered	Rock strength usually changed by weathering. The rock may be highly discoloured. Porosity may be increased by leaching, or may be decreased due to deposition of weathering		
MW (or DW)	Moderately Weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognizable, but shows little or no change of strength from fresh rock.		
sw	Slightly weathered rock	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.		
FR	Fresh rock	Rock shows no sign of decomposition or staining.		

CEMENTATION CLASSIFICATION			
Symbol	Term	Definition	
Uc	Uncemented	Clean grains, exhibiting soil properties.	
VWc	Very weakly cemented	Marginal soil-rock strengths, collapsing feel under light finger pressure, cement seen on some washed grains.	
Wc	Weakly Cemented	Collapsing feel under light soil pressure, breaks down to individual grains or with some grains cemented together, cement seen on many washed grains.	
MWk	Moderately Weakly Cemented	Cement on nearly all grains, breaks down to lumps and some individual grains under finger pressure, can crush to individual grains under knife blade.	
Мо	Moderately Cemented	Cement on most grains, can break fragments off by hand and crush to small lumps under knife blade.	
We	Well Cemented	Practically all grains cemented together, cannot break fragments off by hand, dull sound under hammer.	
VWe	Very Well Cemented	Most Primary Pores filled with cement, requires firm blow with hammer to break off fragments, rings when struck	

	ROCK CORE RECOVERY				
Symbol	Term	Definition			
TCR	Total Core Recovery (%)	The ratio of total length of core recovered to length of core run drilled, expressed as a percentage.			
SCR	,	The ratio of the total length of solid cylindrical pieces of core recovered to length of core run drilled, expressed as a percentage.			
RQD	Rock Quality Designation (%)	The ratio of the total length of solid cylindrical pieces of core over 100mm in length recovered to length of core run drilled, expressed as a percentage.			

Explanatory Notes – Defect Description



Defect Type				
ABBREVIATION	ABBREVIATION TERM DEFINITION DIAGRA			
PT	Parting	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (eg bedding). May be open or closed.		
JΤ	Joint	A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed.		
SS	Sheared Surface	A near planar, curved or undulating surface which is usually smooth, polished or slickensided and which shows evidence of shear displacement.		
SZ	Sheared Zone	Zone of rock material with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks.		
cs	Crushed Zone / Seam	Seam of soil material with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock material which may be more weathered than the host rock. The seam has soil properties.	All	
SM	Seam	Seam of soil material usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1 mm thick may be described as a veneer or coating on a joint surface.		

Surface Roughness				
ABBREVIATION	TERM	Description		
VR	Very Rough	Many large irregularities generally > 1 mm		
RO	Rough	Many small irregularities generally > 1 mm		
SM	Smooth	Few or no surface irregularities		
PO	Polished	Shiny smooth surface		
SI	Slickensided/Striated	Grooved/striated surface, usually polished		

Surface Shape		
ABBREVIATION	TERM	Description
PL	Planar	Does not vary in orientation
CU	Curved	gradual change in orientation
UN	Undulating	wavy surface
ST	Stepped	one or more well defined steps
IR	Irregular	many sharp changes in orientation

Coatings		
ABBREVIATION	TERM	Description
CN	Clean	No visible coating
SN	Stained	No coating but surface discoloured
VN	Veneer	visible coating too thin to measure
СТ	Coating	visible coating up to 1mm thick
IF	Infilled	Over 1mm thick of soil present

Orientation		
ABBREVIATION	TERM	
SH	Sub Vertical	
sv	Sub Horizontal	
10°	Angle from horizontal	

Aperture		
ABBREVIATION	TERM	
DIS	Discontinuous	
CL	Closed	
5mm	Measured width between joint surfaces	

Block Shape		
Term	Description	
Blocky	Roughly equidimensional blocks.	
Tabular	thickness of blocks much less than length or width.	
Columnar	lengths much greater than other dimensions	
Irregular	Irregular discontinuities without arrangement into distinct sets,	

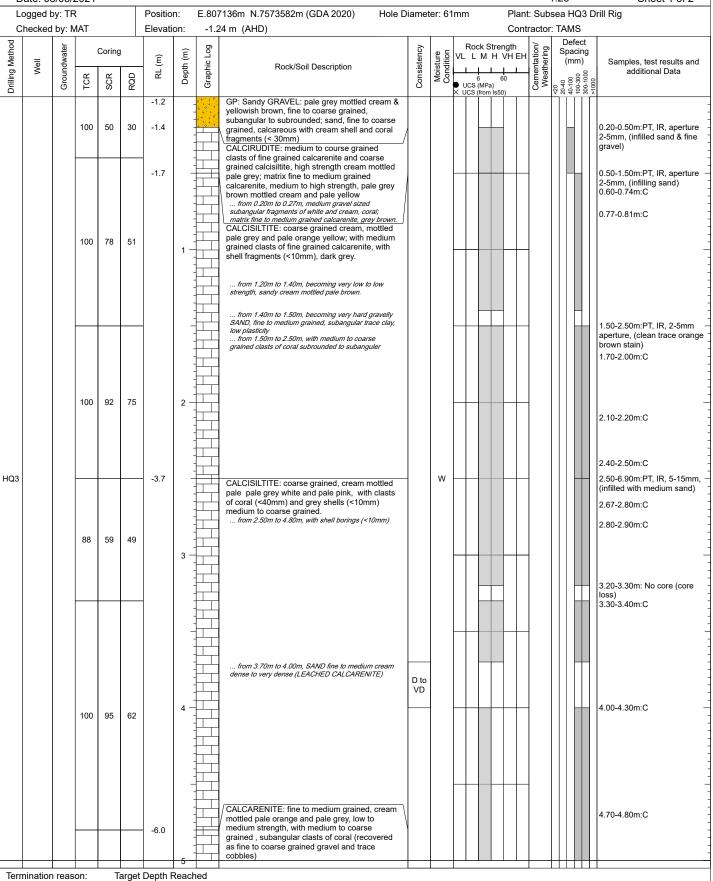
BOREHOLE LOG - BH01

Client: Department of Transport Project: Tantabiddi Boating Facility

Location: Exmouth

Project ID: PER2020-0495

Date: 08/05/2021 1:25 Sheet 1 of 2



Remarks: Hole backfilled by tidal influence. C core sample

Tomano. Horo Subminou Sy muai minuonosi S sono sumpio

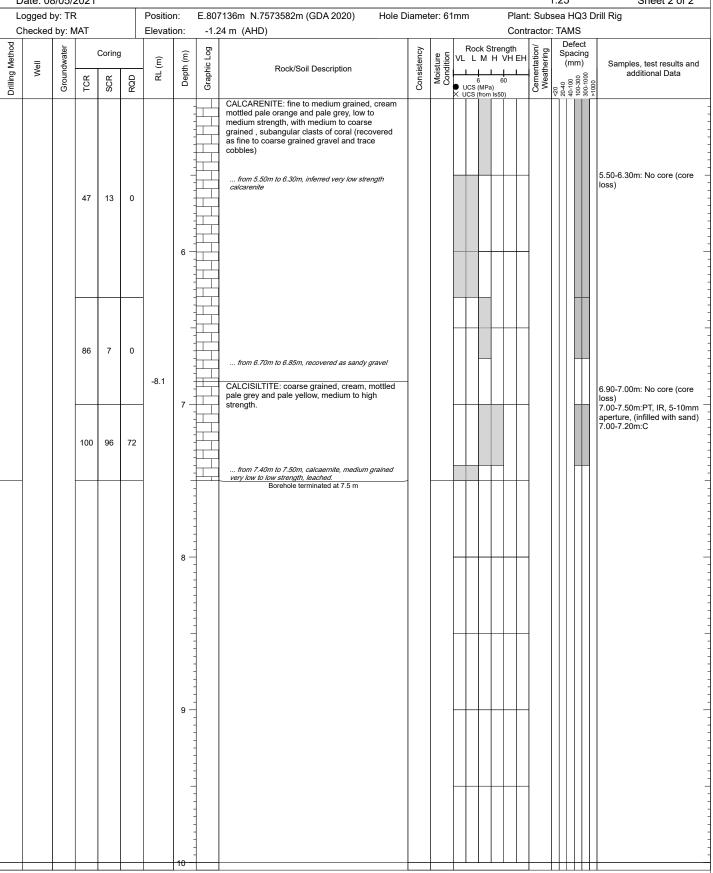
BOREHOLE LOG - BH01

Client: Department of Transport Project: Tantabiddi Boating Facility

Location: Exmouth

Project ID: PER2020-0495





Termination reason: Target Depth Reached
Remarks: Hole backfilled by tidal influence. C core sample

Client: Department of Transport
Project: Tantabiddie Boating Facility
Location: Tantabiddie Boat Ramp, WA

Location: Tantabiddie Boat Project ID: PER2020-0495

8/02/2021

Date:

Sheet No. 1 of 1

Logged by: TR Position: E: 807136.1, N: 7573581.7 Hole Diameter: HQ 96mm Plant: SUBSEA HQ3 RIG
Checked by: MT Elevation: -1.24 Angle from Horizontal: 90° Contractor: TAMS



BH01: 0.0m to 5.0m



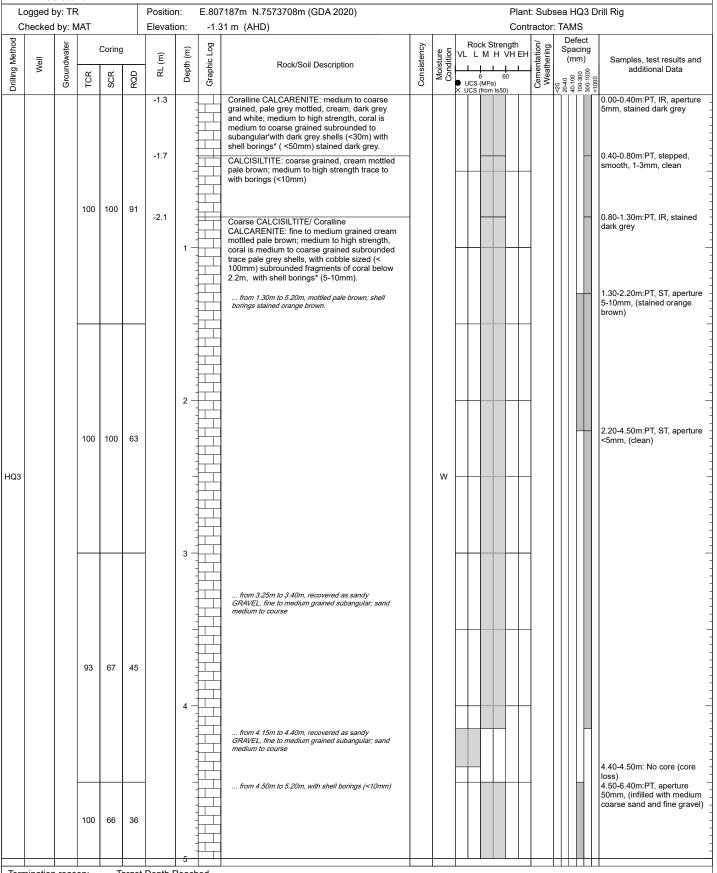
BH01: 5.0m to 7.5m

Client: Department of Transport Project: Tantabiddi Boating Facility

Location: Exmouth

Project ID: PER2020-0495

Date: 09/05/2021 1:25 Sheet 1 of 2



Termination reason:

Target Depth Reached

Remarks: Hole backfilled by tidal influence. C core sample. * a "shell boring" is a tube bored into the calcareous rock by a small mollusc

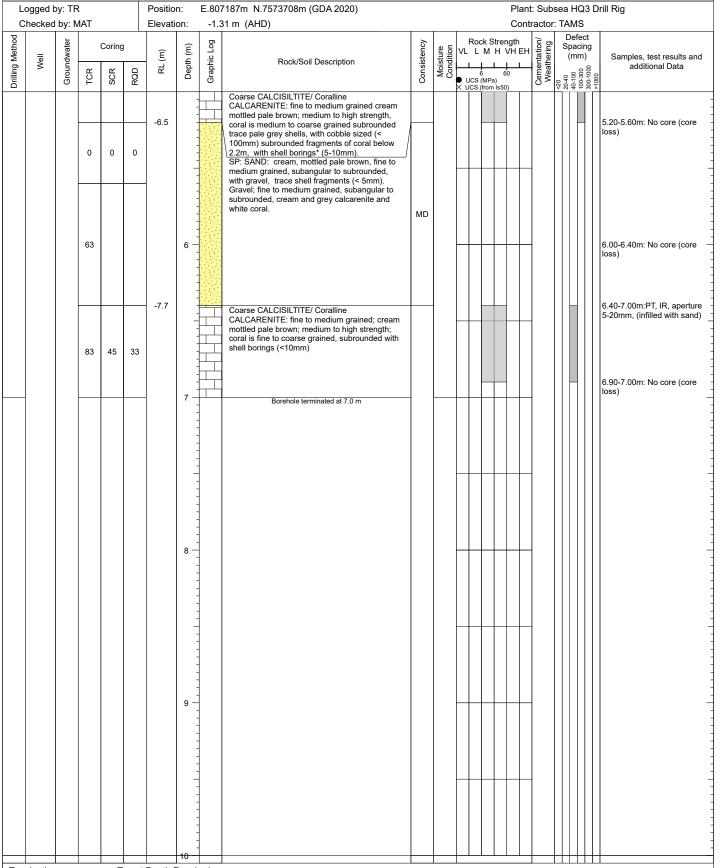
This report must be read in conjunction with accompanying notes and abbreviations.

Client: Department of Transport Project: Tantabiddi Boating Facility

Location: Exmouth

Project ID: PER2020-0495





Termination reason: Target

Target Depth Reached

Remarks: Hole backfilled by tidal influence. C core sample. * a "shell boring" is a tube bored into the calcareous rock by a small mollusc

This report must be read in conjunction with accompanying notes and abbreviations.

Client: Department of Transport Project: **Tantabiddie Boating Facility**

Location: Tantabiddie Boat Ramp, WA Project ID: PER2020-0495

9/05/2021

Date:

Sheet No. 1 of 1

Logged by: Position: E: 807136.1, N: 7573708 Hole Diameter: HQ 96mm Plant: SUBSEA HQ3 RIG Checked by: MT Elevation: Angle from Horizontal: 90° Contractor: TAMS



BH02: 0.0m to 5.0m



BH02: 5.0m to 7.0m

Client: Department of Transport Project: Tantabiddi Boating Facility

Location: Exmouth
Project ID: PER2020-0495



Date: 10/05/2021 1:25 Sheet 1 of 2

Da	ate: 10)/05/2	2021													1:25	Sheet 1 of 2
	gged b	-				Positio		7250m N.7573679m (GDA 2020) Hole [Diamet	er: 6	1mm	า				sea HQ3 I	Orill Rig
Drilling Method	ecked	Groundwater Sq		Coring	RQD	Elevati	Depth (m) Craphic Log	33 m (AHD) Rock/Soil Description	Consistency	Moisture	VL 	L I	Strer M H V 6 MPa) om Is50	ngth VH EH	ntation/ hering	TAMS Defect Spacing (mm) 000-000 000-000	Samples, test results and additional Data
			100	93	75	-1.3	1	Coarse CALCISILTITE/ Coralline CALCARENITE: fine to medium grained cream mottled pale pink and pale brown, medium to high strength; coral is medium to coarse grained, subrounded to subangular with pale grey shells (<10mm) with shell borings (<15mm) from 0.00m to 0.15m, stained dark greenish grey				CS (IT	om Issu			A 4 4 + 0	0.00-2.15m:PT, IR, aperture 5-10mm, (infilled fine gravel and sand) 0.23-0.36m:C 0.34-0.50m:C 0.40-0.50m:C 0.54-0.68m:C
HQ3			90	90	74	-3.5	2	CALCISILITITE: coarse grained, high strength cream mottled pale pinkish brown;		w							2.15-2.85m:, (no beddings partings) 2.40-2.70m:C
			100	100	75	-4.3	4	Coarse CALCISILTITE/ Coralline CALCARENITE: fine to medium grained; 'cream mottled pale brown; medium to high strength; coral is medium to coarse grained; subrounded to rounded; with cream & grey shells (<10mm-15mm) with shell borings (<10mm) at 3.90m, trace cobble sized fragments of coral (<200mm)									3.00-4.30m:PT, IR, aperture -5-10mm, (infilled fine gravel and sand) 4.00-4.30m:C 4.30-7.00m:PT, IR, aperture 5-10mm, (infilled fine gravel and sand)
							5 Reached										anu sanu)

Termination reason:

Target Depth Reached

Remarks: Hole backfilled by tidal influence. C core sample. * a "shell boring" is a tube bored into the calcareous rock by a small mollusc

Client: Department of Transport Project: Tantabiddi Boating Facility

Location: Exmouth
Project ID: PER2020-0495



Date: 10/05/2021 1:25 Sheet 2 of 2

	ate: 10																1:25			Sheet 2 of 2
Lo	ogged b	y: TR	}			Positio	n:	E.807	7250m N.7573679m (GDA 2020) Hole [Diame	ter: 6	1mm	1		Plant	: Sub	sea H	Q3 [Drill F	Rig
CI	hecked	by: N	ΙAΤ			Elevati	on:	-1.3	3 m (AHD)		_			_	Cont	ractor				
Drilling Method	Well	Groundwater		Coring		RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture	١,	- 1	1 1	gth 'H EH	12 2	Det Spa (m	cing m)		Samples, test results and additional Data
iii		Gro	TCR	SCR	RQD	_	ă	ပြီ		١ō	≥ č	, N	CS (MI	60 Pa) m Is50)		Ģĕ	<20 20-40 40-100	100-30	1000	
			67	67	36				Coarse CALCISILTITE/ Coralline CALCARENITE: fine to medium grained; cream mottled pale brown; medium to high strength; coral is medium to coarse grained; subrounded to rounded; with cream & grey shells (<10mm-15mm) with shell borings (<10mm)				CS (III	III ISSU)				1		0-6.00m: No core (core s)
			60	35	13		6													0-6.40m:C 0-7.00m: No core (core s)
\dashv							7 -	\Box	Borehole terminated at 7.0 m	-		\parallel	+	+						
							-													
							8 -													
							-													
							- - - - - - -													
							9													
							-													
							-													
			l				10					\perp						ш		

Termination reason:

Target Depth Reached

Remarks: Hole backfilled by tidal influence. C core sample. * a "shell boring" is a tube bored into the calcareous rock by a small mollusc

This report must be read in conjunction with accompanying notes and abbreviations.

Client: Department of Transport
Project: Tantabiddie Boating Facility
Location: Tantabiddie Boat Ramp, WA

Project ID: PER2020-0495

Date: 10/05/2021

10/05/2021 Sheet No. 1 of 1

Logged by: RC Position: E: 807249.8 , N: 7573679 Hole Diameter: HQ 96mm Plant: SUBSEA HQ3 RIG
Checked by: MT Elevation: -1.33 Angle from Horizontal: 90° Contractor: TAMS



BH03: 0.0m to 5.0m



BH03: 5.0m to 7.0m

Client: Department of Transport Project: Tantabiddi Boating Facility

Location: Exmouth
Project ID: PER2020-0495



Date: 11/05/2021 1:25 Sheet 1 of

Date:	: 11/05	/202	l											1	:25		Sheet 1 of 1
Logge	ed by: T	R			Positio	n:	E.80	7340m N.7573855m (GDA 2020) Hole l	Diame	ter: 6	1mm	1	Plan	t: Subs	sea H	Q3	Drill Rig
Check	ked by:	MAT			Elevati	on:	-1.3	85 m (AHD)					Cont	ractor:	TAM	S	
Drilling Method Well	ater		Corin	_	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture		1 1	rength H VH EH	ntation/ hering	Def Spa (m	ect cing m)	Samples, test results and
Q3	Groun	80 80	62	46	-1.4	1	Grap	CALCARENITE: fine grained pale grey mottled greenish grey and pale pink; with grey and white shell fragments (<25mm) with vugs (<75mm) stained dark grey or partly infilled with grey calcarenite, medium to high strength. from 1.50m to 1.60m, hard/very dense sandy gravel from 1.50m to 3.00m, becoming low to medium strength from 1.90m to 2.05m, hard/very dense sandy gravel		W W	V U	S (MPa)	60 (550)	Ceme	20 204 2040	100-300	additional Data 0.00-2.45m:PT, IR, Aperture 5 to 8mm, (infilled fine gravel and sand) 0.00-0.13m:C 0.50-0.60m:C 1.00-1.15m:C 1.20-1.50m: No core (core loss)
						3		Borehole terminated at 3.0 m									iussi

Termination reason: Target Depth Reached

Remarks: Hole backfilled by tidal influence. C core sample

Client: Department of Transport
Project: Tantabiddie Boating Facility
Location: Tantabiddie Boat Ramp, WA

CMWGeosciences

Project ID: PER2020-0495 Date: 11/05/2021

021 Sheet No. 1 of 1

Logged by: TR Position: E: 807579.0, N: 7573978.9 Hole Diameter: HQ 96mm Plant: SUBSEA HQ3 RIG
Checked by: MT Elevation: -1.57 Angle from Horizontal: 90° Contractor: TAMS



BH04: 0.0m to 3.0m

Client: Department of Transport Project: Tantabiddi Boating Facility

Location: Exmouth
Project ID: PER2020-0495





Logged by: TR Checked by: MAT					Positio	ın.	F 80	7579m N.7573979m (GDA 2020) Hole [)iame	ter: 6	1mr			PIs	nt· !		sea)3 Г	Sheet 1 of 1 Orill Rig
Checked	-				Elevati			57 m (AHD)	, and						ntra	ctor:				
Drilling Method	Groundwater	TCR	Coring & S	RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture	VL	. L 	МН	ength VH E	H	Weathering	S	efe paci mm	ng ı)	Samples, test results and additional Data
		100			-1.6	-		GP: Sandy GRAVEL: cream mottled orange brown, pale pink and yellow, fine to coarse grained, subangular to subrounded with cobbles (<90mm); sand fine to medium grained; Gravel and cobbles are fine grained calcaranite, coral and shells												0.00-1.60m:D 0.5m:SPT: (3,6,7) N=13
Q3		100				1 -				w										
		100	90	57	-3.2	2 -		Coarse CALCISILTITE/ Coralline CALCARENITE: fine grained; cream mottled pale pinkish brown, with vugs (<50mm) stained pale reddish brown or partley infilled with reddish brown sand, fine to medium grained with shell borings (<10mm)												1.60-2.00m:PT, IR, (apertur < 5mm infilled reddish brow sand) 1.60-2.00m:C 2.00-2.50m:PT, IR, (apertur < 5mm infilled reddish brow sand)
		100	0	0		3 -		from 2.50m to 3.00m, recovered as subangular to angular gravel Borehole terminated at 3.0 m												
						-														
						4 —														
						-	-													

Termination reason: Target Depth Reached

Remarks: Hole backfilled by tidal influence. C core sample. D = small disturbed sample. * a "shell boring" is a tube bored into the calcareous rock by a small mollusc

Client: Department of Transport
Project: Tantabiddie Boating Facility
Location: Tantabiddie Boat Ramp, WA

CMWGeosciences

Project ID: PER2020-0495 Date: 12/05/2021

12/05/2021 Sheet No. 1 of 1

Logged by: TR Position: E: 807579.0, N: 7573878.9 Hole Diameter: HQ 96mm Plant: Subsea HQ3 Rig Checked by: MT Elevation: -1.57 Angle from Horizontal: 90° Contractor: TAMS



BH08: 0.0m to 3.0m

Client: Department of Transport Project: Tantabiddi Boating Facility

Location: Exmouth
Project ID: PER2020-0495



Date: 12/05/2021 1:25 Sheet 1 of 1

	ate: 12															1:25			Sheet 1 of 1
1	ogged b					Positio			7257m N.7574115m (GDA 2020) Hole E	Diame	ter: 6	1mm						3 D	rill Rig
-	hecked =			Coring)	Elevati			m (AHD)	ency	ure	F VL	Rock St	Cont rength H VH EH	ation/ aring	_	MS efect acing mm)	g	Samples, test results and
Drilling Method	Well	Groundwater	TCR	SCR	RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	1 .	6 CS (MPa)	1 1	1 # #	20-40			additional Data
			·		_	-3.4			GP: GRAVEL: cream mottled dark and pale grey, fine to coarse grained, sub angular to sub rounded, of calcarentite, coral and shell fragments, trace sand; sand, fine to medium grained. CALCARENITE: fine grained, cream mottled pinkish brown and pale grey, with vugs (< 20mm) infilled trace reddish brown sand or			X UC	CS (from	s50)		7 2 2	01		0.00-1.20m:PT, IR, rough, Aperture <5mm, (clean)
									clean, with shell borings*								Ш		0.50-0.70m:C -
HQ3			87	60	53												Ш		0.70-1.00m:C -
							1 -										Ш		=
																	Ш		-
																	ľ	1	1.30-1.50m: No core (core loss)
						_	-		Borehole terminated at 1.5 m		W								- - -
																			-
							2 -												-
																			- - -
] - -
							-												
																			-
							3 -												-
																			-
							-												_ _ -
																			- - -
							4 -] - -
																			- - - -
																			- - - -
							-					\forall							- - - - -
																			- - - -
							5 -									Ш			- - -
\vdash						1										ш		_	

Termination reason:

Target Depth Reached

Remarks: Hole backfilled by tidal influence. C core sample. * a "shell boring" is a tube bored into the calcareous rock by a small mollusc

Client: Department of Transport
Project: Tantabiddie Boating Facility
Location: Tantabiddie Boat Ramp, WA



Project ID: PER2020-0495 Date: 12/05/2021

12/05/2021 Sheet No. 1 of 1

Logged by: TR Position: E: 807257.4, N: 7574115.2 Hole Diameter: HQ 96mm Plant: Subsea HQ3 Rig Checked by: MT Elevation: -3.4 Angle from Horizontal: 90° Contractor: TAMS



BH10: 0.0m to 1.5m

Client: Department of Transport Project: Tantabiddi Boating Facility

Location: Exmouth
Project ID: PER2020-0495



Date: 13/05/2021 1:25 Sheet 1 of 1

Date: 13/05/2021										:25	Sheet 1 of 1
Logged by: TR		Position:	E.807	7197m N.7574300m (GDA 2020)							Drill Rig
Checked by: MAT		Elevation	: -3.0	01 m (AHD)					_	TAMS	
Well Groundwater	Coring	RL (m)	Depth (m) Graphic Log	Rock/Soil Description	Consistency	ist Indii		Strength M H VH EH	Cementation/ Weathering	Defect Spacing (mm)	Samples, test results and
Di Di) N X	-3.0	- 0	Coralline CALCARENITE: fine grained, cream mottled pale pinkish brown and grey, coral is medium to coarse grained and cobble sized,	O		● UCS (N × UCS (fr	MPa) rom Is50)	3 >	204 40-1	0.00-1.50m:PT, IR, rough to smooth, stained Dark Brown
				subrounded with shell borings; with pale grey shells (<15mm) from 0.10m to 0.45m, vugs (<50mm) stained dark brown and partly infilled with gravelly sand							0.30-0.50m:C
HQ3 100	95 91					w					
			1								- - -
				Borehole terminated at 1.5 m							
			- - - - -								
			2 —								
			-								
			- - - - -								
			-								
			3 —								
			-								
			- - - - - -								
			4 —								
			-								
			- - - - -								
			- - - - - - -								
		+ +:	5								

Termination reason:

Target Depth Reached

Remarks: Hole backfilled by tidal influence. C core sample. * a "shell boring" is a tube bored into the calcareous rock by a small mollusc

Client: Department of Transport
Project: Tantabiddie Boating Facility
Location: Tantabiddie Boat Ramp, WA

CMWGeosciences

Project ID: PER2020-0495 Date: 13/05/2021

13/05/2021 Sheet No. 1 of 1

Logged by: TR Position: E: 807197.4, N: 7574299.6 Hole Diameter: HQ 96mm Plant: Subsea HQ3 Rig Checked by: MT Elevation: -3.01 Angle from Horizontal: 90° Contractor: TAMS



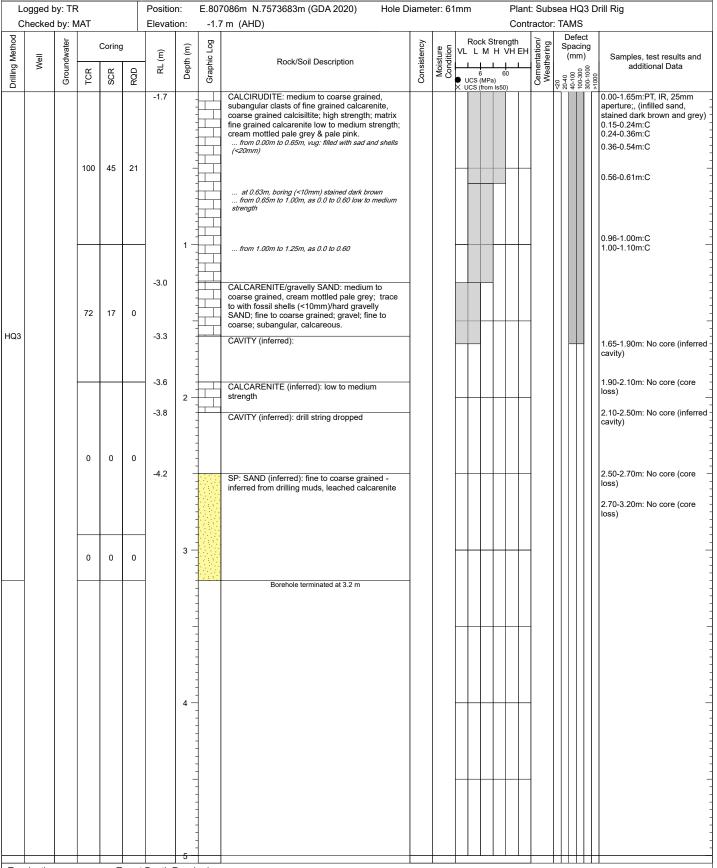
BH11: 0.0m to 1.5m

Client: Department of Transport Project: Tantabiddi Boating Facility

Location: Exmouth

Project ID: PER2020-0495





Termination reason: Target Depth Reached
Remarks: Hole backfilled by tidal influence. C core sample

Client: Department of Transport
Project: Tantabiddie Boating Facility
Location: Tantabiddie Boat Ramp, WA

CMWGeosciences

Project ID: PER2020-0495 Date: 7/05/2021

7/05/2021 Sheet No. 1 of 1

Logged by: TR Position: E: 807086.2, N: 7573682.8 Hole Diameter: HQ 96mm Plant: Subsea HQ3 Rig Checked by: MT Elevation: -1.70 Angle from Horizontal: 90° Contractor: TAMS



BH12: 0.0m to 3.2m

Client: Department of Transport Project: Tantabiddi Boating Facility

Location: Exmouth
Project ID: PER2020-0495



Date: 10/05/2021 1:25 Sheet 1 of

L	D	ate: 10	0/05/	2021													1	1:25			Sheet 1 of 1
	Lo	ogged b	y: TF	₹			Positio	n:	E.807	7289m N.7573779m (GDA 2020) Hole E	Diamet	er: 6	1mm	1		Plan	t: Subs	sea F	IQ3	Dr	rill Rig
		hecked	by: N	ΙΑΤ			Elevation	on:	-1.6	Sm (AHD)						Cont	ractor				
	Drilling Method	Well	Groundwater	TCR	Coring & SC	RaD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition			Stren 1 H V 60 Pa) om Is50)	1	اعجا	Spa	efect acing nm)	9	Samples, test results and additional Data
				100	93	78	-1.6 -1.7	1		GP: GRAVEL: cream mottled pale orange brown, fine to coarse grained, subrounded to sub angular, of coral and calcarenite from 0.0m to 0.0m, stained dark greenish grey Coarse CALCISILTITE/ Coralline CALCARENITE: fine to medium grained; cream mottled pale pink and pale grey; medium to high strength' coral is medium to coarse grained; subrounded to subangular with pale grey shells (less than 25mm); with shell borings (less than 20mm)	L		× 0	CS (fro	m 1550			V &			0.10-1.60m:PT, IR, aperture 5-10mm, (clean or infilled fine gravel stained brown) 0.10-0.30m:C
H	IQ3			100	100	80		2				W									1.60-3.10m:PT, IR, stained dark orange brown
				100	20	20		3 -		at 2.60m, recovered as fine to coarse gravel; trace cobble (<70mm)											
								- - - -		Borehole terminated at 3.1 m											
								4													
		nination					Denth F	5													

Termination reason:

Target Depth Reached

Remarks: Hole backfilled by tidal influence. C core sample. * a "shell boring" is a tube bored into the calcareous rock by a small mollusc

Client: Department of Transport
Project: Tantabiddie Boating Facility
Location: Tantabiddie Boat Ramp, WA

CMWGeosciences

Project ID: PER2020-0495 Date: 10/05/2021

10/05/2021 Sheet No. 1 of 1

Logged by: TR Position: E: 807288.6, N: 7573779.0 Hole Diameter: HQ 96mm Plant: Subsea HQ3 Rig Checked by: MT Elevation: -1.60 Angle from Horizontal: 90° Contractor: TAMS



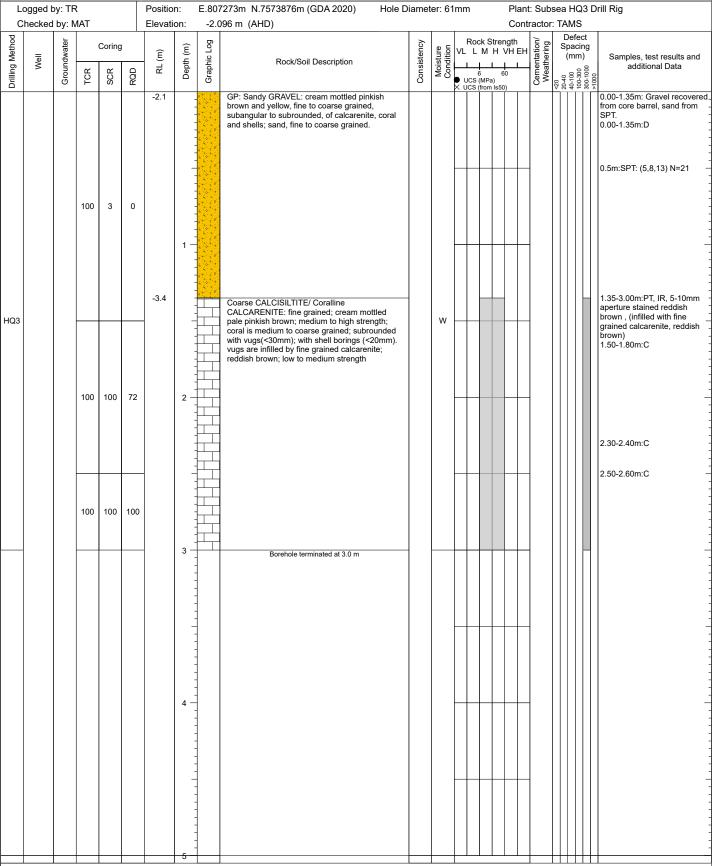
BH13: 0.0m to 3.1m

Client: Department of Transport Project: Tantabiddi Boating Facility

Location: Exmouth

Project ID: PER2020-0495





Termination reason: Target Depth Reached

Remarks: Hole backfilled by tidal influence. C core sample. D= small disturbed sample. * a "shell boring" is a tube bored into the calcareous rock by a small mollusc

This report must be read in conjunction with accompanying notes and abbreviations.

Client: Department of Transport
Project: Tantabiddie Boating Facility
Location: Tantabiddie Boat Ramp, WA



Project ID: PER2020-0495 Date: 11/05/2021

11/05/2021 Sheet No. 1 of 1

Logged by: TR Position: E: 807273.3, N: 7573875.6 Hole Diameter: HQ 96mm Plant: Subsea HQ3 Rig Checked by: MT Elevation: -2.10 Angle from Horizontal: 90° Contractor: TAMS



BH16: 0.0m to 3.0m

Appendix C Daily Site Records



Tantabiddi Boating Facility Daily Site Diary

Project Number/Title: PER2021-0495 Tantabiddi Boating Facility

Site: Tantabiddi Boat Ramp

Day/Shift Time: Day Shift: 05.30 to 18.00

Date: 07 May 2021

Weather: Overcast with Sunshine

CMW Site Representative: Tim Robinson/ M.Tutton

Daily Aim: Set-up Charlie Bill Dive Support Vessel; overboard subsea drill rig and track to

first location at BH12

Time	Actions
05.35	Depart accommodation
06.00	Arrive Tantabiddi Bpoat Ramp and transfer to AMS Boss via dives support vessel AMS1
06.15	Conduct TAMS Pre-start and sign off on SWMS; complete BAC testing
06.30	Continue preparation of dive support vessel Charlie Bill and subsea dive rig
11.00	Overboard subsea drilling rig from deck of AMS Boss; commence tracking to BH12with dive support AMS1 and drill support Charlie Bill in attendance.
12.05	Subsea rig/AMS1/ Charlie Bill arrive in vicinity of BH12
12.40	Commence setting anchors to dive support vessel Charlie Bill; checked position of BH12 with differential GPS – rig in position approx. 2m east and 2m south of drawing coordinates
13.40	Commence drilling at BH12: immediately went to HQ3 coring as limestone pavement encountered below thin veneer (5mm) of sand. Low to medium strength calcirudite (limestone containing gravel sized clasts in a fine grained matrix) encountered to 1.25m, becoming very low strength below this depth to 1.65m. During the core run from 1.90m to 2.70m the drill string dropped between 2.1m and 2.5m depth indicating the presence of a cavity with 0% recovery. Drilling penetration rates below 2.50 to 2.70m inferred the presence of sands. Clay/ sand-or soft clay was inferred from 2.70 based on the observations of the return flush; the borehole was terminated at 3.20m depth. Soundings taken at the position of BH12 indicated the seabed is at 0.90m below chart datum rather than 0.27m below chart datum in borehole table on DoT. Sounding however from recent DoT survey indicate 0.8 m below CD. The termination depth of 3.0m below chart datum was therefore Achieved with an actual termination depth 4.1 m below CD.
17.00	Subsea rig left at BH12 position with the punt Charlie Bill moored alongside in three point anchor spread and navigation buoys set



Notes on tracking the rig and impact on seabed:

After overboarding from the AMS Boss the rig tracked to the position at BH12 on the seabed. The sea bed comprised a veneer of sand some 20 to 50mm thick overlying limestone with clumps of knee-high seaweed. Two small limestone bommies were noted and avoided north and west of BH12.

The rubber tracks of the rig made a faint impression in the sandy substrate as illustrated on the before (Photos 4 and 5) and after photos (Photo 6). These are very faint and will likely by undiscernible after a few hours of wind and wave action. The leading blade at the front of the rig was wrapped in rope to prevent damage to the sea floor (Photo 4) at the borehole site when used to steady the rig when the mast is erected. Similarly, the metal mast plate that contacted the seafloor had a piece of timber strapped to it to prevent damage to the seabed.

Turbidity was noted to be very slight (negligible) with some drilling mud venting into the water column but not enough to affect visibility and completely dispersing in the water current within 2 m of the borehole (Photo 7).

Additional Notes:

- 1. Objectives for tomorrow Track rig from position at BH12 to BH01 and commence drilling.
- 2. In inferred clay or loose sand materials with low or no recovery carry out SPT and continue coring in shorter drill lengths and utilising core catcher.



Figure 1 Overboarding subsea rig from the AMS Boss



Figure 2 Preparation of dive support vessel AMS1 and drill support vessel Charlie Bill



Figure 3 Diver/ driller recovering core barrel from subsea rig at BH12



Figure 4 Seabed state prior to rig advancing - note rope on front blade to prevent abrasion of the seabed

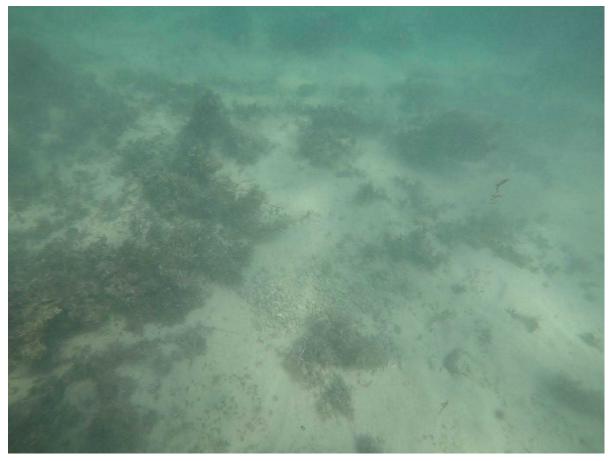


Figure 5 Seabed state bprior to advance of subsea rig



Figure 6 Rear view of subsea rig - note faint impression in sand veneer from rubber tracks at bottom left



Figure 7 Rotary coring underway at BH12 with negligible turbidity from flush returns



Tantabiddi Boating Facility Daily Site Diary

Project Number/Title: PER2021-0495 Tantabiddi Boating Facility

Site: Tantabiddi Boat Ramp

Day/Shift Time: Day Shift: 05.30 to 18.00

Date: 08 May 2021 Weather: Sunshine

CMW Site Representative: Tim Robinson/ M.Tutton

Daily Aim: Track subsea drill rig from overnight location at BH12 to BH01; reset anchors to

dive support vessel Charlie Bill and commence drilling.

Time	Actions
05.40	Depart accommodation
06.00	Arrive Tantabiddi Bpoat Ramp and transfer to AMS Boss via dives support vessel AMS1
06.15	Conduct TAMS Pre-start and sign off on SWMS; complete BAC testing
06.30	AMS1 to overnight location of the Charlie Bill: lift anchors and prepare to track the subsea drilling rig from BH12 to BH01.
09.10	Subsea rig/AMS1/ Charlie Bill arrive in vicinity of BH01; commence manoeuvring of subsea rig to working position and the AMS1/ Charlie Bill to support locations and setting of 3 point anchors.
09.30	Fit replacement water swivel on drill string assembly of subsea rig following malfunction; check position of of BH01 with differential GPS – rig in position within 1.0m of DoT drawing coordinates.
10.45	Commence drilling at BH01: immediately went to HQ3 coring as limestone pavement encountered below thin veneer (20mm) of sand at the surface comprising high strength calcirudite to 0.50m underlain by a medium to high strength calcisiltite (fine grained limestone) to 4.80m. Core recovery fell to 46% between 4.80 and 6.30m due to the inferred presence of low to medium strength coralline calcarenite (limestone composed of sand sized particles) with shell borings. Recovery improved to 85% below 6.30m and was 100% from 6.80m to 7.50m depth in medium to high strength calcisiltite. The borehole was terminated at 7.50m depth below seabed. Soundings taken at the position of BH01 at low tide (15.05hrs) indicated the seabed is at 0.50m below chart datum rather than an estimated 0.42m above chart datum as estimated from the
17.00	borehole table in the DoT drawing. The termination depth of 7.0m below chart datum was therefore achieved with an actual termination depth 8.0 m below CD. Subsea rig left at BH01 position with the punt Charlie Bill moored alongside in three point anchor spread and navigation buoys set



Notes on tracking the rig and impact on seabed:

The rig tracked from the position at BH12 to BH01 on the seabed. The seabed continued to comprise a veneer of sand some 20 to 50mm thick overlying limestone with clumps of knee-high seaweed. This is illustrated in detail in Photo 4.

Photos are provided during the tracking (Photos 3, 4 and 5) from BH012 to BH01. The photos again confirm that faint tracks were left in the sand which will likely become undiscernible after a few hours of wave action. Precautions detailed in the Daily Site Diary for 7 May 2021 to reduce impact or damage to sea floor were taken and will continue to do so for the remainder of this drilling campaign.

Further photos are provided from the drill site at BH12 following completion of this borehole on 7 May 2021. Photo 6 shows a faint impression left from the leading blade wrapped in rope after moving away from the position. Photo 7 shows the seabed around the completed hole after the rig has tracked towards BH01.

Turbidity was again noted to be very slight with some drilling mud venting into the water column but not enough to affect visibility and completely dispersing in the water current within 2 to 5 m of the borehole (Photo 1).

Additional Notes:

1. Objectives for tomorrow – Track subsea rig from position at BH01 to BH02 and commence drilling.



Figure 1 Subsea rig operating at BH01



Figure 2 Calcisiltites (limestone) following extrusion from core barrel being prepared for logging



Figure 3 Sandy seafloor substrate prior to rig advancing through area



Figure 4 Detail of sandy veneer covering sea floor with clumps of 0.50m high seaweed visible



Figure 6 Faint impression in seabed sand from leading blade visible near BH12



Figure 7 Area of seabed sand following completion of BH12 (hole visible)



Tantabiddi Boating Facility Daily Site Diary

Project Number/Title: PER2021-0495 Tantabiddi Boating Facility

Site: Tantabiddi Boat Ramp

Day/Shift Time: Day Shift: 05.30 to 18.00

Date: 09 May 2021 Weather: Sunshine

CMW Site Representative: Tim Robinson

Daily Aim: Track subsea drill rig from overnight location at BH01 to BH02; reset anchors to

dive support vessel Charlie Bill and commence drilling.

Time	Actions
05.35	Depart accommodation
06.05	Arrive Tantabiddi Boat Ramp and transfer to AMS Boss via dives support vessel AMS1
06.30	Conduct TAMS Pre-start and sign off on SWMS; complete BAC testing; load further core boxes & supplies
07.40	AMS1 to overnight location of the Charlie Bill: lift anchors and prepare to track the subsea drilling rig from BH01 to BH02.
09.00	Subsea rig/AMS1/ Charlie Bill arrive in vicinity of BH02; commence manoeuvring of subsea rig to working position and the AMS1/ Charlie Bill to support locations and setting of 3 point anchors. Setup drill rig.
10.00	Commence drilling at BH02 in HQ3 coring as limestone pavement encountered directly at the seabed – no sand cover - comprised medium to high strength coralline calcarenite (limestone with sand sized grains) and coarse calcisilitie (fine grained limestone) to a depth of 5.20m with 93% to 100% recovery. Core recovery fell to 0% between 5.20 and 5.60m depth due to blockage at the drill bit face which was subsequently cleared and drilling resumed from 5.60m where a sand layer was encountered to 6.40m depth with 50% recovery. Before an SPT could be attempted in the sand layer coralline calcarenite/ calcisilitie was again encountered from 6.40m to a depth below seabed of 7.00m where the borehole was terminated.
	Soundings taken at the position of BH01 at 14.37hrs indicated the seabed is at 0.56m below chart datum rather than an estimated 0.30m below chart datum as indicated on the borehole table in the DoT drawing. The termination depth of 7.0m below chart datum was therefore achieved with an actual termination depth 7.56m below CD.
15.10	Diver out of water, lift anchors to Charlie Bill and commence tracking of rig from BH02 to position of BH03; rig positioned at BH03 and the punt Charlie Bill moored alongside in three point anchor spread and navigation buoys set.
16.15	Return to AMS Boss.



Notes on tracking the rig and impact on seabed:

The rig tracked from the position at BH01 to BH02 in the morning and then from BH02 to BH03 in the afternoon. The seabed continued to comprise a veneer of sand up to 50mm thick overlying limestone with clumps of knee-high seaweed.

Photos 3 and 4 illustrate the seabed condition during tracking between BH01 and BH02. Tracking from BH02 to BH03 took place around low tide in the afternoon – Photos 6 and 7 show a snorkeller from the dive crew swimming ahead of the tracking drill rig and providing hand signals to the operator and determining the most direct route along level sandy zones and avoiding exposed limestone and bommies (which are not traversible). The pictures also clearly show the timber strapped to the metal mast plate at the front of the rig to prevent damage to the sea floor during drilling operations.

Further photos are provided from the drill site at BH01 following completion of this borehole on 8 May 2021. Photo 8 shows the seabed following completion and the immediate area completed hole after the rig has tracked towards BH02 in Photo 9.

Turbidity was again noted to be very slight with some drilling mud/ sand return venting into the water column with visibility unaffected.

Additional Notes:

1. Objectives for tomorrow – Commence drilling at BH03.



Figure 1 Rig set up at BH02 with dive support vessel in attendance



Figure 2 Limestone transferred from core barrel and prepared for logging



Figure 3 Detail of seabed while tracking from BH01 to BH02



Figure 4 Tracking between BH01 and BH02



Figure 5 Dive support vessel marking BH03 location



Figure 6 Rig tracking between BH02 and BH03 with snorkeller checking route ahead



Figure 7 Snorkeller signalling to rig operator; timber on metal plate visible at front of rig



Figure 8 Drill rig moving off following completion of BH01



Figure 9 Seabed around BH01 following completion



Site: Tantabiddi Boat Ramp

Day/Shift Time: Day Shift: 05.30 to 18.00

Date: 10 May 2021

Weather: Sunshine and cloud

CMW Site Representative: Tim Robinson

Daily Aim: Commence drilling at BH03, complete and track to BH13.

Time	Actions
05.30	Depart accommodation
06.05	Arrive Tantabiddi Boat Ramp and transfer to AMS Boss via dives support vessel AMS1
06.15	Conduct TAMS Pre-start and sign off on SWMS; complete BAC testing; load further core boxes & supplies
06.40	AMS1 to overnight location of the Charlie Bill/ subsea rig at position of BH03 and prepare for drilling.
07.30	Commence drilling at BH03 in HQ3 coring as limestone pavement encountered directly at the seabed – no sand cover -the recovered core comprised medium to high strength coralline calcarenite (limestone with sand sized grains) and coarse calcisiltite (fine grained limestone) to 2.15m depth where a calcisiltite was encountered which continued to 3.00m. Coralline calcarenite/ calcisiltite was again encountered from 3.0m to 7.0m below seabed level where the borehole was terminated. Recovery throughout the borehole was 100% apart from the drill runs between 4.50 and 6.00m (66%) and 6.00 to 7.00m (60%). Losses were attributed due to closely spaced bedding partings within the limestone noted at these levels. Soundings taken at the position of BH03 at 09.40hrs indicated the seabed is at 0.60m below chart datum rather than an estimated 0.31m below chart datum as indicated on the borehole table in the DoT drawing. The termination depth of 7.0m below chart datum was therefore achieved with an
	actual termination depth of 7.60m below CD.
11.40 to 13:05	Diver out of water, lift anchors to Charlie Bill and track rig from BH03 to position of BH13; rig positioned at BH13 and the punt Charlie Bill moored alongside in three point anchor spread and navigation buoys set.
13:50	Commence drilling at BH13 in HQ3 coring - limestone pavement encountered beneath a 50mm layer of sand at the seabed - the recovered core comprised medium to high strength coralline calcarenite (limestone with sand sized grains) and coarse calcisiltite (fine grained limestone) to 3.00m depth with 100% recovery in both core runs from 0.00 to 1.50m and 1.50 to 3.00m depth below seabed. The borehole was terminated at 3.00m below seabed.
	Soundings taken at the position of BH13 at 15.58hrs indicated the seabed is at 1.08m below chart datum rather than an estimated 0.60m below chart datum as indicated on the borehole table in the DoT drawing. The termination depth of 3.0m below chart datum was therefore achieved with an actual termination depth of 4.08m below CD.



15.55	Recover divers and drilling/coring equipment to AMS1/ Charlie Bill; Charlie Bill/ subsea rig left
to	moored at BH13 overnight in three point anchor spread and navigation buoys set. Inspect existing
16.45	mooring close to BH10 scheduled for completion on Thurs 12 May en route to AMS Boss
16.15	Return to AMS Boss.

The rig tracked from the position at BH03 to BH13 in the morning. As noted on all previous days throughout the drilling campaign to date the seabed continued to comprise a veneer of sand up to 50mm thick overlying limestone with clumps of knee-high seaweed at both locations of BH03 and BH13 and the areas tracked in between these locations.

Photo 4 illustrates the seabed condition during tracking from BH02 to BH03 on 9 May with Photo 5 showing the mast setting up on the location of BH03 today (10 May) with the timber strapped below the metal baseplate of the rig mast at the front of the rig to prevent damage to the sea floor during drilling operations.

Turbidity was again noted to be very slight with some drilling mud/ sand return venting into the water column with visibility unaffected.

Additional Notes:

1. Objectives for tomorrow – Track subsea rig from BH13 to BH04/ BH16; drill both boreholes.



Figure 1 Subsea rig tracking between BH03 and BH13



Figure 2 Subsea rig set up at position of BH13



Figure 3 Limestone core transferred from core barrel in preparation for logging



Figure 4 View of rear of subsea rig tracking left to right – no discernible imprints observed from tracks



Figure 5 Subsea rig setting up at BH03 – timber protecting seabed visible below mast plate



Site: Tantabiddi Boat Ramp

Day/Shift Time: Day Shift: 05.30 to 18.00

Date: 11 May 2021 Weather: Sunshine

CMW Site Representative: Tim Robinson

Daily Aim: Track subsea rig from BH13 to BH16, commence drilling, complete and track to

BH04.

Time	Actions
05.35	Depart accommodation
06.10	Arrive Tantabiddi Boat Ramp and transfer to AMS Boss via dives support vessel AMS1
06.15	Conduct TAMS Pre-start and sign off on SWMS; complete BAC testing; load further core boxes & supplies
06.40 to 08.50	AMS1 to overnight location of the Charlie Bill/ subsea rig at position of BH13; lift anchors, track drilling rig to BH16; rig positioned at BH16 and the punt Charlie Bill moored alongside in three point anchor spread and navigation buoys set.
09.15	Commence drilling at BH16 in HQ3 coring – sandy gravel encountered from the seabed to a depth of 1.35m – a Standard Penetration Test (SPT) completed at 0.50m depth indicated this material is medium dense. Limestone was encountered below the gravel and comprised medium to high strength coralline calcarenite (limestone with sand sized grains) and coarse calcisiltite (fine grained limestone) to 3.00m depth with 100% recovery in core runs from 0.00 to 1.50m, 1.50 to 2.50m and 2.50 to 3.00m depth below seabed. The borehole was terminated at 3.00m below seabed. Soundings taken at the position of BH16 at 09:06hrs indicated the seabed is at 1.40m below chart datum rather than an estimated 1.05m below chart datum as indicated on the borehole table in the DoT drawing. The termination depth of 3.0m below chart datum was therefore achieved with an actual termination depth of 4.40m below CD.
12.35 To 13.45	Diver out of water, lift anchors to Charlie Bill and track rig from BH016 to position of BH04; rig positioned at BH04 and the punt Charlie Bill moored alongside in three point anchor spread and navigation buoys set.



13.55	Commence drilling at BH04 in HQ3 coring - limestone pavement encountered directly at the seabed - the recovered core comprised medium to high strength fine grained calcarenite (limestone with sand sized grains) to 1.50m, becoming low to medium strength to 3.00m depth. Core recovery was 80% in the drill run between 0.00 and 1.50m and 67% from 1.50 to 3.00m. Losses below 1.50m
	depth were attributed to closely spaced bedding partings and leaching of parts of the limestone resulting in discrete layers (100mm) of insitu gravelly sand within the limestone. Vugs (solution cavity features up to 75mm in diameter) were also noted throughout the recovered core. The borehole was terminated at 3.00m below seabed.
	Soundings taken at the position of BH04 at 15.54hrs indicated the seabed is at 0.60m below chart datum rather than an estimated 0.40m below chart datum as indicated on the borehole table in the DoT drawing. The termination depth of 3.0m below chart datum was therefore achieved with an actual termination depth of 3.60m below CD.
16.15 to 16.45	Recover divers and drilling/coring equipment to AMS1/ Charlie Bill; Charlie Bill/ subsea rig left moored at BH04 overnight in three point anchor spread and navigation buoys set.
16.50	Return to AMS Boss.

The rig tracked from the position at BH13 to BH16 in the morning and BH16 to BH04 in the afternoon. Seabed conditions in these areas were observed to be similar to those encountered throughout the drilling campaign to date (and are additionally observable from the support vessels at the surface).

Further photos showing subsea images for previous days are attached:

- 9 May 2021: Photo 2 shows the BH02 drill site following completion and Photo 3 faint impressions in the sandy substrate as the rig tracks from BH02 to BH03.
- 10 May 2021: Photo 4 illustrates the immediate area around the BH03 drill site following completion.
- 10 May 2021: Photo 5 shows the rig tracking from BH03 to BH13 and the general seabed conditions; the mast is set up in advance of drilling BH13 in Photo 6.

Turbidity was again noted to be very slight with some drilling mud/ sand return venting into the water column with visibility unaffected outside a zone extending some 2 to 3m from the return flush at the front of the drill rig.

Additional Notes:

1. Objectives for tomorrow – Track subsea rig from BH04 to BH08/ BH10; drill both boreholes.



Figure 1 Subsea rig at location of BH04 – diver at left checking position with R1 Trimble GPS unit visible on pole



Figure 2 BH02 drill site following completion



Figure 3 Track impressions in sandy substrate during tracking between BH02 and BH03

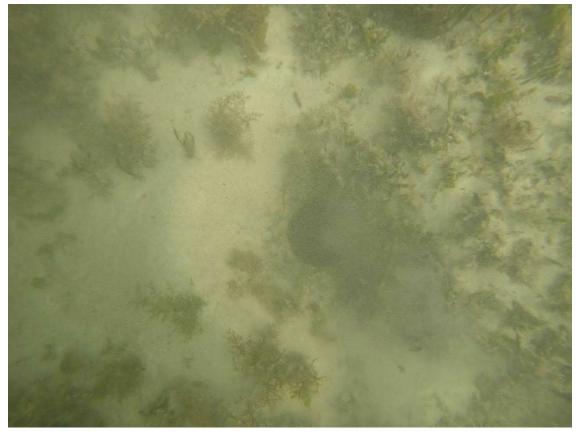


Figure 4 BH04 drill site following completion



Figure 5 Rig tracking from BH03 to BH13



Figure 6 Mast erected at position of BH13 in advance of drilling



Site: Tantabiddi Boat Ramp

Day/Shift Time: Day Shift: 05.30 to 18.00

Date: 12 May 2021 Weather: Sunshine

CMW Site Representative: Tim Robinson

Daily Aim: Track subsea rig from BH04 to BH08, commence drilling, complete and track to

BH10

•

Time	Actions
05.30	Depart accommodation
06.00	Arrive Tantabiddi Boat Ramp and transfer to AMS Boss via dives support vessel AMS1
06.15	Conduct TAMS Pre-start and sign off on SWMS; complete BAC testing; load further core boxes & supplies
06.55 to 09.30	AMS1 to overnight location of the Charlie Bill/ subsea rig at position of BH04; lift anchors, track drilling rig to BH08 immediately NW of the existing boat ramp and within the access channel. TAMS dinghy/ tender in attendance as rig tracked to position at BH08 to safeguard boat traffic passing to and from the ramp (Photos 1 and 2). Rig positioned at BH08 and the punt Charlie Bill moored alongside in three-point anchor spread and navigation buoys set.
09.15	Commence drilling at BH08 in HQ3 coring – sandy gravel encountered from the seabed to a depth of 1.60m – a Standard Penetration Test (SPT) completed at 0.50m depth indicated this material is medium dense. Limestone was encountered below the gravel and comprised medium to high strength coralline calcarenite (limestone with sand sized grains) and coarse calcisiltite (fine grained limestone) to 3.00m depth with 100% recovery in core runs recorded throughout the full depth of the borehole. The borehole was terminated at 3.00m below seabed.
	Soundings taken at the position of BH08 at 13.44hrs indicated the seabed is at 0.88m below chart datum rather than an estimated 0.57m below chart datum as indicated on the borehole table in the DoT drawing. The termination depth of 3.0m below chart datum was therefore achieved with an actual termination depth of 3.58m below CD.
13.50 To 15.25	Diver out of water, lift anchors to Charlie Bill and track rig from BH08 to position of BH10 (Photo 3); rig positioned at BH10 (Photo 4) and the punt Charlie Bill moored alongside in three-point anchor spread and navigation buoys set. Commercial operator had temporarily moved from mooring close to position of BH10



15.50	Commence drilling at BH10 in HQ3 coring - limestone pavement encountered beneath a 300mm sand gravel layer at the seabed - the recovered core comprised medium to high strength fine grained calcarenite (limestone with sand sized grains) to the full depth of 1.50m. Recovery for this core run was 87% - this loss is inferred to represent a zone of leaching of parts of the limestone resulting in discrete layers (100mm) of insitu gravelly sand within the limestone. Vugs (solution cavity features up to 75mm in diameter) were also noted throughout the recovered core. The borehole was terminated at 1.50m below seabed. Soundings taken at the position of BH10 at 15.49hrs indicated the seabed is at 2.48m below chart datum in comparison to the estimated 2.33m below chart datum as indicated on the borehole table in the DoT drawing. The termination depth of 3.00m below chart datum was therefore achieved with an actual termination depth of 3.98m below CD.
16.30	Recover divers and drilling/coring equipment to AMS1/ Charlie Bill; Charlie Bill/ subsea rig left
to	moored at BH10 overnight in three point anchor spread and navigation buoys set.
17.00	
17.05	Return to AMS Boss.
	·

The rig tracked from the position at BH04 to BH08 in the morning and BH08 to BH10 in the afternoon. Seabed conditions in these areas were observed to be similar to those encountered throughout the drilling campaign to date (and are additionally observable from the support vessels at the surface).

Turbidity was slight with some drilling mud/ sand return venting into the water column with visibility unaffected outside a zone extending some 2 to 3m from the return flush at the front of the drill rig.

Additional Notes:

1. Objectives for tomorrow – Track subsea rig from BH10 to BH11 (the final borehole) and then prepare for demobilisation.



Figure 1 Subsea rig tracking from BH04 to BH08 immediately NW of existing boat ramp. Snorkeller and TAMS tender in attendance to safeguard passing boat traffic



Figure 2 TAMS tender watching boat traffic as rig moves to position at BH08



Figure 3 Subsea rig tracking underway from BH08 to BH10 within boat mooring area



Figure 4 Subsea rig set up and ready to drill in boat mooring area at BH10



Site: Tantabiddi Boat Ramp

Day/Shift Time: Day Shift: 05.30 to 18.00

Date: 13 May 2021 Weather: Sunshine

CMW Site Representative: Tim Robinson

Daily Aim: Track subsea rig from BH010 to BH11, commence drilling, complete and TAMS

to commence demobilisation from Tantabiddi.

.

Time	Actions
05.30	Depart accommodation
06.00	Arrive Tantabiddi Boat Ramp and transfer to AMS Boss via dives support vessel AMS1
06.15	Conduct TAMS Pre-start and sign off on SWMS; complete BAC testing; load further core boxes & supplies
06.30 to 08.45	AMS1 to overnight location of the Charlie Bill/ subsea rig at position of BH10; lift anchors, track drilling rig to BH11. Rig positioned at BH11 and the punt Charlie Bill moored alongside in three-point anchor spread and navigation buoys set.
08.45	Commence drilling at BH11 in HQ3 coring – limestone was encountered directly at the seabed beneath a 50mm veneer of sand and comprised medium to high strength coralline calcarenite (limestone with sand sized grains) to 1.50m depth with 100% recovery. The borehole was terminated at 1.50m below seabed.
	Soundings taken at the position of BH11 at 09.15hrs indicated the seabed is at 2.27m below chart datum in comparison to the estimated 2.11m below chart datum as indicated on the borehole table in the DoT drawing. The termination depth of 3.0m below chart datum was therefore achieved with an actual termination depth of 3.77m below CD.
09.40 onwards	Drilling campaign at Tantabiddi is completed.
Oliwalus	Divers out of water, lift anchors to Charlie Bill and commence tracking rig from BH11 to the AMS Boss for recovery of the drill rig.
	TAMS to complete packing of all equipment and stow/ make safe aboard AMS Boss for return to Onslow supply base.
	T. Robinson to AMS Boss, check packing and stowing of core trays for departure to Onslow (then by road transport to nominated Perth laboratory). Return to Exmouth for onward flight to Perth.



Typical seabed conditions consistent with those previously encountered are shown in the attached Photos 1 to 6 taken on 11 May 2021 showing the drill rig tracking from borehole BH13 to BH16 with post completion images of the sites at both locations.

Additional Notes:

1. Complete TAMS demobilisation 14 May 21 - AMS Boss to depart for Onslow supply base with the Charlie Bill in tow. AMS1 to be recovered at Tantabiddi boat ramp then by road to Onslow.



Figure 1 Rig tracking between BH13 and BH16 (11 May 21)



Figure 2 BH13 Drill site after rig moves away to BH16 (11 May 21)



Figure 3 Rig tracking from BH13 to BH16 (11 May 21)



Figure 4 Drill mast deployed showing timber below base plate prior to drilling BH16 (11 May 21)



Figure 5 BH16 drill site following completion (11 May 21)



Figure 6 Close-up of seabed at BH16 following completion (11 May 21)

Appendix D Lawful Authority and Disturbance Approval System (DAS)

OFFICE USE ONLY



Department of Biodiversity, Conservation and Attractions



CONSERVATION AND LAND MANAGEMENT REGULATIONS 2002 Regulation 35A

LAWFUL AUTHORITY TO UNDERTAKE CORE SAMPLING FOR GEOTECHNICAL SURVEYS

This lawful authority is a written notice for the purposes of regulation 35A of the Conservation and Land Management Regulations 2002 (the regulations) and it grants lawful authority to the person named herein as the authority holder to undertake certain activities in the areas specified below, an act that would otherwise be unlawful under the regulations.

This authority is not valid without the signature of the Chief Executive Officer or a delegate of the CEO (Regional or District Manager/Regional Parks Manager) of the Department of Biodiversity, Conservation and Attractions.

The Chief Executive Officer of the Department of Biodiversity, Conservation and Attractions hereby grants to:

Department of Transport (DoT)

lawful authority to undertake quarrying, removing or disturbing soil etc on Conservation and Land Management Act (1984) Land (CALM Land) as specified below:

Waters adjacent to the north, east and south of the Tantabiddi Boat Ramp, within the Ningaloo Marine Park.

This lawful authority is issued subject to the provisions of the Conservation and Land Management Regulations 2002, the terms and conditions as set out in the next section "Conditions for Approval" and "Other Conditions to be observed" (if applicable).

This lawful authority is valid for the period specified below:

Start date: May 5, 2021 Expiry date: June 30, 2021

*Name: Alicia Whittington Signed:

Date: May 5, 2021

Upon arrival to commence the activities listed above, please report to Peter Barnes 0415 483 066.

^{*}A/ Regional Manager as a Delegate of the CEO under Section 133(2) of the Conservation and Land Management Act 1984

OFFICE USE ONLY

CONDITIONS FOR APPROVAL

This application will need to be consistent with the conditions as outlined below:

- Lawful authority is granted to DoT to collect core samples from up to 15 bore holes within a 13ha area from Ningaloo
 Marine Park as identified in Figure 1, noting that there may be some variation to the proposed bore hole locations
 following ground truthing.
- A contractor approved by DoT will use a barge and drill rig to take core samples up to 130mm in diameter and up to 1.5m depth.
- 3. DoT to provide DBCA with contact details for contractor as soon as practicable after the tender is awarded but prior to works commencing. DoT to provide key DBCA contact details to the contractor prior to works commencing.
- 4. The drill rig may traverse through the marine park subject to certain conditions:
 - Divers/spotters will pre-plan a route that enables wide cornering for the rig and traverses sandy ground, where possible.
 - b. The rig will be fitted with rubber tracks to provide a level of cushioning.
 - c. There will be flexibility to locate the rig + or 5m from the planned borehole location, to avoid skewing of the rig in an attempt to get exactly onto position.
 - d. The contractor will conduct an on-site risk assessment of the limestone pavement before works commencing. This will include an evaluation of the structure of the limestone pavement and the likelihood of crushing, based on contractor experience. Areas with a greater risk of crushing will be avoided, where possible.
 - e. This assessment is to be communicated to DBCA prior to works commencing and indicative routes will be provided to the Marine Park Coordinator for District approval.
 - f. After the first day of core sampling, the contractor will provide a situation report to DBCA, including before and after photos of the seabed where the rig has traversed, to enable DBCA to assess any damage to the limestone pavement.
 - g. Contractor to immediately advise DBCA if significant visible damage occurs to the limestone pavement during works thereafter. This may be defined as continuous, visible rig ruts crushed into the limestone pavement, with the potential for long-term visibility (as opposed to minor, discrete instances of crushing which may be considered acceptable).
- 5. Exact drill rig specifications to be provided to DBCA after the contract has been awarded and prior to works commencing.
- Any changes to the proposal due to machinery and equipment being used by the successful contractor to be approved by DBCA prior to works commencing.
- 7. All works and operations to be undertaken within the guidelines and specifications of DBCA's Disturbance Approval System, Approval Number A000426, specifically but not restricted to all management actions contained therein.
- 8. Authority holder is responsible for repairing and/or restoring any damage to CALM land or property sustained whilst undertaking activities permitted under this authority as directed by the District Manager.
- 9. Activities to occur only in daylight hours to avoid impacts on nesting turtles and hatchlings from artificial lighting.
- 10. A trained Marine Fauna Observer will be on site for the duration of the operation.
- 11. Operations to be consistent with *Underwater Piling Noise Guidelines* (Dept of Planning, Transport and Infrastructure SA, 2012) to minimise noise disturbance to sensitive marine fauna species.
- 12. A spill kit suitable for containing any spill contamination must be available onsite at all times. All spills and uncontrolled releases of hydrocarbons to the marine environment will be recorded as an environmental incident and will be reported to DBCA.
- 13. Incidents involving injuries to wildlife and/or benthic communities and habitats will be immediately reported to the DBCA District Office: Elise Launer 0459 845 123 or Peter Barnes 0415 483 066.
- 14. DoT will be responsible for remediation of any impacts resulting from an environmental incident.
- 15. All equipment/vessels brought onto approved CALM land via any landings under this Authority must be checked to ensure it is clean and free of plants (including seeds), animals marine pests and soil.
- 16. No animals (including pets) or plants are to be taken onto approved CALM land via any activity undertaken under this Authority.
- 17. Vehicles and heavy equipment entering CALM lands must be in good running condition: free of fuel, oil and hydraulic leaks.
- 18. No firearms are taken to be taken on to approved CALM land.

19. All rubbish and waste brought onto approved CALM land via any activity approved under this Authority must be removed from CALM land upon departure and disposed of at an appropriate disposal site.

Safety

- 20. DoT must provide notification of proposed activities to users of Tantabiddi Boat Ramp and Ningaloo Marine Park via a Temporary Notice to Mariners.
- 21. Operations to avoid works within the navigation channel during peak usage.
- 22. Safety watch to be maintained and all equipment to be clearly visible to marine park users.

23. Liability

Unless otherwise specified in this application, a group or organisation shall at all times during the currency of this permit maintain a policy of public liability insurance for a sum of not less than \$10 million. The applicant must sign the deed poll clause (Part C) of this form. Individuals conducting an activity by themselves of not as a leader of a group for which they have duty of care, are not required to have public liability insurance (Part B).

24. Reporting

The group or organisation shall advise the District or Regional Manager as soon as practicable of any problems encountered in conducting the approved activity/event or of any personal injuries or damage to property sustained as a consequence of undertaking the activity/event.

25. Findings from geotechnical surveys to be provided in a brief report to DBCA within three months of completion of works.

OTHER CONDITIONS TO BE OBSERVED

1 General

- 1.1 This Lawful Authority must be carried by the Authority Holder or authorised agents (contractors) at all times for the purposes of proving their authority to access Ningaloo Marine Park when questioned by a Wildlife Officer, CALM Officer, Ranger, any other state or local government employee or member of the public.
- 1.2 Approved activities or events must adhere to all conditions as specified in the Conservation and Land Management Act 1984, the Conservation and Land Management Regulations 2002, Biodiversity Conservation Act 2016 and Biodiversity Conservation Regulations 2018 which are to be read in conjunction with this lawful authority.
- 1.3 This approval is subject to any necessary permission being obtained from other authorities.
- 1.4 This approval is subject to compliance with all relevant State and Commonwealth laws, including any relevant Act, regulations, by-laws, ordinances and other forms of statutory instrument
- 1.5 The Director General retains the right to terminate the Authority at any time.
- 1.6 The District Manager (Leah Pearson 0418 416 442) and/or Marine Parks Coordinator (Peter Barnes 0415 483 066) is to be notified before the commencement of any activity. The District Manager can be contacted on 0418 416 442.
- 1.7 The District Manager or his/her delegate has onsite control of all activities.
- 1.8 The Authority holder shall keep the Authority on hand during all periods of collection activity and produced on demand to an officer of the Department of Biodiversity, Conservation and Attractions.
- 1.9 Authorities are not transferrable.
- 1.10 All individuals assisting with the project must be supervised by the Authority holder. The Authority

- 2.7 Fires within a Park must be in an approved site.
- 2.8 On-site camping in a park may be permitted on a site selected by the District Manager or his/her delegate.

3. Specimens

- 3.1 A licence to take fauna for education or public purposes, or a scientific or other prescribed purposes licence (Flora), or a Regulation 89 licence to take flora and fauna in a Marine Reserve for Scientific Purposes is required to collect flora or fauna.
- 3.2 Plant specimens are to be restricted to standard herbarium sheet size or smaller unless specifically indicated.
- 3.3 Rootstocks of plants are to remain undisturbed unless specifically indicated.
- 3.4 All fauna including invertebrates are to be released at the site of collection unless otherwise indicated.
- 3.5 The taking of Buprestidae beetles is not permitted.

- holder remains fully responsibility for all actions undertaken under this Authority.
- 1.11 Commercial use or sale of any specimens taken under this Authority is prohibited.
- 1.12 The Authority does not allow the taking of Declared (or Threatened) Rare Flora or Fauna.
- 1.13 The Authority provides no entry to Parks or Reserves, or parts thereof, listed as limited access or prohibited areas.
- 1.14 The Director General shall be provided with a report at the expiry of the Authority detailing the results of the project and a copy of all publications arising from the project. Details of all specimens taken, where lodged and registration numbers in those collections must be provided.

2. Environmental Considerations

- 2.1 Disturbance to the environment must be minimal
- 2.2 Rocks, logs, litter or similar material are to be returned to their original orientation on completion of research.
- 2.3 Excavations, regardless of size, must be backfilled upon completion of work.
- 2.4 Pit traps must be filled or capped following completion of the work period and removed entirely after completion of the project.
- 2.5 All reference markers must be removed before the expiry date of the Authority.
- Camping or lighting fires on Nature Reserves is prohibited.

Permission is granted to conduct the activity/event nominated in this application subject to the above-mentioned conditions of approval.

Department of Biodiversity, Conservation and Attractions contact

Name:	Peter Barnes 0415 483 066									
Office:	Exmouth (Pilbara Region	1)								
Contact:	(08) 9947 8000	0415 483 066	peter.barnes@dbca.wa.gov.au							

Invoiced	Invoice No.			
Admin Officer	Date / /			

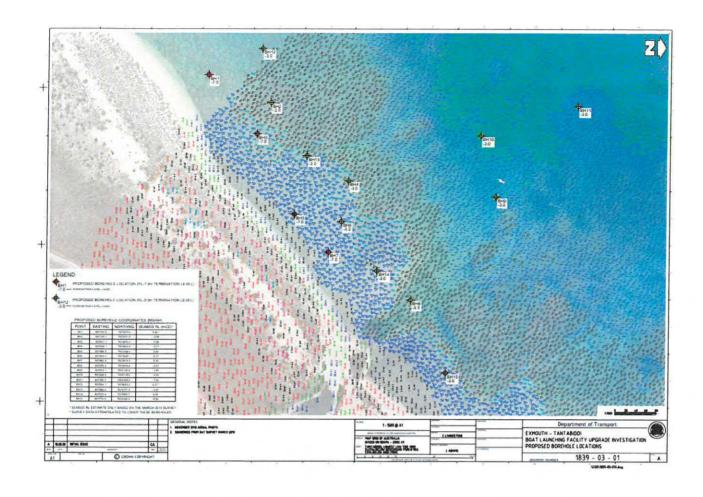


Figure 1. Area adjacent to Tantabiddi boat ramp where the Department of Transport is authorised to take cores samples under the conditions of the accompanying Lawful Authority.

APPENDIX I

Activities that require Lawful Authority under CALM Regulations

Regulation No.	Activity
12 (1)	Possession or use of firearms, spears, restricted devices etc.
15	Bringing and allowing an animal on to CALM Act land
31(1) (a),(b),(c) & (4)	Cause any significant damage or disturbance to a naturally occurring feature, damage or disturb any naturally occurring feature, remove any naturally occurring feature from CALM land (includes fossicking activities)
33 (1)	Abseiling on CALM Act land (except in an abseiling area)
34(1)	Placement of any structure on CALM Act land.
38 (1)	Erecting any sign or notice on CALM Act land (unauthorised signs)
39 (1)	Lighting, kindling, maintaining or using, or assisting another person in lighting, kindling or maintaining, a campfire, barbeque or portable stove on CALM Act land; in a restricted area where that activity is prohibited under r. 5; or contravenes a restriction imposed on that activity under r. 5; or where flora and forest produce is in danger of being burnt or injured
39 (2)	Lighting, kindling, maintaining or using, or assisting another person in lighting, kindling or maintaining, any fire within the boundaries or within 20 metres of any boundary of CALM Act land; or leave a fire described above without taking due precaution against its spreading or causing injury, if in either case any flora or forest produce is in danger of being burnt or injured
49	Being in a cave (cave means a cave or part of a cave which is on or under CALM Act land) and complying with the specified conditions and restrictions
50	Cross country and other events - organising, promoting or conducting any event involving cross country running, orienteering, rogaining, cross country navigation exercises or equestrian events on CALM Act land
51 (1)	Driving or using a vehicle (other than a bicycle) on CALM Act land other than on a road or in a designated area
51A (1)	Bicycles - Riding a bicycle on CALM Act land other than on a road or bicycle path or in a designated area
52	Off- road vehicles into CALM Act land - under the Control of vehicles (Off-road areas) Act 1978
53	Car rallies etc organising, promoting or conducting a car rally, associated navigation exercise, mountain bike event or other race involving vehicles on or through CALM Act land
58	Races - organising, promoting or conducting a race involving vessels on or through CALM Act land
60 (1) (a) & (b)	Anchoring vessels - in a restricted area if that activity is prohibited under Regulation 5, or contravening a restriction on the anchoring of vessels in a restricted area imposed under Regulation 5
65	Launching, landing or making a touch down in an aircraft on CALM Act land (does not apply to an aircraft that is required to launch or touch down contrary to that subregulation to avoid or mitigate danger to human life or significant damage to property)
66	Camping controlled - camping on CALM Act land except in a camping area or on a vessel that is moored or anchored in accordance with these regulations
105 (1)	Organised events and meetings - organising, advertising or holding a meeting, function or event on CALM Act land which is likely to involve or involves the attendance of more than 100 persons



PAGE 1 **NO.** A000426

Department of Transport 5 Newman Court Fremantle WA 6160 Australia

04/05/2021

APPROVAL OF PROPOSAL Tantabiddi Boating Facility – Geotechnical Investigations P000916 TO UNDERTAKE DISTURBANCE ACTIVITY IN Pilbara - Exmouth

The submitted proposal Tantabiddi Boating Facility – Geotechnical Investigations P000916 has been assessed and approved. The approval is granted on the understanding that:

- The potential impacts of the proposal on values the department manages have been removed or minimised to a level 'As Low As Reasonably Practicable' (ALARP) and the proposal is consistent with departmental objectives, associated management plans and the land use category/s in the activity area.
- Approval is granted for the period 05/05/2021 to 30/06/2021. This approval is not valid if Department of Transport
 makes changes to what has been proposed or the proposal has expired. To change the proposal or seek an extension,
 the proponent must re-submit the proposal for assessment.
- The proponent accepts responsibility for advising DBCA of new information or unforeseen threats that may affect the
 risk of the proposed activity.
- Information provided by DBCA for the purposes of this proposal will not be provided to third parties without permission from DBCA.
- The proponent accepts responsibility for supervising and monitoring implementation of activity/ies to ensure compliance with this proposal. DBCA reserves the right to request documents and records demonstrating compliance for departmental monitoring and auditing.
- Non-compliance with the conditions of the proposal may trigger a suspension or withdrawal of the approval for this
 activity.
- Management actions listed in Appendix 1 are implemented.

The following requirements must be satisfied for the approval of the proposal not to be withdrawn:

1 Contractor to immediately advise DBCA if significant visible damage occurs to the limestone pavement during works.

Should you have any queries about this approval, please contact Alicia Whittington, on (08) 9182 2041 or by email at alicia.whittington@dbca.wa.gov.au

To provide feedback on the system used to submit the approval or update contact details, please contact DAS Works Coordinator - das@dbca.wa.gov.au

Approved on behalf of the

Department of Biodiversity, Conservation and Attractions

Alicia Whittington Pilbara - Exmouth

04/05/2021



Department of **Biodiversity**, **Conservation and Attractions**



PAGE 2 **NO.** A000426

Appendix 1 - Management Actions

3.0.3 Specify management actions consistent with pre-approval None specified

3.3.3 Specify management actions consistent with joint vesting/management/agreement/arrangements
The Nyinggulu Coast Joint Management Body was notified of intended works at the November meeting. DoT will provide outcomes of the geotechnical survey to JMB once complete.

4.1.3 Specify management actions to conserve identified fauna and/or special habitat values

Potential management actions include having a spotter/diver in front of the rig to avoid corals and dense patches of macroalgae. Impacts at drilling locations are discrete and will result in minimal disturbance to BCH. The boreholes will be maximum 130 mm diameter. Potential impacts to marine fauna will be managed by: Marine fauna observer on vessel, threshold distances for stop work procedures to minimise impacts on marine species. No work to be undertaken at night time. Any temporary barriers to manage visitor safety will not impede movement of turtles or hatchlings. Potential impacts to BCH will be managed by: • Highest likelihood of crushing will occur when the rig skews/corners tightly. Divers will pre-plan a route the enables wide cornering and traverses sandy ground, where possible. • Rubber tracks on the rig will provide a level of cushioning. • The contractor will conduct an on-site assessment of the limestone pavement before works commencing. This will include an evaluation of the structure of the limestone pavement and the likelihood of crushing, based on contractor experience. Sites with a greater risk of crushing will be avoided where possible. This assessment is to be communicated to DBCA before works commencing. CMW and TAMs will plan indicative routes on Thursday 6 and then meet with Peter Barnes (Marine Park Manager) late afternoon to discuss routes to seek his approval. • After the first day of core sampling, contractor/DoT to provide the daily report to DBCA, including before and after photos of the seabed where the rig has traversed, to enable DBCA to assess any damage to the limestone pavement. • There may be some minor damage to the limestone pavement. Contractor to immediately advise DBCA if significant visible damage occurs to the limestone pavement thereafter. Routes will be pre-planned as specified above. High-value BCH (eg. Corals) will be avoided by relocating borehole to limestone pavement/sand or a location easier to access. It is suggested that we should only strive to locate rig within + or - 5 m of planned position to avoid skewing of rig in an attempt to get exactly onto position.

5.0.2 Specify management actions to minimise dust, noise or air quality impacts

Slow start up procedures will be used to avoid impacts to marine fauna from noise. A marine fauna observer will be on board the vessel and there will be threshold distances to stop work if fauna is observed. We propose to adopt the management practices recommended in the SA guidelines "Underwater Piling Noise Guidelines (Attached). Under these guidelines MFO will be deployed and activities will cease if marine fauna come within the distance specified in the guidelines.

8.4.2 Specify management actions to protect visual amenities

N/A. Cannot be avoided

8.6.2 Specify management actions to remove or minimise visitor risk

DoT will issue a Temporary Notice to Mariners and DBCA could assist by informing the commercial operators. The core sampling is only likely to take a few days at most. DoT will time works to also avoid sampling at locations in the navigation channel during peak times where possible.

8.9.2 Specify management actions to avoid or minimise impacting commercial activities

A Temporary Notice to Mariners will be in place during works. The majority of the proposed bore holes do not impact boat operators, however, a small number may require to be undertaken outside of the busy time of tour operators and have a specific management plan. These do not impact on the operation of the facility but are in the waterway between the facility and access to the navigation channel.

8.12.2 Specify management actions to restrict access

Work will avoid peak times where possible. Temporary notice to mariners by DoT. DBCA to inform commercial operators. Channel will still be navigable - restriction will be to only part of it for short periods of time.

Appendix E Marine Fauna Observer Record Sheets

Tantabiddi Geotechnical Investigations Marine Fauna Sightings forn

					 12 Mg/2	11 May 21	Date
					3458	346	Borehole location
					TRANS Charlie Bill	11 mg/21 Bulb Charlie B: 11 Y	MFO location
					~	~	SPT underway Y/N
					I (the issen Ni)	1 1	Time of first MFO name sighting
		·			7.	Z	Time of first sighting
							Time of Time of first last sighting sighting
							Animal group (e.g. whale, turtle, etc.)
					1 7	11	Species (if known)
							Number of animals in group
							Animal's behaviour
		···					Animal injured (Y/N)

Tantabiddi Geotechnical Investigations Marine Fauna Sightings forn

		:					Distance from SPT activities (m)
							True bearing from borehole (degrees)
					7	=	Within shutdown zone (Y/N)
							SPT ceased (Y/N)
		·					Time
							Time restarted
					Na marine Faunce sightings	No Marine Laurus sightimes	Comments

Tantabiddi Geoterhnical Investigations – Marine Farna Observer Watch

Observer name: 1.15 in Son	Öbserver lo	cation:	Observer location: This Charle 15:1	
MFO watch start time: 10:42	MFO watch end time:	end time:	12:16	
SPT start time: (1:3)	_ SPT end time: 12:16	ле:	6	
Date Time Borehole Pre-start	tart	Normal Op	Normal Operations (SPT)	Notes on SPT activity etc.
Time	Marine fauna sighted?	Time	Marine fauna sighted?	Comments
	Y/N & sighting #		Y/N & sighting #	
11May 21 10:42 BH16 10:42	2 7	16:31	L	He marine fauna sightness during

MFO watch start time: 17:48

SPT start time: 12:34 Observer name: 1. (1) insum 12 May 21 11:48 Time Buos Borehole number Tantabiddi Geoterhnical Investigations – Marine Farma Observer Watch

Observer location: TAMS (harke 3:1)

MFO watch end time: 13:33 11:48 **Pre-start** Z Y/N & sighting # sighted? Marine fauna SPT end time: 13:33 12:36 Time **Normal Operations (SPT)** Marine fauna sighted? Y/N & sighting # Z Comments Notes on SPT activity etc. No marine fauna sightings during

Appendix F Laboratory Test Results and Results Summary Matrix

Mob: 0422 814 231 E-mail: Phillip.li@eprecisionlab.com

12/06/2021

12/06/2021



POINT LOAD STRENGTH INDEX TEST REPORT

Test Method: AS4133.4.1

Client: Western Geotechnical Lab Services

Date Tested:
Date Reported:

Tantabiddi Boating Facility

EP Lab Job Number: WGEO

Lab: EPLAB Tested by: Phil

Project:

Results

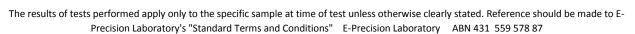
Lab ID:	WG21_7480_PLT	WG21_7481_PLT	WG21_7482_PLT	WG21_7484_PLT	WG21_7485_PLT
Client ID:	BH12	BH12	BH01	BH01	BH01
Photo ID:	-	-	-	-	-
Test Type:	Axial	Axial	Axial	Axial	Axial
Depth (m):	0.24 - 0.36	1.00 - 1.10	0.60 - 0.74	2.40 - 2.50	3.30 - 3.40
Lithology/Description:	-	-	-	-	-
Moisture Content (%):	0	0	0	0	6.39
Diameter (D) (mm):	60.56	60.61	60.62	60.6	60.47
Length (t) (mm):	31.02	37.4	30.82	34.58	36.89
L/D Ratio:	0.51	0.62	0.51	0.57	0.61
Mode of Failure:	Axial Split				
Load at Failure (kN):	3.26	3.24	7.06	4.52	0.45
ls (MPa)	1.36	1.12	2.97	1.69	0.16
ls (50) (MPa)	1.35	1.16	2.93	1.72	0.16

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

Authorised Signatory (Geotechnical Engineer):



Mob: 0422 814 231 E-mail: Phillip.li@eprecisionlab.com



POINT LOAD STRENGTH INDEX TEST REPORT

Test Method: AS4133.4.1

Client: Western Geotechnical Lab Services Date Tested:

EP Lab Job Number:

12/06/2021

WGEO

Project: Tantabiddi Boating Facility

12/06/2021 Date Reported:

EPLAB Lab: Tested by: Phil

Results

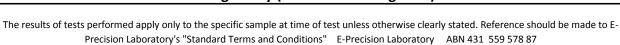
Lab ID:	WG21_7486_PLT	WG21_7487_PLT	WG21_7490_PLT	WG21_7492_PLT	WG21_7493_PLT
Client ID:	BH01	BH02	BH02	BH02	BH02
Photo ID:	-	-	-	-	-
Test Type:	Axial	Axial	Axial	Axial	Axial
Depth (m):	7.00 - 7.20	0.30 - 0.40	1.40 - 1.50	4.90 - 5.00	6.60 - 6.70
Lithology/Description:	-	-	-	-	-
Moisture Content (%):	0	0	3.85	0	0
Diameter (D) (mm):	60.33	60.62	60.22	60.35	60.26
Length (t) (mm):	31.08	32.35	47.19	39.06	33.91
L/D Ratio:	0.52	0.53	0.78	0.65	0.56
Mode of Failure:	Axial Split				
Load at Failure (kN):	7.69	2.58	1.96	3.28	1.87
ls (MPa)	3.22	1.03	0.54	1.09	0.72
ls (50) (MPa)	3.19	1.03	0.59	1.14	0.73

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

Authorised Signatory (Geotechnical Engineer):



Mob: 0422 814 231 E-mail: Phillip.li@eprecisionlab.com



POINT LOAD STRENGTH INDEX TEST REPORT

Test Method: AS4133.4.1

Client: Western Geotechnical Lab Services Date Tested:

12/06/2021 Project: 12/06/2021 Date Reported: Tantabiddi Boating Facility

EP Lab Job Number: **WGEO**

EPLAB Lab: Tested by: Phil

Results

Lab ID:	WG21_7494_PLT	WG21_7496_PLT	WG21_7500_PLT	WG21_7501_PLT	WG21_7502_PLT
Client ID:	BH03	BH03	BH03	BH13	BH13
Photo ID:	-	-	-	-	-
Test Type:	Axial	Axial	Axial	Axial	Axial
Depth (m):	0.23 - 0.36	0.54 - 0.68	6.30 - 6.40	0.10 - 0.30	1.00 - 1.15
Lithology/Description:	-	-	-	-	-
Moisture Content (%):	0	0	0	0	0
Diameter (D) (mm):	60.12	60.02	60.68	60.65	60.47
Length (t) (mm):	31.65	35.43	33.41	37.45	30.79
L/D Ratio:	0.53	0.59	0.55	0.62	0.51
Mode of Failure:	Axial Split				
Load at Failure (kN):	2.49	4.05	3.23	24.1	9.82
ls (MPa)	1.03	1.50	1.25	8.33	4.14
ls (50) (MPa)	1.02	1.52	1.26	8.61	4.09

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

Authorised Signatory (Geotechnical Engineer):

Mob: 0422 814 231 E-mail: Phillip.li@eprecisionlab.com



POINT LOAD STRENGTH INDEX TEST REPORT

Test Method: AS4133.4.1

Client: Western Geotechnical Lab Services

Date Tested: 12/06/2021 Date Reported: 12/06/2021

Project: Tantabiddi Boating Facility

EP Lab Job Number: WGEO

Lab: EPLAB
Tested by: Phil

Results

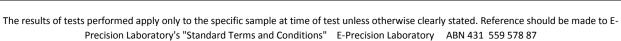
		110001100			
Lab ID:	WG21_7505_PLT	WG21_7506_PLT	WG21_7508_PLT	WG21_7510_PLT	WG21_7513_PLT
Client ID:	BH16	BH04	BH04	BH08	BH11
Photo ID:	-	-	-	-	-
Test Type:	Axial	Axial	Axial	Axial	Axial
Depth (m):	2.30 - 2.40	0.50 - 0.60	2.28 - 2.35	1.60 - 2.00	0.30 - 0.50
Lithology/Description:	-	-	-	-	-
Moisture Content (%):	0	0	0	0	7.39
Diameter (D) (mm):	59.88	60.33	60.45	60.81	60.58
Length (t) (mm):	35.71	37.05	35.52	37.95	36.69
L/D Ratio:	0.60	0.61	0.59	0.62	0.61
Mode of Failure:	Axial Split				
Load at Failure (kN):	10.36	13.05	3.52	2.47	0.52
s (MPa)	3.81	4.59	1.29	0.84	0.18
ls (50) (MPa)	3.88	4.72	1.31	0.87	0.19

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

Authorised Signatory (Geotechnical Engineer):





POINT LOAD STRENGTH INDEX TEST REPORT

Test Method: AS4133.4.1

Client: Western Geotechnical Lab Services Date Tested: 12/06/2021

Project: Date Reported: 12/06/2021

Tantabiddi Boating Facility

EP Lab Job Number: WGEO

Lab: EPLAB Tested by: Phil

PHOTO POST TESTING



Perth 16 Gympie Way, Willetton WA 6155 Ph: (08) 9418 8742

Mob: 0422 814 231 E-mail: Phillip.li@eprecisionlab.com



POINT LOAD STRENGTH INDEX TEST REPORT

Test Method: AS4133.4.1

Client: Western Geotechnical Lab Services Date Tested: 12/06/2021

Project: Date Reported: 12/06/2021

Tantabiddi Boating Facility

Date Reported: 12/06/2021

EP Lab Job Number: WGEO

Lab: EPLAB Tested by: Phil

PHOTO POST TESTING











Mob: 0422 814 231

E-mail: Phillip.li@eprecisionlab.com



UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Test Method: AS4133 4.2.1

Client: Western Geotechnical Lab Services Date Tested: 11/06/2021

Project: Tantabiddi Boating Facility EP Lab Job Number: WGEO

Client ID: BH01 Lab: EPLab

Lab ID: WG21_7483_UCS Issue Date: 12/06/2021

Depth (m): 1.70 - 2.00 Room Temperature at Test: 19°C

Tested by: Phil Sample Description: -

Checked by: Phil

* <u>Testing Temperature:</u> N/A

Length/Diameter Ratio:2.33Bulk Density (t/m³):2.24Correction Applied:NMoisture Content (%):0.00

Failure Mode: Intact Shear

Length (mm): 140.59 Rate of Loading (mm/min): 0.009

Diameter (mm): 60.35

Before Test



After Test



UCS (MPa)	14.86	Bedding Angle (deg)	N/A
Failure Angle (deg)	25.8		

Notes: Accredited for compliance with ISO/IEC 17025 - Testing

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078 Authorised Signatory (Geotechnical Engineer):



Mob: 0422 814 231

E-mail: Phillip.li@eprecisionlab.com



UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Test Method: AS4133 4.2.1

Client: Western Geotechnical Lab Services Date Tested: 11/06/2021

Project: Tantabiddi Boating Facility EP Lab Job Number: WGEO Client ID: BH02 Lab: EPLab

Lab ID: WG21_7488_UCS Issue Date: 12/06/2021

Depth (m): 0.40 - 0.70 Room Temperature at Test: 19°C

Tested by: Phil Sample Description: -

Checked by: Phil

* <u>Testing Temperature:</u> N/A

Length/Diameter Ratio:2.03Bulk Density (t/m³):1.95Correction Applied:NMoisture Content (%):0.00

Failure Mode: Intact Shear

Length (mm): 123.36 Rate of Loading (mm/min): 0.009

Diameter (mm): 60.85

Before Test



After Test



UCS (MPa)	12.14	Bedding Angle (deg)	N/A
Failure Angle (deg)	24.3		

Notes: Accredited for compliance with ISO/IEC 17025 - Testing

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078 Authorised Signatory (Geotechnical Engineer):







UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Test Method: AS4133 4.2.1

Client: Western Geotechnical Lab Services Date Tested: 11/06/2021

Project:Tantabiddi Boating FacilityEP Lab Job Number:WGEOClient ID:BH02Lab:EPLabLab ID:WG21_7491_UCSIssue Date:12/06/2021

Depth (m): 2.75 - 2.95 Room Temperature at Test: 19°C

Tested by: Phil Sample Description: -

Checked by: Phil

* <u>Testing Temperature:</u> N/A

Length/Diameter Ratio:2.10Bulk Density (t/m³):2.03Correction Applied:NMoisture Content (%):0.00

Failure Mode: Intact Shear

Length (mm): 128.03 Rate of Loading (mm/min): 0.009

Diameter (mm): 60.97

Before Test



After Test



UCS (MPa)	4.14	Bedding Angle (deg)	N/A
Failure Angle (deg)	22.7		

Notes: Accredited for compliance with ISO/IEC 17025 - Testing

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078 Authorised Signatory (Geotechnical Engineer):



E-mail: Phillip.li@eprecisionlab.com Mob: 0422 814 231



E-Precision Laboratory

UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Test Method: AS4133 4.2.1

Client: Western Geotechnical Lab Services Date Tested: 11/06/2021

Project: Tantabiddi Boating Facility EP Lab Job Number: WGEO
Client ID: BH03 Lab: EPLab
Lab ID: WG21_7497_UCS Issue Date: 12/06/2021

Depth (m): 0.80 - 1.00 Room Temperature at Test: 19°C

Tested by: Phil Sample Description: -

Checked by: Phil

* <u>Testing Temperature:</u> N/A

Length/Diameter Ratio: 2.07 Bulk Density (t/m³): 1.87 Correction Applied: N Moisture Content (%): 0.00

Failure Mode: Intact Shear

Length (mm): 125.63 Rate of Loading (mm/min): 0.009

Diameter (mm): 60.68

Before Test



After Test



UCS (MPa)	1.94	Bedding Angle (deg)	N/A
Failure Angle (deg)	24.9		

Notes: Accredited for compliance with ISO/IEC 17025 - Testing

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078 Authorised Signatory (Geotechnical Engineer):



E-mail: Phillip.li@eprecisionlab.com Mob: 0422 814 231



UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Test Method: AS4133 4.2.1

Client: Western Geotechnical Lab Services Date Tested: 11/06/2021

Project: Tantabiddi Boating Facility EP Lab Job Number: WGEO
Client ID: BH03 Lab: EPLab

 Lab ID:
 WG21_7498_UCS
 Issue Date:
 12/06/2021

 Depth (m):
 2.40 - 2.70
 Room Temperature at Test:
 19°C

Depth (m): 2.40 - 2.70 Room Temperature at Test: 19°C

Tested by: Phil Sample Description: -

Checked by: Phil

* <u>Testing Temperature:</u> N/A

Length/Diameter Ratio:2.51Bulk Density (t/m³):2.04Correction Applied:NMoisture Content (%):0.00

Failure Mode: Intact Shear

Length (mm): 151.99 Rate of Loading (mm/min): 0.009

Diameter (mm): 60.45

Before Test



After Test



UCS (MPa)	12.54	Bedding Angle (deg)	N/A
Failure Angle (deg)	30.4		

Notes: Accredited for compliance with ISO/IEC 17025 - Testing

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078 Authorised Signatory (Geotechnical Engineer):







UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Test Method: AS4133 4.2.1

Client: Western Geotechnical Lab Services Date Tested: 11/06/2021

Project:Tantabiddi Boating FacilityEP Lab Job Number:WGEOClient ID:BH03Lab:EPLabLab ID:WG21_7499_UCSIssue Date:12/06/2021

Depth (m): 4.00 - 4.30 Room Temperature at Test: 19°C

Tested by: Phil Sample Description: -

Checked by: Phil

* <u>Testing Temperature:</u> N/A

Length/Diameter Ratio: 2.21 Bulk Density (t/m³): 1.93
Correction Applied: N Moisture Content (%): 0.00

Failure Mode: Intact Shear

Length (mm): 133.65 Rate of Loading (mm/min): 0.009

Diameter (mm): 60.48

Before Test



After Test



UCS (MPa)	6.44	Bedding Angle (deg)	N/A
Failure Angle (deg)	31.1		

Notes: Accredited for compliance with ISO/IEC 17025 - Testing

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078 Authorised Signatory (Geotechnical Engineer):







UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Test Method: AS4133 4.2.1

Client: Western Geotechnical Lab Services Date Tested: 11/06/2021

Project: Tantabiddi Boating Facility EP Lab Job Number: WGEO Client ID: BH16 Lab: EPLab

 Lab ID:
 WG21_7504_UCS
 Issue Date:
 12/06/2021

 Depth (m):
 1.50 - 1.80
 Room Temperature at Test:
 19°C

Tested by: Phil Sample Description: -

Checked by: Phil

* <u>Testing Temperature:</u> N/A

Length/Diameter Ratio:2.40Bulk Density (t/m³):2.52Correction Applied:NMoisture Content (%):0.00

Failure Mode: Intact Shear

Length (mm): 145.78 Rate of Loading (mm/min): 0.009

Diameter (mm): 60.62

Before Test



After Test



UCS (MPa)	23.91	Bedding Angle (deg)	N/A
Failure Angle (deg)	24.9		

Notes: Accredited for compliance with ISO/IEC 17025 - Testing

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078 Authorised Signatory (Geotechnical Engineer):







UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Test Method: AS4133 4.2.1

Client: Western Geotechnical Lab Services Date Tested: 11/06/2021

Project: Tantabiddi Boating Facility EP Lab Job Number: WGEO
Client ID: BH10 Lab: EPLab

Lab ID: WG21_7511_UCS Issue Date: 12/06/2021

Depth (m): 0.580 - 0.70 Room Temperature at Test: 19°C

Tested by: Phil Sample Description: -

Checked by: Phil

* <u>Testing Temperature:</u> N/A ength/Diameter Ratio: 2.13 Bulk Density (t/m³): 2.25

Length/Diameter Ratio:2.13Bulk Density (t/m³):2.25Correction Applied:NMoisture Content (%):0.00

Failure Mode: Intact Shear

Length (mm): 128.76 Rate of Loading (mm/min): 0.009

Diameter (mm): 60.57

Before Test



After Test



UCS (MPa)	17.70	Bedding Angle (deg)	N/A
Failure Angle (deg)	29.9		

Notes: Accredited for compliance with ISO/IEC 17025 - Testing

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078 Authorised Signatory (Geotechnical Engineer):





BRAZILIAN INDIRECT TENSILE STRENGTH REPORT

Test Method: ISRM No.8

Client: Western Geotechnical Lab Services Date Tested: 12/06/2021
Project: Tantabiddi Boating Facility Date Reported: 12/06/2021

EP Lab Job Number: WGEO

Lab: EPLAB
Tested by: Phil
Checked by: Phil

Lab ID:	WG21_7489_BDT	WG21_7495_BDT	WG21_7508_BDT	WG21_7512_BDT	
Client ID:	BH02	BH03	BH04	BH10	
Depth (m):	0.70 - 0.80	0.40 - 0.50	2.28 - 2.35	0.70 - 1.00	
Lithology/Description:	-	-	1	-	
Moisture Content (%):	0	0	0	0	
Diameter (D) (mm):	60.28	60.23	60.46	60.31	
Thickness (mm):	31.25	41.17	44.68	28.65	
Bulk Density (t/m³):	1.89	1.98	1.70	2.26	
Mode of Failure:	Axial	Axial	Axial	Axial	
Loading Rate (mm/min):	1	1	1	1	
Load at Failure (kN):	5.83	6.87	2.7	8.93	
Tensile Stress (MPa)	1.97	1.76	0.64	3.29	

Comments:

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

Authorised Signatory (Geotechnical Engineer):



BRAZILIAN INDIRECT TENSILE STRENGTH REPORT

Test Method: ISRM No.8

Client: Western Geotechnical Lab Services Date Tested: 12/06/2021
Project: Tantabiddi Boating Facility Date Reported: 12/06/2021
EP Lab Job Number: WGEO

Lab: EPLAB
Tested by: Phil
Checked by: Phil

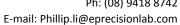
Post Testing Photo

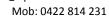














CERCHAR ABRASIVITY INDEX TEST REPORT

Test Method: ASTM D7625 / In-House Method

Client: Western Geotechnical Lab Services Date Tested: 09/06/2021
Project: Tantabiddi Boating Facility EP Lab Job Number: WGEO
Client ID: Various ID Lab: EPLab

Sample ID: -

Depth (m): - Room Temperature at Test: 22°C

Tested by: Phil Li Sample Description: See Below Table

Checked by: Phil Li

Steel Pin (HRC): 54-56 Pin Travel Distance: 10 - 40 mm

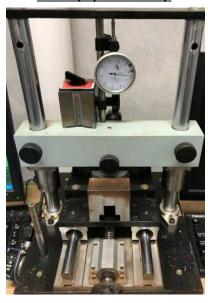
Test Results

Sample ID	Depth (m)	Moisture Content (%)	*Bulk Density (t/m³)	Surface Condition	Cerchar Abrasivity Index (CAI)
WG21_7497_CAI	BH03 0.80-1.0	0	1.865	Sawcut	0.35
WG21_7506_CAI	BH04 0.50-0.60	0	2.064	Sawcut	1.13

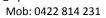
Criteria published by Cerchar

0.3 - 0.5	not very abrasive	
0.5 - 1.0	slightly abrasive	
1.0 - 2.0	medium to abrasive	
2.0 - 4.0	very abrasive	
4.0 - 6.0	extremely abrasive	
6.0 - 7.0	quartzitic	

Test Equipment Setup



Ph: (08) 9418 8742 E-mail: Phillip.li@eprecisionlab.com





CERCHAR ABRASIVITY INDEX TEST REPORT

Test Method: ASTM D7625 / In-House Method

Client: Western Geotechnical Lab Services Date Tested: 09/06/2021
Project: Tantabiddi Boating Facility EP Lab Job Number: WGEO
Client ID: Various ID Lab: EPLab

Sample ID: -

Depth (m): - Room Temperature at Test: 22°C

Tested by: Phil Li Sample Description: See Below Table

Checked by: Phil Li

Steel Pin (HRC): 54-56 Pin Travel Distance: 10 - 40 mm

Photo after Testing





Notes:

Samples supplied by the Client

Authorised Signatory (Geotechnical Engineer):



	SOIL AGGREGATE CONCRETI	E CRUS	HING
	TEST REPORT - WA 915.1		
Client:	CMW Geosciences	Ticket No.	S3282
Client Address:	Suite 1, Level 3/29 Flynn Street, Wembley WA	Report No.	WG21/7491-7501_1_CaC03
Project:	Geotechnical Investigation	Sample No.	WG21/7491-7501
Location:	Tantabiddi Boating Facility	Date Sampled:	Not Specified
Sample Identification	: Various - See below	Date Tested:	3-06-2021

TEST RESULTS - Calcium Carbonate Content

Sampling Method: Sampled by Client, Tested as Received

Sample Number	Sample Identification	Calcium Carbonate Content (%)
WG21/7491	BH02 2.75-2.95m	98.9
WG21/7496	BH03 0.54-0.68m	97.2
WG21/7498	BH03 2.4-2.7m	100.0
WG21/7501	BH13 0.1-0.3m	98.2

Comments:		

Approved Signatory:

Name: Brooke Elliott

Date: 11-June-2021

Accreditation No. 20599
Accredited for compliance
WORLD RECORDITATION
WITH ISO/IEC 17025 - Testing

This document shall not be reproduced except in full

235 Bank Street, Welshpool WA 6106

08 9472 3465

www.wgls.com.au

WG_WA 915.1_TR_3 Page 1 of 1



	SOIL AGGREGATE CONCRETE	E CRUS	HING
	TEST REPORT - WA 915.1		
Client:	CMW Geosciences	Ticket No.	S3282
Client Address:	Suite 1, Level 3/29 Flynn Street, Wembley WA	Report No.	WG21/7506-7512_1_CaC03
Project:	Geotechnical Investigation	Sample No.	WG21/7506-7512
Location:	Tantabiddi Boating Facility	Date Sampled:	Not Specified
Sample Identification	: Various - See below	Date Tested:	3-06-2021

TEST RESULTS - Calcium Carbonate Content

Sampling Method: Sampled by Client, Tested as Received

Sample Number	Sample Identification	Calcium Carbonate Content (%)
WG21/7506	BH04 0.5-0.6m	95.7
WG21/7512	BH10 0.7-1m	84.5

Comments:			,

Approved Signatory:

Name: Brooke Elliott

Date: 11-June-2021

Accreditation No. 20599
Accredited for compliance
WORLD RECORDITATION
With ISO/IEC 17025 - Testing

This document shall not be reproduced except in full

235 Bank Street, Welshpool WA 6106

08 9472 3465

www.wgls.com.au

WG_WA 915.1_TR_3 Page 1 of 1



Our Ref M31301 P21-2057

Contact Trudie Bradbury

Cardno (Qld) Pty Ltd

ABN 57 051 074 992

28 July 2021

Western Geotechnical and Laboratory Services 235 Bank Street WELSHPOOL, WA. 6106 71 Maggiolo Drive Mackay QLD 4740 Australia

Attention: Brooke Elliott Phone: 61 7 4952 5255

Fax: 61 7 4952 5455

Dear Brooke

www.cardno.com.au

PETROGRAPHIC ANALYSIS OF QUARTZ CONTENT, TANTABIDDI BOATING FACILITY 7507.

SAMPLE IDENTIFICATION

CLIENT Department of Transport

SAMPLE DESCRIPTION Core

SOURCE BH04, 1.0-1.15m

PROJECT NAME Geotechnical investigation
SAMPLE REFERENCE WG21/7507 PER2020-0495

DATE SAMPLED Not specified

SAMPLED BY Client

SUMMARY

A sample was submitted for petrographic analysis to determine quartz content. The sample was assessed with reference to:

- AS 1141.65-2008: Alkali aggregate reactivity Qualitative petrological screening for potential alkalisilica reaction:
- ASTM C295. Standard Guide for Petrographic Examination of Aggregates for Concrete;

A thin section was prepared of a representative sample of core for examination in transmitted light through a polarizing microscope. A total of 338 random points within the sample were examined, to give a total of 300 within solid material. Based on the point count, the sample is assessed as containing:

Total 0% free quartz.

99% Calcite; 1% fine clayey sediment (solid material count).

Whole rock point count 297 calcite (88%); 3 fine sediment (1%); void space (11%)

The sample comprises a section through a reef comprising mainly coral growth but also small pockets of entrained sediments and coral sands. For the most part, the sample is made of sparry calcite - generally showing radial growth patterns, with a number of rounded, natural pores – there are some minor pockets of muds and coralline debris, though these do not appear to be significant overall in the sample under examination.

NATA
WORLD RECOGNISED
ACCREDITATION

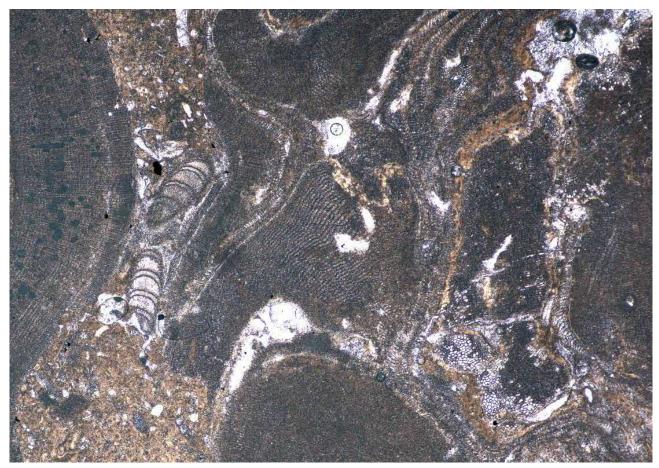
Accredited for compliance with ISO/IEC 17025 - Testing. The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

Trudie Bradbury - Analyst NATA Accreditation Number 910 Mackay Laboratory

Tantabiddi 7507 .Docx Page 1 of 2





Sample under 50x magnification and plain polarised light. Image shows mainly corals with distinctive growth rings, along with some areas of sediment and coral debris, particularly in the bottom left corner. Clear patches are mainly void spaces.

LIMITATIONS

The analysis is based on a single thin section taken from a small sample supplied by the client, it may not be representative of the sample mass as a whole and inspection of the source should be undertaken to further qualify the suitability of the material for the intended use. Comments are specific to the sample examined only. If a specification exists further advice may be sought from a mineralogist to ensure compatibility

Yours faithfully

Trudie Bradbury (analyst)
BSc(hons) MSc MMinRes FGS
Principal Engineering Geologist
for Cardno

Contraction Contraction

Trudie.Bradbury@cardno.com.au

Andrew Williams (reviewer)
BSc(hons) MEnvMgmt FGS CGeol
Senior Principal Engineering Geologist
for Cardno

Andy.Williams@cardno.com.au



Our Ref M31301 P21-2056

Contact Trudie Bradbury

Cardno (Qld) Pty Ltd

ABN 57 051 074 992

28 July 2021

Western Geotechnical and Laboratory Services
235 Bank Street
WELSHPOOL, WA. 6106
71 Maggiolo Drive
Mackay QLD 4740
Australia

Attention: Brooke Elliott Phone: 61 7 4952 5255

Fax: 61 7 4952 5455

Dear Brooke

www.cardno.com.au

PETROGRAPHIC ANALYSIS OF QUARTZ CONTENT, TANTABIDDI BOATING FACILITY 7488.

SAMPLE IDENTIFICATION

CLIENT Department of Transport

SAMPLE DESCRIPTION Core

SOURCE BH02, 0.4-0.7m

PROJECT NAME Geotechnical investigation
SAMPLE REFERENCE WG21/7488 PER2020-0495

DATE SAMPLED Not specified

SAMPLED BY Client

SUMMARY

A sample was submitted for petrographic analysis to determine quartz content. The sample was assessed with reference to:

- AS 1141.65-2008: Alkali aggregate reactivity Qualitative petrological screening for potential alkalisilica reaction;
- ASTM C295. Standard Guide for Petrographic Examination of Aggregates for Concrete;

A thin section was prepared of a representative sample of core for examination in transmitted light through a polarizing microscope. A total of 482 random points within the sample were examined, to give a total of 300 within solid material. Based on the point count, the sample is assessed as containing:

Total 0% free quartz.

100% Calcite (solid material count).

Whole rock point count 300 calcite (62%); 182 void space (38%)

The sample comprises a section through a coral and comprises sparry calcite, generally showing radial growth patterns, with abundant, rounded, natural pores. There does not appear to be significant amounts of any other minerals entrained within the sample under examination.

NATA
WORLD RECOGNISED ACCREDITATION

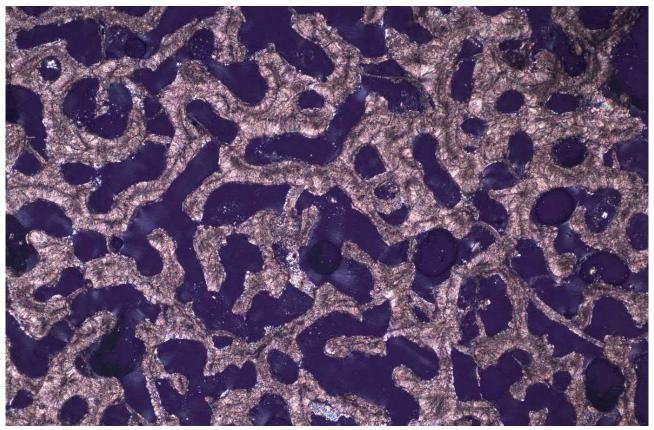
Accredited for compliance with ISO/IEC 17025 - Testing. The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

Trudie Bradbury - Analyst NATA Accreditation Number 910 Mackay Laboratory

Tantabiddi 7488 .Docx Page 1 of 2





Sample under 50x magnification and cross polarised light, sample is stained for calcite. Image shows sparry calcite (pink) with abundant void space (black). No other minerals are present in this image.

LIMITATIONS

The analysis is based on a single thin section taken from a small sample supplied by the client, it may not be representative of the sample mass as a whole and inspection of the source should be undertaken to further qualify the suitability of the material for the intended use. Comments are specific to the sample examined only. If a specification exists further advice may be sought from a mineralogist to ensure compatibility

Yours faithfully

Trudie Bradbury (analyst)
BSc(hons) MSc MMinRes FGS
Principal Engineering Geologist

for Cardno

<u>Trudie.Bradbury@cardno.com.au</u>

Andrew Millians

Andrew Williams (reviewer)
BSc(hons) MEnvMgmt FGS CGeol
Senior Principal Engineering Geologist
for Cardno

Andy.Williams@cardno.com.au

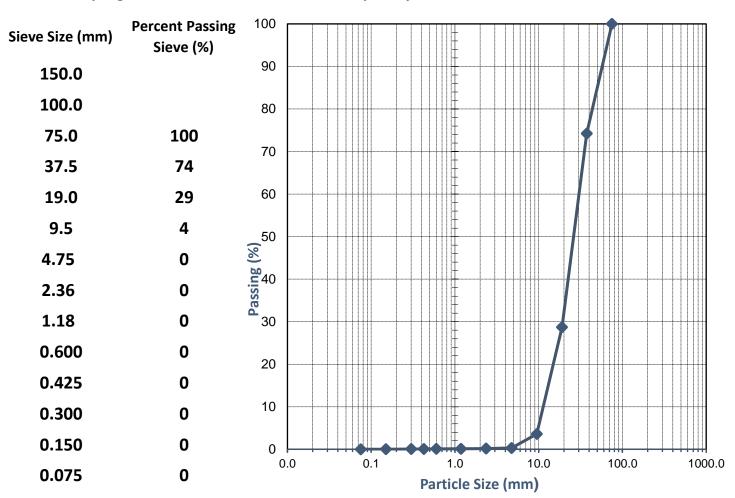


	SOIL AGGREGATE	CONCRETE	CRUSH	IING
	TEST REPOR	T - AS 1289.3.6.1		
Client:	CMW Geosciences		Ticket No.	S3282
Client Address:	Suite 1, Level 3/29 Flynn Street, V	Suite 1, Level 3/29 Flynn Street, Wembley WA		WG21/7509_1_PSD
Project:	Geotechnical Investigation	Geotechnical Investigation		WG21/7509
Location:	Tantabiddi Boating Facility		Date Sampled:	Not Specified
Sample Identification	n: BH08 0-1.6m		Date Tested:	1/6 - 2/6/2021

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments: NATA Accreditation removed due to insufficient sample according to test method requirements.

Approved Signatory:

Edler

Name: Erin Bullen

Date: 03-June-2021

This document shall not be reproduced except in full

235 Bank Street, Welshpool WA 6106 | 08 9472 3465 | www.wgls.com.au

WG_AS 1289.3.6.1_TR_2 Page 1 of 1

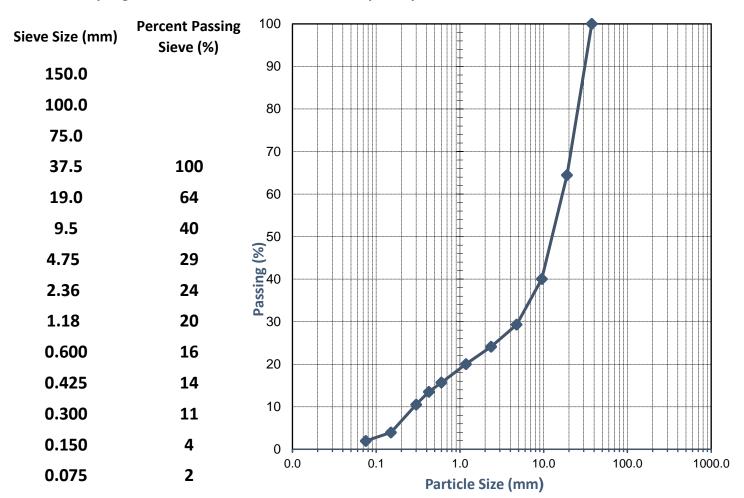


	SOIL AGGREGATE CONCRETE	E CRUSH	IING
	TEST REPORT - *AS 1289.1.1, AS 12	89.3.6.1	
Client:	CMW Geosciences	Ticket No.	S3282
Client Address:	Suite 1, Level 3/29 Flynn Street, Wembley WA	Report No.	WG21/7503_1_PSD
Project:	Geotechnical Investigation	Sample No.	WG21/7503
Location:	Tantabiddi Boating Facility	Date Sampled:	Not Specified
Sample Identificati	on: BH16 0-1.35m	Date Tested:	2/6/21-3/6/21

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments: *AS 1289.1.1- Deviation from standard: Insufficient sample according to test method requirements. NATA accreditation does not cover the performance of this service.

Approved Signatory:

Name: Cody O'Neill

Date: 03/June/2021

NATA WORLD RECOGNISED W

Accreditation No. 20599
Accredited for compliance
with ISO/IEC 17025 - Testing

This document shall not be reproduced except in full

235 Bank Street, Welshpool WA 6106

08 9472 3465

www.wgls.com.au

WG_AS 1289.3.6.1_TR_2 Page 1 of 1





Western Geotechnical and Laboratory Service
235 Bank Street, Welshpool WA 6106
08 9472 3465
www.westerngls.com.au

RESULTS SUMMARY MATRIX

Client CMW Geosciences

Project Tantabiddi Boating Facility

Job ID \$3282 - PER2020-0495

Samp	ole Details								Clas	ssificat	tion							Extern	al Reports
Lab Sample No.	Client Reference / Sample ID							(% F	assin	6.1		Carbonate Abras	Cerchar Abrasivity Index (CAI)	Abrasivity Indirect Index Tensile	Max UCS (MPa)	Point Load (Is (50) (Mpa)			
		100	75	37.5	19	9.5	4.75	2.36	1.18	0.600	0.425	0.300	0.150	0.075	WA 915.1				
WG21/7480	BH12 0.24-0.36m																		1.35
WG21/7481	BH12 1-1.1m																		1.16
WG21/7482	BH01 0.6-0.74m																		2.93
WG21/7483	BH01 1.7-2m																	14.86	
WG21/7484	BH01 2.4-2.5m																		1.72
WG21/7485	BH01 3.3-3.4m																		0.16
WG21/7486	BH01 7-7.2m																		3.19
WG21/7487	BH02 0.3-0.4m																		1.03
WG21/7488	BH02 0.4-0.7m																	12.14	
WG21/7489	BH02 0.7-0.8m																1.97		
WG21/7490	BH02 1.4-1.5m																		0.59
WG21/7491	BH02 2.75-2.95m														98.9			4.14	



Western Geotechnical and Laboratory Service
235 Bank Street, Welshpool WA 6106
08 9472 3465
www.westerngls.com.au

RESULTS SUMMARY MATRIX

Client	CMW Geoscience	CMW Geosciences																	
Project	Tantabiddi Boatir	ng Fac	cility																
Job ID	S3282 - PER2020	-0495																	
WG21/7492	BH02 4.9-5m																		1.14
WG21/7493	BH02 6.6-6.7m																		0.73
WG21/7494	BH03 0.23-0.36m																		1.02
WG21/7495	BH03 0.4-0.5m																1.76		
WG21/7496	BH03 0.54-0.68m														97.2				1.52
WG21/7497	BH03 0.8-1m															0.35		1.94	
WG21/7498	BH03 2.4-2.7m														100			12.54	
WG21/7499	BH03 4-4.3m																	6.44	
WG21/7500	BH03 6.3-6.4m																		1.26
WG21/7501	BH13 0.1-0.3m														98.2				8.61
WG21/7502	BH13 1-1.15m																		4.09
WG21/7503	BH16 0-1.35m			100	64	40	29	24	20	16	14	11	4	2					
WG21/7504	BH16 1.5-1.8m																	23.91	
WG21/7505	BH16 2.3-2.4m																		3.88
WG21/7506	BH04 0.5-0.6m														95.7	1.13			4.72
WG21/7507	BH04 1-1.15m																		



Western Geotechnical and Laboratory Service
235 Bank Street, Welshpool WA 6106
08 9472 3465
www.westerngls.com.au

RESULTS SUMMARY MATRIX

Client	CMW Geosciences																		
Project	Tantabiddi Boatir	tabiddi Boating Facility																	
Job ID	S3282 - PER2020	-0495																	
WG21/7508	BH04 2.28-2.35m																0.64		1.31
WG21/7509	BH08 0-1.6m		100	74	29	4	0	0	0	0	0	0	0	0					
WG21/7510	BH08 1.6-2m																		0.87
WG21/7511	BH10 0.5-0.7m																	17.7	
WG21/7512	BH10 0.7-1m														84.5		3.29		
WG21/7513	BH11 0.3-0.5m																		0.19
	TOTAL								2.0						6.0	2.0	4.0	8.0	20.00

WG _Results Summary __1 3 of 3