



Metro Coastline Sand Sampling

Department of Environment and Water

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1. INTRODUCTION

Environmental Projects were commissioned by the Department for Environment and Water (DEW) to undertake sand sampling along the Adelaide metropolitan coastline, at 27 locations between North Haven and Kingston Park. DEW require sand profile sampling along the entire Adelaide metro coastline from North Haven to Kingston Park to inform the design of the northern sand pumping pipeline, as well as the entire metro beach management project.

This report provides preliminary assessment of ten locations between North Haven and Grange (the Site). A site location plan is provided in Figure 1-1.

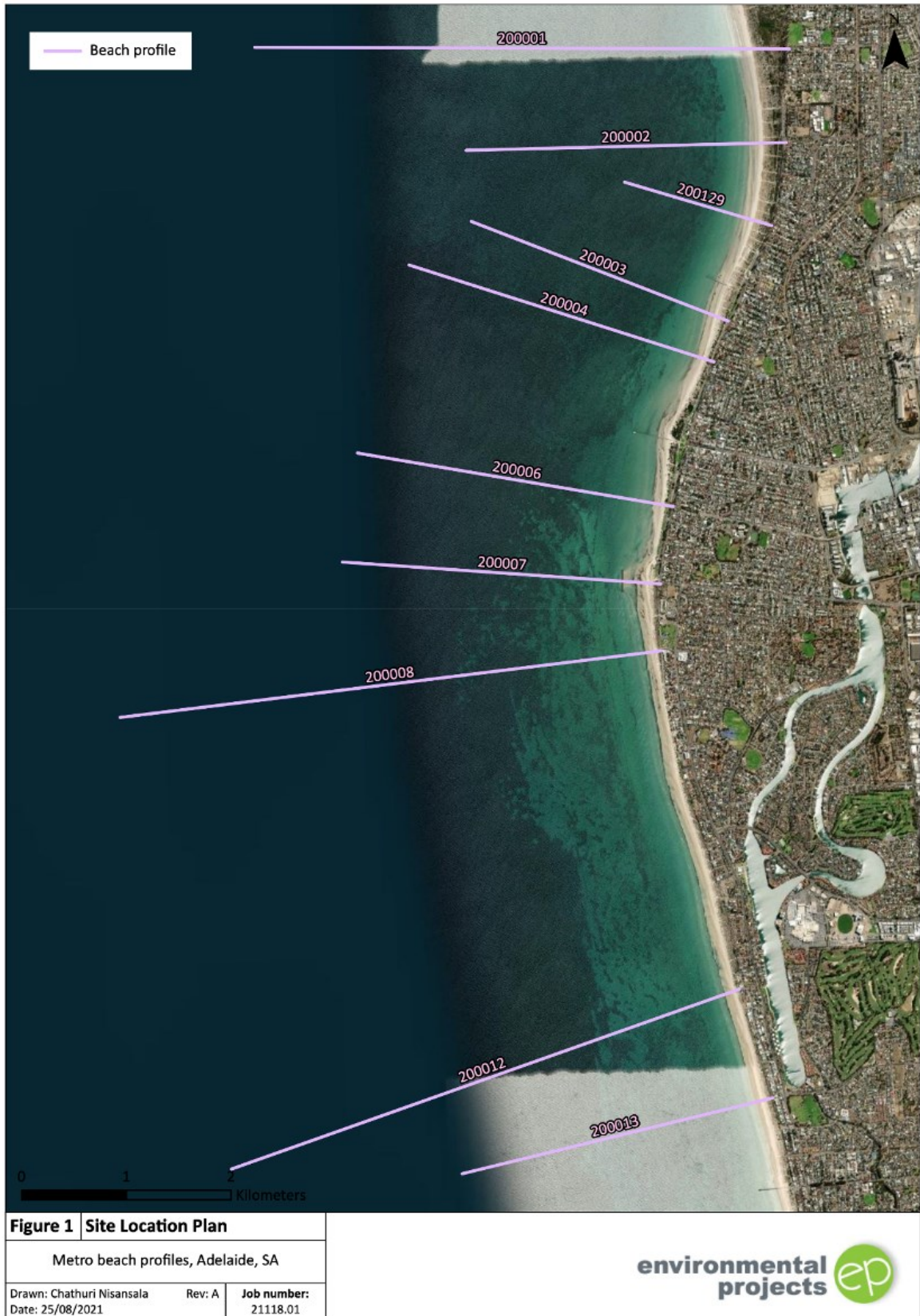


Figure 1-1: Site location plan

1.1 Objectives

The objectives of the assessment were to:

- determine the particle size distribution (PSD) across the profile of the beach at ten locations
- determine the calcium carbonate concentrations of sand samples collected along the beach profile
- collect additional sand samples at the high-water mark (HWM), for clay fraction analysis by DEW.

2. METHODOLOGY

2.1 Regulatory Guidance

Intrusive assessment of shallow soils at the subject site was completed with reference to the guidance in the following publications:

- Australian Standard (AS) 4482.1-2005: Guide to the investigation and sampling of sites with potentially contaminated soil Part 1: Non-volatile and semi-volatile compounds
- National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013 (ASC NEPM)
- SA EPA Guidelines for the assessment and remediation of site contamination, 2018.

2.2 Data Quality Objectives

The data quality objectives (DQO's), quality assurance (QA) and quality control (QC) requirements and QC acceptable limits are provided in **Appendix B**.

2.3 Sampling Methodology

Sand sampling was undertaken on five days over the period 4 August to 12 August, working around the low tide times, using the methodology summarised in Table 2-1. Three additional samples (to account for samples that were unable to be collected in the initial sampling event) were collected on 28 January 2022 to complete the data set.

Table 2-1: Soil Sampling Methodology

Activity	Details
EHS Plan	Prior to fieldwork, Environmental Projects prepared a site-specific EHS plan to identify known hazards to the health and safety of project personnel and the environment, based on an understanding of the proposed work and Environmental Projects experience with similar projects. All Environmental Projects personnel and subcontractors onsite were required to understand and comply with all control measures.
Soil bore drilling and sampling	<p>Sampling was undertaken on the 4 and 5 August, 10, 11 and 12 August 2021, and 28 January 2022, with a total of ten location profiles sampled and a total of 41 primary samples collected for analysis. The maximum sampled depth was 1.5 metres below ground level (m BGL). Sample locations were located across the beach face from the toe of the dune to the low water mark.</p> <p>Samples were collected into laboratory supplied sample bags from a composite created from the full length of the drill hole at each location.</p> <p>Duplicate samples were collected from an additional drill hole located in close proximity to the primary sample location (nominally within one metre).</p> <p>Additionally, a subsample of the primary sample at seven HWM locations was collected and provided directly to DEW for internal clay fraction analysis. These are identified on the soil logs in Appendix B.</p>
Soil logging and photographs	<p>Sand at each location were logged in general accordance with Standards Australia (1993) Geotechnical Site Investigations AS1726. Soil logs are provided in Appendix A. Photos were captured directly to the ARCGIS Collector Application used to identify sample locations.</p> <p>Where applicable, log descriptions included information on:</p> <ul style="list-style-type: none"> • particle size

Activity	Details
	<ul style="list-style-type: none"> • colour • odour • moisture content at time of logging • shell content i.e. shell grit and whole shell inclusions • vegetation inclusions.
Sample handling	Samples were handled exclusively by Environmental Projects personnel and stored in suitable plastic sample bags supplied by the primary contract laboratory.
Sample preservation and delivery	All samples were stored under ambient conditions in a secure storage container, immediately after sampling and during delivery to the NATA accredited primary laboratory.
Decontamination of sampling equipment	Drilling augers and rods and core trays were cleaned between sampling locations by scrubbing with a stiff bristle brush and rinsing with seawater.
Quality control duplicate sampling and testing	Eight blind coded duplicate samples were obtained to meet QA/QC requirements.
Laboratory analysis	<p>Envirolab was contracted as the primary laboratory for analysis of primary and intra-laboratory duplicate samples.</p> <p>Selected samples were analysed for the following:</p> <ul style="list-style-type: none"> • PSD Wet Sieving in accordance with AS 1289.3.6.1 (sieve sample sizes- 9.5, 4.75, 2.36, 1.18, 0.600, 0.425, 0.300, 0.212, 0.150 and 0.075 mm) • calcium carbonate content analysis using method M19A1 and the entire composite sample.

2.3.1 Variations to the proposed methodology

It was identified that the toe of the dune (top of the beach) was in some cases, significantly different from that which was mapped earlier in the year. At each sample location profile, a new sample location point was established with GPS coordinates recorded directly to the ARCGIS Collector application used to identify sample location points. These locations were then sampled as per the soil sampling methodology (see Table 2-1).

During sampling it was identified that the proposed low water mark (LWM) location would be completely inundated at all times, during the lowest point of the tidal range. Inundation levels were in excess of 0.5 m as measured during sampling at the saturated zone sample locations. This resulted in an inability to sample all but one of the LWM locations. In order to meet the objectives of the sand sampling program, an additional sample location (saturated zone) was logged along the profile at approximately the 0.5 m water mark, as measured by the sampler in the wave zone of each profile.

At each location two holes were drilled using the hand auger. The first was to 0.4 m BGL, which was the maximum depth to which the hand auger was able to collect a sediment sample in saturated conditions. The second hole was drilled adjacent the first (the original hole collapsed as soon as the hand auger was removed, making exact hole location identification impossible). The second hole was drilled to 0.2 m BGL and then placed alongside the original core in the core tray. The two cores were then subsequently logged and sampled as a single core and composite sample.

2.3.2 Sample location coordinates

The coordinates for the new dune toe and saturated zone sampling locations are provided in Table 2-2. Sampling locations are shown in Figure 2-1 to Figure 2-4.

Table 2-2: New Sampling Location coordinates (MGA 2020)

Location ID	Eastings	Northings
Dune toe/Top of beach locations		
SB01	270320.3446	6135724.953
SB03	270046.8885	6136772.281
SB04	269293.7595	6140014.7
SB06	269228.6139	6140669.296
SB07	269357.9736	6141418.978
SB09	269753.9436	6142813.702
SB11	269878.4894	6143216.457
SB12	270209.5523	6145779.052
SB14	270300.6959	6144876.718
SB17	270210.6743	6144143.916
Saturated Zone Locations		
SB25	269794.7016	6143248.583
SB26	270201.268	6144873.172
SB27	270106.4034	6145778.446
SB29	270099.3072	6144177.139
SB31	269654.033	6142846.119
SB32	269254.5125	6141435.414
SB34	270254.5648	6135707.852
SB36	269960.3487	6136740.193
SB40	269211.6982	6140002.751
SB99	269106.4655	6140679.391

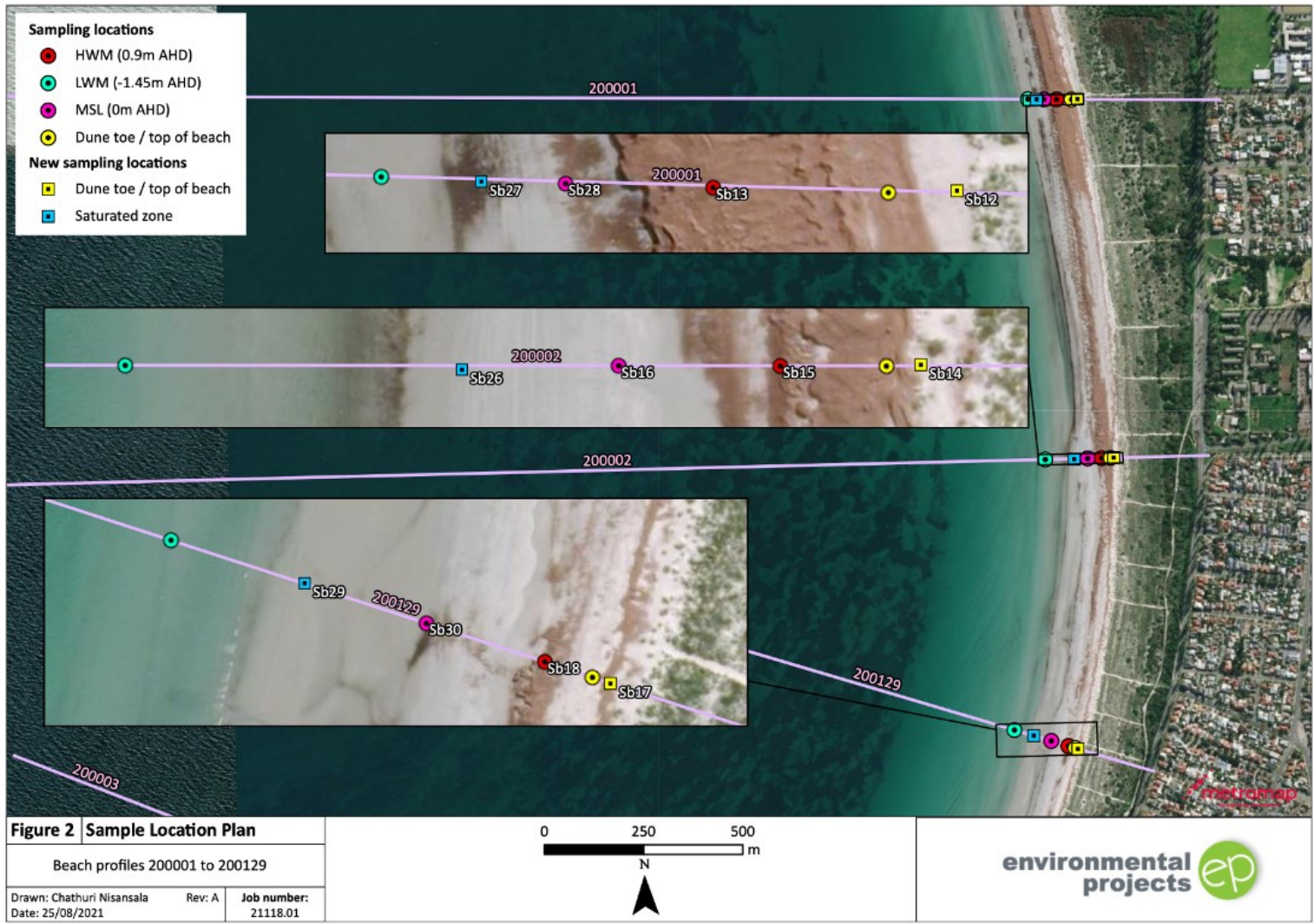


Figure 2-1: Sample location plan 200001-200129

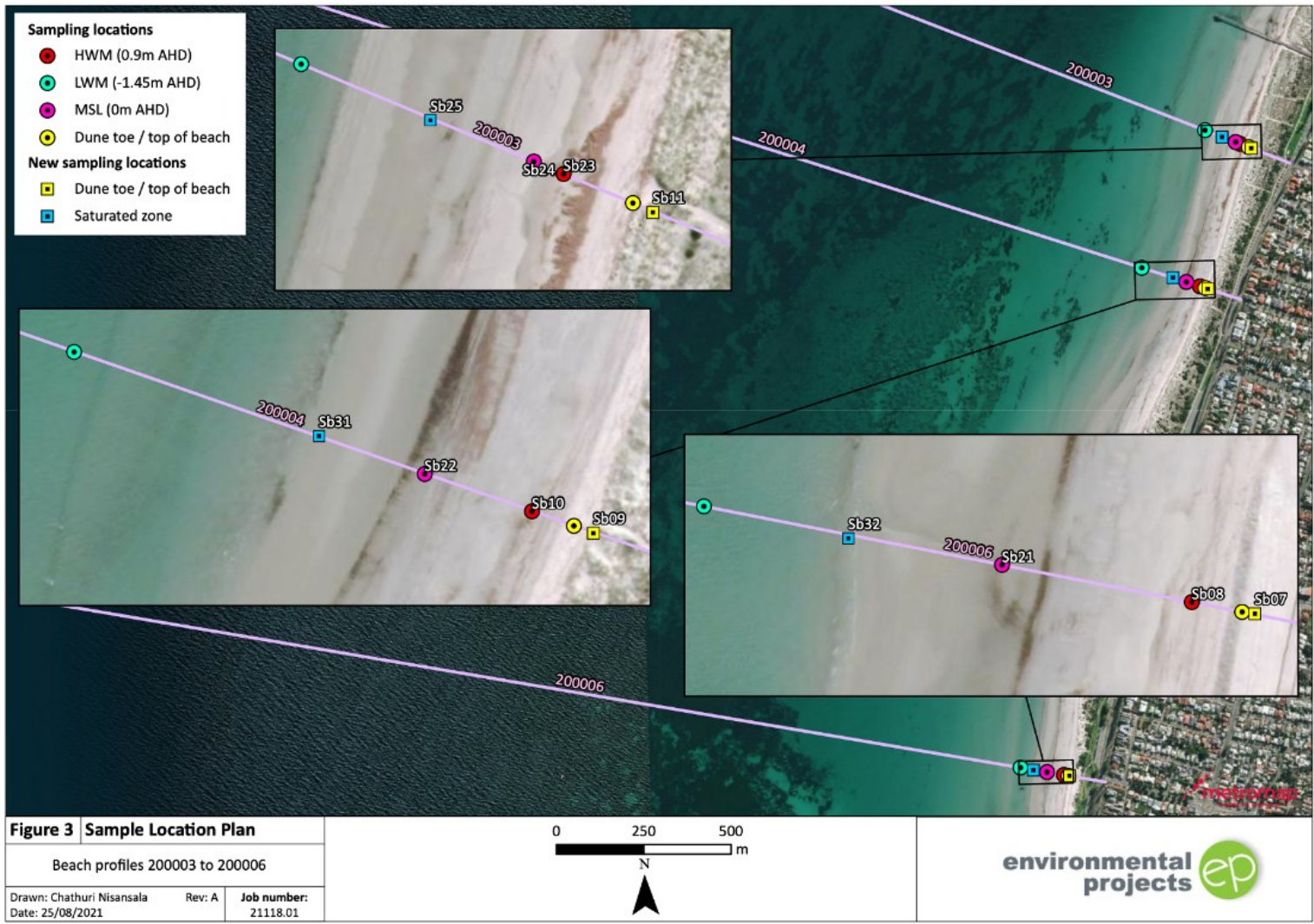


Figure 2-2: Sample location plan 200003 – 200006

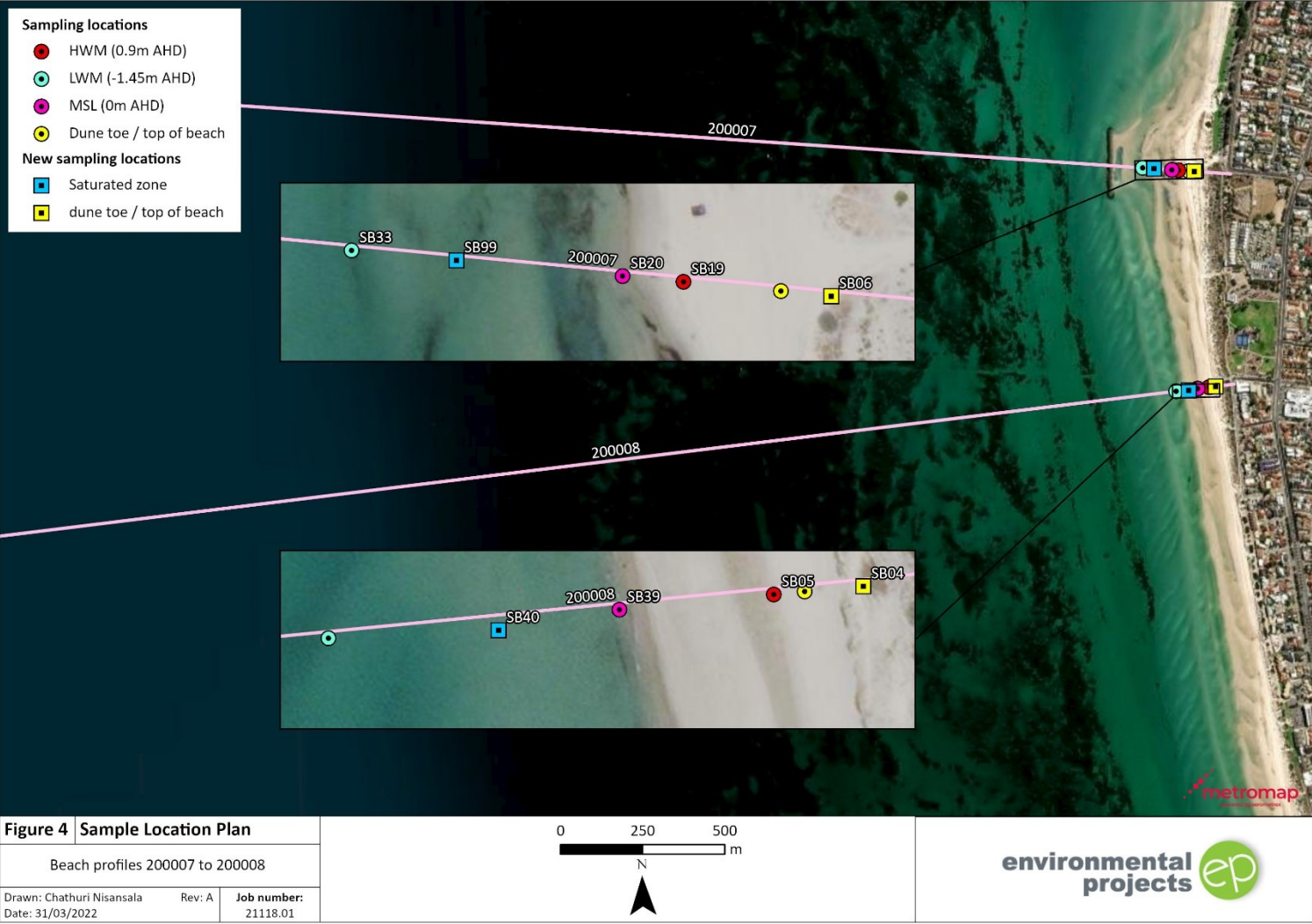


Figure 2-3: Sample location plan 200007 – 200008

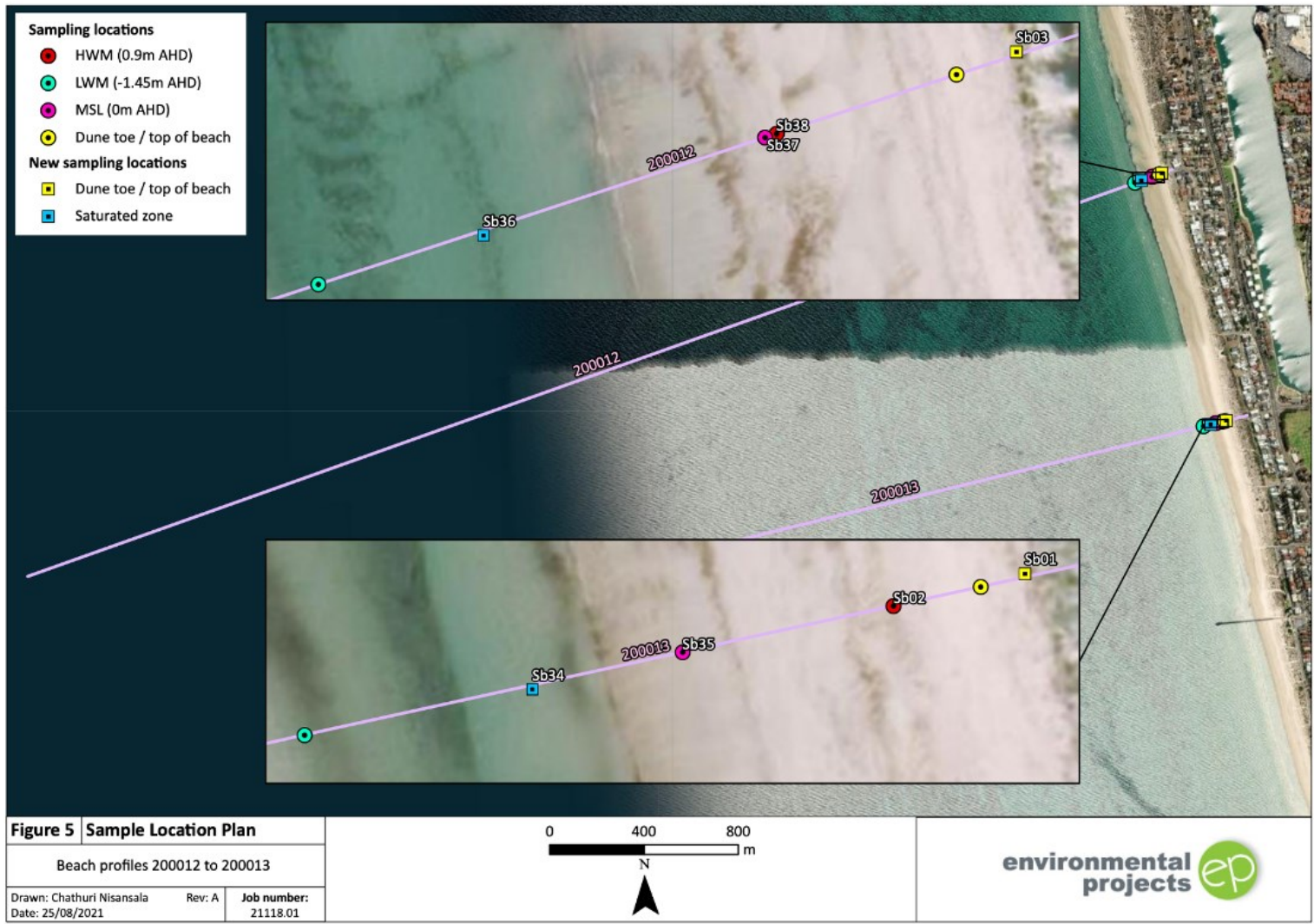


Figure 2-4: Sample location plan 200012 – 200013

3. RESULTS

3.1 The results of the sampling program are provided below.

Sampling locations in the dry zone of the beach profile (toe of the dune) primarily consisted of a fine to medium grained sand, of a cream or grey/cream colour, with some vegetation, shell grit and shells.

HWM locations were generally logged as fine to coarse grained sand, of a cream to grey colour with shell grit, and some small shells. Sample holes were drilled to between 0.6 m BGL and 1 m BGL, with the exception of SB38, which was drilled to 0.45 m BGL as it was located in a saturated water channel.

Mean sea level (MSL) locations were drilled to between 0.4 m BGL and 0.75 m BGL, at which point the hole would collapse due to water saturation. Sand was recorded as fine to coarse grained, cream to pale grey and grey, with coarse shell grit and some shells. Traces of black inclusion (consistent with vegetation) were noted at a number of locations.

Saturated zone samples were drilled to a maximum depth of 0.4 m BGL in nominally 0.5 m of water. Sand was generally recorded as fine to medium grained with some coarse grained, cream to pale grey and grey (sometimes mottled) in colour with shell grit, some whole shells and trace vegetation.

Photographs of the sand collected from each of the four sampling points along three coastline location profiles are provided:

- 200004: SB09, SB10, SB22 and SB31 (see Figure 3-1)
- 200008: SB04, SB05, SB39 and SB40 (see Figure 3-2)
- 200012: SB03, SB36, SB37 and SB38 (see Figure 3-3).

Soil logs are provided in **Appendix A**.



SB09



SB010



SB22



SB31

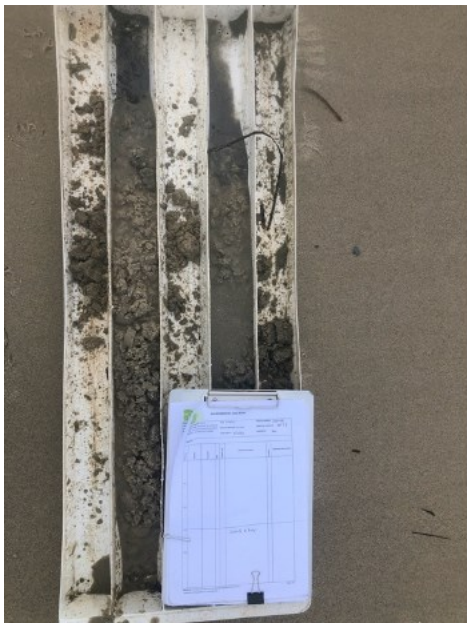
Figure 3-1: Profile 200004 (Toe of dune, HWM, MSL, saturated zone)



SB04



SB05



SB39



SB40

Figure 3-2: Profile 200008 (Toe of dune, HWM, MSL, saturated zone)



SB03



SB36



SB37



SB38

Figure 3-3: Profile 200012 (Toe of dune, HWM, MSL, saturated zone)

3.2 Analytical Results

Table 3-1 and Table 3-2 provide wet sieving results formatted by profile and sample location. The PSD results for the <75 mm and <37.5 mm fractions have been excluded as they both had a 100 per cent pass through rate, whilst the <19 mm had only one sample (SB25) return less than 100 per cent pass through, and <9.5 mm had only two samples (SB25 and SB38) return less than 100 per cent pass through.

The results also indicate that the southern locations consist of generally coarser sand, while the northern locations consist of finer sands, as shown by the pass-through rate of the <0.15 mm fraction.

Calcium carbonate content varied between 5.3 per cent (SB01) and 46 per cent (SB13), with higher levels of calcium noted in the northern locations and lower levels of calcium carbonate noted in the southern locations.

Laboratory certificates are provided in **Appendix C**.

Table 3-1: Sample location by profile

Profile Number	Sample	Carbonate Estimate* (%)	<19 mm (%)	<9.5 mm (%)	<4.75 mm (%)	<2.36 mm (%)	<1.18 mm (%)	<0.6 mm (%)	<0.425 mm (%)	<0.3 mm (%)	<0.212 mm (%)	<0.15 mm (%)	<0.075 mm (%)
200001	SB12	29	100	100	100	100	99	99	97	90	83	44	2
	SB13	46	100	100	99	97	95	91	81	68	56	36	3
	SB28	22	100	100	99	99	97	94	87	78	71	46	4
	SB27	20	100	100	100	99	99	98	95	89	82	55	2
200002	SB14	20	100	100	100	100	99	97	94	90	68	30	10
	SB15	11	100	100	100	99	98	97	95	83	28	2	1
	SB16	32	100	100	100	99	99	98	95	84	75	42	1
	SB26	23	100	100	100	99	98	97	94	84	76	50	3
200129	SB17	12	100	100	100	100	100	100	99	87	53	17	1
	SB18	23	100	100	100	99	99	98	94	77	55	23	3
	SB30	17	100	100	100	98	96	94	90	78	58	24	1
	SB29	15	100	100	100	99	98	97	93	83	69	37	1
200003	SB11A	15	100	100	100	100	99	99	99	91	60	20	3
	SB23	10	100	100	99	99	99	98	92	70	48	17	5
	SB24	12	100	100	99	98	97	96	92	78	56	25	4
	SB25	22	99	99	99	97	96	95	93	85	76	45	15
200004	SB09	15	100	100	100	100	100	99	98	86	57	19	8
	SB10	22	100	100	100	99	99	98	95	82	61	23	10
	SB22	19	100	100	99	97	94	90	83	71	59	34	5
	SB31	17	100	100	100	100	99	98	96	95	92	59	1
200006	SB07	23	100	100	99	99	99	98	96	82	53	22	2
	SB08	16	100	100	100	100	99	99	98	89	64	23	7
	SB21	12	100	100	100	99	99	97	92	73	49	22	3
	SB32	14	100	100	100	99	98	95	90	79	67	47	8
200007	SB06	8.5	100	100	100	100	100	99	96	71	25	5	1
	SB19	11	100	100	99	98	96	93	85	60	30	7	1
	SB20	12	100	100	100	99	98	95	92	81	60	16	1
	SB99	12	100	100	100	100	100	100	98	97	93	68	20
	SB33	15	100	100	100	100	99	98	97	95	86	35	<1
200008	SB04	8.1	100	100	100	100	100	100	98	83	29	5	1
	SB05	7.2	100	100	100	100	100	100	94	65	24	4	<1

Profile Number	Sample	Carbonate Estimate* (%)	<19 mm (%)	<9.5 mm (%)	<4.75 mm (%)	<2.36 mm (%)	<1.18 mm (%)	<0.6 mm (%)	<0.425 mm (%)	<0.3 mm (%)	<0.212 mm (%)	<0.15 mm (%)	<0.075 mm (%)
	SB39	6.8	100	100	100	100	99	98	95	79	39	7	1
	SB40	10	100	100	100	100	99	98	93	81	52	16	<1
200012	SB03	6.6	100	100	100	100	100	99	98	75	19	2	<1
	SB38	17	100	99	96	90	84	74	64	42	15	1	<1
	SB37	11	100	100	99	98	96	91	81	51	18	2	<1
	SB36	11	100	100	100	100	99	98	96	89	66	15	<1
200013	SB01	5.3	100	100	100	100	100	100	99	89	35	7	1
	SB02	8.1	100	100	100	99	99	98	93	64	26	3	1
	SB35	9.9	100	100	99	97	94	88	78	49	17	1	<1
	SB34	22	100	100	99	98	96	92	88	78	51	11	1

Table 3-2: Profile by sample location

	Profile Number	Sample	Carbonate Estimate* (%)	<19 mm (%)	<9.5 mm (%)	<4.75 mm (%)	<2.36 mm (%)	<1.18 mm (%)	<0.6 mm (%)	<0.425 mm (%)	<0.3 mm (%)	<0.212 mm (%)	<0.15 mm (%)	<0.075 mm (%)
Toe of Dune	200001	SB12	29	100	100	100	100	99	99	97	90	83	44	2
	200002	SB14	20	100	100	100	100	99	97	94	90	68	30	10
	200129	SB17	12	100	100	100	100	100	100	99	87	53	17	1
	200003	SB11A	15	100	100	100	100	99	99	99	91	60	20	3
	200004	SB09	15	100	100	100	100	100	99	98	86	57	19	8
	200006	SB07	23	100	100	99	99	99	98	96	82	53	22	2
	200007	SB06	8.5	100	100	100	100	100	99	96	71	25	5	1
	200008	SB04	8.1	100	100	100	100	100	100	98	83	29	5	1
	200012	SB03	6.6	100	100	100	100	100	99	98	75	19	2	<1
	200013	SB01	5.3	100	100	100	100	100	100	99	89	35	7	1
HWM	200001	SB13	46	100	100	99	97	95	91	81	68	56	36	3
	200002	SB15	11	100	100	100	99	98	97	95	83	28	2	1
	200129	SB18	23	100	100	100	99	99	98	94	77	55	23	3
	200003	SB23	10	100	100	99	99	99	98	92	70	48	17	5
	200004	SB10	22	100	100	100	99	99	98	95	82	61	23	10
	200006	SB08	16	100	100	100	100	99	99	98	89	64	23	7
	200007	SB19	11	100	100	99	98	96	93	85	60	30	7	1
	200008	SB05	7.2	100	100	100	100	100	100	94	65	24	4	<1
	200012	SB38	17	100	99	96	90	84	74	64	42	15	1	<1
	200013	SB02	8.1	100	100	100	99	99	98	93	64	26	3	1
MSL	200001	SB28	22	100	100	99	99	97	94	87	78	71	46	4
	200002	SB16	32	100	100	100	99	99	98	95	84	75	42	1
	200129	SB30	17	100	100	100	98	96	94	90	78	58	24	1
	200003	SB24	12	100	100	99	98	97	96	92	78	56	25	4
	200004	SB22	19	100	100	99	97	94	90	83	71	59	34	5
	200006	SB21	12	100	100	100	99	99	97	92	73	49	22	3
	200007	SB20	12	100	100	100	99	98	95	92	81	60	16	1
	200008	SB39	6.8	100	100	100	100	99	98	95	79	39	7	1
	200012	SB37	11	100	100	99	98	96	91	81	51	18	2	<1
	200013	SB35	9.9	100	100	99	97	94	88	78	49	17	1	<1

	Profile Number	Sample	Carbonate Estimate* (%)	<19 mm (%)	<9.5 mm (%)	<4.75 mm (%)	<2.36 mm (%)	<1.18 mm (%)	<0.6 mm (%)	<0.425 mm (%)	<0.3 mm (%)	<0.212 mm (%)	<0.15 mm (%)	<0.075 mm (%)
Saturated	200001	SB27	20	100	100	100	99	99	98	95	89	82	55	2
	200002	SB26	23	100	100	100	99	98	97	94	84	76	50	3
	200129	SB29	15	100	100	100	99	98	97	93	83	69	37	1
	200003	SB25	22	99	99	99	97	96	95	93	85	76	45	15
	200004	SB31	17	100	100	100	100	99	98	96	95	92	59	1
	200006	SB32	14	100	100	100	99	98	95	90	79	67	47	8
	200007	SB99	12	100	100	100	100	100	100	98	97	93	68	20
	200008	SB40	10	100	100	100	100	99	98	93	81	52	16	<1
	200012	SB36	11	100	100	100	100	99	98	96	89	66	15	<1
	200013	SB34	22	100	100	99	98	96	92	88	78	51	11	1

3.2.1 Particle Size Distribution D50

The median d50 results ranged between 122.11 µm (SB99) and 345.7 µm (SB38) and are presented in Table 3-3.

Table 3-3: PSD (d50) Summary results

Sample	d50 value (µm)	Sample	d50 value (µm)
SB01	236.6	SB21	217.1
SB02	267.0	SB22	189.3
SB03	260.6	SB23	218.6
SB04	245.97	SB24	200.6
SB05	266.0	SB25	159.6
SB06	259.9	SB26	150.5
SB07	206.6	SB27	143.3
SB08	190.9	SB28	159.6
SB09	200.3	SB29	175.6
SB10	195.2	SB30	196.6
SB11	197.5	SB31	138.0
SB12	159.75	SB32	158.9
SB13	193.88	SB33	122.11
SB14	182.95	SB34	210
SB15	265.83	SB35	303.8
SB16	164.6	SB36	192.7
SB17	207.4	SB37	296.5
SB18	202.3	SB38	345.7
SB19	271.1	SB39	236.4
SB20	197.9	SB40	209.1

Detailed PSD results are provided in **Appendix C**.

4. QUALITY CONTROL

Data validation results are provided in **Appendix B**.

The results of the QA/QC process and testing data (Table 5-1, **Appendix B**) provided appropriate confidence the data could be relied upon for the purposes of this assessment.

Duplicate RPD results are presented in Table 4-1.

Table 4-1: Duplicate RPD results

	Carbonate Estimate*	<75 mm	<37.5 mm	<19 mm	<9.5 mm	<4.75 mm	<2.36 mm	<1.18 mm	<0.6 mm	<0.425 mm	<0.3 mm	<0.212 mm	<0.15 mm	<0.075 mm
DUP2	16	100	100	100	100	100	100	100	99	98	86	60	22	10
SB08	16	100	100	100	100	100	100	99	99	98	89	64	23	7
RPD	0	0	0	0	0	0	0	1	0	0	-3	-6	-4	35
DUP6	12	100	100	100	100	100	99	98	96	90	71	50	16	1
SB23	10	100	100	100	100	99	99	99	98	92	70	48	17	5
RPD	18	0	0	0	0	1	0	-1	-2	-2	1	4	-6	-133
Dup7	22	100	100	100	100	99	97	96	92	87	74	42	10	1
SB30	17	100	100	100	100	100	98	96	94	90	78	58	24	1
RPD	26	0	0	0	0	-1	-1	0	-2	-3	-5	-32	-82	0

5. CONCLUSIONS

Ten locations along the Adelaide metropolitan coastline were sampled and analysed for PSD and calcium carbonate concentrations to inform the engineering design of the northern sand pumping pipeline.

41 primary composite samples were collected and analysed with PSD wet sieving conducted in accordance with AS 1289.3.6.1. Sieve sample sizes ranged from 9.5 mm to 0.075 mm, with results presented as per cent passed through. Calcium carbonate content analysis using method M19A1 was also undertaken. Calcium carbonate content ranged from 5.3 per cent at SB01 (Grange) to 46 per cent at SB13 (North Haven), and the median d50 result ranged between 122.11 μm (SB99) and 345.7 μm (SB38).

Sand was relatively uniform along the beach profiles, with a fine to medium grained, cream to pale grey/grey sand reported in all sampling points. Vegetation was prevalent in varying degrees across the beach profiles, however, was more dominant in samples collected from the northern end of the coastline.

PSD testing indicates that finer sands are generally located in the northern locations (towards North Haven) and coarser sands are located in the southern locations (Grange).

To meet the objectives of the sampling program a saturated zone sample was included in the sampling program, nominally from the wave break area at a water depth of 0.5 m and collected to a maximum depth of 0.4 m BGL.

This report must be read in conjunction with the limitations described in Section 6.

6. LIMITATIONS

Scope of Services

This environmental site assessment report (“the report”) has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client and Environmental Projects (“scope of services”). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints

Reliance on Data

In preparing the report, Environmental Projects has relied upon data, surveys, analyses, designs and plans as well as any other information provided by the client and other individuals and organisations, most of which are referred to in the report (“the data”). Except as otherwise stated in the report, Environmental Projects has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (“conclusions”) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Environmental Projects will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Environmental Projects.

Environmental Conclusions

In accordance with the scope of services, Environmental Projects has relied upon the data and conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

On all sites, varying degrees of non-uniformity of the vertical and horizontal soil or groundwater conditions are encountered. Hence no monitoring, common testing or sampling techniques can eliminate the possibility that monitoring or testing results/samples are not totally representative of soil and/or groundwater conditions encountered. The conclusions are based upon the data and the environmental field monitoring and/or testing and are therefore merely indicative of the environmental condition of the site at the time of preparing the report, including the presence or otherwise of contaminants or emissions.

Also, it should be recognised that site conditions, including the extent and concentration of contaminants, can change with time.

Within the limitations imposed by the scope of services, the monitoring testing, sampling and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

Report for Benefit of Client

The report has been prepared for the benefit of the client and no other party. Environmental Projects assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitations matters arising from any negligent act or omission of Environmental Projects or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the

report or the accuracy or completeness of any conclusion and should make their own enquiries and obtain independent advice in relation to such matters.

Other Limitations

Environmental Projects will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

Appendix A

Soil Logs



ENVIRONMENTAL SOIL BORE SB99

PROJECT NUMBER 21118.02	DATE 28/01/2022	PROFILE NUMBER 200007
PROJECT NAME Metro Coastline Sand Sampling	DRILLING COMPANY N/A	LOGGED BY R. L
CLIENT Dept of Environment and Water	DRILLER N/A	
ADDRESS 81-95 Waymouth St, Adelaide	DRILLING METHOD Hand Auger	
	TOTAL DEPTH 0.45 m BGL	

COMMENTS

Depth (m)	Samples	Duplicate	PID	Graphic Log	Material Description	Moisture	Additional Observations
0.2	SB99			•••••	SAND, fine to coarse grained, grey, fine shell grit.	W	
0.4				•••••	SAND, fine to coarse grained, dark grey, sulphur odour on extraction and logging.	W	
0.6					End of hole at 0.45 m BGL.		
0.8							
1							

Appendix B

Data Quality

Data Quality Objectives

The ASC NEPM recommends use of the data quality objective (DQO) process (described in detail in ASC NEPM Schedule B2, Appendix B) to assess the accuracy and reliability of a dataset to ensure any risk-based conclusions or recommendations that will rely on that dataset are not influenced by sampling or measurement error. The DQO process develops the decision performance criteria, which outline the acceptable limits of error that limit the potential for uncertainties in the data.

Data quality indicators (DQI's) (outlined in ASC NEPM Schedule B2, Appendix B) are a measurable way to assess the reliability of field procedures and analytical data that highlight any exceedances of the performance criteria. To ensure the DQI's are met, specific quality assurance (QA) and quality control (QC) procedures must be followed.

Table B-1 illustrates the QA/QC requirements relating to each DQI adopted during the assessment.

Table B-1: QA/QC Requirements

Assessment Component	Quality Assurance		Quality Control	
	QA Component	DQI Addressed	QC Component	DQI Addressed
Soil bores Groundwater well drilling and installation Soil vapour sampling Test Pits	Suitably experienced operator	Representativeness	-	-
	Bore/installation details recorded on log sheet	Representativeness and Completeness	-	-
	Standard operating procedure (SOP) followed	Comparability	-	-
Soil lithology recording	Suitably experienced and trained field personnel	Accuracy, representativeness, comparability, and completeness	-	-
	Lithology and observations recorded on soil log sheet	Representativeness and comparability	-	-
	Photographs of test pits and site	Representativeness and comparability	-	-
Sample collection	Standard operation procedures followed	Comparability	-	-
	Suitably experienced and trained field personnel	Accuracy, representativeness, comparability, and completeness	-	-
	All sampling equipment decontaminated prior to use (by field personnel and/or rental company if applicable) and between sample locations and consumables changed between locations (i.e. pump bladder)	Accuracy, representativeness, completeness	Equipment rinsate blank samples	Precision

Assessment Component	Quality Assurance		Quality Control	
	QA Component	DQI Addressed	QC Component	DQI Addressed
	Measurement equipment calibrated (i.e. PID, gas detection meter, water quality meter)	Accuracy, precision	Calibration records	Accuracy, precision
Sample preservation	Laboratory supplied sample containers only, pre-dosed with preservative where required	Precision, comparability, completeness	Recommended sample holding times met	Completeness
	Standard operating procedures followed	Comparability	-	-
Sample handling and transportation	Chain of custody documentation used	Accuracy	Trip blank samples	Accuracy, precision
Laboratory analysis	NATA accredited laboratories used	Precision, accuracy, comparability, completeness	Intra-laboratory and inter-laboratory field duplicate relative percentage differences (RPDs)	Precision and accuracy
			Internal laboratory duplicates, matrix spikes and surrogate spikes	Precision, completeness

Table B-2 outlines the acceptable limits for the QC samples described in Table B-1.

The RPD% for a pair of duplicate concentrations is calculated using the formula:

$$\text{RPD (\%)} = \frac{100(x_1 - x_2)}{x}$$

where x_1 , x_2 = duplicate results and x = mean of duplicate results.

According to the ASC NEPM:

- typical RPD values for soils are in the range of $\pm 30\%$
- typical RPD values for groundwater are in the range of $\pm 20\%$.

Table B-2: QC Acceptable Limits

QC Sample	Minimum Frequency	Formula	Acceptable Limit
Blind-coded intra-laboratory field duplicates	1 in 20 (soil and soil vapour) 1 in 10 (groundwater)	Relative percent difference	-30% to +30% (soil and soil vapour) -20% to +20% (groundwater)
Laboratory Control Sample	1 in 20	Standard Recovery	70% to 130%
Matrix Spikes	1 in 10	Standard Recovery	70% to 130%
Surrogate Spikes	1 in 10	Standard Recovery	70% to 130%
Inter-laboratory duplicates	1 in 20 (soil and soil vapour) 1 in 10 (groundwater)	Relative percent difference	30% to +30% (soil and soil vapour) -20% to +20% (groundwater)
Field Split Sample	1 in 20	Relative percent difference	-50% to +50%
Laboratory Duplicate	1 in 20	Relative percent difference	<30%
Field Trip Blank	One per batch of samples	Laboratory PQL	<PQL
Field Equipment Rinse	One per day of sampling	Laboratory PQL	<PQL
Laboratory Method Blank	1 in 20	Laboratory PQL	<PQL
Holding Times	Every sample	-	All samples should be extracted and analysed within the hold times for the requested analytes
Completion (%)	-	Relative Completion	>90%

Data Validation

QA/QC requirements for this assessment are outlined in Table B-1. The acceptance criteria for laboratory replicates and recoveries are detailed in RPDs within the ranges described in Table B-3 were considered to show acceptable agreement with the dataset and conversely, relatively poor agreement where a RPD was outside this rang.

Generally, higher RPD values occur for organic compounds, and where low concentrations of an analyte are recorded.

Table B-3: Data Validation

QA/QC Requirement	Outcome	Comment
Chain of custody documentation completed	Yes	All samples were transported under Environmental Projects COC procedures. A copy of the COC is provided in Appendix C .
Samples delivered to laboratory within sample holding times and with correct preservative	Yes	All samples were delivered to the laboratories within the sample holding times and in the appropriate laboratory-supplied bags.
Limits of reporting less than screening criteria	Yes	Laboratory practical quantitation limit (PQLs) were below the screening criterion.
All analyses NATA accredited	Yes	Envirolab are NATA accredited for the analyses performed.
Equipment calibrations	N/A	No field screening equipment was used as part of the assessment.
Intra-laboratory and inter-laboratory field duplicate testing frequency of at least 5% (1 in 20)	Yes	In accordance with ASC NEPM, duplicate testing frequency for key analytes complied with the required 5% of primary samples.
A majority of intra-laboratory field duplicate samples reported RPDs within +/-30% recommended by ASC NEPM	Yes	All duplicates were within acceptable ranges except for: <ul style="list-style-type: none"> • SB08/DUP02: <0.075 mm (35%) • SB23/DUP06: <0.075 mm • SB30/DUP07: <0.212 mm (32%) and <0.15 mm (82%). RPD exceedances are attributed to the duplicate collection process which required the duplicate sample to be collected from a separate hole, located in close proximity to the primary sampling location.
Field trip blanks frequency of at least one per batch	Yes	No trip blank was required due to the nature of the testing, which is limited to PSD and calcium carbonate content.
Equipment Rinsate Blank frequency of at least one per batch	N/A	No equipment rinsate was collected during the sampling program due to the nature of testing, which is limited to PSD and calcium carbonate content.
Acceptable laboratory QC results	Yes	Laboratory certificates are provided in Appendix C .

Appendix C

Laboratory Certificates



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customerservice@envirolab.com.au

www.envirolab.com.au

CERTIFICATE OF ANALYSIS 287867

Client Details

Client	Environmental Projects
Attention	Lisa Bailie
Address	Suite 3/117 King William St, ADELAIDE, SA, 5000

Sample Details

Your Reference	<u>21118.02, Additional Metro Coastline Sand Sampling</u>
Number of Samples	83 Soil
Date samples received	02/02/2022
Date completed instructions received	02/02/2022

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by 18/02/2022

Date of Issue 18/02/2022

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By

Diego Bigolin, Inorganics Supervisor

Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Client Reference: 21118.02, Additional Metro Coastline Sand Sampling

Misc Inorg - Soil						
Our Reference		287867-1	287867-2	287867-3	287867-4	287867-5
Your Reference	UNITS	SB99	SB32	SB15	SB01	SB02
Date Sampled		28/01/2022	28/01/2022	28/01/2022	28/01/2022	28/01/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	11/02/2022	11/02/2022	11/02/2022	11/02/2022	11/02/2022
Date analysed	-	11/02/2022	11/02/2022	11/02/2022	11/02/2022	11/02/2022
Carbonate Estimate*	%	12	14	11	11	12

Misc Inorg - Soil						
Our Reference		287867-6	287867-7	287867-8	287867-9	287867-10
Your Reference	UNITS	SB03	SB04	DUP1	SB05	SB06
Date Sampled		28/01/2022	28/01/2022	28/01/2022	31/01/2022	31/01/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	11/02/2022	11/02/2022	11/02/2022	11/02/2022	11/02/2022
Date analysed	-	11/02/2022	11/02/2022	11/02/2022	11/02/2022	11/02/2022
Carbonate Estimate*	%	11	3.3	3.6	6.1	9.8

Misc Inorg - Soil						
Our Reference		287867-11	287867-12	287867-13	287867-14	287867-15
Your Reference	UNITS	SB07	SB08	SB10	SB12	SB14
Date Sampled		31/01/2022	31/01/2022	31/01/2022	31/01/2022	31/01/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	11/02/2022	11/02/2022	11/02/2022	11/02/2022	11/02/2022
Date analysed	-	11/02/2022	11/02/2022	11/02/2022	11/02/2022	11/02/2022
Carbonate Estimate*	%	21	14	9.9	5.3	6.5

Misc Inorg - Soil						
Our Reference		287867-16	287867-17	287867-18	287867-19	287867-20
Your Reference	UNITS	SB16	SB18	SB20	SB22	SB24
Date Sampled		31/01/2022	31/01/2022	31/01/2022	31/01/2022	31/01/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	11/02/2022	11/02/2022	11/02/2022	11/02/2022	11/02/2022
Date analysed	-	11/02/2022	11/02/2022	11/02/2022	11/02/2022	11/02/2022
Carbonate Estimate*	%	7.9	8.3	7.1	5.6	3.6

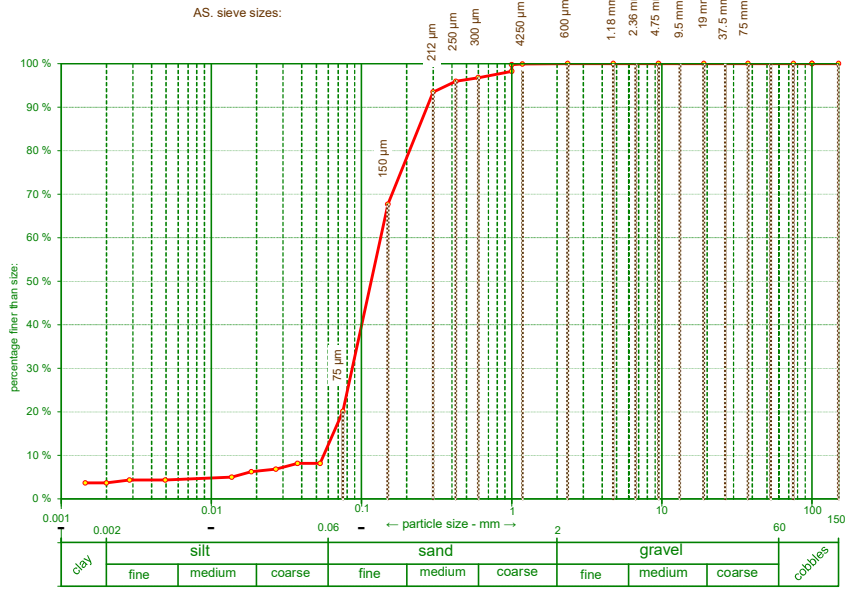
Misc Inorg - Soil						
Our Reference		287867-23	287867-24	287867-25	287867-26	287867-27
Your Reference	UNITS	DUP5	SB09	SB17	SB19	SB15
Date Sampled		31/01/2022	31/01/2022	31/01/2022	31/01/2022	31/01/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	11/02/2022	11/02/2022	11/02/2022	11/02/2022	11/02/2022
Date analysed	-	11/02/2022	11/02/2022	11/02/2022	11/02/2022	11/02/2022
Carbonate Estimate*	%	3.8	3.3	5.3	6.6	11

Client Reference: 21118.02, Additional Metro Coastline Sand Sampling

Particle Size Distribution in Soils						
Our Reference		287867-1	287867-2	287867-3	287867-4	287867-5
Your Reference	UNITS	SB99	SB32	SB15	SB01	SB02
Date Sampled		28/01/2022	28/01/2022	28/01/2022	28/01/2022	28/01/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	07/02/2022	07/02/2022	07/02/2022	07/02/2022	07/02/2022
Date analysed	-	08/02/2022	08/02/2022	08/02/2022	08/02/2022	08/02/2022
<75mm	%	100	100	100	100	100
<37.5mm	%	100	100	100	100	100
<19mm	%	100	100	100	100	100
<9.5mm	%	100	100	100	100	100
<4.75mm	%	100	100	100	100	100
<2.36mm	%	100	99	99	100	100
<1.18mm	%	100	98	98	100	99
<0.6mm	%	100	95	97	99	96
<0.425mm	%	98	90	95	94	93
<0.3mm	%	97	79	83	78	80
<0.250mm	%	96	73	35	64	70
<0.212mm	%	93	67	28	51	59
<0.15mm	%	68	47	2	18	28
<0.075mm	%	20	8	1	4	4
<0.020mm	%	3	<1	<1	<1	<1
Clay <0.002mm	%	4	1	<1	<1	<1

PARTICLE SIZE DISTRIBUTION

287867-1



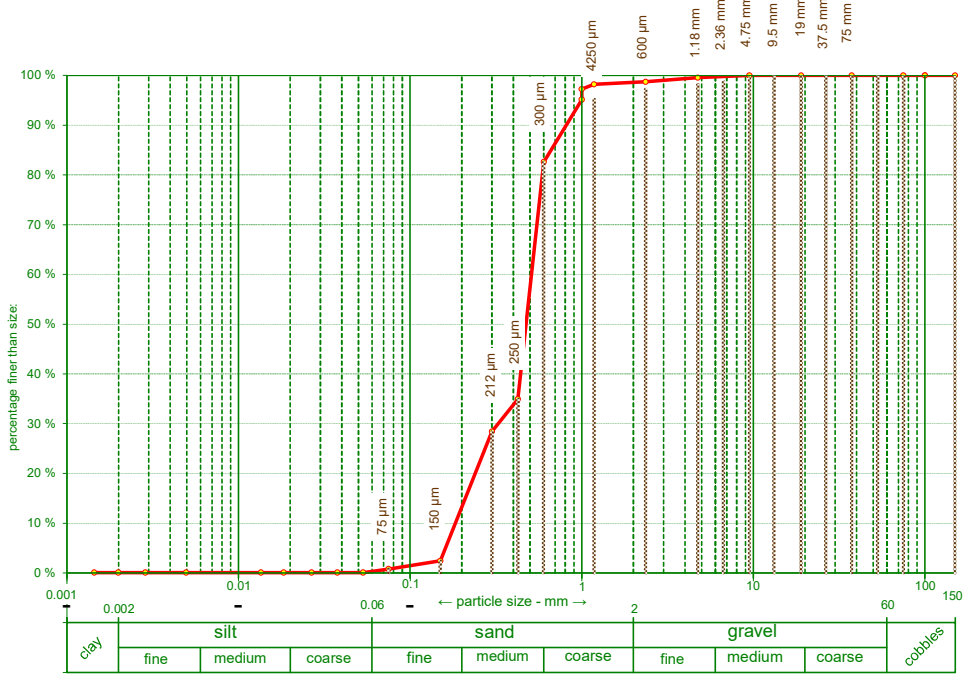
Sieve Analysis		Hydrometer Analysis	
Sieve Size mm	% Passing	Particle Size μm	% Passing
100	100.0	53.1	8.2
100	100.0	37.5	8.2
75	100.0	26.9	6.9
37.5	100.0	18.5	6.3
19	100.0	13.7	5.0
9.5	100.0	4.9	4.3
4.75	100.0	2.9	4.3
2.36	100.0	2.0	3.7
1.18	99.9	1.4	3.7
600 μm	99.8		
425 μm	98.3		
300 μm	96.8		
250 μm	95.9		
212 μm	93.5		
150 μm	67.7		
75 μm	20.1		

NOTES:

d50 122.11μm

PARTICLE SIZE DISTRIBUTION

287867-3



Sieve Analysis		Hydrometer Analysis	
Sieve Size	% Passing	Particle Size	% Passing
mm		µm	
100	100.0	53.2	0.1
100	100.0	37.6	0.1
75	100.0	26.7	0.1
37.5	100.0	18.3	0.1
19	100.0	13.5	0.1
9.5	100.0	5.0	0.1
4.75	99.5	2.9	0.1
2.36	98.7	2.0	0.1
1.18	98.2	1.4	0.1
600 µm	97.2		
425 µm	95.2		
300 µm	82.6		
250 µm	34.9		
212 µm	28.4		
150 µm	2.4		
75 µm	0.8		

NOTES:

d50 265.83