



Benthic assessment Port of Townsville Dredge Material Placement Area Final Report

Port of Townsville Limited

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Executive summary

GHD was engaged by the Port to undertake a monitoring program to assess the benthic communities and sediment compositional characteristics of sites within, adjacent to and at a distance from the Dredge Material Placement Area (DMPA) before and after the 2025 maintenance dredging campaign that involved placement of 349,000m³ of material at the DMPA. This report presents the findings of the assessment.

Maintenance dredging and placement at the DMPA occurred from 7th July to 3rd August 2025. Samples were collected in June 2025 prior to dredging and placement (Event 1), and in September 2025 approximately five weeks after dredging and placement (Event 2). Replicate samples were collected from 45 sites across the Project Area, comprising:

- Sites that are subject to direct disturbance during maintenance dredging placement activities (i.e. within the bounds of the DMPA)
- Sites within the modelled Zone of Influence (ZOI), derived from the hydrodynamic modelling undertaken for the Port of Townsville maintenance dredging assessment (BMT WBM, 2014).
- Control sites at distance from the DMPA and ZOI.

Collected samples were analysed for particle size distribution and benthic community composition (identified to family units). The sampling effort applied was confirmed sufficient to detect both common and less common taxa and had a detection rate adequate to describe the communities present in the Project Area. A combination of different univariate and multivariate statistical analysis techniques were used to assist in interpreting the benthic community and sediment composition characteristics across all sites within the Project Area.

Particle Size Distribution (PSD) was assessed across the Project Area before and after dredge material placement, with no significant differences recorded. Significant spatial differences were recorded, with DMPA sites differing from Control and ZOI sites. Review of the PSD results has identified that sites within the northern portion of DMPA were dominated by fine sediments across both events, with sites at the southern portion of DMPA exhibiting a non-significant change in composition towards finer sediments post material placement. Sites located in the modelled ZOI and Control areas were generally dominated by sands.

There were no significant changes in sediment composition at the control sites or the sites located within the modelled ZOI, indicating that the finer sediments placed at the DMPA are not migrating beyond the DMPA boundary. This finding is consistent with those reported under GHD (2022), associated with the 2020 maintenance dredging campaign.

The taxa groups recorded during this study were typical of communities found in tropical soft sediment environments, and consistent with previous studies (GHD, 2022; GHD, 2019; Cruz, 2000). Across the two monitoring events, 1,142 individuals (93 families) were recorded in Event 1 and 1,128 individuals (91 families) in Event 2. Community composition was dominated by Annelids (marine worms) and Crustacea, with Crustacea also the most diverse group (35–41 families across events).

Review of benthic community composition identified some grouping of sites, aligned with sediment composition characteristics. Sites with higher proportions of fine sediments were generally less abundant and diverse than the sites dominated by sands. These findings are consistent with the results of DMPA recovery study (GHD, 2022). Benthic community composition changed significantly across the Project Area between events, however there were no significant differences between the DMPA and Control benthic communities before and after dredge material placement. These results indicate the occurrence of additional influences on the system beyond that of dredge material placement.

Collected data indicates that the benthic community contains a subset of taxa that highly influences the overall community composition. This core cohort was comprised of commonly occurring marine worms, crustacea, bivalves and brittle stars that persisted across the Project Area during both monitoring events. Eighteen taxa of this cohort were also identified as 'influential' during the previous DMPA recovery study (GHD, 2022). The persistence of this cohort through time, including across multiple maintenance dredge campaigns, and large-scale climatic events, indicates that taxa within the cohort can be considered fully established foundation species.

Disturbances associated with dredge material placement were found to be confined within the boundary of the DMPA. Based on the data collected from this study, as well as previous investigations of the region (GHD, 2022; GHD 2019; Cruz 2000), dredge material placement at the DMPA does not appear to have a long-term effect on the sediment or benthic community composition of the Project Area.

This report is subject to, and must be read in conjunction with, the limitations set out in Section 1.2 and the assumptions and qualifications contained throughout the Report.

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1. Introduction

1.1 Background

Townsville Port is the third largest multi-cargo port in Queensland handling exports and imports, including but not limited to mineral ores, fertiliser, sugar, fuel and motor vehicles. This facility is managed by the Port of Townsville Limited (the Port; POTL).

In order to maintain navigable depths, the Port undertakes routine maintenance dredging. Material produced from this suitable for offshore relocation is placed in the approved Dredge Material Placement Area (DMPA). The Port has been utilising the DMPA for the placement of maintenance dredge material since the early 1990's. The DMPA is located 15km offshore to the north of Cleveland Bay. The Port currently holds a Sea Dumping Permit (SD2018-3942 under the Environment Protection (Sea Dumping) Act 1981) that is set to expire in 2026. The Port are currently preparing an application for a new 10-year sea dumping permit.

To support this application GHD was engaged by the Port to undertake the monitoring program to assess the benthic communities and sediment compositional characteristics of sites within, adjacent to, and at a distance from the DMPA, both pre and post dredge material placement. This report presents the findings of the assessment.

1.2 Scope and limitations

This report: has been prepared by GHD for Port of Townsville Limited and may only be used and relied on by Port of Townsville Limited for the purpose agreed between GHD and Port of Townsville Limited as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Port of Townsville Limited arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.2 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sampling points. Site conditions at other parts of the site may be different from the site conditions found at the specific sampling points.

Investigations undertaken in respect to this report are constrained by the particular site conditions, such as vegetation or seabed condition. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if site conditions change.

1.3 Project location

The Port is located in Cleveland Bay, Townsville, between the mouths of Ross Creek and Ross River. The Port is linked to national shipping routes via a 14.9 km long access channel in Cleveland Bay. Maintenance dredging of port infrastructure is undertaken on a routine basis, with suitable dredged material placed at the offshore DMPA. The DMPA is authorised under both Queensland state, and Commonwealth approvals. From 2019 to 2024 a total of 2,874,000m³ of dredge material was placed in the DMPA (Port of Townsville, 2025). To understand the benthic communities potentially affected by the placement of maintenance dredging material, areas within, adjacent to and

at distance from the DMPA were assessed before and after the 2025 maintenance dredging campaign (dredge volume of approximately 349,000 m³). These areas comprise the Project Area (Figure 1) and include:

- Sites that are subject to direct disturbance during maintenance dredging placement activities (i.e. within the bounds of the DMPA)
- Sites within the modelled Zone of Influence (ZOI), derived from the hydrodynamic modelling undertaken for the Port of Townsville maintenance dredging assessment (BMT WBM, 2014). See section 1.4 for details on the ZOI.
- Control sites at distance from the DMPA and ZOI.

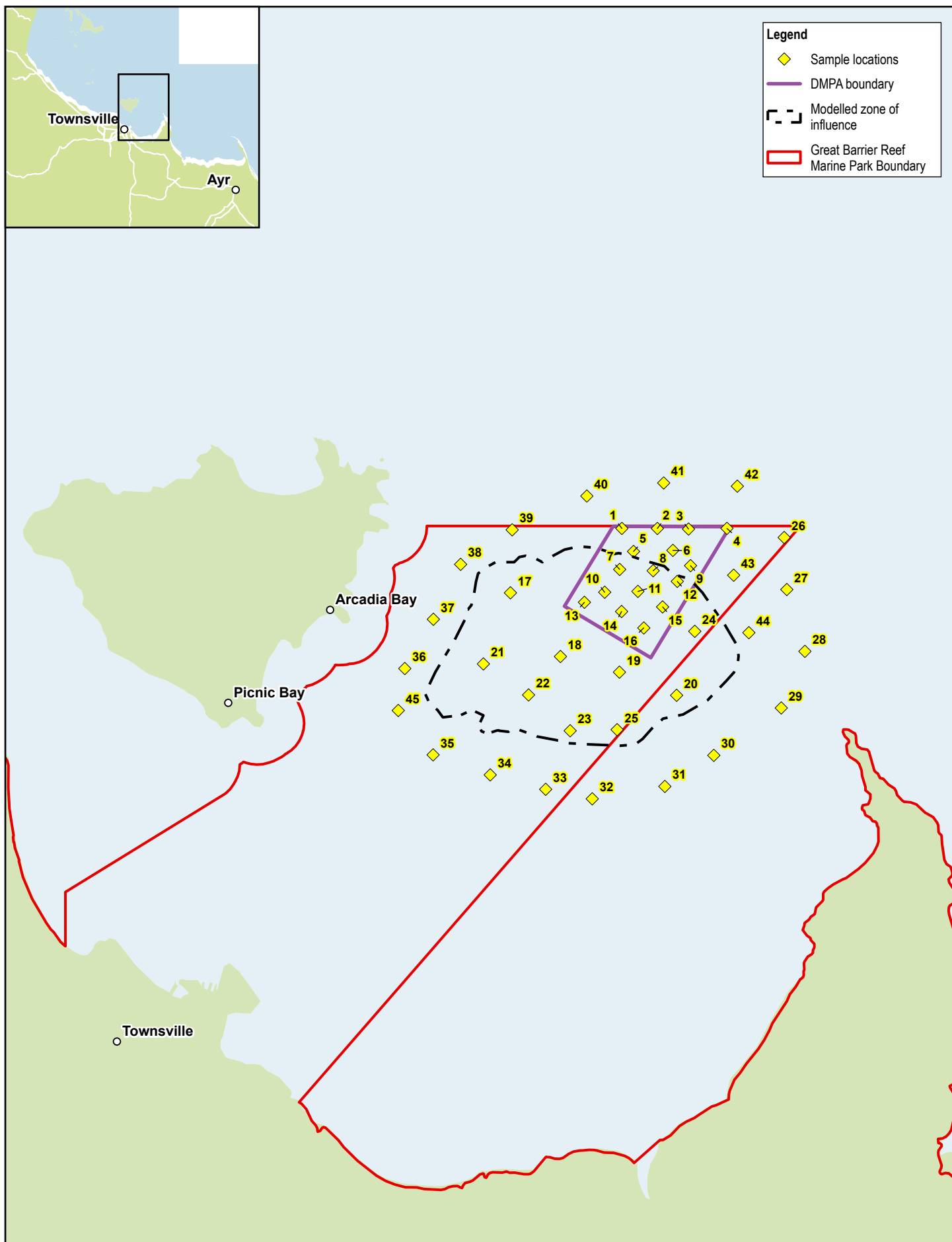
Information relating to the biological and physical characteristics of the greater Cleveland Bay area gained from previous studies was used to inform the survey design, including the assessment reported under the DMPA Recovery Study (GHD, 2022).

1.4 Approach to the study

This study was designed to assess the benthic communities and composition of sediments present at the Project Area. By collecting samples before and after the 2025 placement of maintenance dredge material in the DMPA, this study enables:

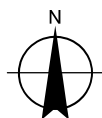
- The description of the benthic assemblages and sediment characteristics that occur across the Project area, at timeframes of relevance to the 2025 placement of maintenance dredge material in the DMPA
- The assessment of the differences, including statistical comparison, in composition and structure of assemblages and sediments across the Project Area, including the examination of potential influences on any identified differences, and
- The examination of potential rates of recovery and/or resilience that assemblages may have to direct or indirect effects of dredged material placement.

This study utilised the ZOI model outputs developed for the Port of Townsville maintenance dredging assessment (BMT WBM, 2014). The modelling considers the potential resuspension of dredge material placed within the DMPA over a 12-month period. For this assessment the suspended sediment model outputs were overlayed for El Nino, La Nina and transitional year 12-month periods, with the combined overlay forming the ZOI.



Paper Size ISO A4
0 1 2 3 4
Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55



Port of Townsville Limited
Benthic Assessment Port of Townsville DMPA

Project No. 12668542
Revision No. C
Date 13/05/2026

Final sample locations

FIGURE 1

2. Methodology

The aim of the study was to collect representative information from sites within the Project Area to characterise the benthic communities and sediment composition. This enables comparison of the benthic assemblages at time periods of relevance to the 2025 placement of maintenance dredge material.

2.1 Sampling effort

To achieve the project aim, two survey events were conducted prior to (Event 1) and post (Event 2) maintenance dredge placement activities. The design of the sampling program was informed by the results of a pilot study completed in 2018 (GHD, 2019), the DMPA Recovery Study associated with the 2020 maintenance dredge campaign (GHD 2022), and by review of results of a previous assessment of benthos in the area (i.e. Cruz, 2000). Results from the pilot and recovery studies affirmed the number of sites and level of sampling replication to be applied was considered appropriate to achieve the project aim. This included a post-hoc examination of actual and permuted species accumulation curves to confirm that the design applied adequate replication for characterisation of assemblages.

The project follows a “beyond Before-After-Control-Impact (BACI)” design, allowing for robust statistical analysis to be undertaken on the resulting data. Use of adjacent reference areas supports detection of natural variability in assemblage structure in conjunction with anthropogenic drivers of change.

Timing of the surveys was informed by the results presented in Cruz (2000) and GHD (2022). Cruz (2000) identified detectable differences in benthic communities 15 days after dredging, however samples collected after three months were not able to distinguish impacts from placement activities. GHD (2022) identified that three weeks post material placement there were still some observable changes in sediment composition. Survey timing for this study therefore comprised (as depicted by Figure 2):

- Event 1: Before dredge material placement – June 24-27, 2025
- Event 2: Post dredge material placement – September 9-12, 2025 (approximately five weeks following completion of the dredge campaign).

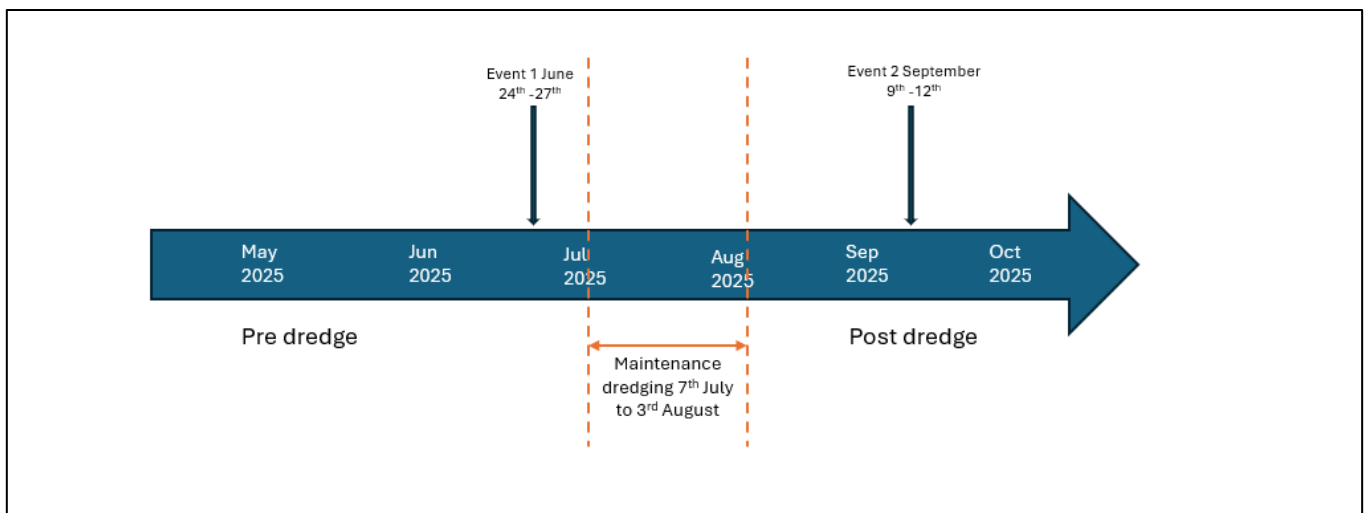


Figure 2 Survey timing in relation to the 2025 maintenance dredging campaign

On each sampling event samples were collected from a total of 45 sites, including 11 sites located within the general use zone of the Great Barrier Reef Marine Park (GBRMP). Works were undertaken in accordance with GHD's research permit for the Great Barrier Reef Marine Park (G20/44380.1). Figure 1 provides a map of sampling sites for the program. The design of the sampling program comprised sampling at sites within, adjacent to and at a distance from the DMPA, including:

- Sites that are subject to direct disturbance during maintenance dredging placement activities (i.e. within the bounds of the DMPA)

- Sites in the ZOI
- Control sites at distance from the DMPA and ZOI.

Depth and current regimes were accounted for when choosing locations of control sites. Control sites were placed up-current of the DMPA, along depth contours (ranging from approximately 7.0 m LAT (meters lowest astronomical tide) to 16.0 m LAT depth) that aligned with sites subject to disturbance within the DMPA.

At each sampling site a small (0.02 m³), hand operated van veen grab was deployed to collect samples from the upper 10 cm of the sediment. Four replicate samples (each approximately 1kg of sediment) were collected from each site.

Three of the replicates collected were used for assessment of benthic macroinvertebrates, and one replicate was collected for analysis of sediment particle size distribution (PSD). To inform sediment characteristics, one replicate sample per site was dispatched to the National Association of Testing Authorities (NATA) accredited ALS Laboratory for analysis of PSD.

To quantitatively assess benthic macroinvertebrate communities, each collected grab sample (3 per site) were sieved in-situ using a 0.5 mm mesh sieve, and retained benthic fauna were live picked and preserved for identification and enumeration. Collected taxa were sorted to major functional groups and identified to family units. The level of taxonomic resolution selected for this assessment was informed by the results of the pilot and recovery studies (GHD 2019, GHD 2022), which demonstrated family level identification was suitable to detect community changes between sites and over time.

During the post-dredge field survey (Event 2), in-situ video footage of the DMPA seabed was recorded. This footage was examined to identify presence of infauna burrows and mounds.

Field and laboratory quality assurance and quality control measures were interrogated during each stage of the project. This included confirming consistency in field team members and methods for each sampling event and checking of taxonomic identifications. This enabled confirmation that all results received are valid.

2.2 Data analysis

All data collated over all sampling events was subject to a combination of different univariate and multivariate statistical analysis techniques to assist in interpreting the benthic community and sediment composition characteristics across sites and monitoring events. Analysis was undertaken using the PRIMER-6 software (version 6.1.12) and Permanova+ add-on package (Anderson et al., 2008). Univariate diversity indices were calculated to provide a measure of benthic infauna taxa richness (abundance, Shannon Diversity Index, and Margalef's Index) and equitability (Pielou's Evenness Index).

Spatial differences (and similarities) in taxonomic composition between and within sites was undertaken by applying non-metric multidimensional scaling (nMDS) and BVSTEP analyses. Spatial differences (and similarities) in PSD data were analysed using the Principal Coordinates Ordination (PCO) method. The nMDS analyses were based on a similarity matrix produced using the Bray-Curtis co-efficient, as is appropriate for biological abundance data (Clarke and Warwick, 2001). Data was square-root transformed to down-weight the importance of highly abundant species, so that similarity calculations also captured the influence of less common species (Clarke and Warwick, 2001). The PCO analyses were based on a similarity matrix produced using Euclidean distances, as is appropriate for environmental data (Clarke and Warwick, 2001). Results of the nMDS and PCO have been graphically presented to assist in interpretation of findings.

These analyses facilitated detection of whether sites within a designated area were more similar to each other than sites in a different area, and whether there were any changes through time that were informed by any observed changes in PSD.

3. Results

3.1 Sampling design review

Numerous researchers have examined the validity of analysing data at higher levels of taxonomic discrimination (e.g. family, order or phylum) to detect resilience or changes resulting from pollution and/or disturbance events (see Ellis, 1985; Warwick, 1998; Vanderklift et al., 1996; Olsgard et al., 1997; Cruz, 2000). Warwick (1998) suggested that responses of benthic communities to anthropogenic environmental variables were more clearly evidenced at a higher level of taxonomic resolution than species level (i.e. family or order), whereas responses of assemblages to natural environmental variables (e.g. variation in water depth) were more distinct at a level of species. That study (and others) indicated that identification of biota to taxonomic levels higher than species (e.g. family or order) resulted in little loss of information and in many cases yielded better discrimination of patterns associated with community resilience or response to purported impacts.

In order to accurately describe the benthic communities present in the region, the sampling design must have the ability to detect both common and rare taxa. The adequacy of the sampling design in detecting taxa present was tested as part of the pilot and recovery studies (GHD 2019, GHD 2022). This was undertaken via the examination of observed and permuted taxa accumulation curves. This exercise has been repeated here to understand confidence in the data as representative of assemblages and inform interpretation of results presented herein.

The observed taxa accumulation curves ('Sobs' in Figure 3) found that for any order of samples selected, the first 50 samples detected 77.1% (Event 1) and 77.2% (Event 2) of all taxa collected during each event. The next 50 samples detected 15.7% (Event 1) and 15.8% (Event 2), and the final 35 samples detected 7.1% (Event 1) and 7.0% (Event 2) of the collected taxa. The decreasing rate in detection of new taxa (corresponding to the levelling out of the graphs) indicates that increasing sampling effort beyond that applied in this study provides little additional return of species data for increased effort. Permuted data indicates that the sampling effort applied during the study (n=3 across 45 sites) is sufficient in detecting both common and less common taxa to inform assemblage characterisation and comparison between samples.

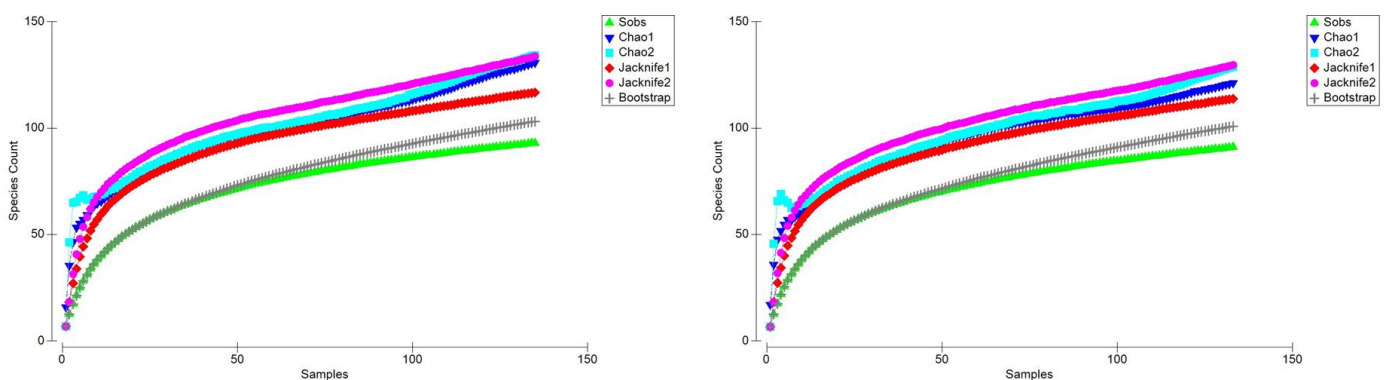


Figure 3 Observed and permuted family level taxa accumulation curves for Event 1 (left) and Event 2 (right)

3.2 Physical site characteristics

Sediment characteristics can influence composition of benthic macroinvertebrates, and dredged material can have a different sediment profile of that of offshore areas supporting placement. Analysis of particle size distribution (PSD) was therefore incorporated in the study to understand any changes in sediment composition between sampling events, and support interpretation of benthic community composition data.

An analysis of PSD for both events across the Project Area found that sand was the dominant fraction (average 60% during both Event 1 and Event 2, followed by clay (35% average during Event 1, 23% average during Event 2), silt (11% average during Event 1, 15% average during Event 2) and gravel (3.4% average during Event 1, 2.5% average during Event 2) (Table 1, Figure 4, Figure 5). No cobbles were identified in any sediment samples.

Analysis of sediment composition identified that there was no significant variation between events (Two-way PERMANOVA, $P(\text{perm}) > 0.05$; Appendix B). In contrast, significant differences between site groupings during each monitoring event were recorded (Two-way PERMANOVA, $P(\text{perm}) = 0.001$; Appendix B), with DMPA sites being significantly different to Control and ZOI sites before and after material placement.

Table 1 Particle size distribution summary statistics

Fraction	Event	Minimum (%)	Maximum (%)	Average (%)	Standard error (%)
Clay ($< 2 \mu\text{m}$)	Event 1 (pre)	17	50	35	8.2
	Event 2 (post)	10	46	23	7.4
Silt ($2\text{-}60 \mu\text{m}$)	Event 1 (pre)	4	37	11	8.4
	Event 2 (post)	6	46	15	9.1
Sand ($0.06\text{-}2.00 \text{ mm}$)	Event 1 (pre)	13	75	60	17
	Event 2 (post)	12	78	60	15
Gravel ($> 2 \text{ mm}$)	Event 1 (pre)	1	32	3.4	5.6
	Event 2 (post)	1	10	2.5	2.1

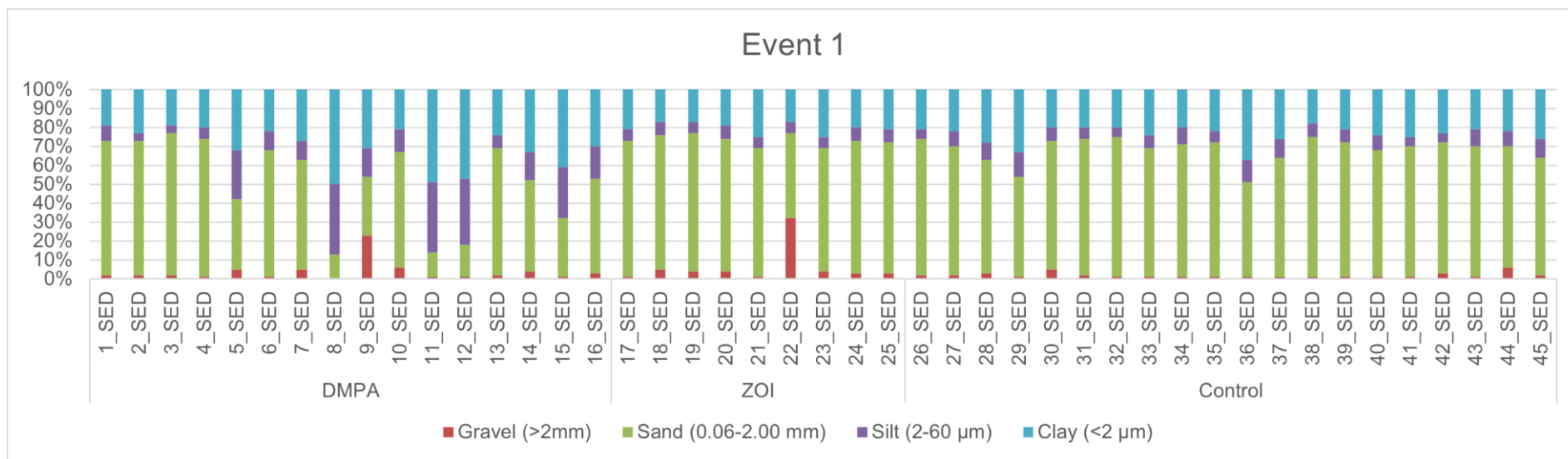


Figure 4 Event 1 PSD for all sites across the Project Area

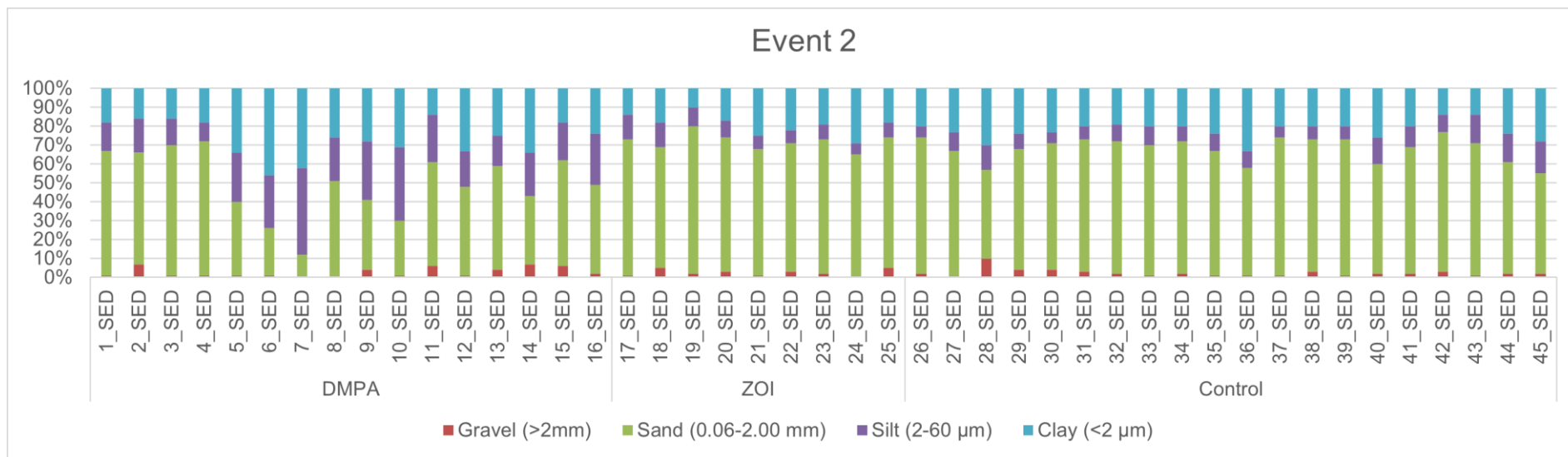


Figure 5 Event 2 PSD for all sites across the Project Area

Multivariate principal coordinates analysis (PCO) explains 98.7% (Event 1) and 98.3% (Event 2) of the variation in measured sediment composition (Figure 6). The PCO plots are therefore considered a robust representation of the relationships between samples. The PCO plots indicate that there are natural groupings in sediment composition, which loosely align with the spatial distribution of the sites (Figure 6).

During Event 1 (Figure 6 top), prior to the commencement of the maintenance dredge placement activities, the sediment composition was significantly different across the spatial distribution of the sites (One-way PERMANOVA, $P(\text{perm}) = 0.001$; Appendix B). Sites at the north of the DMPA were least similar to the remaining sites, with composition influenced by higher fine fractions (silts and clays). The majority of the sites within the southern portion of the DMPA, and the Control and ZOI groupings were characterised by higher concentrations of sands and lower concentrations of clays and silts. One site within the ZOI (site 22) had a higher proportion of gravel compared to the rest of the ZOI sites.

During Event 2 (Figure 6 bottom), which occurred five weeks following the completion of the maintenance dredge material placement, the sediment composition was significantly different across the spatial distribution of the sites (One-way PERMANOVA, $P(\text{perm}) = 0.001$; Appendix B). Differences in sediment composition at the DMPA were observed, however these were not significant (Appendix B). Compared to Event 1, during Event 2 the sites at the south of the DMPA were more similar to the sites at the north DMPA, with an increased proportion of fines (silts and clays). These non-significant changes at the DMPA are likely attributable to the placement of dredged material. The sediment composition at sites within the ZOI and Control areas remained relatively stable between monitoring events, with no significant changes (Appendix B), indicating a lack of influence of dredge placement on the composition of sediments beyond the DMPA.

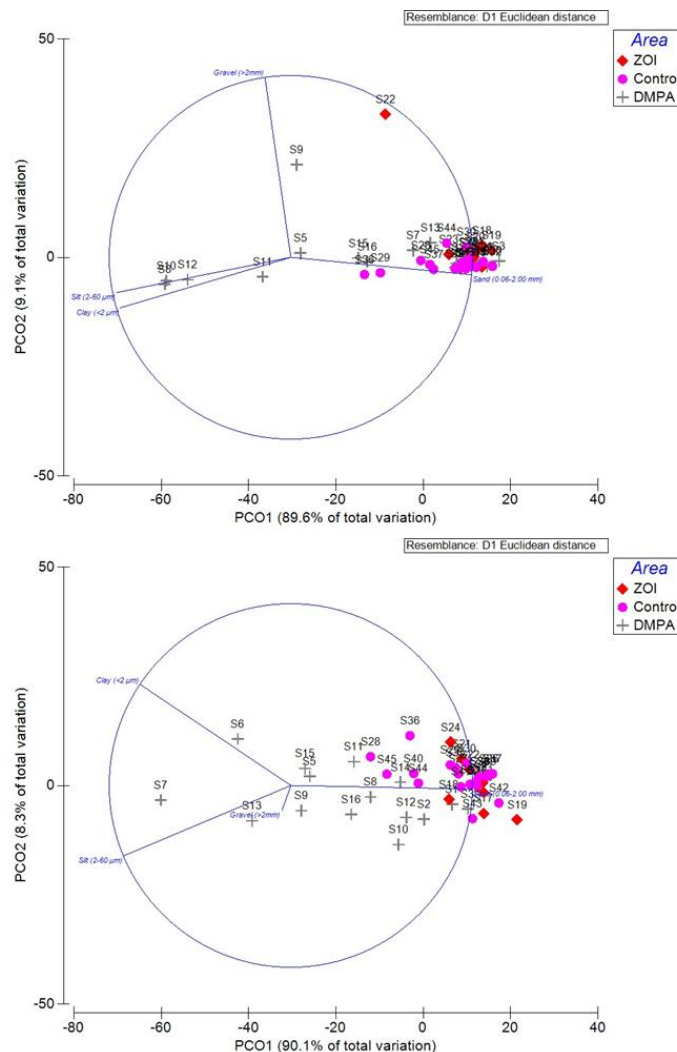


Figure 6 *Principal Coordinate Analysis of sediment composition across monitoring sites for Event 1 (top) and Event 2 (bottom)*

3.3 Benthic community composition

The benthic community composition surveyed under this program is typical of communities found in tropical soft sediment environments. Provided following is an overview of the community composition measured during each survey, including observed spatial patterns.

The total number of individuals collected ranged between 1128 (Event 2) and 1142 (Event 1). Across both events Annelids (marine worms) were the most abundant phylum, comprising of 51.14% (Event 1) and 49.91% (Event 2) of the overall composition (Figure 7, Figure 8). Crustacea (small crabs, amphipods, etc.) were the next most abundant phylum, comprising between 37.57% (Event 1) and 37.15% (Event 2) of the overall composition (Figure 7, Figure 8). Crustacea were also the most diverse phylum across the two events with 35 (Event 1) and 41 (Event 2) families identified across the Project Area. Annelids were the second most diverse phylum across both events, with 33 (Event 1) and 32 (Event 2) families identified across the Project Area.

All other phyla combined contributed 11.29% (Event 1) and 12.94% (Event 2) to the overall community composition (Figure 7, Figure 8).

Table 2 *Benthic community composition summary statistics per Event*

	Event 1	Event 2
Number of individuals	1142	1128
Number of families	93	91
Number of Phyla	10	9

Univariate diversity indices were calculated to provide a measure of taxonomic richness (abundance, Shannon Diversity Index, and Margalef's Index) and evenness (Pielou's Evenness Index). Average abundance was highest during Event 1 (Figure 9). The sites with the highest concentrations of fine sediments, for example in the northern DMPA region, exhibited lower average abundance than sites with higher concentrations of sands. This same spatial pattern is evident during Event 2 (Figure 9).

Average taxonomic richness (Figure 10) and diversity (Figure 11) followed the same general patterns as described for abundance, with spatial patterns reflecting the patterns observed for particle size distribution. In contrast, average evenness (Figure 12) was more variable between sites in Event 2 than Event 1.

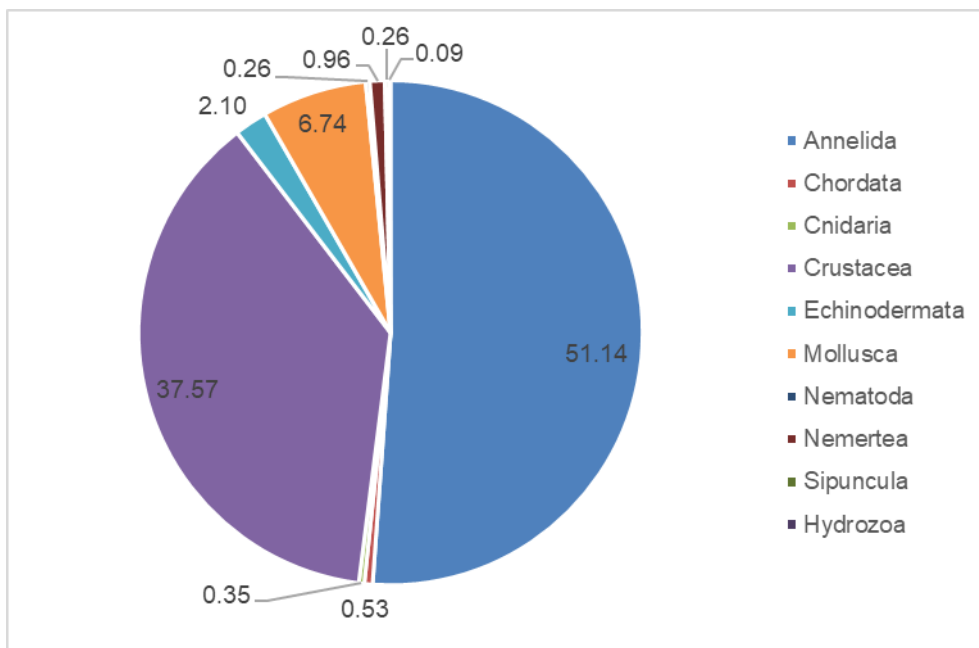


Figure 7 Benthic community across the Project area for Event 1 – pre dredge material placement

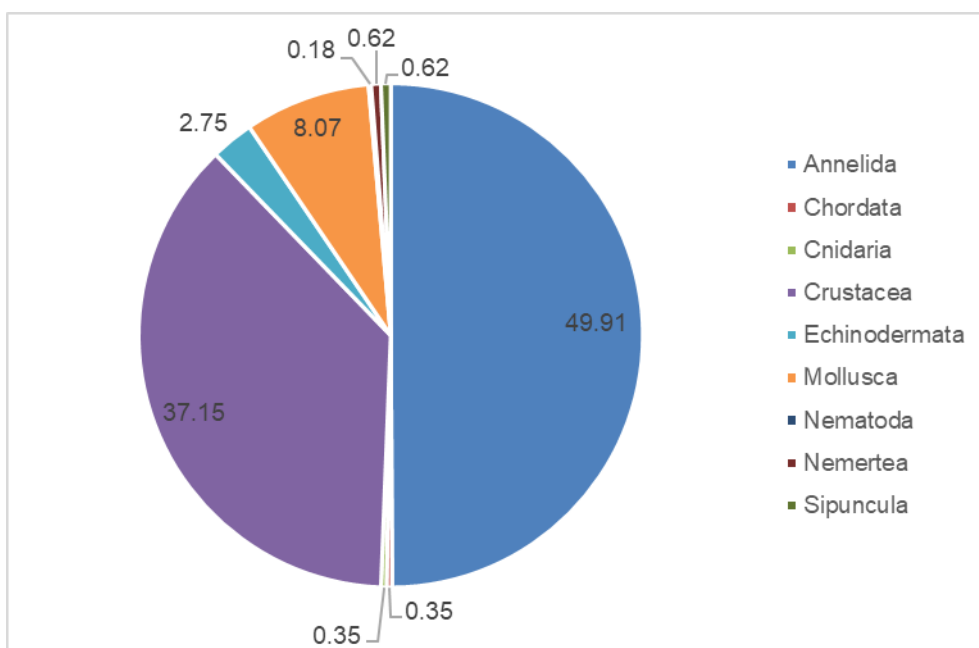


Figure 8 Benthic community across the Project area for Event 2 – Post dredge material placement

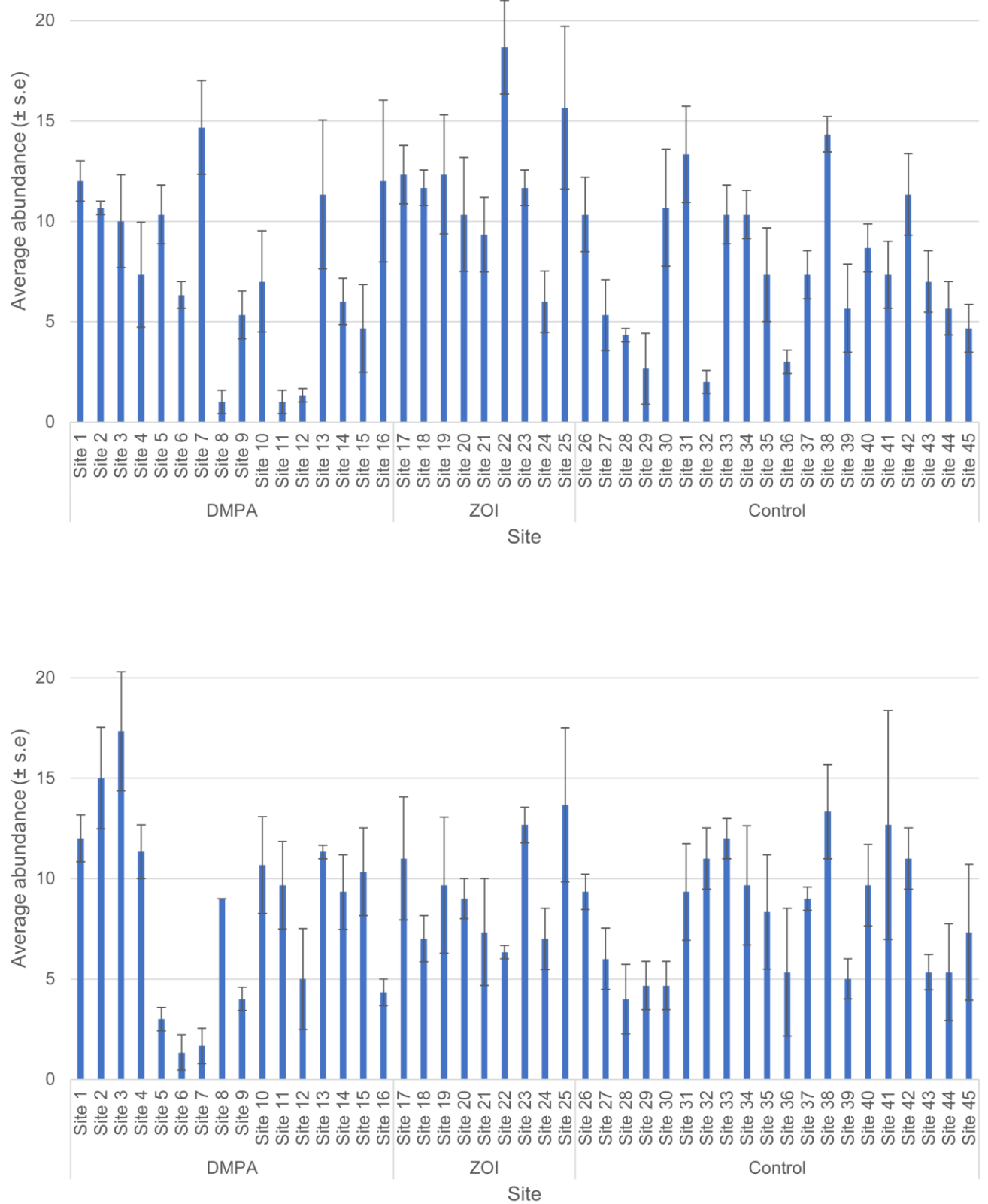


Figure 9 Average (± s.e.) taxonomic abundance across the Project Area for Event 1 (top) and Event 2 (bottom)

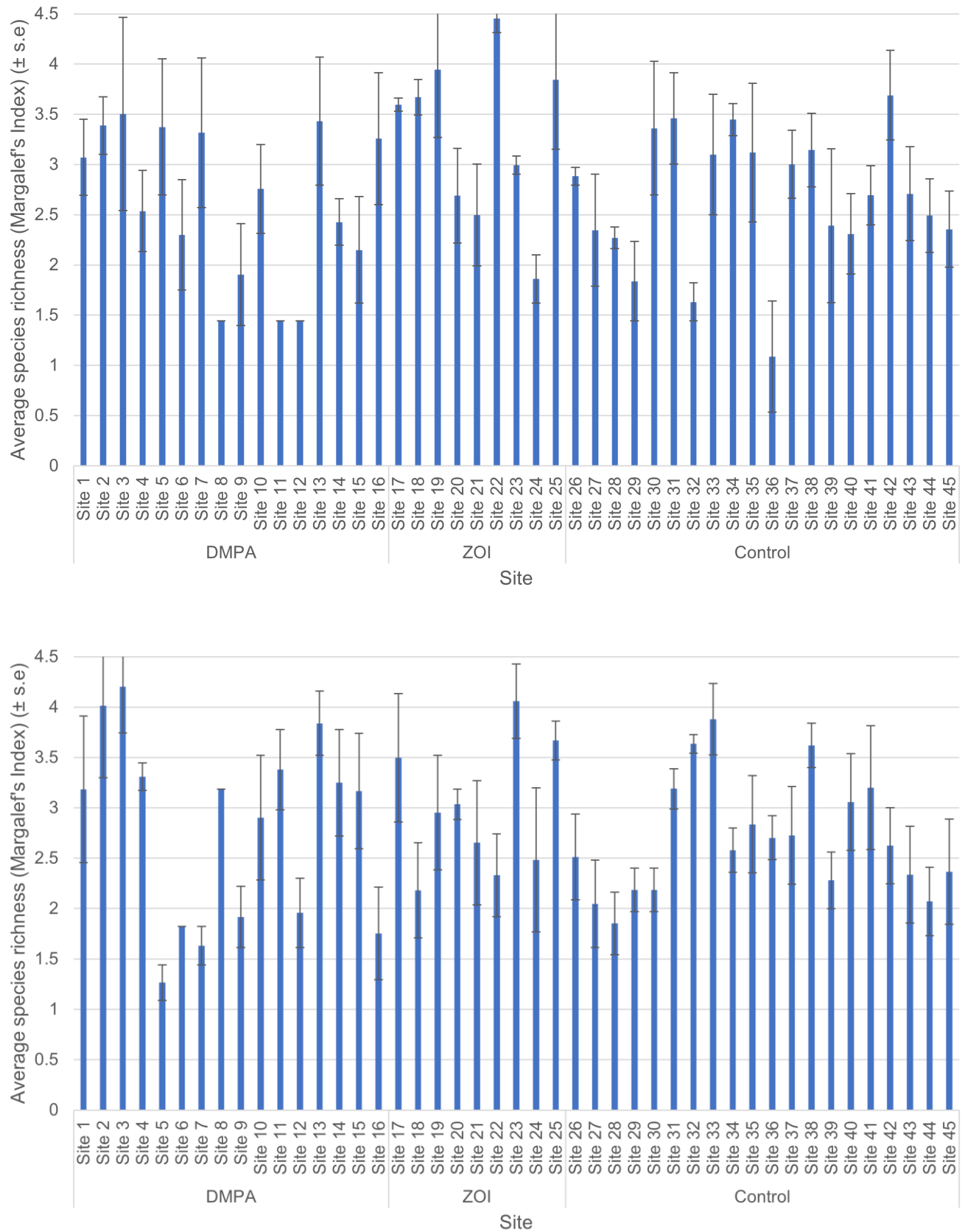


Figure 10 Average (± s.e.) taxonomic richness across the Project Area for Event 1 (top) and Event 2 (bottom)

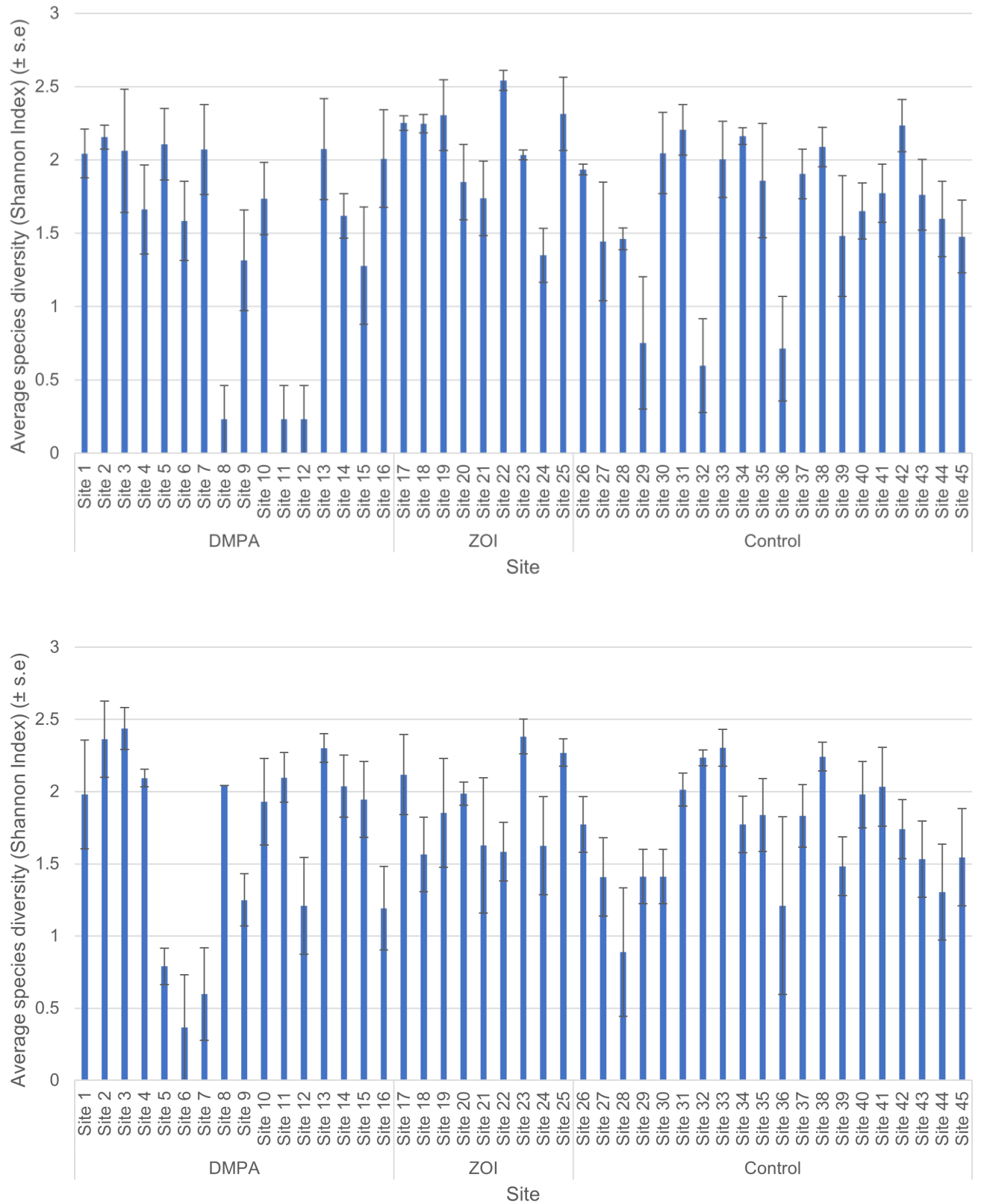


Figure 11 Average (± s.e.) taxonomic diversity across the Project Area for Event 1 (top) and Event 2 (bottom)

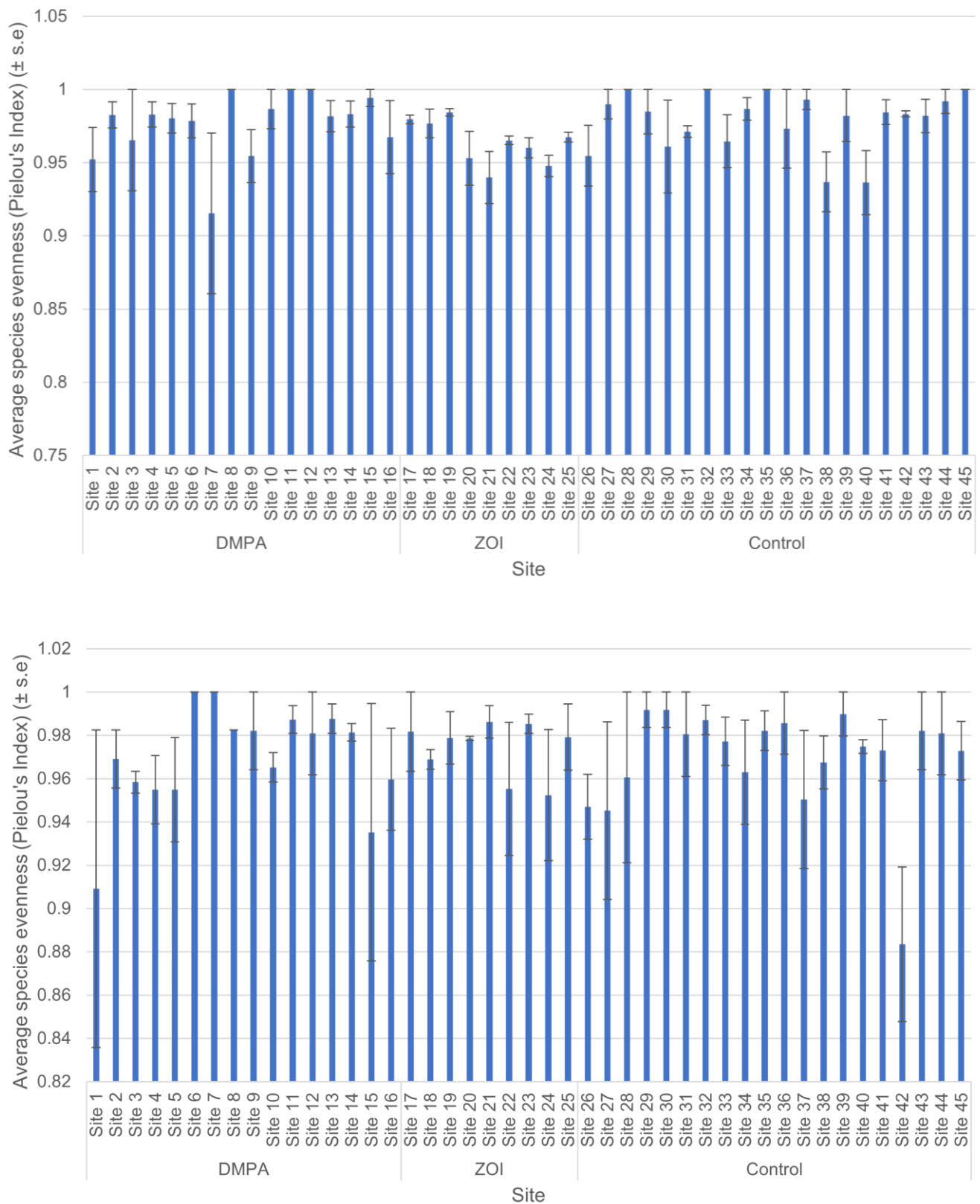


Figure 12 Average (± s.e.) taxonomic evenness across the Project Area for Event 1 (top) and Event 2 (bottom)

Non-metric Multi-Dimensional Scaling (nMDS) analysis indicates that during Event 1 there is some natural grouping (approximately 30% similarity) in benthic assemblages between samples that have a lower concentration of coarse sediments (Figure 13 – depicted by the closer grouping of these sites). The benthic assemblages at sites with higher proportions of fine sediments (i.e. select DMPA sites – 8, 11, 12, 15 and some Control sites – 29, 36) were generally less similar to sites with higher proportions of coarse sediments. Similar patterns were observed after Event 2 (Figure 14), with sites with higher proportions of fine sediment (i.e. DMPA sites 5-9) displaying less similar assemblages than sites with coarser sediments.

The benthic assemblages varied significantly between the events (Two-way PERMANOVA, $P(\text{perm})=0.001$; Appendix B), with all site groupings (DMPA, Control, ZOI) changing significantly between events. The benthic community at the DMPA was significantly different to the benthic community at the ZOI both before and after dredge material placement (Appendix B). However, there were no significant differences between the DMPA and Control benthic communities before and after dredge placement (Appendix B).

These results indicate the occurrence of additional influences on the system beyond that of dredge material placement.

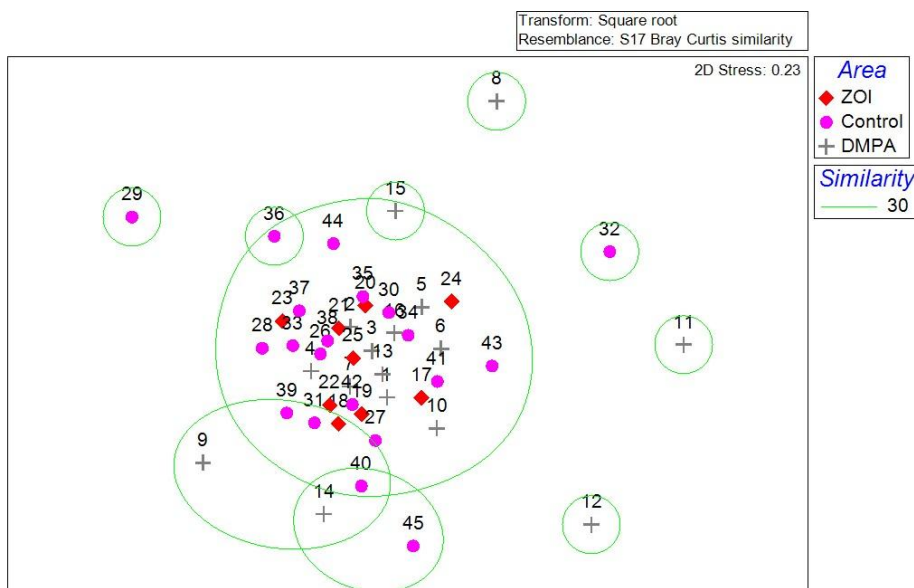


Figure 13 nMDS plot of benthic assemblages across the Project Area for Event 1

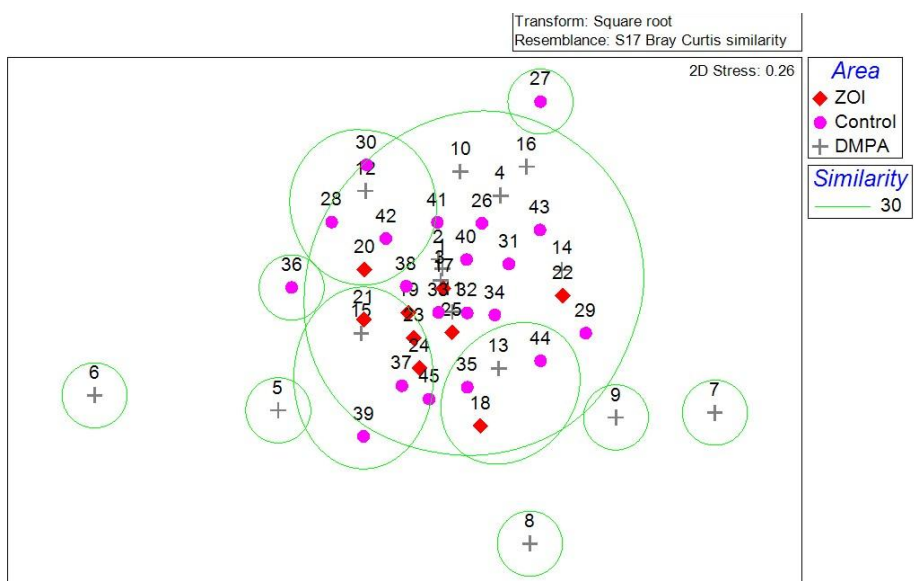


Figure 14 nMDS plot of benthic assemblages across the Project Area for Event 2

To determine which taxa were potentially driving the community compositional groupings of each event a BVSTEP analysis was performed. This identified that for each event, and for all events combined, there was a subset of 23-25 taxa that was a near-perfect match ($\rho = 0.95$) for the composition displayed on the nMDS by the full set of taxa (91-93 taxa; refer Table 2) (Table 3; Figure 13; Figure 14). These 'influential taxa', were comprised of marine worms, crustacea, bivalves and ophiuroidea (brittle stars) and accounted for 80% of the overall abundance during each survey (Table 3). Eighteen of these 'influential taxa' were also identified as influential during the DMPA recovery study (GHD, 2022).

Sixteen taxa were considered 'influential taxa' across both monitoring events (Table 3 – denoted by blue shading). These were marine worms (10 families) and crustacea (six families) (Table 3). These taxa were among the most abundant during each event. Of the taxa that were only influential during one event (Table 3), some taxa recorded high variability in abundance between events, whereas others recorded relatively consistent abundance across both events.

These results indicate that it is primarily the presence and prevalence of the more commonly occurring taxa that present a good indicator of how sites relate to each other under the two monitoring scenarios.

Table 3 'Influential taxa' subset for each Event

Phylum	Class/Order	Family	Abundance across the Project Area	
			Event 1 (pre-dredge material placement)	Event 2 (post-dredge material placement)
Annelida	Polychaeta	Capitellidae*	36	35
Annelida	Polychaeta	Cirratulidae	29	25
Annelida	Polychaeta	Eunicidae*	21	21
Annelida	Polychaeta	Glyceridae	20	35
Annelida	Polychaeta	Goniadidae*	25	48
Annelida	Polychaeta	Lumbrineridae*	38	25
Annelida	Polychaeta	Magelonidae*	37	41
Annelida	Polychaeta	Maldanidae*	29	29
Annelida	Polychaeta	Nephtyidae	12	13
Annelida	Polychaeta	Nereididae*	28	28
Annelida	Polychaeta	Orbiniidae	20	20
Annelida	Polychaeta	Pareonidae	12	12
Annelida	Polychaeta	Pilargidae*	102	98
Annelida	Polychaeta	Spionidae	59	38
Annelida	Polychaeta	Syllidae	27	14
Annelida	Polychaeta	Terebellidae*	23	15
Crustacea	Amphipoda	Ampeliscidae*	51	49
Crustacea	Amphipoda	Aoridae	38	16
Crustacea	Amphipoda	Ischyroceridae*	83	28
Crustacea	Amphipoda	Metilidae*	0	28
Crustacea	Amphipoda	Phoxocephalidae*	16	16
Crustacea	Caridea	Alphidae*	8	14
Crustacea	Caridea	Pasiphaeidae	17	27
Crustacea	Copepoda	Copepoda	15	10
Crustacea	Isopoda	Anthuridae*	29	15

Phylum	Class/Order	Family	Abundance across the Project Area	
			Event 1 (pre-dredge material placement)	Event 2 (post-dredge material placement)
Crustacea	Tanaidacea	Apseudidae*	26	30
Crustacea	Tanaidacea	c.f.Tanaidae	19	1
Crustacea	Thalassinidae	Callianassidae*	25	68
Echinodermata	Ophiuroidea	Ophiuroidea*	18	26
Mollusca	Bivalvia	Corbulidae	11	18
Mollusca	Bivalvia	Tellinidae	21	34
Mollusca	Bivalvia	Veneridae	21	24
<i>Count of influential taxa</i>			23	25
<i>Sum influential taxa</i>			916	901
<i>% of total abundance comprised of influential taxa</i>			80.2%	79.9%
<i>rho</i>			0.955	0.95
Notes:				
Blue shading indicates taxa is considered 'influential' for selected event				
Asterisk (*) indicates taxa were part of 'influential' set under GHD (2022) assessment				

As noted in Section 2.1, underwater video footage was recorded from select locations within the DMPA during Event 2. Figure 15 provides still images from that footage that shows evidence of bioturbation including infauna burrows and mounds.



Figure 15 Video footage of DMPA seabed during Event 2. Arrows indicate infauna mounds and/or burrows.

4. Discussions and Conclusions

Review of the sampling design has identified that the sampling effort applied is sufficient to detect both common and less common taxa. Assessment of collected and permuted data indicates that increasing sampling effort via additional replication is unlikely to provide additional data that would influence results. This is consistent with findings of the pilot and recovery studies (GHD 2019, GHD 2022), as well as historical results. Cruz (2000) extensively sampled the Project Area over a larger sampling effort (665 samples across six sampling events). From this he identified a total of 89 families, with the most abundant families consistent across surveys. The recovery study (GHD, 2022) identified 112 families from 540 samples across four sampling events. The current study identified 107 families from 270 samples across two sampling efforts, indicating a detection rate adequate to describe the communities present in the Project Area.

Placement of dredged material has the potential to influence sediment characteristics of offshore placement areas. Particle size distribution (PSD) was assessed across the Project Area, prior to the placement of the dredge material (Event 1), and post placement of the dredge material (Event 2). Review of PSD results has identified that sites within the northern extent of the DMPA were dominated by fine sediments across both events, with sites in the southern extent of the DMPA exhibiting a non-significant change in composition towards finer sediments post material placement (Event 2). Sites located in the ZOI and Control areas were generally dominated by sands. Differences between the sediment composition measured at the DMPA and at the Control and ZOI sites were significant, however locations did not change significantly through time. Comparison of results collected under this assessment to previous studies indicates that changes in sediment composition are detectable 15 days post dredging (Cruz, 2000), three weeks post dredging (GHD, 2022). At five weeks post dredging (this assessment) changes are still detectable, however non-significant. Longer term studies have identified that changes observed in sediment composition following dredging do not persist through time, which indicates that use of the DMPA on an annual / routine basis for maintenance dredging does not result in long-term changes to sediment composition of the region (GHD, 2022).

Benthic macroinvertebrates are known to assimilate fine sediments into the substrate via bioturbation (Kristensen et al., 2012). This was observed three weeks post dredging under the previous assessment (GHD, 2022). Underwater video taken at selected sites within the DMPA during Event 2 of this study further supports this, providing visual evidence of bioturbation in the form of infauna burrows and mounds at five weeks post dredging.

Review of the PSD data at the Control and ZOI locations showed no significant changes in sediment composition at these sites, indicating that the finer sediments placed at the DMPA are not migrating beyond the DMPA boundary. These results are also consistent with those reported under GHD (2022), associated with the 2020 maintenance dredging campaign.

Review of benthic community composition identified some grouping of sites, aligned with sediment composition characteristics. Sites with higher proportions of fine sediments were generally less abundant and diverse than the sites dominated by sands. These findings are consistent with the results of the recovery study (GHD, 2022). Benthic community composition changed significantly across the Project Area between events, however there were no significant differences between the DMPA and Control benthic communities before and after dredge material placement. These results indicate the occurrence of additional influences on the system beyond that of dredge material placement.

The taxa groups recorded during this study were typical of communities found in tropical soft sediment environments, and consistent with previous studies (GHD, 2022; GHD, 2019; Cruz, 2000). Review of the 'influential taxa' subsets for each event (23 taxa for Event 1 and 25 taxa for Event 2), and overall, provide insight into a core cohort that persists through placement activities. This cohort was comprised of commonly occurring marine worms, crustacea, bivalves and brittle stars that persisted across the Project Area during both Event 1 (pre placement) and Event 2 (post placement). Eighteen of the 'influential taxa' subset identified in this assessment were also identified as 'influential' during the previous DMPA recovery study (GHD, 2022). The persistence of this cohort through time, including across multiple maintenance dredge campaigns, and large-scale climatic events, indicates that 18 taxa within the cohort (as indicated by an asterisk in Table 3) can be considered fully established foundation species.

It is these taxa that provide the benthic assemblages across the Project Area resilience to change, regardless of whether the disturbance is related to large scale climatic events, or smaller scale dredge material placement activities. During the placement of maintenance dredge material, disturbance is limited to the immediate DMPA, as is evidenced by sediment results at the ZOI and Control locations. Furthermore, it is likely that benthic community composition recovery of resilient species is supported by re-seeding from adjacent undisturbed communities. Given the link noted above between bioturbation and the recovery of sediment composition immediately following placement of dredge material, it therefore follows that the presence of the fully established foundation species also influences the resilience of the sediment composition to change.

Disturbances associated with dredge material placement were found to be confined within the boundary of the DMPA. Based on the data collected from this study, as well as previous investigations of the region (GHD, 2022; GHD 2019; Cruz 2000), dredge material placement at the DMPA does not appear to have a long-term effect on the sediment or benthic community composition of the Project Area.

5. References

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Appendices

Appendix A

Laboratory reports



CERTIFICATE OF ANALYSIS

Work Order : **EB2522559**
Client : **GHD PTY LTD**
Contact : **HAMISH WHITNEY**
Address : **P O BOX 930**
TOWNSVILLE QLD, AUSTRALIA 4810
Telephone : **+61 7 4720 0468**
Project : **12668542**
Order number : **12668542**
C-O-C number : **----**
Sampler : **PRASANNA WIJESINGHE**
Site : **----**
Quote number : **TV/096/18 B**
No. of samples received : **45**
No. of samples analysed : **45**

Page : 1 of 20
Laboratory : Environmental Division Brisbane
Contact : Nathan King
Address : 2 Byth Street Stafford QLD Australia 4053
Telephone : +61-7-3552-8685
Date Samples Received : 01-Jul-2025 08:40
Date Analysis Commenced : 08-Jul-2025
Issue Date : 08-Jul-2025 15:44



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	Position	Accreditation Category
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

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

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

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

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

- EA150H: Soil particle density results fell outside the scope of AS1289.3.6.3. Results should be scrutinised accordingly.



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				1_SED	2_SED	3_SED	4_SED	5_SED
Sampling date / time				26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit	EB2522559-001	EB2522559-002	EB2522559-003	EB2522559-004	EB2522559-005
				Result	Result	Result	Result	Result
EA150: Particle Sizing								
ø +2µm	----	1	%	81	77	81	80	68
ø +5µm	----	1	%	78	76	81	79	64
ø +10µm	----	1	%	78	75	79	78	60
ø +15.6µm	----	1	%	76	75	79	77	57
ø +20µm	----	1	%	76	75	79	76	55
ø +30µm	----	1	%	76	75	78	76	50
ø +40µm	----	1	%	75	74	78	76	45
ø +50µm	----	1	%	73	73	78	75	43
ø +60µm	----	1	%	73	73	77	74	42
+75µm	----	1	%	71	72	76	73	41
+150µm	----	1	%	54	53	59	55	24
+300µm	----	1	%	16	15	20	18	18
+425µm	----	1	%	10	9	12	11	15
+600µm	----	1	%	7	6	8	7	12
+1180µm	----	1	%	3	3	3	3	8
+2.36mm	----	1	%	2	1	1	<1	4
+4.75mm	----	1	%	<1	<1	<1	<1	1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	19	23	19	20	32
Silt (2-60 µm)	----	1	%	8	4	4	6	26
Sand (0.06-2.00 mm)	----	1	%	71	71	75	73	37
Gravel (>2mm)	----	1	%	2	2	2	1	5
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	1_SED	2_SED	3_SED	4_SED	5_SED
Sampling date / time					26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit		EB2522559-001	EB2522559-002	EB2522559-003	EB2522559-004	EB2522559-005
					Result	Result	Result	Result	Result
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	-----	0.01	g/cm3		2.52	2.86	2.77	2.84	2.70



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				6_SED	7_SED	8_SED	9_SED	10_SED
Sampling date / time				26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit	EB2522559-006	EB2522559-007	EB2522559-008	EB2522559-009	EB2522559-010
				Result	Result	Result	Result	Result
EA150: Particle Sizing								
ø +2µm	----	1	%	78	73	50	69	79
ø +5µm	----	1	%	78	72	43	65	77
ø +10µm	----	1	%	75	69	38	63	76
ø +15.6µm	----	1	%	74	68	34	63	74
ø +20µm	----	1	%	73	68	31	61	74
ø +30µm	----	1	%	72	67	24	59	72
ø +40µm	----	1	%	71	66	19	57	69
ø +50µm	----	1	%	69	64	16	56	68
ø +60µm	----	1	%	68	63	13	54	67
+75µm	----	1	%	67	62	13	53	66
+150µm	----	1	%	49	37	5	45	42
+300µm	----	1	%	13	24	3	38	30
+425µm	----	1	%	7	20	1	35	24
+600µm	----	1	%	4	17	<1	32	19
+1180µm	----	1	%	2	10	<1	26	10
+2.36mm	----	1	%	<1	4	<1	21	5
+4.75mm	----	1	%	<1	<1	<1	13	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	22	27	50	31	21
Silt (2-60 µm)	----	1	%	10	10	37	15	12
Sand (0.06-2.00 mm)	----	1	%	67	58	13	31	61
Gravel (>2mm)	----	1	%	1	5	<1	23	6
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	6_SED	7_SED	8_SED	9_SED	10_SED
Sampling date / time					26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit		EB2522559-006	EB2522559-007	EB2522559-008	EB2522559-009	EB2522559-010
					Result	Result	Result	Result	Result
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	-----	0.01	g/cm3		2.79	2.87	2.36	2.69	2.67



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				11_SED	12_SED	13_SED	14_SED	15_SED
Sampling date / time				26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit	EB2522559-011	EB2522559-012	EB2522559-013	EB2522559-014	EB2522559-015
				Result	Result	Result	Result	Result
EA150: Particle Sizing								
ø +2µm	----	1	%	51	53	76	67	59
ø +5µm	----	1	%	45	46	74	64	54
ø +10µm	----	1	%	40	39	74	61	50
ø +15.6µm	----	1	%	35	35	73	60	45
ø +20µm	----	1	%	32	33	73	59	42
ø +30µm	----	1	%	23	28	72	56	36
ø +40µm	----	1	%	17	23	71	54	34
ø +50µm	----	1	%	15	19	70	53	33
ø +60µm	----	1	%	14	18	69	52	32
+75µm	----	1	%	13	18	68	51	32
+150µm	----	1	%	6	11	45	30	20
+300µm	----	1	%	4	7	18	21	13
+425µm	----	1	%	4	4	11	16	10
+600µm	----	1	%	3	3	8	12	7
+1180µm	----	1	%	2	1	3	6	3
+2.36mm	----	1	%	<1	<1	1	3	<1
+4.75mm	----	1	%	<1	<1	<1	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	49	47	24	33	41
Silt (2-60 µm)	----	1	%	37	35	7	15	27
Sand (0.06-2.00 mm)	----	1	%	13	17	67	48	31
Gravel (>2mm)	----	1	%	1	1	2	4	1
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	11_SED	12_SED	13_SED	14_SED	15_SED
Sampling date / time					26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit		EB2522559-011	EB2522559-012	EB2522559-013	EB2522559-014	EB2522559-015
					Result	Result	Result	Result	Result
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	-----	0.01	g/cm3		2.29	2.64	2.75	2.72	2.76



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				16_SED	17_SED	18_SED	19_SED	20_SED
Sampling date / time				26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit	EB2522559-016	EB2522559-017	EB2522559-018	EB2522559-019	EB2522559-020
				Result	Result	Result	Result	Result
EA150: Particle Sizing								
ø +2µm	----	1	%	70	79	83	83	81
ø +5µm	----	1	%	67	78	81	82	79
ø +10µm	----	1	%	62	78	80	80	78
ø +15.6µm	----	1	%	61	76	80	80	77
ø +20µm	----	1	%	59	75	80	80	76
ø +30µm	----	1	%	56	75	79	80	76
ø +40µm	----	1	%	55	75	78	79	76
ø +50µm	----	1	%	54	74	77	78	75
ø +60µm	----	1	%	53	73	76	77	74
+75µm	----	1	%	52	71	75	75	73
+150µm	----	1	%	34	51	57	61	66
+300µm	----	1	%	24	13	27	31	38
+425µm	----	1	%	19	8	19	19	24
+600µm	----	1	%	14	5	15	14	15
+1180µm	----	1	%	5	2	8	6	6
+2.36mm	----	1	%	2	<1	4	2	3
+4.75mm	----	1	%	<1	<1	1	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	30	21	17	17	19
Silt (2-60 µm)	----	1	%	17	6	7	6	7
Sand (0.06-2.00 mm)	----	1	%	50	72	71	73	70
Gravel (>2mm)	----	1	%	3	1	5	4	4
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	16_SED	17_SED	18_SED	19_SED	20_SED
Sampling date / time					26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit		EB2522559-016	EB2522559-017	EB2522559-018	EB2522559-019	EB2522559-020
					Result	Result	Result	Result	Result
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	-----	0.01	g/cm3		2.66	2.62	2.75	2.60	2.68



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				21_SED	22_SED	23_SED	24_SED	25_SED
Sampling date / time				26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit	EB2522559-021	EB2522559-022	EB2522559-023	EB2522559-024	EB2522559-025
				Result	Result	Result	Result	Result
EA150: Particle Sizing								
ø +2µm	----	1	%	75	83	75	80	79
ø +5µm	----	1	%	73	82	73	78	76
ø +10µm	----	1	%	71	81	73	76	75
ø +15.6µm	----	1	%	71	80	71	75	74
ø +20µm	----	1	%	71	79	71	73	74
ø +30µm	----	1	%	71	77	69	73	72
ø +40µm	----	1	%	71	77	69	73	72
ø +50µm	----	1	%	70	77	69	73	72
ø +60µm	----	1	%	69	77	69	73	72
+75µm	----	1	%	69	76	68	71	72
+150µm	----	1	%	49	65	56	61	62
+300µm	----	1	%	8	52	25	30	35
+425µm	----	1	%	5	47	16	16	24
+600µm	----	1	%	3	43	11	10	16
+1180µm	----	1	%	2	36	6	5	6
+2.36mm	----	1	%	<1	30	3	2	1
+4.75mm	----	1	%	<1	21	<1	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	25	17	25	20	21
Silt (2-60 µm)	----	1	%	6	6	6	7	7
Sand (0.06-2.00 mm)	----	1	%	68	45	65	70	69
Gravel (>2mm)	----	1	%	1	32	4	3	3
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	21_SED	22_SED	23_SED	24_SED	25_SED
Sampling date / time					26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit	EB2522559-021	EB2522559-022	EB2522559-023	EB2522559-024	EB2522559-025	
				Result	Result	Result	Result	Result	
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.66	2.64	2.55	2.59	2.87	



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				26_SED	27_SED	28_SED	29_SED	30_SED
Sampling date / time				26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit	EB2522559-026	EB2522559-027	EB2522559-028	EB2522559-029	EB2522559-030
				Result	Result	Result	Result	Result
EA150: Particle Sizing								
ø +2µm	----	1	%	79	78	72	67	80
ø +5µm	----	1	%	79	74	69	65	77
ø +10µm	----	1	%	77	74	67	63	77
ø +15.6µm	----	1	%	77	73	65	60	76
ø +20µm	----	1	%	76	72	65	59	75
ø +30µm	----	1	%	75	72	65	59	75
ø +40µm	----	1	%	75	72	65	58	75
ø +50µm	----	1	%	75	70	64	55	73
ø +60µm	----	1	%	74	70	63	54	73
+75µm	----	1	%	73	70	63	53	72
+150µm	----	1	%	56	57	58	44	62
+300µm	----	1	%	15	21	35	22	41
+425µm	----	1	%	9	11	21	12	26
+600µm	----	1	%	6	6	13	7	17
+1180µm	----	1	%	3	3	5	2	7
+2.36mm	----	1	%	1	2	2	<1	4
+4.75mm	----	1	%	<1	1	<1	<1	2
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	21	22	28	33	20
Silt (2-60 µm)	----	1	%	5	8	9	13	7
Sand (0.06-2.00 mm)	----	1	%	72	68	60	53	68
Gravel (>2mm)	----	1	%	2	2	3	1	5
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	26_SED	27_SED	28_SED	29_SED	30_SED
Sampling date / time					26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit		EB2522559-026	EB2522559-027	EB2522559-028	EB2522559-029	EB2522559-030
					Result	Result	Result	Result	Result
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	-----	0.01	g/cm3		2.65	2.75	2.61	2.66	2.65



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				31_SED	32_SED	33_SED	34_SED	35_SED
Sampling date / time				26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit	EB2522559-031	EB2522559-032	EB2522559-033	EB2522559-034	EB2522559-035
				Result	Result	Result	Result	Result
EA150: Particle Sizing								
ø +2µm	----	1	%	80	80	76	80	78
ø +5µm	----	1	%	79	80	73	80	78
ø +10µm	----	1	%	79	77	72	76	75
ø +15.6µm	----	1	%	78	77	72	75	75
ø +20µm	----	1	%	76	77	71	74	75
ø +30µm	----	1	%	74	75	69	74	73
ø +40µm	----	1	%	74	75	69	74	73
ø +50µm	----	1	%	74	75	69	72	73
ø +60µm	----	1	%	74	75	69	71	72
+75µm	----	1	%	72	73	67	71	69
+150µm	----	1	%	65	65	52	52	30
+300µm	----	1	%	40	21	14	10	6
+425µm	----	1	%	25	11	8	6	4
+600µm	----	1	%	16	7	6	5	3
+1180µm	----	1	%	5	2	3	2	1
+2.36mm	----	1	%	1	<1	<1	1	<1
+4.75mm	----	1	%	<1	<1	<1	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	20	20	24	20	22
Silt (2-60 µm)	----	1	%	6	5	7	9	6
Sand (0.06-2.00 mm)	----	1	%	72	74	68	70	71
Gravel (>2mm)	----	1	%	2	1	1	1	1
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	31_SED	32_SED	33_SED	34_SED	35_SED
Sampling date / time					26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit	EB2522559-031	EB2522559-032	EB2522559-033	EB2522559-034	EB2522559-035	
				Result	Result	Result	Result	Result	
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.61	2.59	2.60	2.56	2.61	



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				36_SED	37_SED	38_SED	39_SED	40_SED
Sampling date / time				26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit	EB2522559-036	EB2522559-037	EB2522559-038	EB2522559-039	EB2522559-040
				Result	Result	Result	Result	Result
EA150: Particle Sizing								
ø +2µm	----	1	%	63	74	82	79	76
ø +5µm	----	1	%	61	74	81	76	74
ø +10µm	----	1	%	57	68	77	76	72
ø +15.6µm	----	1	%	56	68	77	76	72
ø +20µm	----	1	%	54	68	75	75	72
ø +30µm	----	1	%	54	66	75	74	72
ø +40µm	----	1	%	52	66	75	72	72
ø +50µm	----	1	%	52	65	75	72	70
ø +60µm	----	1	%	51	64	75	72	68
+75µm	----	1	%	50	63	73	72	68
+150µm	----	1	%	19	24	58	50	50
+300µm	----	1	%	5	4	11	9	13
+425µm	----	1	%	4	3	6	5	8
+600µm	----	1	%	3	2	5	3	6
+1180µm	----	1	%	2	1	2	1	2
+2.36mm	----	1	%	<1	<1	<1	<1	<1
+4.75mm	----	1	%	<1	<1	<1	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	37	26	18	21	24
Silt (2-60 µm)	----	1	%	12	10	7	7	8
Sand (0.06-2.00 mm)	----	1	%	50	63	74	71	67
Gravel (>2mm)	----	1	%	1	1	1	1	1
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	36_SED	37_SED	38_SED	39_SED	40_SED
Sampling date / time					26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit		EB2522559-036	EB2522559-037	EB2522559-038	EB2522559-039	EB2522559-040
					Result	Result	Result	Result	Result
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	-----	0.01	g/cm3		2.66	2.61	2.60	2.57	2.61



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				41_SED	42_SED	43_SED	44_SED	45_SED
Sampling date / time				26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit	EB2522559-041	EB2522559-042	EB2522559-043	EB2522559-044	EB2522559-045
				Result	Result	Result	Result	Result
EA150: Particle Sizing								
ø +2µm	----	1	%	75	77	79	78	74
ø +5µm	----	1	%	73	77	76	77	74
ø +10µm	----	1	%	73	75	74	75	70
ø +15.6µm	----	1	%	73	75	72	75	69
ø +20µm	----	1	%	71	75	72	75	68
ø +30µm	----	1	%	71	73	70	75	67
ø +40µm	----	1	%	70	73	70	73	66
ø +50µm	----	1	%	70	72	70	71	64
ø +60µm	----	1	%	70	72	70	70	64
+75µm	----	1	%	69	71	70	70	63
+150µm	----	1	%	51	54	56	65	21
+300µm	----	1	%	14	18	17	41	6
+425µm	----	1	%	8	12	8	25	4
+600µm	----	1	%	6	9	4	17	4
+1180µm	----	1	%	3	4	2	8	2
+2.36mm	----	1	%	<1	2	<1	5	2
+4.75mm	----	1	%	<1	<1	<1	2	1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	25	23	21	22	26
Silt (2-60 µm)	----	1	%	5	5	9	8	10
Sand (0.06-2.00 mm)	----	1	%	69	69	69	64	62
Gravel (>2mm)	----	1	%	1	3	1	6	2
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	41_SED	42_SED	43_SED	44_SED	45_SED
Sampling date / time					26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00	26-Jun-2025 00:00
Compound	CAS Number	LOR	Unit	EB2522559-041	EB2522559-042	EB2522559-043	EB2522559-044	EB2522559-045	
				Result	Result	Result	Result	Result	
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.65	2.61	2.58	2.52	2.64	



QUALITY CONTROL REPORT

Work Order	: EB2522559	Page	: 1 of 3
Client	: GHD PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: HAMISH WHITNEY	Contact	: Nathan King
Address	: P O BOX 930 TOWNSVILLE QLD, AUSTRALIA 4810	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 7 4720 0468	Telephone	: +61-7-3552-8685
Project	: 12668542	Date Samples Received	: 01-Jul-2025
Order number	: 12668542	Date Analysis Commenced	: 08-Jul-2025
C-O-C number	: ----	Issue Date	: 08-Jul-2025
Sampler	: PRASANNA WIJESINGHE		
Site	: ----		
Quote number	: TV/096/18 B		
No. of samples received	: 45		
No. of samples analysed	: 45		



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

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

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

Signatories	Position	Accreditation Category
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

- **No Laboratory Duplicate (DUP) Results are required to be reported.**



Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit			Result	LCS	Low
EA152: Soil Particle Density (QCLot: 6689085)								
EA152: Soil Particle Density (Clay/Silt/Sand)	----	----	g/cm3	----	2.68 g/cm3	101	80.0	120
EA152: Soil Particle Density (QCLot: 6689087)								
EA152: Soil Particle Density (Clay/Silt/Sand)	----	----	g/cm3	----	2.68 g/cm3	98.5	80.0	120
EA152: Soil Particle Density (QCLot: 6689089)								
EA152: Soil Particle Density (Clay/Silt/Sand)	----	----	g/cm3	----	2.68 g/cm3	97.0	80.0	120

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.



QA/QC Compliance Assessment to assist with Quality Review

Work Order : **EB2522559**

Page : 1 of 10

Client : **GHD PTY LTD**
Contact : **HAMISH WHITNEY**
Project : **12668542**
Site : **----**
Sampler : **PRASANNA WIJESINGHE**
Order number : **12668542**

Laboratory : **Environmental Division Brisbane**
Telephone : **+61-7-3552-8685**
Date Samples Received : **01-Jul-2025**
Issue Date : **08-Jul-2025**
No. of samples received : **45**
No. of samples analysed : **45**

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- **NO** Matrix Spike outliers occur.
- For all regular sample matrices, where applicable to the methodology, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- **NO** Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers exist - please see following pages for full details.



Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type		Count		Rate (%)		Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)						
Soil Particle Density	EA152	0	45	0.00	10.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Particle Sizing							
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 1_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 1_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✔
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 2_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 2_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✔
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 3_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 3_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✔
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 4_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 4_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✔
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 5_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 5_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✔
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 6_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 6_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✔
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 7_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H)							



Matrix: SOIL

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Particle Sizing - Continued							
7_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 8_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 8_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 9_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 9_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 10_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 10_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 11_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 11_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 12_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 12_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 13_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 13_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 14_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 14_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 15_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 15_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 16_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 16_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 17_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 17_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 18_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 18_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓



Matrix: SOIL

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Particle Sizing - Continued							
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 19_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 19_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 20_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 20_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 21_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 21_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 22_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 22_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 23_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 23_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 24_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 24_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 25_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 25_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 26_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 26_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 27_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 27_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 28_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 28_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 29_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 29_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD)							



Matrix: SOIL

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Particle Sizing - Continued							
30_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 30_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 31_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 31_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 32_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 32_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 33_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 33_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 34_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 34_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 35_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 35_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 36_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 36_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 37_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 37_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 38_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 38_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 39_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 39_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 40_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 40_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 41_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----



Matrix: SOIL Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Particle Sizing - Continued							
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 41_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 42_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 42_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 43_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 43_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 44_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 44_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H-FXD) 45_SED	26-Jun-2025	----	----	----	08-Jul-2025	----	----
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) 45_SED	26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Soil Classification based on Particle Size								
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H)		26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
1_SED,	2_SED,							
3_SED,	4_SED,							
5_SED,	6_SED,							
7_SED,	8_SED,							
9_SED,	10_SED,							
11_SED,	12_SED,							
13_SED,	14_SED,							
15_SED,	16_SED,							
17_SED,	18_SED,							
19_SED,	20_SED,							
21_SED,	22_SED,							
23_SED,	24_SED,							
25_SED,	26_SED,							
27_SED,	28_SED,							
29_SED,	30_SED,							
31_SED,	32_SED,							
33_SED,	34_SED,							
35_SED,	36_SED,							
37_SED,	38_SED,							
39_SED,	40_SED,							
41_SED,	42_SED,							
43_SED,	44_SED,							
45_SED,								

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA152: Soil Particle Density								
Snap Lock Bag - Friable Asbestos/PSD Bag (EA152)		26-Jun-2025	----	----	----	08-Jul-2025	23-Dec-2025	✓
1_SED,	2_SED,							
3_SED,	4_SED,							
5_SED,	6_SED,							
7_SED,	8_SED,							
9_SED,	10_SED,							
11_SED,	12_SED,							
13_SED,	14_SED,							
15_SED,	16_SED,							
17_SED,	18_SED,							
19_SED,	20_SED,							
21_SED,	22_SED,							
23_SED,	24_SED,							
25_SED,	26_SED,							
27_SED,	28_SED,							
29_SED,	30_SED,							
31_SED,	32_SED,							
33_SED,	34_SED,							
35_SED,	36_SED,							
37_SED,	38_SED,							
39_SED,	40_SED,							
41_SED,	42_SED,							
43_SED,	44_SED,							
45_SED,								



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Soil Particle Density	EA152	0	45	0.00	10.00	✖	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Soil Particle Density	EA152	3	45	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3
Particle Size Analysis by Hydrometer (Fixed Fractions)	* EA150H-FXD	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 Fixed Size fractions and percentages based on linear interpolation of hydrometer analysis results
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1: Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method

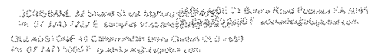
[illegible]

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: Samples from marine environment.

Environmental Division
Brisbane
Work Order Reference
EB2522559

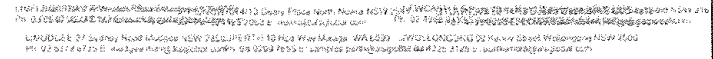


Telephone : 61-7-3652-8686

[illegible]

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: Samples from marine environment.

[illegible]



COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: Samples from marine environment.

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfrigh; Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulfate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfrigh Unpreserved Vial SG = Sulfonic Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfonic Preserved Plastic; F = Formaldehyde Preserved Glass
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Stannic Bottle; ASS = Plastic Bag for Acid Sulfate Soils; B = Unpreserved Bag.



Job No/Project		12668542		Client	
Date collected				Quotation Reference* QLD Ports	
Sample ID	Date	Time	Sample Matrix (e.g. Sediment, Water, Groundwater)	Container Type & Quantity	Remarks
1 SED				1	
1A HNF				1	
1B HNF				1	
1C HNF				1	
5 SED				1	
6 SED				1	
7 SED				1	
8 SED				1	
9 SED				1	
10 SED				1	
11 SED				1	
12 SED				1	
13 SED				1	
14 SED				1	
15 SED				1	
16 SED				1	
17 SED				1	
18 SED				1	
19 SED				1	
20 SED				1	
21 SED				1	
22 SED				1	
Nothing Follows					
Total Sites:		Total containers / site: 1			
		Total Containers: 22			

Environmental Division
Brisbane
Work Order Reference
ED2522559



Telephone : + 61-7-3562-9684

Contact	Name	Telephone No	Email Address
Laboratory			
GHD Lead Consultant	Anna Boden	-	anna.boden@ghd.com
Project Manager	Hamish Whitney	-	hamish.whitney@ghd.com
Field Contact	Prasanna Wijesinghe	0423968637	prasanna.wijesinghe@ghd.com

Sample Received by	Signature
Date and Time	Sample Transport Method

MK 1/7/25
0840

✓ 21/6/25
11/30

~~blue bag~~ plastic bag
1 x esky with ~~ice~~ lid.
1 x styrofoam box with plastic bag lid.



Job No/Project		12668542		Client	
Date collected				Quotation Reference*	
Sample ID	Date	Time	Sample Matrix (e.g. Sediment, Water, Groundwater)	Container Type & Quantity	Remarks
23 SED				1	
24 SED				1	
25 SED				1	
26 SED				1	
27 SED				1	
28 SED				1	
29 SED				1	
30 SED				1	
31 SED				1	
32 SED				1	
33 SED				1	
34 SED				1	
35 SED				1	
36 SED				1	
37 SED				1	
38 SED				1	
39 SED				1	
40 SED				1	
41 SED				1	
42 SED				1	
43 SED				1	
44 SED					
Nothing Follows					
Total Sites:		Total containers / site: 1			
		Total Containers: 23			

Contact	Name	Telephone No	Email Address
Laboratory			
GHD Lead Consultant	Anna Boden	-	anna.boden@ghd.com
Project Manager	Hamish Whitney	-	hamish.whitney@ghd.com
Field Contact	Prasanna Wijesinghe	0423966637	prasanna.wijesinghe@ghd.com
Sample Received by	Signature		
Date and Time	Sample Transport Method		

MK 17/25
0840

Certificate of Analysis

ALS Laboratory Group Pty Ltd
2 Byth Street
Stafford, QLD 4053
pH 07 3243 7222
samples.brisbane@alsenviro.com

ALS Environmental
Brisbane QLD



CLIENT: HAMISH WHITNEY

DATE REPORTED: 8-Jul-2025

COMPANY: GHD PTY LTD

DATE RECEIVED: 1-Jul-2025

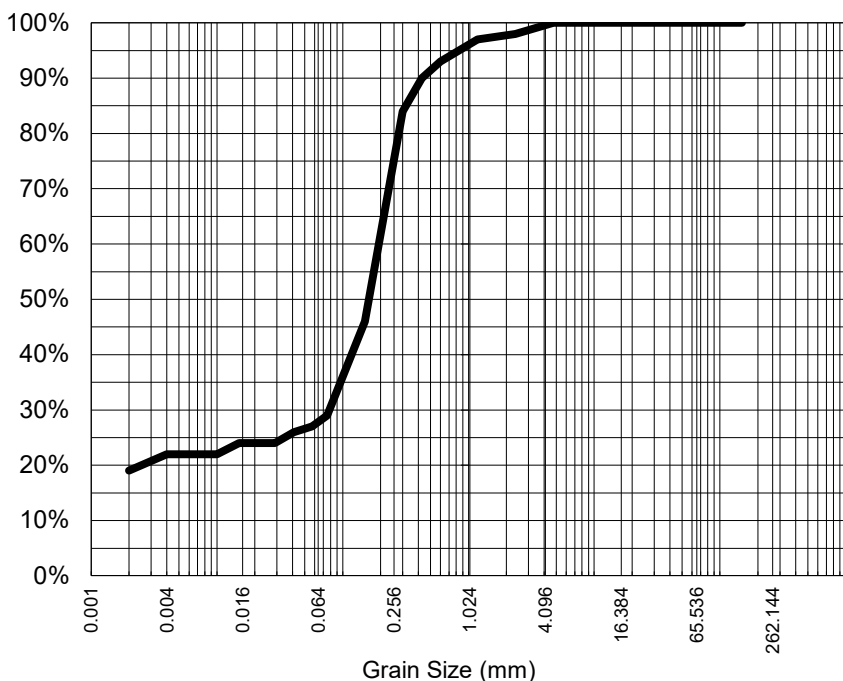
ADDRESS: P O Box 930
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Qld, Australia

REPORT NO: EB2522559-001 / PSD

PROJECT: 12668542

SAMPLE ID: 1_SED

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	98%
1.18	97%
0.600	93%
0.425	90%
0.300	84%
0.150	46%
0.075	29%
Particle Size (microns)	
57	27%
41	26%
29	24%
20	24%
15	24%
10	22%
7	22%
5	22%
2	19%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.166
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.52

NATA Accreditation: 825 Site: Brisbane
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Satish Trivedi
Soil Senior Chemist
Authorised Signatory

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ALS Environmental
Brisbane QLD



CLIENT: HAMISH WHITNEY

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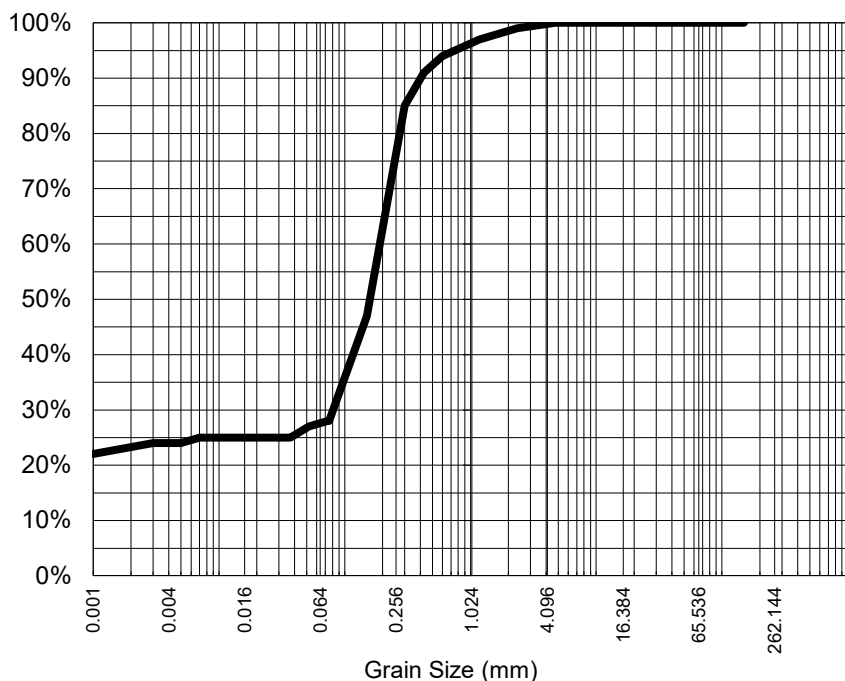
ADDRESS: P O Box 930
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REPORT NO: EB2522559-002 / PSD

PROJECT: 12668542

SAMPLE ID: 2_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

* Soil Particle Density results fell outside the scope of AS 1289.3.6.3. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Loss on Pretreatment NA

Sample Description:

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.86 (2.85)*

Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	97%
0.600	94%
0.425	91%
0.300	85%
0.150	47%
0.075	28%
Particle Size (microns)	
52	27%
37	25%
26	25%
18	25%
13	25%
9	25%
7	25%
5	24%
1	22%

Median Particle Size (mm)*	0.162
----------------------------	-------

Analysed: 4-Jul-25

Limit of Reporting: 1%

Dispersion Method Shaker

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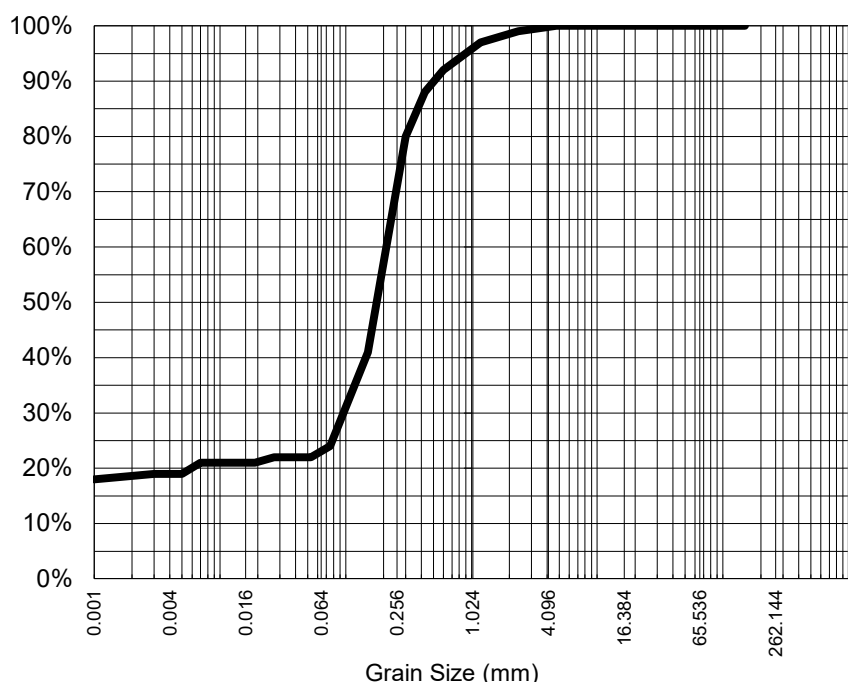
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PROJECT: 12668542

SAMPLE ID: 3_SED

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	97%
0.600	92%
0.425	88%
0.300	80%
0.150	41%
0.075	24%
Particle Size (microns)	
53	22%
38	22%
27	22%
19	21%
14	21%
10	21%
7	21%
5	19%
1	18%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.185
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.77

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Satish Trivedi

Soil Senior Chemist

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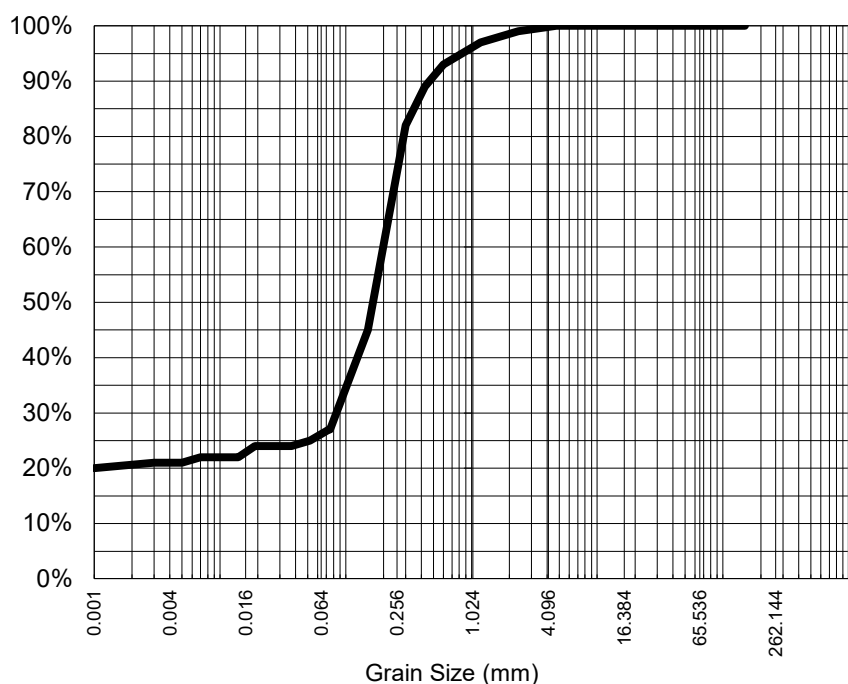
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PROJECT: 12668542

SAMPLE ID: 4_SED

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	97%
0.600	93%
0.425	89%
0.300	82%
0.150	45%
0.075	27%
Particle Size (microns)	
52	25%
37	24%
26	24%
19	24%
14	22%
10	22%
7	22%
5	21%
1	20%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.170
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.84

Satish

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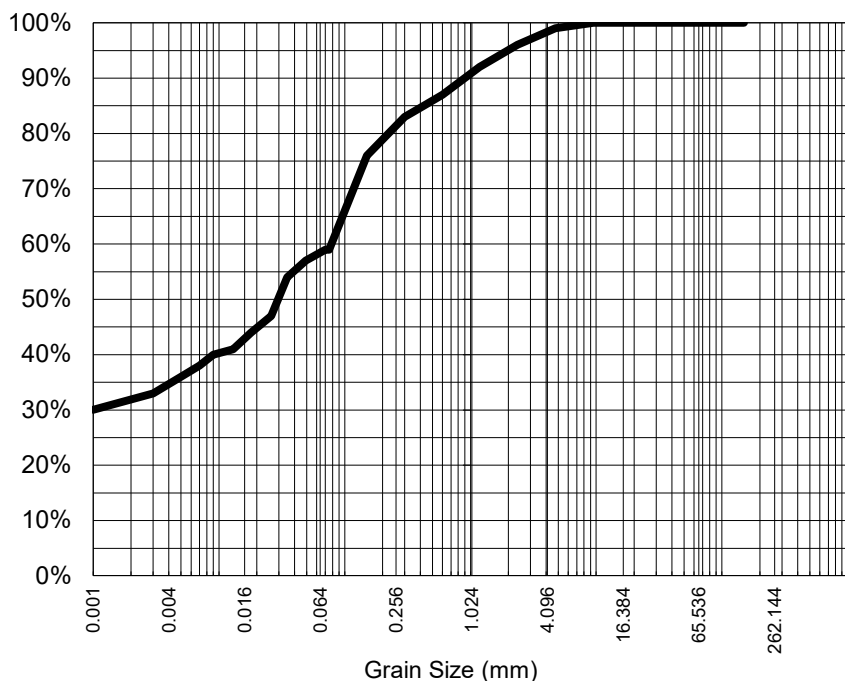
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SAMPLE ID: 5_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	96%
1.18	92%
0.600	87%
0.425	85%
0.300	83%
0.150	76%
0.075	59%
Particle Size (microns)	
49	57%
35	54%
26	47%
18	44%
13	41%
9	40%
7	38%
5	36%
1	30%

Median Particle Size (mm)*	0.030
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.7

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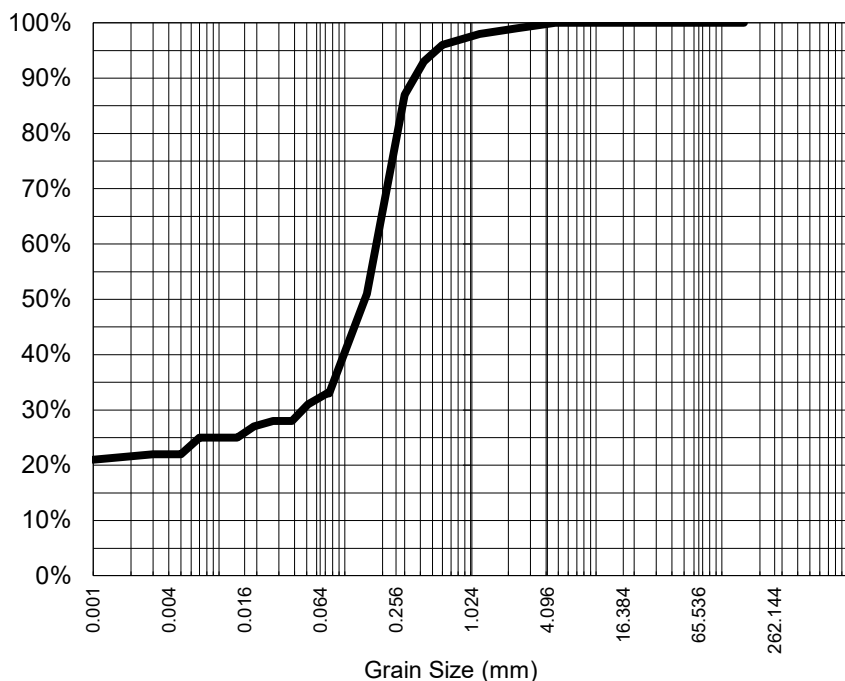
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SAMPLE ID: 6_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	98%
0.600	96%
0.425	93%
0.300	87%
0.150	51%
0.075	33%
Particle Size (microns)	
51	31%
38	28%
27	28%
19	27%
14	25%
10	25%
7	25%
5	22%
1	21%

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.146
----------------------------	-------

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.79

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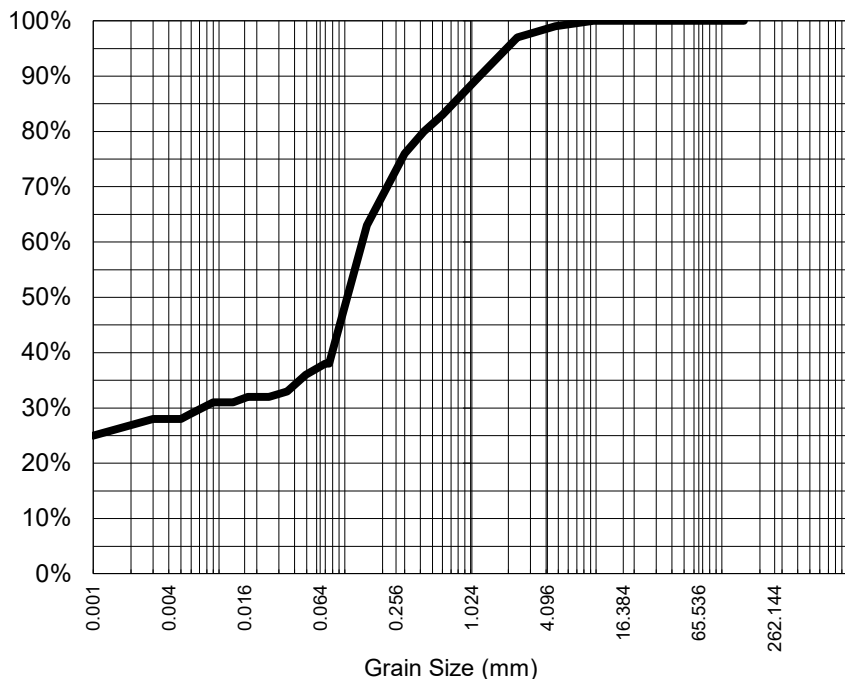
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SAMPLE ID: 7_SED

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	97%
1.18	90%
0.600	83%
0.425	80%
0.300	76%
0.150	63%
0.075	38%
Particle Size (microns)	
49	36%
35	33%
25	32%
17	32%
13	31%
9	31%
6	29%
5	28%
1	25%

Analysis Notes

Samples analysed as received.

* Soil Particle Density results fell outside the scope of AS 1289.3.6.3. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.111
----------------------------	-------

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.87 (2.85)*

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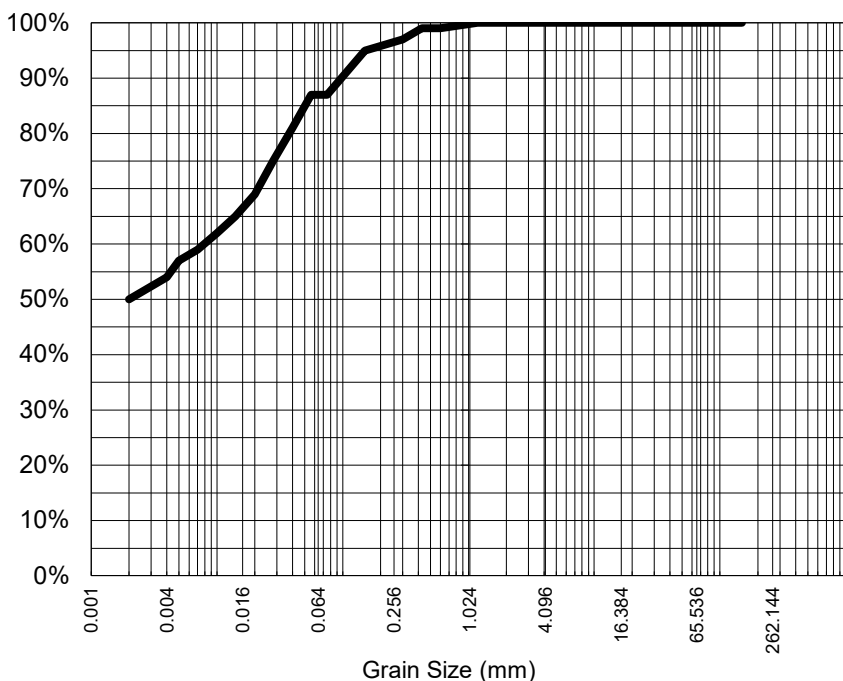
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PROJECT: 12668542

SAMPLE ID: 8_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

* Soil Particle Density results fell outside the scope of AS 1289.3.6.3. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Loss on Pretreatment NA

Sample Description:

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.36 (2.45)*

Particle Size (mm)	% Passing
1.18	100%
0.600	99%
0.425	99%
0.300	97%
0.150	95%
0.075	87%
Particle Size (microns)	
56	87%
40	81%
28	75%
20	69%
14	65%
10	62%
7	59%
5	57%
2	50%

Median Particle Size (mm)*	<0.007
----------------------------	--------

Analysed: 4-Jul-25

Limit of Reporting: 1%

Dispersion Method Shaker

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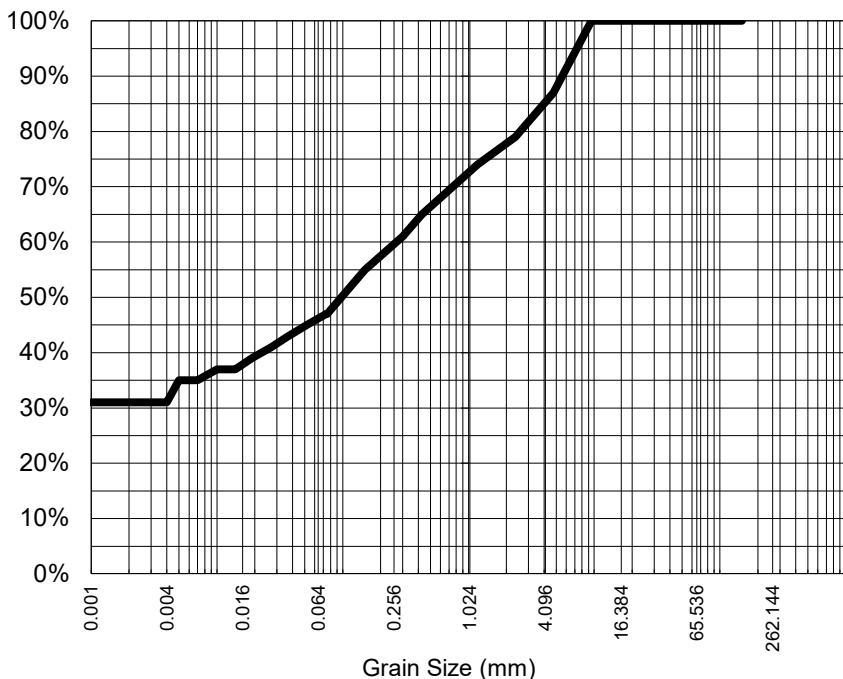
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SAMPLE ID: 9_SED

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	87%
2.36	79%
1.18	74%
0.600	68%
0.425	65%
0.300	61%
0.150	55%
0.075	47%
Particle Size (microns)	
52	45%
37	43%
27	41%
19	39%
14	37%
10	37%
7	35%
5	35%
1	31%

Analysis Notes

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.103
----------------------------	-------

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.69

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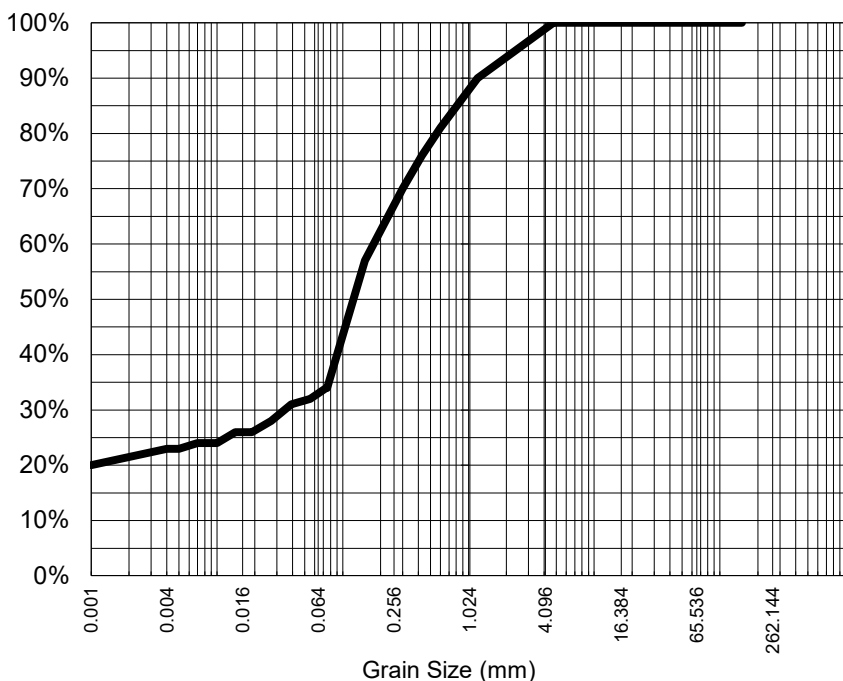
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SAMPLE ID: 10_SED

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	95%
1.18	90%
0.600	81%
0.425	76%
0.300	70%
0.150	57%
0.075	34%
Particle Size (microns)	
55	32%
39	31%
27	28%
19	26%
14	26%
10	24%
7	24%
5	23%
1	20%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.127
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.67

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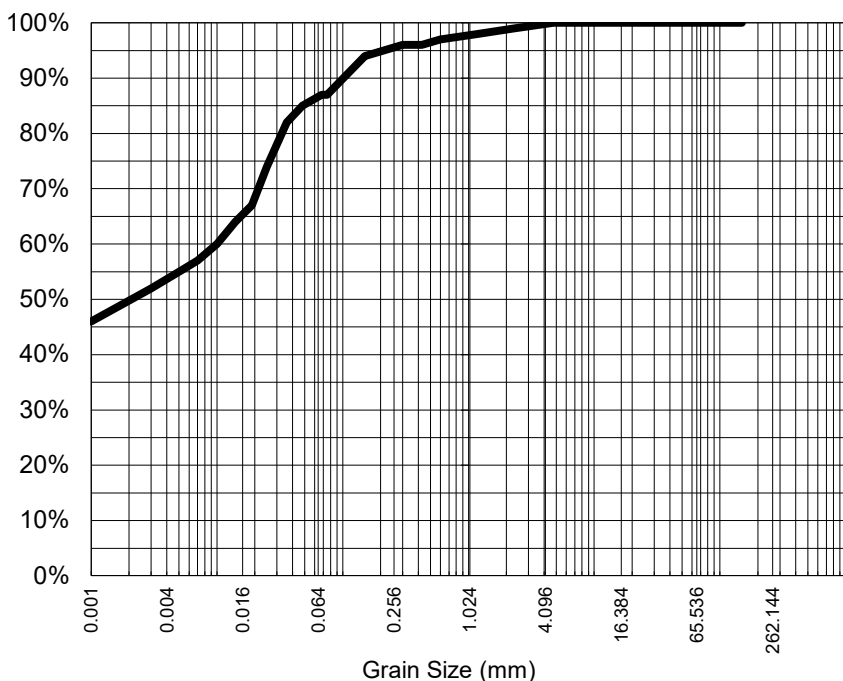
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PROJECT: 12668542

SAMPLE ID: 11_SED

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	98%
0.600	97%
0.425	96%
0.300	96%
0.150	94%
0.075	87%
Particle Size (microns)	
48	85%
36	82%
25	74%
19	67%
14	64%
10	60%
7	57%
5	55%
1	46%

Analysis Notes

Samples analysed as received.

* Soil Particle Density results fell outside the scope of AS 1289.3.6.3. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	<0.007
----------------------------	--------

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.29 (2.45)*

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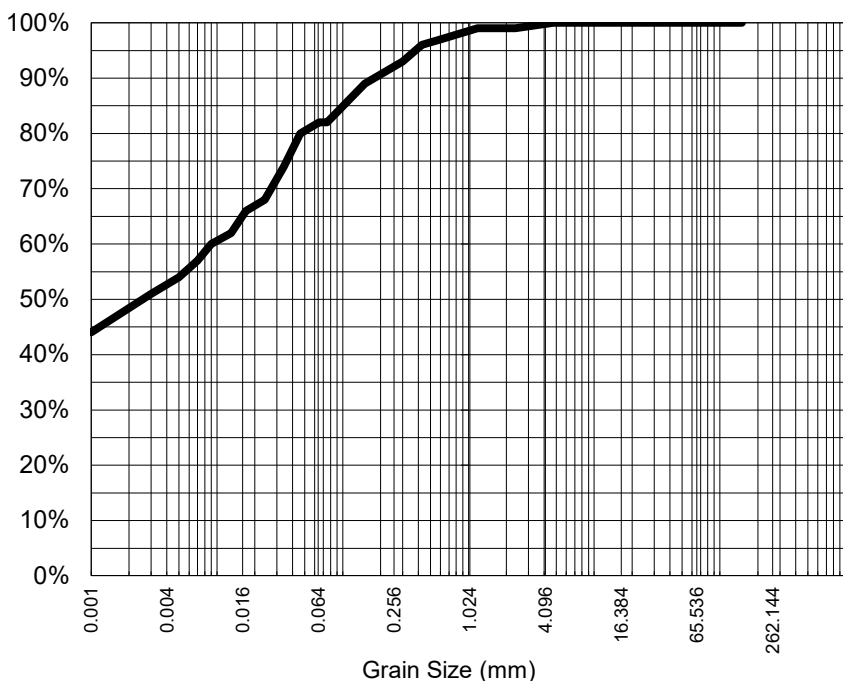
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PROJECT: 12668542

SAMPLE ID: 12_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	99%
0.600	97%
0.425	96%
0.300	93%
0.150	89%
0.075	82%
Particle Size (microns)	
46	80%
34	74%
24	68%
17	66%
13	62%
9	60%
7	57%
5	54%
1	44%

Median Particle Size (mm)*	<0.007
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.64

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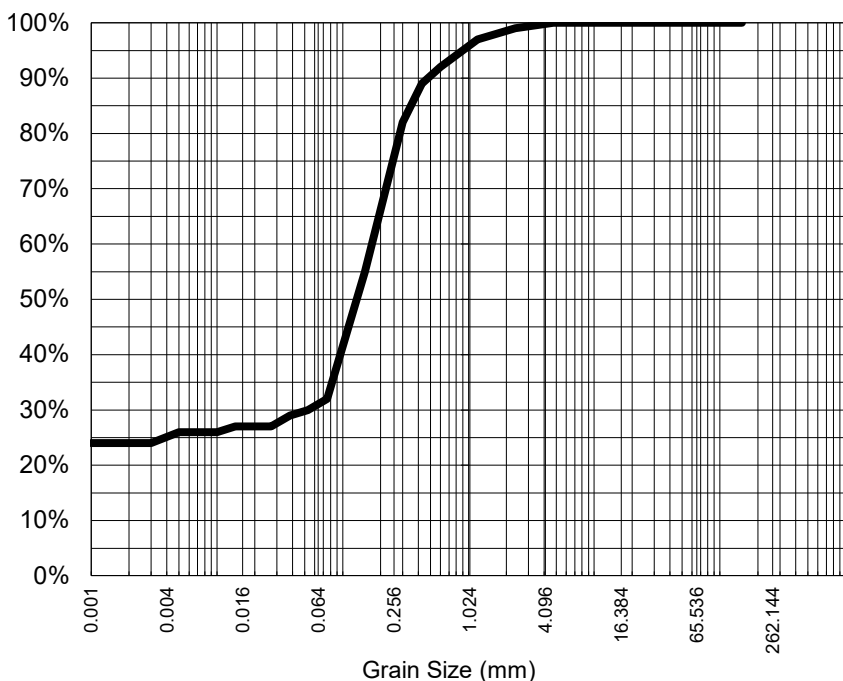
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PROJECT: 12668542

SAMPLE ID: 13_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	97%
0.600	92%
0.425	89%
0.300	82%
0.150	55%
0.075	32%
Particle Size (microns)	
53	30%
38	29%
27	27%
19	27%
14	27%
10	26%
7	26%
5	26%
1	24%

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.134
----------------------------	-------

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.75

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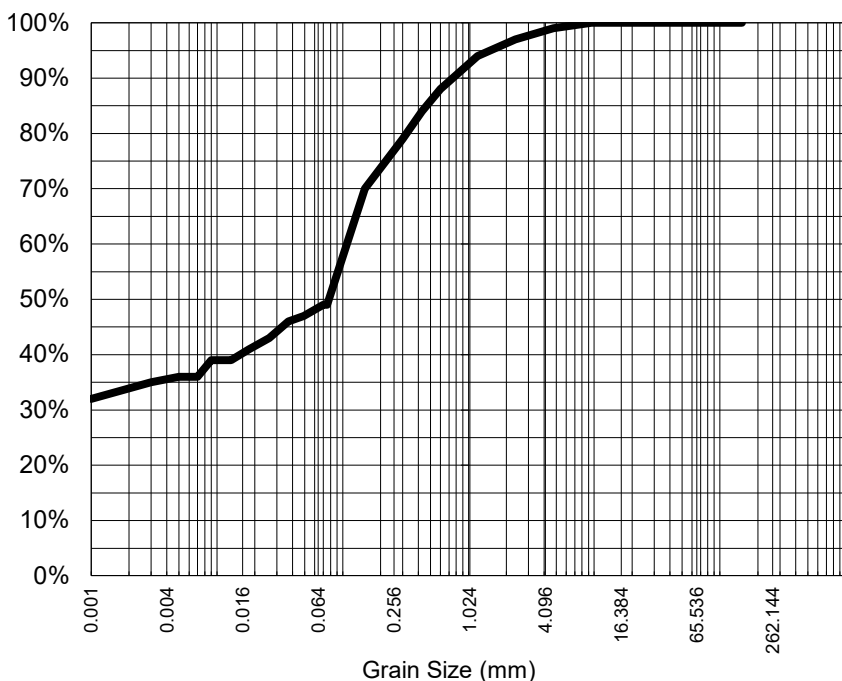
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PROJECT: 12668542

SAMPLE ID: 14_SED

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	97%
1.18	94%
0.600	88%
0.425	84%
0.300	79%
0.150	70%
0.075	49%
Particle Size (microns)	
49	47%
37	46%
26	43%
18	41%
13	39%
9	39%
7	36%
5	36%
1	32%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.079
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.72

NATA Accreditation: 825 Site: Brisbane

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Soil Senior Chemist
Authorised Signatory

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ALS Environmental
Brisbane QLD



CLIENT: HAMISH WHITNEY

DATE REPORTED: 8-Jul-2025

COMPANY: GHD PTY LTD

DATE RECEIVED: 1-Jul-2025

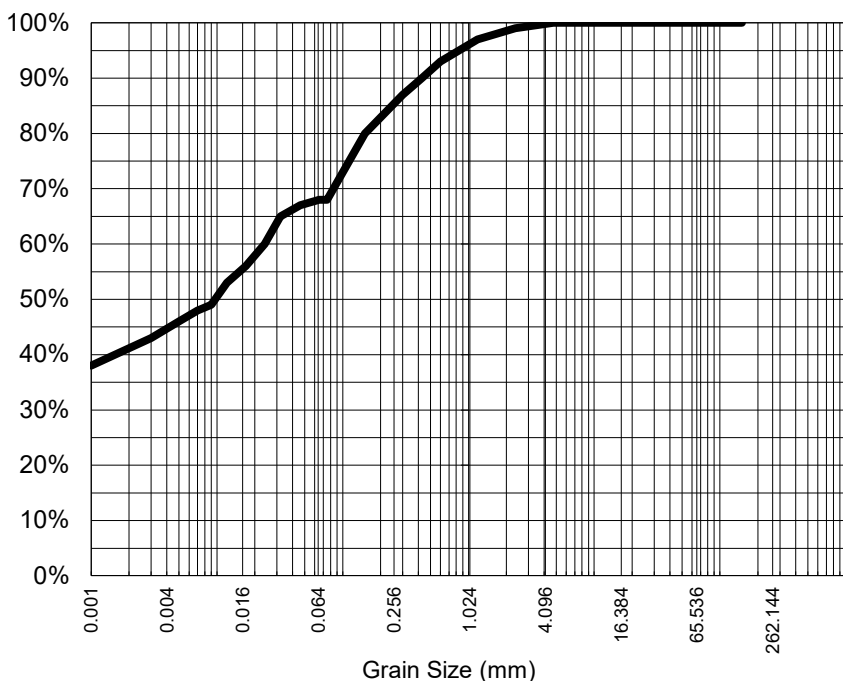
ADDRESS: P O Box 930
Townsville
Qld, Australia

REPORT NO: EB2522559-015 / PSD

PROJECT: 12668542

SAMPLE ID: 15_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	97%
0.600	93%
0.425	90%
0.300	87%
0.150	80%
0.075	68%
Particle Size (microns)	
46	67%
32	65%
24	60%
17	56%
12	53%
9	49%
7	48%
5	46%
1	38%

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.010
----------------------------	-------

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.76

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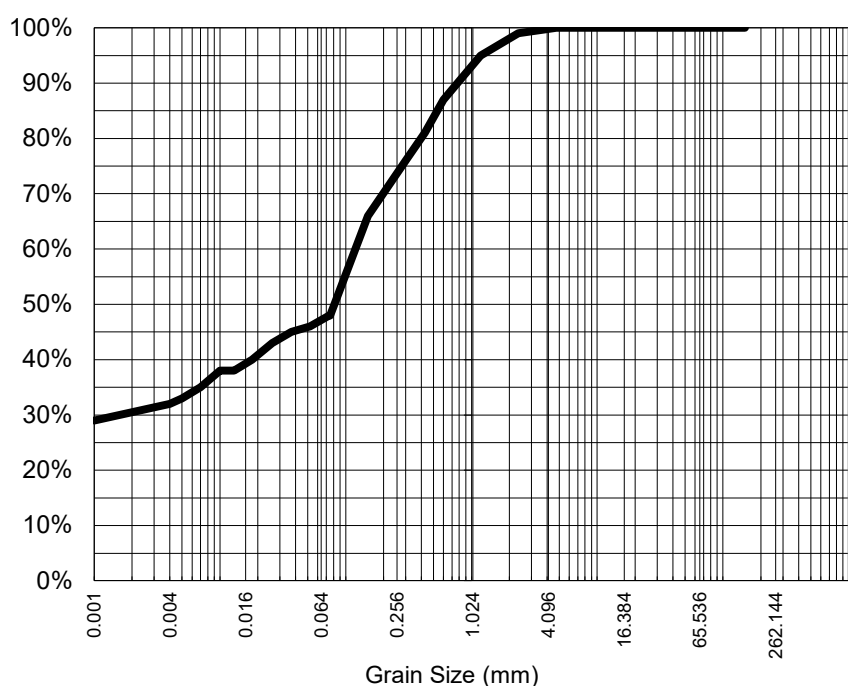
ADDRESS: P O Box 930
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Qld, Australia

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PROJECT: 12668542

SAMPLE ID: 16_SED

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	95%
0.600	87%
0.425	81%
0.300	76%
0.150	66%
0.075	48%
Particle Size (microns)	
52	46%
37	45%
26	43%
18	40%
13	38%
10	38%
7	35%
5	33%
1	29%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.083
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.66

Satish Trivedi

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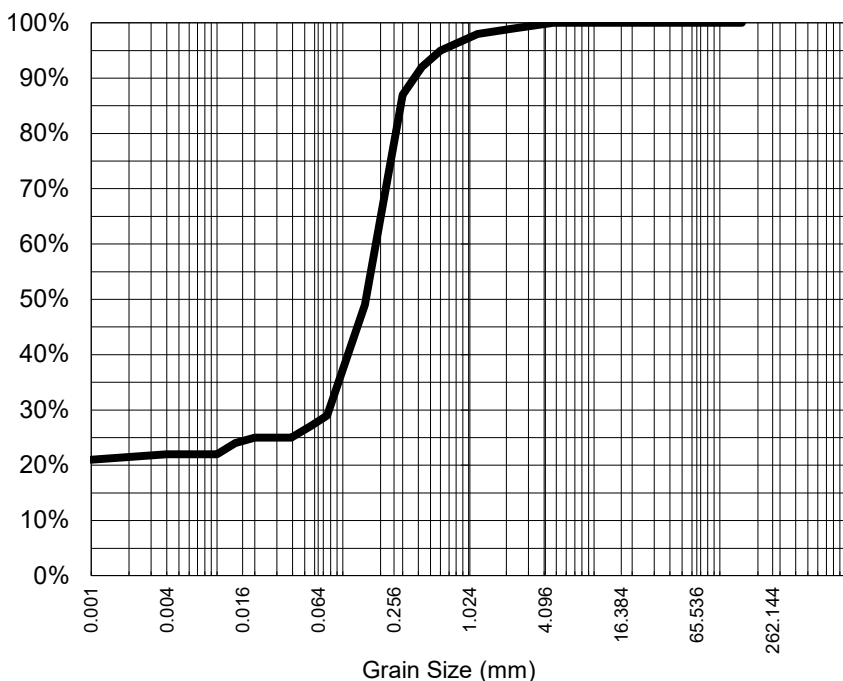
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REPORT NO: EB2522559-017 / PSD

PROJECT: 12668542

SAMPLE ID: 17_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	98%
0.600	95%
0.425	92%
0.300	87%
0.150	49%
0.075	29%
Particle Size (microns)	
55	27%
39	25%
28	25%
20	25%
14	24%
10	22%
7	22%
5	22%
1	21%

Median Particle Size (mm)*	0.154
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.62

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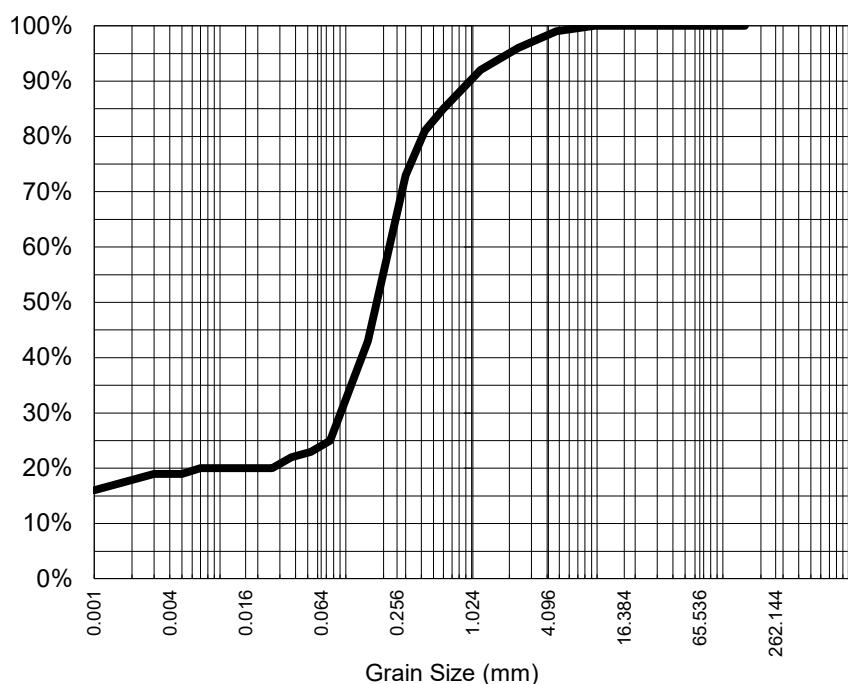
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PROJECT: 12668542

SAMPLE ID: 18_SED

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	96%
1.18	92%
0.600	85%
0.425	81%
0.300	73%
0.150	43%
0.075	25%
Particle Size (microns)	
53	23%
37	22%
26	20%
19	20%
14	20%
10	20%
7	20%
5	19%
1	16%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.185
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.75

Satish

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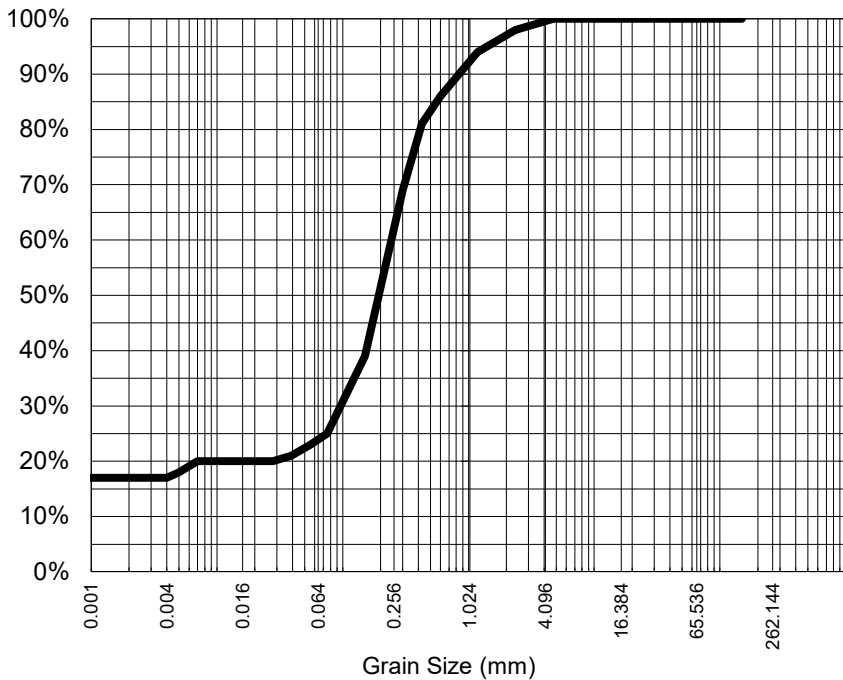
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PROJECT: 12668542

SAMPLE ID: 19_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
4.75	100%
2.36	98%
1.18	94%
0.600	86%
0.425	81%
0.300	69%
0.150	39%
0.075	25%
Particle Size (microns)	
55	23%
39	21%
28	20%
20	20%
14	20%
10	20%
7	20%
5	18%
1	17%

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.205
----------------------------	-------

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.6

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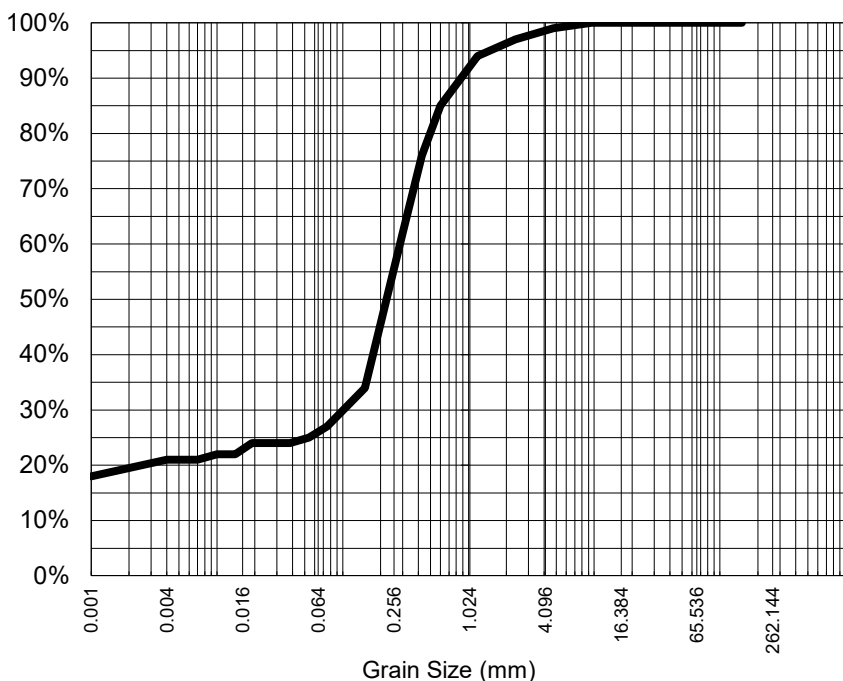
ADDRESS: P O Box 930
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REPORT NO: EB2522559-020 / PSD

PROJECT: 12668542

SAMPLE ID: 20_SED

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	97%
1.18	94%
0.600	85%
0.425	76%
0.300	62%
0.150	34%
0.075	27%
Particle Size (microns)	
54	25%
38	24%
27	24%
19	24%
14	22%
10	22%
7	21%
5	21%
1	18%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.236
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.68

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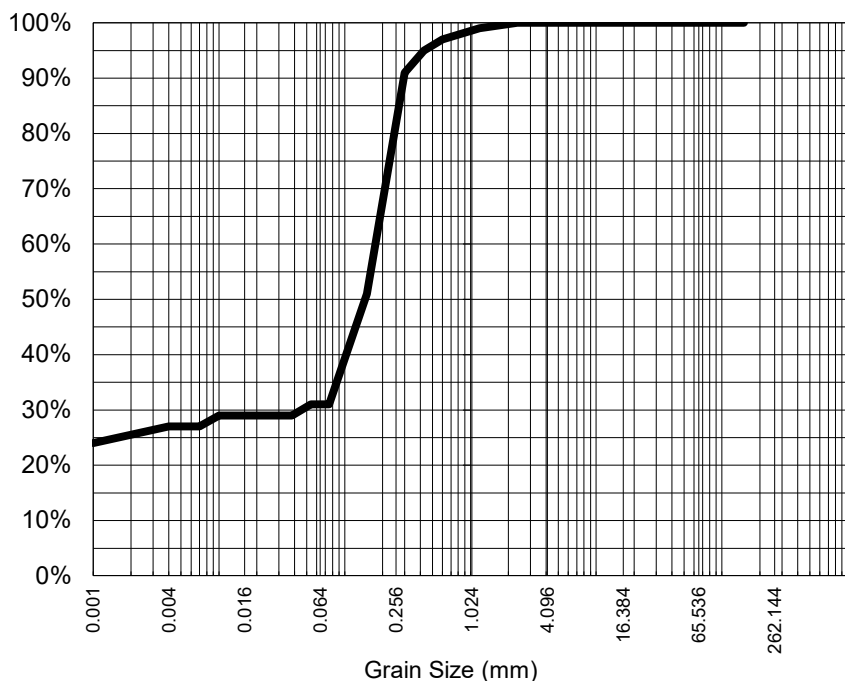
ADDRESS: P O Box 930
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REPORT NO: EB2522559-021 / PSD

PROJECT: 12668542

SAMPLE ID: 21_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	97%
0.425	95%
0.300	91%
0.150	51%
0.075	31%
Particle Size (microns)	
54	31%
38	29%
27	29%
19	29%
14	29%
10	29%
7	27%
5	27%
1	24%

Median Particle Size (mm)*	0.146
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.66

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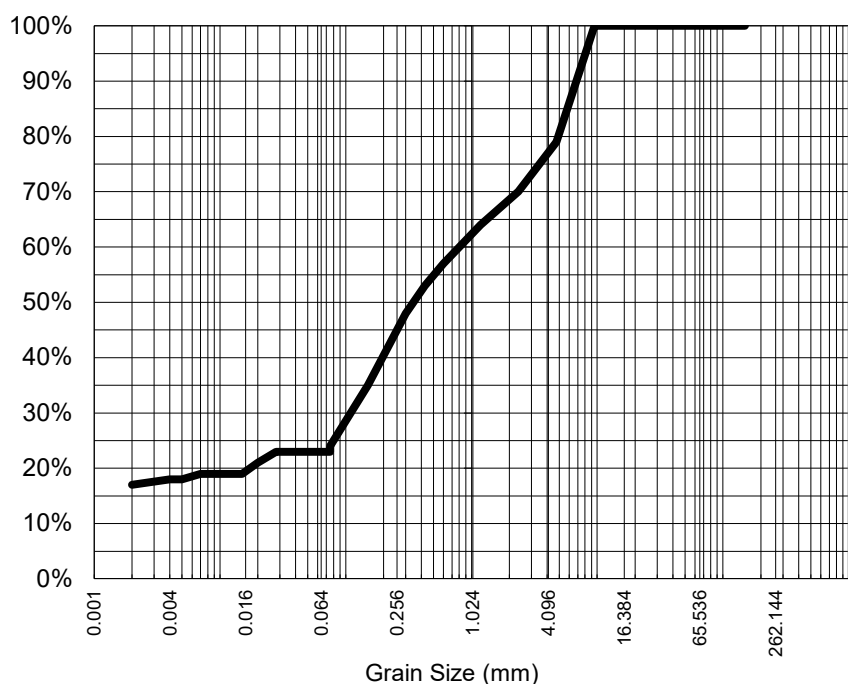
ADDRESS: P O Box 930
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REPORT NO: EB2522559-022 / PSD

PROJECT: 12668542

SAMPLE ID: 22_SED

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	79%
2.36	70%
1.18	64%
0.600	57%
0.425	53%
0.300	48%
0.150	35%
0.075	24%
Particle Size (microns)	
55	23%
39	23%
28	23%
20	21%
15	19%
10	19%
7	19%
5	18%
2	17%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.350
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.64

Satish

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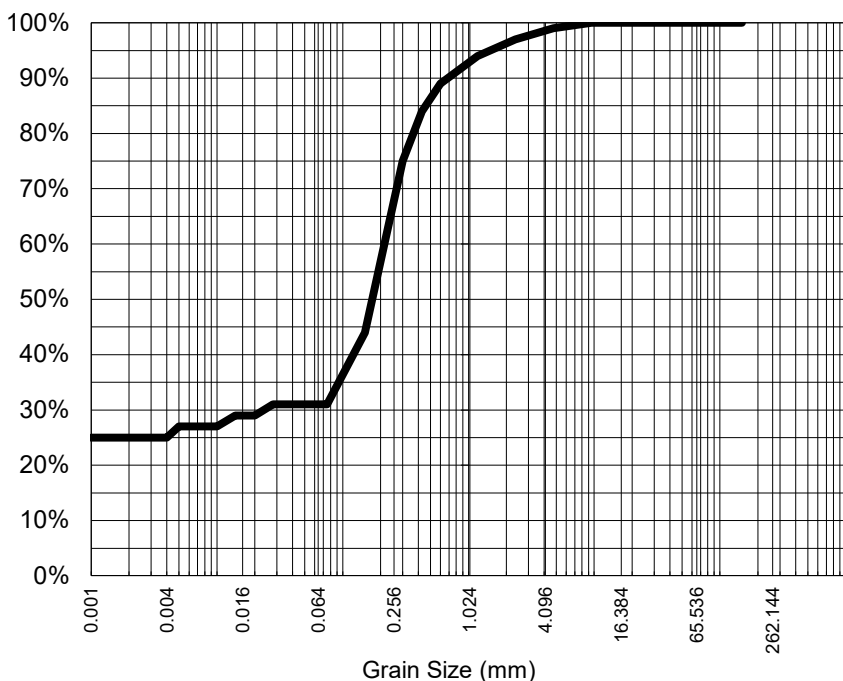
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REPORT NO: EB2522559-023 / PSD

PROJECT: 12668542

SAMPLE ID: 23_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	97%
1.18	94%
0.600	89%
0.425	84%
0.300	75%
0.150	44%
0.075	31%
Particle Size (microns)	
56	31%
40	31%
28	31%
20	29%
14	29%
10	27%
7	27%
5	27%
1	25%

Median Particle Size (mm)*	0.179
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.55

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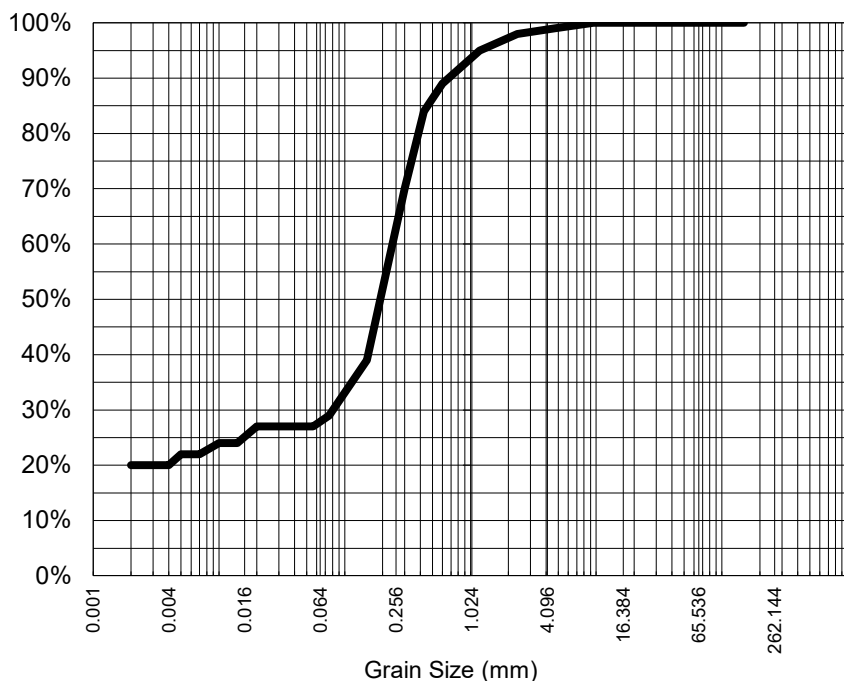
ADDRESS: P O Box 930
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REPORT NO: EB2522559-024 / PSD

PROJECT: 12668542

SAMPLE ID: 24_SED

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	98%
1.18	95%
0.600	89%
0.425	84%
0.300	70%
0.150	39%
0.075	29%
Particle Size (microns)	
56	27%
40	27%
28	27%
20	27%
14	24%
10	24%
7	22%
5	22%
2	20%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.203
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.59

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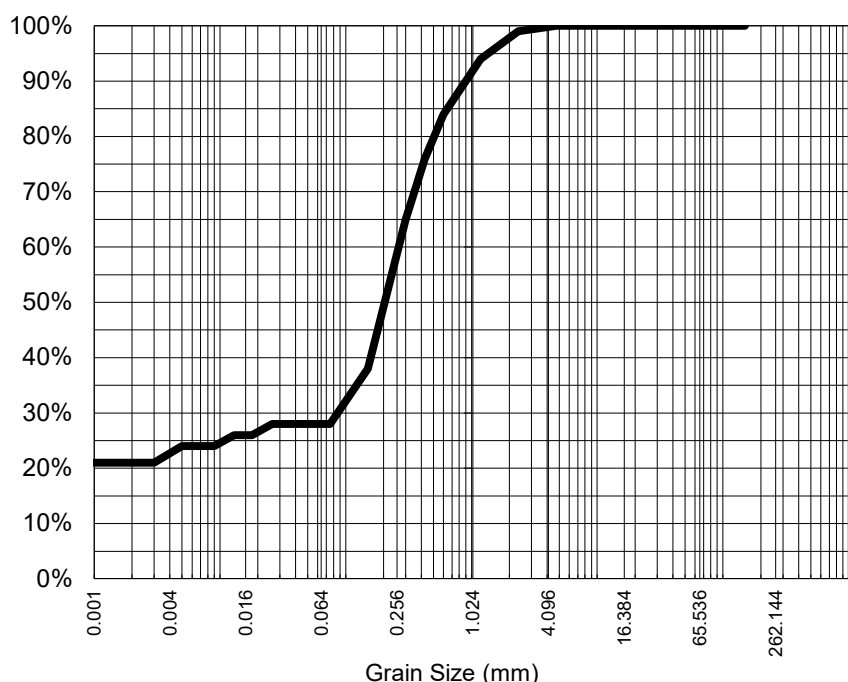
ADDRESS: P O Box 930
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REPORT NO: EB2522559-025 / PSD

PROJECT: 12668542

SAMPLE ID: 25_SED

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	94%
0.600	84%
0.425	76%
0.300	65%
0.150	38%
0.075	28%
Particle Size (microns)	
51	28%
36	28%
26	28%
18	26%
13	26%
9	24%
7	24%
5	24%
1	21%

Analysis Notes

Samples analysed as received.

* Soil Particle Density results fell outside the scope of AS 1289.3.6.3. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.217
----------------------------	-------

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.87 (2.85)*

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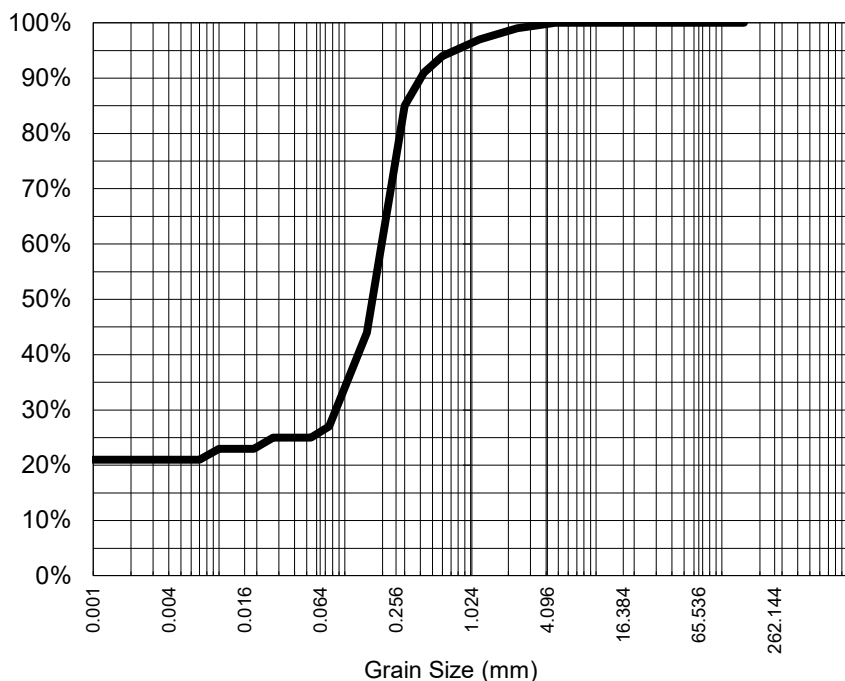
ADDRESS: P O Box 930
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REPORT NO: EB2522559-026 / PSD

PROJECT: 12668542

SAMPLE ID: 26_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	97%
0.600	94%
0.425	91%
0.300	85%
0.150	44%
0.075	27%
Particle Size (microns)	
54	25%
38	25%
27	25%
19	23%
14	23%
10	23%
7	21%
5	21%
1	21%

Median Particle Size (mm)*	0.172
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65

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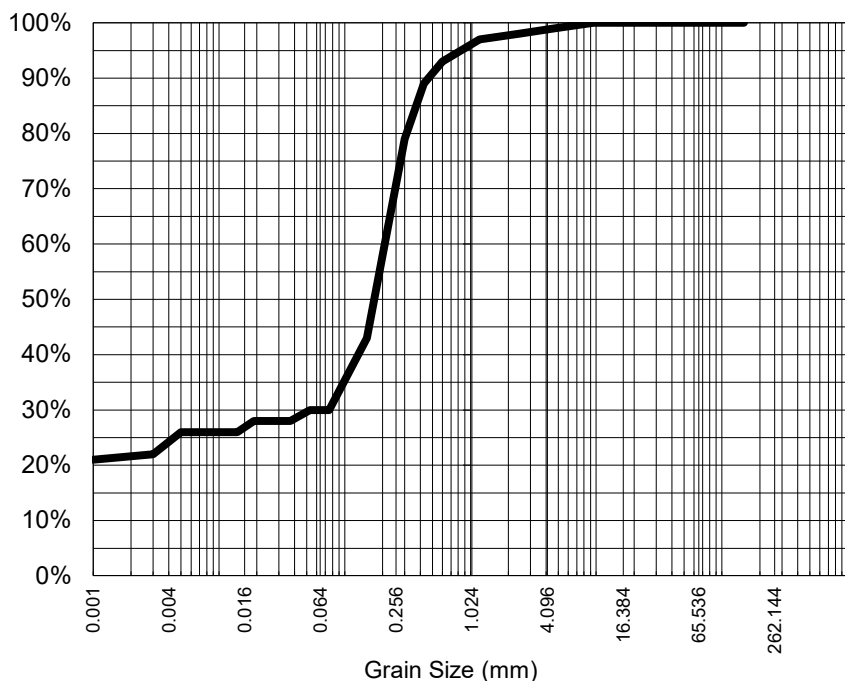
ADDRESS: P O Box 930
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REPORT NO: EB2522559-027 / PSD

PROJECT: 12668542

SAMPLE ID: 27_SED

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	98%
1.18	97%
0.600	93%
0.425	89%
0.300	79%
0.150	43%
0.075	30%
Particle Size (microns)	
53	30%
37	28%
26	28%
19	28%
14	26%
10	26%
7	26%
5	26%
1	21%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.179
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.75

Satish

Satish Trivedi
Soil Senior Chemist
Authorised Signatory

NATA Accreditation: 825 Site: Brisbane
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Certificate of Analysis

ALS Laboratory Group Pty Ltd
2 Byth Street
Stafford, QLD 4053
pH 07 3243 7222
samples.brisbane@alsenviro.com

ALS Environmental
Brisbane QLD



CLIENT: HAMISH WHITNEY

DATE REPORTED: 8-Jul-2025

COMPANY: GHD PTY LTD

DATE RECEIVED: 1-Jul-2025

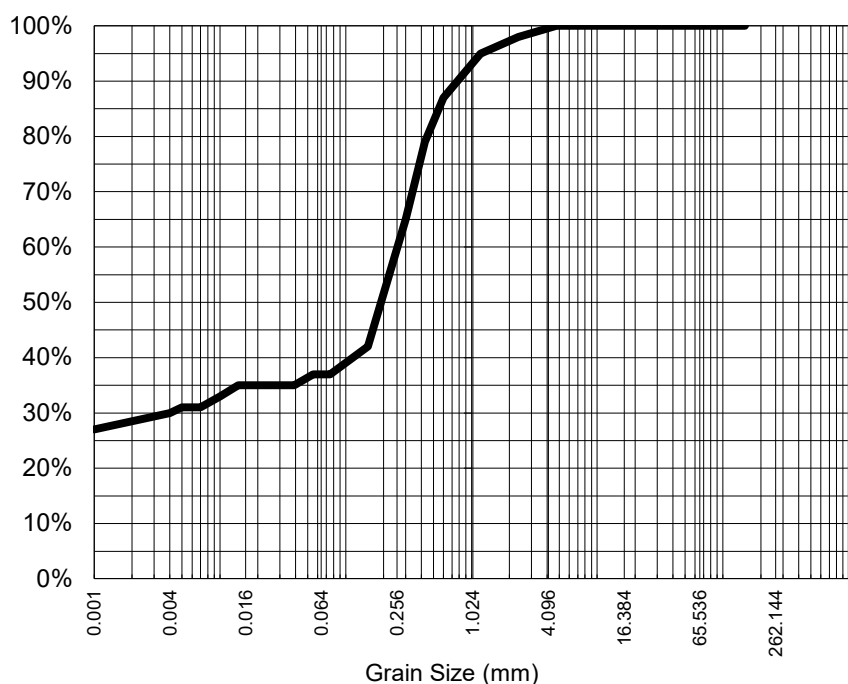
ADDRESS: P O Box 930
Townsville
Qld, Australia

REPORT NO: EB2522559-028 / PSD

PROJECT: 12668542

SAMPLE ID: 28_SED

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	98%
1.18	95%
0.600	87%
0.425	79%
0.300	65%
0.150	42%
0.075	37%
Particle Size (microns)	
55	37%
39	35%
28	35%
20	35%
14	35%
10	33%
7	31%
5	31%
1	27%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.202
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.61

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Soil Senior Chemist
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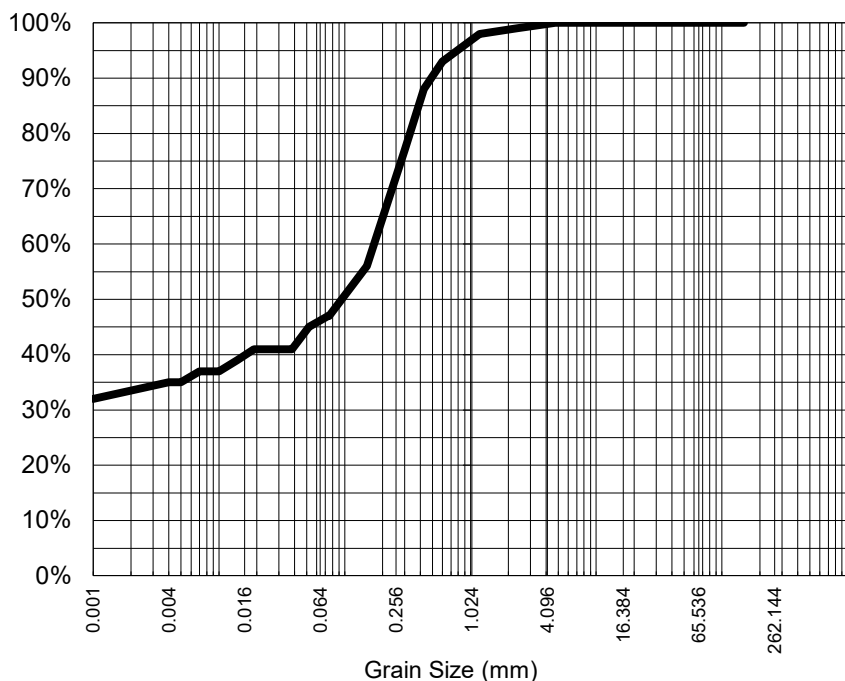
ADDRESS: P O Box 930
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Qld, Australia

REPORT NO: EB2522559-029 / PSD

PROJECT: 12668542

SAMPLE ID: 29_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	98%
0.600	93%
0.425	88%
0.300	77%
0.150	56%
0.075	47%
Particle Size (microns)	
52	45%
38	41%
27	41%
19	41%
14	39%
10	37%
7	37%
5	35%
1	32%

Median Particle Size (mm)*	0.100
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.66

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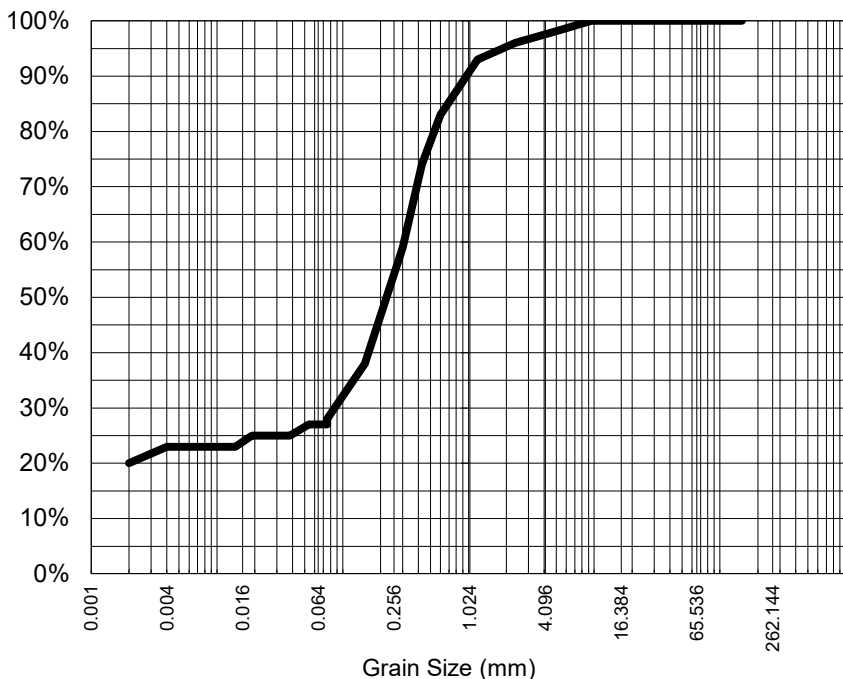
ADDRESS: P O Box 930
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Qld, Australia

REPORT NO: EB2522559-030 / PSD

PROJECT: 12668542

SAMPLE ID: 30_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
9.50	100%
4.75	98%
2.36	96%
1.18	93%
0.600	83%
0.425	74%
0.300	59%
0.150	38%
0.075	28%
Particle Size (microns)	
54	27%
38	25%
27	25%
19	25%
14	23%
10	23%
7	23%
5	23%
2	20%

Median Particle Size (mm)*	0.236
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65

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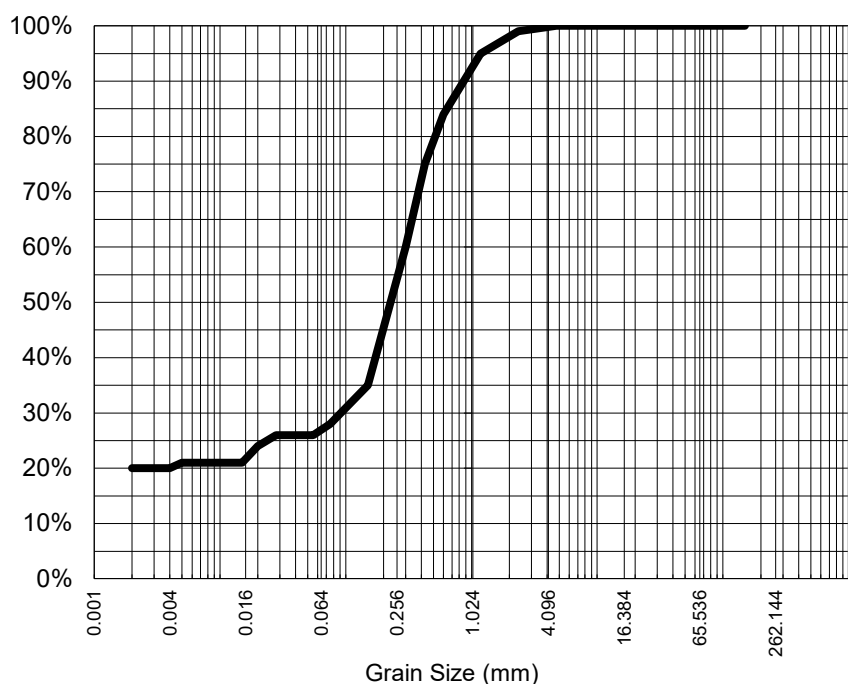
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REPORT NO: EB2522559-031 / PSD

PROJECT: 12668542

SAMPLE ID: 31_SED

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	95%
0.600	84%
0.425	75%
0.300	60%
0.150	35%
0.075	28%
Particle Size (microns)	
55	26%
39	26%
28	26%
20	24%
15	21%
10	21%
7	21%
5	21%
2	20%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.240
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.61

Satish

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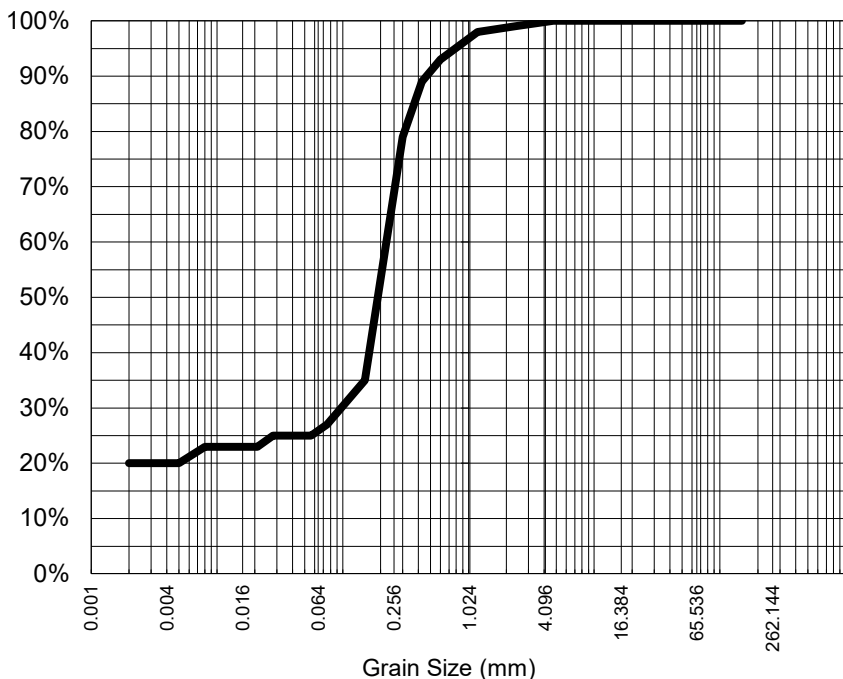
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REPORT NO: EB2522559-032 / PSD

PROJECT: 12668542

SAMPLE ID: 32_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	98%
0.600	93%
0.425	89%
0.300	79%
0.150	35%
0.075	27%
Particle Size (microns)	
56	25%
40	25%
28	25%
21	23%
15	23%
11	23%
8	23%
5	20%
2	20%

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.201
----------------------------	-------

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.59

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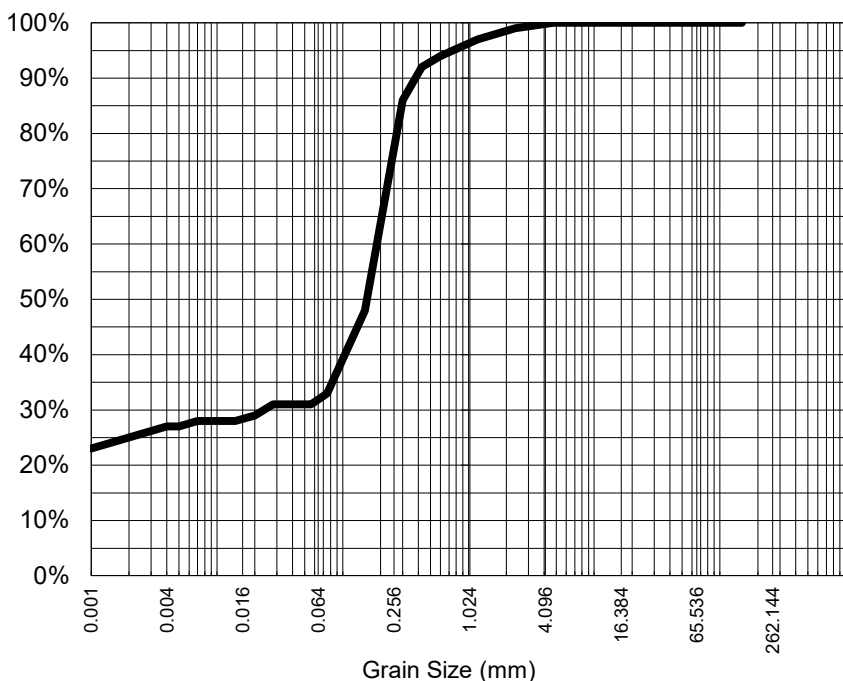
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REPORT NO: EB2522559-033 / PSD

PROJECT: 12668542

SAMPLE ID: 33_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	97%
0.600	94%
0.425	92%
0.300	86%
0.150	48%
0.075	33%
Particle Size (microns)	
56	31%
39	31%
28	31%
20	29%
14	28%
10	28%
7	28%
5	27%
1	23%

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.158
----------------------------	-------

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.6

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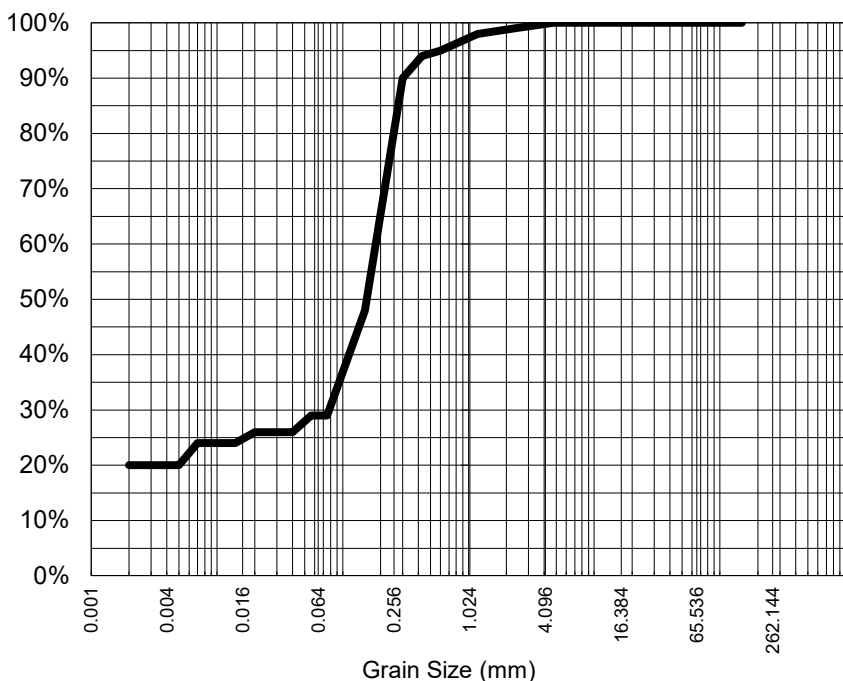
ADDRESS: P O Box 930
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REPORT NO: EB2522559-034 / PSD

PROJECT: 12668542

SAMPLE ID: 34_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	98%
0.600	95%
0.425	94%
0.300	90%
0.150	48%
0.075	29%
Particle Size (microns)	
56	29%
40	26%
28	26%
20	26%
14	24%
10	24%
7	24%
5	20%
2	20%

Median Particle Size (mm)*	0.157
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.56

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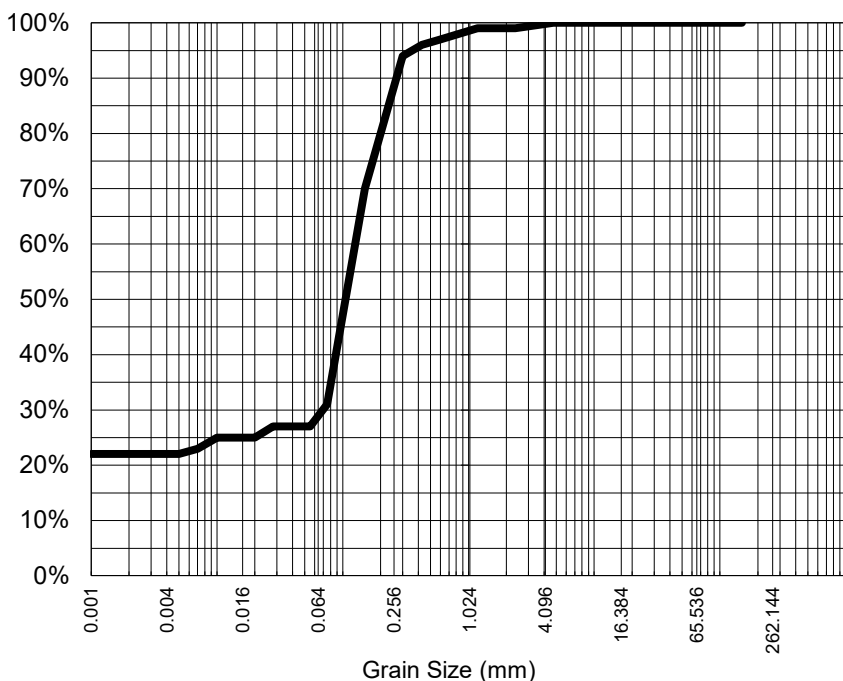
ADDRESS: P O Box 930
Townsville
Qld, Australia

REPORT NO: EB2522559-035 / PSD

PROJECT: 12668542

SAMPLE ID: 35_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	99%
0.600	97%
0.425	96%
0.300	94%
0.150	70%
0.075	31%
Particle Size (microns)	
55	27%
39	27%
28	27%
20	25%
14	25%
10	25%
7	23%
5	22%
1	22%

Median Particle Size (mm)*	0.112
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.61

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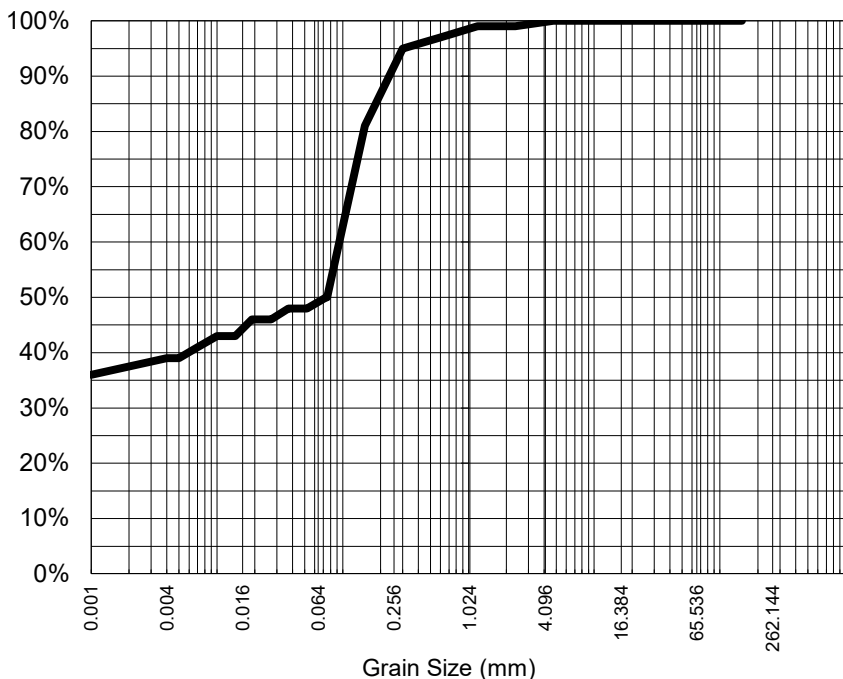
ADDRESS: P O Box 930
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REPORT NO: EB2522559-036 / PSD

PROJECT: 12668542

SAMPLE ID: 36_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	99%
0.600	97%
0.425	96%
0.300	95%
0.150	81%
0.075	50%
Particle Size (microns)	
52	48%
37	48%
27	46%
19	46%
14	43%
10	43%
7	41%
5	39%
1	36%

Median Particle Size (mm)*	0.075
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.66

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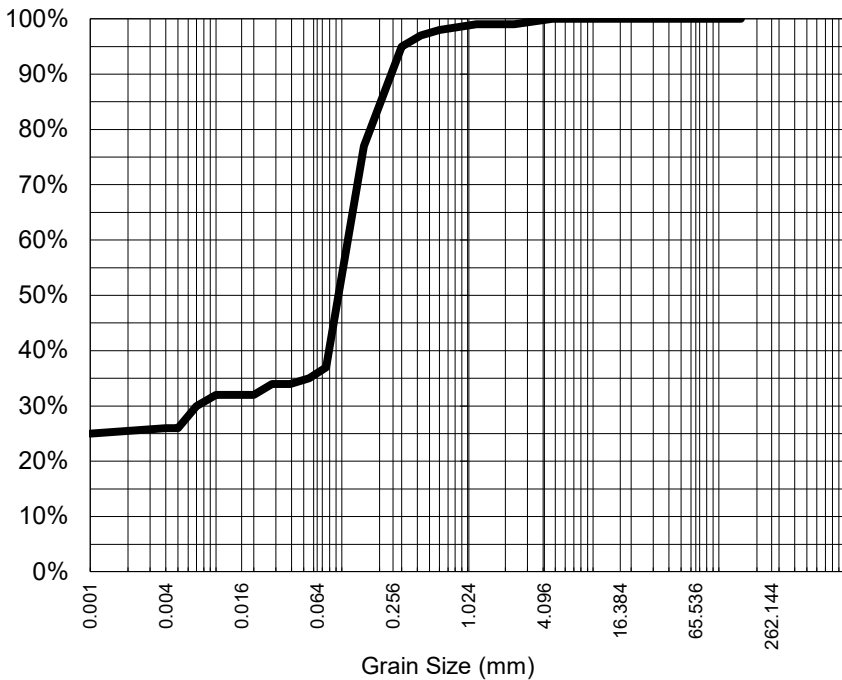
ADDRESS: P O Box 930
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REPORT NO: EB2522559-037 / PSD

PROJECT: 12668542

SAMPLE ID: 37_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	99%
0.600	98%
0.425	97%
0.300	95%
0.150	77%
0.075	37%
Particle Size (microns)	
55	35%
39	34%
28	34%
20	32%
14	32%
10	32%
7	30%
5	26%
1	25%

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.099
----------------------------	-------

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.61

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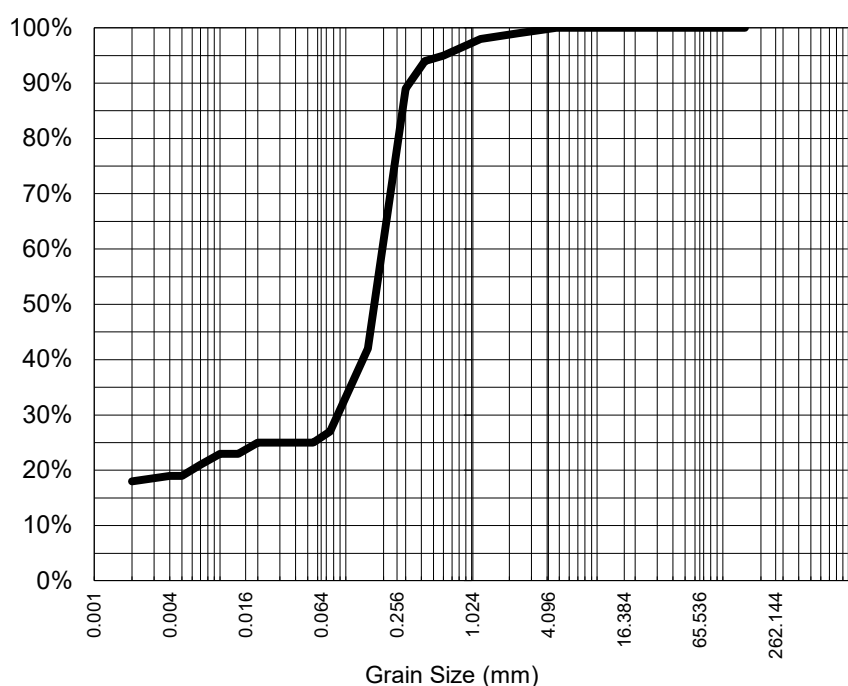
ADDRESS: P O Box 930
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REPORT NO: EB2522559-038 / PSD

PROJECT: 12668542

SAMPLE ID: 38_SED

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	98%
0.600	95%
0.425	94%
0.300	89%
0.150	42%
0.075	27%
Particle Size (microns)	
55	25%
39	25%
28	25%
20	25%
14	23%
10	23%
7	21%
5	19%
2	18%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.176
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.6

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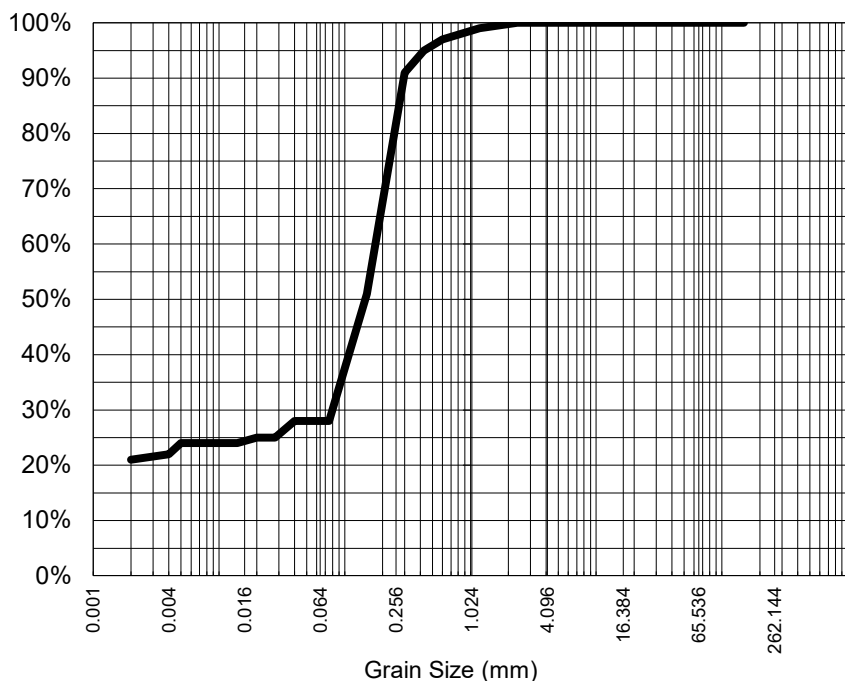
ADDRESS: P O Box 930
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REPORT NO: EB2522559-039 / PSD

PROJECT: 12668542

SAMPLE ID: 39_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	97%
0.425	95%
0.300	91%
0.150	51%
0.075	28%
Particle Size (microns)	
56	28%
40	28%
28	25%
20	25%
14	24%
10	24%
7	24%
5	24%
2	21%

Median Particle Size (mm)*	0.147
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.57

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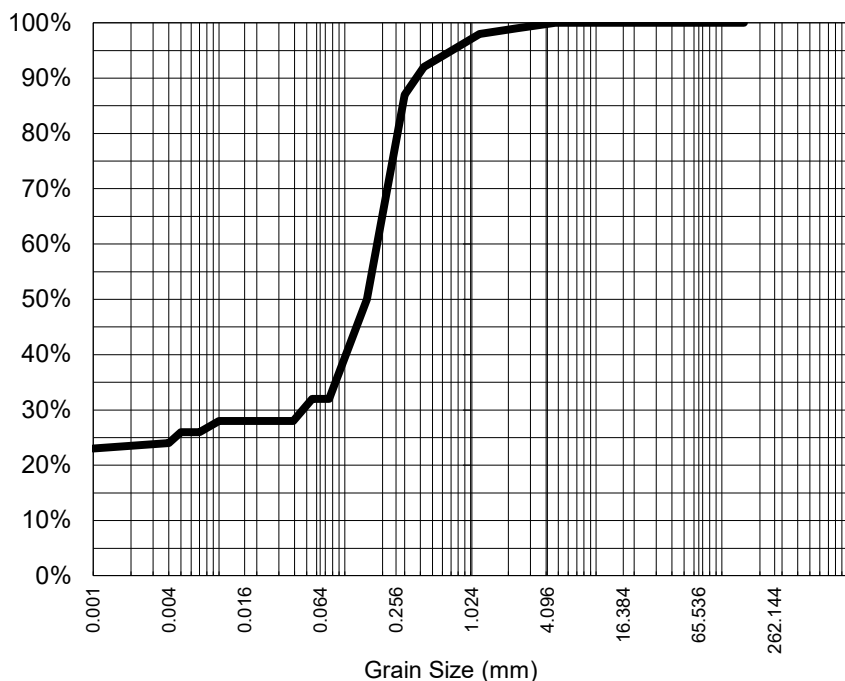
ADDRESS: P O Box 930
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REPORT NO: EB2522559-040 / PSD

PROJECT: 12668542

SAMPLE ID: 40_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	98%
0.600	94%
0.425	92%
0.300	87%
0.150	50%
0.075	32%
Particle Size (microns)	
55	32%
39	28%
28	28%
20	28%
14	28%
10	28%
7	26%
5	26%
1	23%

Median Particle Size (mm)*	0.150
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.61

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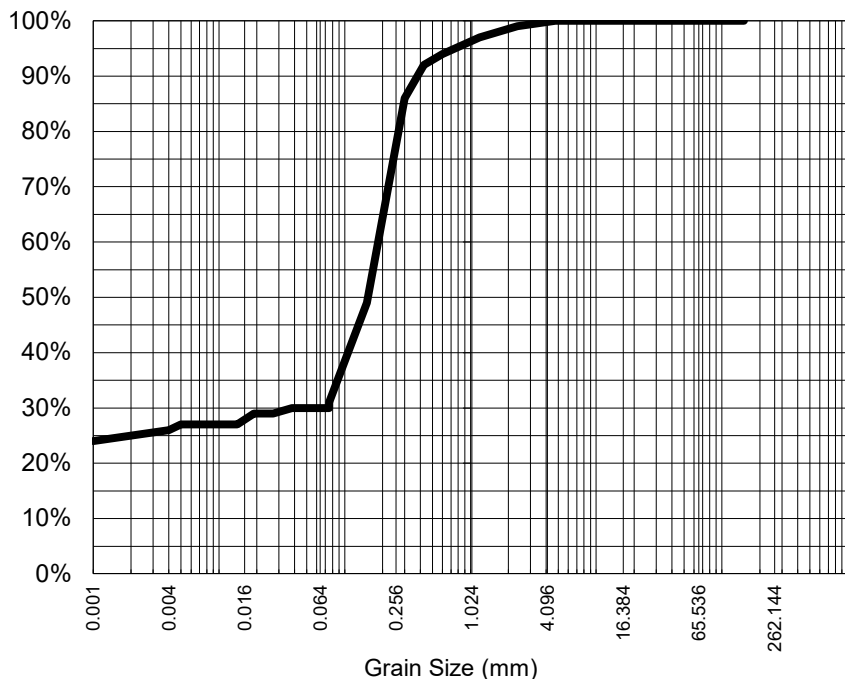
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REPORT NO: EB2522559-041 / PSD

PROJECT: 12668542

SAMPLE ID: 41_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	97%
0.600	94%
0.425	92%
0.300	86%
0.150	49%
0.075	31%
Particle Size (microns)	
54	30%
38	30%
27	29%
19	29%
14	27%
10	27%
7	27%
5	27%
1	24%

Median Particle Size (mm)*	0.154
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65

NATA Accreditation: 825 Site: Brisbane
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Satish Trivedi
Soil Senior Chemist
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
2 Byth Street
Stafford, QLD 4053
pH 07 3243 7222
samples.brisbane@alsenviro.com

ALS Environmental
Brisbane QLD



CLIENT: HAMISH WHITNEY

DATE REPORTED: 8-Jul-2025

COMPANY: GHD PTY LTD

DATE RECEIVED: 1-Jul-2025

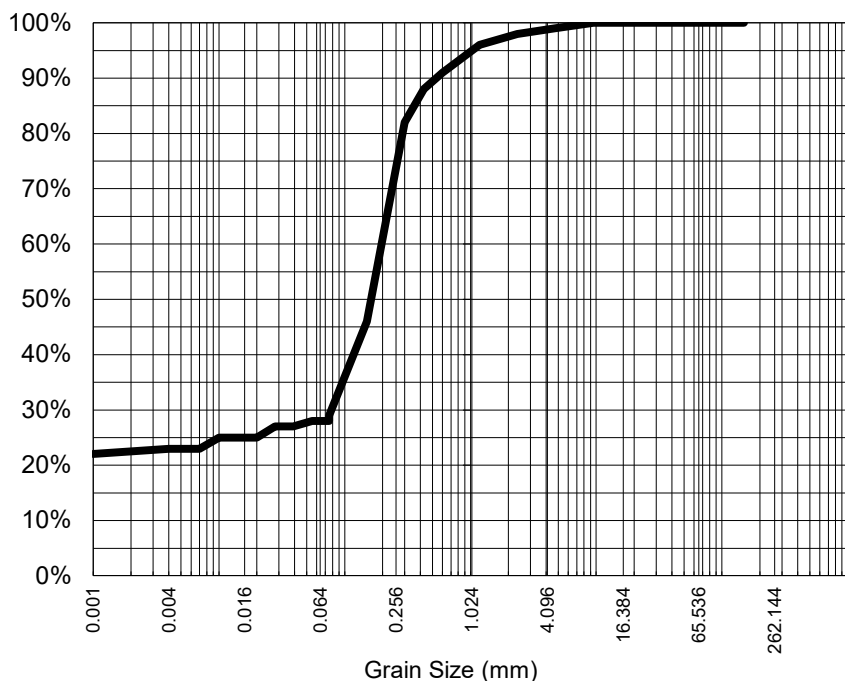
ADDRESS: P O Box 930
Townsville
Qld, Australia

REPORT NO: EB2522559-042 / PSD

PROJECT: 12668542

SAMPLE ID: 42_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	98%
1.18	96%
0.600	91%
0.425	88%
0.300	82%
0.150	46%
0.075	29%
Particle Size (microns)	
55	28%
39	27%
28	27%
20	25%
14	25%
10	25%
7	23%
5	23%
1	22%

Median Particle Size (mm)*	0.167
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.61

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DATE REPORTED: 8-Jul-2025

COMPANY: GHD PTY LTD

DATE RECEIVED: 1-Jul-2025

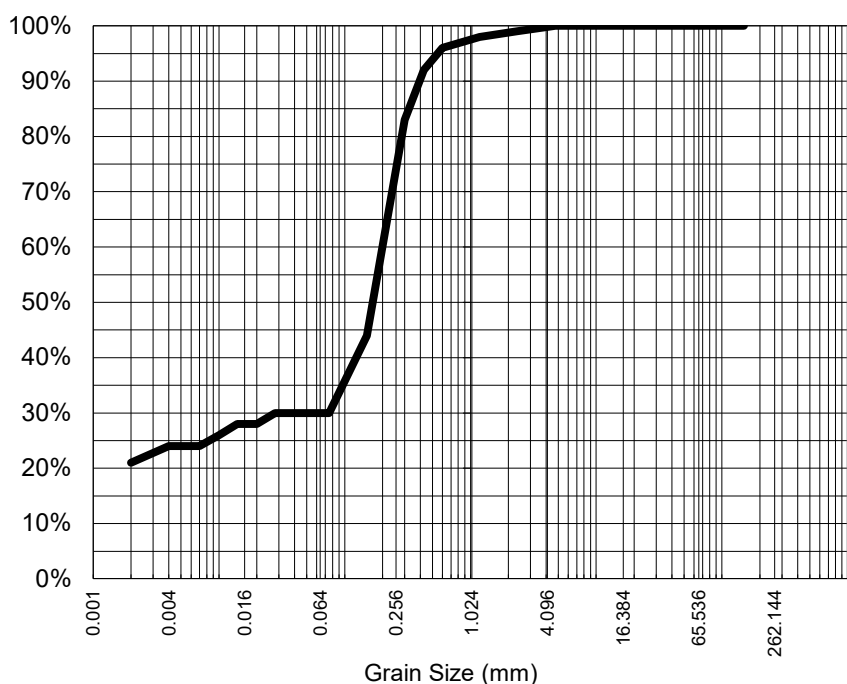
ADDRESS: P O Box 930
Townsville
Qld, Australia

REPORT NO: EB2522559-043 / PSD

PROJECT: 12668542

SAMPLE ID: 43_SED

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	98%
0.600	96%
0.425	92%
0.300	83%
0.150	44%
0.075	30%
Particle Size (microns)	
56	30%
40	30%
28	30%
20	28%
14	28%
10	26%
7	24%
5	24%
2	21%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.173
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.58

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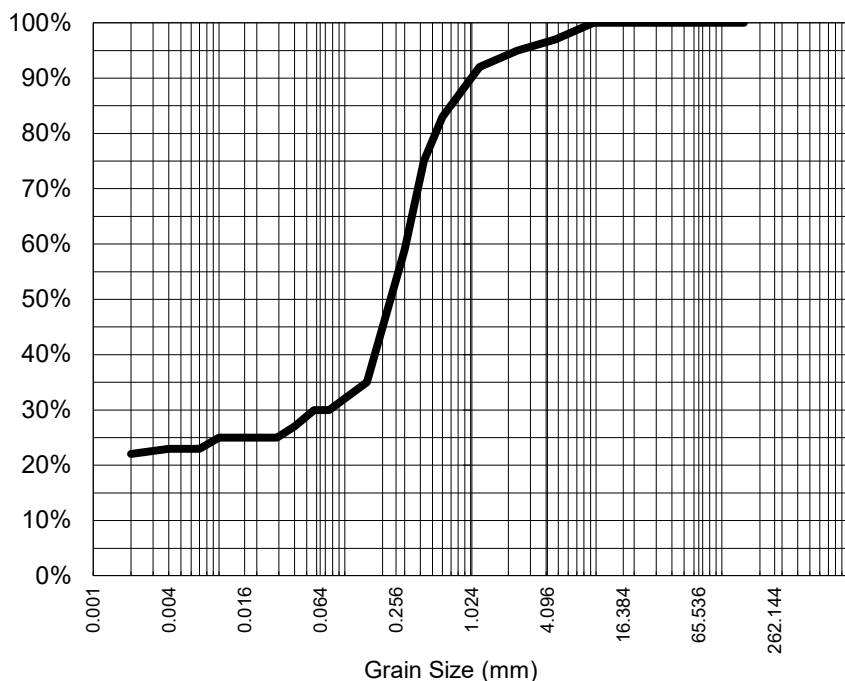
ADDRESS: P O Box 930
Townsville
Qld, Australia

REPORT NO: EB2522559-044 / PSD

PROJECT: 12668542

SAMPLE ID: 44_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
9.50	100%
4.75	97%
2.36	95%
1.18	92%
0.600	83%
0.425	75%
0.300	59%
0.150	35%
0.075	30%
Particle Size (microns)	
57	30%
40	27%
29	25%
20	25%
15	25%
10	25%
7	23%
5	23%
2	22%

Median Particle Size (mm)*	0.244
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.52

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DATE REPORTED: 8-Jul-2025

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DATE RECEIVED: 1-Jul-2025

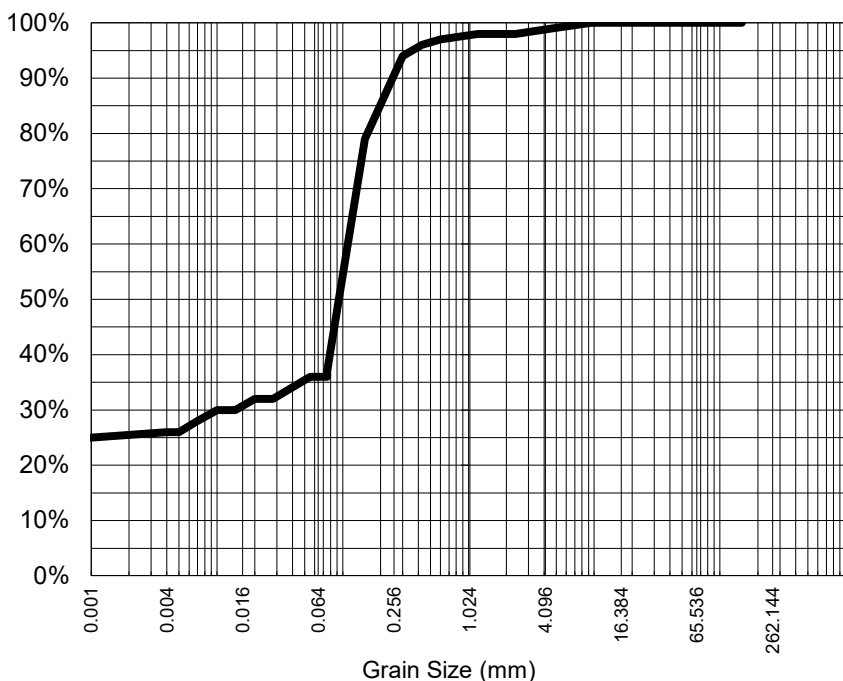
ADDRESS: P O Box 930
Townsville
Qld, Australia

REPORT NO: EB2522559-045 / PSD

PROJECT: 12668542

SAMPLE ID: 45_SED

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	98%
1.18	98%
0.600	97%
0.425	96%
0.300	94%
0.150	79%
0.075	37%
Particle Size (microns)	
55	36%
39	34%
28	32%
20	32%
14	30%
10	30%
7	28%
5	26%
1	25%

Median Particle Size (mm)*	0.098
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 4-Jul-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.64

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Appendix B

PERMANOVA Tables

Table B.1 Particle Size Distribution PERMANOVA table of results for Event 1 and Event 2

Source	d.f.	S.S.	M.S.	Pseudo-F	P(perm)	Unique perms
Event	1	434.37	434.37	1.5435	0.207	999
Area	2	11350	5675	20.166	0.001	999
Event x Area	2	265.47	132.74	0.47169	0.688	999
Residual	84	23638	281.41			
Total	89	35736				

Table B.2 Particle Size Distribution PERMANOVA – Event 1 and 2 pairwise test results

Groups	t	P(perm)	Unique perms
DMPA, ZOI	4.0749	0.002	999
DMPA, Control	5.2523	0.001	999
ZOI, Control	1.6763	0.070	999

Table B.3 Particle Size Distribution PERMANOVA table of results for Event 1

Source	d.f.	S.S.	M.S.	Pseudo-F	P(perm)	Unique perms
Area	2	5074.9	2537.5	7.3282	0.001	999
Residual	42	14543	346.26			
Total	44	19618				

Table B.4 Particle Size Distribution PERMANOVA – Event 1 pairwise test results

Groups	t	P(perm)	Unique perms
DMPA , ZOI	2.3436	0.015	994
DMPA, Control	3.2138	0.001	984
ZOI, Control	1.4315	0.088	946

Table B.5 Particle Size Distribution PERMANOVA table of results for Event 2

Source	d.f.	S.S.	M.S.	Pseudo-F	P(perm)	Unique perms
Area	2	6540.6	3270.3	15.101	0.001	998
Residual	42	9095.5	216.56			
Total	44	15636				

Table B.6 Particle Size Distribution PERMANOVA – Event 2 pairwise test results

Groups	t	P(perm)	Unique perms
DMPA , ZOI	3.7165	0.001	992
DMPA, Control	4.4322	0.001	991
ZOI, Control	1.334	0.176	979

Table B.7 *Infauna PERMANOVA table of results for Event 1 and Event 2*

Source	d.f.	S.S.	M.S.	Pseudo-F	P(perm)	Unique perms
Event	1	17024	17024	4.6362	0.001	997
Area	2	17051	8525.3	2.3217	0.001	998
Event x Area	2	7557.2	3778.6	1.029	0.426	999
Residual	252	9.25E+05	3672			
Total	257	9.67E+05				

Table B.8 *Infauna PERMANOVA – Event 1 and 2 pairwise test results*

Groups	t	P(perm)	Unique perms
DMPA	1.278	0.031	997
ZOI	1.6925	0.001	999
Control	1.5378	0.002	998

Table B.9 *Infauna PERMANOVA – Event 1 pairwise test results*

Groups	t	P(perm)	Unique perms
DMPA, ZOI	1.412	0.006	999
DMPA, Control	1.2541	0.056	999
ZOI, Control	1.2644	0.067	998

Table B.10 *Infauna PERMANOVA – Event 2 pairwise test results*

Groups	t	P(perm)	Unique perms
DMPA, ZOI	1.5255	0.001	997
DMPA, Control	1.1651	0.120	999
ZOI, Control	1.2137	0.099	998



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