

ARDERSIER PORT ENERGY TRANSITION FACILITY PORT EXTENSION



November 2025

Appendix 3.1 Whiteness Head Stability Assessment

Haventus Group
Ardersier Port
Whiteness Head Stability Assessment

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1.0 Introduction

Haventus Group are currently undertaking significant redevelopment works including construction of a new heavy lift quayside and associated dredging pocket to facilitate operations principally targeted at the offshore renewables sector. The navigation channel within the port is sheltered by Whiteness Head which is comprised principally from wind blown sands, and forms a natural breakwater from the outer Moray Firth, providing a high degree of protection from prevailing environmental actions.

The current proposals for Ardersier Port involve further extension of the previously widened and deepened navigation channel and berthing pocket created within Phase 1, into Phase 2 of the quayside works, thereby creating additional berths with a dredge level of -12.4mCD (+500mm overdredge allowance) and hence enabling vessels with a draft of up to 12.0metres to access the site.

This report has been compiled to summarise the initial assessment of the proposed dredging works and vessel operations within the site, utilising existing ground investigation information to create site-specific ground model to facilitate a stability assessment of the dredge pocket and proposed side slopes to Whiteness Head. These slopes have been compared against existing side slopes formed within Phase 1, to provide an onsite comparison, acknowledging there is considered to be a relatively low risk of significant variation in ground conditions within the Phase 2 area of the spit. The dredge slope profiles have been developed with particular consideration of the long-term stability of Whiteness Head.

The head of the spit is considered to present a lower risk to the overall stability of the spit due to the ongoing long-shore sediment transport from the East of the site, currently resulting in ongoing material deposition. It should be noted, this does present a challenge to maintain navigation from the Outer Moray Firth into the site, due to the significant deepening of the bathymetric from the end of the spit towards the port navigation channel. This is likely to result in material deposition as the short, steep waves are broken, resulting in transient material being deposited at this location, by this acting as a sediment sink. The impact of this deposition may result in localised instability to the head of the spit, which will require monitoring through a regular inspection, management and reinstatement (where necessary) regime.

In addition to the natural spit deposits, additional reinstatement works have been undertaken under the direction of Haventus Group, by DEME Offshore utilising material arising from the Phase 1 dredging works. This reinstatement extends over approximately 1100metres on the landward side of the spit, over both Phase 1 & Phase 2, and comprises the deposition of 120,000m³ of material. It is understood these works have been undertaken in line with NewWaves Solutions (DEME Group) Document No: 6240-NWS-EXE-MST-0001 (Rev 01), Dated: 11th February 2025. It should be noted that as part of these works, no construction issue drawings showing the preparation, staging or benching of the deposited material have been provided, however a coordinated survey showing the finalised levels has been provided.

The impact of scour from the operation of vessels within the port has not been assessed within this report, however this remains an important aspect of the long-term stability of the dredged slopes on the lee-ward side of the spit. It should be noted that owing to the fine grain, tightly graded granular nature of the material forming the spit, these are highly susceptible to mobilisation under vessel thruster action, resulting in localised areas of scour unless protection measures are implemented. The degree to which scour may occur, will relate principally to the diameter/area and degree of power applied on the vessel thrusters (hence the velocity of water ejected from the thruster), as well as the linear distance and angle through which dispersion of the thruster force may be spread within the channel. This risk will require active management through regular bathymetric surveys and where necessary, localised reinstatement, to avoid development of larger-scale slope failures.

2.0 Basis of Design Assessment

2.1 Background

The findings of the design assessment presented within this report are based upon information available at the time of writing, when assessing the spit stability over the extent of the Phase 2 boundary. The proposed Marine Ground Investigation works extending over the Phase 2 footprint have not been undertaken to date, however boreholes undertaken on the spit, as part of previous phases of ground investigation, have been used in developing the ground model utilised within this assessment. This report is referenced below:

Solmek Ltd:

Ardersier Port (Scotland) Ltd, Ardersier Port, Inverness – Factual Site Investigation Report, Issue 4, Dated: March 2024, Status: Final;

Following completion of the proposed investigation works within Phase 2, encompassing works on the spit, the conclusions of this assessment will be reviewed in the context of the associated borehole logs and laboratory testing results.

This report presents the findings of the geotechnical stability assessment of the spit, in line with the proposed dredging works as part of the Phase 2 redevelopment, which encompassed the proposed dredge level of -12.4mCD (+500mm overdredge allowance).

This assessment has been undertaken to reflect the varied impacts of prevailing tidal level, throughout the tidal range noted below, as detailed within UK Hydrographic Office NP201B, Volume 1B, 2025:

• HAT:	+4.80mCD	(+2.70mOD)
• MHWS:	+4.20mCD	(+2.65mOD)
• MHWN:	+3.30mCD	(+1.20mOD)
• MSL:	+2.50mCD	(+0.40mOD)
• OD:	+2.10mCD	(+0.00mOD)
• MLWN:	+1.70mCD	(-0.40mOD)
• MLWS:	+0.90mCD	(-1.20mOD)
• LAT:	+0.20mCD	(-1.90mCD)

In addition, this assessment has been undertaken in accordance with the following recognised standards and guidance associated with dredging, land reclamation and vessel induced scour;

- BS6349 1-1 2013 - Code of practice for Planning and design of Operations;
- BS6349 1-3 2021 - Code of practice for Geotechnical Design;
- BS6349 5 2016 - Code of practice for Dredging & Land Reclamation;
- Eurocode 7 - Geotechnical Design - Part 1, General Rules (*and National Annex*);
- PIANC WG180 (2015) - Guidelines for protecting berthing structures from scour caused by ships;

2.2 Dredge Profile

The dredge profile within this analysis has been developed to provide an initial base, at which it is anticipated the spit will remain stable, with cognisance of the following documentation:

- Existing ground investigation undertaken on the spit (*as here-in referenced*). This highlights the existing superficial deposits are almost entirely sands, albeit with coarser granular material within the shallower deposits, with occasional pockets of silts at depth;
- Bathymetric and topographic data from the spit. From the available data within the footprint of Phase 2, the current profile is located at a broadly comparable (1:6) gradient;
- Guidance detailed within BS6349-1-3:2012 with reference to the range of dredge pocket slopes;
- Previous Phase 1 stability assessment undertaken by Arup;
- In addition to the above documentation, it is understood anecdotally that dredging works undertaken within Phase 1 have typically resulted in the dredge slopes forming a repose at around 1:6;

In line with the above previous findings, for the purposes of this initial assessment the dredge slopes through the natural sands have been considered at a slope of 1:6.

With consideration of the spit reinstatement method statement: NewWaves Solutions (DEME Group) Document No: 6240-NWS-EXE-MST-0001 (Rev 01), Dated: 11th February 2025, it is considered that owing to this material being newly placed with compaction induced through self-surcharging, the reinstated sands will perform as 'loose sands'. As no investigation has been undertaken through the reinstatement since completion, conservative estimates as to the likely insitu and laboratory properties of the material, have been adopted. Furthermore, whilst it is known the spit reinstatement materials were from dredge arisings within Phase 1, their precise location and level have not been clarified, therefore the PSDs from prior site investigation targets in the vicinity of their origin have not been reviewed.

Furthermore, the reinstatement works present a number of risks which can be mitigated and quantified to an extent by further site investigation, however may remain as inherent risks until the dredging works within Phase 2 are completed:

- In lieu of construction or as-built drawings of the spit reinstatement works, it is envisaged that in order to prevent planar failure(s) of the dredge slopes, preparatory works would have entailed benching of the existing natural sands prior to placement of the reinstatement material. In preparing this report, there has been no constructional evidence provided to clarify where these works have been undertaken. As such, there remains an outstanding risk of dredge slope failure as it cannot be determined if the material has been placed upon a flat or inclined slope. Placement upon an inclined slope would significantly increase the likelihood of planar failures as the spit material would not appropriately interlock with the reinstated material;
- Similarly, there is an inherent risk that owing to variations in the moisture content, from that of its origin location, which may occur through the dredging and placement process, there is an inherent risk that under self-surge and settlement, the reinstatement material may fail by piping as the moisture content is pushed to the surface of the slope. Evidently this action is highly subjective to the permeability of the sands, however the shallower deposits of sands are most vulnerable to this form of failure as a result of their lesser magnitude of self-surge;

- In addition, there is also a further risk that shallow piping failure of the dredge slope may occur due to the lack of practicable methods by which to compact the material when placed. As a result, there is potential by which cohesion of the sands (particularly with a higher silt content) may result in the arching of deposited material, which may subsequently be disturbed by variation in tidal levels, passing vessels or prevailing waves within the channel;

As a result of the risks associated with these potential mechanisms of failure within the spit reinstatement material, for the purposes of initial assessment, a considerably shallower dredge slope graded at 1:8 has been analysed. It is recognised this slope is particularly conservative, however this is modelled in lieu of any ground investigation reporting and with cognisance of the previously outlined risks.

3.0 Ground Conditions

The following subsections to this report detail the scope of spit investigation works in conjunction with a summary of the ground model developed, and upon which this initial stability assessment is based.

3.1 Ground Investigation Works

An intrusive ground investigation was undertaken by Solmek within the Phase 1 area of the spit between May and July 2023. These works were undertaken to determine the ground conditions, by undertaking insitu and laboratory testing to enable derivation of material properties of the stratification, and hence enable initial assessment of the spit footprint within Phase 2.

The scope of the investigation works comprised 5No. boreholes drilled up to 40m below ground level, with associated sampling, insitu and laboratory testing. This report is referenced below:

Solmek Ltd:

Ardersier Port (Scotland) Ltd, Ardersier Port, Inverness – Factual Site Investigation Report, Issue 4, Dated: March 2024, Status: Final;

Following review of the previously reported ground conditions, it is considered the stratification throughout the extent of the spit is relatively consistent. As a result of this, for initial assessment purposes, the stratification layering reported within borehole BH-SP05 has been utilised. In lieu of the surveyed level of the borehole at the time of drilling, it has been inferred the ground level on the spit was approximately MHWS (+4.20mCD).

It is understood that owing to statutory protections which apply to Whiteness Head, investigation works can only be undertaken at or below the level of MHWS. As a result, the properties of material above this level have been considered to be of comparable nature to that encountered immediately below the surface at MHWS.

3.2 Ground Model

Whiteness Head is a shingle spit formed by ongoing westerly longshore sediment transport, resulting in the surface of the spit being comprised from resultant coastal erosion deposits.

From the available site investigation data, the uppermost stratification is comprised from Dense Sandy Gravel overlying fine sands of Holocene age. Within these sands, the strata is typically described as medium-dense, varying locally from silty to gravelly Medium-Dense Sand, becoming finer with depth. The solid geology located below the site has not been confirmed during the previous phases of ground investigation however this is understood to be located at significant depth on the site, and therefore does not provide any meaningful influence upon the stability of the spit.

In summary of the preceding ground investigation works, the ground conditions and stratification detailed within Table 3.1, have been utilised within this initial assessment:

Stratification Description	Stratification Level		Unit Weight (kN/m ³)	Friction Angle (°)	Cohesion (kPa)	Youngs' Modulus (kN/m ² /m)
	From (mCD)	To (mCD)				
Dense Sandy Gravel	+6.400	+1.500	20	36	0	40,000
Medium-Dense Sand (Silty)	+1.500	-0.800	20	34	0	30,000
Medium-Dense Sand (Gravelly)	-0.800	-7.800	20	34	1	30,000
Medium-Dense Sand	-7.800	-10.800	20	35	0	35,000
Dense Sand	-10.800	-30.300	20	35	0	35,000
<i>Fine-Medium Grain Sand (Reinstatement)</i>	<i>N / A</i>	<i>N / A</i>	17	28	0	15,000

Table 3.1: Summary of material properties derived/assumed for stratification on site

In deriving the above material properties, the Standard Penetration Tests (SPT *n*) values obtained from the tests within the respective stratification were reviewed and correlated throughout the extent of the ground investigation works. Subsequent to their review, correction of the SPT results was undertaken in order to reflect the overburden pressures and rod length under testing, utilising the methods detailed within BS EN ISO 22476-3:2005 + A1:2011. Following this, a characteristic friction angle for the respective layers was derived based upon Mayne (2011).

The laboratory testing data from the shear box and triaxial (consolidated-drained) tests were shown to be in line with those derived from insitu testing therefore allowing derivation of the friction angle. Throughout the insitu and laboratory testing data, it can be demonstrated the uppermost layers containing a higher gravel content, have an elevated friction angle when compared to the increasingly fine grain sands at depth. It should be noted that as a result of the particularly narrow grading of the sands, the interlocking of particles is particularly poor hence the friction angles considered within this analysis.

With consideration of the spit reinstatement method statement from DEME Group, it is noted these materials are likely to perform in a less favourable manner than that of the sands encountered within the ground investigation of the spit. As a result of this, it is envisaged the reinstatement material is likely to perform comparable to 'Loose Sands' and hence a reduced friction angle and Youngs' Modulus has been considered for this material. Similarly, as the placed density of the material is unknown in lieu of ground investigation information from the material now insitu, this has been conservatively considered as 17kN/m³. These assumptions on the reinstatement material also recognise that their precise location and level have not been clarified, therefore the PSDs from prior site investigation targets in the vicinity of their origin could not be reviewed. On receipt of the Phase 2 ground investigation report from the spit, these parameters will be reviewed in the context of insitu findings.

4.0 Slope Stability Assessment

4.1 Modelling Inputs

The geometry utilised within initial assessment has been taken from bathymetric and topographical data provided by Haventus Group surveyed prior to, and shortly after the reinstatement works. In line with this survey data, this assessment utilises the geometry surveyed at both Chainage 700 & 1100 from model: 'ACAD-NAV-CHAN-Model', provided by Haventus Group. This chainage has been selected for this assessment, owing to these reflecting the largest cross section of material utilised within the reinstatement (Chainage 700) and that envisaged to be the general profile throughout Phase 2 (Chainage 1100), hence are considered likely to be reflective of the long-term spit stability.

In undertaking this assessment, a gradient of 1:6 has been considered throughout the depth of natural sands, whilst a gradient of 1:8 has been considered through the depth of the reinstatement material, encountered at Chainage 700. It is recognised that under operation and prevailing environmental conditions, this material is likely to form a continuous gradient from the toe level (-12.9mCD incorporating overdredge allowance) of the dredge slope, up to the head of the reinstatement works, with the slope ravelling back to an alignment struck between the dredged toe and existing crest alignments, from that analysed. In light of the slope angle, this process is considered unlikely to result in destabilisation of the existing spit.

In addition, analysis has been undertaken in order to demonstrate the impacts of both Lowest and Highest Astronomical Tide upon the proposed dredge slopes. For the purposes of this initial assessment, allowance for scour from vessel thrusters has not been considered; the impacts of this upon the dredge side slopes will be reviewed once the Phase 2 ground investigation works on the spit have been completed.

4.2 Modelling Method

This analysis has been undertaken utilising Plaxis 2D finite element analysis software, to verify the proposed dredge slope stability and review the slip failure mechanisms which may impact the spit. The Plaxis model was initialised as a flat profile, with the dredge profiles of the existing spit reviewed at the respective LAT & HAT levels, before a comparable analysis incorporating the reinstatement works, utilising both EC7 SLS & EC7 DA1 C2. EC7 DA1 C1 was not considered relevant as no surcharge loading has been considered upon the spit.

A plane strain model type has been utilised with boundary conditions defined to simulate insitu behaviour of the materials as far as possible. Mesh discretisation has been undertaken utilising the medium coarseness option, however this has been adjusted to finer grading within the finalised slope.

The factors of safety calculated within the various scenarios were computed utilising the strength reduction (ϕ/c reduction) method in which the material strength is continually reduced until failure occurs.

The following scenarios have been considered within this analysis; these are shown graphically within Figures 4.1-4.6:

- Condition 1: Pre-existing profile at Chainage 700 (without reinstatement works) with LAT tidal level;
- Condition 2: Pre-existing profile at Chainage 700 (without reinstatement works) with HAT tidal level;
- Condition 3: Current profile at Chainage 700, with consideration of reinstatement works at LAT tidal level;
- Condition 4: Current profile at Chainage 700, with consideration of reinstatement works at HAT tidal level;
- Condition 5: Current profile at Chainage 1100 with LAT tidal level;
- Condition 6: Current profile at Chainage 1100 with HAT tidal level;

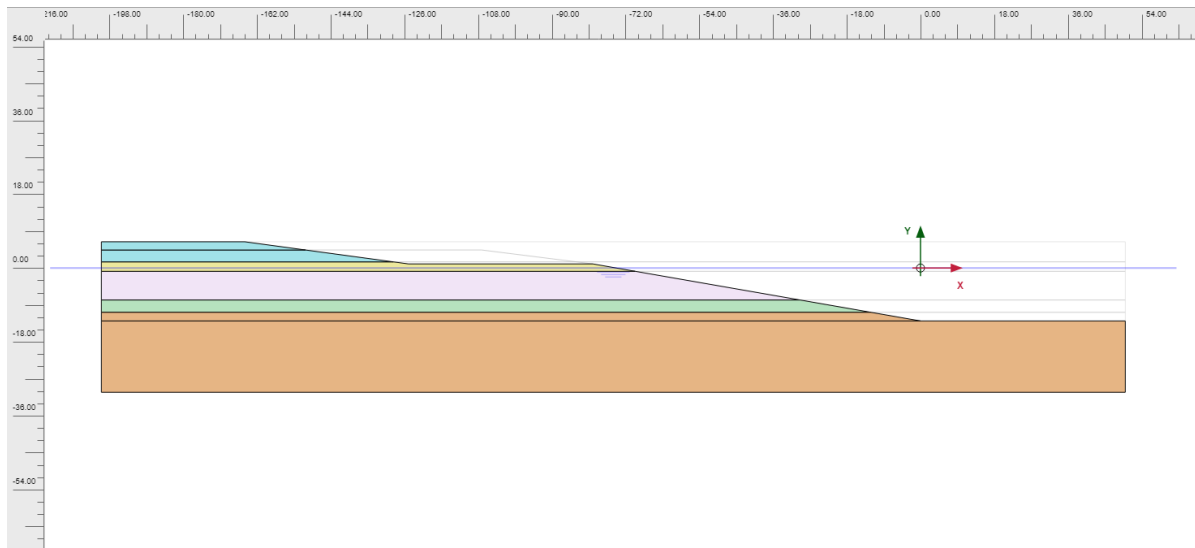


Figure 4.1: Pre-existing profile at Chainage 700 with LAT tidal level (Condition 1)

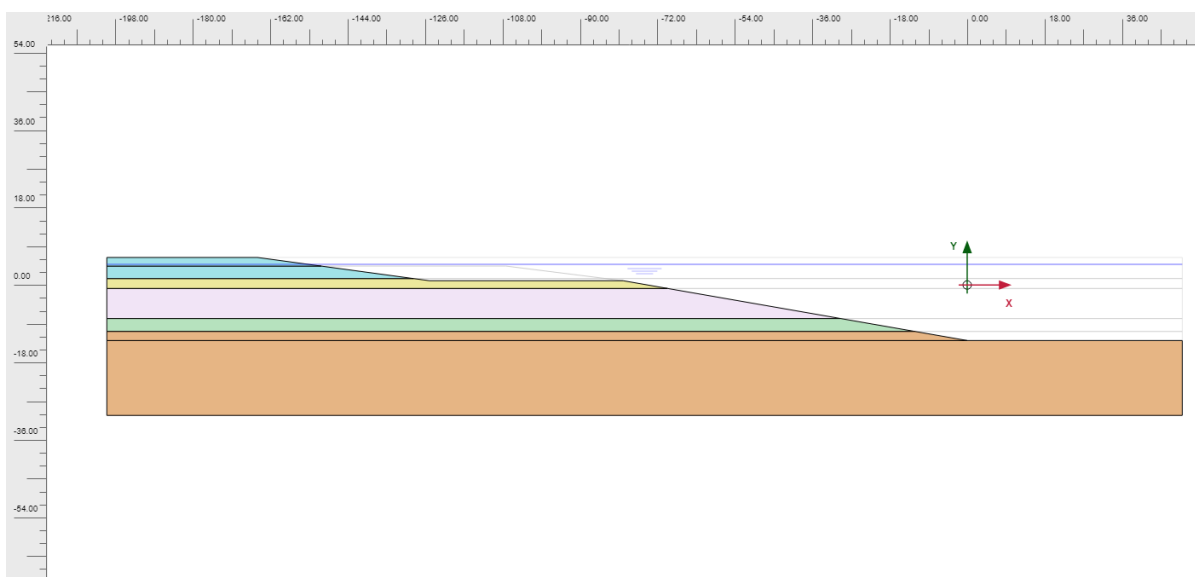


Figure 4.2: Pre-existing profile at Chainage 700 with HAT tidal level (Condition 2)

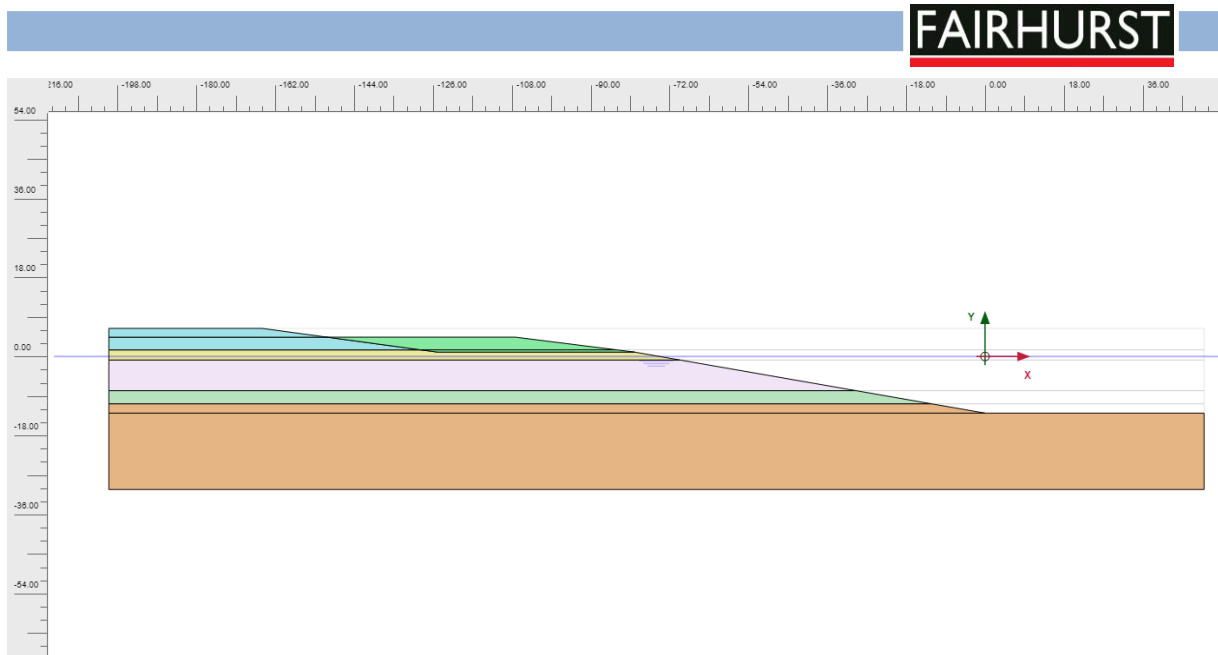


Figure 4.3: Current profile at Chainage 700, with consideration of reinstatement works at LAT tidal level (Condition 3)

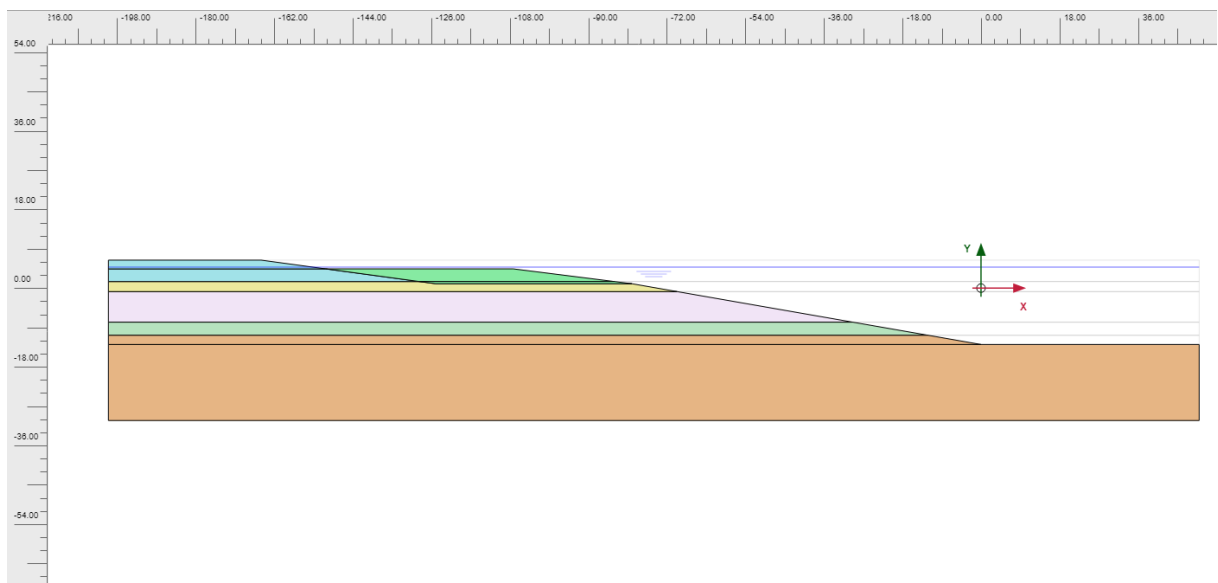


Figure 4.4: Current profile at Chainage 700, with consideration of reinstatement works at HAT tidal level (Condition 4)

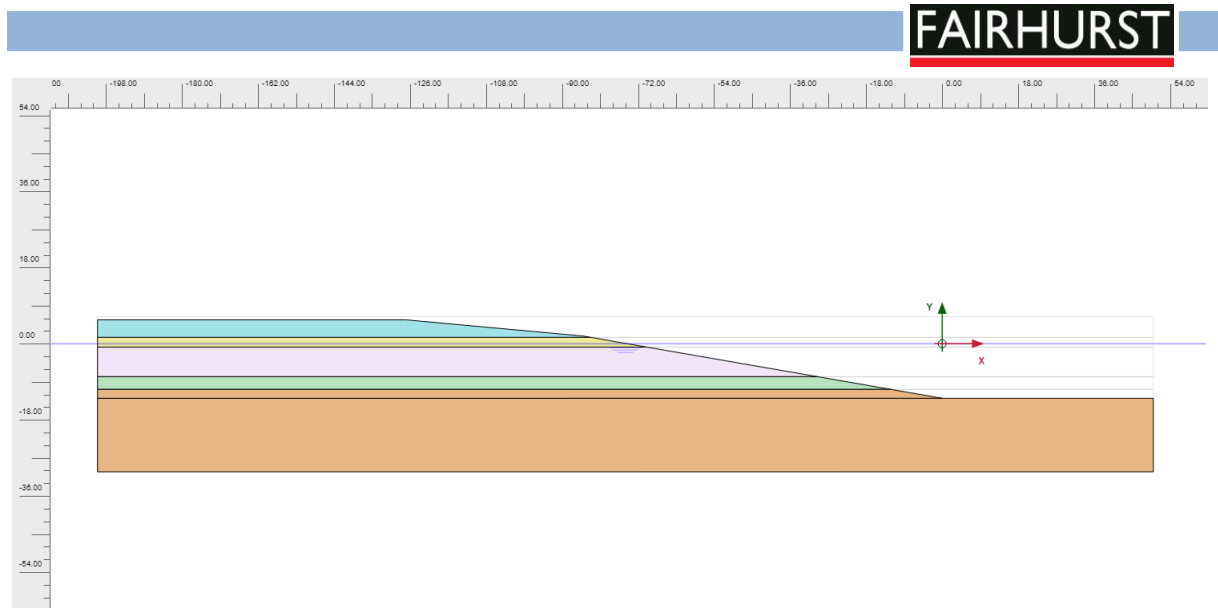


Figure 4.5: Current profile at Chainage 1100 with LAT tidal level (Condition 5)

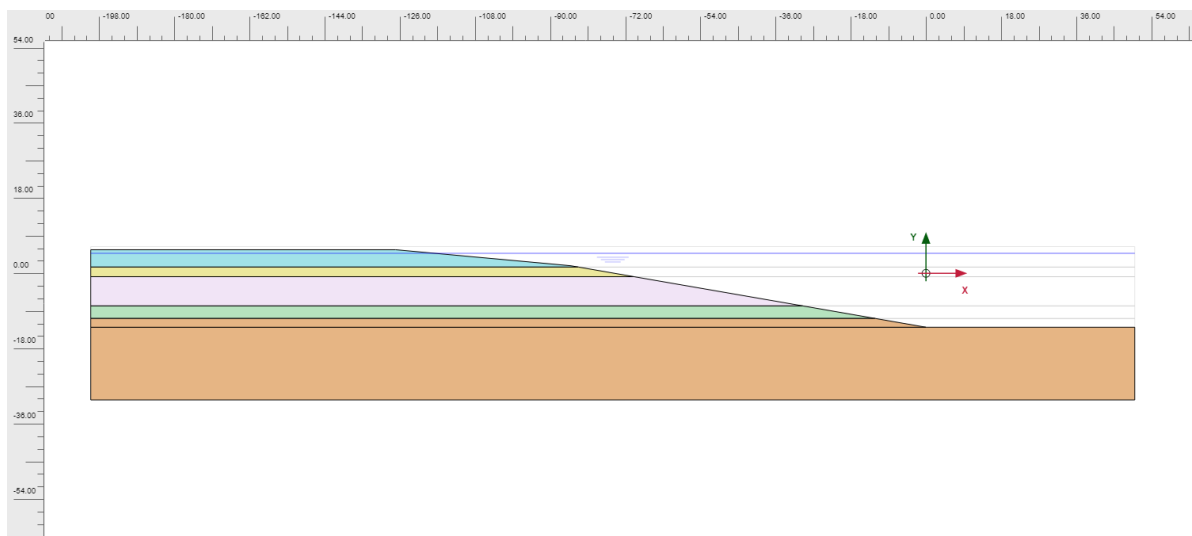


Figure 4.6: Current profile at Chainage 1100 with LAT tidal level (Condition 6)

4.3 Assessment Findings

In line with the existing ground investigation information as well as both bathymetric and topographic surveys of the spit, as well as the assumptions here-in stated in relation to the reinstatement works, Table 4.1 details presents the analysed factors of safety (FoS) / over-design factor (ODF) in the context of both EC7 SLS and EC7 DA1 C2.

Condition	EC7 SLS (FoS / ODF)	EC7 DA1 C2 (FoS / ODF)
1	3.237	2.590
2	4.103	2.587
3	3.235	3.247
4	4.069	3.132
5	3.253	2.599
6	3.956	3.173

Table 4.1: Summary of Plaxis 2D, SLS & DA1 C2 results from Chainage 700 & 1100

The factor of safety calculated within Condition 1 was of a lesser magnitude than calculated in Condition 2, due to the LAT level being located in very close proximity to the crest of the lower dredge side slope, based upon the pre-existing profile. Within Condition 1 the failure mechanism was observed to propagate from within the Medium-Dense Sand (Silty) as shown within Figure 4.5 & 4.5a. With consideration of the phi/c reduction method, factoring down the tangent of the friction angle, utilising the FoS within this condition equates to a friction angle of 11.8°.

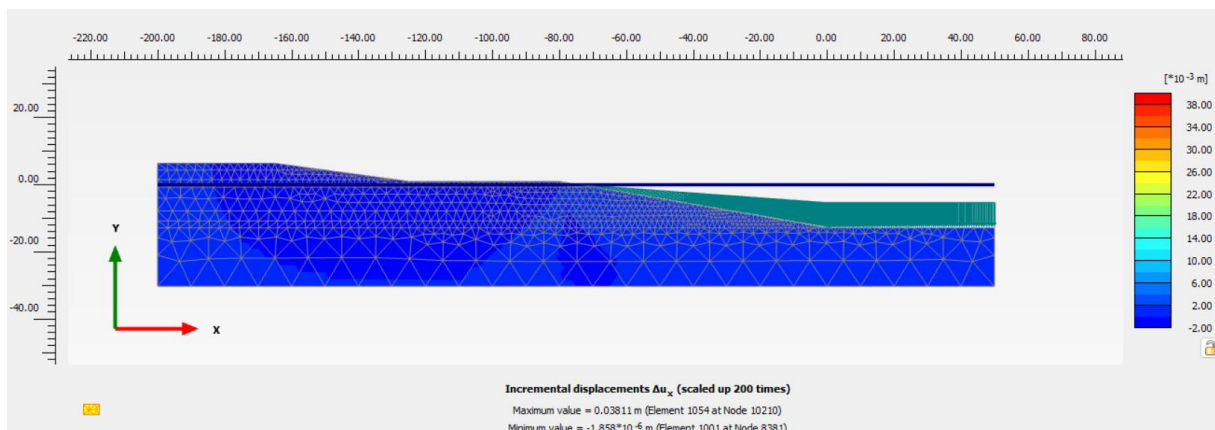


Figure 4.5: EC7 SLS FoS Incremental Displacement Plot (x-direction) – Condition 1

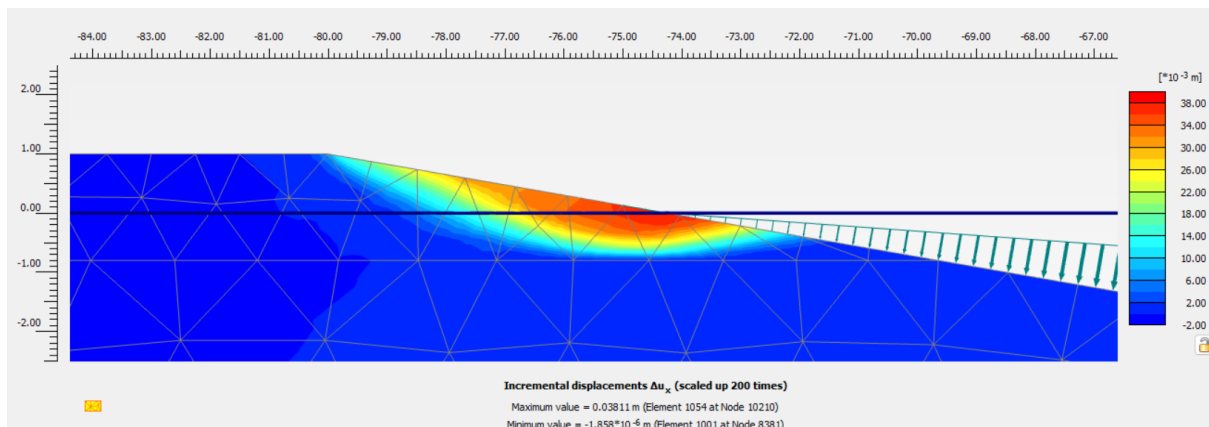
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Figure 4.5a: Enlarged EC7 SLS FoS Incremental Displacement Plot (x-direction) – Condition 1

With consideration of Condition 2, the factor of safety at a HAT tidal level was calculated to be of a greater magnitude than that of LAT. This is principally due to the consistent gradient of the dredge slope throughout the upper intertidal zone, as well as the increased friction angle of the shallower deposits. From review of the modelling outputs, the failure mechanism was observed to propagate from the lower section of the dredge side slopes, based upon the pre-existing profile. Within this condition, the failure mechanism was observed to propagate through the Medium-Dense Sands as shown within Figure 4.6. With consideration of the ϕ/c reduction method, factoring down the tangent of the friction angle, utilising the FoS within this condition equates to a friction angle of 9.3° .

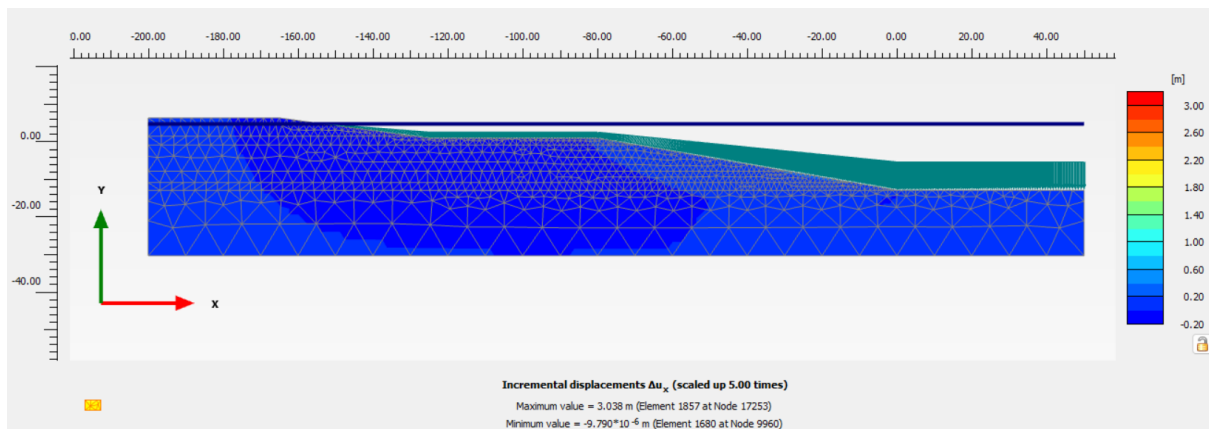


Figure 4.6: EC7 SLS FoS Incremental Displacement Plot (x-direction) – Condition 2

The factor of safety calculated within Condition 3 was of a comparable magnitude to that of Condition 1, due to the LAT level being located close to the transition of the gradient between the pre-existing material (graded at 1:6) and the reinstatement material (graded at 1:8). The highlighted failure mechanism propagates from the Medium-Dense Sand (Silty) as shown within Figure 4.7 & 4.7a. As a result of the ϕ/c reduction method, factoring down the tangent of the friction angle, utilising the FoS within this condition equates to the same friction angle of 11.8° .

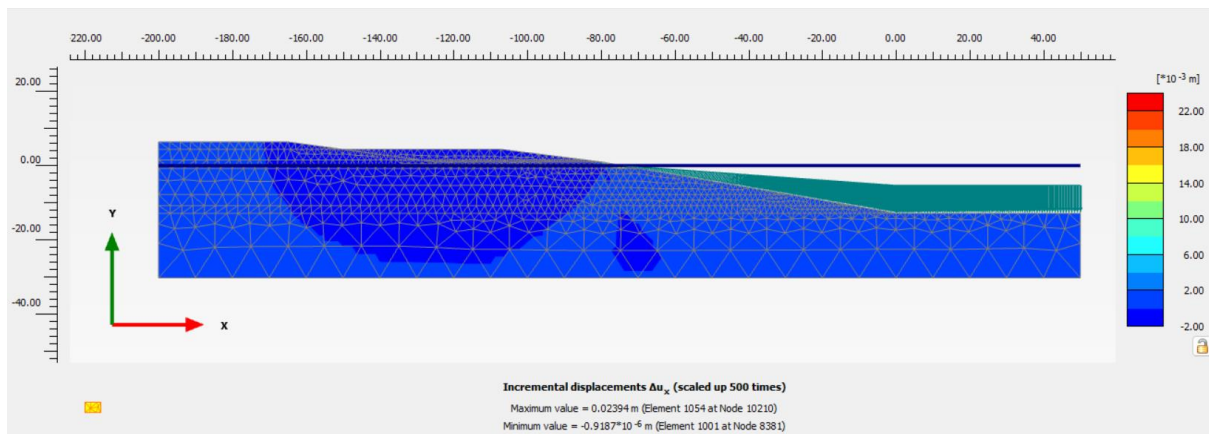
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Figure 4.7: EC7 SLS FoS Incremental Displacement Plot (x-direction) – Condition 3

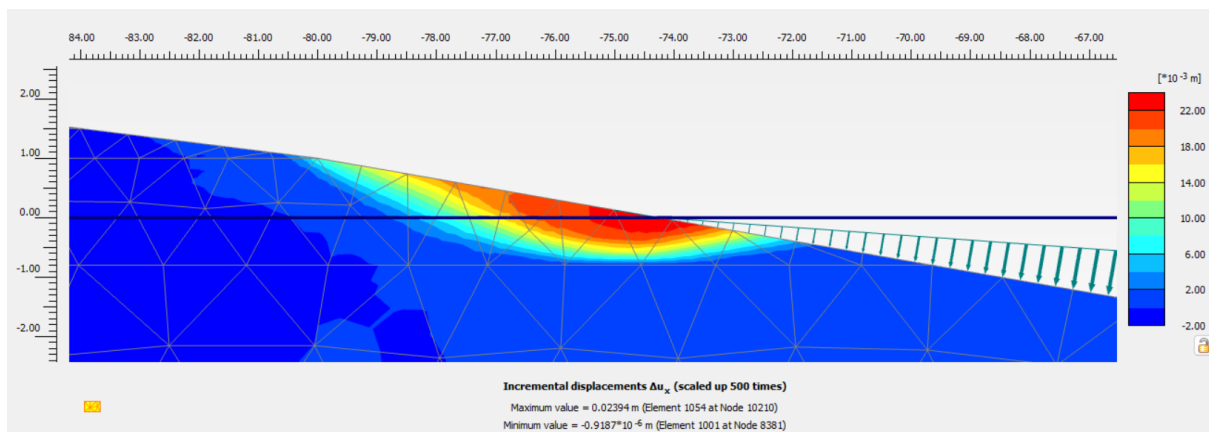
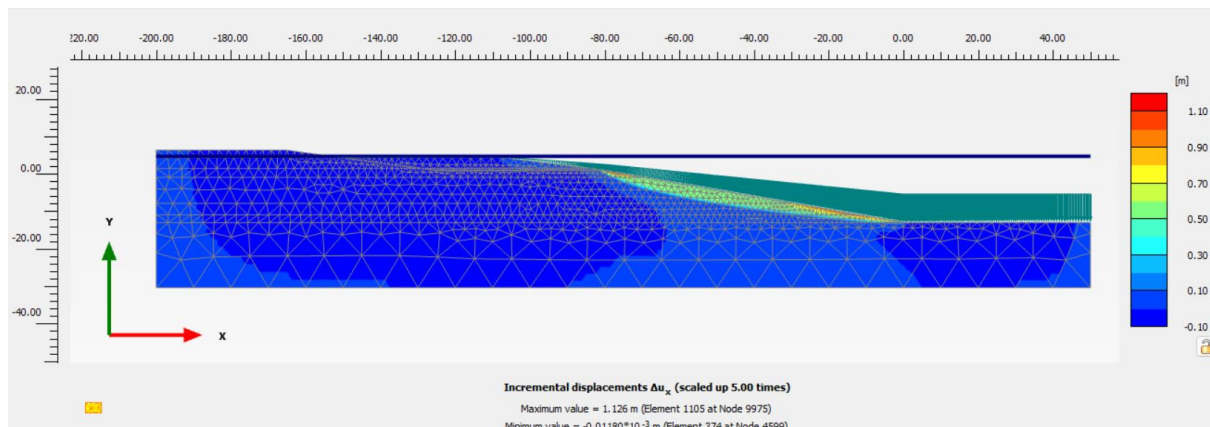
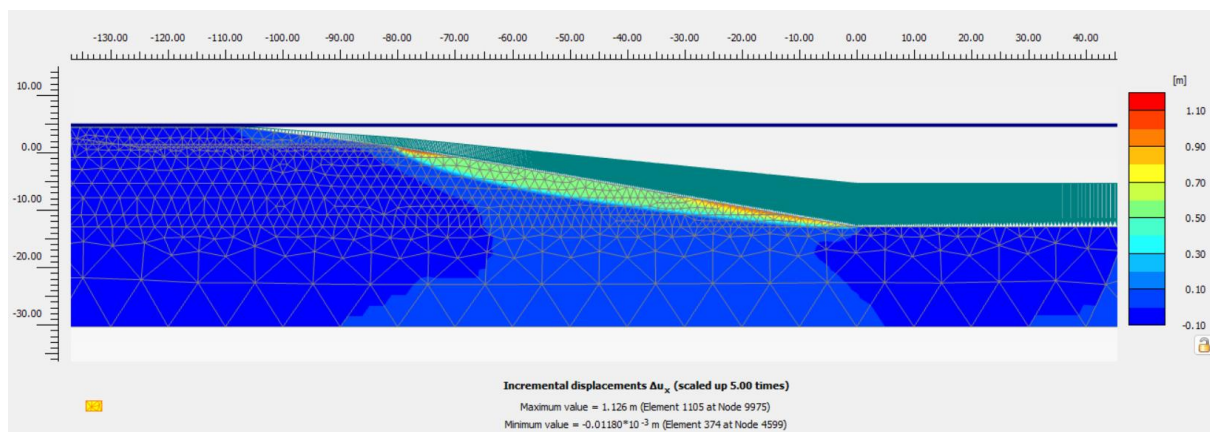


Figure 4.7a: Enlarged EC7 SLS FoS Incremental Displacement Plot (x-direction) – Condition 3

The factor of safety calculated within Condition 4 was of a comparable magnitude to that of Condition 2, due to the HAT level being located in close proximity to the finished level of the reinstated material. From review of the modelling outputs, the failure mechanism was observed to propagate from the transition in gradient between the pre-existing material (graded at 1:6) and the reinstatement material (graded at 1:8). From review of the modelling outputs, the failure mechanism within this condition was observed to propagate from the lower Medium-Dense Sands of the dredge side slope, based upon the profile following the reinstatement works, as shown within Figure 4.8 & 4.8a. With consideration of the phi/c reduction method, factoring down the tangent of the friction angle, utilising the FoS within this condition equates to a friction angle of 9.3° , as calculated from the results of Condition 2.

In line with the obtained results, it is envisaged that under operational and prevailing active water conditions, the slope would likely form an evenly graded slope between the toe and crest of the side slope alignments.

FAIRHURST**Figure 4.8: EC7 SLS FoS Incremental Displacement Plot (x-direction) – Condition 4****Figure 4.8a: Enlarged EC7 SLS FoS Incremental Displacement Plot (x-direction) – Condition 4**

The factor of safety calculated within Condition 5 was of a lesser magnitude than calculated in Condition 6, due to the LAT level being located in very close proximity to the crest of the lower dredge side slope, based upon the pre-existing profile. Within Condition 5 the failure mechanism was observed to propagate from within the Medium-Dense Sand (Silty) as shown within Figure 4.9 & 4.9a. With consideration of the ϕ/c reduction method, factoring down the tangent of the friction angle, utilising the FoS within this condition equates to a friction angle of 11.7° .

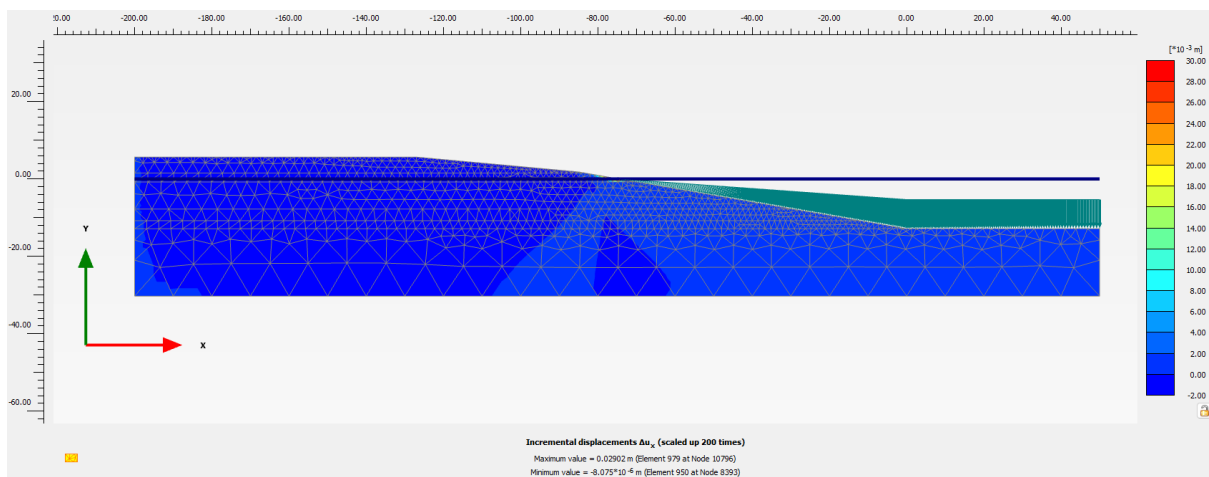


Figure 4.9: EC7 SLS FoS Incremental Displacement Plot (x-direction) – Condition 5

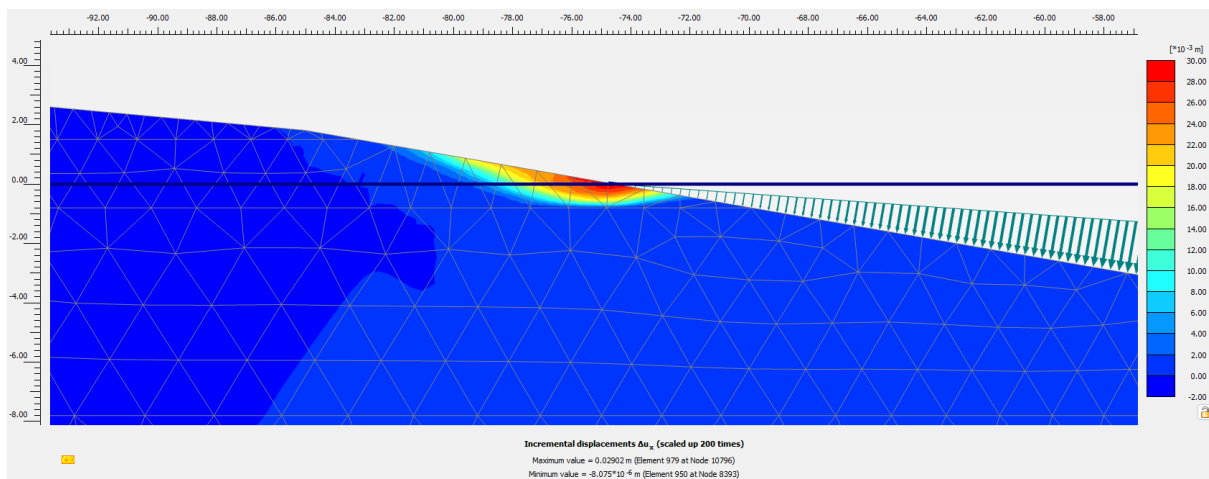


Figure 4.9a: Enlarged EC7 SLS FoS Incremental Displacement Plot (x-direction) – Condition 5

With consideration of Condition 6, the factor of safety at a HAT tidal level was calculated to be of a greater magnitude than that of LAT. This is principally due to the increased friction angle of the shallower deposits. From review of the modelling outputs, the failure mechanism was observed to propagate from the upper section of the dredge side slopes, where the proposed dredging aligns with the existing spit, based upon the pre-existing profile. Within this condition, the failure mechanism was observed to propagate through the Medium-Dense Sand (Silty) as shown within Figure 4.10 & 4.10a. With consideration of the ϕ/c reduction method, factoring down the tangent of the friction angle, utilising the FoS within this condition equates to a friction angle of 9.7° .

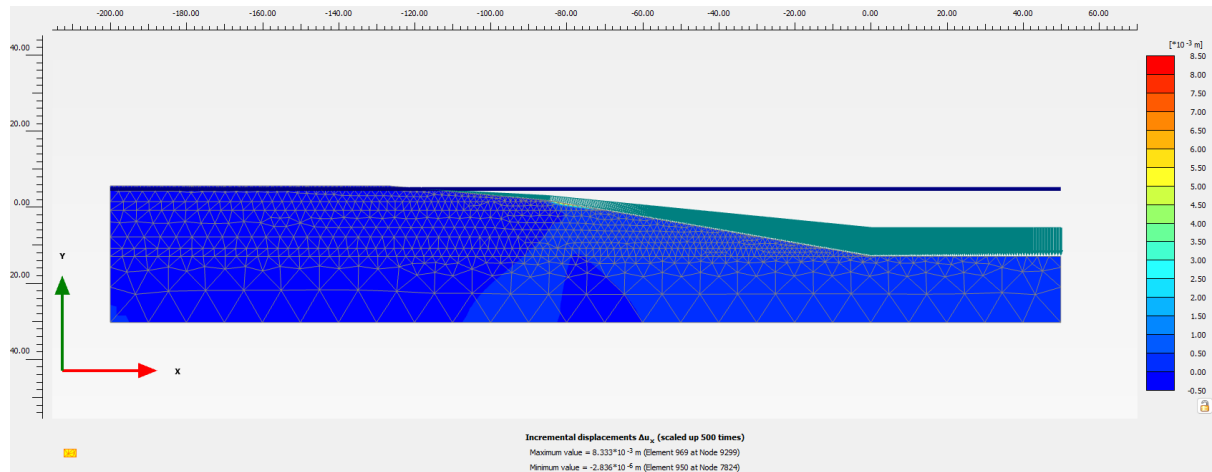


Figure 4.10: EC7 SLS FoS Incremental Displacement Plot (x-direction) – Condition 6

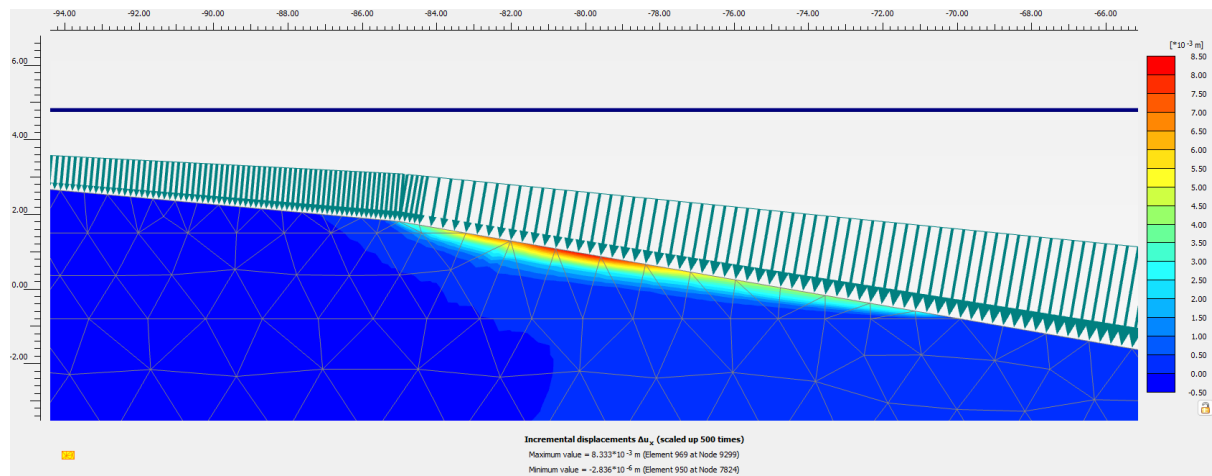


Figure 4.10a: Enlarged EC7 SLS FoS Incremental Displacement Plot (x-direction) – Condition 6

4.4 Assessment Findings Discussion

The enclosed analysis has been undertaken utilising still water conditions, however these findings will require contextualisation in active water conditions. BS6349-1-3:2012 details typical side slopes for Coarse Sands & Fine Sands in both still and active water conditions. These gradients are reproduced within Table 4.2.

Material Type	Typical Side Slope		Ratio of Typical Side Slope
	Still Water	Active Water	
Coarse Sands	20° (1 : 2.75)	10° (1 : 5.67)	2.06 : 1
Fine Sands	15° (1 : 3.73)	5° (1 : 11.43)	3.06 : 1

Table 4.2: Typical side slopes for selected stratification reproduced from BS6349-1.3:2012 (Table 1)

A further variation to the analysis was undertaken to derive the slope angles at which the FoS/ODF of 1.0 are achieved in still water conditions. In line with the particle size distributions from the previous ground investigation undertaken on the spit, a comparison has been made to the slope angles of Fine Sands due to the failure mechanism propagating from the fine grain sands close to the toe of the slope. This has utilised a gradient of 1:2 through the depth of the pre-existing sands whilst a gradient of 1:2.5 was adopted through the depth of reinstated material.

Condition	EC7 DA1 C2 (FoS / ODF)	Required Slope Gradients for Fine Sand in Active Water Conditions (factor = 3.06)
3	1.068	1 : 5.73 – Natural Superficials 1 : 7.16 – Reinstatement Material
4	1.166	1 : 5.25 – Natural Superficials 1 : 6.56 – Reinstatement Material
5	1.030	1 : 5.94 – Natural Superficials
6	1.150	1 : 5.32 – Natural Superficials

Table 4.3: Derived side slopes for active water conditions

From review of the derived side slopes in active water conditions in comparison with the inputted dredge side slopes to the modelling completed, there is a high degree of agreement. The dredge slopes within the natural superficial deposits were modelled at a marginally steeper angle than required based upon BS6349-1-3:2012. Through the depth of reinstatement material, the modelled angle of side slope was marginally shallower than that derived from this standard.

5.0 Conclusions

In conclusion of this initial assessment, it is considered the dredge side slopes within the footprint of Phase 2 may be graded at 1:6 through the depth of natural superficial deposits, whilst the reinstatement material imported to the spit may be graded at 1:8 through their prevailing depth. From review of the existing ground investigation findings from within Phase 1, in conjunction with the surveyed profiles provided by Haventus Group, it can be demonstrated the spit will remain stable when subject to active water conditions at these gradients.

It should be expressly noted the initial assessment findings are undertaken with reference to Chainage 700 & Chainage 1100 within the spit, and further chainages will require analysis in order to review the factor of safety from these locations, whilst reflecting the varying bathymetry and topography throughout the extent of the spit, in conjunction with prevailing tidal levels. Furthermore, in the context of this initial assessment, the impacts of vessel thruster induced scour have not been reviewed, however it is recognised that owing to the typically fine grain granular nature of the natural superficial and reinstatement material within the side slopes, these are highly susceptible to becoming suspended within the channel. These will be reviewed once vessel data has been confirmed.

The findings of this assessment should be read in the context of the following engineering judgements made in preparing this document:

- The ground conditions within the footprint of the Phase 2 are assumed to be broadly comparable to those encountered within Phase 1, with little variation in the material properties, layering and grading of the superficial deposits, including those above MHWS which cannot be investigated due to prevailing protections on the spit;
- The performance of the reinstatement material has been considered to be as stated within Table 3.1. These parameters will require refinement (as necessary), based upon the findings of the Phase 2 Marine Ground Investigation works;
- The bathymetric and topographic data provided by Haventus Group, survey: 'ACAD-NAV-CHAN-Model' are assumed to be an accurate reflection of the existing profile of the spit prior to the reinstatement works. The levels of the reinstatement works are assumed to be reflective of that currently onsite;

In lieu of construction drawings explicitly showing the intent of the reinstatement works, the following risks are highlighted; whilst these can be partially mitigated from ground investigation works, these may remain inherent to the dredged side slopes, where construction drawings of the reinstatement works cannot be provided:

- It is envisaged that in order to prevent planar failure(s) of the dredge slopes, preparatory works entailed benching of the existing natural sands prior to placement of the reinstatement material, thereby mitigating the risk of planar failure which may be induced from a slope inclined towards the proposed channel. Placement upon an inclined slope would significantly increase the likelihood of planar failures as the spit material would not appropriately interlock with the reinstated material;
- Similarly, there is scope for variation in the moisture content of the reinstatement material, from that of its origin location, which may occur through the dredging and placement process. There is an inherent risk that under self-surcharge and settlement, the reinstatement material may fail by piping as the moisture content is pushed to the surface of the slope. From modelling undertaken within this assessment, there is noted to be a marginal degree of settlement which should be anticipated within the reinstatement material. This action is highly subjective to the

permeability of the sands (testing to be undertaken as part of the Phase 2 Marine GI), however the shallower deposits of sands are most vulnerable to this form of failure as a result of the lesser magnitude of self-surcharge;

- In addition, there is also a further risk that shallow piping failure of the dredge slope may occur due to the lack of practicable methods by which to compact the material when placed. As a result, there is potential by which cohesion of the sands (particularly with a higher silt content) may result in the arching of deposited material, which may subsequently be disturbed by variation in tidal levels, passing vessels or prevailing waves within the channel;

6.0 References

BS6349-1-1:2013 – Maritime Works – General – Code of practice for Planning and design of Operations;

BS6349-1-3:2021 – Maritime Works – General – Code of practice for Geotechnical Design;

BS6349-5:2016 – Maritime Works – Code of practice for Dredging & Land Reclamation;

Eurocode 7 - Geotechnical Design - Part 1, General Rules (and National Annex);

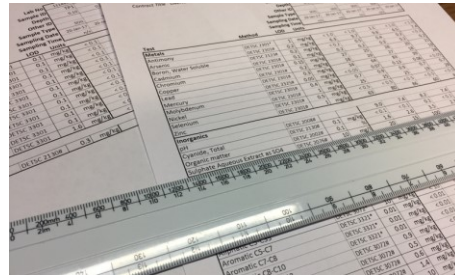
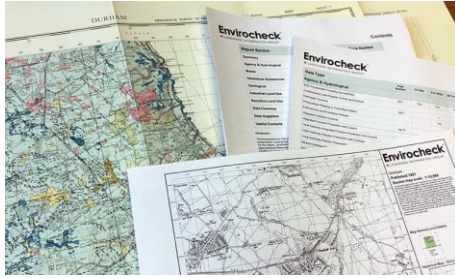
PIANC WG180 (2015) - Guidelines for protecting berthing structures from scour caused by ships;

Mayne, P.W. 2001. Stress-strain-strength-flow parameters from enhanced in-situ tests. Proceedings, International Conference on In-Situ Measurement of Soil Properties & Case Histories [In-Situ 2001], Bali, Indonesia, May 21-24, 2001, pp. 27-48;

Appendix A – Site Investigation Works

Solmek Ltd:

Ardersier Port (Scotland) Ltd, Ardersier Port, Inverness – Factual Site Investigation Report, Issue 4,
Dated: March 2024, Status: Final;



Phase 2: Site Investigation

Ardersier Port, Spit Boreholes, Inverness

Ardersier Port (Scotland) Ltd

S230503

Solmek Ltd

12 Yarm Road
Stockton-on-Tees
TS18 3NA
Tel: 01642 607083

www.solmek.com

info@solmek.com



PHASE 2 SITE INVESTIGATION REPORT

ARDERSIER PORT, SPIT BOREHOLES INVERNESS

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Appendix B:	Borehole Logs
Appendix C:	Geotechnical Laboratory Results
Appendix D:	Falling Head Test Results
Appendix E:	Groundwater Data Log Summary
Appendix F:	Notes on Limitations

Revision	Date	Prepared by	Signed
Final	March 2024	A Cutts <i>Senior Engineering Geologist</i>	[Redacted]
		Checked by	
		R Woods <i>Principal Geotechnical Engineer</i>	[Redacted]
		Approved by	
		R Woods <i>Principal Geotechnical Engineer</i>	[Redacted]

1 INTRODUCTION

1.1 Authorisation

The site investigation described in this report was carried out by Solmek to the instructions of ARUP on behalf of Haventus, Ardersier Port (Scotland) Ltd, on the spit area of land located at Ardersier Port to the east of Inverness.

A site location plan is presented in Appendix A, Figure 1.

1.2 Background & Scope of Works

The port is to become an Energy Transition Facility involving the recycling of old oil rigs to be used as foundations for floating offshore wind farms. The proposed development will also include a concrete production plant using dredged sand from the port inlet.

This phase of works concerns investigating the spit extending into the Moray Firth. A series of boreholes were required along the spit to determine its composition at depth and to provide geotechnical parameters to determine its integrity as a natural breakwater following dredging works in the main channel.

The following steps may be required in the investigation and remediation of potentially contaminated land:

- Phase 1: Desk Study
- Phase 2: Intrusive Investigation
- Phase 3: Remediation Statement
- Phase 4: Validation Reports

Phases 1 and 2 are generally required in the redevelopment of most sites. Phases 3 and 4 are subject to the findings of the initial stages.

A factual geotechnical report (Phase 2) was requested. The fieldwork and testing was generally carried out according to:

- BS 5930:2015+A1:2020 Code of Practice for Ground Investigations
- Rock and soil descriptions shall be in accordance with BS EN ISO 14689-1:2003, BS EN ISO 14688-1:2002 and BS EN ISO 14688-2:2004

This report forms part of a Stage 1 Risk Assessment (Generic Quantitative Risk Assessment) with respect to the Environment Agency's guidance document Environment Agency *Land Contamination Risk Management*, which replaced the now-withdrawn *Contaminated Land Report 11 – Model Procedures for the Management of Land Contamination (2004)*.

The information provided in this report is based on the investigation fieldwork and is subject to the comments and approval of the various regulatory authorities. There may be other conditions prevailing on the site which have not been disclosed by this investigation and which have not been taken into account by this report. Solmek reserve the right to alter conclusions and recommendations should further information be available or provided.

Any schematic representation or opinion of the possible configuration of ground conditions between exploratory holes is conjectural and given for guidance only and confirmation of intermediate ground conditions should be considered if deemed necessary.

2 SITE DESCRIPTION AND FIELDWORK

A initial site inspection, as recommended in BS 5930 and BS 10175, was undertaken on 23rd May 2023.

The site is centred at Ordnance Survey Co-ordinates 280420E, 858666N and lies immediately north east of Ardersier Port dock area. The spit is of generally sand and gravel construction which lies parallel to the dock side extending into the mouth of the Moray Firth.

2.1 Fieldwork

The drilling fieldwork was carried out between 23rd May and 6th July 2023. The extent of the investigation was:

- 5no. cable percussive boreholes (BHSP05 to BHSP09 inclusive) drilled to a maximum depth of 40.00m below ground level (bgl).
 - The boreholes were positioned by the client to target areas along the length of the spit in order to assess the deep ground conditions.
- Groundwater monitoring wells were installed in 2no. boreholes (BHSP07 & BHSP08).
 - Groundwater data logging was undertaken between October 2023 and February 2024 (Appendix E).
 - Falling head testing in BHSP07 & BHSP08 (Appendix D).
- In-situ testing in the boreholes as Standard Penetration Tests (SPTs).
- Retrieval of disturbed and undisturbed samples (attempted) for geotechnical testing.

The boreholes were backfilled with bentonite grout and monitoring installations upon completion.

Descriptions of the strata encountered in the boreholes together with details of sampling and groundwater are presented in Appendix B of this report.

A plan showing all exploratory locations can be found in Appendix A, Figure 2. It should be noted that these are indicative locations and have not, as yet, been surveyed.

3 GROUND CONDITIONS

A summary of the ground conditions encountered is given below.

3.1 Made Ground Deposits

Not proven.

3.2 Superficial Deposits

The superficial deposits generally comprised the following stratum units.

TABLE 1: NATURAL SUPERFICIAL GEOLOGY

Stratum	Base Depth (mbgl)	Details
Sandy GRAVEL	2.40-2.70mbgl	Noted from surface level in SPBH05 & SPBH08. Medium dense to dense light brown to dark grey slightly sandy to very sandy gravel with occasional inferred cobbles. The gravel and cobble fractions consisted of mixed lithologies including sandstone, limestone and mudstone.
Gravelly SAND	5.00-9.00mbgl	Noted in SPBH09. Dense brown and grey slightly gravelly to gravelly sand. The gravel fractions consisted of mixed lithologies including sandstone, limestone and mudstone.
Silty sandy GRAVEL	5.00-27.00mbgl	Medium dense to dense light brown to dark grey slightly silty very sandy gravel. The gravel fractions consisted of mixed lithologies including sandstone, limestone and mudstone.
Silty gravelly SAND	1.50-35.00mbgl	One of the main stratum units, this comprised very loose to very dense light brown to dark grey locally black slightly silty to silty slightly gravelly to very gravelly sand. The gravel fractions consisted of mixed lithologies including sandstone, limestone, mudstone and shell fragments.
Silty SAND	2.40-40.00mbgl	One of the main stratum units, this comprised medium dense to very dense light brown to dark grey slightly silty to silty sand.

3.3 Bedrock

Not proven.

3.4 Groundwater

Groundwater strikes are shown in Table 2 below.

TABLE 2: GROUNDWATER RECORDS FROM BOREHOLES DURING FIELDWORK

Location	Depth of Strike (mbgl)	Stratum
BHSP05	3.60	Silty SAND
BHSP06	4.50	Silty gravelly SAND
BHSP07	6.40	Silty gravelly SAND
BHSP08	3.10	Silty gravelly SAND
BHSP09	3.20	Silty sandy GRAVEL

The rapid rate of advancement of the exploratory holes may mask minor seepages and it should be borne in mind that water levels fluctuate with a number of influences including tides, season, rainfall, dewatering and pumping activities.

Therefore, water levels significantly higher than those found during this investigation may be encountered.

4 GEOTECHNICAL TESTING

Samples taken from the boreholes underwent a series of geotechnical tests to aid design and soil description.

In addition, insitu Standard Penetration Tests (SPTs) were undertaken at regular intervals during drilling.

4.1 Laboratory Testing

The full scope of the laboratory testing (requested by ARUP) is presented below along with the respective testing laboratories.

The results are presented in Appendix D with a summary of selected geotechnical properties by depth range presented in Table 3.

G2M Testing Ltd, 12-16 Yarm Rd, Stockton on Tees, TS18 3NA

- 77no. Moisture Contents
- 77no. Particle Size Distribution

Geolabs, Bucknalls Lane, Watford, Hertfordshire, WD25 9XX

- 20no. Min/Max Relative Density
- 11no. Shear Box Tests (set of three specimens per test)
- 9no. Consolidated Drained Multistage Triaxial Compression Tests

TABLE 3: SUMMARY OF GEOTECHNICAL TEST DATA BY DEPTH

General Stratigraphy	Depth Range (mbgl)		Test Type	Parameters Range
	From	To		
Sandy GRAVEL Gravelly SAND Silty sandy GRAVEL Silty gravelly SAND Silty SAND	0.00	10.00	SPT N Value	11-45
			Moisture Content	1.80-23%
			(Min) Max Dry Density	(1.20-1.30g/cm ³) 1.58-1.65g/cm ³
			Small Shear Box Φ (Ap Cohesion)	33.5-39° (1-6kPa)
			Sand Con Drained Tx Φ (Cohesion)	36-39.5° (3.30kPa)
Silty sandy GRAVEL Silty gravelly SAND Silty SAND	10.00	20.00	SPT N Value	2-50
			Moisture Content	18-32%
			(Min) Max Dry Density	(1.13-1.22g/cm ³) 1.54-1.65g/cm ³
			Small Shear Box Φ (Ap Cohesion)	32.5-35° (1-9kPa)
			Sand Con Drained Tx Φ (Cohesion)	35-37° (0-3.60kPa)
Silty sandy GRAVEL Silty gravelly SAND Silty SAND	20.00	30.00	SPT N Value	20-50
			Moisture Content	9.30-25%
			(Min) Max Dry Density	(1.13-1.24g/cm ³) 1.60-1.71g/cm ³
			Small Shear Box Φ (Ap Cohesion)	33-37.5° (1-9kPa)
			Sand Con Drained Tx Φ (Cohesion)	34° (0kPa)
Silty sandy GRAVEL Silty gravelly SAND Silty SAND	30.00	40.00	SPT N Value	29-50
			Moisture Content	14-26%

4.2 Percolation Tests

A series of falling head tests were undertaken in BHSP07 & BHSP08 across the site. The boreholes were filled with water and the time for the water to fall back to natural groundwater level was recorded.

Table 4 summarises the range of soil infiltration rates.

TABLE 4 : SUMMARY OF FALLING HEAD TESTS

Borehole (Depth)	Soil Infiltration Rate (x 10 ⁻⁶ ms)
BHSP07 (10.00mbgl)	0.0103
BHSP07 (20.00mbgl)	0.00795
BHSP07 (35.00mbgl)	0.000895
BHSP08 (10.00mbgl)	0.000935
BHSP08 (21.00mbgl)	0.000120

The full results are presented in Appendix D.

5 GROUNDWATER MONITORING

During the site investigation works, groundwater monitoring wells were installed within SPBH07 & SPBH08, at the request of ARUP. Data loggers were placed into the wells and were monitored over a four month period between October 2023 and February 2024 with readings taken every 15 minutes.

A summary of the results is presented in Appendix E.

SOLMEK

APPENDIX A



12-16 Yarm Road, Stockton on Tees, TS18 3NA
Tel: 01642 607083 Email: info@solmek.com

Figure Title

Site Location Plan

Project Number

S230503

Project Name

Spit Boreholes - Ardersier Port, Inverness

Client

Ardersier Port

Date

March 2024

DRG Number

Figure 1

Scale

1:51500 @ A4 [DO NOT SCALE]

Legend Key

 Project Bounds - Project Bounds



12-16 Yarm Road, Stockton on Tees, TS18 3NA
Tel: 01642 607083 Email: info@solmek.com

Figure Title

BH Location Plan

Project Number

S230503

Project Name

Spit Boreholes - Ardersier Port, Inverness

Client

Ardersier Port

Date

March 2024

DRG Number

Figure 2

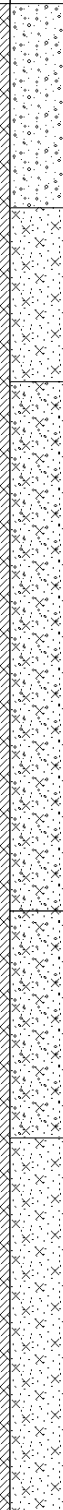
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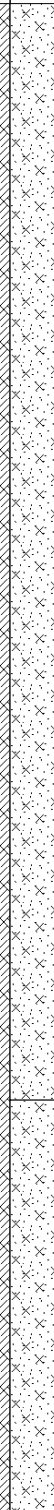
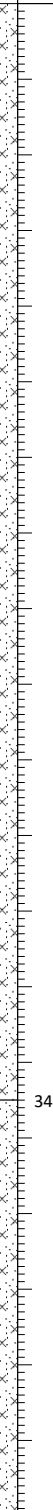
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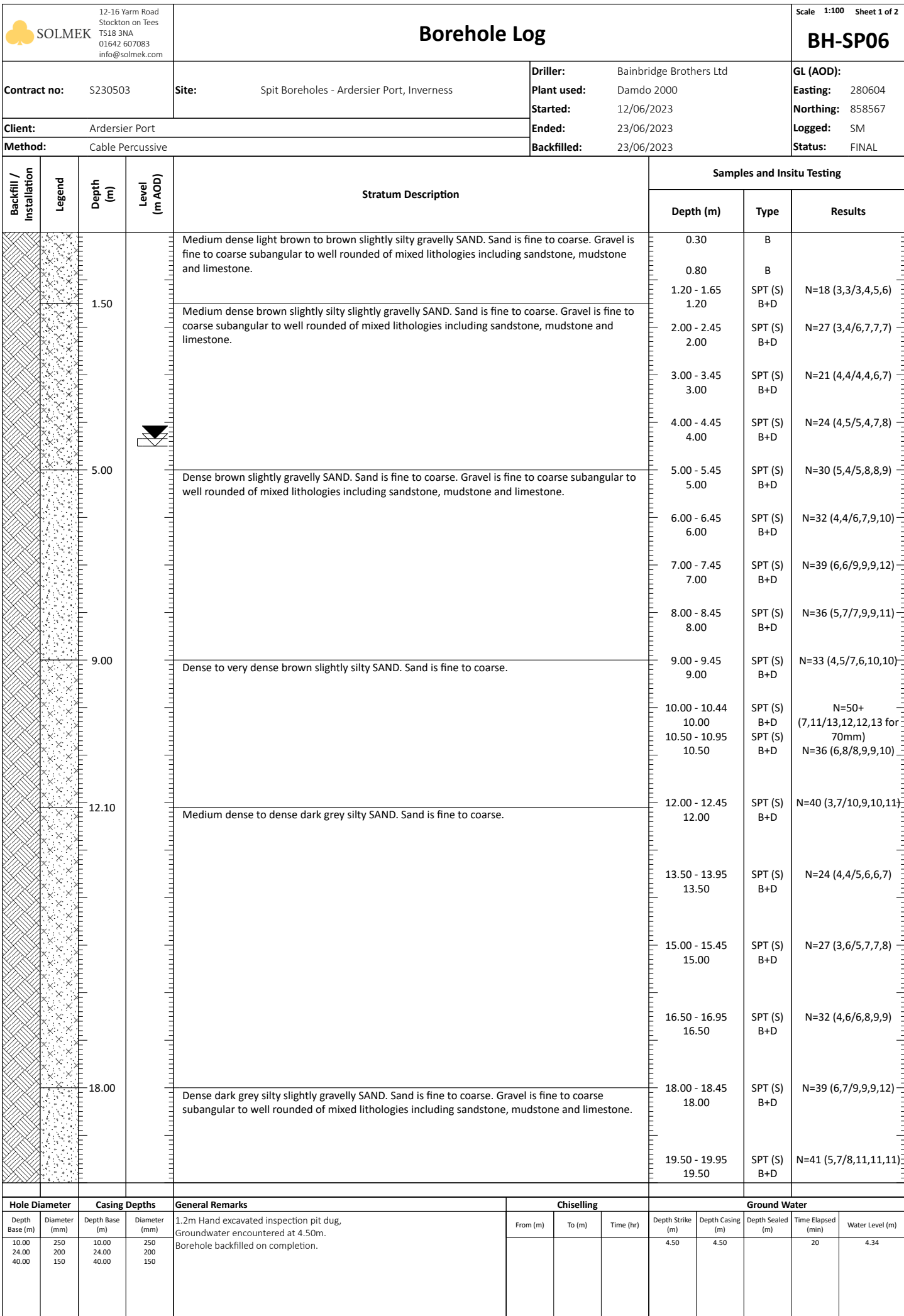
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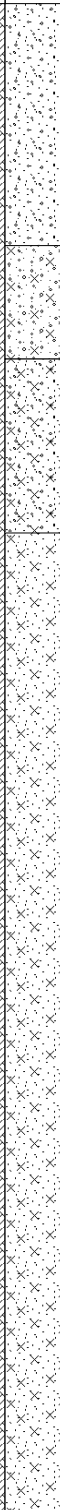
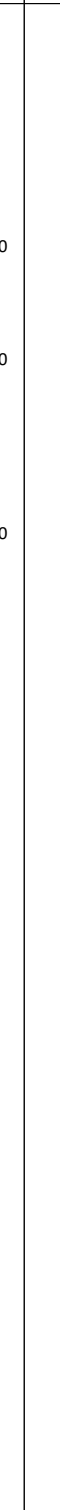
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-  Project Bounds - Project Bounds

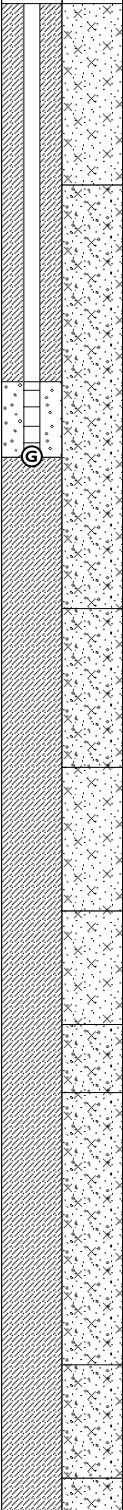
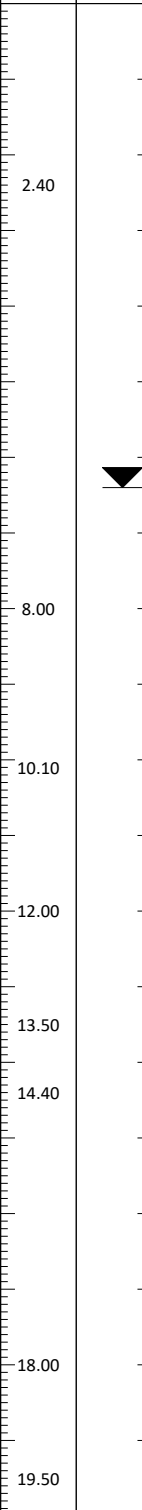
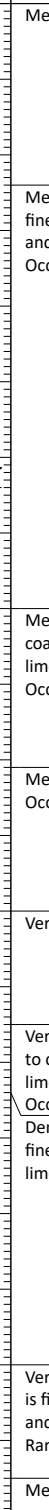
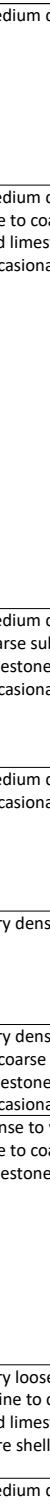
APPENDIX B

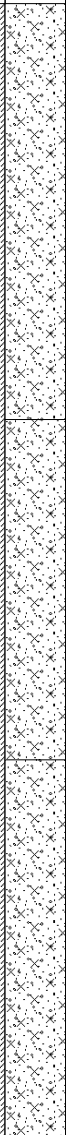
 SOLMEK 12-16 Yarm Road Stockton on Tees TS18 3NA 01642 607083 info@solmek.com				Borehole Log						Scale 1:100 Sheet 1 of 2 BH-SP05			
Contract no: S230503				Site: Spit Boreholes - Ardersier Port, Inverness				Driller: Bainbridge Brothers Ltd			GL (AOD):		
								Plant used: Dando 2000			Easting: 280799		
Client: Ardersier Port								Started: 23/06/2023			Northing: 858470		
Method: Cable Percussive								Ended: 06/07/2023			Logged: SM		
								Backfilled: 06/07/2023			Status: FINAL		
Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description	Samples and Insitu Testing								
					Depth (m)		Type	Results					
				Dense dark grey to greyish brown slightly sandy GRAVEL with an inferred low cobble content. Sand is fine to coarse. Gravel is fine to coarse subangular to well rounded of mixed lithologies including sandstone, mudstone and limestone. Cobbles are subrounded to rounded of mixed lithologies including sandstone, mudstone, limestone.	0.30	B							
				0.80	B								
				1.20 - 1.65	SPT (S)	N=30 (3,6/7,7,8,8)							
				1.20	B + D								
				2.00 - 2.45	SPT (S)	N=39 (4,9/9,9,10,11)							
				2.00	B + D								
				3.00 - 3.45	SPT (S)	N=13 (1,1/2,2,4,5)							
				3.00	B + D								
				4.00 - 4.45	SPT (S)	N=17 (2,2/3,3,4,7)							
				4.00	B + D								
				5.00 - 5.45	SPT (S)	N=22 (1,2/4,5,5,8)							
				5.00	B + D								
				6.00 - 6.45	SPT (S)	N=12 (2,3/3,2,3,4)							
				6.00	B + D								
				7.00 - 7.45	SPT (S)	N=19 (2,3/3,5,6,5)							
				7.00	B + D								
				8.00 - 8.45	SPT (S)	N=21 (3,5/5,5,6,5)							
				8.00	B + D								
				9.00 - 9.45	SPT (S)	N=25 (3,4/5,7,7,6)							
9.00				B + D									
10.00 - 10.45		SPT (S)		N=19 (2,3/3,4,6,6)									
10.00	B + D												
10.50 - 10.95	SPT (S)	N=28 (2,4/7,7,7,7)											
10.50	B + D												
12.00													
Medium dense to dense dark grey to brown slightly silty slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to well rounded of mixed lithologies including sandstone, mudstone and limestone.	12.00 - 12.45	SPT (S)	N=37 (3,5/8,8,9,12)										
	12.00	B + D											
	13.50 - 13.95	SPT (S)	N=29 (4,7/7,6,7,9)										
	13.50	B + D											
15.00													
Dense dark grey slightly silty SAND. Sand is fine to coarse.	15.00 - 15.45	SPT (S)	N=30 (2,2/5,7,7,11)										
	15.00	B + D											
	16.50 - 16.95	SPT (S)	N=38 (3,8/8,9,9,12)										
	16.50	B + D											
	18.00 - 18.45	SPT (S)	N=42 (7,9/9,11,10,12)										
	18.00	B + D											
	19.50 - 19.95	SPT (S)	N=32 (6,6/7,8,8,9)										
	19.50	B + D											
General Remarks					Chiselling			Ground Water					
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	1.2m Hand excavated inspection pit dug. Groundwater encountered at 3.60m. Borehole backfilled on completion.	From (m)	To (m)	Time (hr)	Depth Strike (m)	Depth Casing (m)	Depth Sealed (m)	Time Elapsed (min)	Water Level (m)	
10.00	250	10.00	250					3.60	3.60		20	3.55	
22.50	200	22.50	200										
40.00	150	40.00	150										

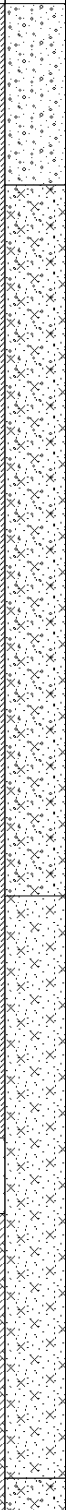
 SOLMEK 12-16 Yarm Road Stockton on Tees TS18 3NA 01642 607083 info@solmek.com				Borehole Log				Scale 1:100 Sheet 2 of 2 BH-SP05							
Contract no: S230503				Site: Spit Boreholes - Ardersier Port, Inverness				Driller: Bainbridge Brothers Ltd Plant used: Dando 2000 Started: 23/06/2023 Ended: 06/07/2023 Backfilled: 06/07/2023				GL (AOD): Easting: 280799 Northing: 858470 Logged: SM Status: FINAL			
Client: Ardersier Port															
Method: Cable Percussive															
Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description	Samples and Insitu Testing										
					Depth (m)	Type	Results								
				Dense dark grey slightly silty SAND. Sand is fine to coarse.	21.00 - 21.45 21.00	SPT (S) B + D	N=36 (7,7/7,9,9,11)								
					22.50 - 22.95 22.50	SPT (S) B + D	N=35 (4,6/8,9,9,9)								
					24.00 - 24.45 24.00	SPT (S) B + D	N=39 (7,9/10,9,10,10)								
					25.50 - 25.95 25.50	SPT (S) B + D	N=32 (3,6/7,8,7,10)								
					27.00 - 27.45 27.00	SPT (S) B + D	N=41 (5,7/9,10,10,12)								
					28.50 - 28.95 28.50	SPT (S) B + D	N=41 (8,8/9,11,11,10)								
					30.00 - 30.45 30.00	SPT (S) B + D	N=44 (2,4/7,9,13,15)								
					31.50 - 31.95 31.50	SPT (S) B + D	N=37 (5,9/9,9,9,10)								
					33.00 - 33.45 33.00	SPT (S) B + D	N=36 (10,9/9,8,9,10)								
					34.50 - 34.94 34.50	SPT (S) B + D	N=50+ (4,13/13,14,16,7 for 70mm)								
					36.00 - 36.45 36.00	SPT (S) B + D	N=31 (5,5/5,8,8,10)								
					37.50 - 37.95 37.50	SPT (S) B + D	N=43 (4,6/8,11,11,13)								
					39.00 - 39.44 39.00	SPT (S) B + D	N=50+ (7,8/9,10,15,16 for 65mm)								
				40.00				End of Borehole at 40.000m							
Hole Diameter				Casing Depths		General Remarks			Chiselling			Ground Water			
Depth Base (m)		Diameter (mm)		Depth Base (m)	Diameter (mm)	1.2m Hand excavated inspection pit dug. Groundwater encountered at 3.60m. Borehole backfilled on completion.			From (m)	To (m)	Time (hr)	Depth Strike (m)	Depth Casing (m)	Depth Sealed (m)	Time Elapsed (min)
10.00	250	10.00	250							3.60	3.60		20	3.55	
22.50	200	22.50	200												
40.00	150	40.00	150												

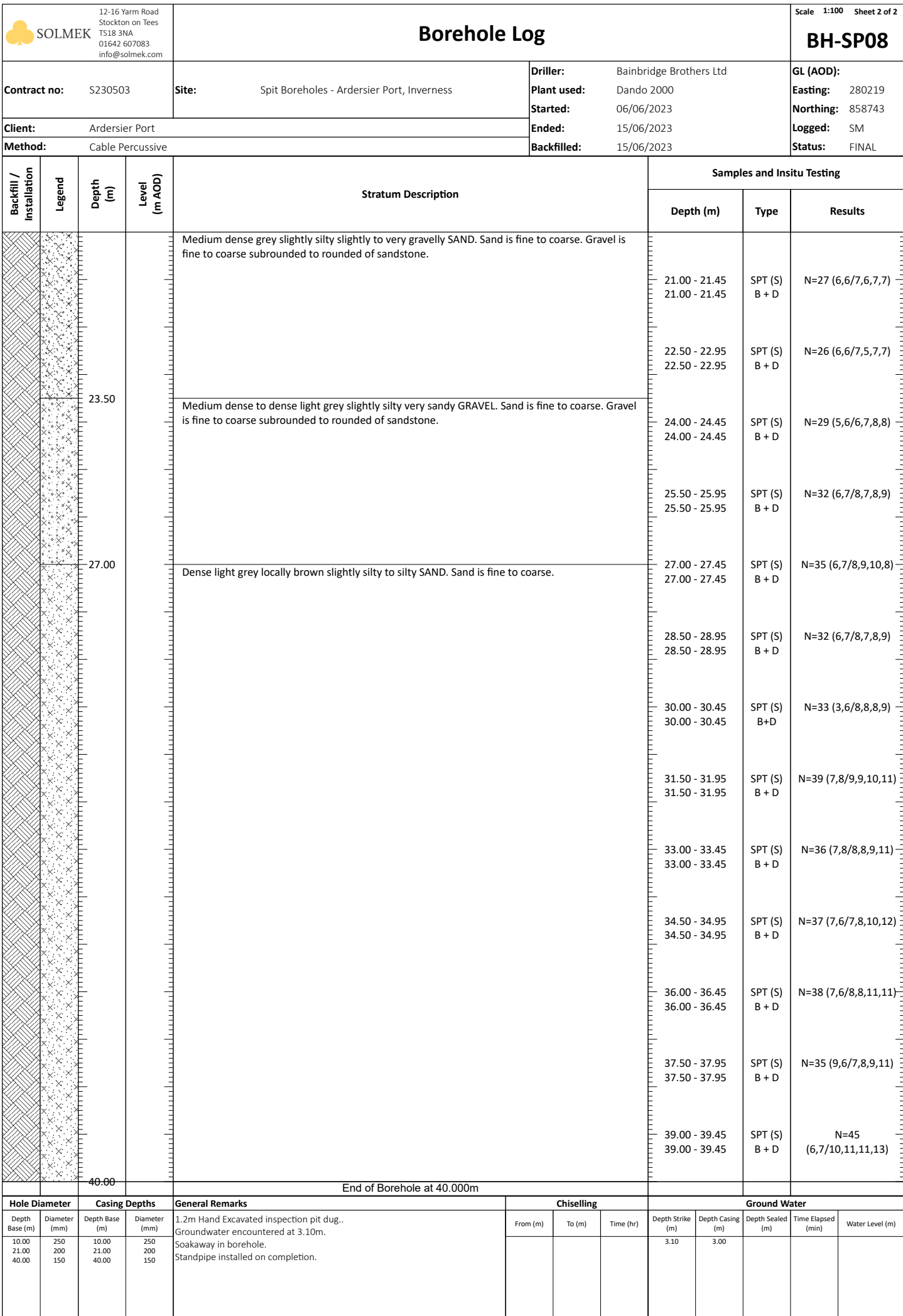


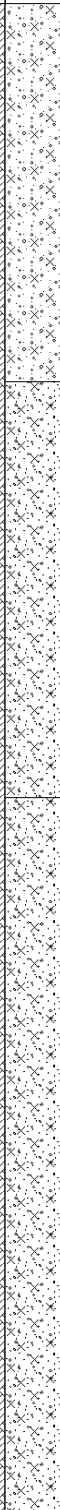
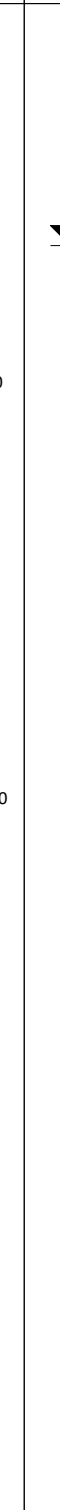
 SOLMEK 12-16 Yarm Road Stockton on Tees TS18 3NA 01642 607083 info@solmek.com				Borehole Log				Scale 1:100 Sheet 2 of 2 BH-SP06					
Contract no: S230503		Site: Spit Boreholes - Ardersier Port, Inverness			Driller: Bainbridge Brothers Ltd		GL (AOD):						
					Plant used: Damdo 2000		Easting: 280604						
Client: Ardersier Port					Started: 12/06/2023		Northing: 858567						
Method: Cable Percussive					Ended: 23/06/2023		Logged: SM						
					Backfilled: 23/06/2023		Status: FINAL						
Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description	Samples and Insitu Testing								
					Depth (m)	Type	Results						
				Dense dark grey silty slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to well rounded of mixed lithologies including sandstone, mudstone and limestone.	21.00 - 21.45 21.00	SPT (S) B+D	N=36 (7,6/8,9,9,10)						
				22.50 - 22.95 22.50	SPT (S) B+D	N=42 (8,9/9,10,10,13)							
				Dense dark grey slightly silty very sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse subrounded to rounded of sandstone.	24.00 - 24.45 24.00	SPT (S) B+D	N=41 (5,7/7,12,12,10)						
				Dense dark grey silty slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to well rounded of mixed lithologies including sandstone, mudstone and limestone.	25.50 - 25.95 25.50	SPT (S) B+D	N=40 (6,9/10,10,10,10)						
				Dense to very dense dark grey slightly silty SAND.	27.00 - 27.45 27.00	SPT (S) B+D	N=43 (9,9/11,10,11,11)						
				28.50 - 28.94 28.50	SPT (S) B+D	N=50+ (7,10/10,11,17,12 for 60mm)							
				30.00 - 30.44 30.00	SPT (S) B+D	N=50+ (6,7/7,13,15,15 for 65mm)							
				31.50 - 31.95 31.50	SPT (S) B+D	N=38 (7,8/8,9,10,11)							
				33.00 - 33.44 33.00	SPT (S) B+D	N=50+ (9,10/9,17,17,7 for 70mm)							
				34.50 - 34.78 34.50	SPT (S) B+D	N=50+ (4,11/27,23 for 50mm)							
				36.00 - 36.37 36.00	SPT (S) B+D	N=50+ (5,8/19,24,7 for 70mm)							
				37.50 - 37.77 37.50	SPT (S) B+D	N=50+ (11,13/26,24 for 45mm)							
				39.00 - 39.44 39.00	SPT (S) B+D	N=50+ (2,5/8,15,16,11 for 70mm)							
				40.00	End of Borehole at 40.000m								
Hole Diameter		Casing Depths			General Remarks	Chiselling			Ground Water				
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	From (m)		To (m)	Time (hr)	Depth Strike (m)	Depth Casing (m)	Depth Sealed (m)	Time Elapsed (min)	Water Level (m)	
10.00	250	10.00	250	1.2m Hand excavated inspection pit dug, Groundwater encountered at 4.50m. Borehole backfilled on completion.					4.50	4.50		20	4.34
24.00	200	24.00	200										
40.00	150	40.00	150										

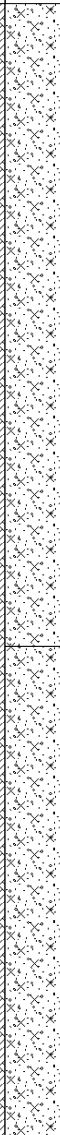
 12-16 Yarm Road Stockton on Tees TS18 3NA 01642 607083 info@solmek.com				Borehole Log				Scale 1:100 Sheet 1 of 2 BH-SP07				
Contract no: S230503		Site: Spit Boreholes - Ardersier Port, Inverness			Driller: Bainbridge Brothers Ltd		GL (AOD):					
					Plant used: Dando 2000		Easting: 280420					
Client: Ardersier Port					Started: 20/06/2023		Northing: 858666					
Method: Cable Percussive					Ended: 29/06/2023		Logged: SM					
					Backfilled: 29/06/2023		Status: FINAL					
Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description	Samples and Insitu Testing							
					Depth (m)	Type	Results					
				Medium dense light brown slightly silty SAND. Sand is fine to coarse.	0.20 - 0.30	B						
					0.70 - 0.80	B						
					1.20 - 1.65	SPT (S)	N=11 (2,3/3,3,2,3)					
					1.20 - 1.65	B + D						
					2.00 - 2.45	SPT (S)	N=16 (2,3/3,4,5,4)					
					2.00 - 2.45	B + D						
				Medium dense light brown slightly silty slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to well rounded of mixed lithologies including sandstone, mudstone and limestone. Occasional shell fragments noted, frequent fine to coarse coal gravels noted.	3.00 - 3.45	SPT (S)	N=18 (3,4/5,4,5,4)					
					3.00 - 3.45	B + D						
					4.00 - 4.45	SPT (S)	N=20 (4,5/4,5,6,5)					
					4.00 - 4.45	B + D						
					5.00 - 5.45	SPT (S)	N=20 (4,6/4,5,5,6)					
					5.00 - 5.45	B + D						
					6.00 - 6.45	SPT (S)	N=26 (4,6/7,6,7,6)					
					6.00 - 6.45	B + D						
					7.00 - 7.45	SPT (S)	N=27 (6,7/6,6,7,8)					
					7.00 - 7.45	B + D						
				Medium dense light brown slightly silty gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to well rounded of mixed lithologies including sandstone, mudstone and limestone. Occasional shell fragments noted, frequent fine to coarse coal gravels noted.	8.00 - 8.45	SPT (S)	N=24 (4,5/5,6,6,7)					
					8.00 - 8.45	B + D						
					9.00 - 9.45	SPT (S)	N=29 (6,7/9,8,7,5)					
					9.00 - 9.45	B + D						
				Medium dense grey and locally light brown slightly silty SAND. Sand is fine to coarse. Occasional shell fragments noted.	10.10 - 10.20	B						
					10.50 - 10.95	SPT (S)	N=15 (1,1/0,5,5,5)					
					10.50 - 10.95	B + D						
				Very dense grey slightly silty SAND. Sand is fine to coarse.	12.00 - 12.36	SPT (S)	N=50+ (5,8/14,16,20 for 60mm)					
					12.00 - 12.45	B + D						
				Very dense grey and locally light brown silty gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to well rounded of mixed lithologies including sandstone, mudstone and limestone. Occasional shell fragments noted.	13.50 - 13.88	SPT (S)	N=50+ (6,8/10,15,23,2 for 2mm)					
					13.50 - 13.95	B + D						
				Dense to very dense dark grey slightly silty slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to rounded of mixed lithologies including sandstone, mudstone and limestone.	15.00 - 15.36	SPT (S)	N=50+ (6,7/13,17,20 for 55mm)					
					15.00 - 15.45	B + D						
					16.50 - 16.95	SPT (S)	N=37 (4,7/8,10,9,10)					
					16.50 - 16.95	B + D						
				Very loose dark grey locally grey slightly silty slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to well rounded of mixed lithologies including sandstone, mudstone and limestone. Rare shell fragments noted. Frequent fine to coarse coal gravels noted.	18.00 - 18.45	SPT (S)	N=2 (1,1/0,1,0,1)					
					18.00 - 18.45	B + D						
				Medium dense dark grey locally grey slightly silty slightly gravelly SAND. Sand is fine to coarse.	19.50 - 19.95	SPT (S)	N=19 (2,3/5,5,4,5)					
					19.50 - 19.95	B + D						
Hole Diameter		Casing Depths		General Remarks			Chiselling			Ground Water		
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	1.2m Hand excavated inspection pit dug. Groundwater encountered at 6.40m. Soakaway in borehole. Standpipe installed on completion.			From (m)	To (m)	Time (hr)	Depth Strike (m)	Depth Casing (m)	Depth Sealed (m)
10.00	250	10.00	250							6.40	6.40	
20.00	200	19.50	200									
35.00	150	34.50	150									

 12-16 Yarm Road Stockton on Tees TS18 3NA 01642 607083 info@solmek.com				Borehole Log						Scale 1:100 Sheet 2 of 2 BH-SP07			
Contract no: S230503				Site: Spit Boreholes - Ardersier Port, Inverness				Driller: Bainbridge Brothers Ltd Plant used: Dando 2000 Started: 20/06/2023 Ended: 29/06/2023 Backfilled: 29/06/2023		GL (AOD): Easting: 280420 Northing: 858666 Logged: SM Status: FINAL			
Client: Ardersier Port				Method: Cable Percussive									
Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description	Samples and Insitu Testing								
					Depth (m)		Type	Results					
				Medium dense dark grey locally grey slightly silty slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to well rounded of mixed lithologies including sandstone, mudstone and limestone. Rare shell fragments noted. Frequent fine to coarse coal gravels noted.	21.00 - 21.45 21.00 - 21.45		SPT (S) B + D	N=20 (3,4/4,5,6,5)					
				22.50 - 22.95 22.50 - 22.95		SPT (S) B + D	N=24 (5,4/5,6,6,7)						
				24.00 - 24.45 24.50 - 24.95 24.50 - 24.95		U SPT (S) B + D	82 blows [NR] N=25 (4,5/6,6,7,6)						
				25.50 - 25.95 25.50 - 25.95		SPT (S) B + D	N=22 (4,5/5,6,5,6)						
				27.00 - 27.45 27.00 - 27.45		SPT (S) B + D	N=24 (5,6/6,6,5,7)						
				28.50 - 28.95 28.50 - 28.95		SPT (S) B + D	N=28 (6,5/7,6,7,8)						
				30.00 - 30.45 30.00 - 30.45		SPT (S) B + D	N=30 (6,4/7,6,7,10)						
				31.50 - 31.95 31.50 - 31.95		SPT (S) B + D	N=42 (6,7/9,10,12,11)						
				33.00 - 33.45 33.00 - 33.45		SPT (S) B + D	N=41 (5,6/8,9,11,13)						
				34.50 - 34.95 34.50 - 34.95		SPT (S) B + D	N=38 (5,7/7,8,11,12)						
				End of Borehole at 35.000m									

12-16 Yarm Road Stockton on Tees TS18 3NA 01642 607083 info@solmek.com Borehole Log				Scale 1:100 Sheet 1 of 2								
BH-SP08												
Contract no: S230503		Site: Spit Boreholes - Ardersier Port, Inverness		Driller: Bainbridge Brothers Ltd		GL (AOD):						
				Plant used: Dando 2000		Easting: 280219						
Client: Ardersier Port				Started: 06/06/2023		Northing: 858743						
Method: Cable Percussive				Ended: 15/06/2023		Logged: SM						
				Backfilled: 15/06/2023		Status: FINAL						
Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description	Samples and Insitu Testing							
					Depth (m)		Type	Results				
		2.40		Medium dense light brown very sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse subangular to well rounded of mixed lithologies including sandstone, mudstone and limestone. Becoming silty below 2.00m.	0.30 - 0.40	B						
				0.80 - 0.90	B							
				1.20 - 1.65	SPT (S)	N=20 (4,9/6,5,5,4)						
				1.20 - 1.65	B+D							
				2.00 - 2.45	SPT (S)	N=16 (2,3/2,5,4,5)						
				2.00 - 2.45	B+D							
				Medium dense light brown slightly silty slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to well rounded of mixed lithologies including sandstone, mudstone and limestone. Dense at 10.00m.	3.00 - 3.45	SPT (S)	N=15 (1,1/1,2,5,7)					
				3.00 - 3.45	B+D							
				4.00 - 4.45	SPT (S)	N=22 (3,4/5,5,5,7)						
				4.00 - 4.45	B+D							
				5.00 - 5.45	SPT (S)	N=27 (3,5/6,6,7,8)						
				5.00 - 5.45	B+D							
				6.00 - 6.45	SPT (S)	N=29 (1,4/7,7,6,9)						
				6.00 - 6.45	B+D							
				7.00 - 7.45	SPT (S)	N=18 (1,3/2,5,5,6)						
				7.00 - 7.45	B+D							
				8.00 - 8.45	SPT (S)	N=29 (4,5/6,5,9,9)						
				8.00 - 8.45	B+D							
				9.00 - 9.45	SPT (S)	N=29 (2,4/4,7,8,10)						
				9.00 - 9.45	B+D							
10.00 - 10.45	SPT (S)	N=36 (5,5/8,9,10,9)										
10.00 - 10.45	B+D											
10.50 - 10.95	SPT (S)	N=18 (3,4/4,5,4,5)										
10.50 - 10.95	B+D											
11.80				Medium dense light grey locally brown slightly silty SAND. Sand is fine to coarse. Gravelly at 13.50m.	11.80 - 11.90	B						
				12.00 - 12.45	SPT (S)	N=20 (4,3/4,5,5,6)						
				12.00 - 12.45	B + D							
				13.50 - 13.95	SPT (S)	N=22 (4,4/5,6,5,6)						
				13.50 - 13.95	B + D							
				15.00 - 15.45	SPT (S)	N=20 (5,4/5,5,4,6)						
				15.00 - 15.45	B + D							
				16.50 - 16.95	SPT (S)	N=25 (4,5/6,6,6,7)						
				16.50 - 16.95	B + D							
				18.00 - 18.45	SPT (S)	N=21 (5,6/4,5,6,6)						
18.00 - 18.45	B + D											
19.50				Medium dense grey slightly silty slightly to very gravelly SAND. Sand is fine to coarse. Gravel is	19.50 - 19.95	SPT (S)	N=21 (6,7/4,6,5,6)					
				19.50	B + D							
Hole Diameter	Casing Depths			General Remarks	Chiselling			Ground Water				
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)		From (m)	To (m)	Time (hr)	Depth Strike (m)	Depth Casing (m)	Depth Sealed (m)	Time Elapsed (min)	Water Level (m)
10.00	250	10.00	250					3.10	3.00			
21.00	200	21.00	200									
40.00	150	40.00	150									



 12-16 Yarm Road Stockton on Tees TS18 3NA 01642 607083 info@solmek.com				Borehole Log				Scale 1:100 Sheet 1 of 2 BH-SP09						
Contract no: S230503		Site: Spit Boreholes - Ardersier Port, Inverness			Driller: Bainbridge Brothers Ltd		GL (AOD):							
					Plant used: Dando 2000		Easting: 280060							
Client: Ardersier Port					Started: 23/05/2023		Northing: 858762							
Method: Cable Percussive					Ended: 26/05/2023		Logged: SM							
					Backfilled: 26/05/2023		Status: FINAL							
Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description	Samples and Insitu Testing									
					Depth (m)	Type	Results							
				Medium dense to dense light brown to grey slightly silty very sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse subangular to very well rounded of mixed lithologies including sandstone, mudstone and limestone.	0.50 - 0.60	B								
				1.00 - 1.45	SPT (S)	N=25 (9,8/7,6,6,6)								
				1.00 - 1.45	B + D									
				2.00 - 2.45	SPT (S)	N=23 (4,6/7,5,5,6)								
				2.00 - 2.45	B + D									
				3.00 - 3.45	SPT (S)	N=45 (3,5/6,7,20,12)								
				3.00 - 3.45	B + D									
				4.00 - 4.45	SPT (S)	N=14 (4,4/3,3,4,4)								
				4.00 - 4.45	B + D									
				Becoming gravelly SAND.				5.00 - 5.45	SPT (S)	N=23 (2,2/3,4,6,10)				
				Medium dense to dense light brown slightly silty very gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to very well rounded of mixed lithologies including sandstone, mudstone and limestone. Gravel at 8.00m.				5.00 - 5.45	B + D					
								6.00 - 6.45	SPT (S)	N=24 (1,3/2,6,8,8)				
								6.00 - 6.45	B + D					
								7.00 - 7.45	SPT (S)	N=24 (6,6/5,7,6,6)				
								7.00 - 7.45	B + D					
								8.00 - 8.45	SPT (S)	N=29 (6,7/7,7,8,7)				
								8.00 - 8.45	B + D					
								9.00 - 9.45	SPT (S)	N=33 (6,8/8,9,9,7)				
								9.00 - 9.45	B + D					
				Medium dense dark grey and locally black slightly silty to silty slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to well rounded of mixed lithologies including sandstone, mudstone and limestone. Occasional fine to coarse shell fragments noted throughout.				10.50 - 10.95	SPT (S)	N=15 (2,4/4,4,4,3)				
								10.50 - 10.95	B + D					
								12.00 - 12.45	SPT (S)	N=12 (2,2/3,3,2,4)				
								12.00 - 12.45	B + D					
								13.50 - 13.95	SPT (S)	N=12 (3,3/3,2,3,4)				
								13.50 - 13.95	B + D					
								15.00 - 15.45	SPT (S)	N=18 (4,4/4,5,4,5)				
								15.00 - 15.45	B + D					
								16.50 - 16.95	SPT (S)	N=21 (4,5/5,5,6,5)				
								16.50 - 16.95	B + D					
								18.00 - 18.45	SPT (S)	N=22 (5,5/5,6,6,5)				
								18.00 - 18.45	B + D					
								19.50 - 19.95	SPT (S)	N=22 (6,6/6,5,6,5)				
								19.50 - 19.95	B + D					
Hole Diameter		Casing Depths		General Remarks			Chiselling			Ground Water				
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	1.2m Hand Excavated inspection pit dug. Groundwater encountered at 3.20m. Borehole backfilled on completion.			From (m)	To (m)	Time (hr)	Depth Strike (m)	Depth Casing (m)	Depth Sealed (m)	Time Elapsed (min)	Water Level (m)
10.00	250	10.00	250							3.20	3.00			
21.00	200	21.00	200											
35.00	150	35.00	150											

 SOLMEK 12-16 Yarm Road Stockton on Tees TS18 3NA 01642 607083 info@solmek.com		Borehole Log					Scale 1:100 Sheet 2 of 2 BH-SP09	
Contract no: S230503		Site: Spit Boreholes - Ardersier Port, Inverness			Driller: Bainbridge Brothers Ltd		GL (AOD):	
					Plant used: Dando 2000		Easting: 280060	
Client: Ardersier Port					Started: 23/05/2023		Northing: 858762	
Method: Cable Percussive					Ended: 26/05/2023		Logged: SM	
					Backfilled: 26/05/2023		Status: FINAL	
Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description	Samples and Insitu Testing			
					Depth (m)	Type	Results	
		28.50	35.00	Medium dense dark grey and locally black slightly silty to silty slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to well rounded of mixed lithologies including sandstone, mudstone and limestone. Occasional fine to coarse shell fragments noted throughout.	21.00 - 21.45	SPT (S)	N=23 (6,6/5,6,6,6)	
				21.00 - 21.45	B + D			
				Medium dense to dense dark grey and locally black slightly silty to silty slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to well rounded of mixed lithologies including sandstone, mudstone and limestone. Occasional fine to coarse shell fragments noted throughout.	22.50 - 22.95	SPT (S)	N=25 (7,6/6,6,7,6)	
					22.50 - 22.95	B + D	N=25 (6,6/5,6,7,7)	
					23.00 - 23.45	SPT (S)		
					23.00 - 23.45	B + D		
					24.00 - 24.45	SPT (S)	N=29 (7,6/7,7,8,7)	
					24.00 - 24.45	B + D		
					25.50 - 25.95	SPT (S)	N=25 (5,6/5,5,7,8)	
					25.50 - 25.95	B + D		
					27.00 - 27.45	SPT (S)	N=27 (5,5/6,7,7,7)	
					27.00 - 27.45	B + D		
				28.50 - 28.95	SPT (S)	N=33 (6,7/7,8,8,10)		
				28.50 - 28.95	B + D			
				30.00 - 30.45	SPT (S)	N=34 (6,7/7,8,8,11)		
				30.00 - 30.45	B + D			
				31.50 - 31.95	SPT (S)	N=29 (4,5/5,7,8,9)		
				31.50 - 31.95	B + D			
				33.00 - 33.45	SPT (S)	N=38 (5,5/7,8,12,11)		
				33.00 - 33.45	B + D			
				34.50 - 34.95	SPT (S)	N=39 (6,5/7,8,11,13)		
				34.50 - 34.95	B + D			
End of Borehole at 35.000m								

APPENDIX C

Laboratory Report Front Sheet

Site name	Job number	G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	 10258
Ardersier Port	S230503		

Client details:

Reference: S230503
Name: Solmek
Address: 12 Yarm Road,
Stockton-on-tees,
TS18 3NA

Telephone: 01642 607083
Email: [Redacted]

FAO: Adrian Cutts

Samples received:

Date commenced: 14/07/2023

Date reported: 21/07/2023

Observations and interpretations are outside of the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Samples will be held at the laboratory for a period of 4 weeks after the report date. After the above reporting date the samples will be disposed of. Should further testing be required then the office should be informed before the above date.

Signature:	Approved Signatories:
[Redacted]	☐ D.Anderson (Managing Director) ☒ J. Brischuk (Laboratory Manager) ☐

Summary of Classification Tests

G2M Testing (Stockton)

12-16 Yarm Road,
Stockton on Tees,
TS18 3NA

01642 033318

info@g2mtesting.co.uk



10258

Site name	Job number
Ardersier Port	S230503

Hole	Depth		Type	w %	Oven temp. °C	wa %	Pa %	Pr %	wL %	wP %	IP %	IL	Plasticity class	Preparation method
	Top m	Base m												
BHSP05	0.30		B	2.3	105									
BHSP05	1.20		B	1.8	105									
BHSP05	3.00		B	19	105									
BHSP05	5.00		B	21	105									
BHSP05	7.00		B	20	105									
BHSP05	9.00		B	23	105									
BHSP05	12.00		B	25	105									
BHSP05	15.00		B	26	105									
BHSP05	18.00		B	31	105									
BHSP05	21.00		B	22	105									
BHSP05	24.00		B	21	105									
BHSP05	27.00		B	20	105									
BHSP05	30.00		B	20	105									
BHSP05	33.00		B	21	105									
BHSP05	36.00		B	25	105									
BHSP05	39.00		B	22	105									

All tests found in G2M Testing UKAS Schedule of Accreditation are tested to standard unless otherwise indicated

Key	Description	Category	BS Test Code
w	Moisture content		BS 1377:1990 Part 2 Clause 3.2
wa	Equivalent moisture content passing 425µm sieve		BS 1377:1990 Part 2 Clause 3.2
wL	Liquid limit Single point Four point	-s	BS 1377:1990 Part 2 Clause 4.4
		-f	BS 1377:1990 Part 2 Clause 4.3
wP	Plastic limit		BS 1377:1990 Part 2 Clause 5.2
Pa	Percentage passing 425µm sieve		
Pr	Percentage retained 425µm sieve		
IP	Plasticity index		BS 1377:1990 Part 2 Clause 5.4
IL	Liquidity index		BS 1377:1990 Part 2 Clause 5.4
	Suffix indicating test is "Not UKAS Accredited"	*	

Approved by	JBrischuk
Approval date	20/07/2023 15:28
Date report generated	
Report Number	

PARTICLE SIZE DISTRIBUTION

G2M Testing (Stockton)

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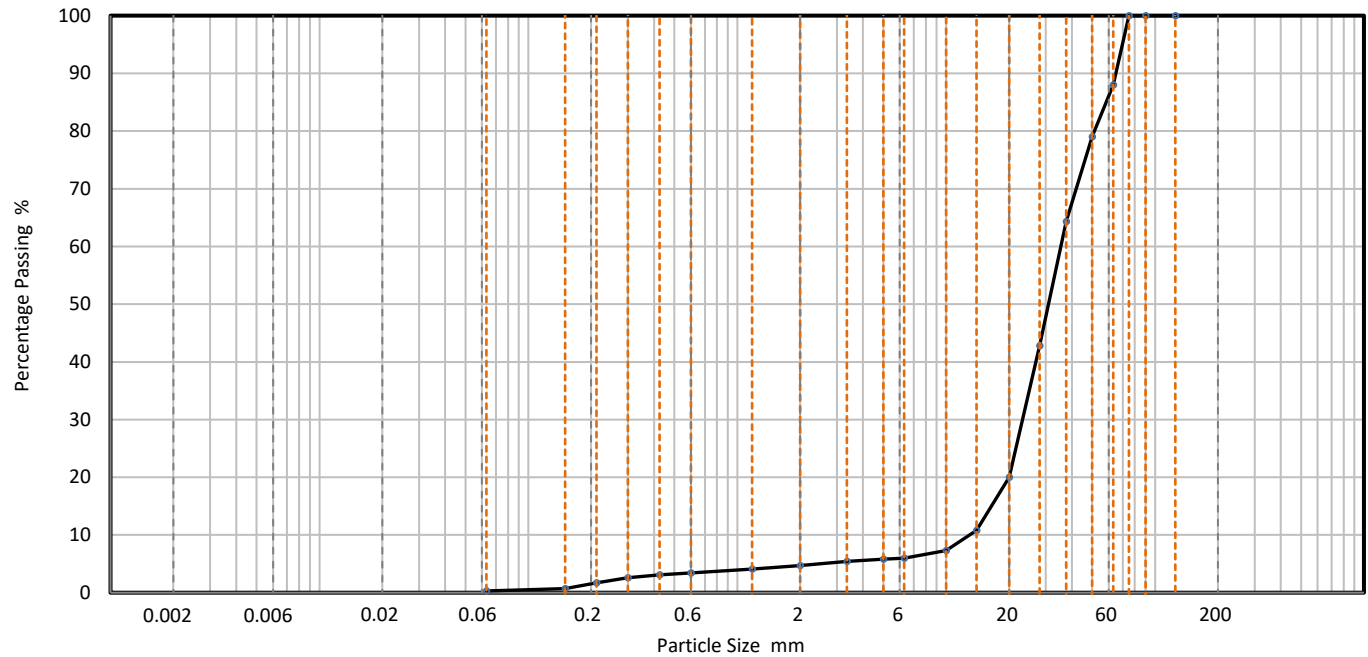
Site name

Job number

Ardersier Port

S230503

Hole		BHSP05	Lab sample ID	G2MT20230714106
Depth (Top)	m	0.30	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Sandy, Very Gravelly (with Cobbles)
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	88		
50	79		
37.5	64		
28	43		
20	20		
14	11		
10	7		
6.3	6		
5	6		
3.35	5		
2	5		
1.18	4		
0.6	3		
0.425	3		
0.3	3		
0.212	2		
0.15	1		
0.063	0		

Dry Mass of sample, g

8207

Sample Proportions	% dry mass
Very coarse	12.0
Gravel	83.3
Sand	4.4
Fines <0.063mm	0.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.7
Curvature Coefficient	1.2

Remarks
Preparation and testing in accordance with test method unless noted below
Sample tested was deviating in accordance with BS1377 test standard

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

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Approval date	20/07/2023 16:24

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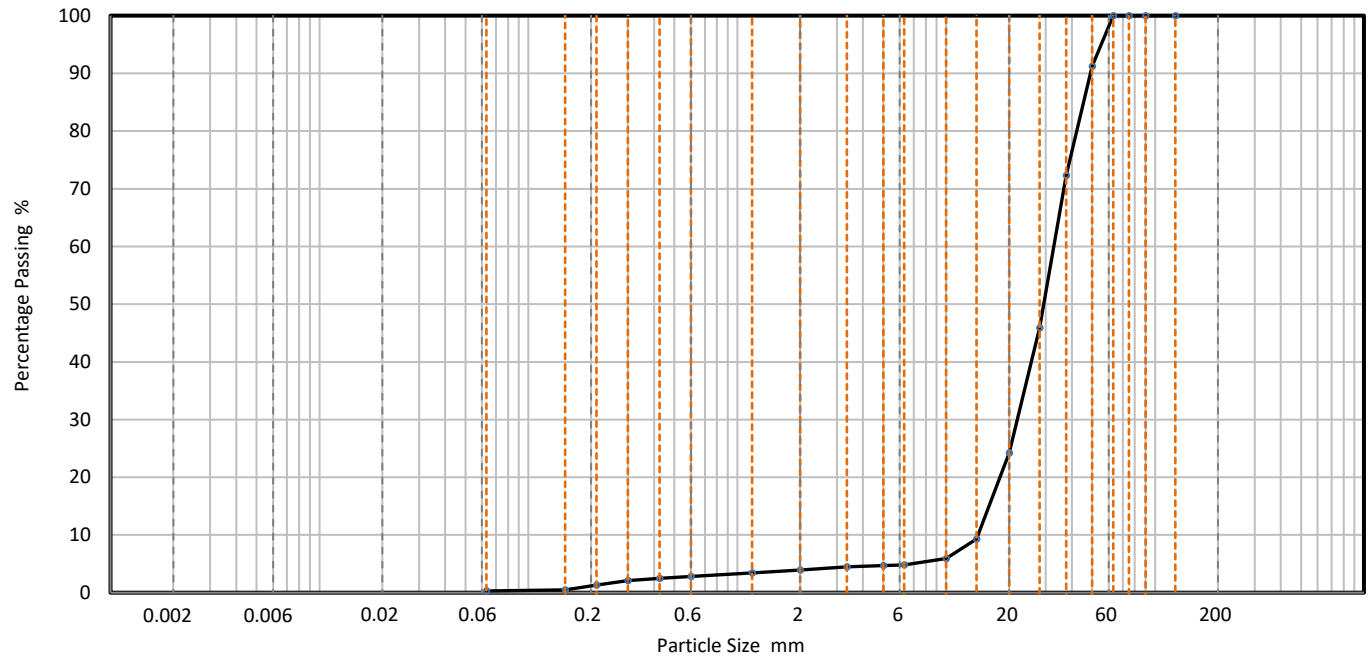
Site name

Job number

Ardersier Port

S230503

Hole		BHSP05	Lab sample ID	G2MT20230714107
Depth (Top)	m	1.20	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Sandy GRAVEL
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	91		
37.5	72		
28	46		
20	24		
14	9		
10	6		
6.3	5		
5	5		
3.35	5		
2	4		
1.18	3		
0.6	3		
0.425	3		
0.3	2		
0.212	1		
0.15	1		
0.063	0		

Dry Mass of sample, g

11484

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	96.1
Sand	3.7
Fines <0.063mm	0.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.3
Curvature Coefficient	1

Remarks
Preparation and testing in accordance with test method unless noted below
Sample tested was deviating in accordance with BS1377 test standard

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

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01642 033318

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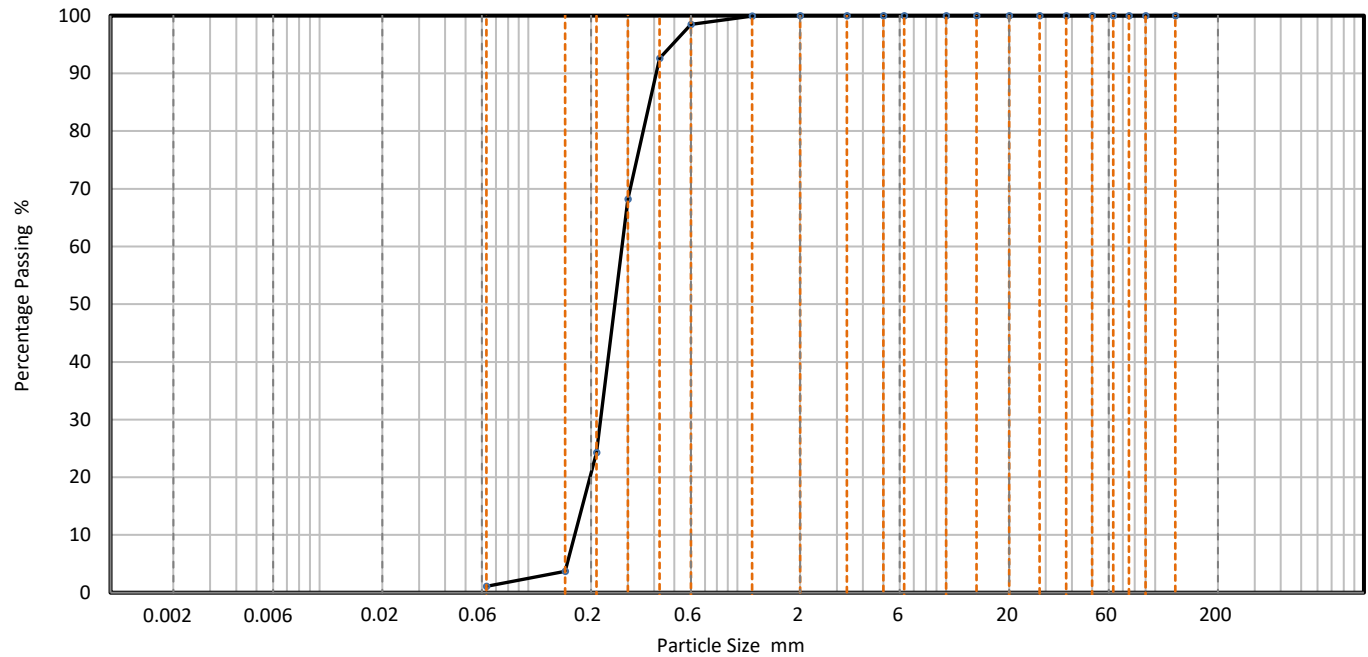
Site name

Job number

Ardersier Port

S230503

Hole		BHSP05	Lab sample ID	G2MT20230714108
Depth (Top)	m	3.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Clayey SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99		
0.425	93		
0.3	68		
0.212	24		
0.15	4		
0.063	1		

Dry Mass of sample, g

466

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	98.9
Fines <0.063mm	1.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1.7
Curvature Coefficient	1

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

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Approval date	20/07/2023 16:24

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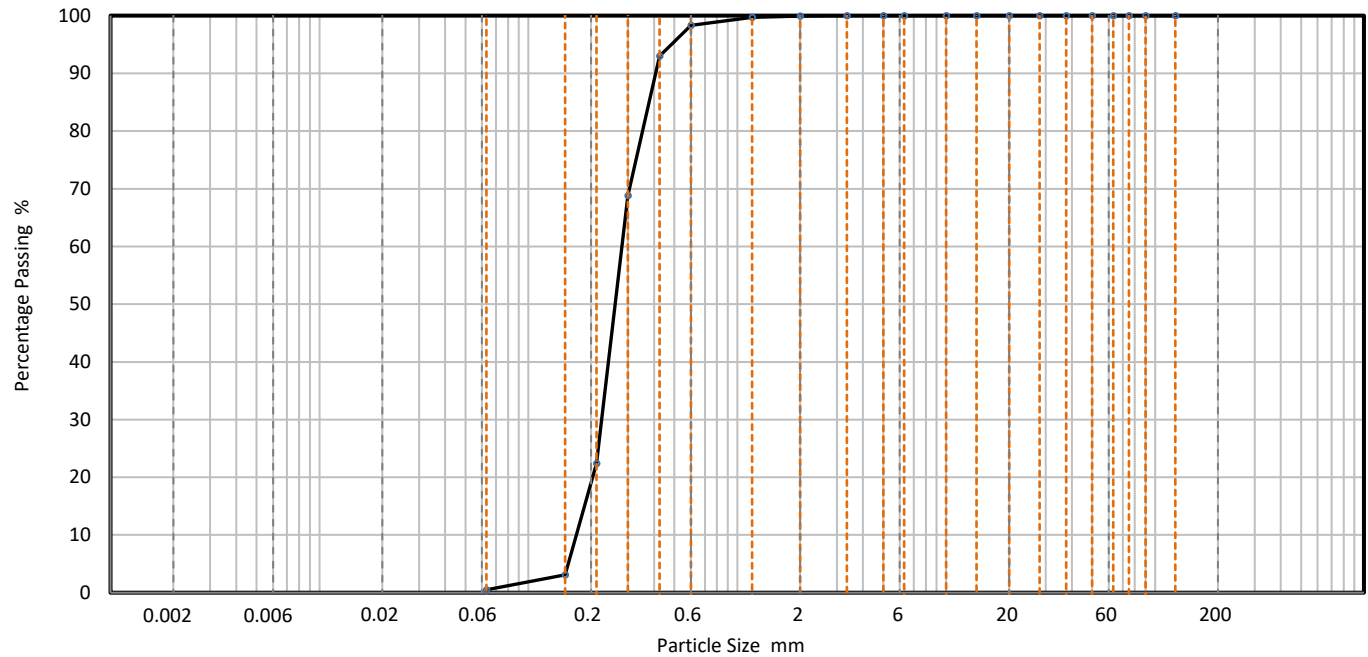
Site name

Job number

Ardersier Port

S230503

Hole	BHSP05	Lab sample ID	G2MT20230714109
Depth (Top)	m	5.00	Test Method
Depth (Base)	m		BS 1377 - 2 : 1990 Clause 9.2
Sample type	B	Soil Description	Slightly Gravelly, Slightly Clayey SAND



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	98		
0.425	93		
0.3	69		
0.212	22		
0.15	3		
0.063	1		

Dry Mass of sample, g

521

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.1
Sand	99.4
Fines <0.063mm	1.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1.7
Curvature Coefficient	1.1

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

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JBrischuk

Approval date

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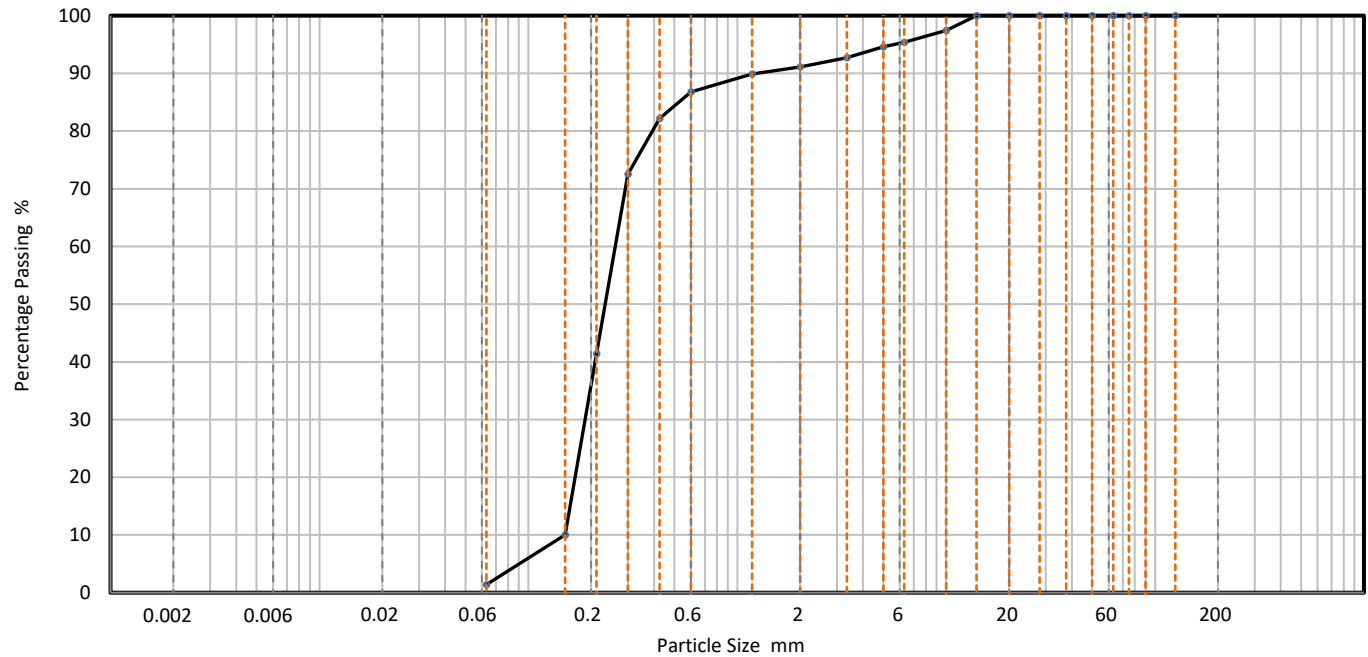
Site name

Job number

Ardersier Port

S230503

Hole		BHSP05	Lab sample ID	G2MT20230714110
Depth (Top)	m	7.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Clayey, Gravelly SAND
Sample type		B		



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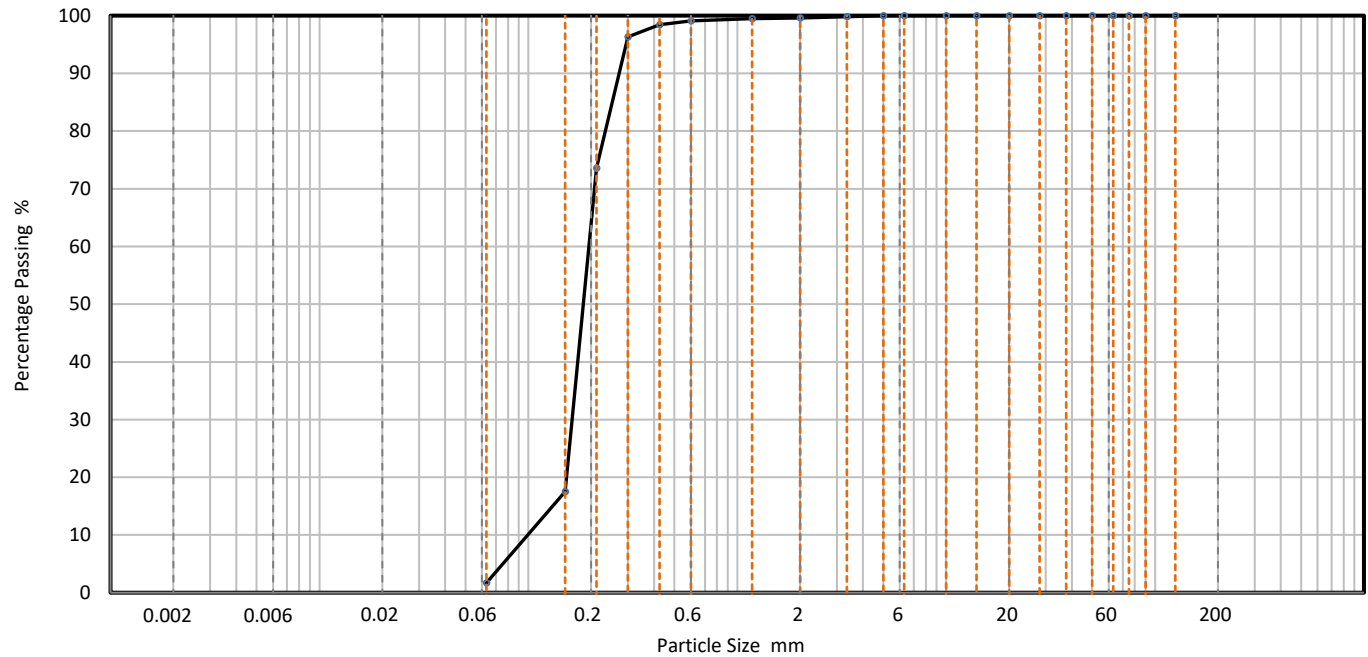
Site name

Job number

Ardersier Port

S230503

Hole	BHSP05	Lab sample ID	G2MT20230714111
Depth (Top)	m 9.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Slightly Gravelly, Slightly Clayey SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99		
0.425	98		
0.3	96		
0.212	74		
0.15	18		
0.063	2		

Dry Mass of sample, g

952

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.4
Sand	98.0
Fines <0.063mm	2.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2
Curvature Coefficient	1.4

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

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Approval date	20/07/2023 16:24

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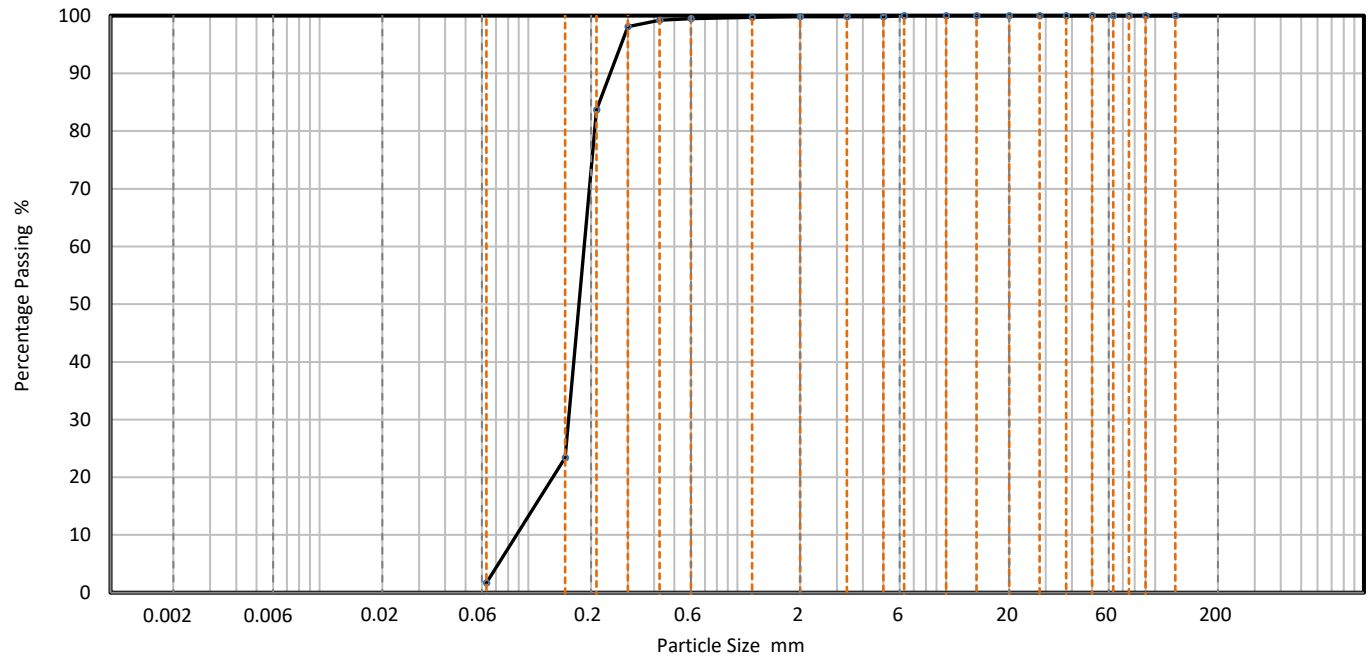
Site name

Job number

Ardersier Port

S230503

Hole	BHSP05	Lab sample ID	G2MT20230714112
Depth (Top)	m 12.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Slightly Gravelly, Slightly Clayey SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	98		
0.212	84		
0.15	23		
0.063	2		

Dry Mass of sample, g

446

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.2
Sand	98.0
Fines <0.063mm	2.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.1
Curvature Coefficient	1.5

Remarks
Preparation and testing in accordance with test method unless noted below

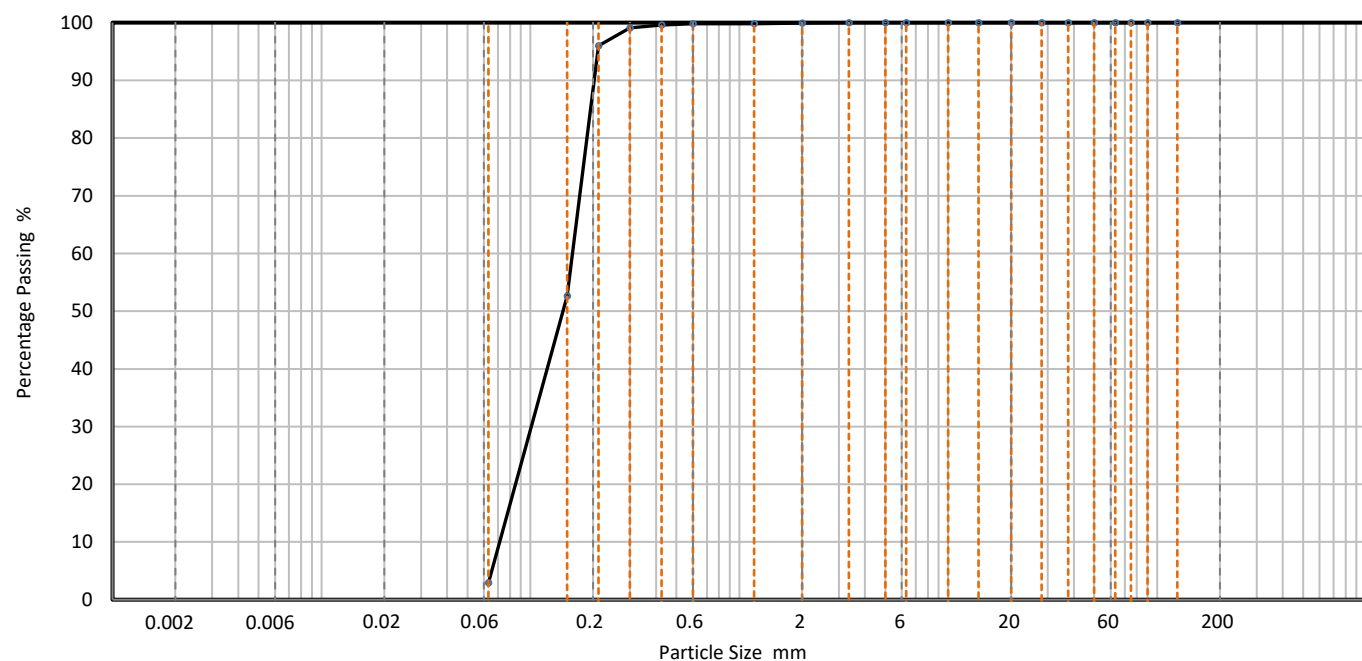
Accreditation status

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Approval date	20/07/2023 16:24

PARTICLE SIZE DISTRIBUTION		G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	 10258
Site name	Job number		
Ardersier Port	S230503		

Hole	BHSP05	Lab sample ID	G2MT20230714113
Depth (Top)	m 15.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Slightly Gravelly, Slightly Clayey, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	99		
0.212	96		
0.15	53		
0.063	3		

Dry Mass of sample, g	440

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.1
Sand	97.0
Fines <0.063mm	3.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.2
Curvature Coefficient	0.9

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status
 Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	JBrischuk
Approval date	20/07/2023 16:24

PARTICLE SIZE DISTRIBUTION

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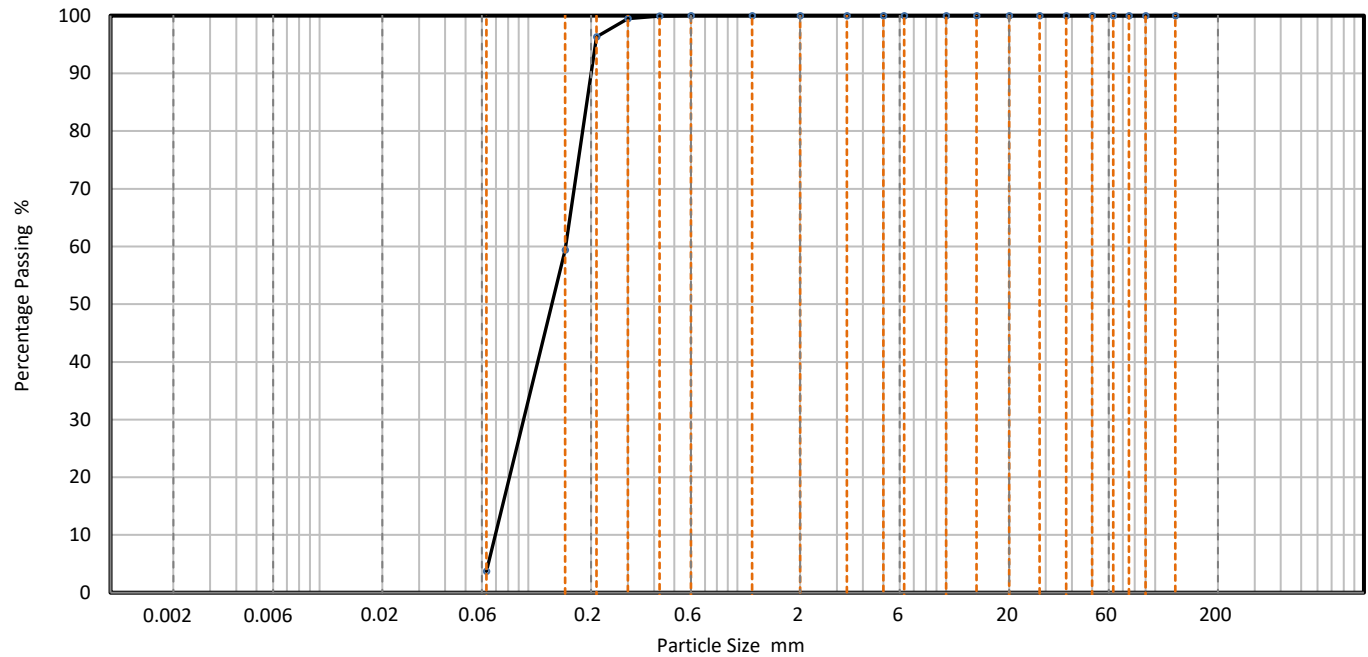
Site name

Job number

Ardersier Port

S230503

Hole		BHSP05	Lab sample ID	G2MT20230714114
Depth (Top)	m	18.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Clayey, SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	96		
0.15	59		
0.063	4		

Dry Mass of sample, g

516

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	96.3
Fines <0.063mm	4.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.2
Curvature Coefficient	0.86

Remarks
Preparation and testing in accordance with test method unless noted below

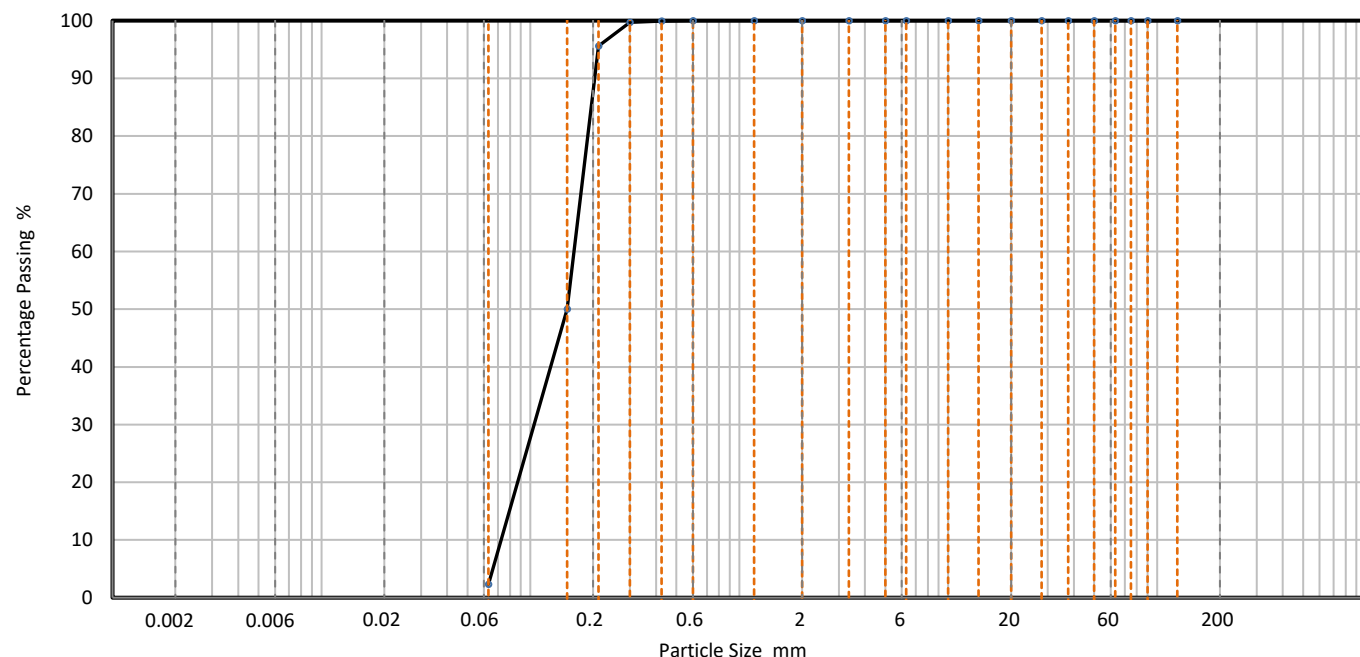
Accreditation status

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PARTICLE SIZE DISTRIBUTION		G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	 10258
Site name	Job number		
Ardersier Port	S230503		

Hole	BHSP05	Lab sample ID	G2MT20230714115
Depth (Top)	m 21.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Slightly Clayey SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	96		
0.15	50		
0.063	2		

Dry Mass of sample, g	477

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	97.7
Fines <0.063mm	2.0

Grading Analysis	
D100	mm
D60	mm 0.162
D30	mm 0.104
D10	mm 0.0725
Uniformity Coefficient	2.2
Curvature Coefficient	0.93

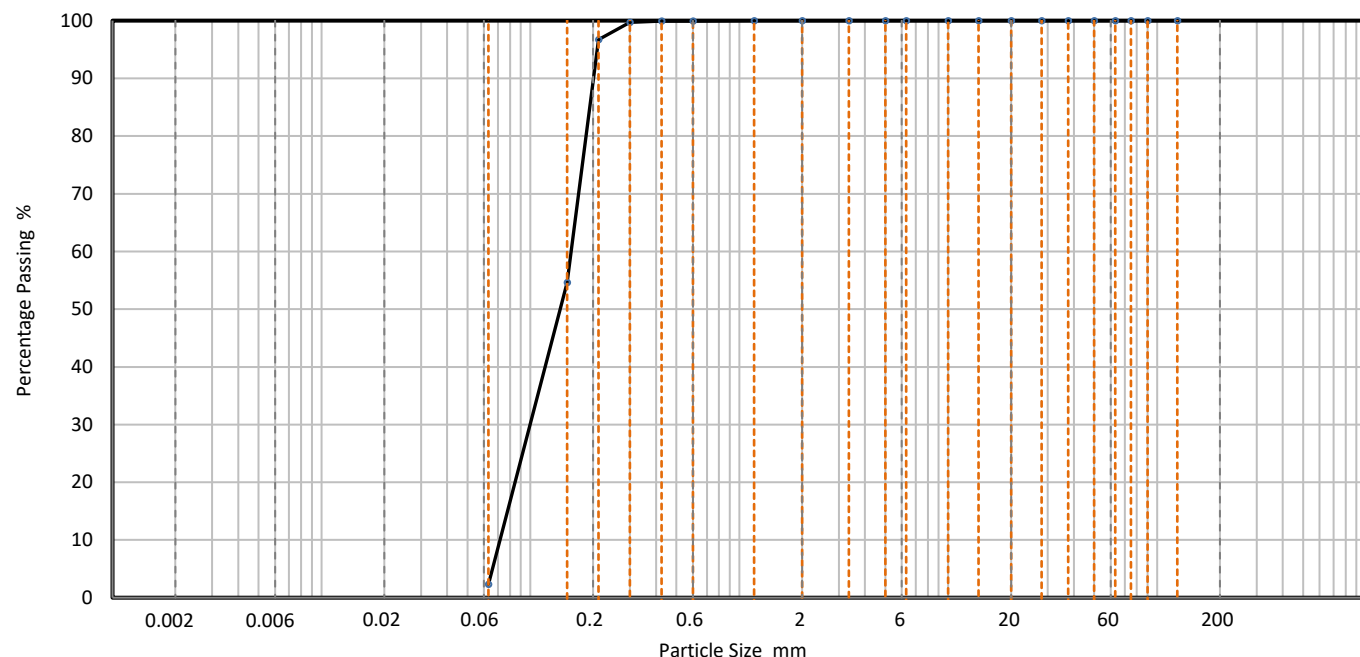
Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status
 Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	JBrischuk
Approval date	20/07/2023 16:24

PARTICLE SIZE DISTRIBUTION		G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	 10258
Site name	Job number		
Ardersier Port	S230503		

Hole	BHSP05	Lab sample ID	G2MT20230714116
Depth (Top)	m 24.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Slightly Clayey, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	97		
0.15	55		
0.063	2		

Dry Mass of sample, g	461

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	97.7
Fines <0.063mm	2.0

Grading Analysis	
D100 mm	
D60 mm	0.157
D30 mm	0.0997
D10 mm	0.0716
Uniformity Coefficient	2.2
Curvature Coefficient	0.89

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status
 Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	JBrischuk
Approval date	20/07/2023 16:24

PARTICLE SIZE DISTRIBUTION

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TS18 3NA

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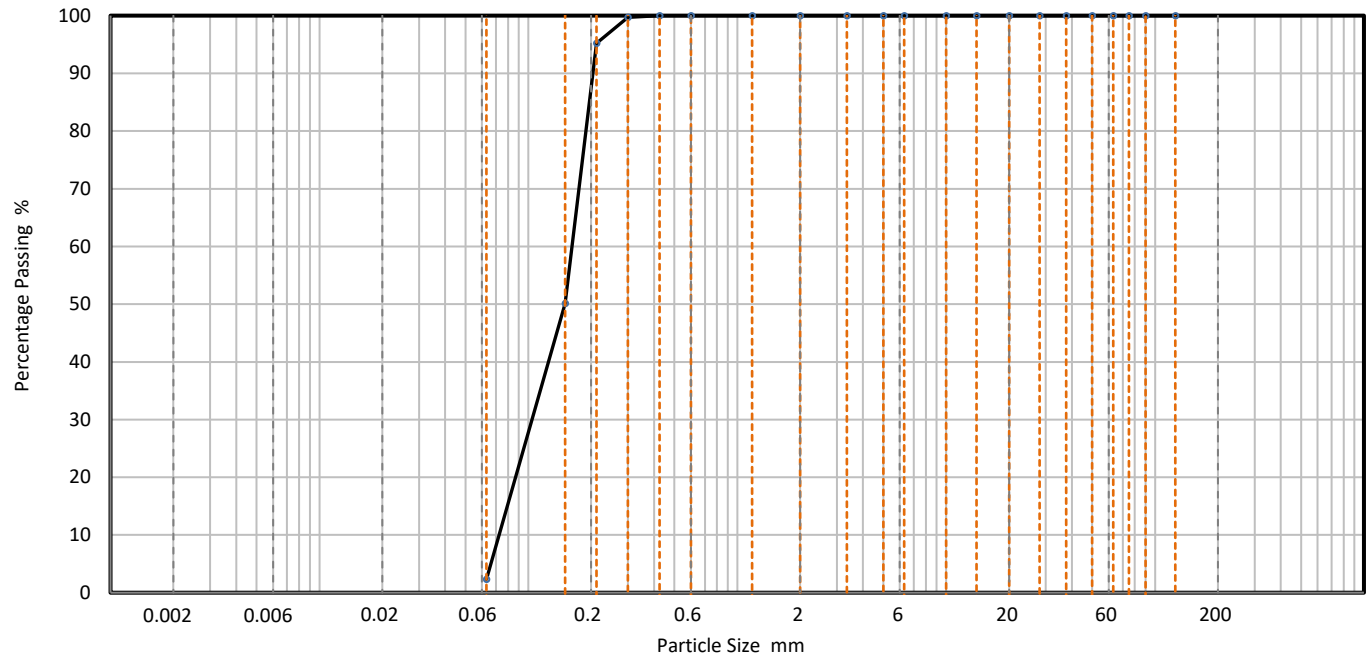
Site name

Job number

Ardersier Port

S230503

Hole		BHSP05	Lab sample ID	G2MT20230714117
Depth (Top)	m	27.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Clayey, SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	95		
0.15	50		
0.063	2		

Dry Mass of sample, g

472

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	97.7
Fines <0.063mm	2.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.2
Curvature Coefficient	0.92

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	JBrischuk
Approval date	20/07/2023 16:24

PARTICLE SIZE DISTRIBUTION

G2M Testing (Stockton)

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Stockton on Tees,
TS18 3NA

01642 033318

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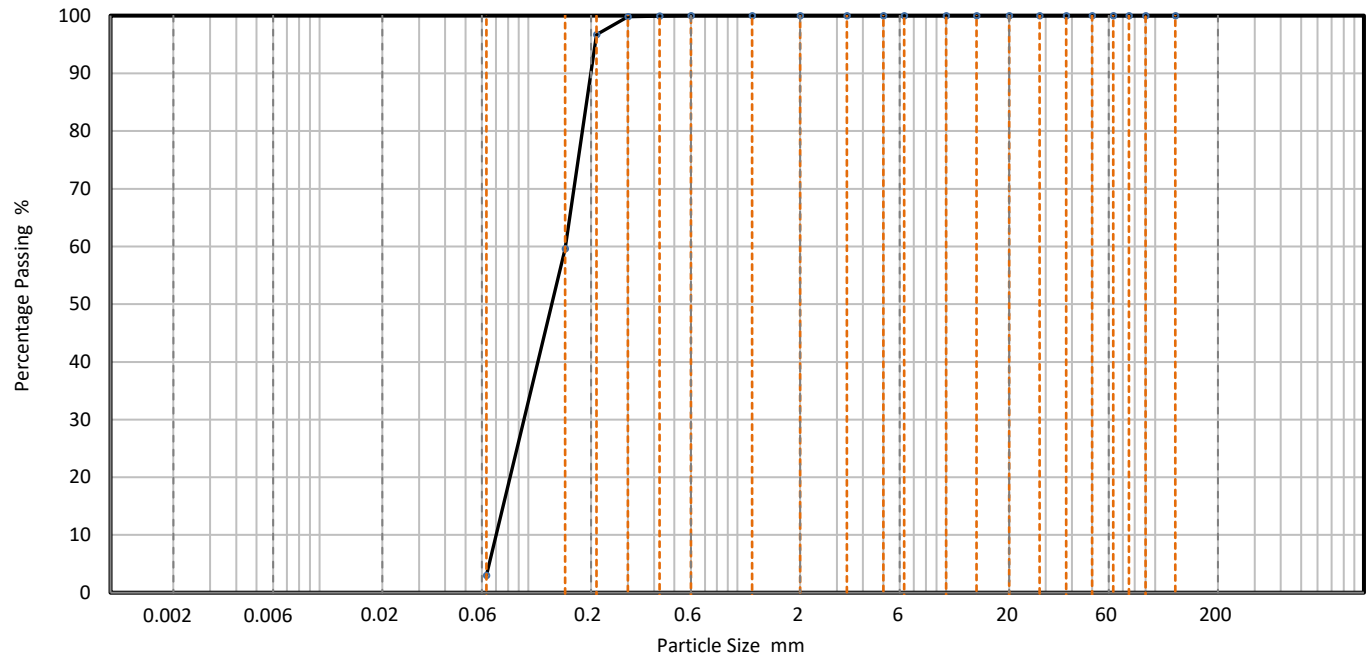
Site name

Job number

Ardersier Port

S230503

Hole		BHSP05	Lab sample ID	G2MT20230714118
Depth (Top)	m	30.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Clayey, SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	97		
0.15	60		
0.063	3		

Dry Mass of sample, g

435

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	97.0
Fines <0.063mm	3.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.1
Curvature Coefficient	0.86

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	JBrischuk
Approval date	20/07/2023 16:24

PARTICLE SIZE DISTRIBUTION

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Stockton on Tees,
TS18 3NA

01642 033318

info@g2mtesting.co.uk



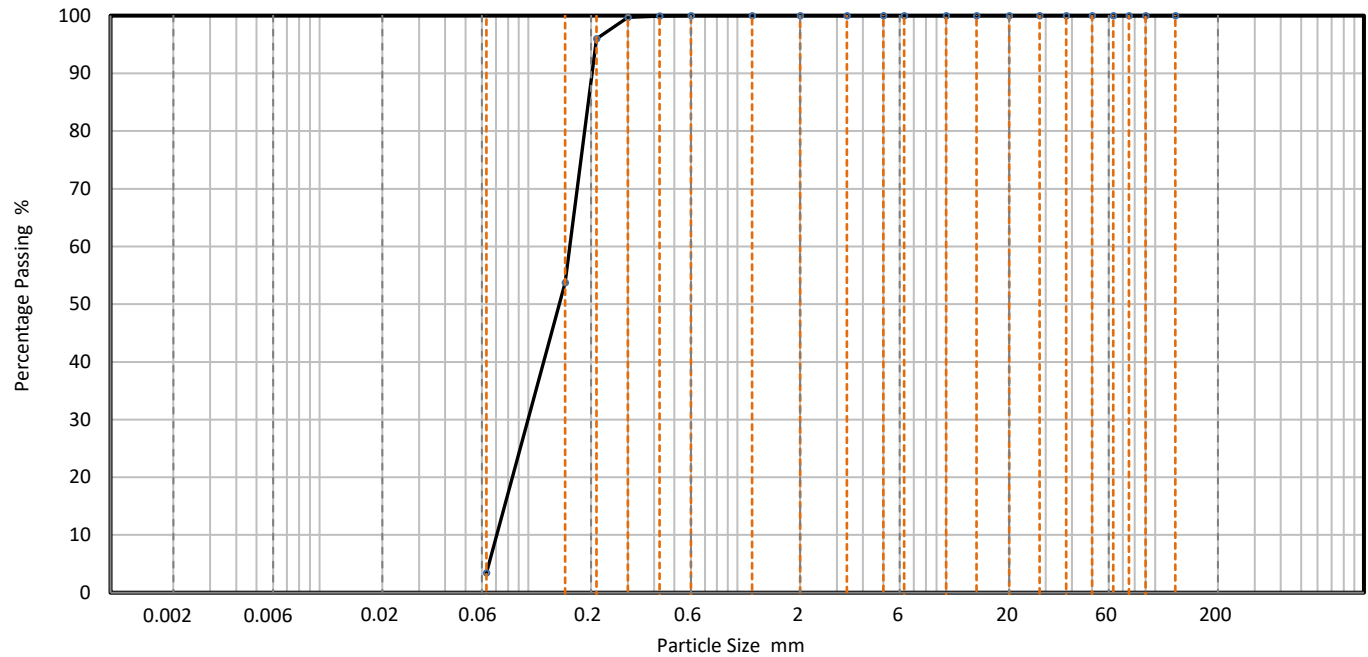
Site name

Job number

Ardersier Port

S230503

Hole		BHSP05	Lab sample ID	G2MT20230714119
Depth (Top)	m	33.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Clayey SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	96		
0.15	54		
0.063	3		

Dry Mass of sample, g

462

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	96.6
Fines <0.063mm	3.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.2
Curvature Coefficient	0.89

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	JBrischuk
Approval date	20/07/2023 16:24

PARTICLE SIZE DISTRIBUTION

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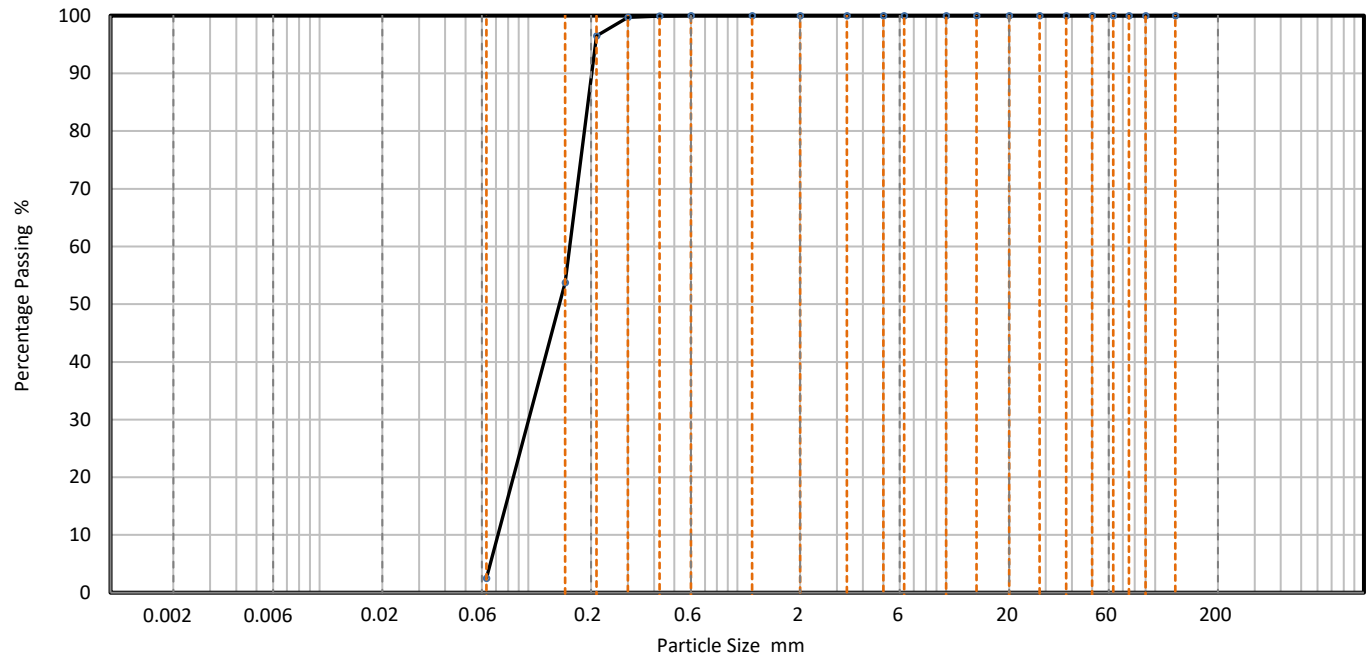
Site name

Job number

Ardersier Port

S230503

Hole		BHSP05	Lab sample ID	G2MT20230714120
Depth (Top)	m	36.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Clayey SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	97		
0.15	54		
0.063	3		

Dry Mass of sample, g

464

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	97.4
Fines <0.063mm	3.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.2
Curvature Coefficient	0.89

Remarks
Preparation and testing in accordance with test method unless noted below

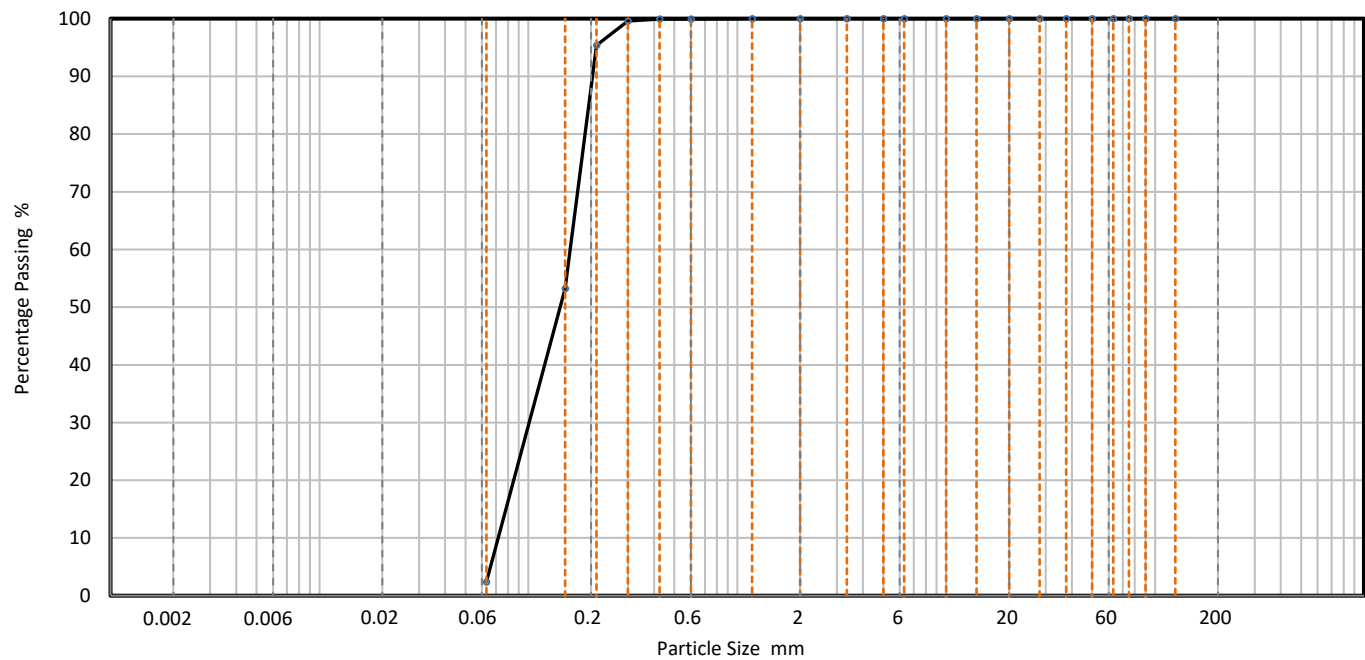
Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	JBrischuk
Approval date	20/07/2023 16:24

PARTICLE SIZE DISTRIBUTION		G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	 10258
Site name	Job number		
Ardersier Port	S230503		

Hole		BHSP05	Lab sample ID	G2MT20230714121
Depth (Top)	m	39.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Clayey, SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	95		
0.15	53		
0.063	2		

Dry Mass of sample, g	453

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	97.6
Fines <0.063mm	2.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.2
Curvature Coefficient	0.9

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status
 Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	JBrischuk
Approval date	20/07/2023 16:24

Laboratory Report Front Sheet		G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	
Site name	Job number		
Ardersier Port	S230503		

Client details:

Reference: S230503
Name: Solmek
Address: 12 Yarm Road,
Stockton-on-tees,
TS18 3NA

Telephone: 01642 607083
Email: [Redacted]

FAO: Adrian Cutts

Samples received:

Date commenced: 27/06/2023

Date reported: 30/06/2023

Observations and interpretations are outside of the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Samples will be held at the laboratory for a period of 4 weeks after the report date. After the above reporting date the samples will be disposed of. Should further testing be required then the office should be informed before the above date.

Signature:	Approved Signatories:
[Redacted]	☒ D.Anderson (Managing Director) ☐ J. Brischuk (Laboratory Manager) ☐

Summary of Classification Tests

G2M Testing (Stockton)

12-16 Yarm Road,
Stockton on Tees,
TS18 3NA

01642 033318

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10258

Site name	Job number
Ardersier Port	S230503

Hole	Depth		Type	w %	Oven temp. °C	wa %	Pa %	Pr %	wL %	wP %	IP %	IL	Plasticity class	Preparation method
	Top m	Base m												
BHSP06	0.30		B	5.2	105									
BHSP06	1.20		B	22	105									
BHSP06	3.00		B	22	105									
BHSP06	5.00		B	20	105									
BHSP06	7.00		B	18	105									
BHSP06	9.00		B	20	105									
BHSP06	12.00		B	32	105									
BHSP06	15.00		B	22	105									
BHSP06	18.00		B	20	105									
BHSP06	21.00		B	21	105									
BHSP06	24.00		B	9.3	105									
BHSP06	27.00		B	23	105									
BHSP06	30.00		B	20	105									
BHSP06	31.50		B	20	105									
BHSP06	34.50		B	20	105									
BHSP06	36.00		B	20	105									
BHSP06	39.00		D	14	105									

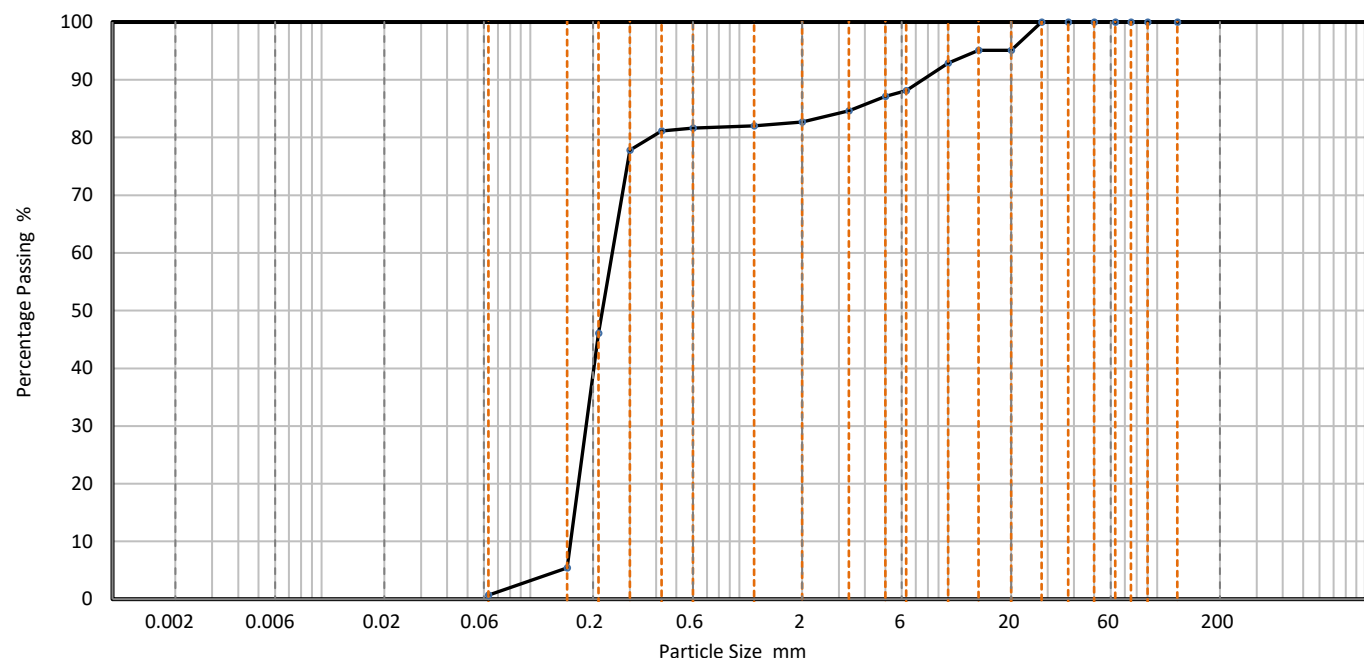
All tests found in G2M Testing UKAS Schedule of Accreditation are tested to standard unless otherwise indicated

Key	Description	Category	BS Test Code
w	Moisture content		BS 1377:1990 Part 2 Clause 3.2
wa	Equivalent moisture content passing 425µm sieve		BS 1377:1990 Part 2 Clause 3.2
wL	Liquid limit Single point Four point	-s	BS 1377:1990 Part 2 Clause 4.4
		-f	BS 1377:1990 Part 2 Clause 4.3
wP	Plastic limit		BS 1377:1990 Part 2 Clause 5.2
Pa	Percentage passing 425µm sieve		
Pr	Percentage retained 425µm sieve		
IP	Plasticity index		BS 1377:1990 Part 2 Clause 5.4
IL	Liquidity index		BS 1377:1990 Part 2 Clause 5.4
	Suffix indicating test is "Not UKAS Accredited"	*	

Approved by	D Anderson
Approval date	30/06/2023 11:50
Date report generated	
Report Number	

PARTICLE SIZE DISTRIBUTION		G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	 10258
Site name	Job number		
Ardersier Port	S230503		

Hole	BHSP06	Lab sample ID	G2MT2023062722
Depth (Top)	m 0.30	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Very slightly Silty, Gravelly, SAND
Sample type	B		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	95		
14	95		
10	93		
6.3	88		
5	87		
3.35	85		
2	83		
1.18	82		
0.6	82		
0.425	81		
0.3	78		
0.212	46		
0.15	5		
0.063	1		

Dry Mass of sample, g	1167

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	17.3
Sand	82.0
Fines <0.063mm	1.0

Grading Analysis	
D100 mm	
D60 mm	0.247
D30 mm	0.185
D10 mm	0.156
Uniformity Coefficient	1.6
Curvature Coefficient	0.89

Remarks
 Preparation and testing in accordance with test method unless noted below

 Sample tested was deviating in accordance with BS1377 test standard

Accreditation status Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.		Approved by D Anderson
		Approval date 30/06/2023 12:41

PARTICLE SIZE DISTRIBUTION

G2M Testing (Stockton)

12-16 Yarm Road,
Stockton on Tees,
TS18 3NA

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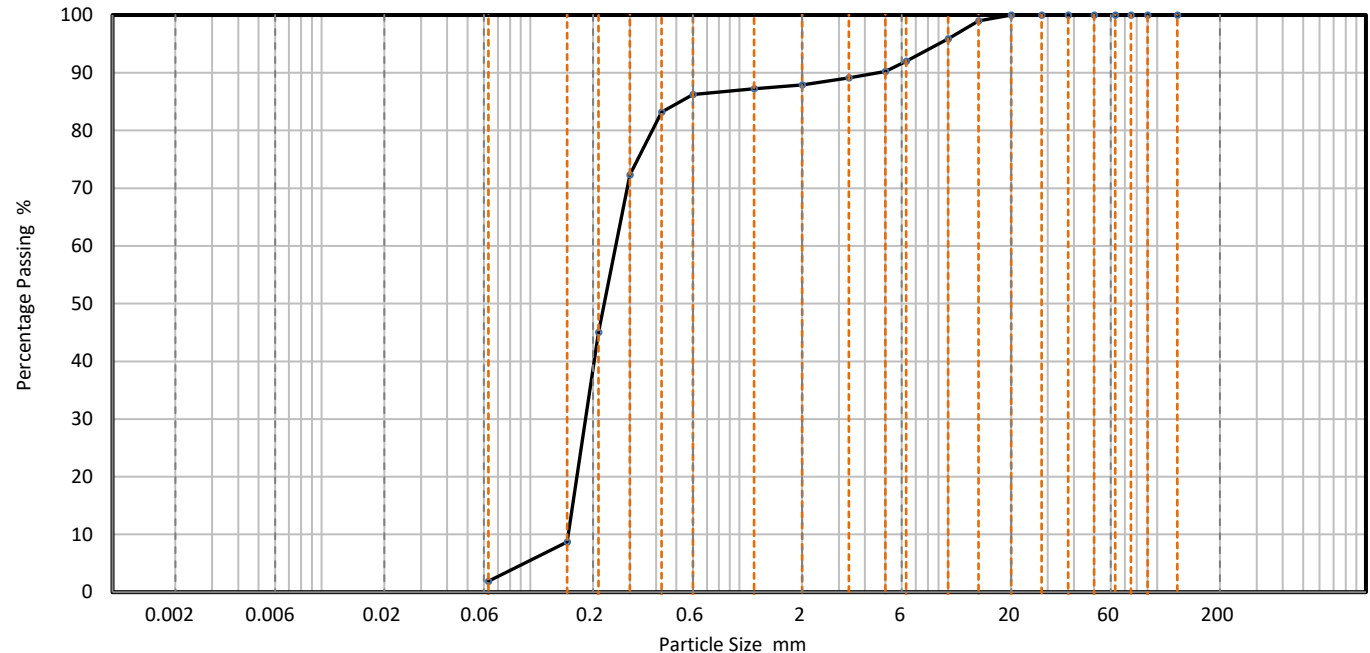
Site name

Job number

Ardersier Port

S230503

Hole		BHSP06	Lab sample ID	G2MT2023062723
Depth (Top)	m	1.20	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Silty, Gravelly, SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	96		
6.3	92		
5	90		
3.35	89		
2	88		
1.18	87		
0.6	86		
0.425	83		
0.3	72		
0.212	45		
0.15	9		
0.063	2		

Dry Mass of sample, g

1041

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	12.1
Sand	86.0
Fines <0.063mm	2.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1.7
Curvature Coefficient	0.87

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	30/06/2023 12:44

PARTICLE SIZE DISTRIBUTION

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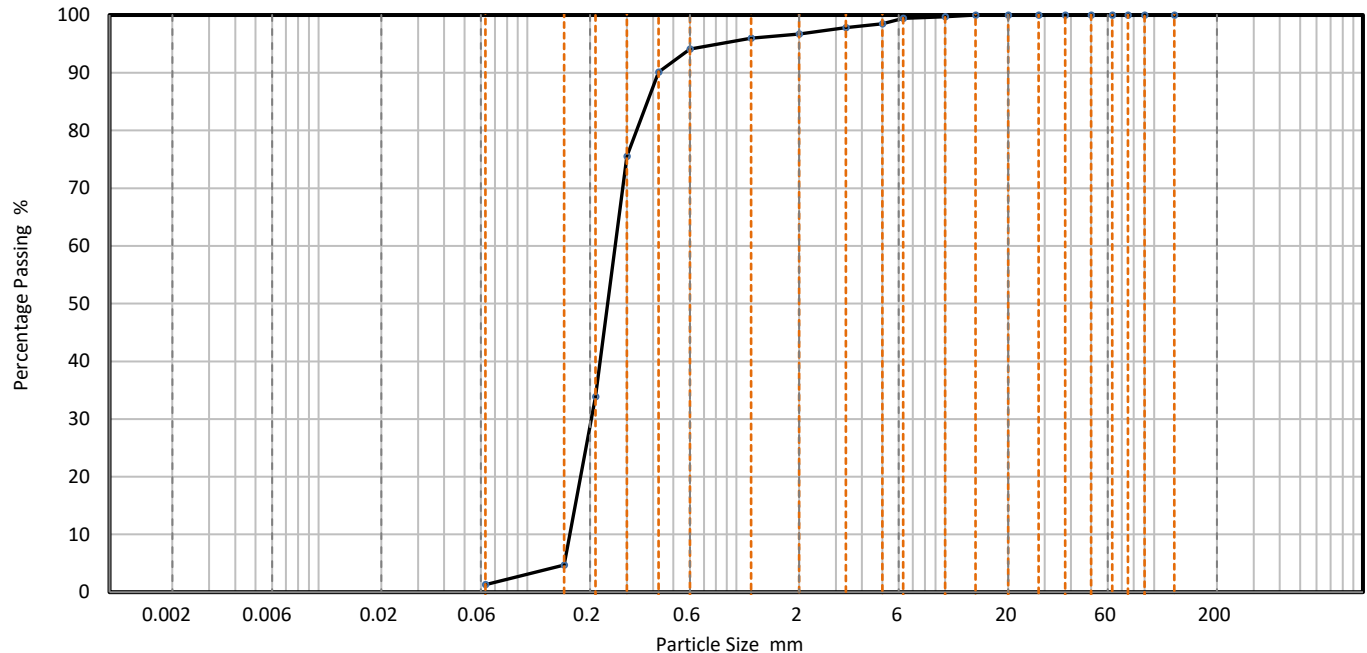
Site name

Job number

Ardersier Port

S230503

Hole		BHSP06	Lab sample ID	G2MT2023062724
Depth (Top)	m	3.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Very slightly Silty, slightly Gravelly, SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99		
5	99		
3.35	98		
2	97		
1.18	96		
0.6	94		
0.425	90		
0.3	76		
0.212	34		
0.15	5		
0.063	1		

Dry Mass of sample, g

1158

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	3.3
Sand	95.4
Fines <0.063mm	1.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1.7
Curvature Coefficient	0.97

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	30/06/2023 12:48

PARTICLE SIZE DISTRIBUTION

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TS18 3NA

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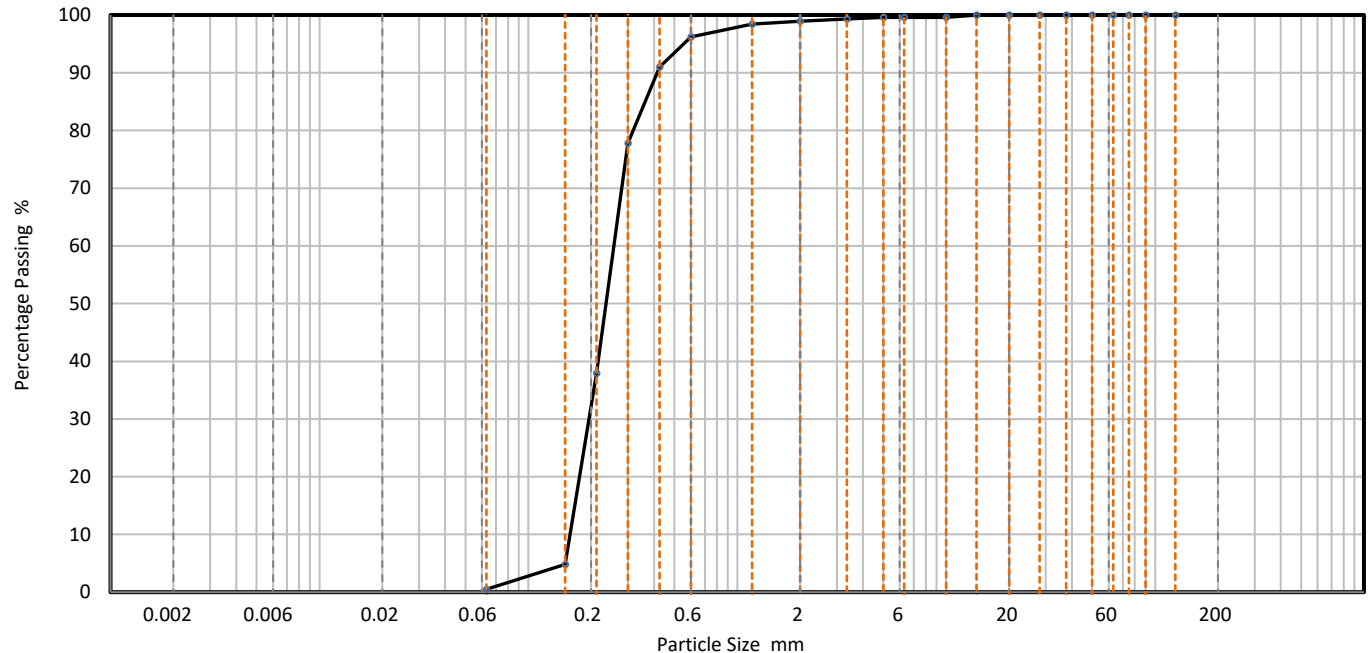
Site name

Ardersier Port

Job number

S230503

Hole		BHSP06	Lab sample ID	G2MT2023062725
Depth (Top)	m	5.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Very slightly Silty, very slightly Gravelly, SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	99		
2	99		
1.18	98		
0.6	96		
0.425	91		
0.3	78		
0.212	38		
0.15	5		
0.063	1		

Dry Mass of sample, g

959

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	1.1
Sand	98.4
Fines <0.063mm	1.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1.6
Curvature Coefficient	0.94

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	30/06/2023 10:06

PARTICLE SIZE DISTRIBUTION

G2M Testing (Stockton)

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TS18 3NA

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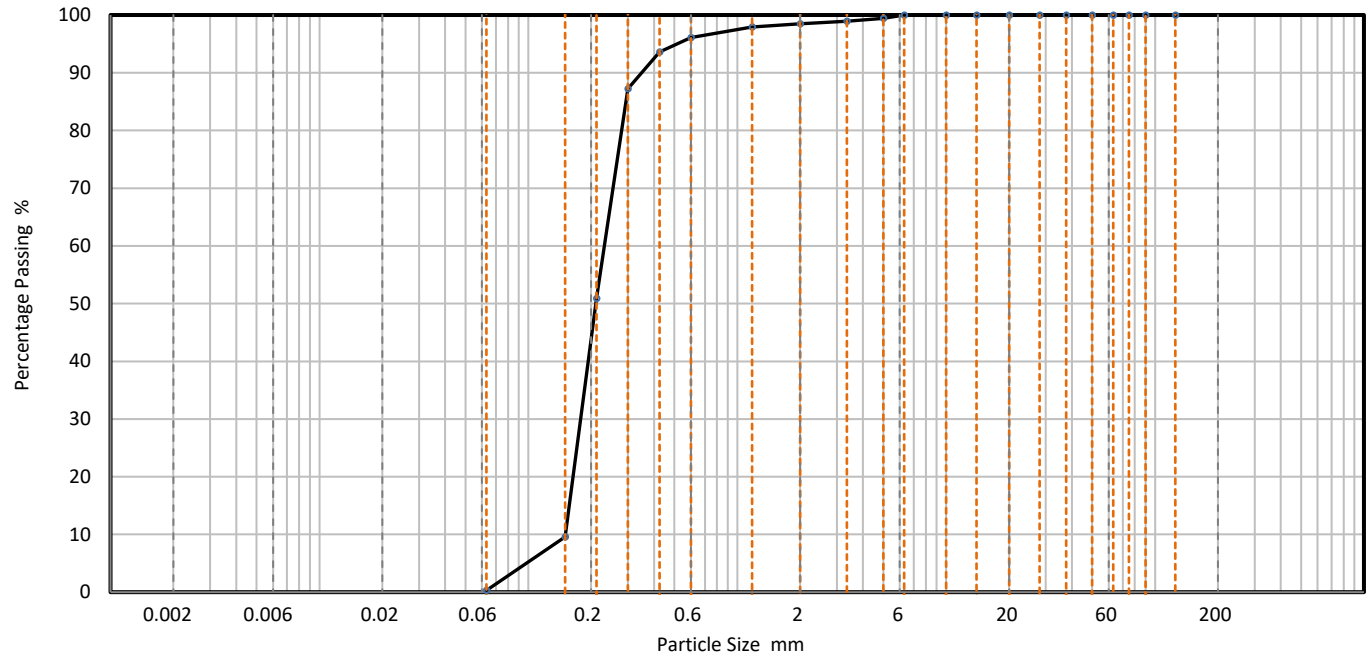
Site name

Job number

Ardersier Port

S230503

Hole		BHSP06	Lab sample ID	G2MT2023062726
Depth (Top)	m	7.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Very slightly Gravelly, SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	99		
3.35	99		
2	99		
1.18	98		
0.6	96		
0.425	94		
0.3	87		
0.212	51		
0.15	10		
0.063	0		

Dry Mass of sample, g

994

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	1.5
Sand	98.2
Fines <0.063mm	0.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1.5
Curvature Coefficient	0.91

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	30/06/2023 10:09

PARTICLE SIZE DISTRIBUTION

G2M Testing (Stockton)

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TS18 3NA

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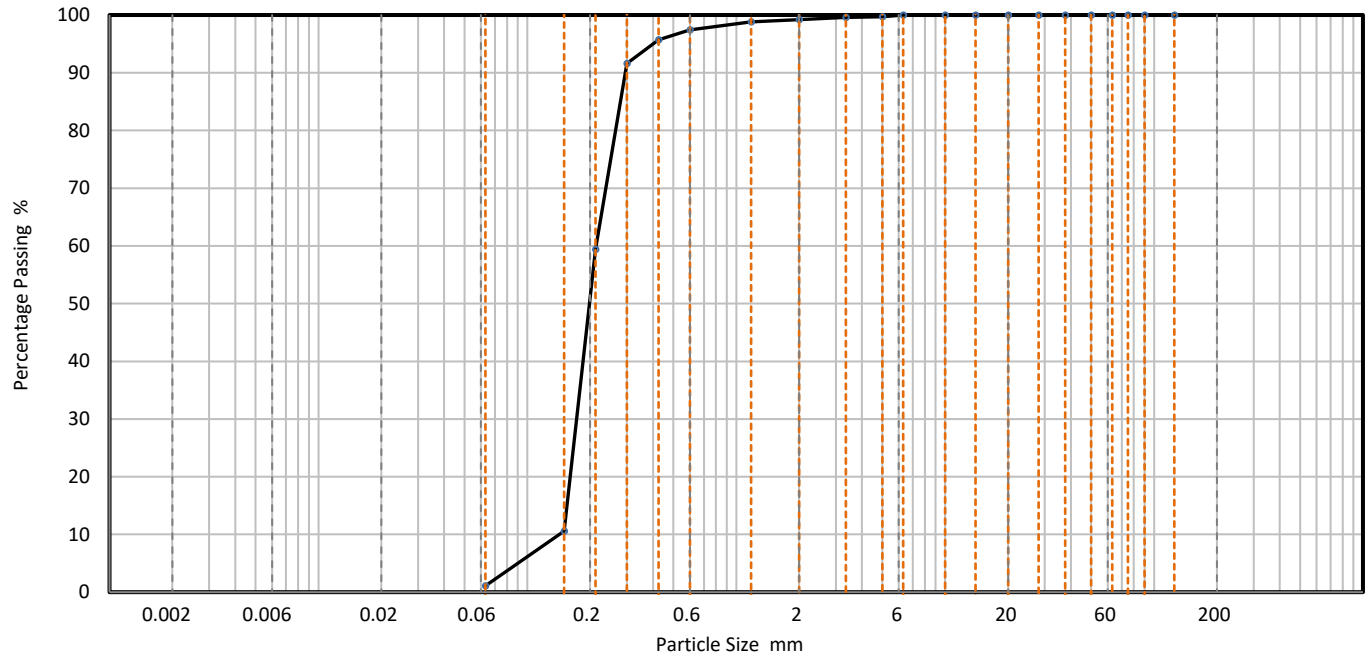
Site name

Ardersier Port

Job number

S230503

Hole	BHSP06	Lab sample ID	G2MT2023062727
Depth (Top) m	9.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Very slightly Silty, very slightly Gravelly, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	97		
0.425	96		
0.3	92		
0.212	59		
0.15	11		
0.063	1		

Dry Mass of sample, g

845

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.8
Sand	98.1
Fines <0.063mm	1.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1.5
Curvature Coefficient	0.97

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	30/06/2023 12:52

PARTICLE SIZE DISTRIBUTION

G2M Testing (Stockton)

12-16 Yarm Road,
Stockton on Tees,
TS18 3NA

01642 033318

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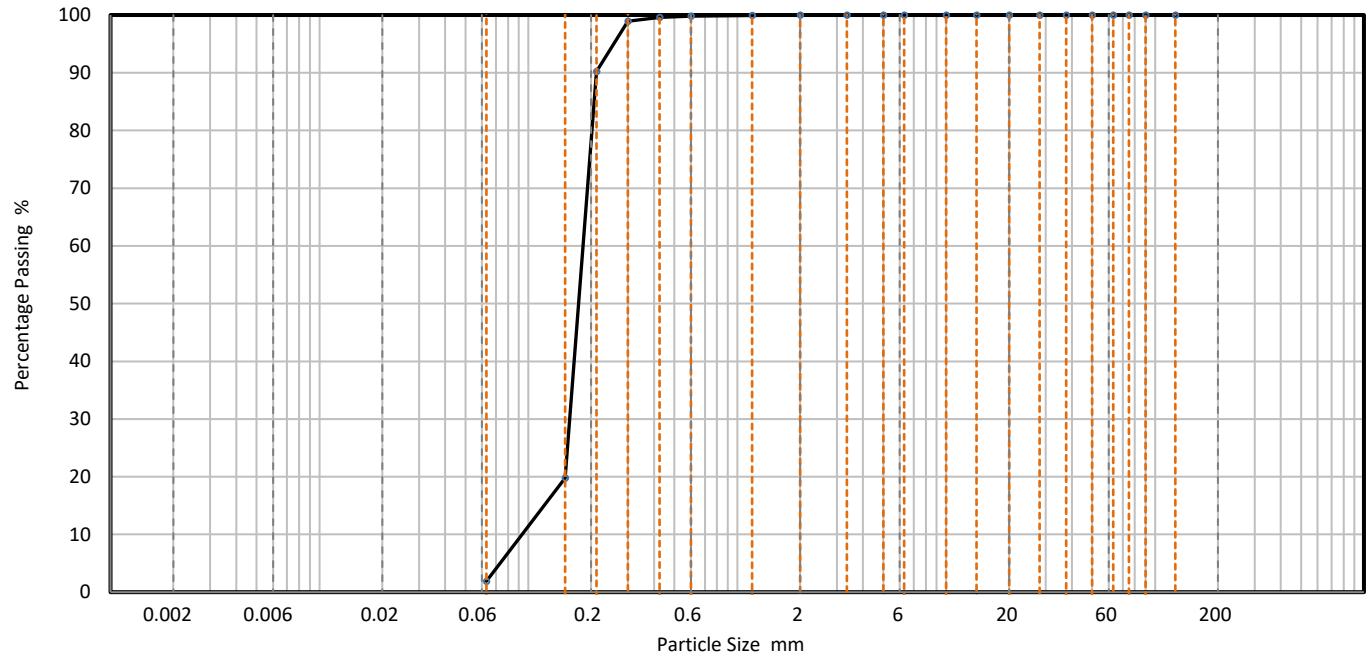
Site name

Job number

Ardersier Port

S230503

Hole	BHSP06	Lab sample ID	G2MT2023062728
Depth (Top) m	12.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	99		
0.212	90		
0.15	20		
0.063	2		

Dry Mass of sample, g

731

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	98.1
Fines <0.063mm	2.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2
Curvature Coefficient	1.5

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	30/06/2023 12:54

PARTICLE SIZE DISTRIBUTION

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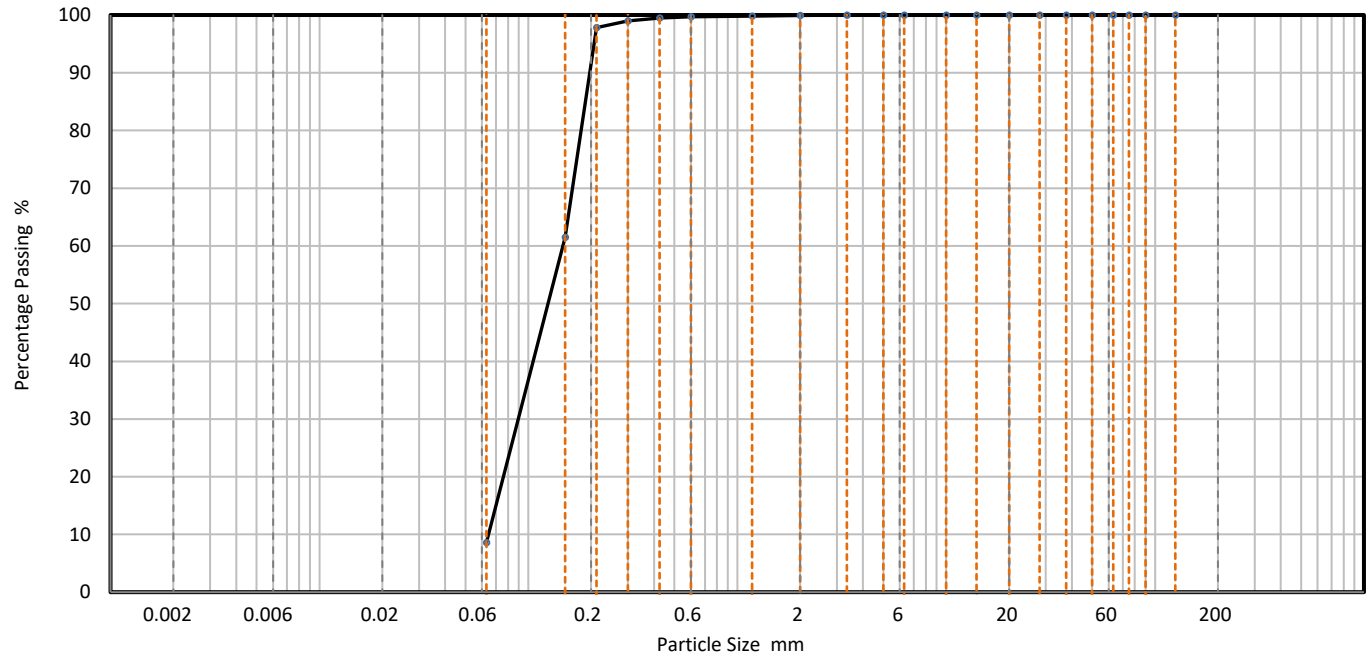
Site name

Job number

Ardersier Port

S230503

Hole	BHSP06	Lab sample ID	G2MT2023062729
Depth (Top) m	15.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Very slightly Gravelly, slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	99		
0.212	98		
0.15	62		
0.063	9		

Dry Mass of sample, g

698

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.1
Sand	91.3
Fines <0.063mm	9.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.3
Curvature Coefficient	0.85

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	30/06/2023 10:12

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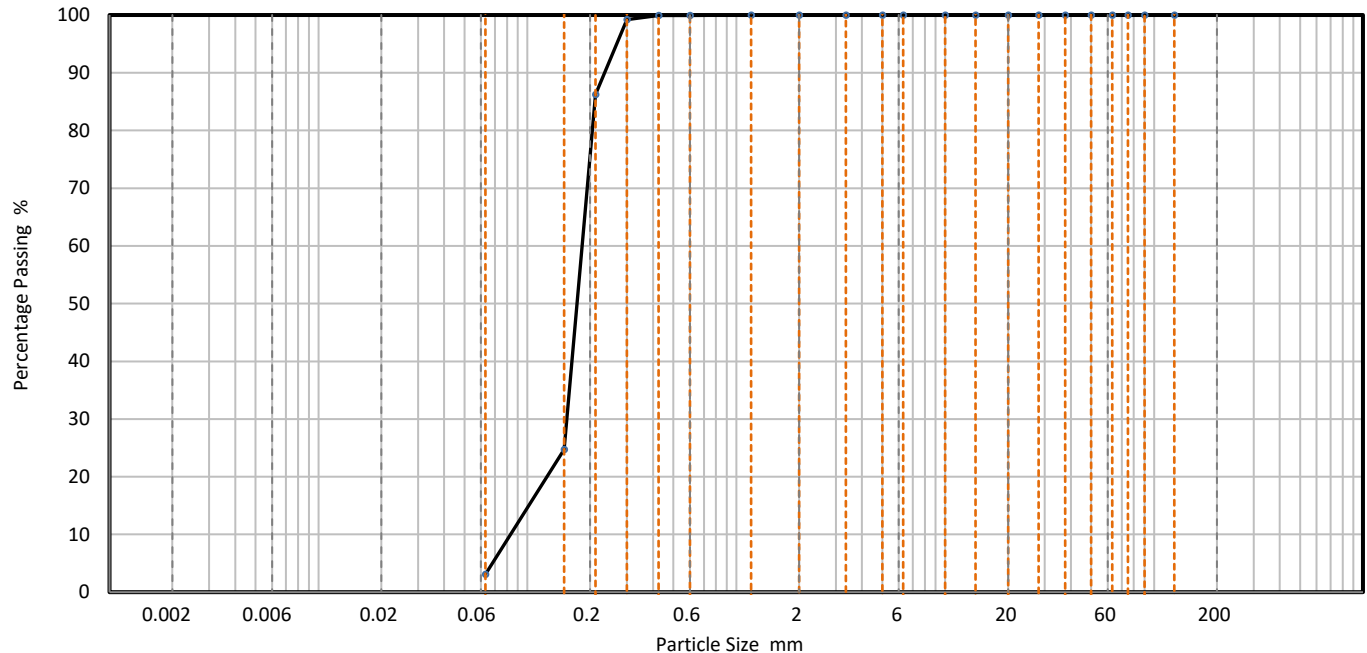
Site name

Job number

Ardersier Port

S230503

Hole	BHSP06	Lab sample ID	G2MT2023062730
Depth (Top) m	18.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	99		
0.212	86		
0.15	25		
0.063	3		

Dry Mass of sample, g

865

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	96.9
Fines <0.063mm	3.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.2
Curvature Coefficient	1.6

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	30/06/2023 10:19

PARTICLE SIZE DISTRIBUTION

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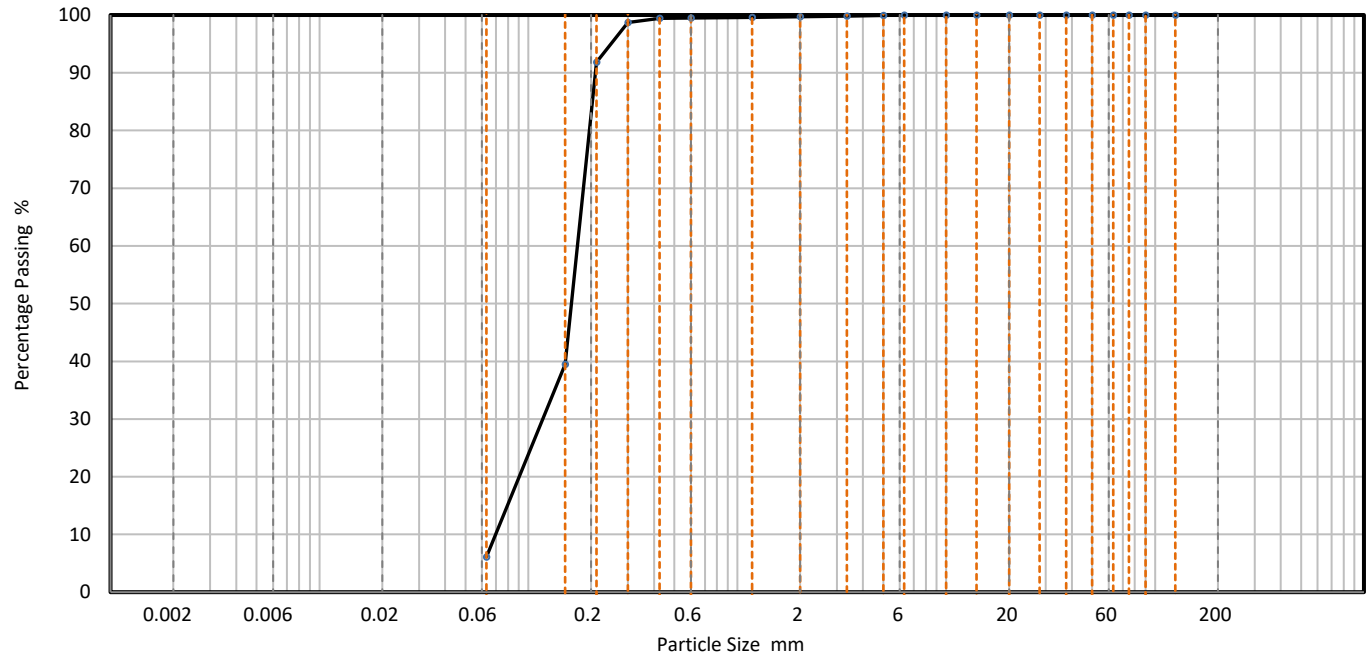
Site name

Job number

Ardersier Port

S230503

Hole	BHSP06	Lab sample ID	G2MT2023062731
Depth (Top)	m	21.00	Test Method
Depth (Base)	m		BS 1377 - 2 : 1990 Clause 9.2
Sample type	B	Soil Description	Very slightly Gravelly, slightly Silty, SAND



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	99		
0.212	92		
0.15	40		
0.063	6		

Dry Mass of sample, g

896

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.3
Sand	93.7
Fines <0.063mm	6.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.5
Curvature Coefficient	1.1

Remarks
Preparation and testing in accordance with test method unless noted below

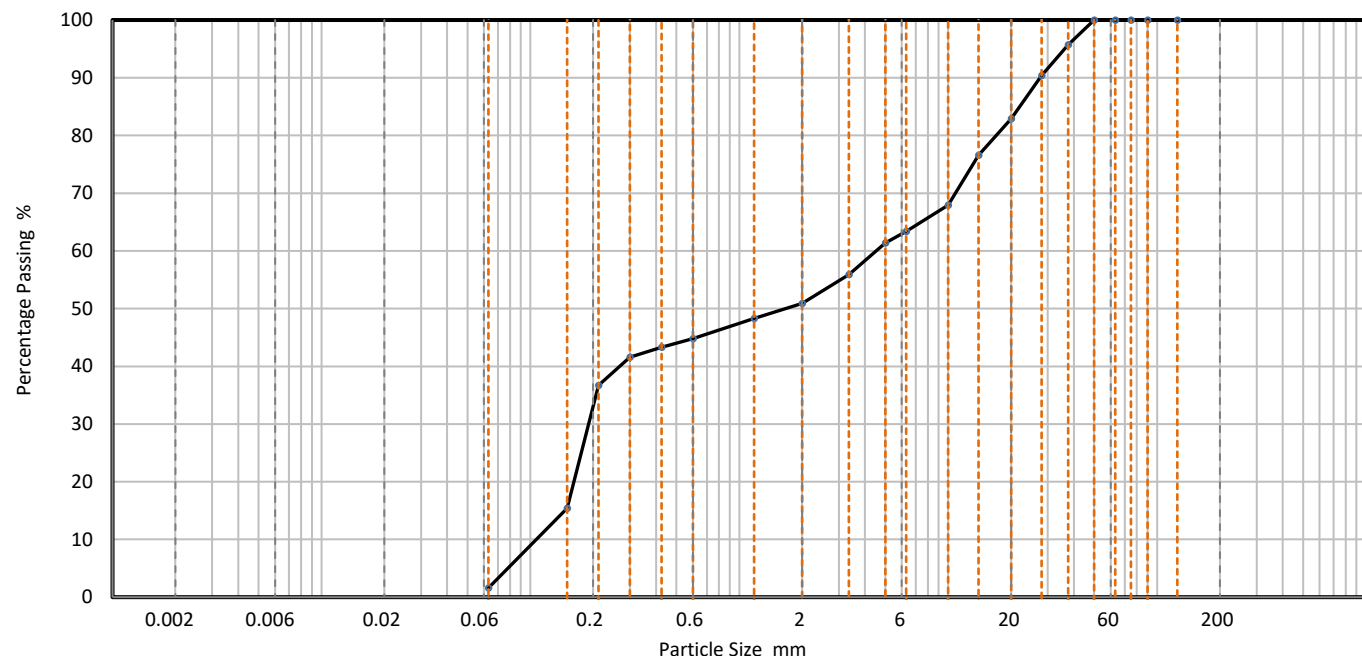
Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	30/06/2023 12:56

PARTICLE SIZE DISTRIBUTION		G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	 10258
Site name	Job number		
Ardersier Port	S230503		

Hole	BHSP06	Lab sample ID	G2MT2023062732
Depth (Top)	m 24.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Slightly Silty, very Gravelly, SAND
Sample type	B		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	96		
28	90		
20	83		
14	77		
10	68		
6.3	63		
5	61		
3.35	56		
2	51		
1.18	48		
0.6	45		
0.425	43		
0.3	42		
0.212	37		
0.15	15		
0.063	2		

Dry Mass of sample, g	2081

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	49.1
Sand	49.3
Fines <0.063mm	2.0

Grading Analysis	
D100	mm 100
D60	mm 4.52
D30	mm 0.19
D10	mm 0.107
Uniformity Coefficient	42
Curvature Coefficient	0.075

Remarks
 Preparation and testing in accordance with test method unless noted below

 Sample tested was deviating in accordance with BS1377 test standard

Accreditation status Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Approved by</td> <td style="width: 50%;">D Anderson</td> </tr> <tr> <td>Approval date</td> <td>30/06/2023 10:16</td> </tr> </table>	Approved by	D Anderson	Approval date	30/06/2023 10:16
Approved by	D Anderson				
Approval date	30/06/2023 10:16				

PARTICLE SIZE DISTRIBUTION

G2M Testing (Stockton)

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Stockton on Tees,
TS18 3NA

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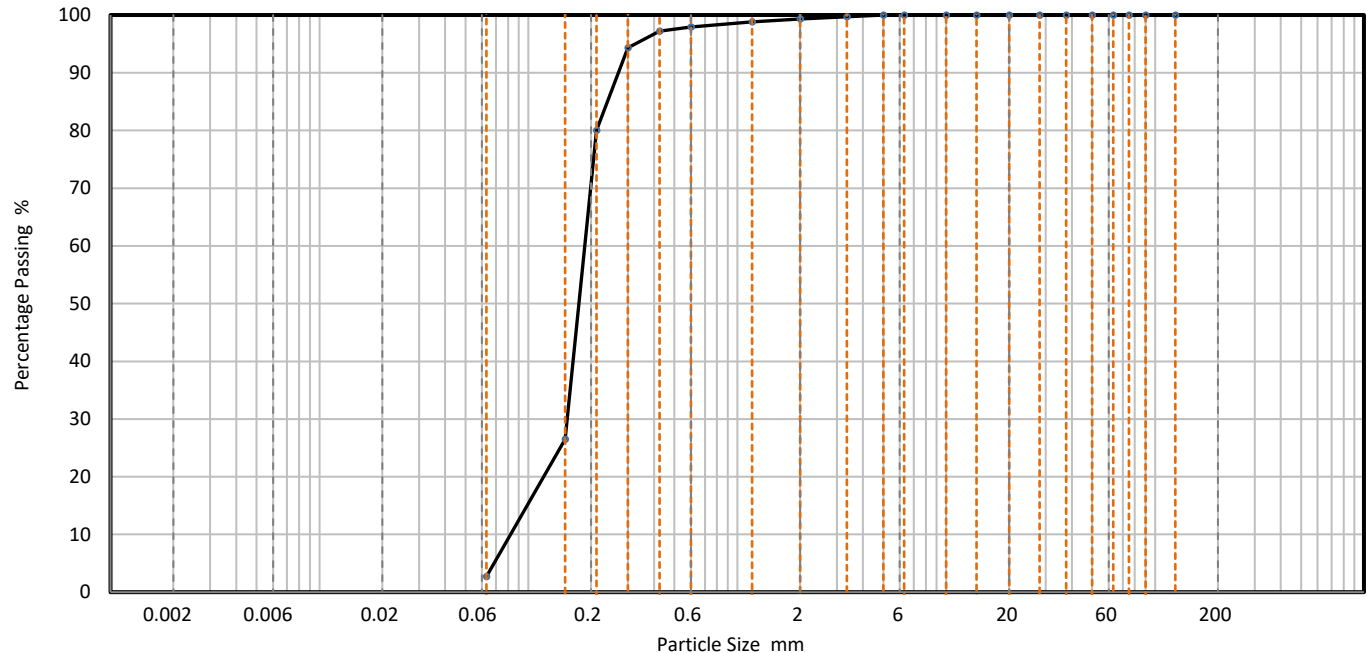
Site name

Job number

Ardersier Port

S230503

Hole	BHSP06	Lab sample ID	G2MT2023062733
Depth (Top) m	27.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Very slightly Gravelly, slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	98		
0.425	97		
0.3	94		
0.212	80		
0.15	27		
0.063	3		

Dry Mass of sample, g

972

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.7
Sand	96.6
Fines <0.063mm	3.0

Grading Analysis	
D100 mm	
D60 mm	0.186
D30 mm	0.153
D10 mm	0.0821
Uniformity Coefficient	2.3
Curvature Coefficient	1.5

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	30/06/2023 12:59

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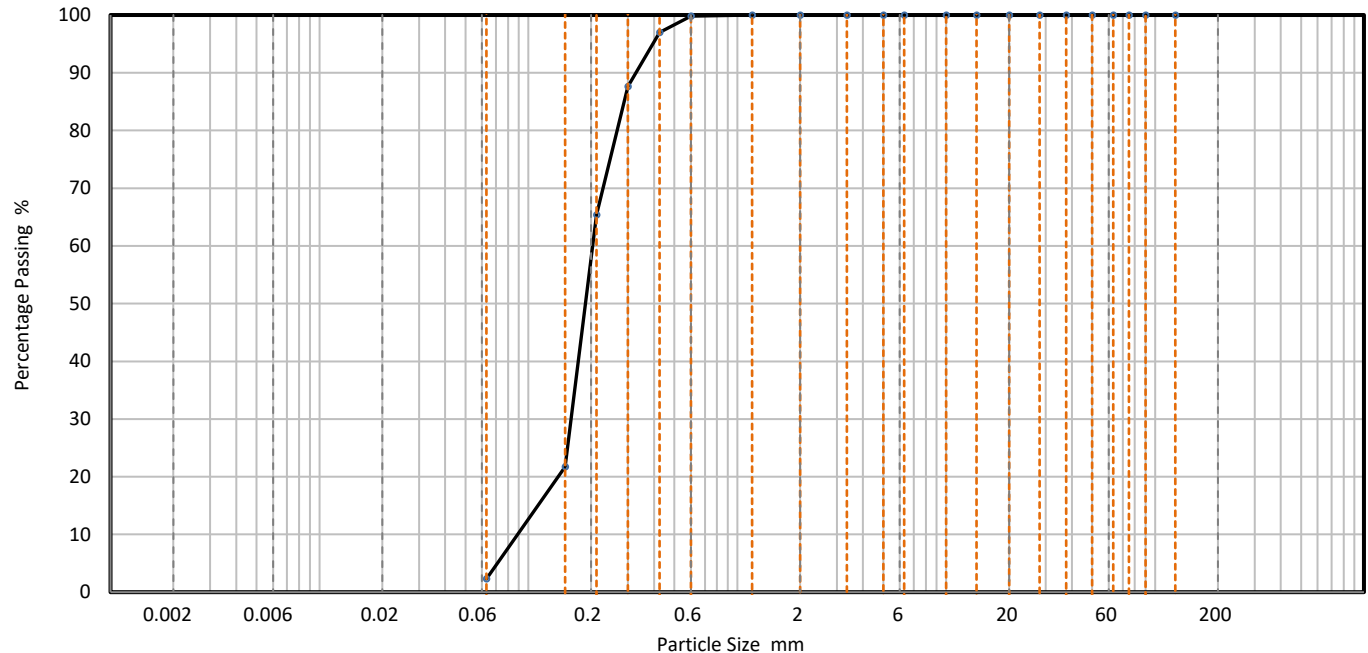
Site name

Job number

Ardersier Port

S230503

Hole	BHSP06	Lab sample ID	G2MT2023062734
Depth (Top)	m 30.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	97		
0.3	88		
0.212	65		
0.15	22		
0.063	2		

Dry Mass of sample, g

1095

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	97.7
Fines <0.063mm	2.0

Grading Analysis	
D100	mm 100
D60	mm 0.203
D30	mm 0.16
D10	mm 0.089
Uniformity Coefficient	2.3
Curvature Coefficient	1.4

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	30/06/2023 13:02

PARTICLE SIZE DISTRIBUTION

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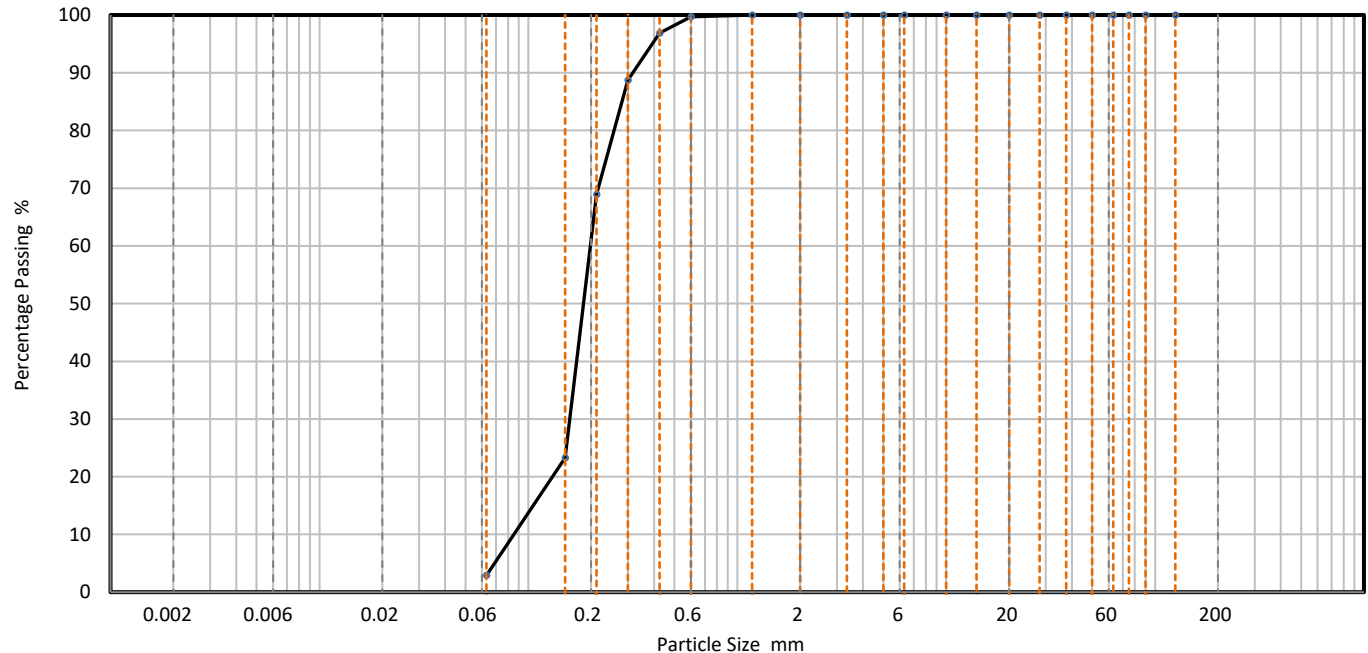
Site name

Job number

Ardersier Port

S230503

Hole	BHSP06	Lab sample ID	G2MT2023062735
Depth (Top) m	31.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	97		
0.3	89		
0.212	69		
0.15	23		
0.063	3		

Dry Mass of sample, g

1158

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	97.1
Fines <0.063mm	3.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.3
Curvature Coefficient	1.5

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	30/06/2023 13:04

PARTICLE SIZE DISTRIBUTION

G2M Testing (Stockton)

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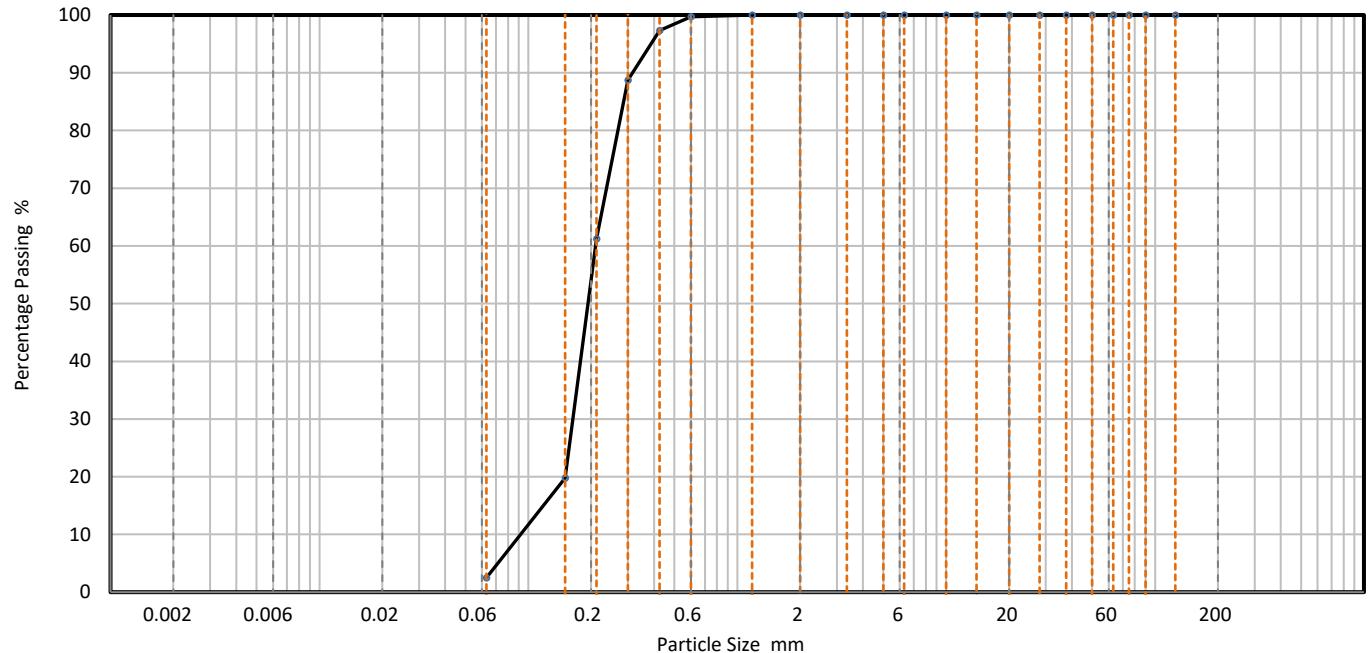
Site name

Job number

Ardersier Port

S230503

Hole	BHSP06	Lab sample ID	G2MT2023062736
Depth (Top) m	34.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	97		
0.3	89		
0.212	61		
0.15	20		
0.063	3		

Dry Mass of sample, g

1019

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	97.5
Fines <0.063mm	2.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.3
Curvature Coefficient	1.4

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	30/06/2023 13:06

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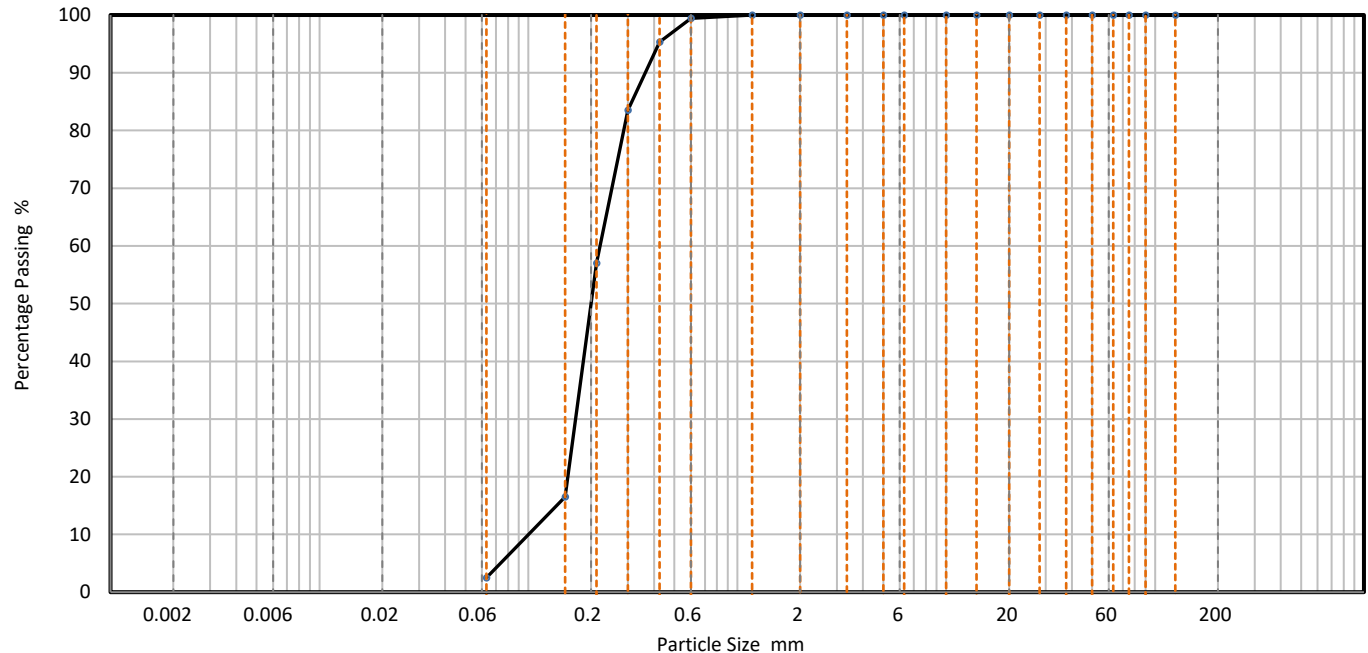
Site name

Job number

Ardersier Port

S230503

Hole	BHSP06	Lab sample ID	G2MT2023062737
Depth (Top)	m 36.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99		
0.425	95		
0.3	84		
0.212	57		
0.15	17		
0.063	3		

Dry Mass of sample, g

1219

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	97.5
Fines <0.063mm	2.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.2
Curvature Coefficient	1.3

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	30/06/2023 10:19

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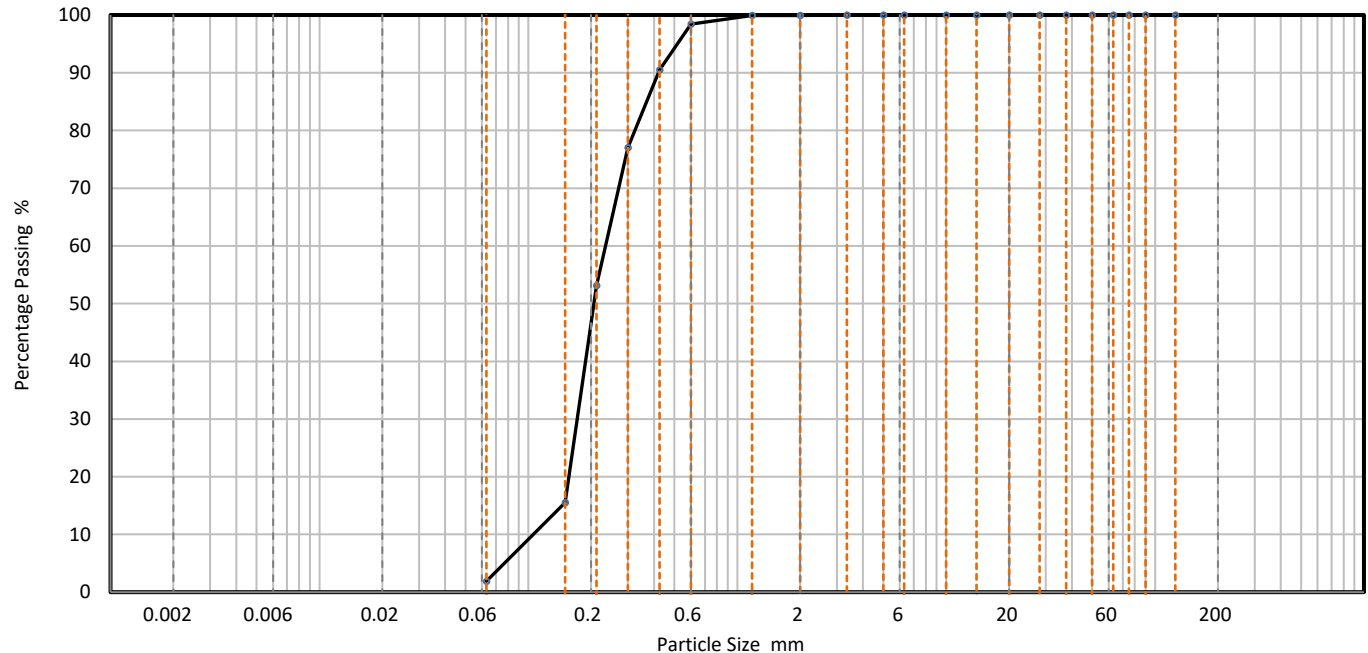
Site name

Job number

Ardersier Port

S230503

Hole	BHSP06	Lab sample ID	G2MT2023062738
Depth (Top)	m 39.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Very slightly Gravelly, slightly Silty, SAND
Sample type	D		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	98		
0.425	91		
0.3	77		
0.212	53		
0.15	16		
0.063	2		

Dry Mass of sample, g

503

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.1
Sand	98.1
Fines <0.063mm	2.0

Grading Analysis	
D100 mm	
D60 mm	0.234
D30 mm	0.171
D10 mm	0.106
Uniformity Coefficient	2.2
Curvature Coefficient	1.2

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	30/06/2023 13:08

Laboratory Report Front Sheet

Site name	Job number	G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	 10258
Ardersier Port	S230503		

Client details:

Reference: S230503
Name: Solmek
Address: 12 Yarm Road,
Stockton-on-tees,
TS18 3NA

Telephone: 01642 607083

Email: [Redacted]

FAO: Adrian Cutts

Samples received:

Date commenced: 14/07/2023

Date reported: 20/07/2023

Observations and interpretations are outside of the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Samples will be held at the laboratory for a period of 4 weeks after the report date. After the above reporting date the samples will be disposed of. Should further testing be required then the office should be informed before the above date.

Signature:	Approved Signatories:
[Redacted]	☐ D.Anderson (Managing Director) ☒ J. Brischuk (Laboratory Manager) ☐

Summary of Classification Tests

G2M Testing (Stockton)

12-16 Yarm Road,
Stockton on Tees,
TS18 3NA

01642 033318

info@g2mtesting.co.uk



10258

Site name	Job number
Ardersier Port	S230503

Hole	Depth		Type	w %	Oven temp. oc	wa %	Pa %	Pr %	wL %	wP %	IP %	IL	Plasticity class	Preparation method
	Top m	Base m												
BHSP07	0.70		B	20	105									
BHSP07	2.00		B	19	105									
BHSP07	4.00		B	19	105									
BHSP07	6.00		B	17	105									
BHSP07	8.00		B	7.6	105									
BHSP07	10.10		B	18	105									
BHSP07	13.50		B	19	105									
BHSP07	16.50		B	20	105									
BHSP07	19.50		B	21	105									
BHSP07	22.50		B	21	105									
BHSP07	25.50		B	21	105									
BHSP07	28.50		B	20	105									
BHSP07	31.50		B	18	105									
BHSP07	34.50		B	19	105									

All tests found in G2M Testing UKAS Schedule of Accreditation are tested to standard unless otherwise indicated

Key	Description	Category	BS Test Code
w	Moisture content		BS 1377:1990 Part 2 Clause 3.2
wa	Equivalent moisture content passing 425µm sieve		BS 1377:1990 Part 2 Clause 3.2
wL	Liquid limit	Single point	-s BS 1377:1990 Part 2 Clause 4.4
		Four point	-f BS 1377:1990 Part 2 Clause 4.3
wP	Plastic limit		BS 1377:1990 Part 2 Clause 5.2
Pa	Percentage passing 425µm sieve		
Pr	Percentage retained 425µm sieve		
IP	Plasticity index		BS 1377:1990 Part 2 Clause 5.4
IL	Liquidity index		BS 1377:1990 Part 2 Clause 5.4
	Suffix indicating test is "Not UKAS Accredited"	*	

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Approval date	20/07/2023 14:09
Date report generated	
Report Number	

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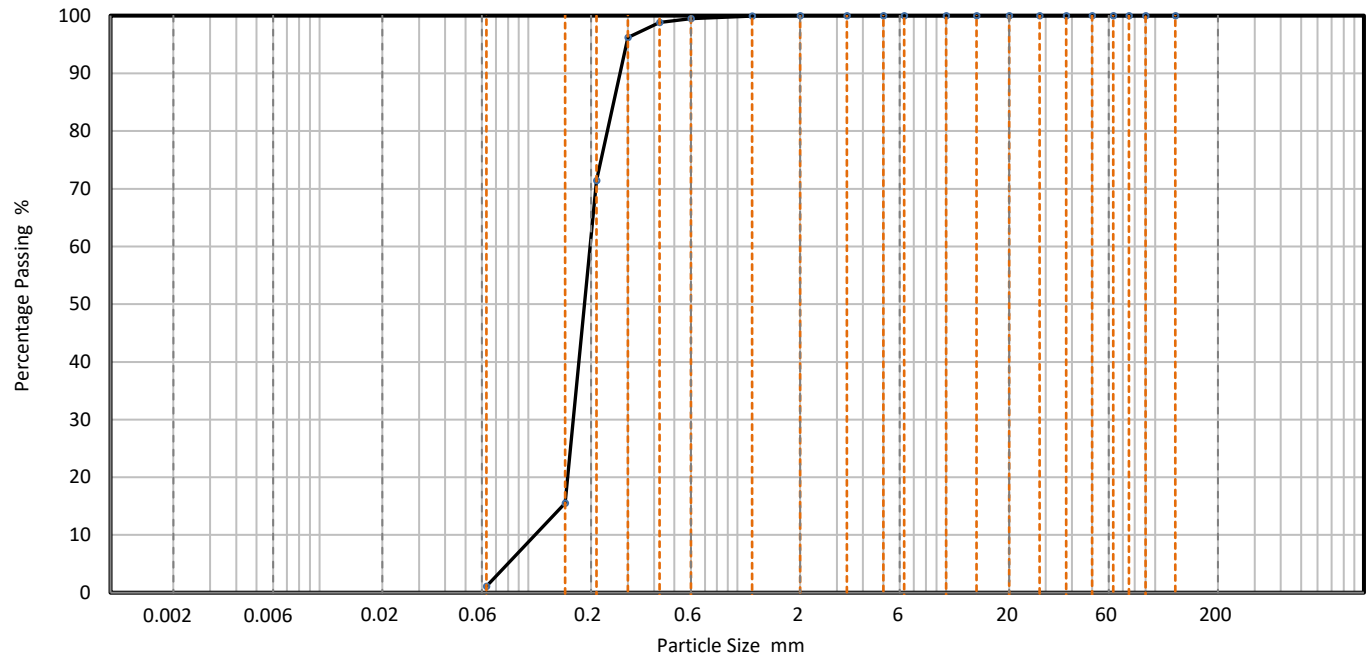
Site name

Job number

Ardersier Port

S230503

Hole		BHSP07	Lab sample ID	G2MT2023071492
Depth (Top)	m	0.70	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Clayey SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	96		
0.212	71		
0.15	16		
0.063	1		

Dry Mass of sample, g

497

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	98.9
Fines <0.063mm	1.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1.8
Curvature Coefficient	1.3

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

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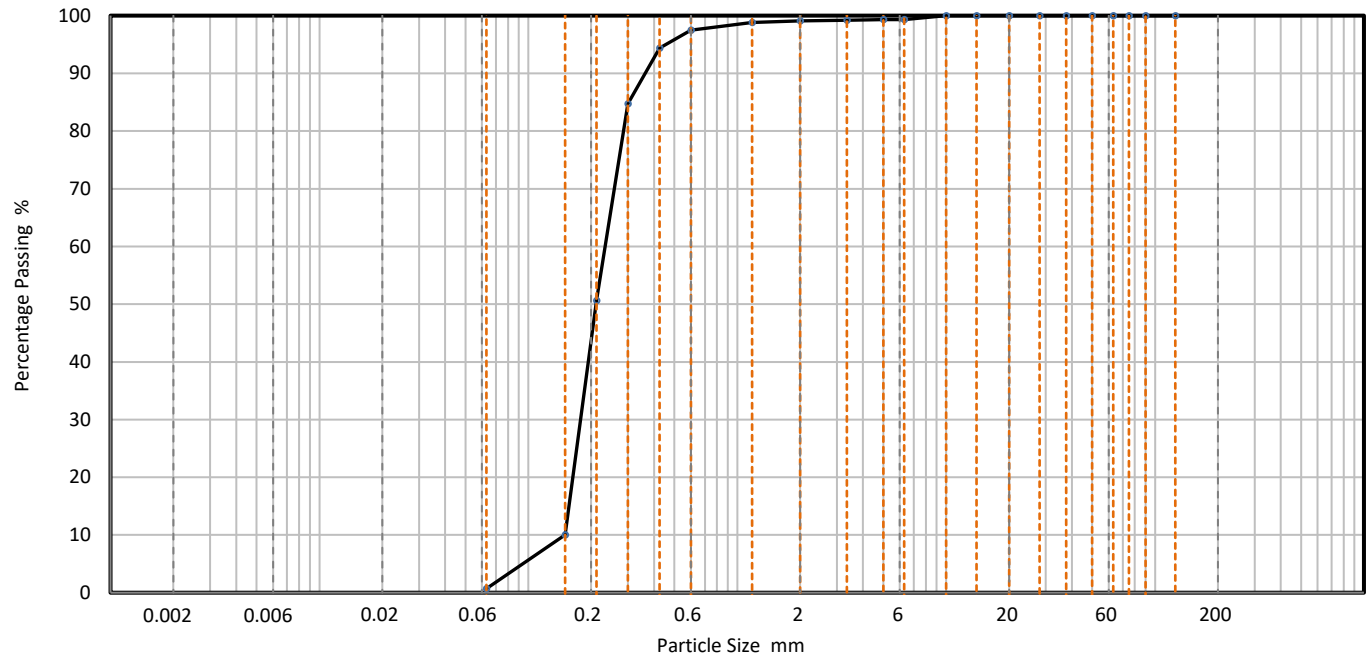
Site name

Job number

Ardersier Port

S230503

Hole		BHSP07	Lab sample ID	G2MT2023071493
Depth (Top)	m	2.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Gravelly, Slightly Clayey, SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99		
5	99		
3.35	99		
2	99		
1.18	99		
0.6	98		
0.425	94		
0.3	85		
0.212	51		
0.15	10		
0.063	1		

Dry Mass of sample, g

434

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.9
Sand	98.4
Fines <0.063mm	1.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1.6
Curvature Coefficient	0.9

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

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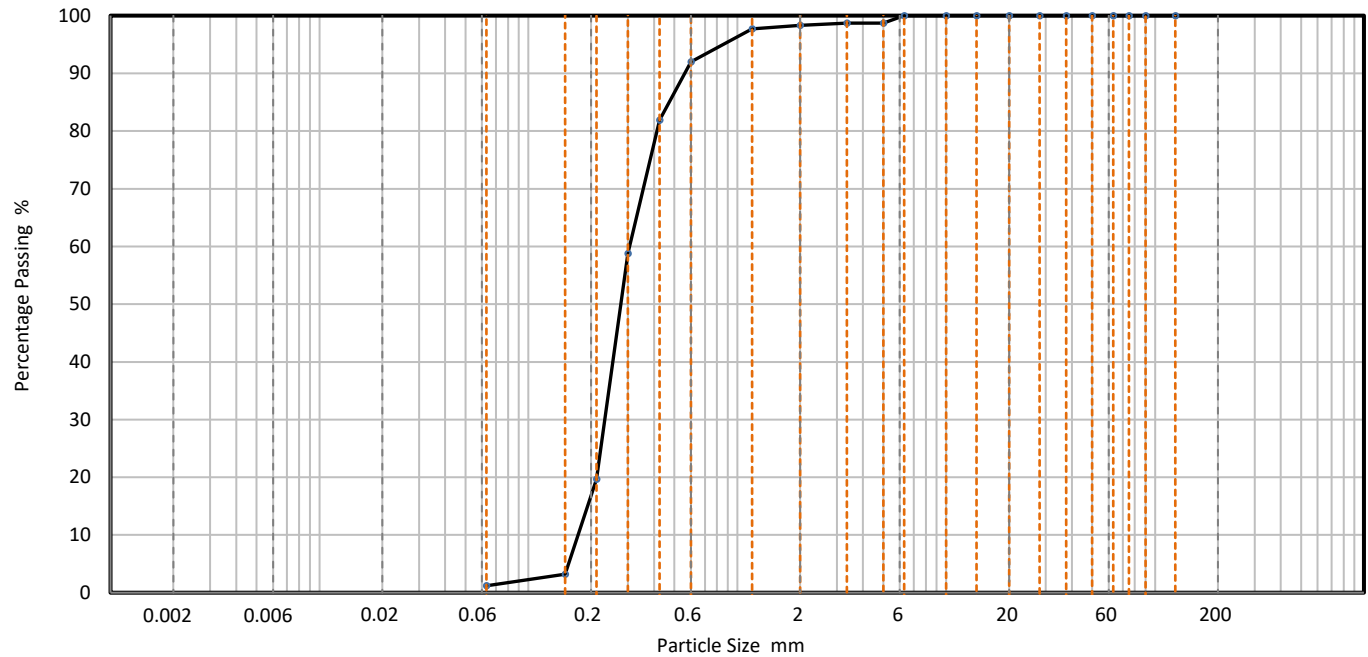
Site name

Job number

Ardersier Port

S230503

Hole		BHSP07	Lab sample ID	G2MT2023071494
Depth (Top)	m	4.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Clayey, Slightly Gravelly, SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	99		
3.35	99		
2	98		
1.18	98		
0.6	92		
0.425	82		
0.3	59		
0.212	20		
0.15	3		
0.063	1		

Dry Mass of sample, g

911

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	1.7
Sand	97.1
Fines <0.063mm	1.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1.8
Curvature Coefficient	1

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

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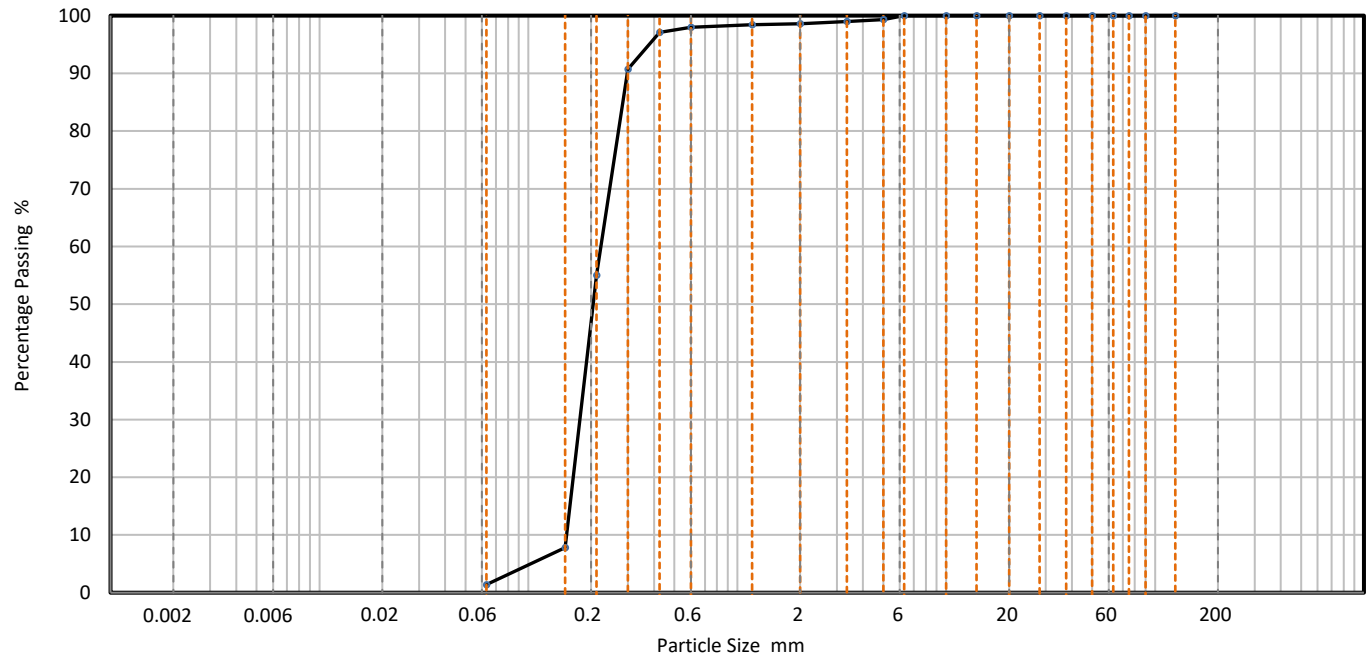
Site name

Job number

Ardersier Port

S230503

Hole		BHSP07	Lab sample ID	G2MT2023071495
Depth (Top)	m	6.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Clayey, Slightly Gravelly, SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	99		
3.35	99		
2	99		
1.18	98		
0.6	98		
0.425	97		
0.3	91		
0.212	55		
0.15	8		
0.063	1		

Dry Mass of sample, g

429

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	1.4
Sand	97.2
Fines <0.063mm	1.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1.5
Curvature Coefficient	0.92

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

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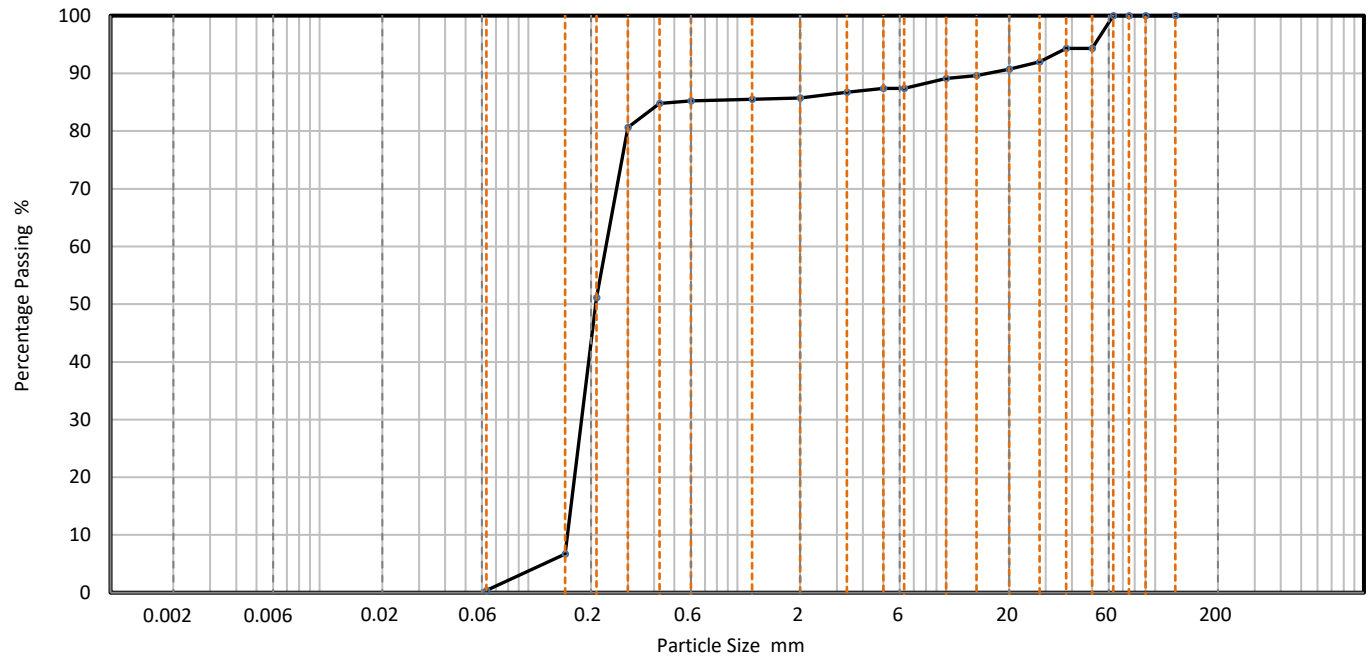
Site name

Job number

Ardersier Port

S230503

Hole		BHSP07	Lab sample ID	G2MT2023071496
Depth (Top)	m	8.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Gravelly SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	94		
37.5	94		
28	92		
20	91		
14	90		
10	89		
6.3	87		
5	87		
3.35	87		
2	86		
1.18	86		
0.6	85		
0.425	85		
0.3	81		
0.212	51		
0.15	7		
0.063	0		

Dry Mass of sample, g

6819

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	14.3
Sand	85.3
Fines <0.063mm	0.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1.5
Curvature Coefficient	0.89

Remarks
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Accreditation status

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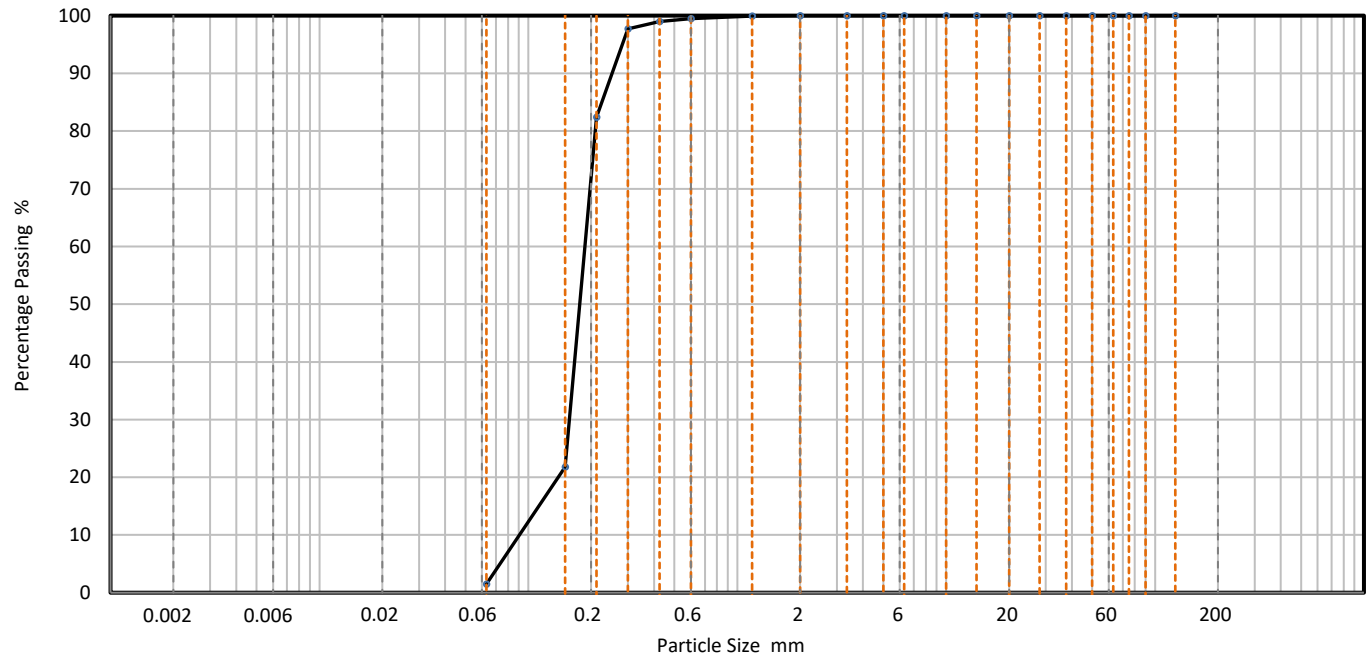
Site name

Job number

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S230503

Hole		BHSP07	Lab sample ID	G2MT2023071497
Depth (Top)	m	10.10	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Clayey SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	98		
0.212	82		
0.15	22		
0.063	2		

Dry Mass of sample, g

539

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	98.5
Fines <0.063mm	2.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.1
Curvature Coefficient	1.5

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

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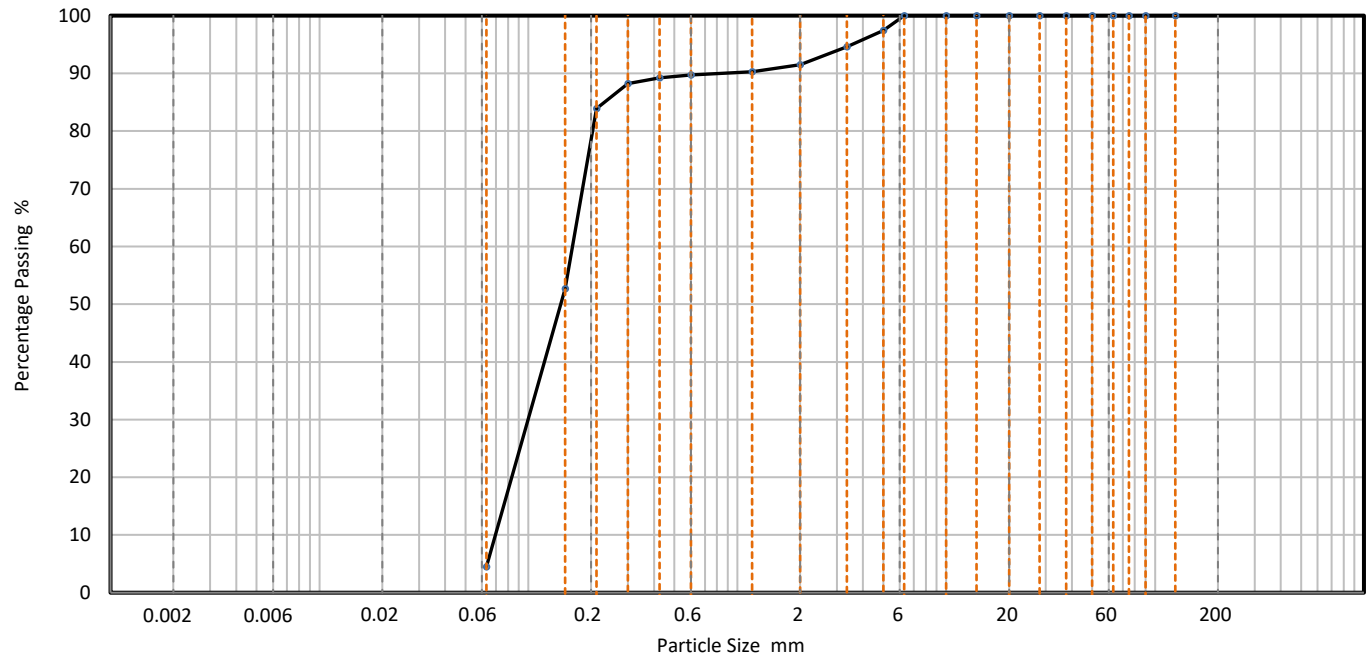
Site name

Job number

Ardersier Port

S230503

Hole	BHSP07	Lab sample ID	G2MT2023071498
Depth (Top)	m	13.50	Test Method
Depth (Base)	m		BS 1377 - 2 : 1990 Clause 9.2
Sample type	B	Soil Description	Slightly Clayey, Gravelly SAND



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	97		
3.35	95		
2	92		
1.18	90		
0.6	90		
0.425	89		
0.3	88		
0.212	84		
0.15	53		
0.063	5		

Dry Mass of sample, g

458

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	8.5
Sand	87.0
Fines <0.063mm	4.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.3
Curvature Coefficient	0.88

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

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Approval date	20/07/2023 14:37

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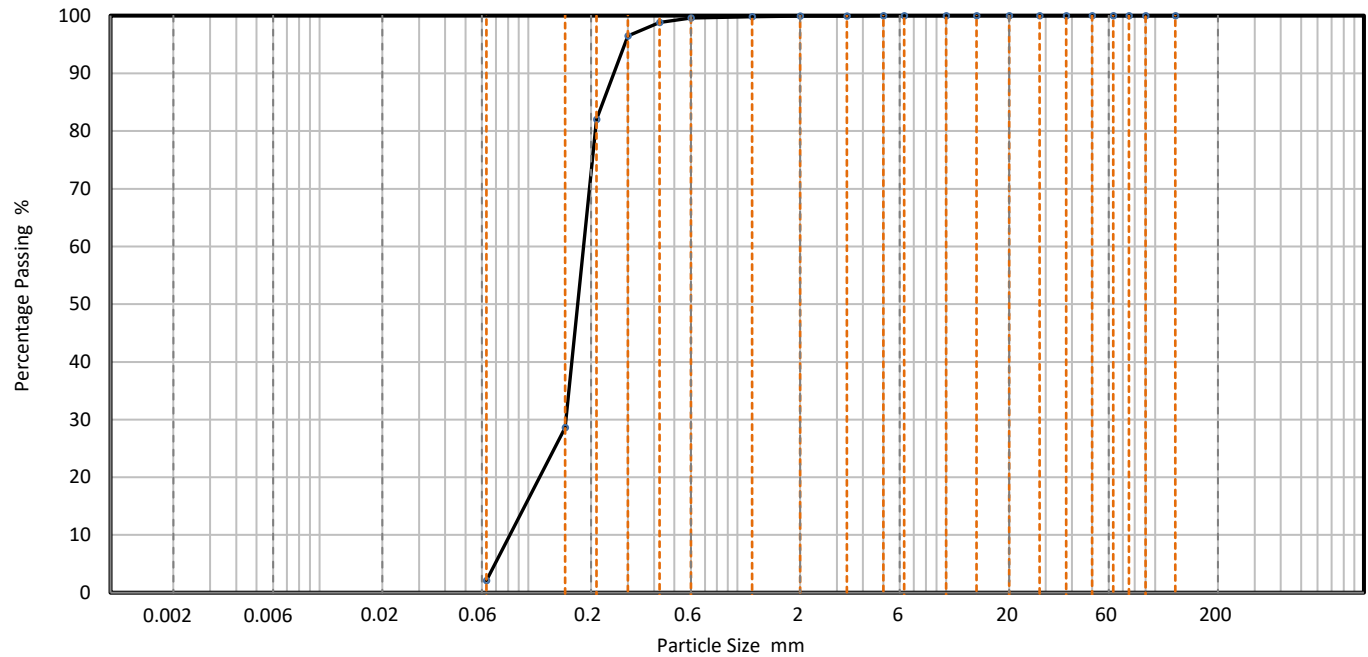
Site name

Job number

Ardersier Port

S230503

Hole		BHSP07	Lab sample ID	G2MT2023071499
Depth (Top)	m	16.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Gravelly, Slightly Clayey, SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	97		
0.212	82		
0.15	29		
0.063	2		

Dry Mass of sample, g

437

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.1
Sand	97.7
Fines <0.063mm	2.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.3
Curvature Coefficient	1.5

Remarks
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Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

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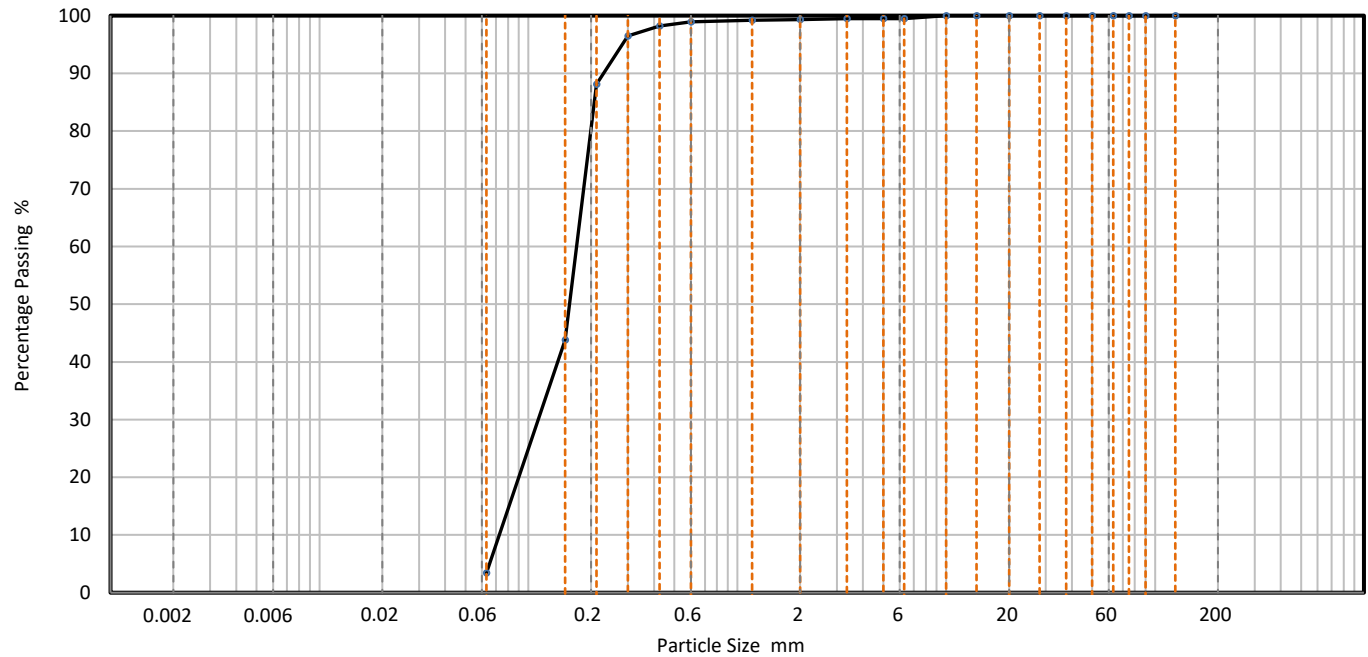
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Ardersier Port

S230503

Hole		BHSP07	Lab sample ID	G2MT20230714100
Depth (Top)	m	19.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Gravelly, Slightly Clayey SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	99		
0.425	98		
0.3	97		
0.212	88		
0.15	44		
0.063	3		

Dry Mass of sample, g

854

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.7
Sand	95.9
Fines <0.063mm	3.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.3
Curvature Coefficient	1

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

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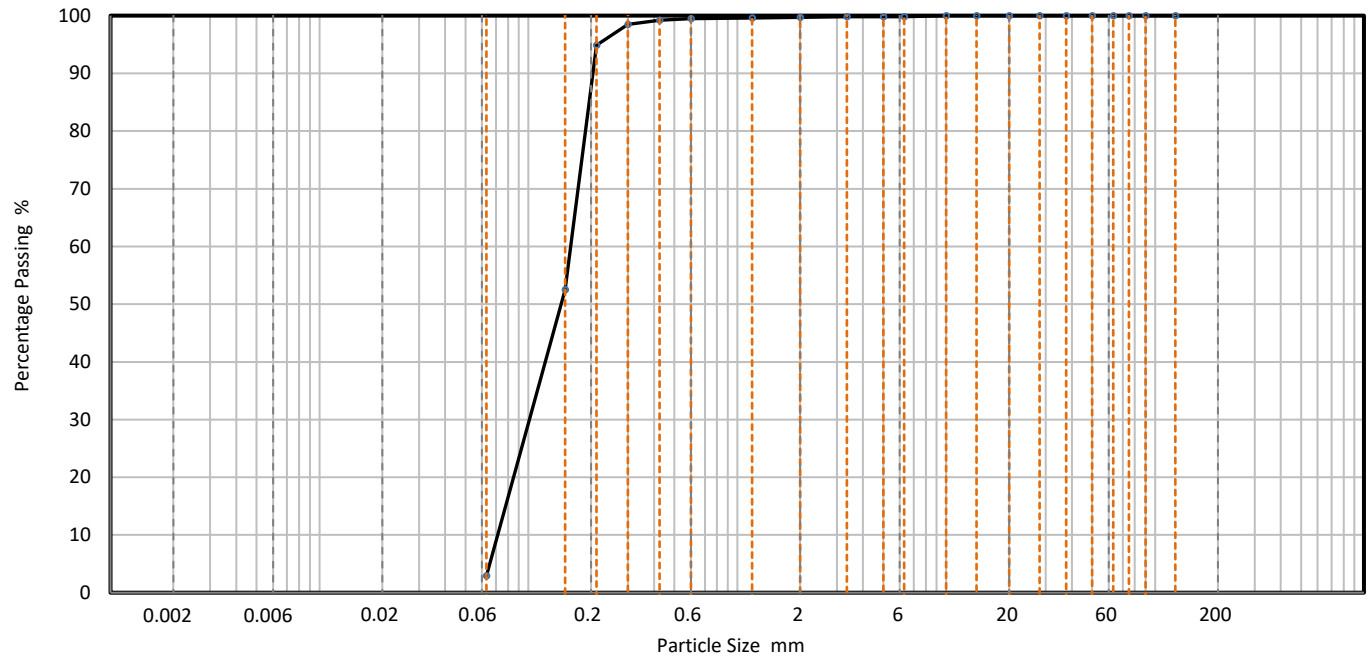
Site name

Job number

Ardersier Port

S230503

Hole		BHSP07	Lab sample ID	G2MT20230714101
Depth (Top)	m	22.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Gravelly, Slightly Clayey SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	99		
0.212	95		
0.15	53		
0.063	3		

Dry Mass of sample, g

449

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.3
Sand	96.8
Fines <0.063mm	3.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.2
Curvature Coefficient	0.9

Remarks
Preparation and testing in accordance with test method unless noted below

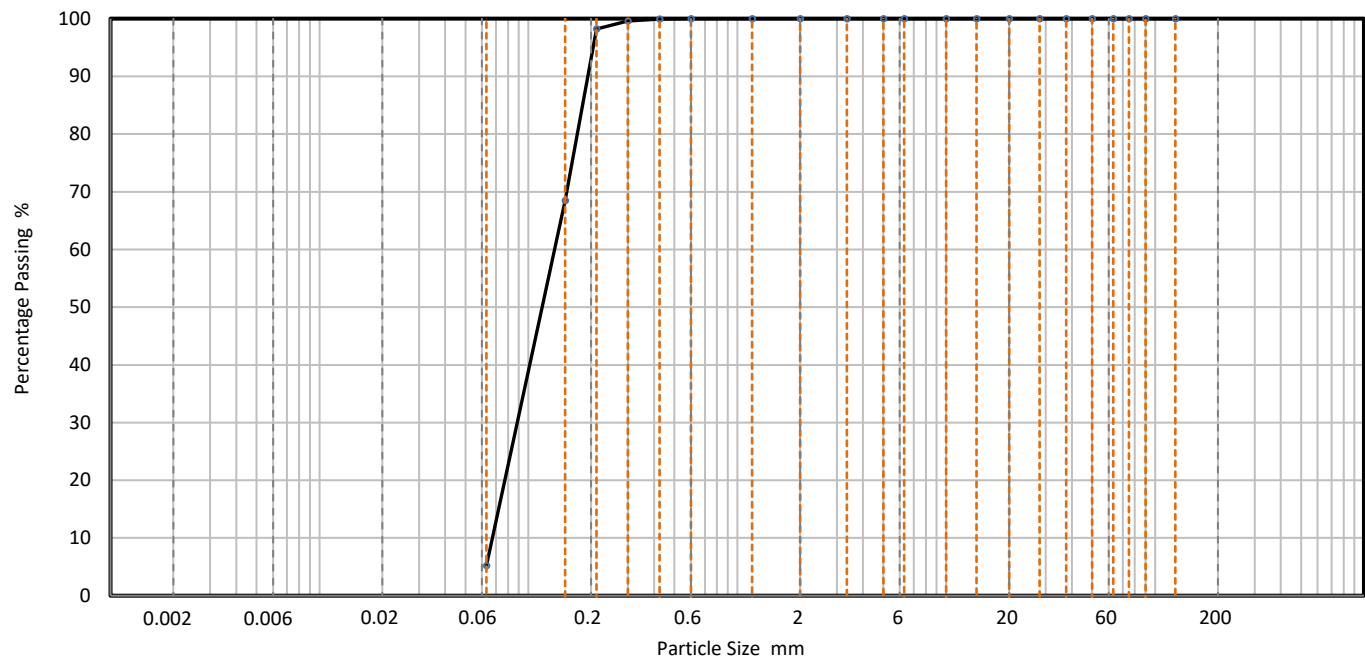
Accreditation status

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Site name	Job number		
Ardersier Port	S230503		

Hole		BHSP07	Lab sample ID	G2MT20230714102
Depth (Top)	m	25.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Clayey SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	98		
0.15	69		
0.063	5		

Dry Mass of sample, g	443

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	94.8
Fines <0.063mm	5.0

Grading Analysis	
D100 mm	100
D60 mm	0.134
D30 mm	0.0885
D10 mm	0.0673
Uniformity Coefficient	2
Curvature Coefficient	0.87

Remarks
 Preparation and testing in accordance with test method unless noted below

Accreditation status
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Approval date	20/07/2023 14:37

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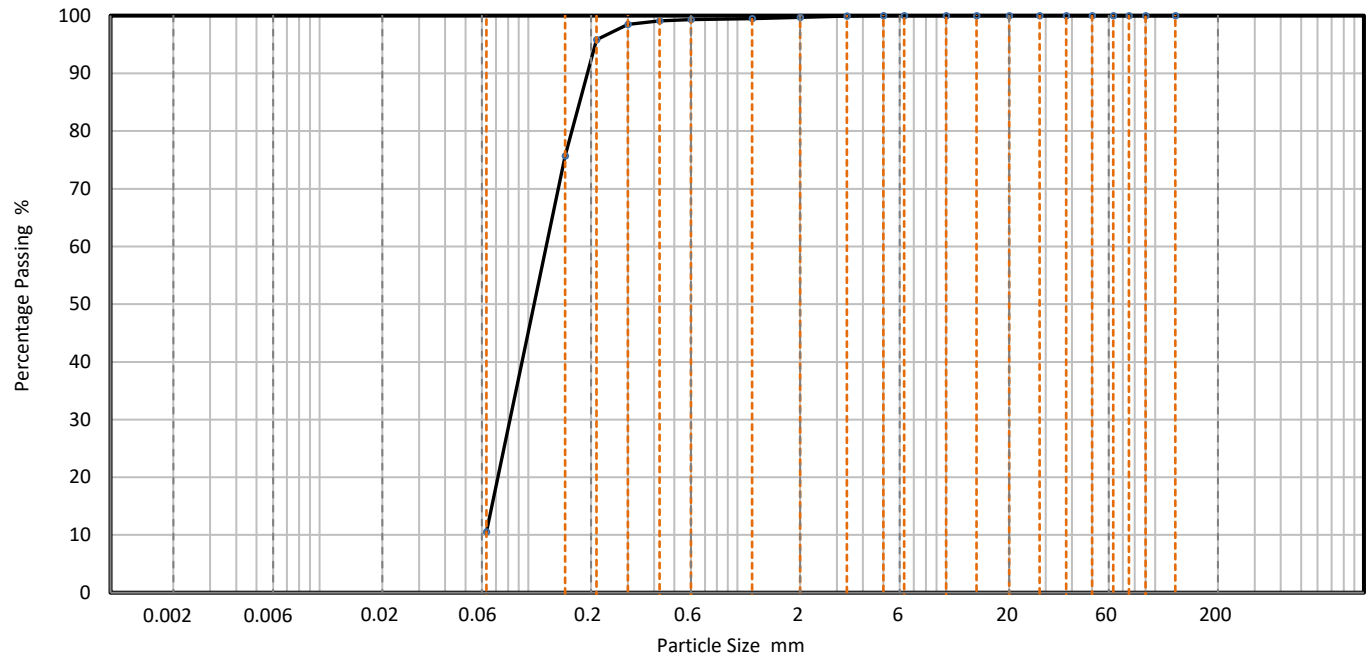
Site name

Job number

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S230503

Hole	BHSP07	Lab sample ID	G2MT20230714103
Depth (Top)	m 28.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Slightly Gravelly, Clayey, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99		
0.425	99		
0.3	99		
0.212	96		
0.15	76		
0.063	11		

Dry Mass of sample, g

428

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.3
Sand	89.1
Fines <0.063mm	11.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	JBrischuk
Approval date	20/07/2023 14:37

PARTICLE SIZE DISTRIBUTION

G2M Testing (Stockton)

12-16 Yarm Road,
Stockton on Tees,
TS18 3NA

01642 033318

info@g2mtesting.co.uk



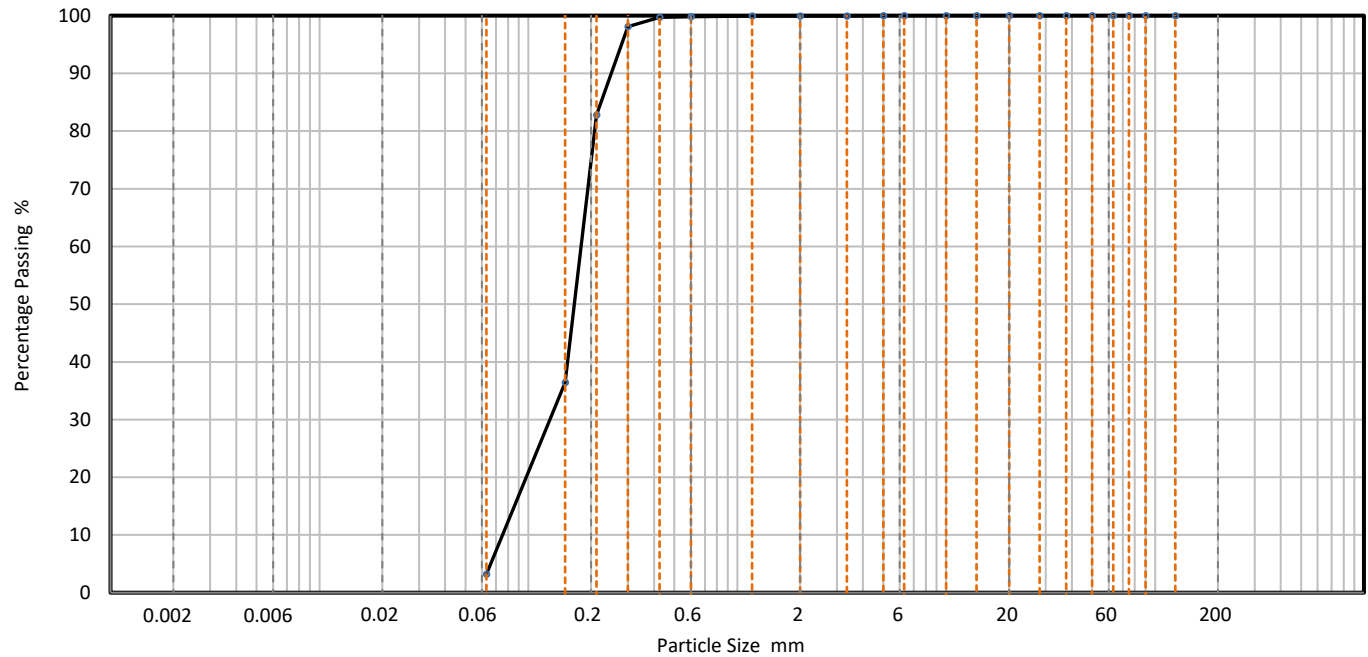
Site name

Job number

Ardersier Port

S230503

Hole		BHSP07	Lab sample ID	G2MT20230714104
Depth (Top)	m	31.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Gravelly, Slightly Clayey SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	98		
0.212	83		
0.15	36		
0.063	3		

Dry Mass of sample, g

434

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.1
Sand	96.7
Fines <0.063mm	3.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.4
Curvature Coefficient	1.2

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	JBrischuk
Approval date	20/07/2023 14:37

PARTICLE SIZE DISTRIBUTION

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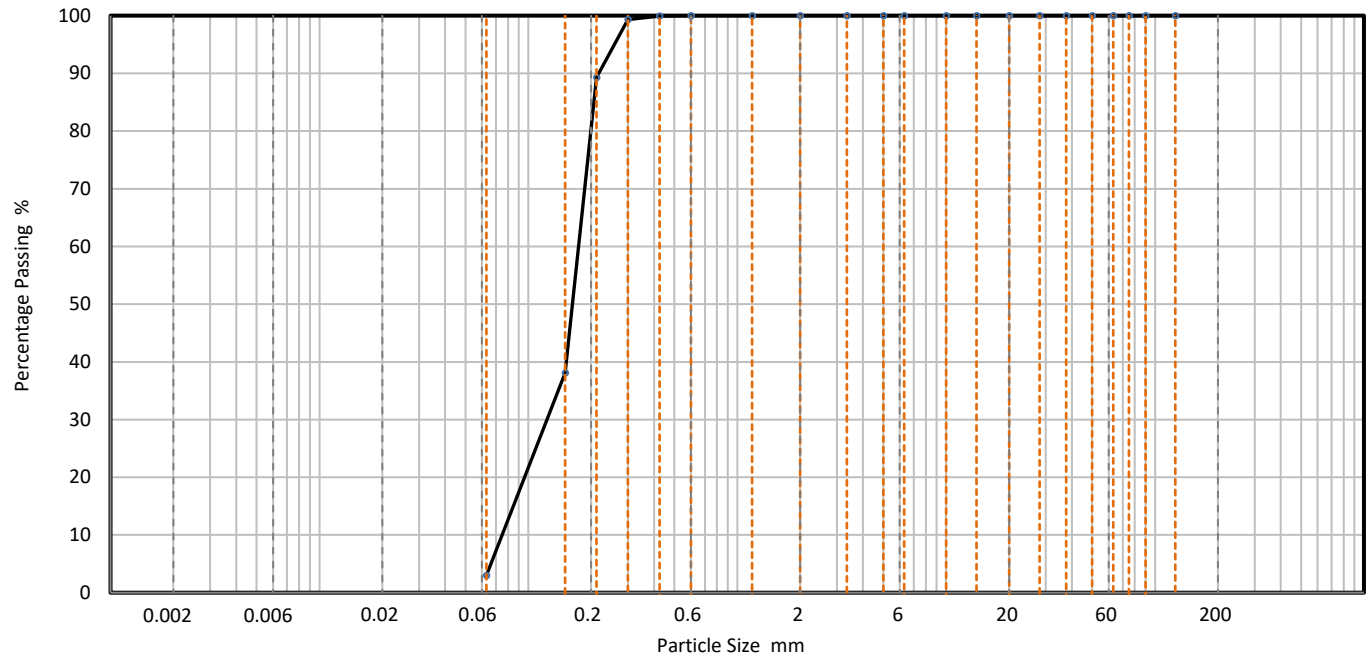
Site name

Job number

Ardersier Port

S230503

Hole		BHSP07	Lab sample ID	G2MT20230714105
Depth (Top)	m	34.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Slightly Clayey SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	99		
0.212	89		
0.15	38		
0.063	3		

Dry Mass of sample, g

553

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	97.0
Fines <0.063mm	3.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.3
Curvature Coefficient	1.2

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by

JBrischuk

Approval date

20/07/2023 14:37

Laboratory Report Front Sheet		G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	
Site name	Job number		
Ardersier Port	S230503		

Client details:

Reference: S230503
 Name: Solmek
 Address: 12 Yarm Road,
 Stockton-on-tees,
 TS18 3NA

Telephone: 01642 607083
 Email: [Redacted]

FAO: Adrian Cutts

Samples received:

Date commenced: 28/07/2023

Date reported: 31/07/2023

Observations and interpretations are outside of the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Samples will be held at the laboratory for a period of 4 weeks after the report date. After the above reporting date the samples will be disposed of. Should further testing be required then the office should be informed before the above date.

Signature:	Approved Signatories:
[Redacted]	☒ D.Anderson (Managing Director) ☐ J. Brischuk (Laboratory Manager) ☐

Summary of Classification Tests

G2M Testing (Stockton)

12-16 Yarm Road,
Stockton on Tees,
TS18 3NA

01642 033318

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10258

Site name

Job number

Ardersier Port

S230503

[illegible]

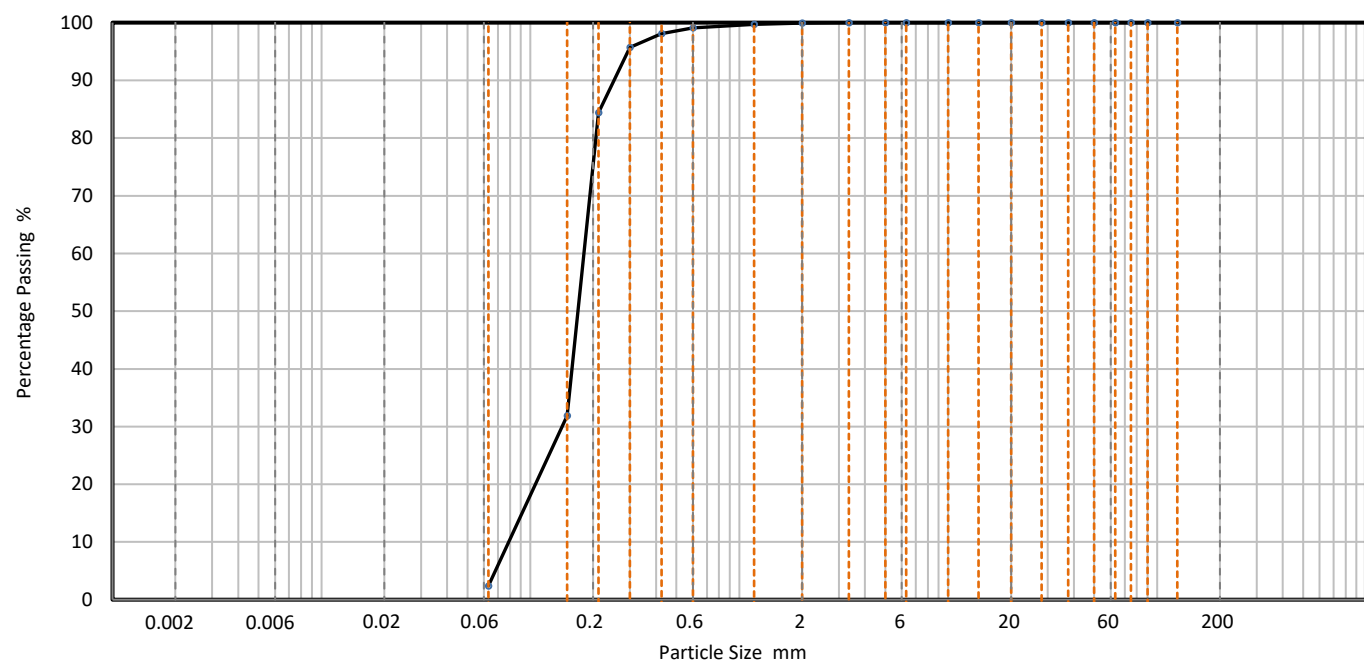
All tests found in G2M Testing UKAS Schedule of Accreditation are tested to standard unless otherwise indicated

Key	Description	Category	BS Test Code
w	Moisture content		BS 1377:1990 Part 2 Clause 3.2
wa	Equivalent moisture content passing 425µm sieve		BS 1377:1990 Part 2 Clause 3.2
wL	Liquid limit Single point Four point	-s	BS 1377:1990 Part 2 Clause 4.4
		-f	BS 1377:1990 Part 2 Clause 4.3
wP	Plastic limit		BS 1377:1990 Part 2 Clause 5.2
Pa	Percentage passing 425um sieve		
Pr	Percentage retained 425um sieve		
IP	Plasticity index		BS 1377:1990 Part 2 Clause 5.4
IL	Liquidity index		BS 1377:1990 Part 2 Clause 5.4
	Suffix indicating test is "Not UKAS Accredited"	*	

Approved by	D Anderson
Approval date	31/07/2023 12:32
Date report generated	
Report Number	

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Site name	Job number		
Ardersier Port	S230503		

Hole	BHSP07	Lab sample ID	G2MT202307280
Depth (Top)	m 18.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Very slightly Gravelly, slightly Silty, SAND
Sample type	B		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99		
0.425	98		
0.3	96		
0.212	84		
0.15	32		
0.063	2		

Dry Mass of sample, g	463

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.1
Sand	97.5
Fines <0.063mm	2.0

Grading Analysis	
D100 mm	
D60 mm	0.181
D30 mm	0.142
D10 mm	0.0788
Uniformity Coefficient	2.3
Curvature Coefficient	1.4

Remarks
 Preparation and testing in accordance with test method unless noted below

Accreditation status Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Approved by</td> <td style="width: 50%;">D Anderson</td> </tr> <tr> <td>Approval date</td> <td>31/07/2023 12:35</td> </tr> </table>	Approved by	D Anderson	Approval date	31/07/2023 12:35
Approved by	D Anderson				
Approval date	31/07/2023 12:35				

Laboratory Report Front Sheet		G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	 10258
Site name	Job number		
Ardersier Port	S230503		

Client details:

Reference: S230503
 Name: Solmek
 Address: 12 Yarm Road,
 Stockton-on-tees,
 TS18 3NA

Telephone: 01642 607083
 Email: [Redacted]

FAO: Ardian Cutts / Richard Woods

Samples received:

Date commenced: 19/06/2023

Date reported: 23/06/2023

Observations and interpretations are outside of the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Samples will be held at the laboratory for a period of 4 weeks after the report date. After the above reporting date the samples will be disposed of. Should further testing be required then the office should be informed before the above date.

Signature:	Approved Signatories:
[Redacted]	☐ D.Anderson (Managing Director) ☒ J. Brischuk (Laboratory Manager) ☐

Summary of Classification Tests

G2M Testing (Stockton)

12-16 Yarm Road,
Stockton on Tees,
TS18 3NA

01642 033318

info@g2mtesting.co.uk



10258

Site name	Job number
Ardersier Port	S230503

Hole	Depth		Type	w %	Oven temp. °C	wa %	Pa %	Pr %	wL %	wP %	IP %	IL	Plasticity class	Preparation method
	Top m	Base m												
BHSP08	0.30		B	4.3	105									
BHSP08	2.00		B	6.1	105									
BHSP08	5.00		B	22	105									
BHSP08	8.00		B	11	105									
BHSP08	10.00		B	22	105									
BHSP08	11.80		B	20	105									
BHSP08	13.50		B	19	105									
BHSP08	16.50		B	25	105									
BHSP08	19.50		B	18	105									
BHSP08	21.00		B	22	105									
BHSP08	24.00		B	15	105									
BHSP08	27.00		B	25	105									
BHSP08	30.00		B	20	105									
BHSP08	33.00		B	22	105									
BHSP08	36.00		B	21	105									
BHSP08	39.00		B	26	105									
BHSP09	0.50		B	7.1	105									
BHSP09	2.00		B	5.1	105									
BHSP09	5.00		B	15	105									
BHSP09	8.00		B	9.2	105									

All tests found in G2M Testing UKAS Schedule of Accreditation are tested to standard unless otherwise indicated

Key	Description	Category	BS Test Code
w	Moisture content		BS 1377:1990 Part 2 Clause 3.2
wa	Equivalent moisture content passing 425µm sieve		BS 1377:1990 Part 2 Clause 3.2
wL	Liquid limit	Single point	-s BS 1377:1990 Part 2 Clause 4.4
		Four point	-f BS 1377:1990 Part 2 Clause 4.3
wP	Plastic limit		BS 1377:1990 Part 2 Clause 5.2
Pa	Percentage passing 425µm sieve		
Pr	Percentage retained 425µm sieve		
IP	Plasticity index		BS 1377:1990 Part 2 Clause 5.4
IL	Liquidity index		BS 1377:1990 Part 2 Clause 5.4
	Suffix indicating test is "Not UKAS Accredited"	*	

Approved by	D Anderson
Approval date	23/06/2023 08:00
Date report generated	
Report Number	

Summary of Classification Tests

G2M Testing (Stockton)

12-16 Yarm Road,
Stockton on Tees,
TS18 3NA

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10258

Site name	Job number
Ardersier Port	S230503

Hole	Depth		Type	w %	Oven temp. oc	wa %	Pa %	Pr %	wL %	wP %	IP %	IL	Plasticity class	Preparation method
	Top m	Base m												
BHSP09	10.50		B	20	105									
BHSP09	13.50		B	24	105									
BHSP09	16.50		B	24	105									
BHSP09	19.50		B	23	105									
BHSP09	22.50		B	24	105									
BHSP09	24.00		B	22	105									
BHSP09	27.00		B	25	105									
BHSP09	30.00		B	21	105									
BHSP09	33.00		B	22	105									

All tests found in G2M Testing UKAS Schedule of Accreditation are tested to standard unless otherwise indicated

Key	Description	Category	BS Test Code
w	Moisture content		BS 1377:1990 Part 2 Clause 3.2
wa	Equivalent moisture content passing 425µm sieve		BS 1377:1990 Part 2 Clause 3.2
wL	Liquid limit Single point Four point	-s	BS 1377:1990 Part 2 Clause 4.4
		-f	BS 1377:1990 Part 2 Clause 4.3
wP	Plastic limit		BS 1377:1990 Part 2 Clause 5.2
Pa	Percentage passing 425µm sieve		
Pr	Percentage retained 425µm sieve		
IP	Plasticity index		BS 1377:1990 Part 2 Clause 5.4
IL	Liquidity index		BS 1377:1990 Part 2 Clause 5.4
	Suffix indicating test is "Not UKAS Accredited"	*	

Approved by	JBrischuk
Approval date	23/06/2023 10:28
Date report generated	
Report Number	

PARTICLE SIZE DISTRIBUTION

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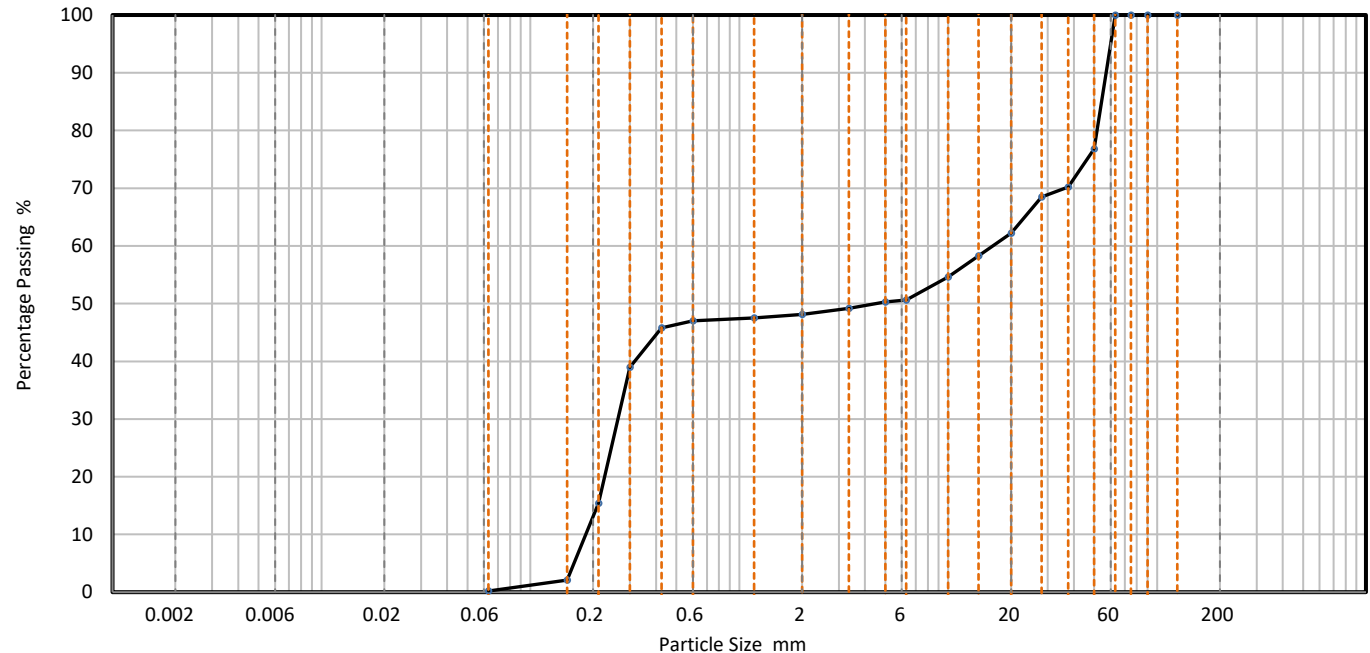
Site name

Job number

Ardersier Port

S230503

Hole		BHSP08	Lab sample ID	G2MT2023061943
Depth (Top)	m	0.30	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Very Sandy, GRAVEL
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	77		
37.5	70		
28	69		
20	62		
14	58		
10	55		
6.3	51		
5	50		
3.35	49		
2	48		
1.18	48		
0.6	47		
0.425	46		
0.3	39		
0.212	15		
0.15	2		
0.063	0		

Dry Mass of sample, g

4893

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	51.9
Sand	47.8
Fines <0.063mm	0.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	89
Curvature Coefficient	0.023

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	23/06/2023 08:05

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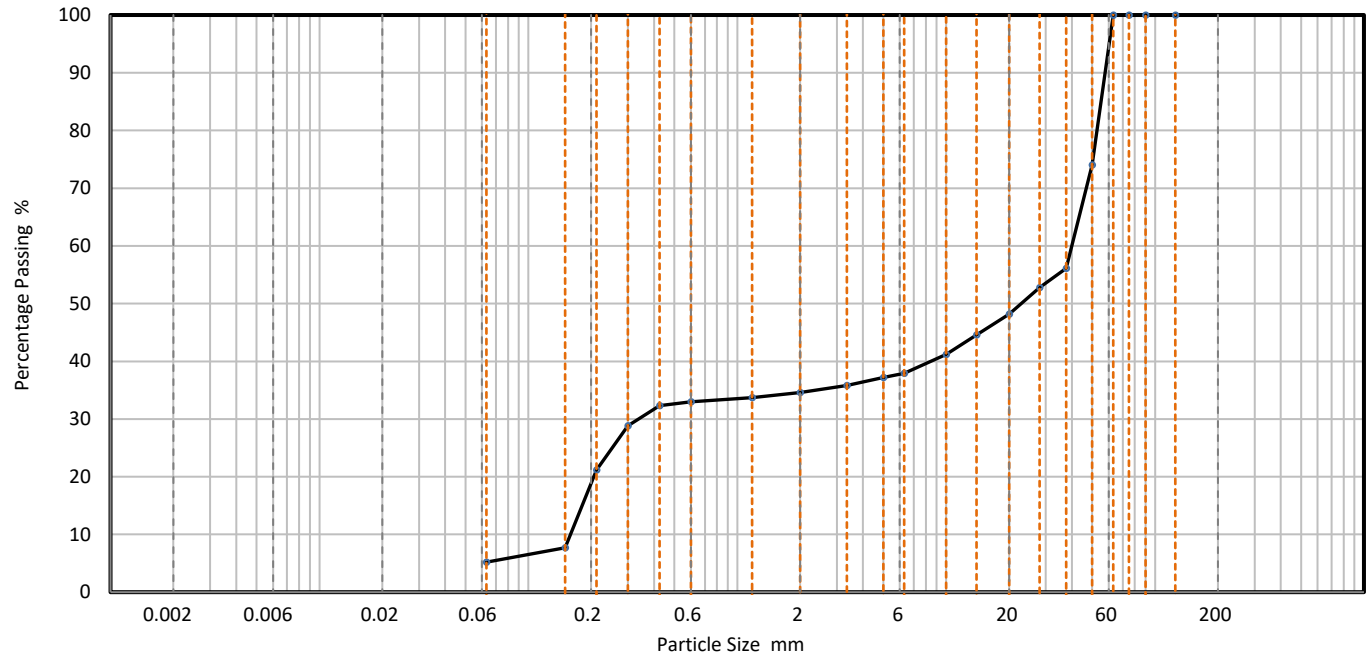
Site name

Job number

Ardersier Port

S230503

Hole	BHSP08	Lab sample ID	G2MT2023061944
Depth (Top) m	2.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Slightly Silty, very Sandy, GRAVEL
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	74		
37.5	56		
28	53		
20	48		
14	45		
10	41		
6.3	38		
5	37		
3.35	36		
2	35		
1.18	34		
0.6	33		
0.425	32		
0.3	29		
0.212	21		
0.15	8		
0.063	5		

Dry Mass of sample, g

3735

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	65.4
Sand	29.4
Fines <0.063mm	5.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	250
Curvature Coefficient	0.018

Remarks
Preparation and testing in accordance with test method unless noted below
Sample tested was deviating in accordance with BS1377 test standard

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	23/06/2023 07:52

PARTICLE SIZE DISTRIBUTION

G2M Testing (Stockton)

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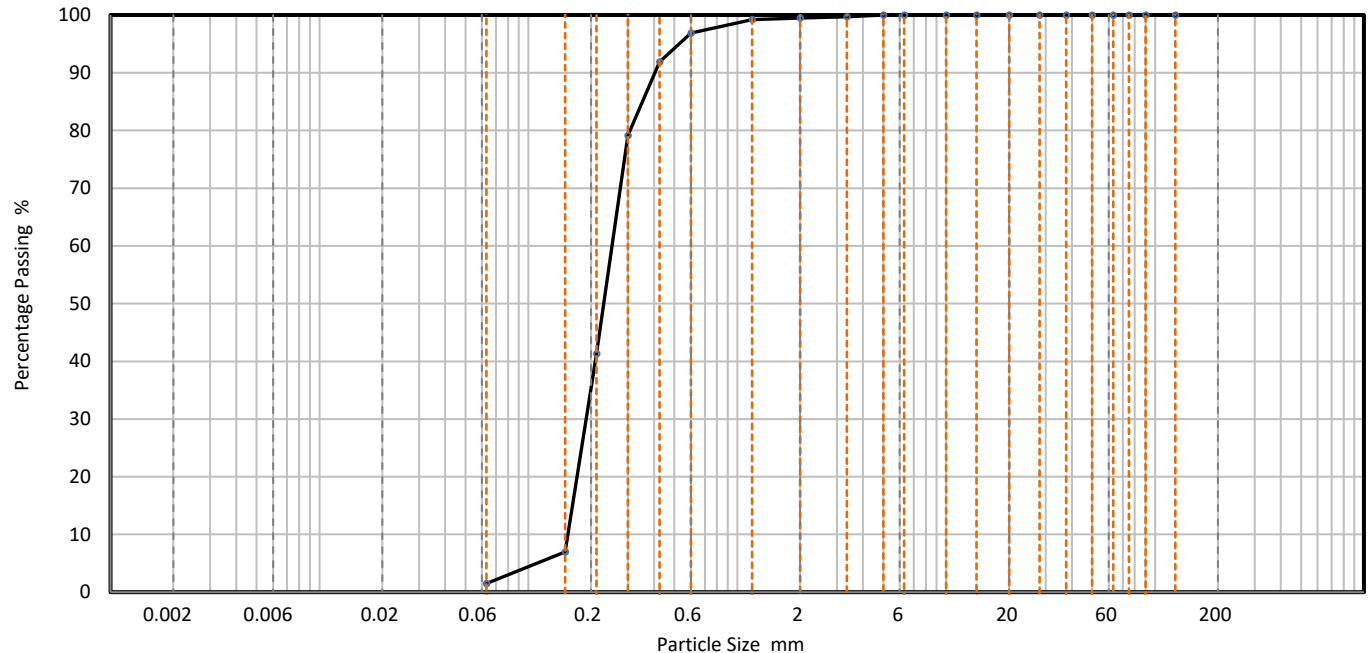
Site name

Job number

Ardersier Port

S230503

Hole	BHSP08	Lab sample ID	G2MT2023061945
Depth (Top) m	5.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Very slightly Gravelly, very slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	97		
0.425	92		
0.3	79		
0.212	41		
0.15	7		
0.063	2		

Dry Mass of sample, g

1409

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.5
Sand	98.0
Fines <0.063mm	1.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1.6
Curvature Coefficient	0.92

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	23/06/2023 08:14

PARTICLE SIZE DISTRIBUTION

G2M Testing (Stockton)

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Stockton on Tees,
TS18 3NA

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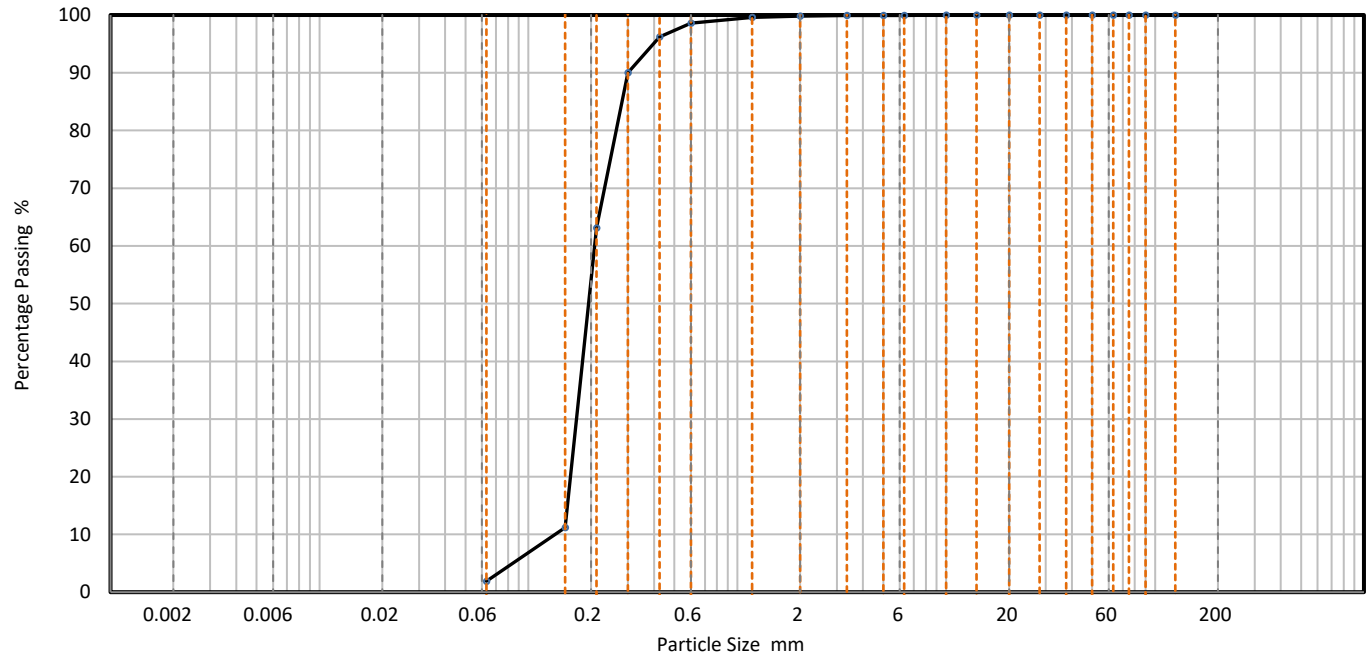
Site name

Job number

Ardersier Port

S230503

Hole	BHSP08	Lab sample ID	G2MT2023061946
Depth (Top) m	8.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Very slightly Gravelly, slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99		
0.425	96		
0.3	90		
0.212	63		
0.15	11		
0.063	2		

Dry Mass of sample, g

824

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.2
Sand	97.9
Fines <0.063mm	2.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1.5
Curvature Coefficient	1

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	22/06/2023 10:56

PARTICLE SIZE DISTRIBUTION

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Stockton on Tees,
TS18 3NA

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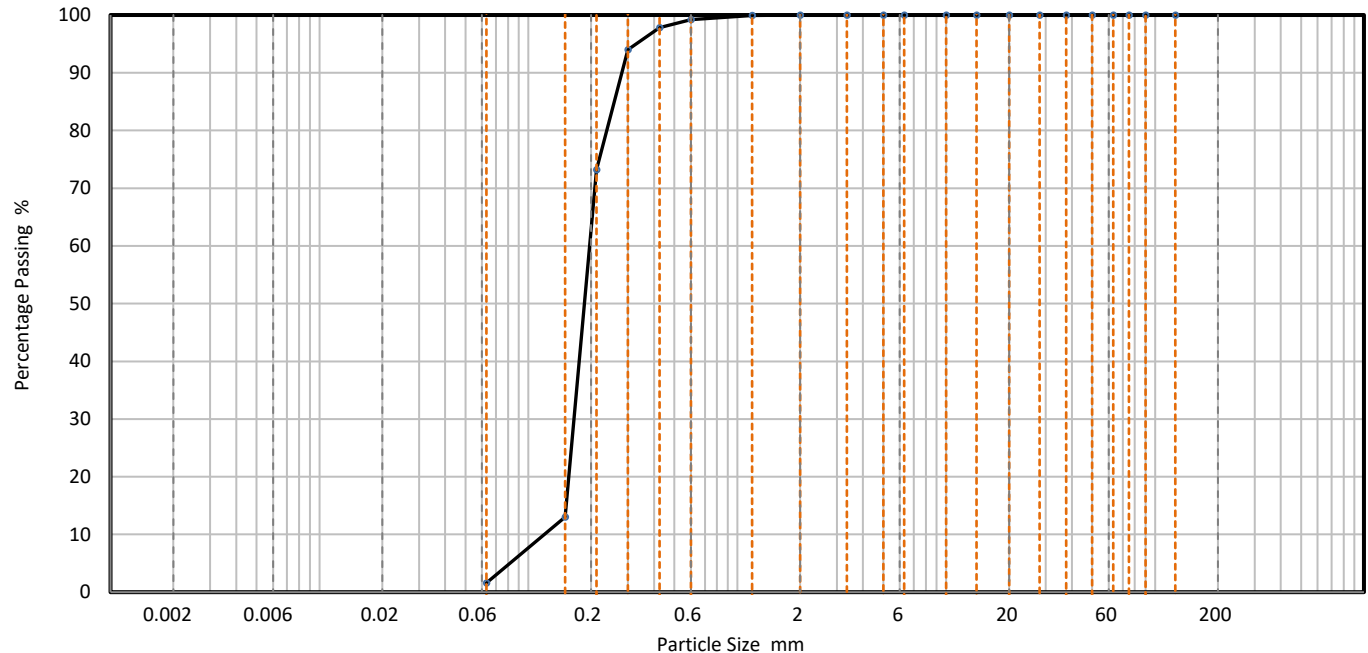
Site name

Job number

Ardersier Port

S230503

Hole	BHSP08	Lab sample ID	G2MT2023061947
Depth (Top) m	10.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99		
0.425	98		
0.3	94		
0.212	73		
0.15	13		
0.063	2		

Dry Mass of sample, g

1403

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	98.4
Fines <0.063mm	2.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1.6
Curvature Coefficient	1.2

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	22/06/2023 11:02

PARTICLE SIZE DISTRIBUTION

G2M Testing (Stockton)

12-16 Yarm Road,
Stockton on Tees,
TS18 3NA

01642 033318

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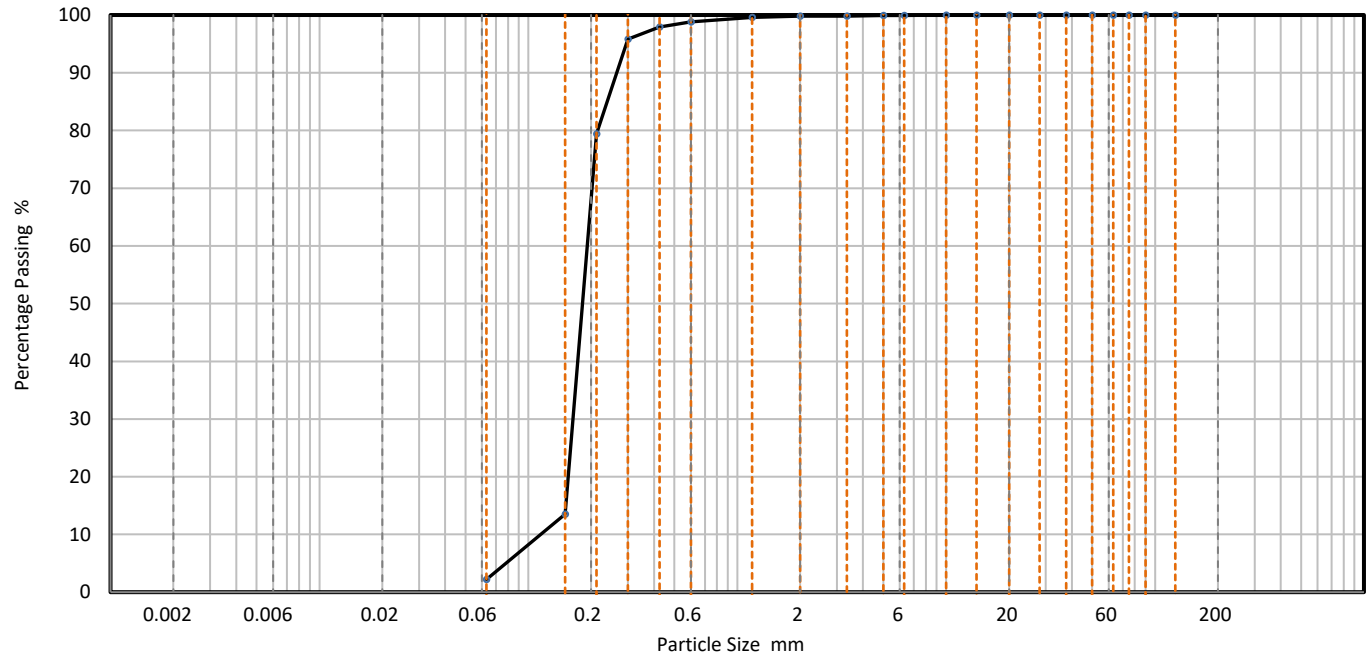
Site name

Job number

Ardersier Port

S230503

Hole	BHSP08	Lab sample ID	G2MT2023061948
Depth (Top)	m 11.80	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Very slightly Gravelly, slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99		
0.425	98		
0.3	96		
0.212	79		
0.15	14		
0.063	2		

Dry Mass of sample, g

1477

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.2
Sand	97.5
Fines <0.063mm	2.0

Grading Analysis	
D100	mm
D60	mm 0.191
D30	mm 0.164
D10	mm 0.115
Uniformity Coefficient	1.7
Curvature Coefficient	1.2

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	23/06/2023 09:45

PARTICLE SIZE DISTRIBUTION

G2M Testing (Stockton)

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info@g2mtesting.co.uk



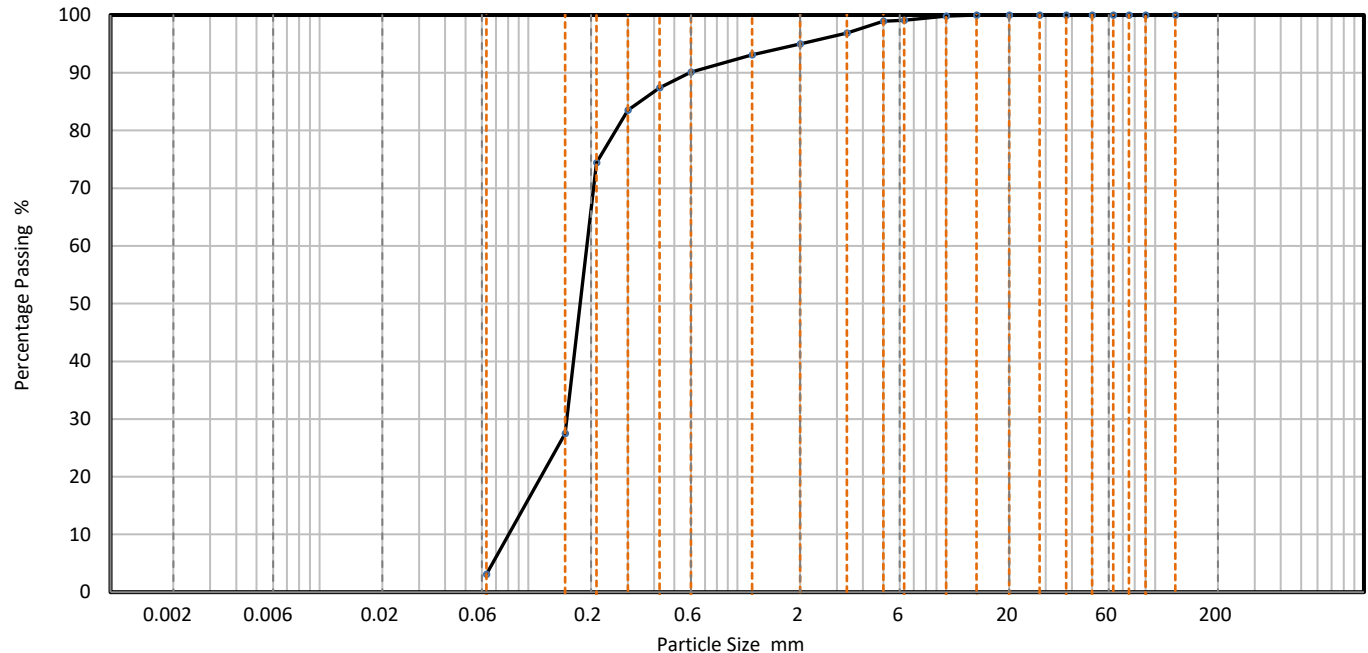
Site name

Ardersier Port

Job number

S230503

Hole	BHSP08	Lab sample ID	G2MT2023061949
Depth (Top) m	13.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Slightly Silty, slightly Gravelly, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99		
5	99		
3.35	97		
2	95		
1.18	93		
0.6	90		
0.425	87		
0.3	84		
0.212	74		
0.15	28		
0.063	3		

Dry Mass of sample, g

1806

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	5.0
Sand	91.9
Fines <0.063mm	3.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.4
Curvature Coefficient	1.5

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	23/06/2023 09:55

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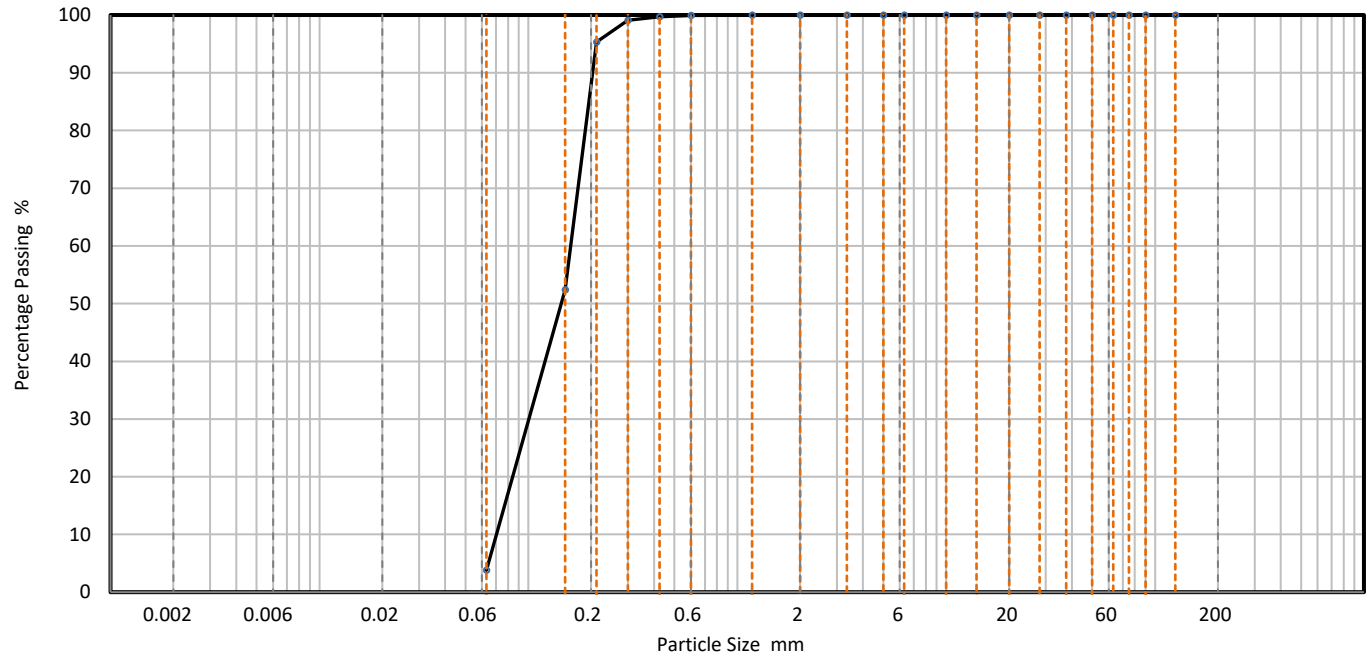
Site name

Job number

Ardersier Port

S230503

Hole	BHSP08	Lab sample ID	G2MT2023061950
Depth (Top) m	16.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	99		
0.212	95		
0.15	52		
0.063	4		

Dry Mass of sample, g

1523

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	96.2
Fines <0.063mm	4.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.3
Curvature Coefficient	0.9

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	22/06/2023 11:05

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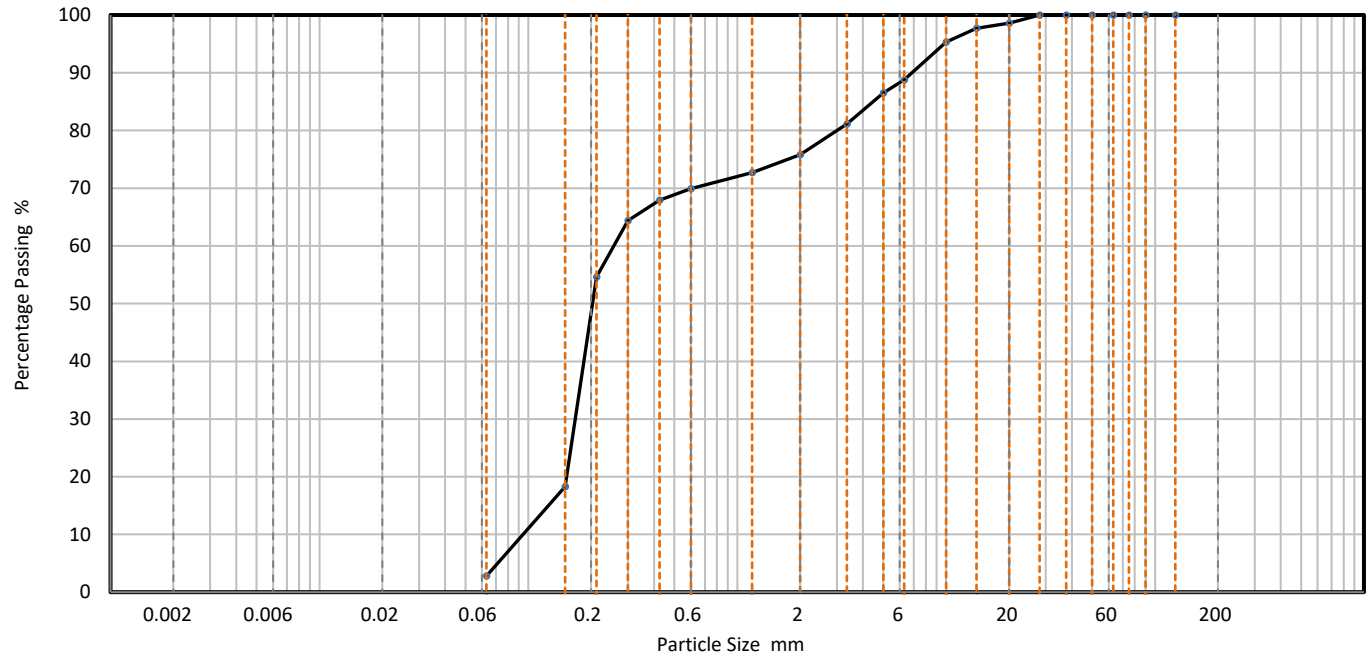
Site name

Job number

Ardersier Port

S230503

Hole	BHSP08	Lab sample ID	G2MT2023061951
Depth (Top) m	19.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Slightly Silty, very Gravelly, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	99		
14	98		
10	95		
6.3	89		
5	87		
3.35	81		
2	76		
1.18	73		
0.6	70		
0.425	68		
0.3	64		
0.212	55		
0.15	18		
0.063	3		

Dry Mass of sample, g

1695

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	24.2
Sand	73.0
Fines <0.063mm	3.0

Grading Analysis	
D100 mm	
D60 mm	0.256
D30 mm	0.168
D10 mm	0.0943
Uniformity Coefficient	2.7
Curvature Coefficient	1.2

Remarks
Preparation and testing in accordance with test method unless noted below
Sample tested was deviating in accordance with BS1377 test standard

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	22/06/2023 07:58

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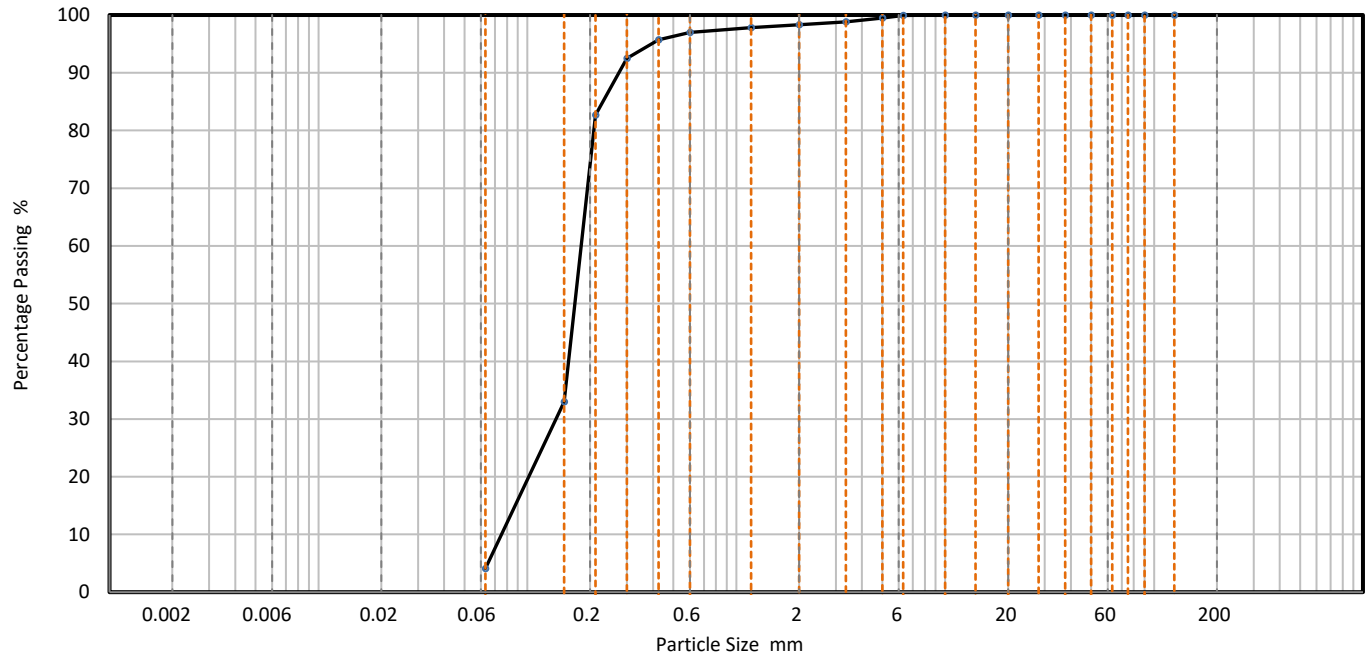
Site name

Job number

Ardersier Port

S230503

Hole	BHSP08	Lab sample ID	G2MT2023061952
Depth (Top)	m 21.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Slightly Gravelly, slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	99		
2	98		
1.18	98		
0.6	97		
0.425	96		
0.3	93		
0.212	83		
0.15	33		
0.063	4		

Dry Mass of sample, g

1379

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	1.7
Sand	94.2
Fines <0.063mm	4.0

Grading Analysis	
D100	mm
D60	mm 0.181
D30	mm 0.137
D10	mm 0.0753
Uniformity Coefficient	2.4
Curvature Coefficient	1.4

Remarks
Preparation and testing in accordance with test method unless noted below

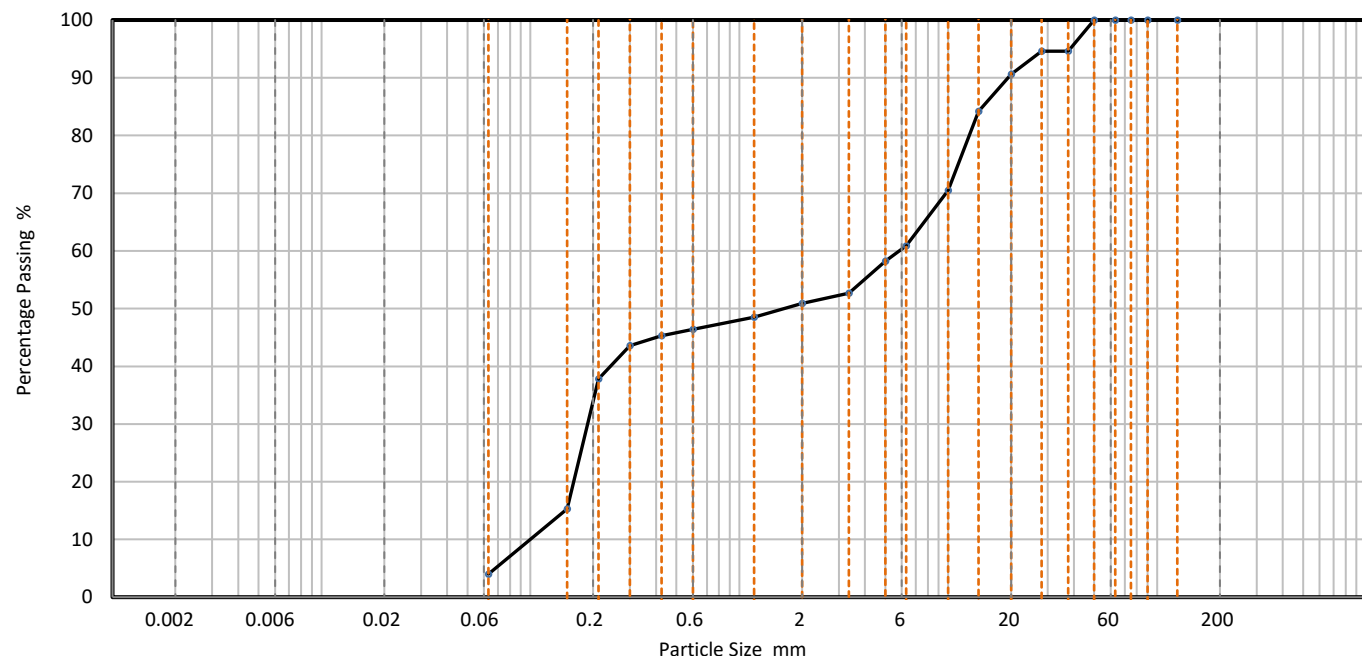
Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	23/06/2023 07:58

PARTICLE SIZE DISTRIBUTION		G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	 10258
Site name	Job number		
Ardersier Port	S230503		

Hole	BHSP08	Lab sample ID	G2MT2023061953
Depth (Top)	m 24.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Slightly Silty, very Sandy, GRAVEL
Sample type	B		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	95		
28	95		
20	91		
14	84		
10	71		
6.3	61		
5	58		
3.35	53		
2	51		
1.18	49		
0.6	46		
0.425	45		
0.3	44		
0.212	38		
0.15	15		
0.063	4		

Dry Mass of sample, g	1772

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	49.1
Sand	47.0
Fines <0.063mm	4.0

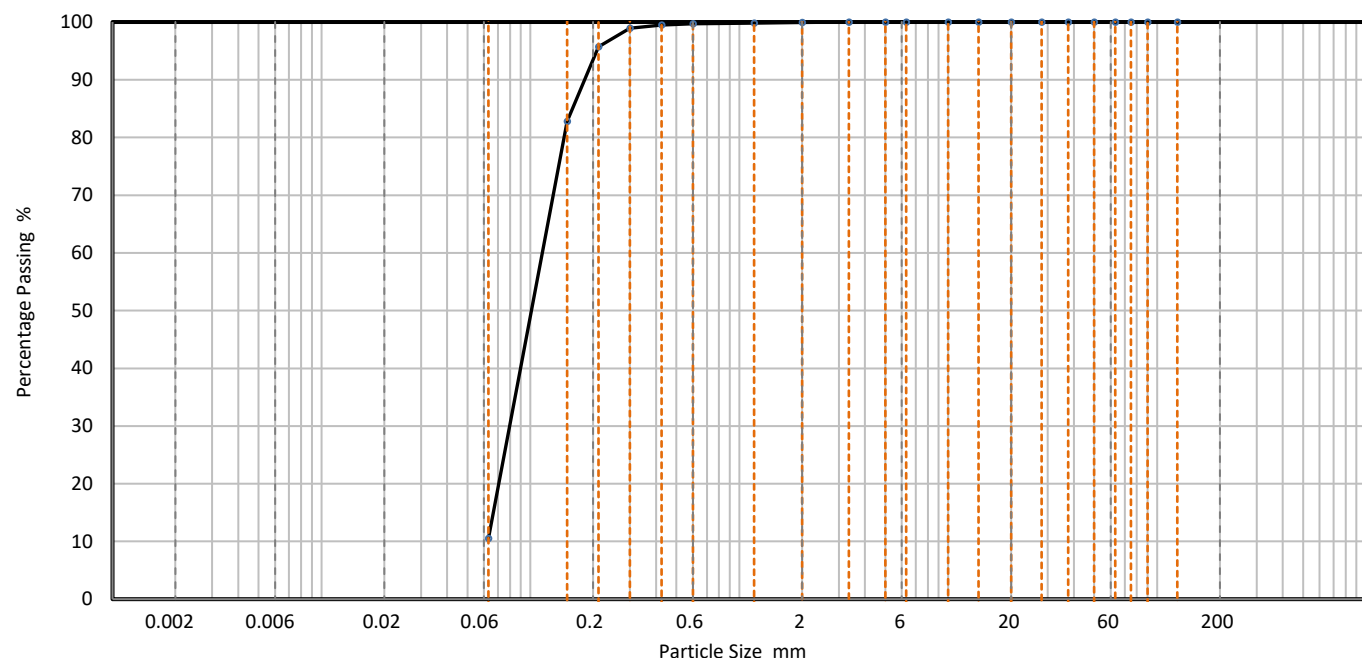
Grading Analysis	
D100	mm
D60	mm 5.84
D30	mm 0.188
D10	mm 0.0999
Uniformity Coefficient	58
Curvature Coefficient	0.061

Remarks
Preparation and testing in accordance with test method unless noted below
Sample tested was deviating in accordance with BS1377 test standard

Accreditation status Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Approved by</td> <td style="width: 50%;">D Anderson</td> </tr> <tr> <td>Approval date</td> <td>23/06/2023 08:10</td> </tr> </table>	Approved by	D Anderson	Approval date	23/06/2023 08:10
Approved by	D Anderson				
Approval date	23/06/2023 08:10				

PARTICLE SIZE DISTRIBUTION		G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	 10258
Site name	Job number		
Ardersier Port	S230503		

Hole	BHSP08	Lab sample ID	G2MT2023061954
Depth (Top)	m 27.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Very slightly Gravelly, Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	99		
0.212	96		
0.15	83		
0.063	11		

Dry Mass of sample, g	1402

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.1
Sand	89.4
Fines <0.063mm	11.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks Preparation and testing in accordance with test method unless noted below

Accreditation status
 Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	23/06/2023 10:03

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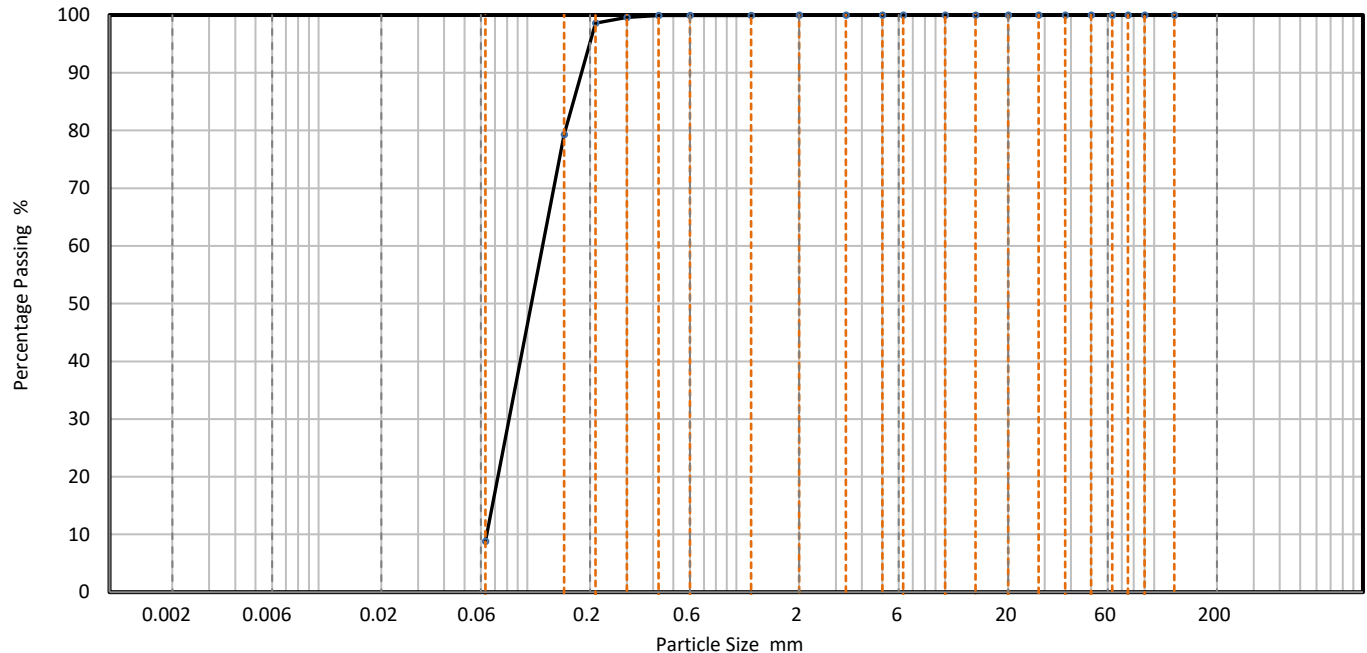
Site name

Job number

Ardersier Port

S230503

Hole	BHSP08	Lab sample ID	G2MT2023061955
Depth (Top) m	30.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	99		
0.15	79		
0.063	9		

Dry Mass of sample, g

1600

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	91.1
Fines <0.063mm	9.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1.9
Curvature Coefficient	0.88

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	22/06/2023 11:09

PARTICLE SIZE DISTRIBUTION

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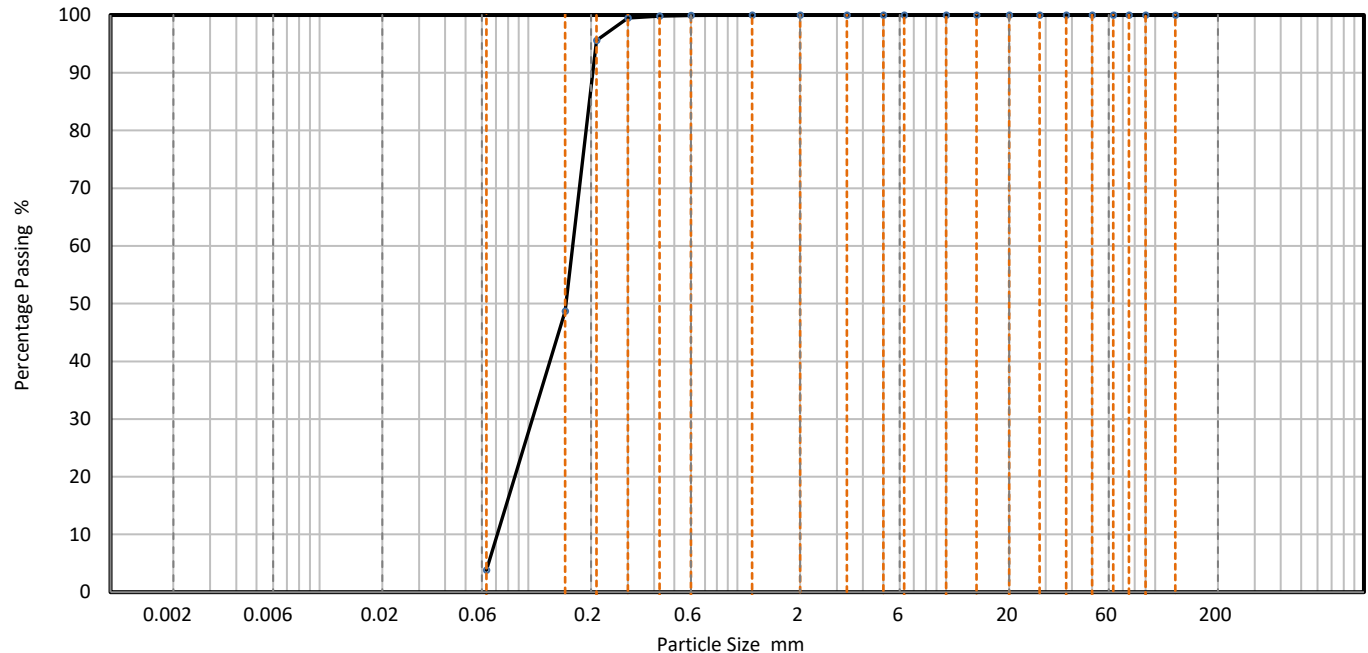
Site name

Ardersier Port

Job number

S230503

Hole	BHSP08	Lab sample ID	G2MT2023061956
Depth (Top)	m 33.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	96		
0.15	49		
0.063	4		

Dry Mass of sample, g

1549

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	96.2
Fines <0.063mm	4.0

Grading Analysis	
D100 mm	
D60 mm	0.163
D30 mm	0.105
D10 mm	0.0711
Uniformity Coefficient	2.3
Curvature Coefficient	0.94

Remarks
Preparation and testing in accordance with test method unless noted below

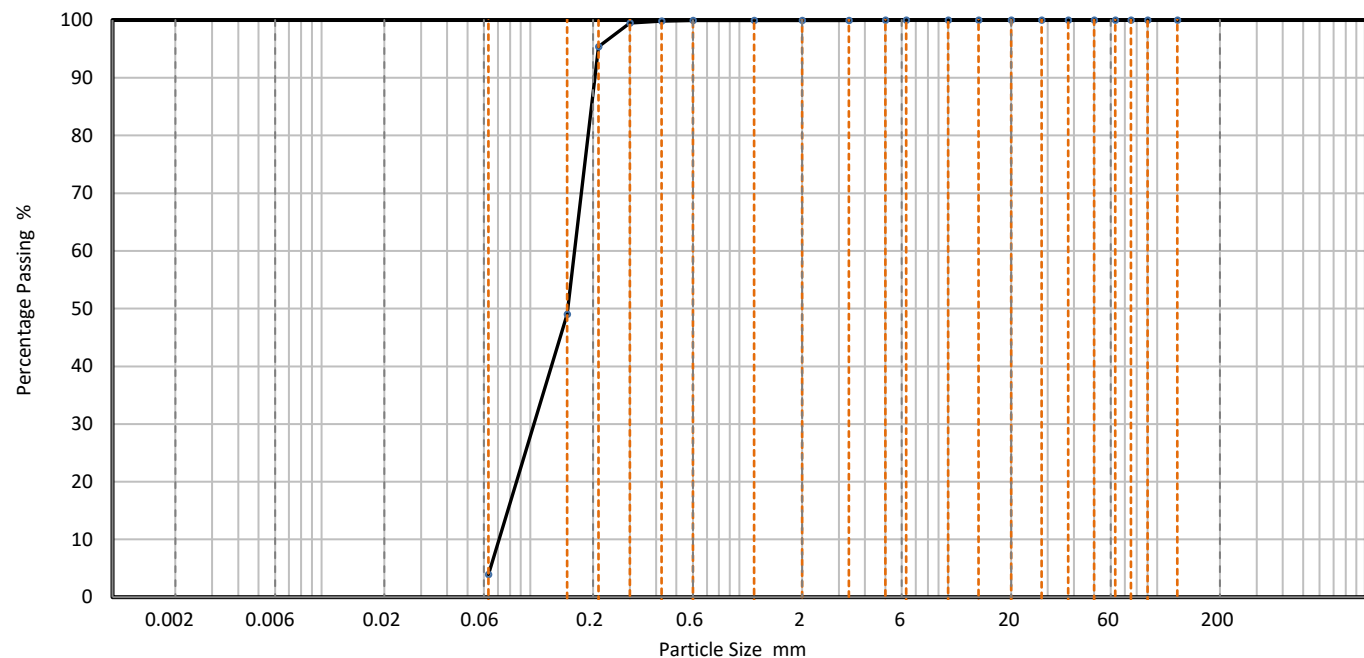
Accreditation status

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Approved by	D Anderson
Approval date	22/06/2023 11:12

PARTICLE SIZE DISTRIBUTION		G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	 10258
Site name	Job number		
Ardersier Port	S230503		

Hole	BHSP08	Lab sample ID	G2MT2023061957
Depth (Top)	m 36.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Very Slightly Gravelly, slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	95		
0.15	49		
0.063	4		

Dry Mass of sample, g	1528

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.1
Sand	96.0
Fines <0.063mm	4.0

Grading Analysis	
D100	mm 100
D60	mm 0.163
D30	mm 0.104
D10	mm 0.0708
Uniformity Coefficient	2.3
Curvature Coefficient	0.94

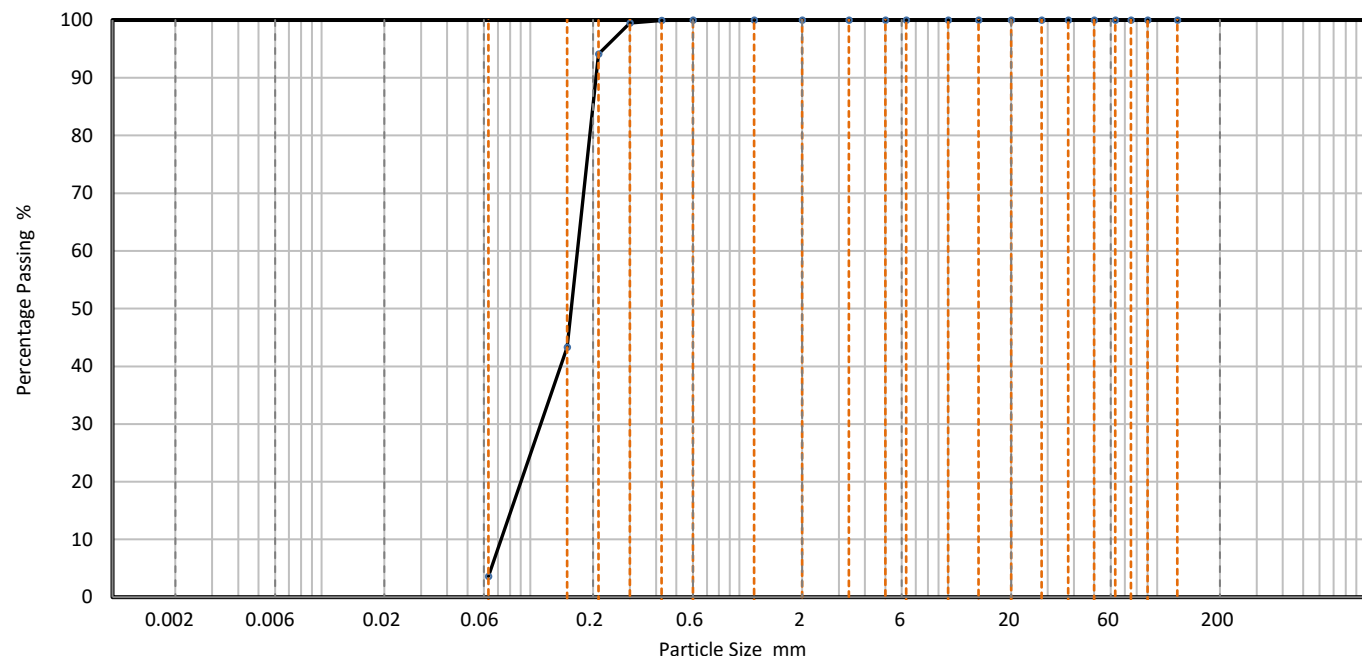
Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status
 Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	23/06/2023 10:06

PARTICLE SIZE DISTRIBUTION		G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	 10258
Site name	Job number		
Ardersier Port	S230503		

Hole	BHSP08	Lab sample ID	G2MT2023061958
Depth (Top)	m 39.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Slightly Silty, SAND
Sample type	B		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	94		
0.15	43		
0.063	4		

Dry Mass of sample, g	1338

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	96.4
Fines <0.063mm	4.0

Grading Analysis	
D100 mm	
D60 mm	0.168
D30 mm	0.112
D10 mm	0.0724
Uniformity Coefficient	2.3
Curvature Coefficient	1

Remarks
 Preparation and testing in accordance with test method unless noted below

Accreditation status Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Approved by</td> <td style="width: 50%;">D Anderson</td> </tr> <tr> <td>Approval date</td> <td>22/06/2023 10:59</td> </tr> </table>	Approved by	D Anderson	Approval date	22/06/2023 10:59
Approved by	D Anderson				
Approval date	22/06/2023 10:59				

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12-16 Yarm Road,
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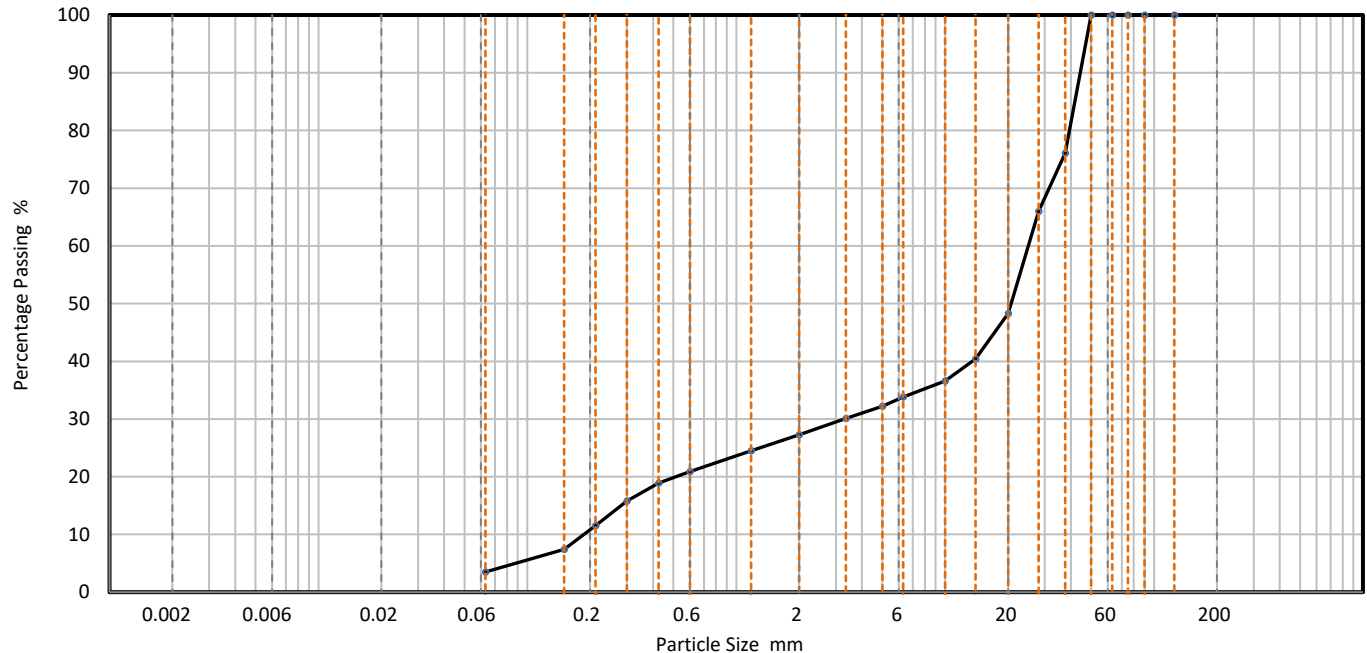
Site name

Job number

Ardersier Port

S230503

Hole	BHSP09	Lab sample ID	G2MT2023061926
Depth (Top) m	0.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Slightly Silty, very Sandy, GRAVEL
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	76		
28	66		
20	48		
14	40		
10	37		
6.3	34		
5	32		
3.35	30		
2	27		
1.18	25		
0.6	21		
0.425	19		
0.3	16		
0.212	12		
0.15	7		
0.063	4		

Dry Mass of sample, g

3217

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	72.7
Sand	23.9
Fines <0.063mm	3.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	130
Curvature Coefficient	2.3

Remarks
Preparation and testing in accordance with test method unless noted below
Sample tested was deviating in accordance with BS1377 test standard

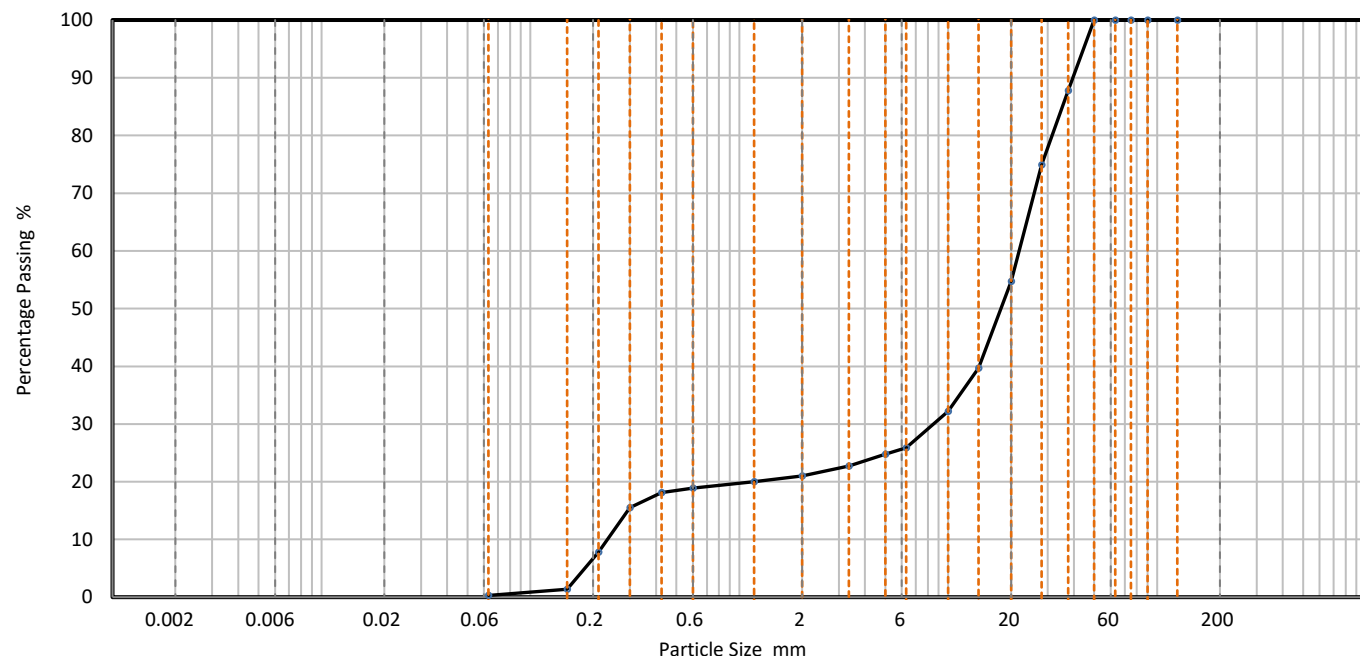
Accreditation status

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Approved by	D Anderson
Approval date	23/06/2023 09:08

PARTICLE SIZE DISTRIBUTION		G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	 10258
Site name	Job number		
Ardersier Port	S230503		

Hole	BHSP09	Lab sample ID	G2MT2023061928
Depth (Top)	m 2.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Very Sandy, GRAVEL
Sample type	B		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	88		
28	75		
20	55		
14	40		
10	32		
6.3	26		
5	25		
3.35	23		
2	21		
1.18	20		
0.6	19		
0.425	18		
0.3	16		
0.212	8		
0.15	1		
0.063	0		

Dry Mass of sample, g	3331

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	79.0
Sand	20.7
Fines <0.063mm	0.0

Grading Analysis	
D100	mm
D60	mm 21.8
D30	mm 8.52
D10	mm 0.234
Uniformity Coefficient	93
Curvature Coefficient	14

Remarks
 Preparation and testing in accordance with test method unless noted below

 Sample tested was deviating in accordance with BS1377 test standard

Accreditation status Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.		Approved by Approval date	D Anderson 22/06/2023 10:47

PARTICLE SIZE DISTRIBUTION

G2M Testing (Stockton)

12-16 Yarm Road,
Stockton on Tees,
TS18 3NA

01642 033318

info@g2mtesting.co.uk



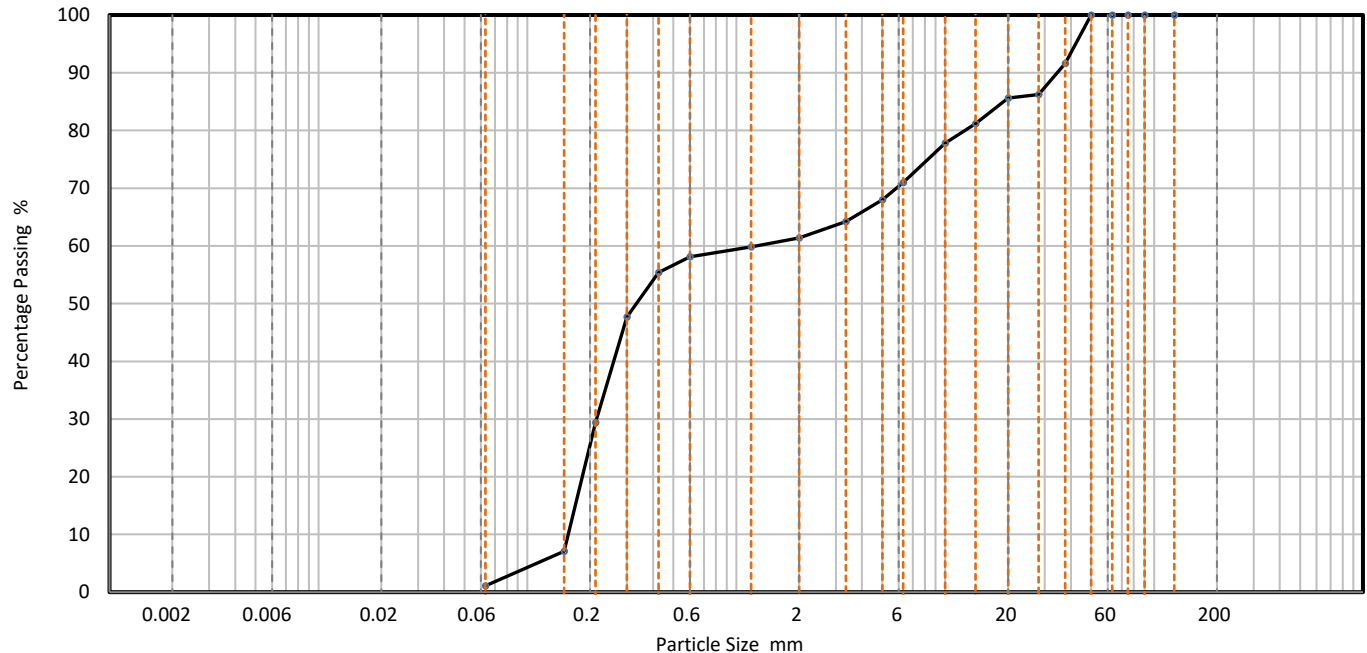
Site name

Job number

Ardersier Port

S230503

Hole	BHSP09	Lab sample ID	G2MT2023061931
Depth (Top) m	5.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Very slightly Silty, very Gravelly, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	92		
28	86		
20	86		
14	81		
10	78		
6.3	71		
5	68		
3.35	64		
2	61		
1.18	60		
0.6	58		
0.425	55		
0.3	48		
0.212	29		
0.15	7		
0.063	1		

Dry Mass of sample, g

2382

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	38.6
Sand	60.2
Fines <0.063mm	1.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	7.9
Curvature Coefficient	0.24

Remarks
Preparation and testing in accordance with test method unless noted below
Sample tested was deviating in accordance with BS1377 test standard

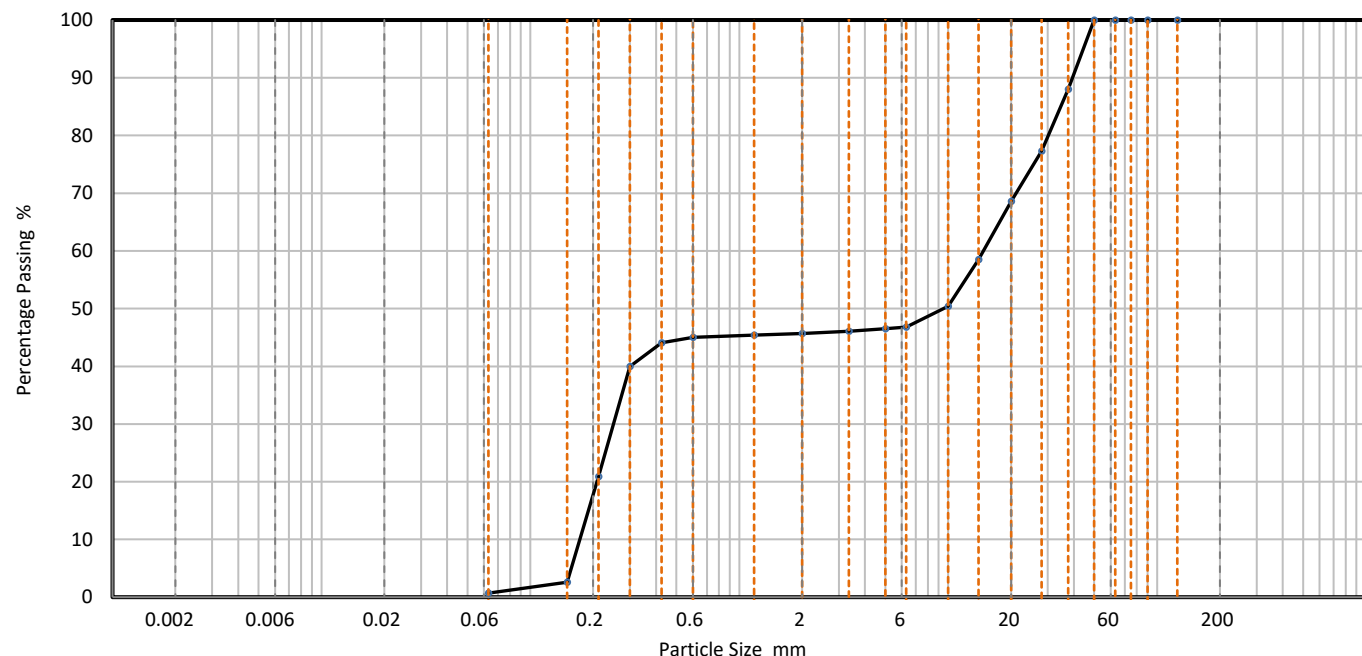
Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	22/06/2023 10:34

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Site name	Job number		
Ardersier Port	S230503		

Hole	BHSP09	Lab sample ID	G2MT2023061933
Depth (Top)	m 8.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Very slightly Silty, very Sandy, GRAVEL
Sample type	B		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	88		
28	77		
20	69		
14	59		
10	50		
6.3	47		
5	47		
3.35	46		
2	46		
1.18	45		
0.6	45		
0.425	44		
0.3	40		
0.212	21		
0.15	3		
0.063	1		

Dry Mass of sample, g	4370

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	54.3
Sand	45.0
Fines <0.063mm	1.0

Grading Analysis	
D100 mm	100
D60 mm	14.8
D30 mm	0.25
D10 mm	0.173
Uniformity Coefficient	86
Curvature Coefficient	0.025

Remarks
 Preparation and testing in accordance with test method unless noted below

 Sample tested was deviating in accordance with BS1377 test standard

Accreditation status Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.		Approved by D Anderson
		Approval date 22/06/2023 10:43

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Stockton on Tees,
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01642 033318

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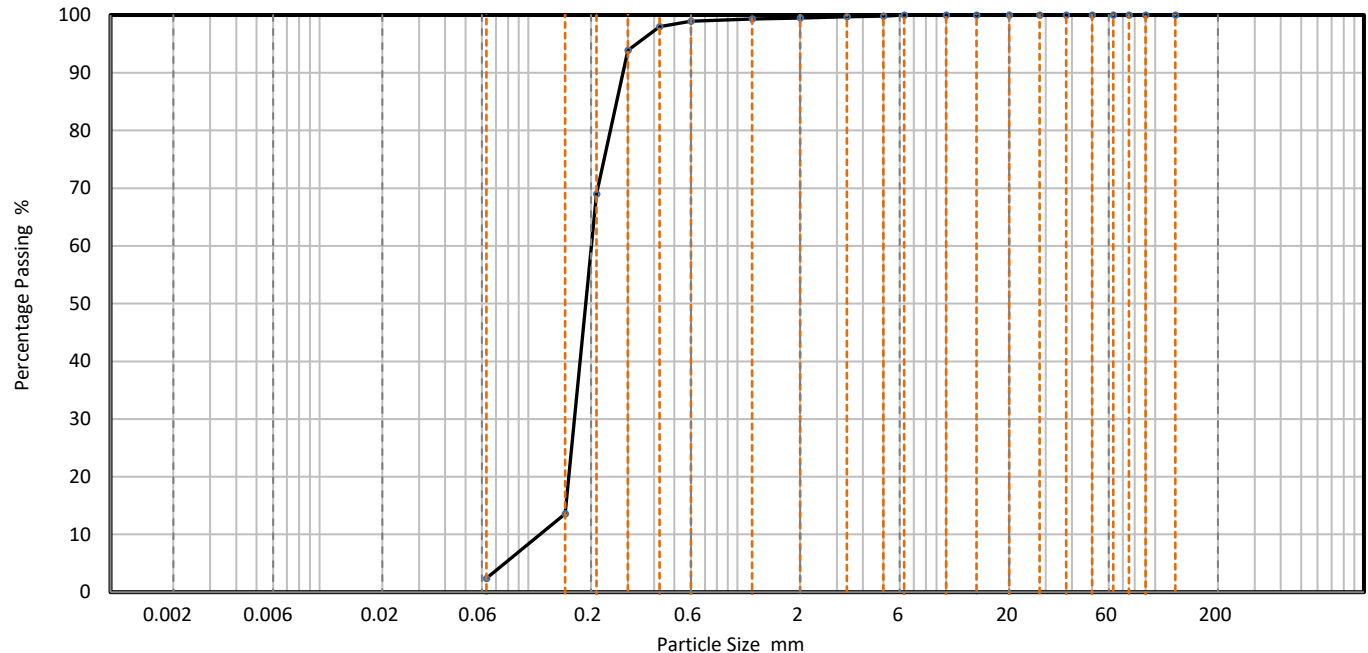
Site name

Job number

Ardersier Port

S230503

Hole	BHSP09	Lab sample ID	G2MT2023061934
Depth (Top) m	10.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Very slightly Gravelly, slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	99		
0.425	98		
0.3	94		
0.212	69		
0.15	14		
0.063	2		

Dry Mass of sample, g

1531

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.5
Sand	97.1
Fines <0.063mm	2.0

Grading Analysis	
D100 mm	
D60 mm	0.2
D30 mm	0.166
D10 mm	0.114
Uniformity Coefficient	1.8
Curvature Coefficient	1.2

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	22/06/2023 10:38

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12-16 Yarm Road,
Stockton on Tees,
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01642 033318

info@g2mtesting.co.uk



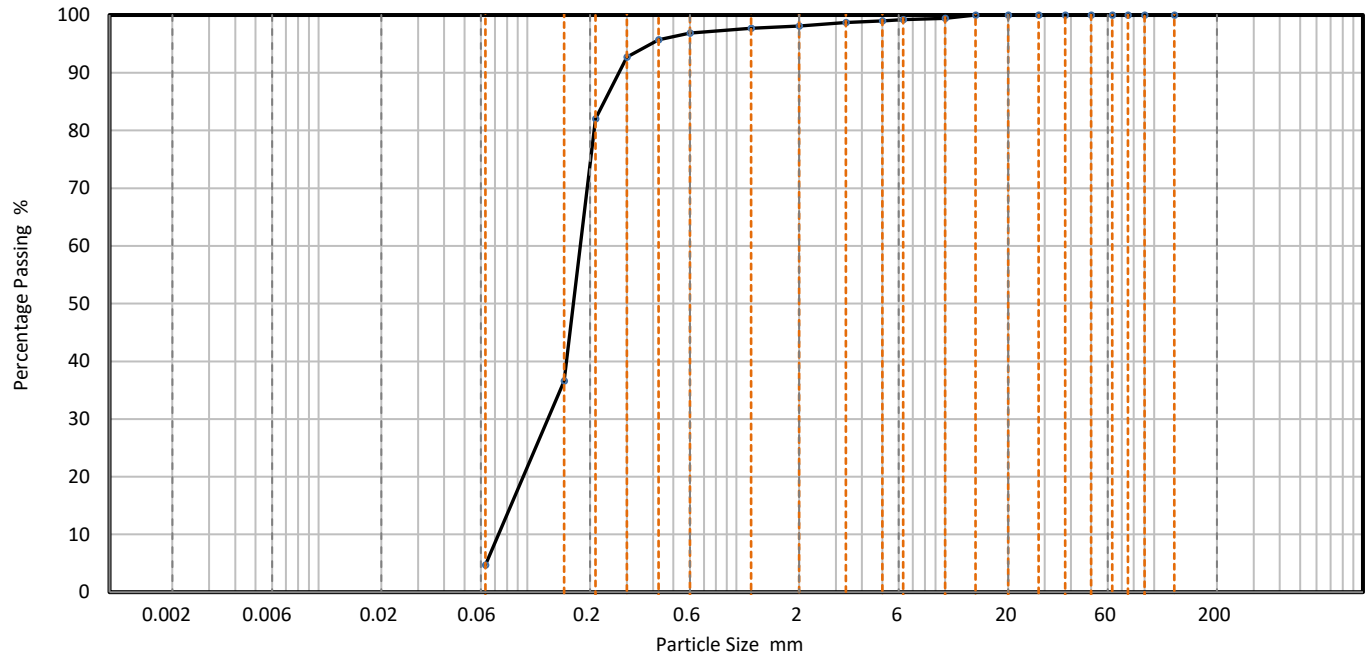
Site name

Ardersier Port

Job number

S230503

Hole	BHSP09	Lab sample ID	G2MT2023061935
Depth (Top) m	13.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Slightly Gravelly, slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	99		
6.3	99		
5	99		
3.35	99		
2	98		
1.18	98		
0.6	97		
0.425	96		
0.3	93		
0.212	82		
0.15	37		
0.063	5		

Dry Mass of sample, g

1703

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	1.9
Sand	93.4
Fines <0.063mm	5.0

Grading Analysis	
D100 mm	
D60 mm	0.179
D30 mm	0.125
D10 mm	0.0727
Uniformity Coefficient	2.5
Curvature Coefficient	1.2

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	23/06/2023 08:36

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12-16 Yarm Road,
Stockton on Tees,
TS18 3NA

01642 033318

info@g2mtesting.co.uk



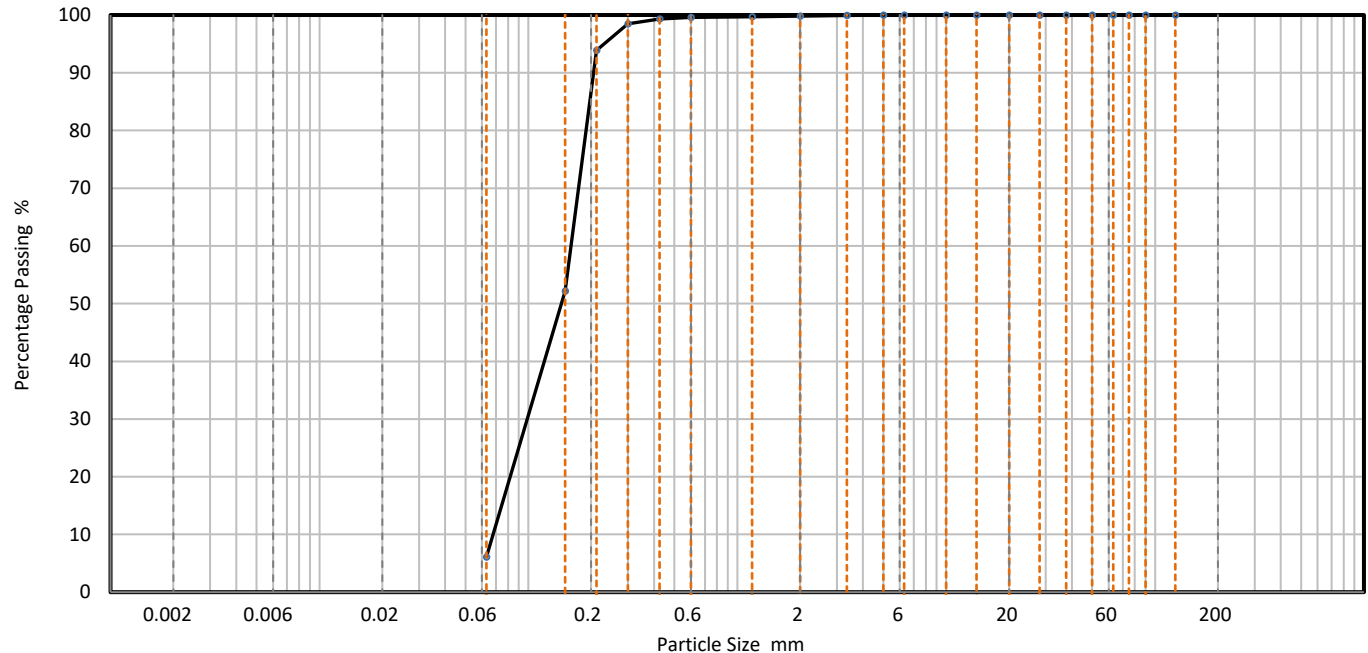
Site name

Job number

Ardersier Port

S230503

Hole		BHSP09	Lab sample ID	G2MT2023061936
Depth (Top)	m	16.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m		Soil Description	Very slightly Gravelly, slightly Silty, SAND
Sample type		B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	99		
0.212	94		
0.15	52		
0.063	6		

Dry Mass of sample, g

1553

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.2
Sand	93.7
Fines <0.063mm	6.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.4
Curvature Coefficient	0.9

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	23/06/2023 08:44

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Stockton on Tees,
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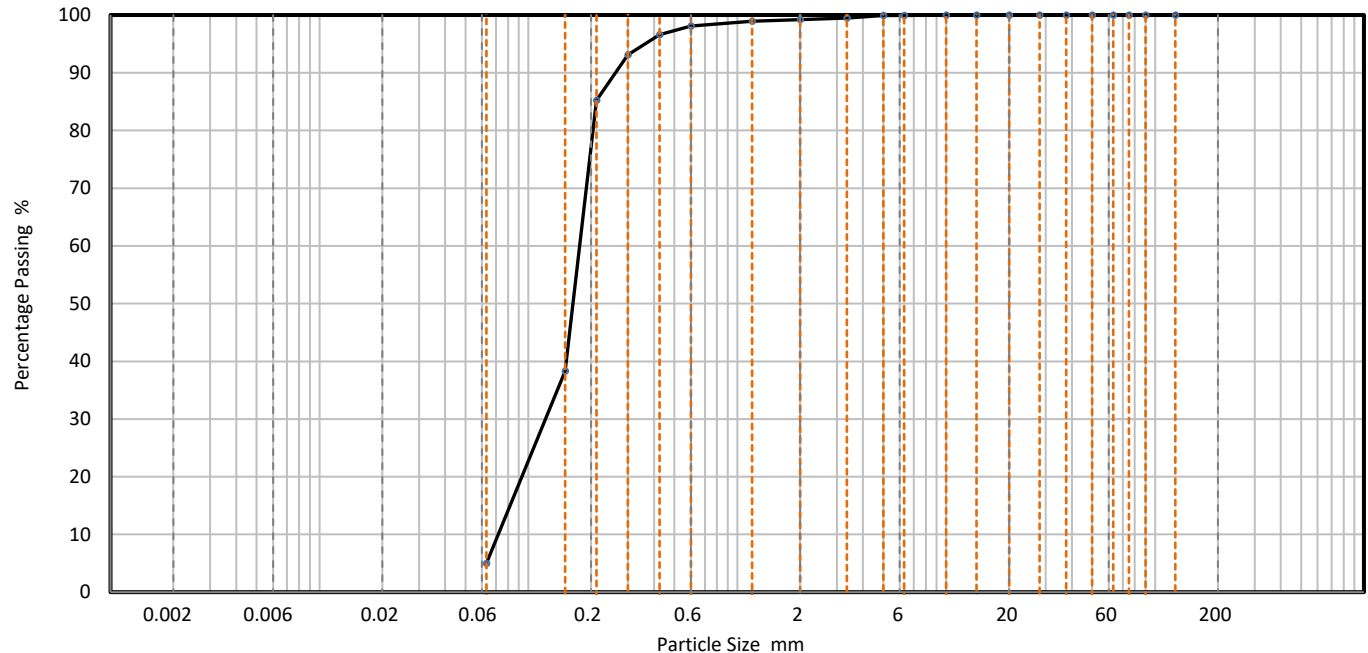
Site name

Ardersier Port

Job number

S230503

Hole	BHSP09	Lab sample ID	G2MT2023061937
Depth (Top)	m	19.50	Test Method
Depth (Base)	m		BS 1377 - 2 : 1990 Clause 9.2
Sample type	B	Soil Description	Very slightly Gravelly, slightly Silty, SAND



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	98		
0.425	97		
0.3	93		
0.212	85		
0.15	38		
0.063	5		

Dry Mass of sample, g

1286

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.8
Sand	94.2
Fines <0.063mm	5.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.5
Curvature Coefficient	1.2

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	23/06/2023 09:12

PARTICLE SIZE DISTRIBUTION

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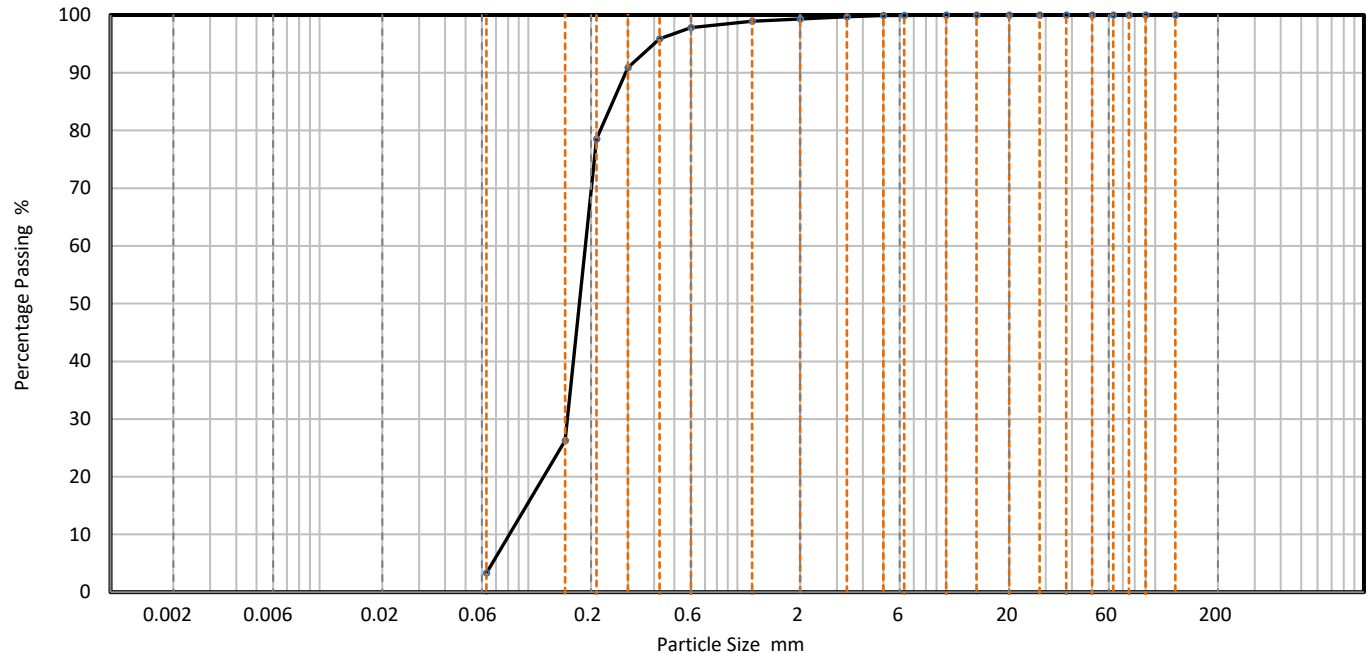
Site name

Job number

Ardersier Port

S230503

Hole	BHSP09	Lab sample ID	G2MT2023061938
Depth (Top) m	22.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Very slightly Gravelly, slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	98		
0.425	96		
0.3	91		
0.212	79		
0.15	26		
0.063	3		

Dry Mass of sample, g

1417

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.7
Sand	95.9
Fines <0.063mm	3.0

Grading Analysis	
D100 mm	
D60 mm	0.188
D30 mm	0.154
D10 mm	0.081
Uniformity Coefficient	2.3
Curvature Coefficient	1.6

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	23/06/2023 08:31

PARTICLE SIZE DISTRIBUTION

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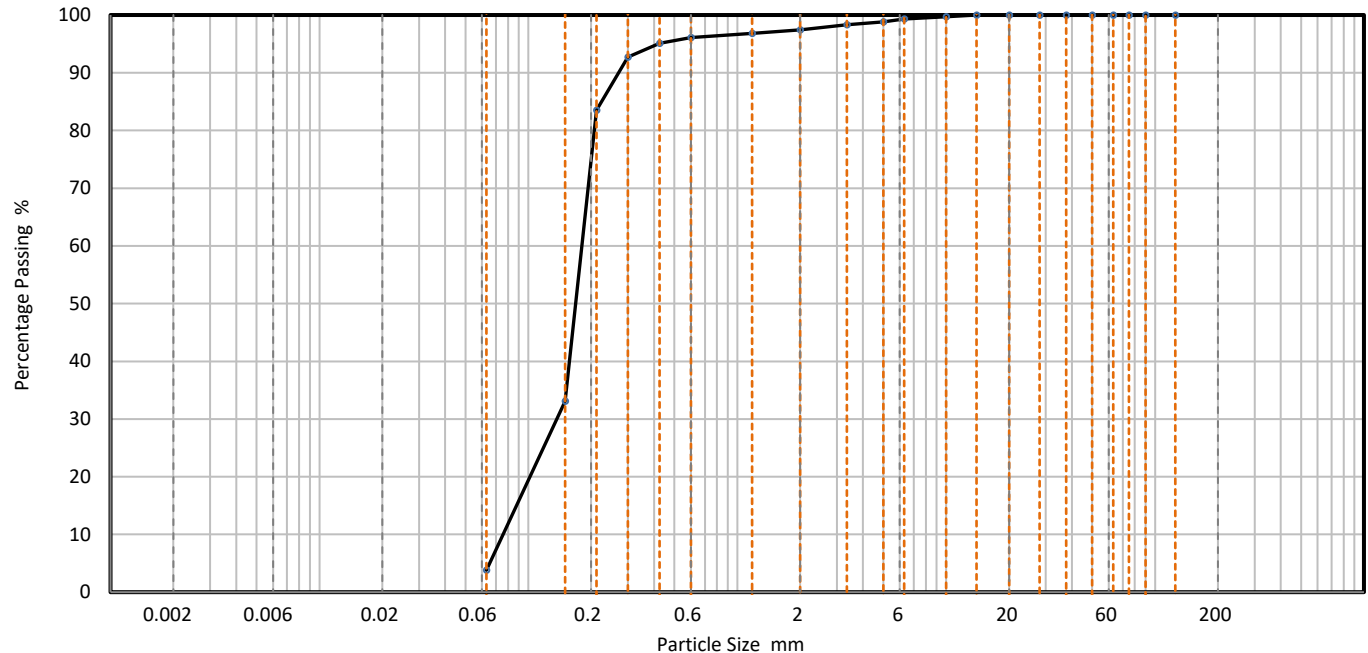
Site name

Job number

Ardersier Port

S230503

Hole	BHSP09	Lab sample ID	G2MT2023061939
Depth (Top) m	24.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m		Soil Description	Slightly Gravelly, slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99		
5	99		
3.35	98		
2	97		
1.18	97		
0.6	96		
0.425	95		
0.3	93		
0.212	84		
0.15	33		
0.063	4		

Dry Mass of sample, g

1565

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	2.6
Sand	93.6
Fines <0.063mm	4.0

Grading Analysis	
D100 mm	
D60 mm	0.18
D30 mm	0.137
D10 mm	0.0757
Uniformity Coefficient	2.4
Curvature Coefficient	1.4

Remarks
Preparation and testing in accordance with test method unless noted below

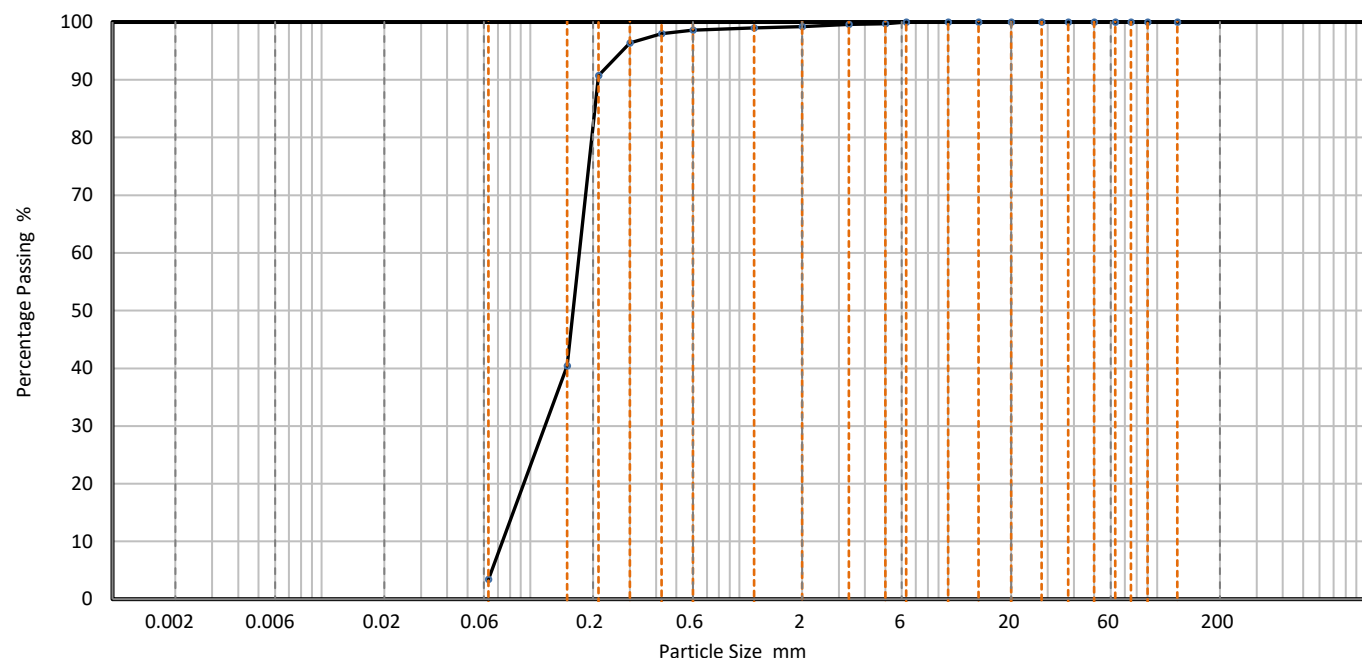
Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	22/06/2023 10:30

PARTICLE SIZE DISTRIBUTION		G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	 10258
Site name	Job number		
Ardersier Port	S230503		

Hole	BHSP09	Lab sample ID	G2MT2023061940
Depth (Top)	m 27.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Very slightly Gravelly, slightly Silty, SAND
Sample type	B		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	99		
0.425	98		
0.3	96		
0.212	91		
0.15	40		
0.063	3		

Dry Mass of sample, g	1762

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.8
Sand	95.8
Fines <0.063mm	3.0

Grading Analysis	
D100 mm	
D60 mm	0.172
D30 mm	0.118
D10 mm	0.0735
Uniformity Coefficient	2.3
Curvature Coefficient	1.1

Remarks
 Preparation and testing in accordance with test method unless noted below

Accreditation status Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.		Approved by D Anderson
		Approval date 22/06/2023 10:51

PARTICLE SIZE DISTRIBUTION

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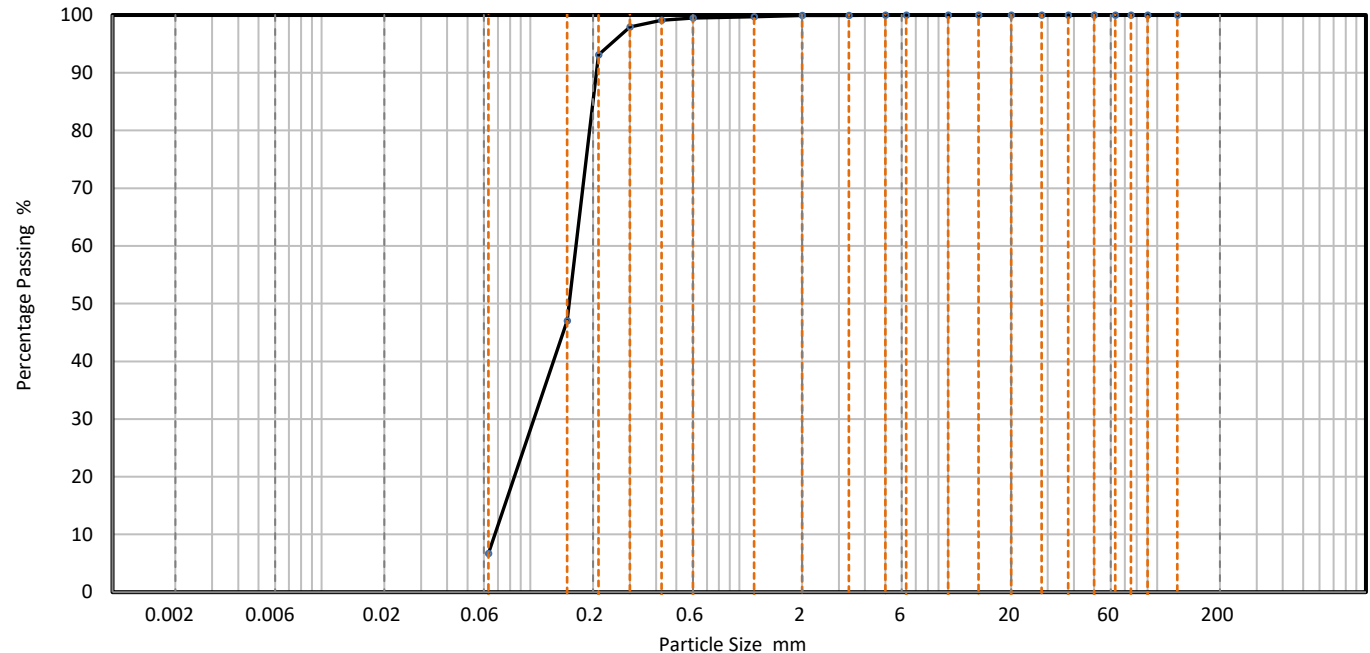
Site name

Ardersier Port

Job number

S230503

Hole	BHSP09	Lab sample ID	G2MT2023061941
Depth (Top)	m 30.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Very slightly Gravelly, slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	98		
0.212	93		
0.15	47		
0.063	7		

Dry Mass of sample, g

1503

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.1
Sand	93.2
Fines <0.063mm	7.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.4
Curvature Coefficient	0.97

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	23/06/2023 09:17

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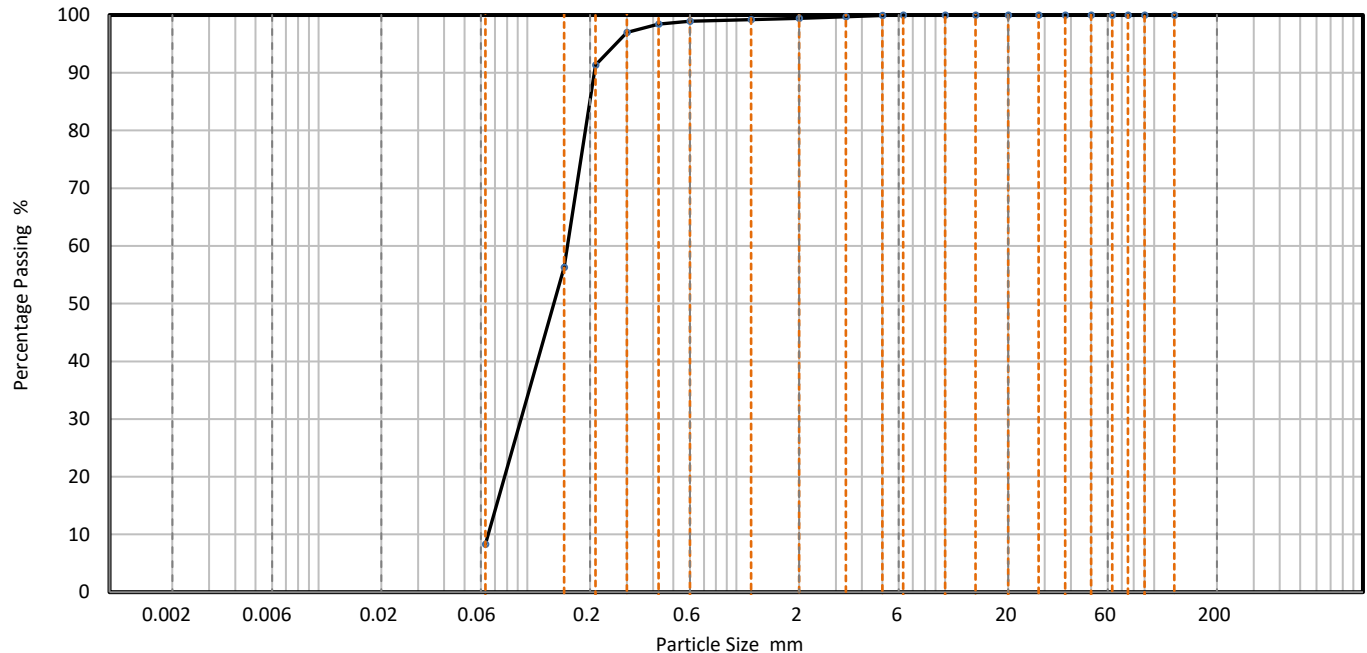
Site name

Ardersier Port

Job number

S230503

Hole	BHSP09	Lab sample ID	G2MT2023061942
Depth (Top)	m 33.00	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	Very slightly Gravelly, slightly Silty, SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	99		
0.425	98		
0.3	97		
0.212	91		
0.15	56		
0.063	8		

Dry Mass of sample, g

1639

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.6
Sand	91.1
Fines <0.063mm	8.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.4
Curvature Coefficient	0.86

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Hydrometer is the usual Sedimentation method carried out by G2M Testing and is part of the G2M Testing UKAS accreditation schedule.

Approved by	D Anderson
Approval date	22/06/2023 08:02

GEOLABS Limited
Bucknalls Lane
Garston
Watford
Hertfordshire
WD25 9XX

Tel: +44(0) 1923 892 190
Fax: +44(0) 1923 892 191
email: admin@geolabs.co.uk
web: www.geolabs.co.uk

Solmek
12 Yarm Road
Stockton-on-Tees
TS18 3NA

16 October 2023

Report No : GEO/38553/01

Page 1 of 1

For the attention of Mr A Cutts

Our ref **GEO / 38553**
Your Ref **S23053**

Date samples received 27/07/2023
Date written instructions received 28/07/2023
Date testing commenced 29/07/2023
Date of sample disposal 13/11/2023

Project **ARDERSIER PORT**

Further to your instructions we have pleasure in enclosing the results of the tests you requested in the attached figures.

LABORATORY TEST REPORT

Item No	Test Quantity	Description
1	4	Maximum & Minimum Density
2	2	Shear Strength by Direct Shear
3	2	Isotropic Consolidated Drained Triaxial Compression (CID) - remoulded

Any opinions or interpretations expressed herein are outside the scope of UKAS accreditation. All results contained in this report are provisional unless signed by an approved signatory. The results contained in this report relate only to samples received in the laboratory and are tested 'as received' unless otherwise stated. This report should not be reproduced, except in full, without the written approval of the laboratory. The results reported are applicable only to the test items received by the laboratory.

All the necessary data required by the documented test procedures has been recorded and will be stored for a period of not less than 6 years. This data will be issued to yourselves at your request. All samples will be disposed of after the date shown above. Written confirmation will be required to retain the samples beyond this period and a storage charge may be applied.

We trust that the above meets your requirements and should you require any further information or assistance, please do not hesitate to contact us.

Yours faithfully
on behalf of **GEOLABS Limited**

[Redacted]

J Sturges
Operations Manager



Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP05
Depth (m) 8.00-8.45
Sample Type B

Description:

Greyish brown fine to medium SAND with rare fine to medium gravel.

Percentage of material retained on the 2 mm test sieve 0.5 %

The fines content was measured to be 1.1 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.62 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.610	g/cm ³
Maximum dry density after surcharge application	1.622	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.610	g/cm ³
Maximum dry density after surcharge application	1.625	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.26 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.13 g

Mass of sand	Run		
	1	558.89	g
	2	556.98	g
	3	557.25	g
	4	556.67	g
	5	557.88	g
	Minimum	557.53	g

Checked and Approved by
[Redacted]

Project Number:

38553

Project Name:

**ARDERSIER PORT
S23053**

J Powell - Technical Consultant
23/08/2023

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Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP05
Depth (m) 10.00-10.45
Sample Type B

Description:

Greyish brown fine to medium SAND with occasional fine to medium gravel.

Percentage of material retained on the 2 mm test sieve 0.4 %

The fines content was measured to be 0.7 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.55 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.548	g/cm ³
Maximum dry density after surcharge application	1.557	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.536	g/cm ³
Maximum dry density after surcharge application	1.550	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.20 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.11 g

Mass of sand	Run		
	1	529.56	g
	2	530.84	g
	3	530.62	g
	4	530.89	g
	5	530.88	g
	Minimum	530.56	g

Checked and Approved by
[Redacted]

Project Number:

38553

Project Name:

ARDERSIER PORT
S23053

J Powell - Technical Consultant
23/08/2023

GEOLABS®

Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP05
Depth (m) 16.50-16.95
Sample Type B

Description:

Brownish grey slightly silty fine to medium SAND with rare shell fragments and fine gravel.

Percentage of material retained on the 2 mm test sieve 0.1 %

The fines content was measured to be 3.5 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.54 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.522	g/cm ³
Maximum dry density after surcharge application	1.536	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.536	g/cm ³
Maximum dry density after surcharge application	1.548	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.13 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.11 g

Mass of sand	Run		
	1	499.56	g
	2	501.90	g
	3	502.90	g
	4	502.42	g
	5	501.29	g
	Minimum	501.61	g

Checked and Approved by
[Redacted]

J Powell - Technical Consultant
23/08/2023

Project Number:

38553

Project Name:

**ARDERSIER PORT
S23053**

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Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP05
Depth (m) 19.50-19.95
Sample Type B

Description:

Brownish grey slightly silty fine to medium SAND.

Percentage of material retained on the 2 mm test sieve 0.0 %

The fines content was measured to be 2.9 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.55 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.527	g/cm ³
Maximum dry density after surcharge application	1.543	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.542	g/cm ³
Maximum dry density after surcharge application	1.557	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.15 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.11 g

Mass of sand	Run		
	1	507.42	g
	2	509.87	g
	3	511.23	g
	4	510.50	g
	5	509.77	g
	Minimum	509.76	g

[Redacted]

J Powell - Technical Consultant
23/08/2023

Project Number:

38553

Project Name:

**ARDERSIER PORT
S23053**

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DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP05
Depth (m) 8.00-8.45
Sample Type B

Description:

Greyish brown slightly gravelly fine to medium SAND.

Specimen Details

Depth within original sample *m* n/a
Orientation within original sample n/a
Test condition Submerged
Preparation < 2 mm material remoulded at existing water content to a relative density of 75% ¹

Particle density *Mg/m³* 2.65 (assumed)

Specimen Number		1	2	3
Length	<i>mm</i>	59.78	60.00	60.06
Width	<i>mm</i>	59.77	59.98	59.99
Height	<i>mm</i>	22.48	22.37	22.38
Initial water content	%	23.4	23.4	23.4
Initial bulk density	<i>Mg/m³</i>	1.87	1.86	1.86
Initial dry density	<i>Mg/m³</i>	1.51	1.51	1.51
Initial voids ratio		0.752	0.756	0.758
Degree of Saturation	%	82.6	82.2	81.9

Shearing Stage

	<i>kPa</i>	35	70	140
Normal stress				
Peak Conditions:				
Rate of horizontal displacement	<i>mm/min</i>	0.18	0.18	0.18
Maximum shear stress	<i>kPa</i>	23.8	48.5	93.3
Horizontal displacement at MSS	<i>mm</i>	3.3	1.6	1.3
Vertical Displacement at Peak	<i>mm</i>	-0.25	-0.06	-0.06

	%	28.5	27.2	25.1
Final water content				
Duration	<i>day(s)</i>	1	1	1

Shear Strength Parameters

	<i>kPa</i>	Peak Condition
Apparent Cohesion		1
Angle of Shearing Resistance	<i>degrees</i>	33.5

Notes: ¹ Maximum dry density = 1.62 Mg/m³ and minimum dry density = 1.26 Mg/m³

Tested by JJR
Checked and Approved by
[Redacted]

C F Wallace - Technical Director
20/09/2023

Project Number:

GEO / 38553

Project Name:

ARDERSIER PORT
S23053

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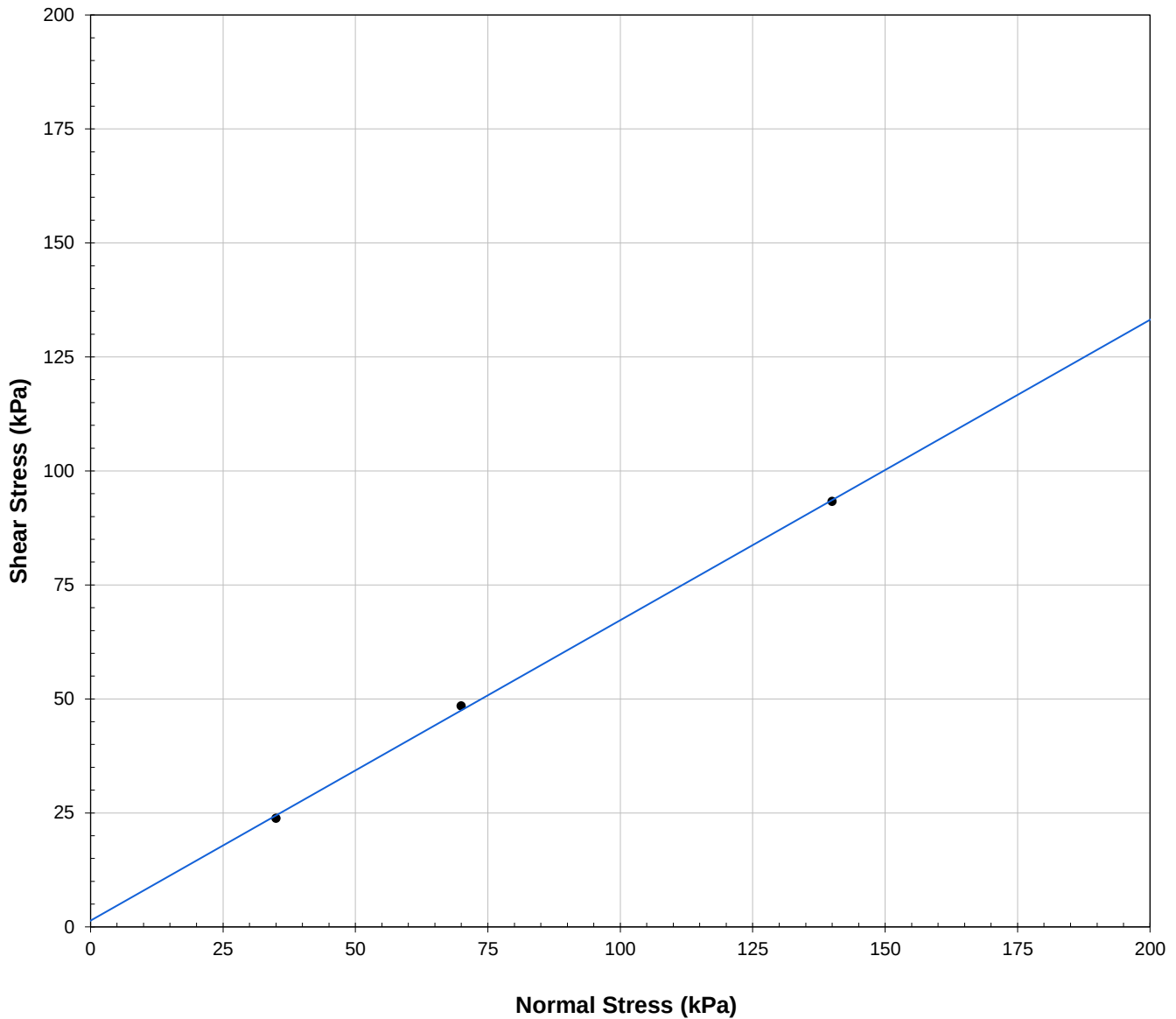
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP05
 Depth (m) 8.00-8.45
 Sample Type B

Description:

Greyish brown slightly gravelly fine to medium SAND.

Shear Stress v Normal Stress**Peak: $c' = 1$** **$\Phi' = 33.5$**

Tested by JJR
 Checked and Approved by

C F Wallace - Technical Director
 20/09/2023

Project Number:

GEO / 38553

Project Name:

ARDERSIER PORT
S23053

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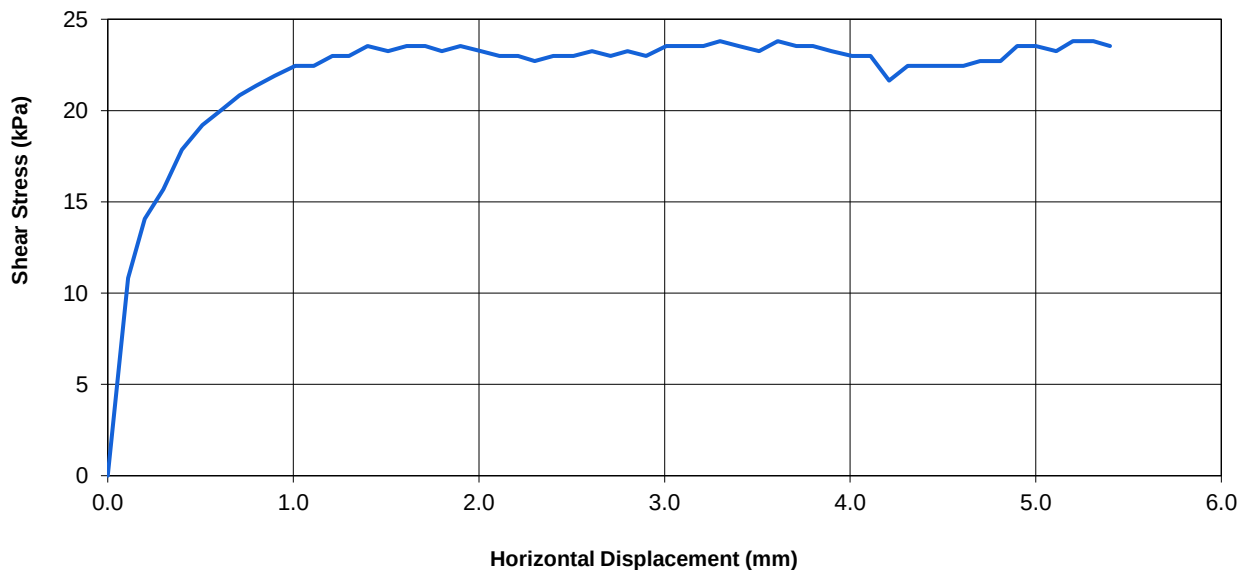
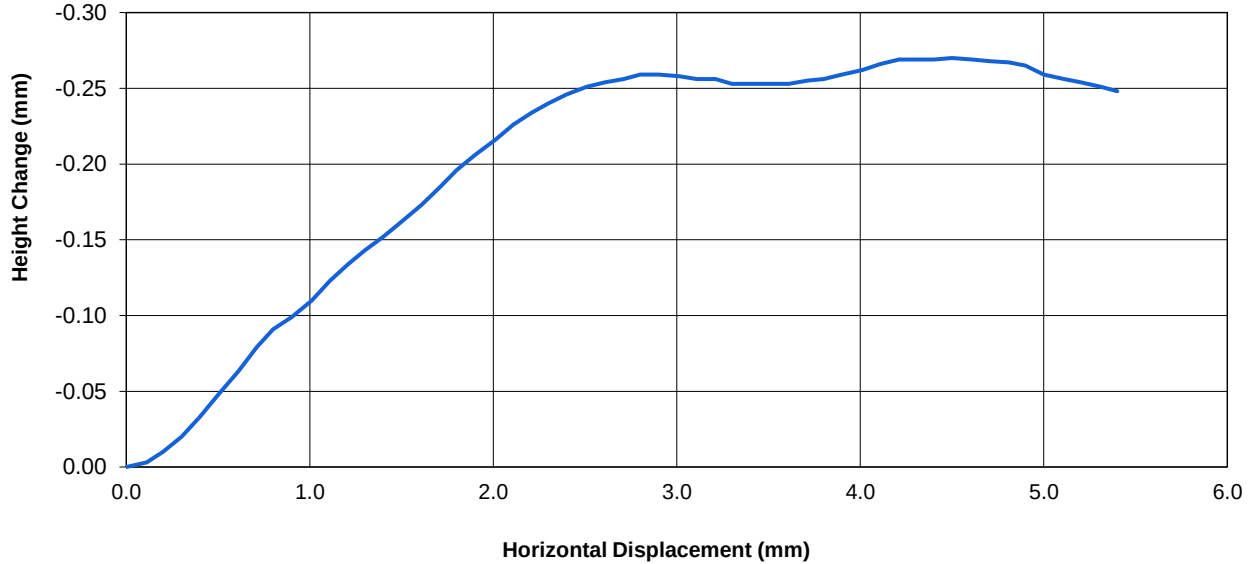
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP05
Depth (m) 8.00-8.45
Sample Type B

Description:

Greyish brown slightly gravelly fine to medium SAND.

Specimen: 1**Shear Stage**

Tested by JJR
Checked and Approved by
[Redacted]

C F Wallace - Technical Director
20/09/2023

Project Number:

GEO / 38553

Project Name:

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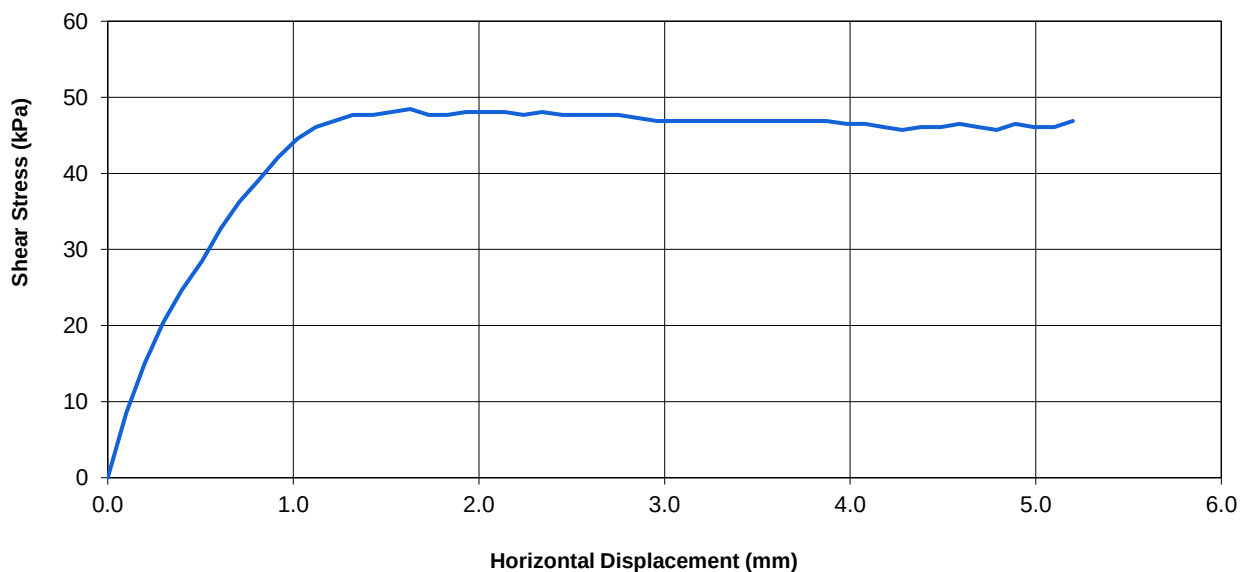
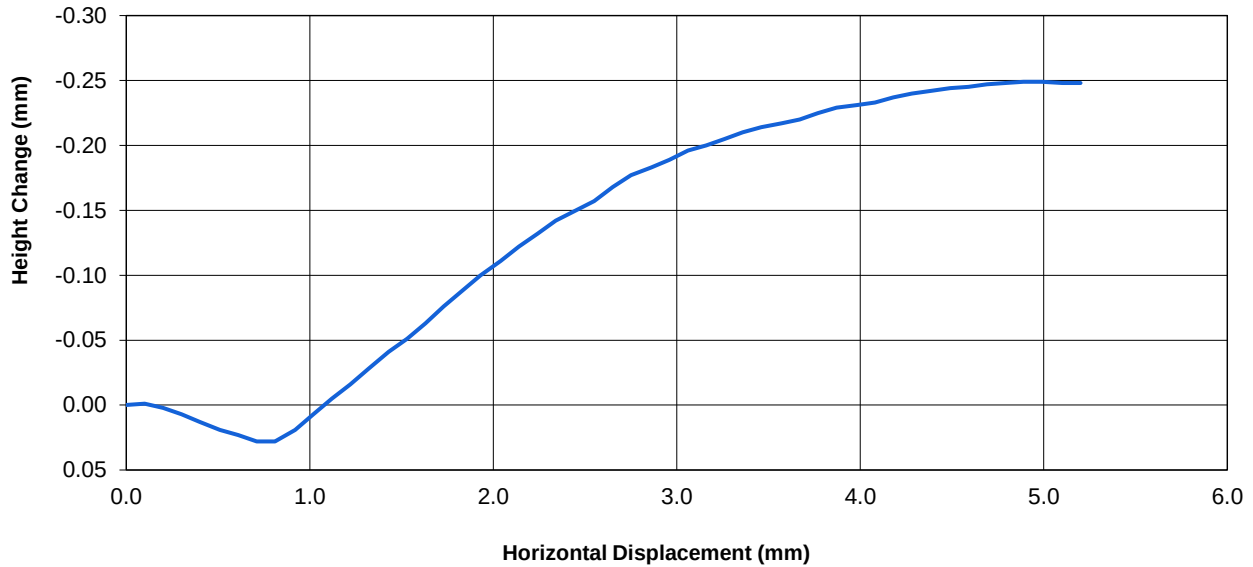
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP05
Depth (m) 8.00-8.45
Sample Type B

Description:

Greyish brown slightly gravelly fine to medium SAND.

Specimen: 2**Shear Stage**

Tested by JJR
Checked and Approved by
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C F Wallace - Technical Director
20/09/2023

Project Number:

GEO / 38553

Project Name:

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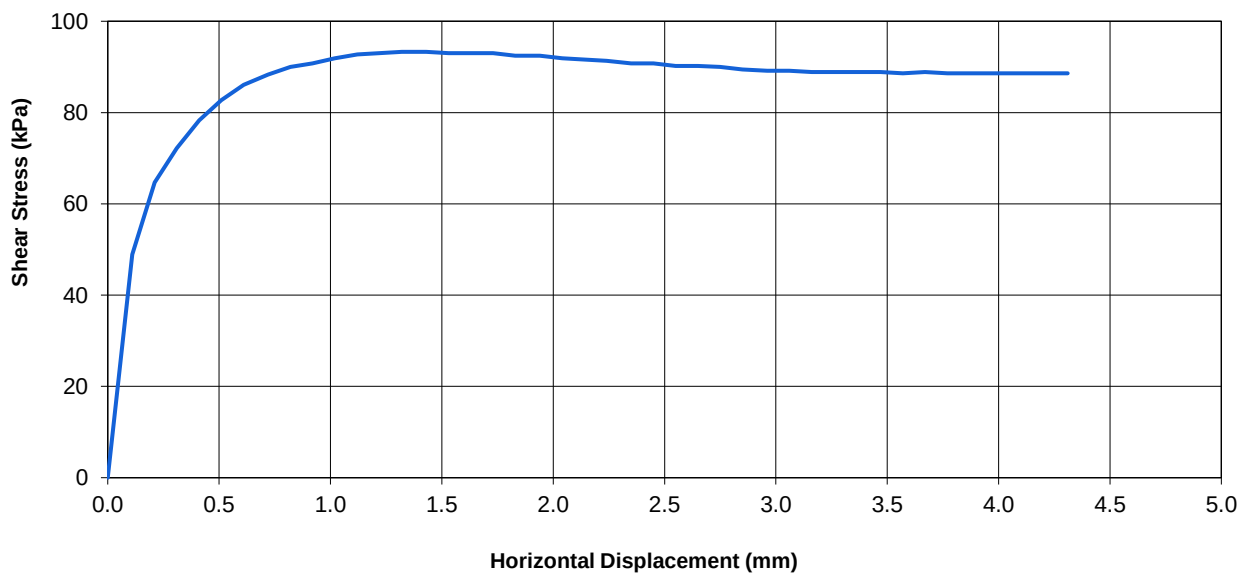
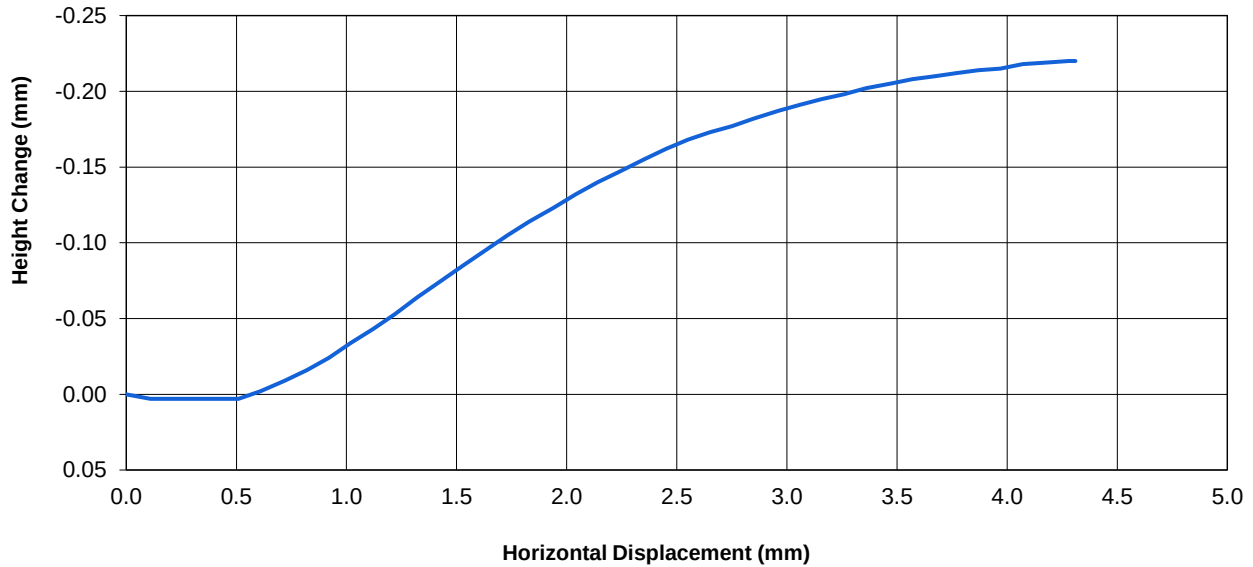
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP05
 Depth (m) 8.00-8.45
 Sample Type B

Description:

Greyish brown slightly gravelly fine to medium SAND.

Specimen: 3**Shear Stage**

Tested by JJR
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C F Wallace - Technical Director
 20/09/2023

Project Number:

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Project Name:

ARDERSIER PORT
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DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP05
 Depth (m) 19.50-19.95
 Sample Type B

Description:

Brownish grey slightly silty fine to medium SAND.

Specimen Details

Depth within original sample *m* n/a
 Orientation within original sample n/a
 Test condition Submerged
 Preparation < 2 mm material remoulded at existing water content to a relative density of 50% ¹

Particle density *Mg/m³* 2.65 (assumed)

Specimen Number		1	2	3
Length	<i>mm</i>	59.78	60.00	60.06
Width	<i>mm</i>	59.77	59.98	59.99
Height	<i>mm</i>	25.24	25.12	25.16
Initial water content	%	27.1	27.1	27.1
Initial bulk density	<i>Mg/m³</i>	1.66	1.66	1.65
Initial dry density	<i>Mg/m³</i>	1.31	1.31	1.30
Initial voids ratio		1.025	1.030	1.036
Degree of Saturation	%	70.1	69.7	69.4

Shearing Stage

	<i>kPa</i>	65	130	260
Normal stress				
Peak Conditions:				
Rate of horizontal displacement	<i>mm/min</i>	0.18	0.18	0.18
Maximum shear stress	<i>kPa</i>	42.7	91.9	174.5
Horizontal displacement at MSS	<i>mm</i>	7.8	5.0	8.0
Vertical Displacement at Peak	<i>mm</i>	0.59	0.24	0.56

	%	28.8	27.6	28.3
Final water content				
Duration	<i>day(s)</i>	1	1	1

Shear Strength Parameters

	<i>kPa</i>	Peak Condition
Apparent Cohesion		2
Angle of Shearing Resistance	<i>degrees</i>	34.0

Notes: ¹ Maximum dry density = 1.54 Mg/m³ and minimum dry density = 1.13 Mg/m³

Tested by JJR
 Checked and Approved by
 [Redacted]

C F Wallace - Technical Director
 20/09/2023

Project Number:

GEO / 38553

Project Name:

ARDERSIER PORT
S23053

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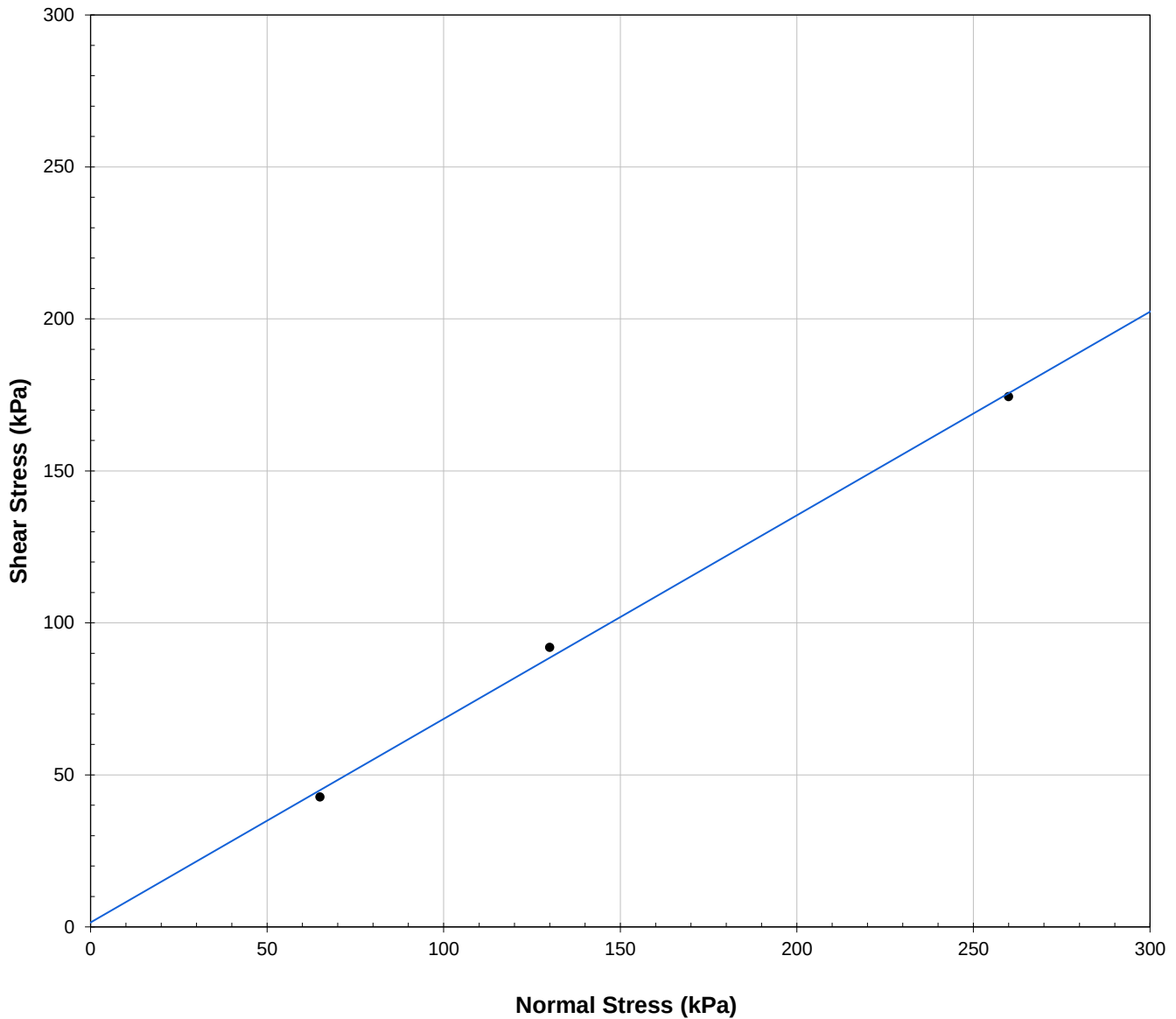
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP05
Depth (m) 19.50-19.95
Sample Type B

Description:

Brownish grey slightly silty fine to medium SAND.

Shear Stress v Normal Stress**Peak: $c' = 2$** **$\Phi' = 34.0$**

Tested by JJR
Checked and Approved by

[Redacted]

C F Wallace - Technical Director
20/09/2023

Project Number:

GEO / 38553

Project Name:

**ARDERSIER PORT
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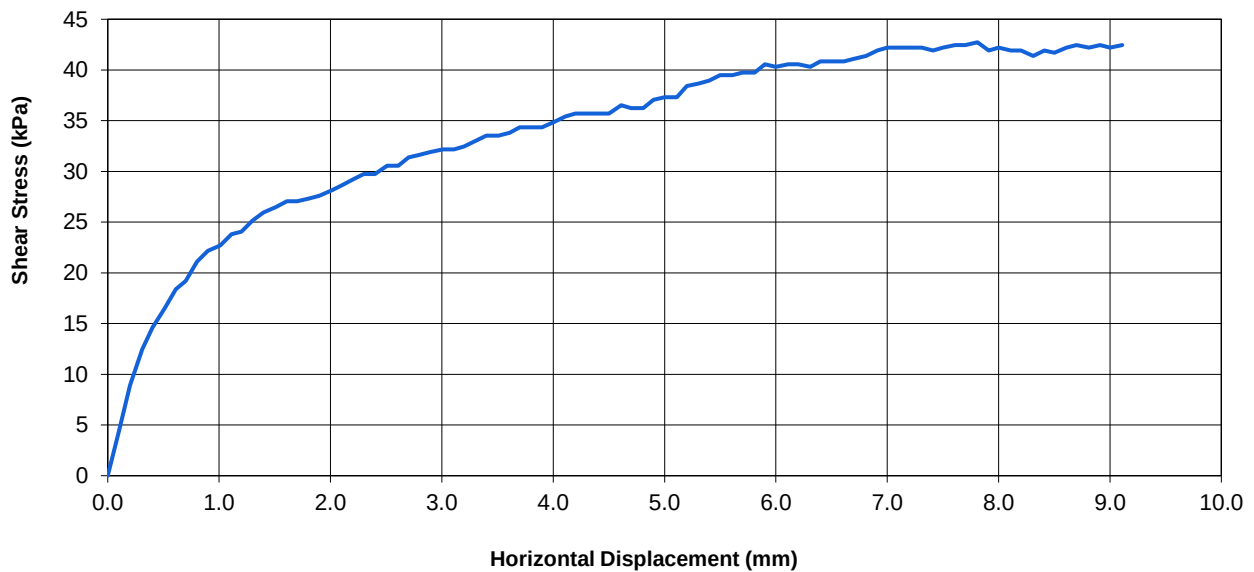
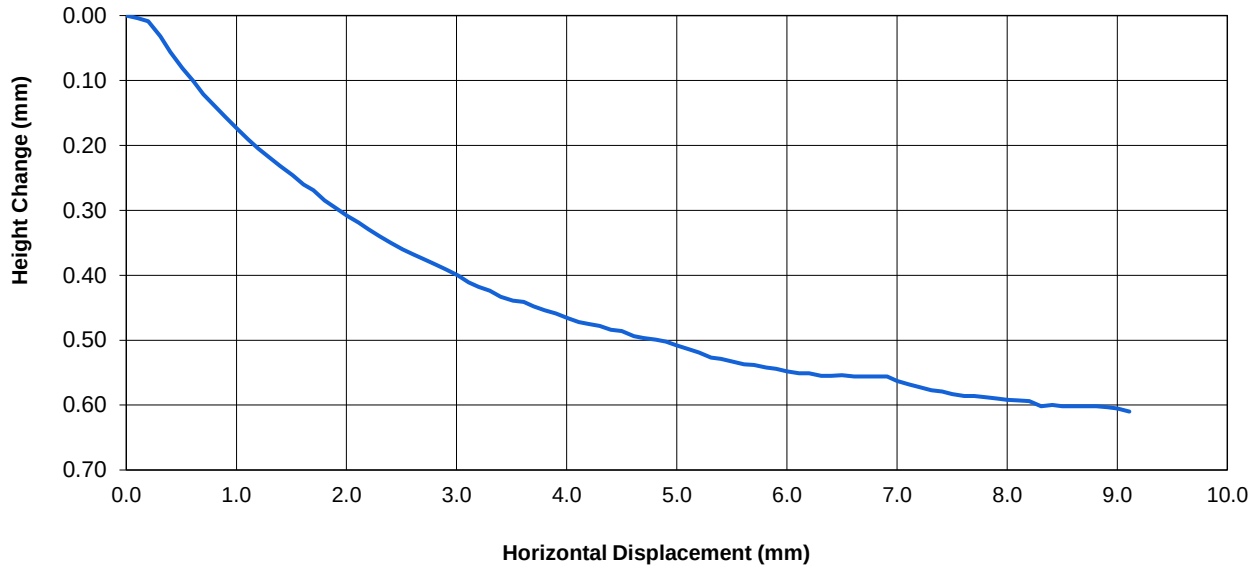
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP05
Depth (m) 19.50-19.95
Sample Type B

Description:

Brownish grey slightly silty fine to medium SAND.

Specimen: 1**Shear Stage**

Tested by JJR
Checked and Approved by

[Redacted]

C F Wallace - Technical Director
20/09/2023

Project Number:

GEO / 38553

Project Name:

**ARDERSIER PORT
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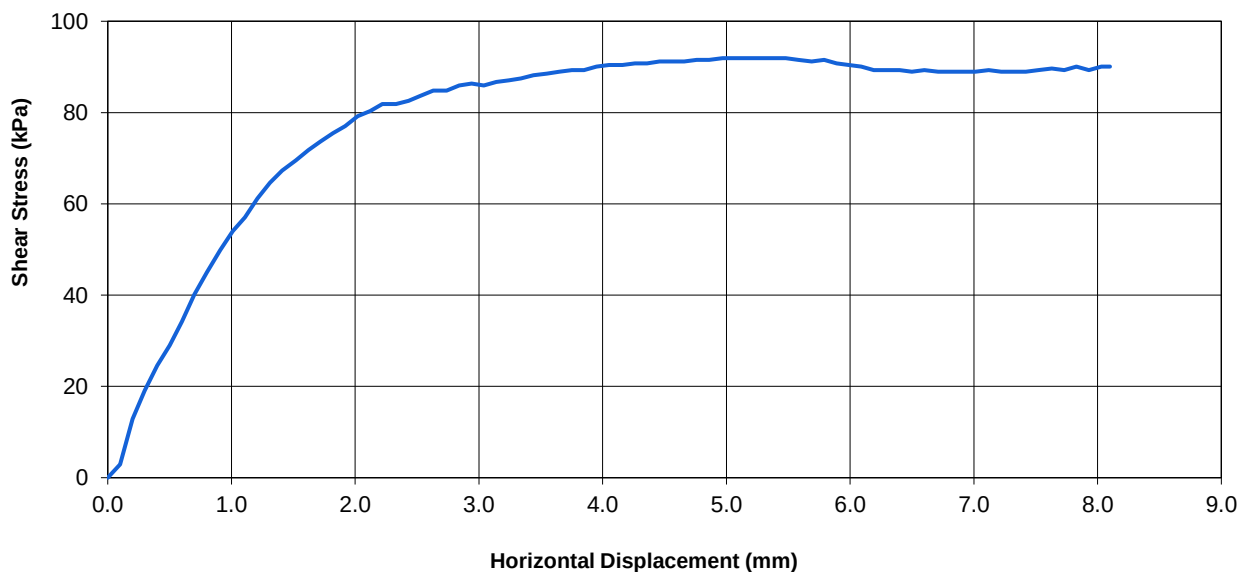
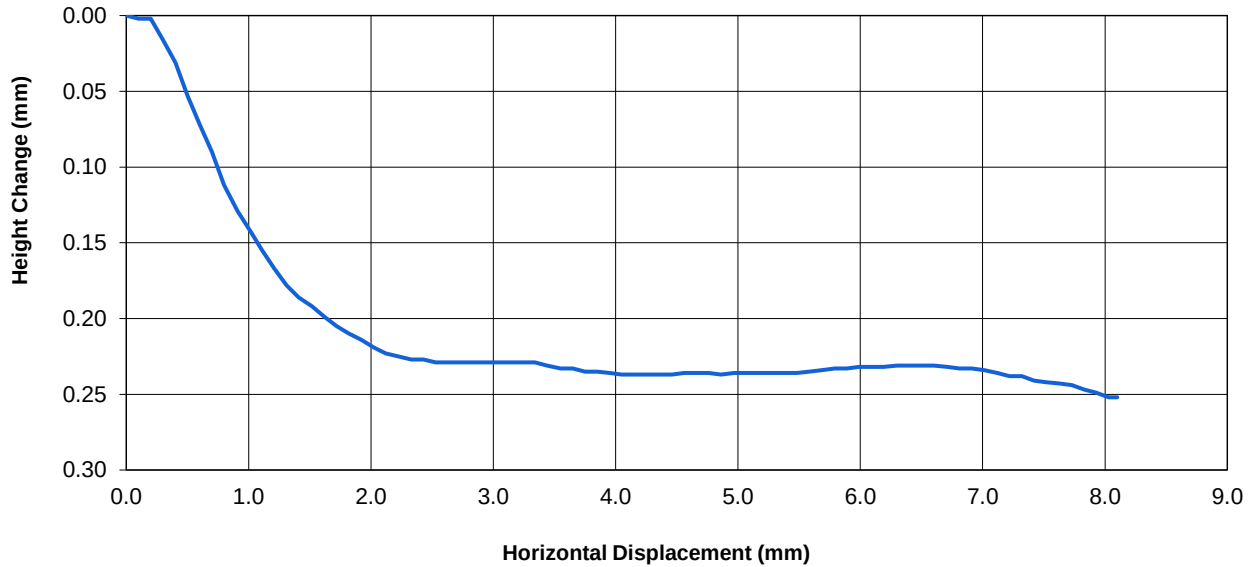
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP05
Depth (m) 19.50-19.95
Sample Type B

Description:

Brownish grey slightly silty fine to medium SAND.

Specimen: 2**Shear Stage**

Tested by JJR
Checked and Approved by
[Redacted]

Project Number:

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Project Name:

**ARDERSIER PORT
S23053**

C F Wallace - Technical Director
20/09/2023

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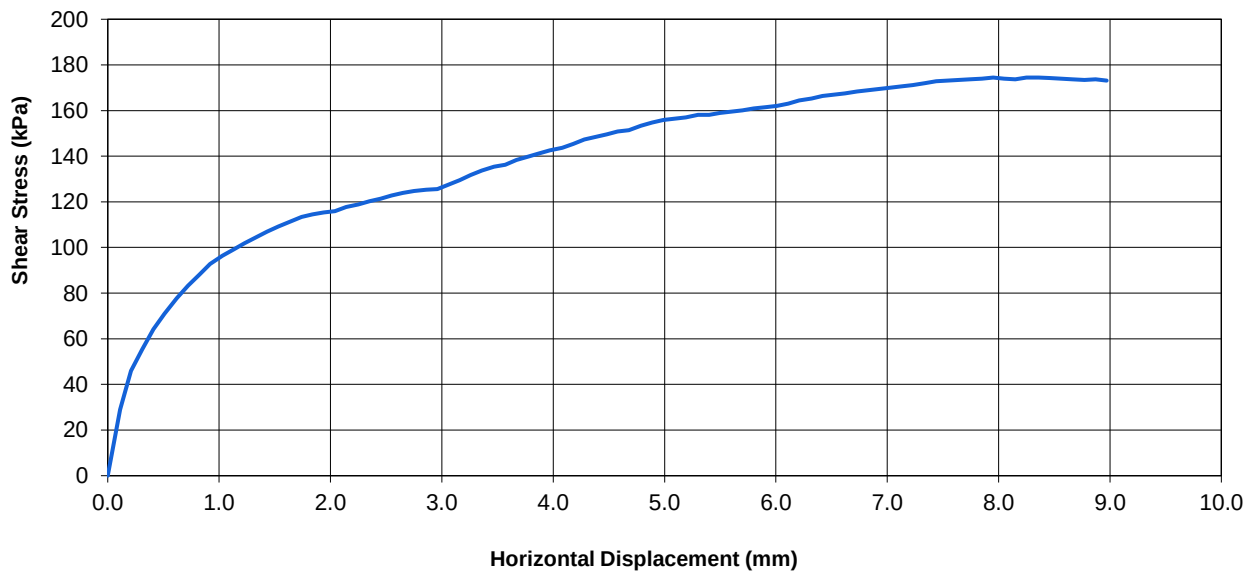
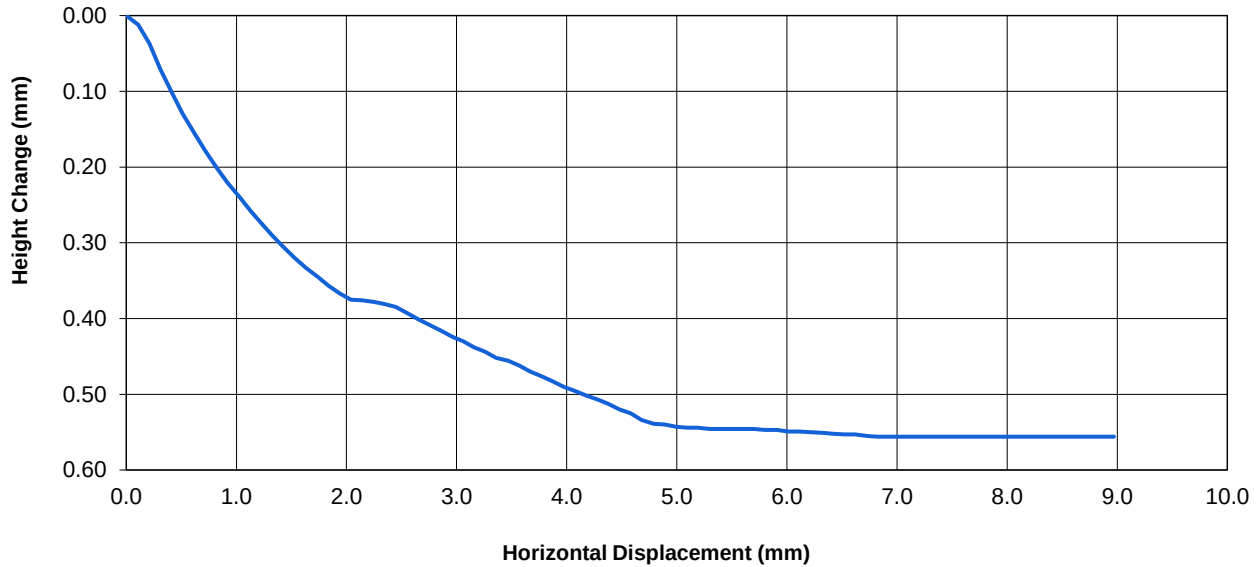
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP05
Depth (m) 19.50-19.95
Sample Type B

Description:

Brownish grey slightly silty fine to medium SAND.

Specimen: 3**Shear Stage**

Tested by JJR
Checked and Approved by
[Redacted]

C F Wallace - Technical Director
20/09/2023

Project Number:

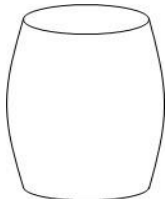
GEO / 38553

Project Name:

**ARDERSIER PORT
S23053****GEOLABS**®

Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.:	BHSP05	Description: Greyish brown fine to medium SAND with occasional fine to medium gravel. .
Depth (m):	10.00-10.45	

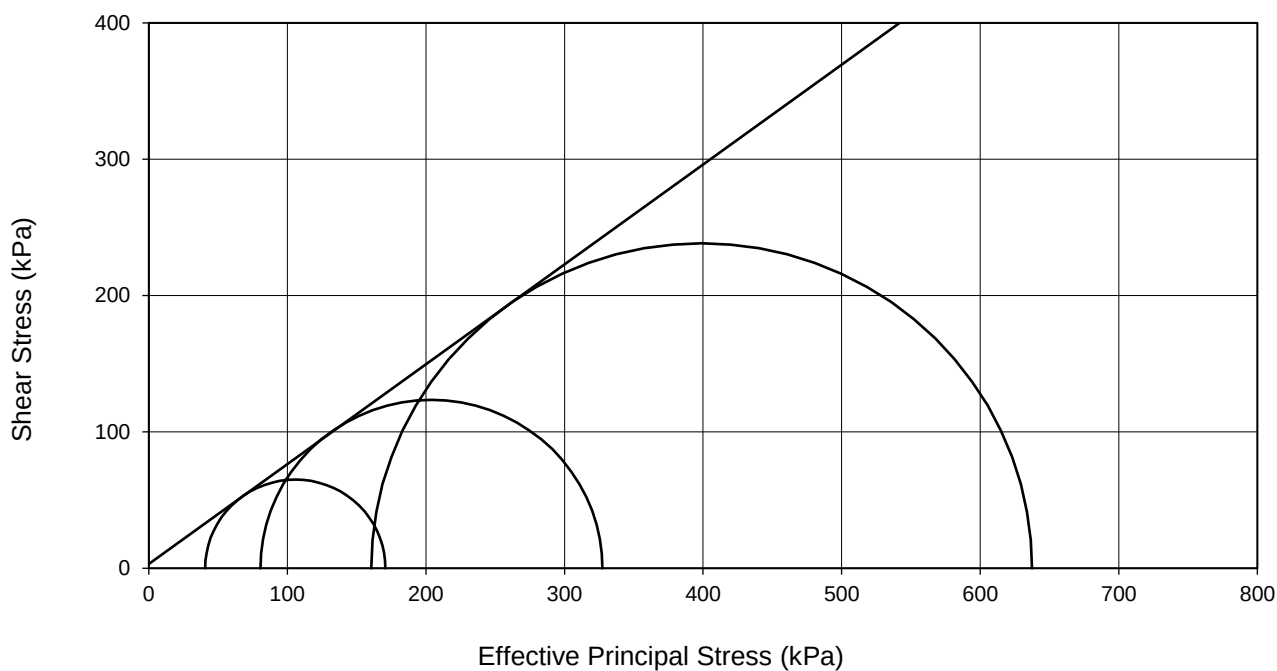
SPECIMEN DETAILS Depth within original sample Remarks		NA Orientation within original sample: NA Remoulded to a target 10% water content and a target dry density of 1.492 Mg/m ³		
TEST DETAILS Specimen Type and Preparation Cell Preparation Specimen Number Initial Diameter Initial Length Initial Water Content Initial Wet Density Drainage Conditions		B (Remoulded) Checks performed in accordance with Clause 3.5		
		Multistage		
		70.22		
		139.49		
		10.1		
		1.64		
		One end only		
SATURATION STAGE Final Cell Pressure Final Pore Pressure Final Pore Pressure Parameter B Duration		Method: Clause 5.2 540 535 0.97 7		
CONSOLIDATION STAGE Cell Pressure Back Pressure Effective Pressure Final Pore Pressure Final Pore Pressure Dissipation Duration		Stage No 1 540 500 40 500 100 1	Stage No 2 580 500 80 500 100 1	Stage No 3 660 500 160 500 100 1
SHEARING STAGE Cell Pressure Rate of Axial Displacement Initial Pore Pressure Initial Effective Stress		540 0.015 500 40	580 0.020 500 80	660 0.016 500 160
CONDITIONS AT FAILURE Pore Pressure Minor Effective Principal Stress Deviator Stress Major Effective Principal Stress Volume Change Volumetric Strain Axial Strain Membrane correction applied to Deviator Stress Duration		Maximum deviator stress		
		499	500	499
		41	80	161
		130	247	477
		171	327	638
		-3.20	-2.90	-2.99
		-0.6	-0.5	-0.6
		2.5	1.7	2.2
		1	0	0
		1	1	1
Final Water Content Final Wet Density		28.2 1.93		
EFFECTIVE STRESS PARAMETERS Cohesion Angle of Shear Resistance		3.1 36		
FAILURE SKETCH				

Checked and Approved by [Redacted] P Heritage - Project Manager 16/10/2023	Project Number: GEO / 38553 Project Name: ARDERSIER PORT S23053	GEOLABS 

Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP05
Depth (m): 10.00-10.45

Description:
Greyish brown fine to medium SAND with occasional fine to medium gravel. .



Checked and Approved by
[Redacted]

P Heritage - Project Manager
16/10/2023

Project Number:

GEO / 38553

Project Name:

**ARDERSIER PORT
S23053**

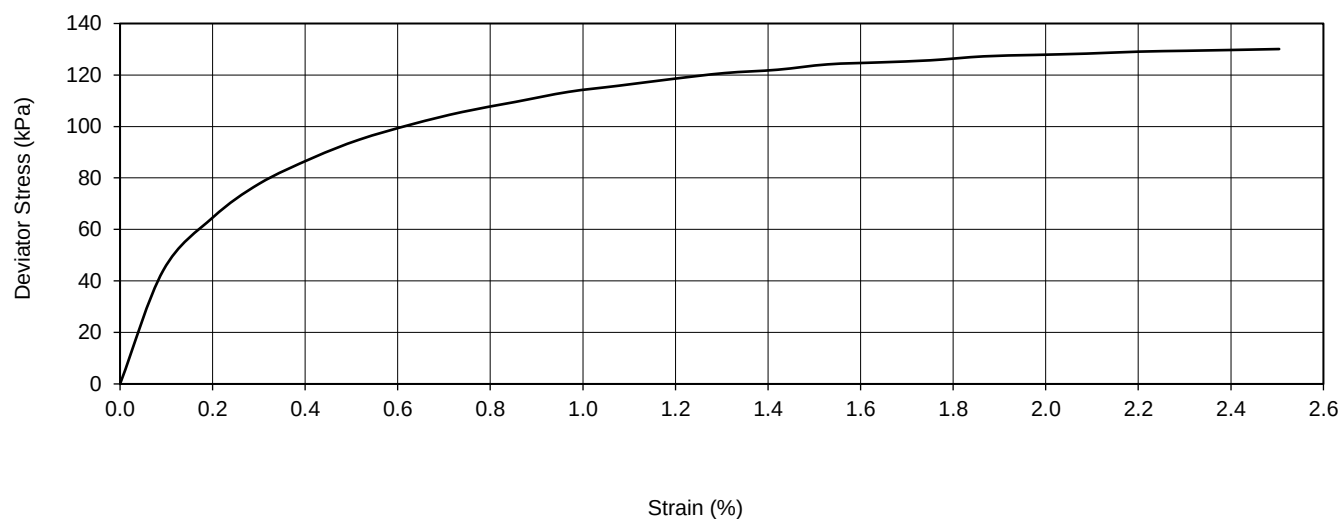
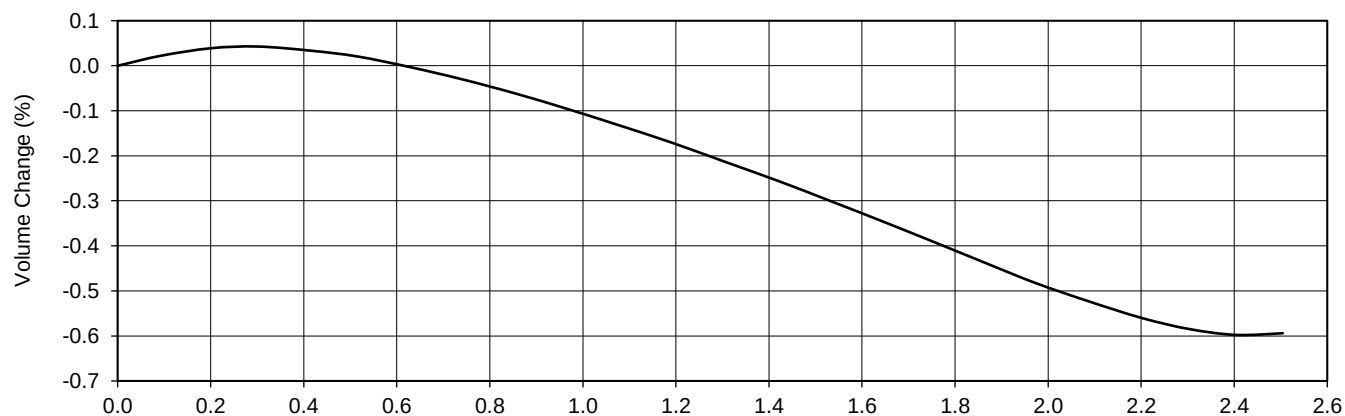
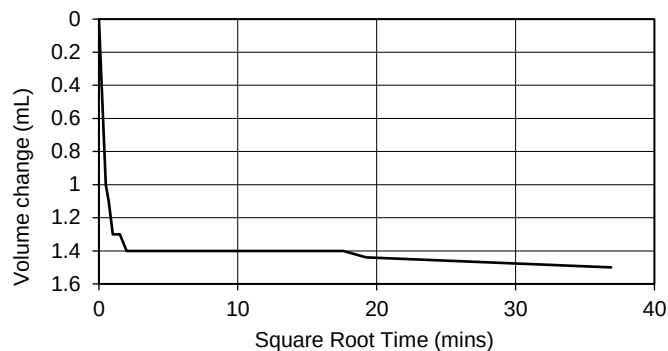
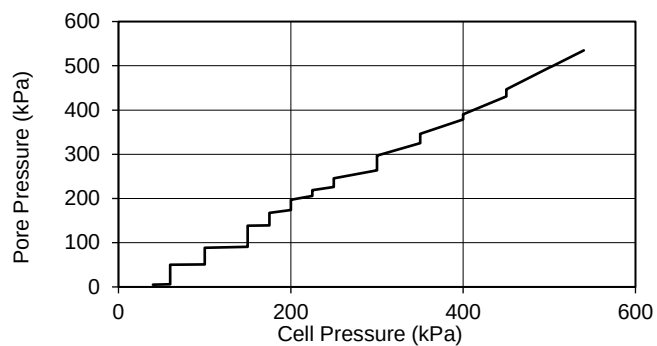
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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP05
Depth (m): 10.00-10.45

Stage No 1



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[Redacted]

P Heritage - Project Manager
16/10/2023

Project Number:

GEO / 38553

Project Name:

ARDERSIER PORT
S23053

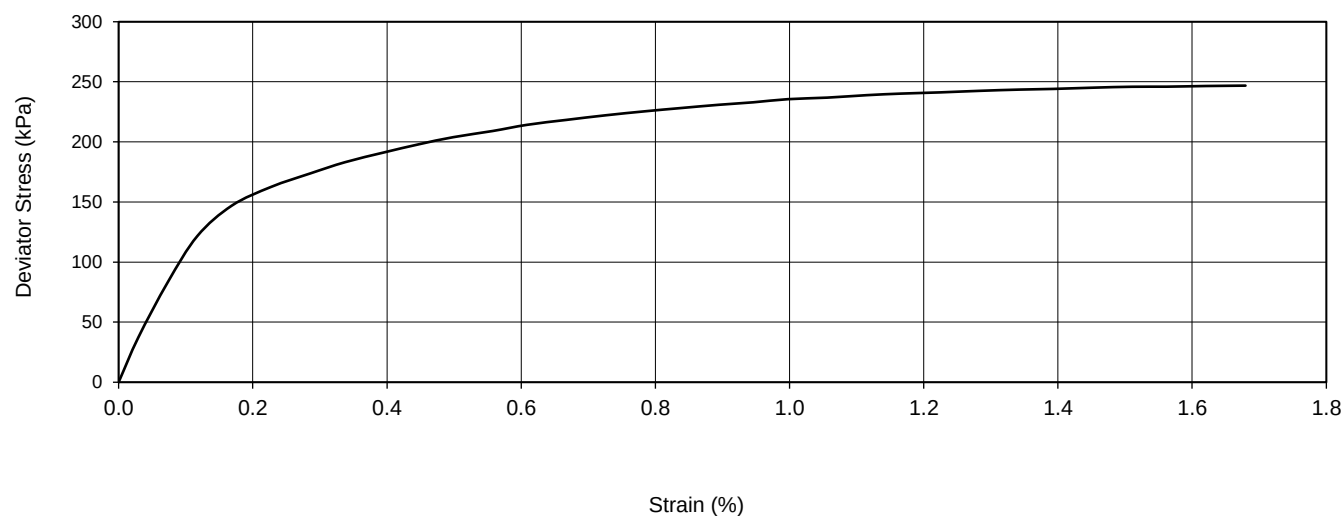
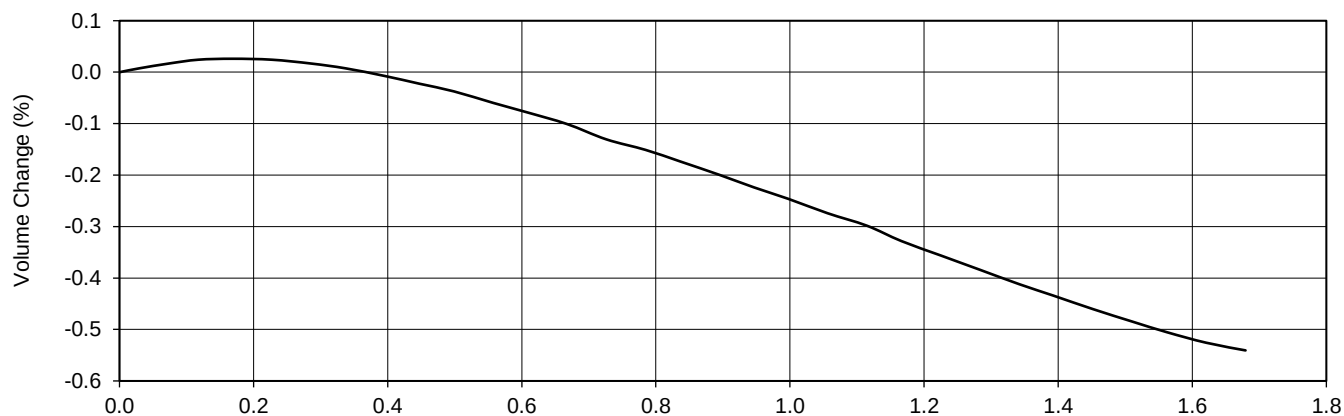
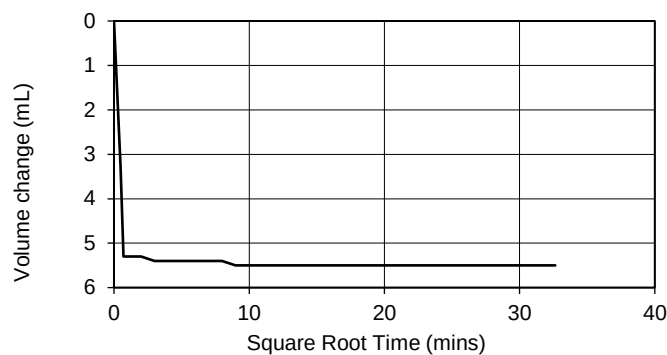
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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP05
Depth (m): 10.00-10.45

Stage No 2



Checked and Approved by
[Redacted]

P Heritage - Project Manager
16/10/2023

Project Number:

GEO / 38553

Project Name:

**ARDERSIER PORT
S23053**

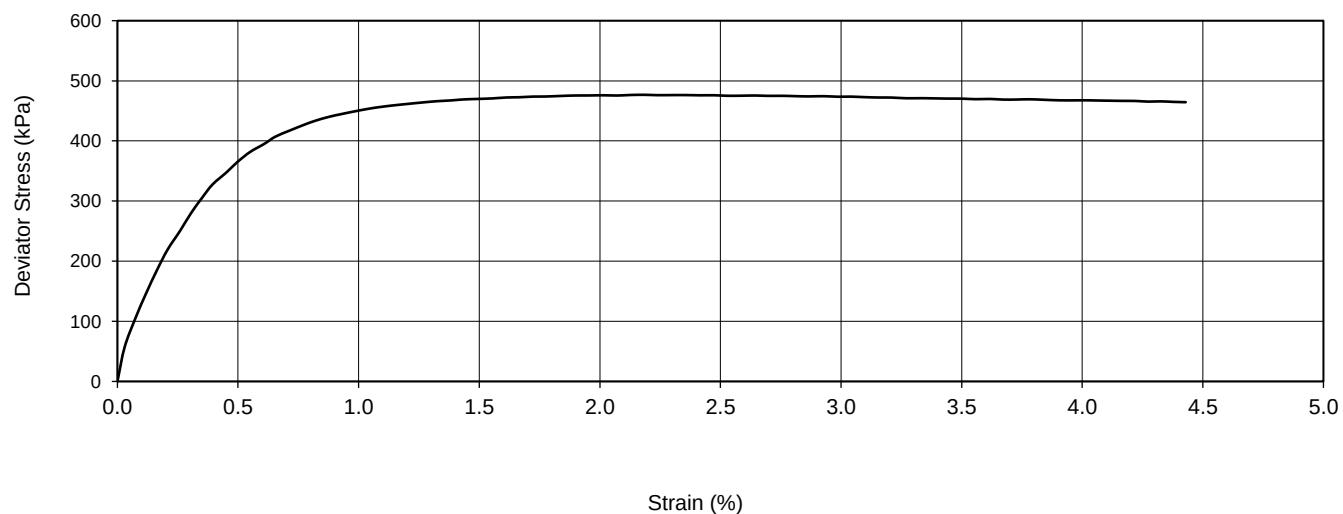
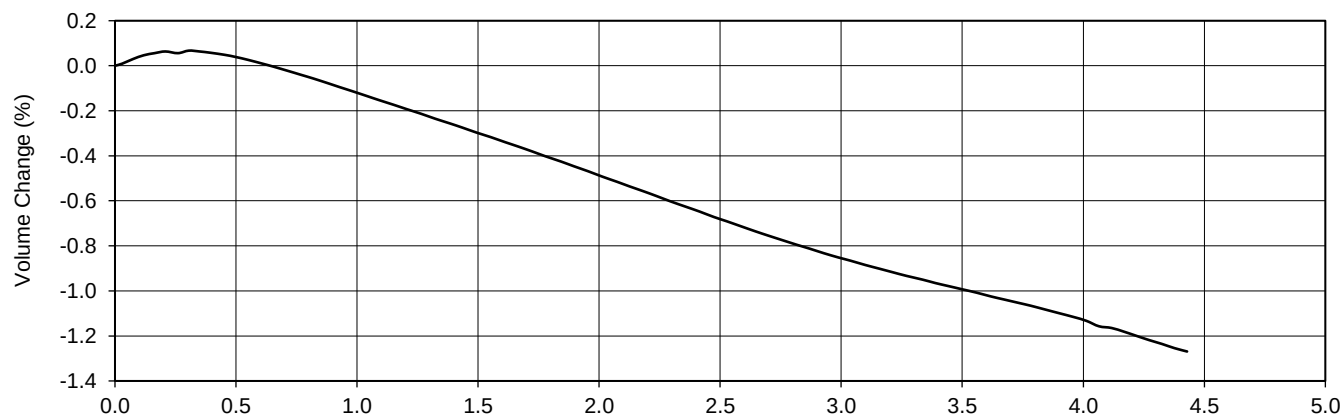
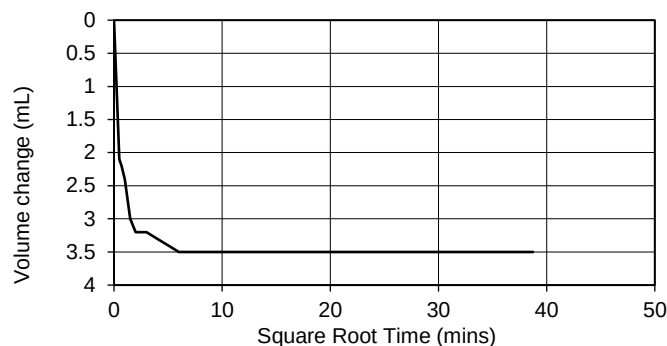
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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP05
Depth (m): 10.00-10.45

Stage No 3



Checked and Approved by
[Redacted]

P Heritage - Project Manager
16/10/2023

Project Number:

GEO / 38553

Project Name:

**ARDERSIER PORT
S23053**

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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.:	BHSP05	Description: Brownish grey slightly silty fine to medium SAND with rare shell fragments and fine gravel.
Depth (m):	16.50-16.95	

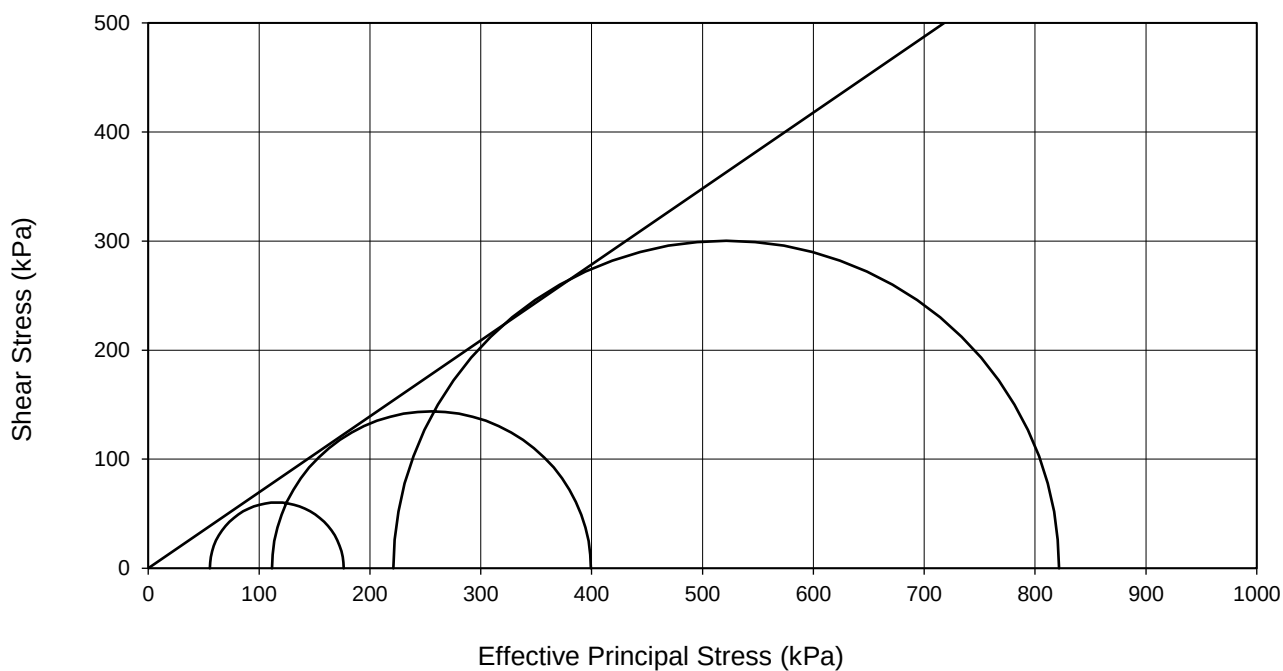
SPECIMEN DETAILS Depth within original sample Remarks		NA Orientation within original sample: NA Remoulded to a target 10% water content and a target dry density of 1.304Mg/m ³		
TEST DETAILS Specimen Type and Preparation Cell Preparation Specimen Number Initial Diameter Initial Length Initial Water Content Initial Wet Density Drainage Conditions		B (Remoulded) Checks performed in accordance with Clause 3.5 Multistage 70.22 139.49 10.4 1.43 One end and radial boundary		
SATURATION STAGE Final Cell Pressure Final Pore Pressure Final Pore Pressure Parameter B Duration		Method: Clause 5.2 655 642 1.00 7		
CONSOLIDATION STAGE Cell Pressure Back Pressure Effective Pressure Final Pore Pressure Final Pore Pressure Dissipation Duration		Stage No 1 655 600 55 600 100 1	Stage No 2 710 600 110 600 100 1	Stage No 3 820 600 220 600 100 1
SHEARING STAGE Cell Pressure Rate of Axial Displacement Initial Pore Pressure Initial Effective Stress		655 0.015 600 55	710 0.020 600 110	820 0.020 600 220
CONDITIONS AT FAILURE Pore Pressure Minor Effective Principal Stress Deviator Stress Major Effective Principal Stress Volume Change Volumetric Strain Axial Strain Membrane & filter correction applied to Deviator Stress Duration		Maximum deviator stress 599 56 121 177 3.60 0.7 5.0 6 1		
Final Water Content Final Wet Density		29.5 1.79		
EFFECTIVE STRESS PARAMETERS Cohesion Angle of Shear Resistance		0 35		
FAILURE SKETCH				

Checked and Approved by [Redacted] P Heritage - Project Manager 16/10/2023	Project Number: GEO / 38553 Project Name: ARDERSIER PORT S23053	GEOLABS 

Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP05
Depth (m): 16.50-16.95

Description:
Brownish grey slightly silty fine to medium SAND with rare shell fragments and fine gravel.



Checked and Approved by
[Redacted]

P Heritage - Project Manager
16/10/2023

Project Number:

GEO / 38553

Project Name:

**ARDERSIER PORT
S23053**

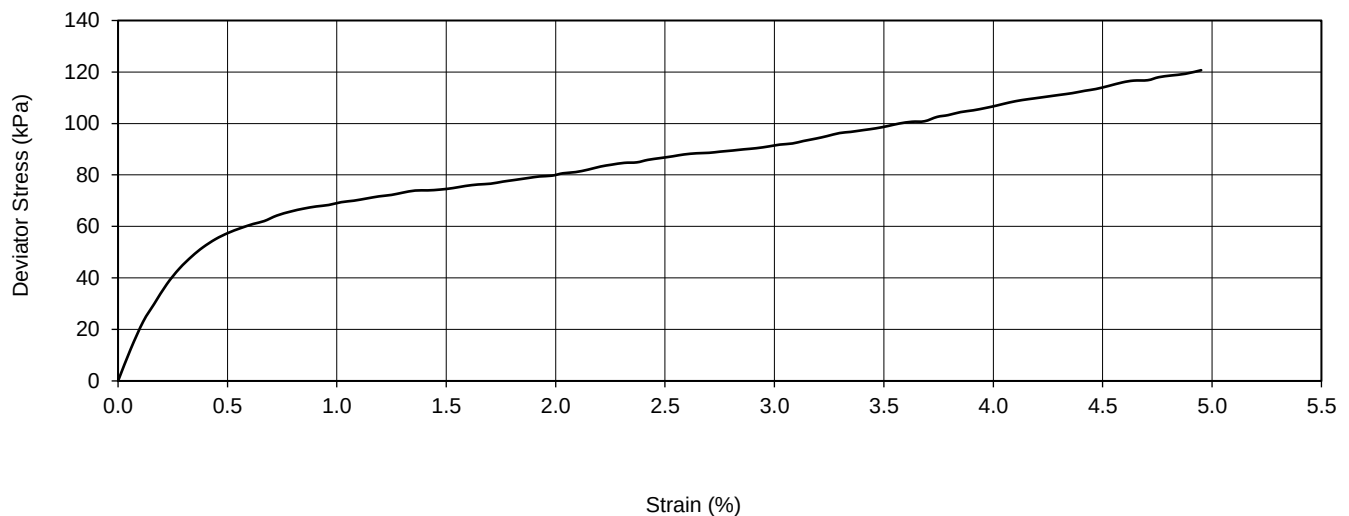
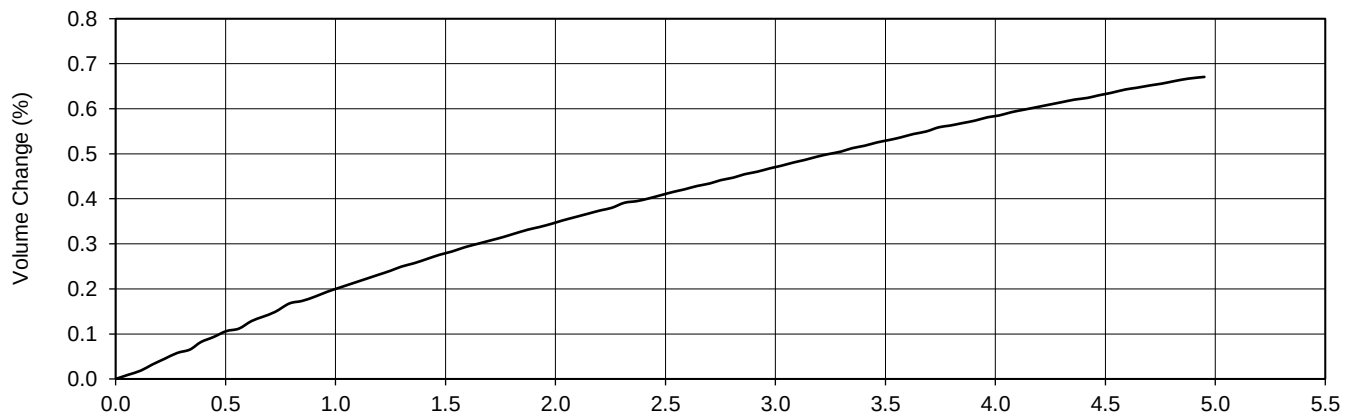
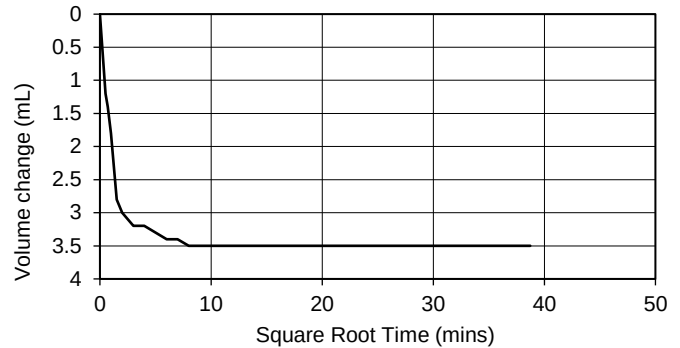
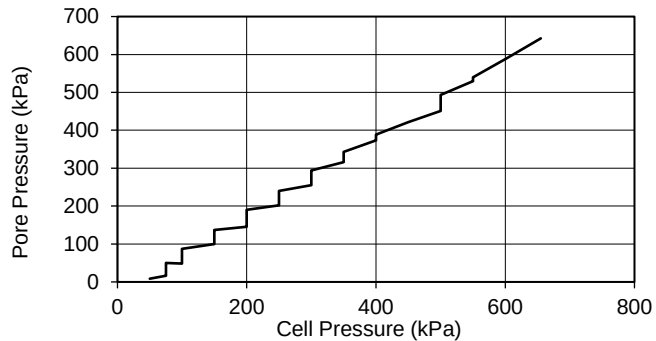
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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP05
Depth (m): 16.50-16.95

Stage No 1



Checked and Approved by
[Redacted]

P Heritage - Project Manager
16/10/2023

Project Number:

GEO / 38553

Project Name:

**ARDERSIER PORT
S23053**

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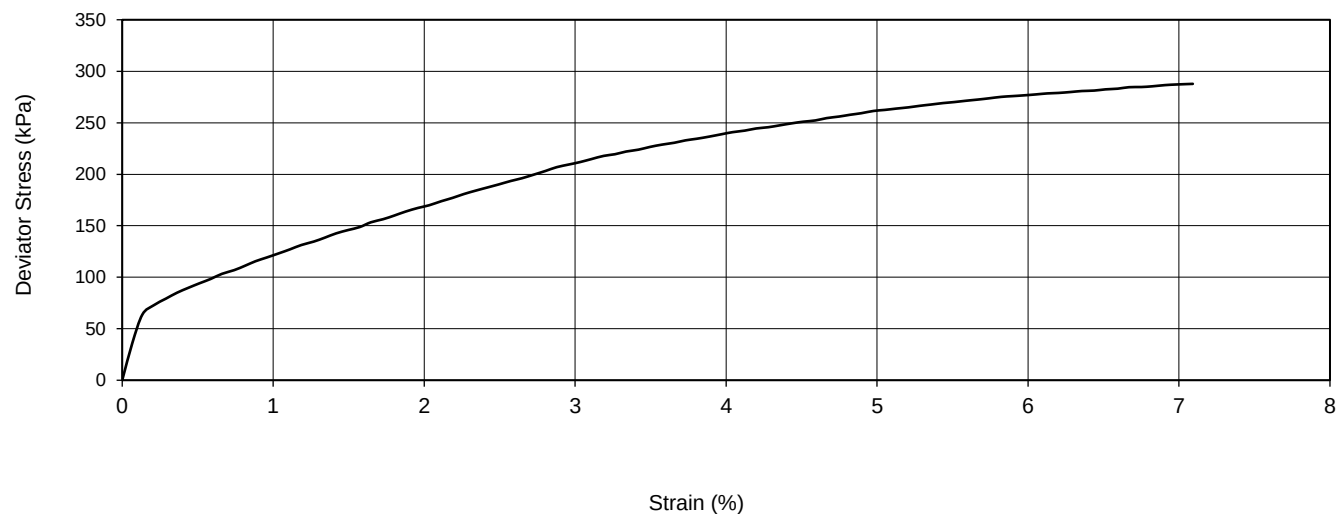
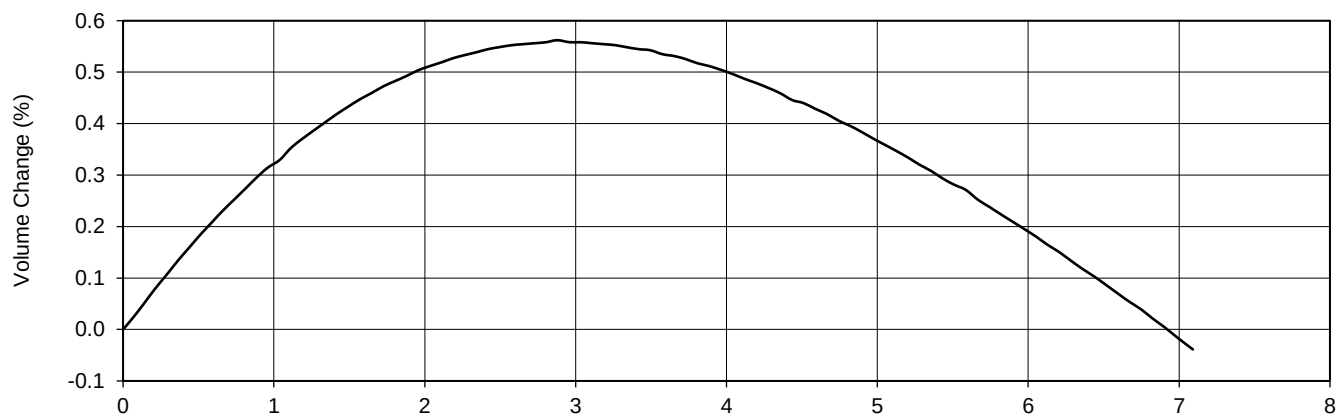
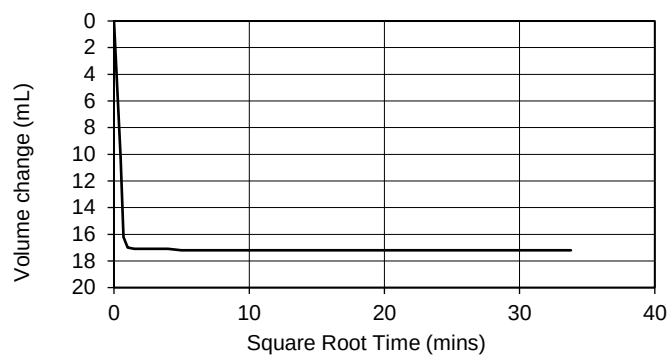


Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP05

Depth (m): 16.50-16.95

Stage No 2

Checked and Approved by
[Redacted]P Heritage - Project Manager
16/10/2023

Project Number:

GEO / 38553

Project Name:

ARDERSIER PORT
S23053

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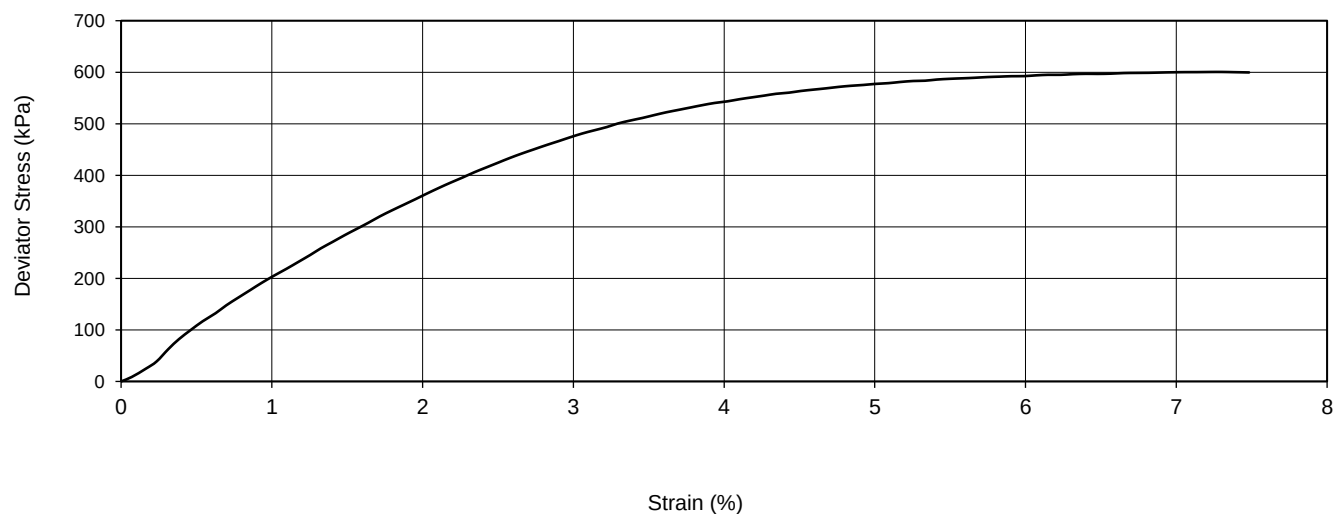
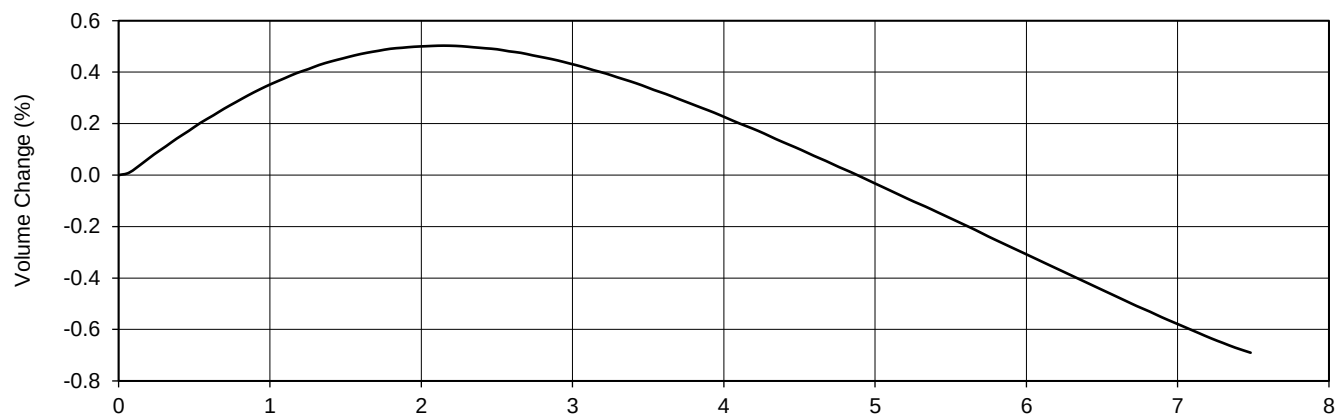
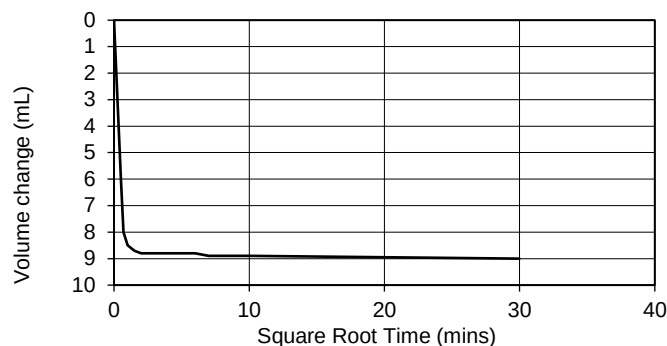


Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP05

Depth (m): 16.50-16.95

Stage No 3

Checked and Approved by
[Redacted]P Heritage - Project Manager
16/10/2023

Project Number:

GEO / 38553

Project Name:

ARDERSIER PORT
S23053

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GEOLABS Limited
Bucknalls Lane
Garston
Watford
Hertfordshire
WD25 9XX

Tel: +44(0) 1923 892 190
Fax: +44(0) 1923 892 191
email: admin@geolabs.co.uk
web: www.geolabs.co.uk

Solmek
12 Yarm Road
Stockton-on-Tees
TS18 3NA

03 October 2023

Report No : GEO/38551/01

Page 1 of 1

For the attention of Mr A Cutts

Our ref **GEO / 38551**
Your Ref **S23053**

Date samples received 08/08/2023
Date written instructions received 28/07/2023
Date testing commenced 09/08/2023
Date of sample disposal 31/10/2023

Project **ARDERSIER PORT**

Further to your instructions we have pleasure in enclosing the results of the tests you requested in the attached figures.

LABORATORY TEST REPORT

Item No	Test Quantity	Description
1	2	Maximum & Minimum Density
2	1	Shear Strength by Direct Shear
3	1	Isotropic Consolidated Drained Multistage Triaxial Compression (CIDM) - Remoulded

Any opinions or interpretations expressed herein are outside the scope of UKAS accreditation. All results contained in this report are provisional unless signed by an approved signatory. The results contained in this report relate only to samples received in the laboratory and are tested 'as received' unless otherwise stated. This report should not be reproduced, except in full, without the written approval of the laboratory. The results reported are applicable only to the test items received by the laboratory.

All the necessary data required by the documented test procedures has been recorded and will be stored for a period of not less than 6 years. This data will be issued to yourselves at your request. All samples will be disposed of after the date shown above. Written confirmation will be required to retain the samples beyond this period and a storage charge may be applied.

We trust that the above meets your requirements and should you require any further information or assistance, please do not hesitate to contact us.

Yours faithfully
on behalf of **GEOLABS Limited**
[Redacted]

J Sturges
Operations Manager



Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP06
Depth (m) 19.50-19.95
Sample Type B

Description:

Brownish grey slightly silty fine to medium SAND with rare fine to medium gravel.

Percentage of material retained on the 2 mm test sieve 0.1 %

The fines content was measured to be 4.5 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.59 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.587	g/cm ³
Maximum dry density after surcharge application	1.594	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.584	g/cm ³
Maximum dry density after surcharge application	1.591	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.17 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.12 g

Mass of sand	Run		
	1	517.85	g
	2	520.89	g
	3	520.80	g
	4	520.52	g
	5	519.87	g
	Minimum	519.99	g

Checked and Approved by
[Redacted]

J Powell - Technical Consultant
17/08/2023

Project Number:

38551

Project Name:

**ARDERSIER PORT
S23053**

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Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP06
Depth (m) 22.50-22.95
Sample Type B

Description:

Brownish grey slightly silty fine to medium SAND with frequent fine to medium gravel and shell fragments.

Percentage of material retained on the 2 mm test sieve 10.2 %

The fines content was measured to be 5.3 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.62 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.594	g/cm ³
Maximum dry density after surcharge application	1.614	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.605	g/cm ³
Maximum dry density after surcharge application	1.617	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.20 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.12 g

Mass of sand	Run		
	1	531.95	g
	2	533.99	g
	3	533.02	g
	4	535.19	g
	5	534.78	g
	Minimum	533.79	g

Checked and Approved by
[Redacted]

J Powell - Technical Consultant
17/08/2023

Project Number:

38551

Project Name:

**ARDERSIER PORT
S23053**

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DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP06
 Depth (m) 22.50-22.95
 Sample Type B

Description:

Brownish grey slightly silty gravelly fine to medium SAND
 with occasional shell fragments. Gravel is fine to medium.

Specimen Details

Depth within original sample *m* n/a
 Orientation within original sample n/a
 Test condition Submerged
 Preparation < 2 mm material remoulded at existing water content to a relative density of 45% ¹

Particle density *Mg/m³* 2.65 (assumed)

Specimen Number		1	2	3
Length	<i>mm</i>	59.78	59.78	59.78
Width	<i>mm</i>	59.77	59.77	59.77
Height	<i>mm</i>	25.23	25.43	25.43
Initial water content	%	22.0	22.0	22.0
Initial bulk density	<i>Mg/m³</i>	1.66	1.65	1.65
Initial dry density	<i>Mg/m³</i>	1.36	1.35	1.35
Initial voids ratio		0.943	0.958	0.958
Degree of Saturation	%	61.8	60.8	60.8

Shearing Stage

	<i>kPa</i>	75	150	300
Normal stress				
Peak Conditions:				
Rate of horizontal displacement	<i>mm/min</i>	0.4	0.4	0.4
Maximum shear stress	<i>kPa</i>	58.7	117.7	232.9
Horizontal displacement at MSS	<i>mm</i>	2.6	2.8	3.4
Vertical Displacement at Peak	<i>mm</i>	-0.19	-0.23	-0.18

	%	24.4	22.9	23.1
Final water content				
Duration	<i>day(s)</i>	1	1	1

Shear Strength Parameters

	<i>kPa</i>	Peak Condition
Apparent Cohesion		1
Angle of Shearing Resistance	<i>degrees</i>	37.5

Notes: ¹ Maximum dry density = 1.62 mg/m³ and minimum dry density = 1.20 Mg/m³

Tested by JJR
 Checked and Approved by

[Redacted]

Project Number:

GEO / 38551

Project Name:

ARDERSIER PORT
S23053

C F Wallace - Technical Director
 19/09/2023

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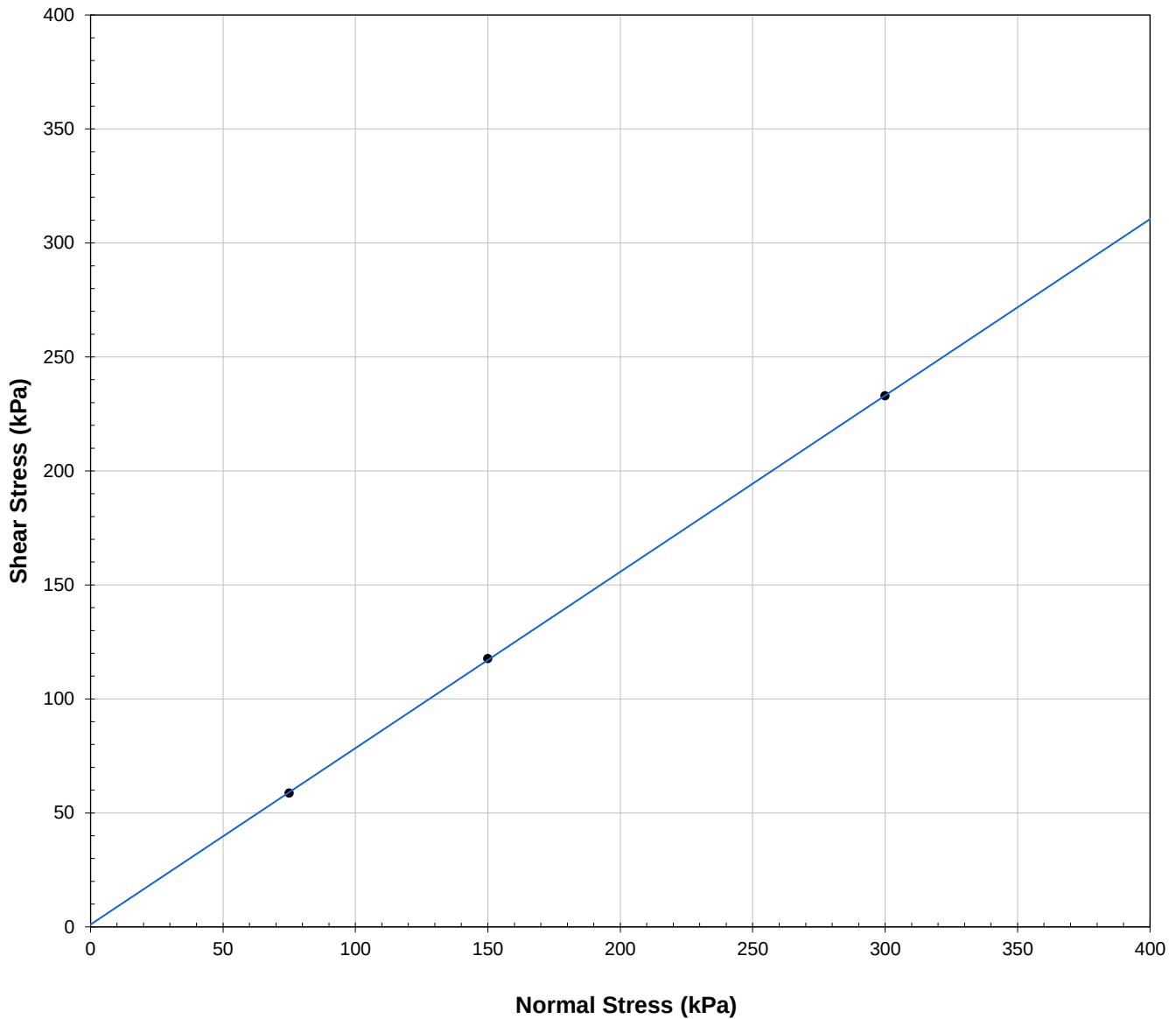
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP06
Depth (m) 22.50-22.95
Sample Type B

Description:

Brownish grey slightly silty gravelly fine to medium SAND
with occasional shell fragments. Gravel is fine to medium.

Shear Stress v Normal Stress**Peak: $c' = 1$** **$\Phi' = 37.5$**

Tested by JJR
Checked and Approved by
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C F Wallace - Technical Director
19/09/2023

Project Number:

GEO / 38551

Project Name:

**ARDERSIER PORT
S23053****GEOLABS®**

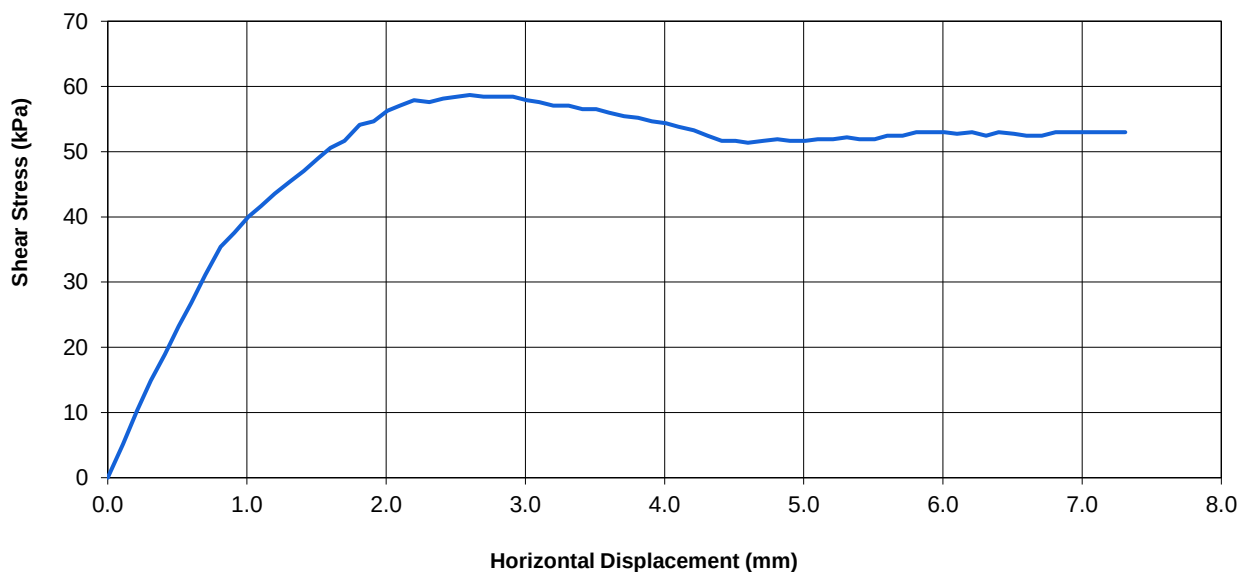
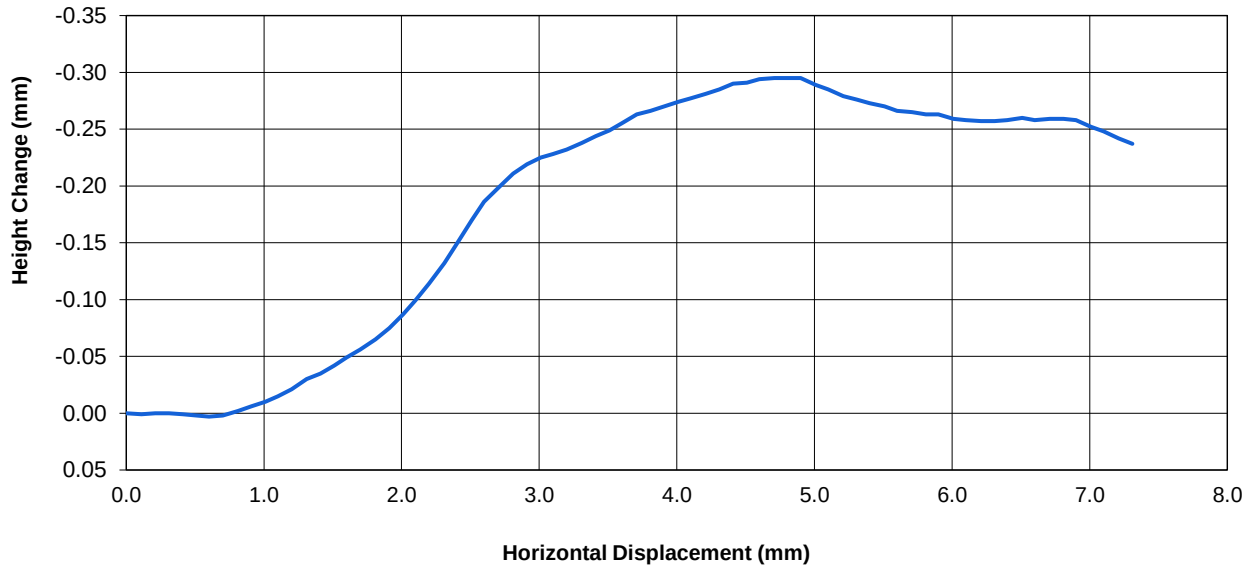
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP06
 Depth (m) 22.50-22.95
 Sample Type B

Description:

Brownish grey slightly silty gravelly fine to medium SAND
 with occasional shell fragments. Gravel is fine to medium.

Specimen: 1**Shear Stage**

Tested by JJR
 Checked and Approved by
 [Redacted]

C F Wallace - Technical Director
 19/09/2023

Project Number:

GEO / 38551

Project Name:

ARDERSIER PORT
S23053

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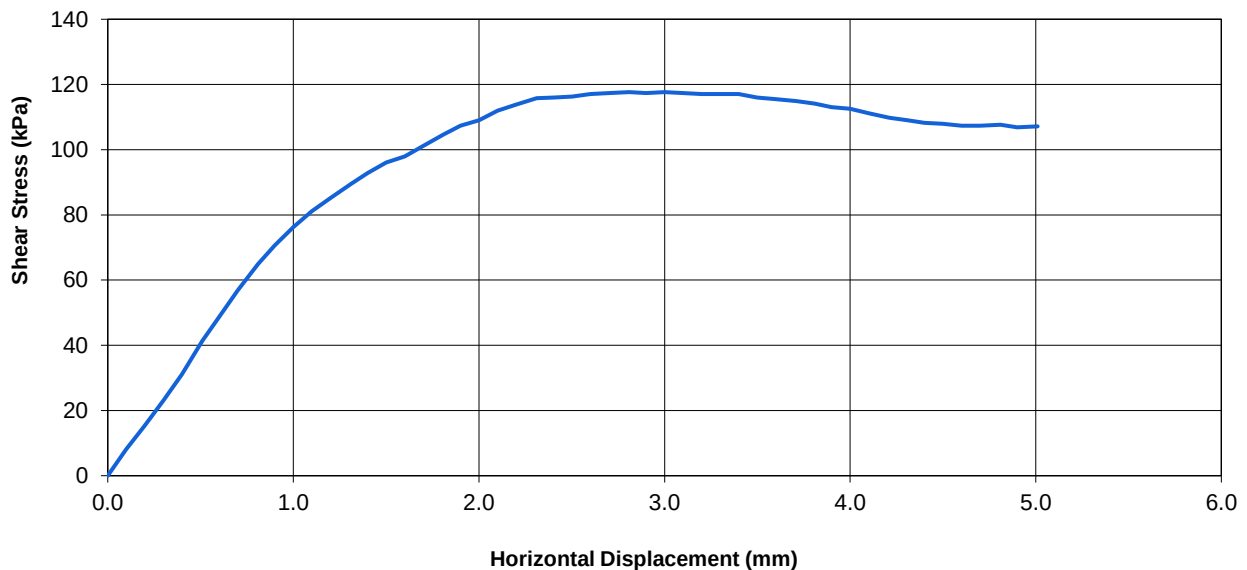
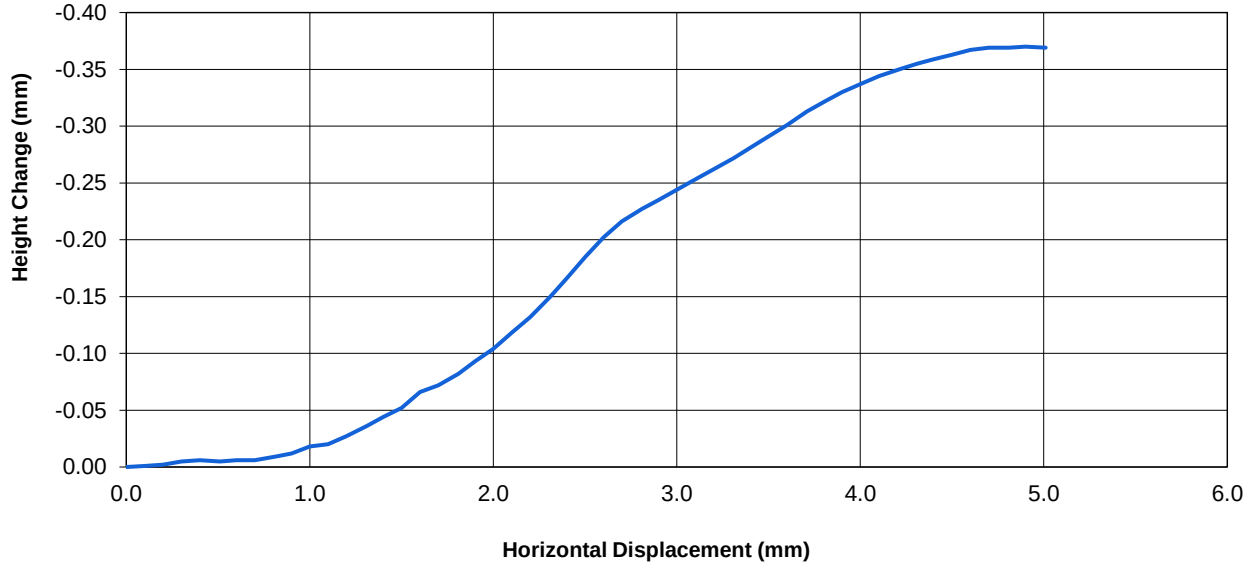
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP06
Depth (m) 22.50-22.95
Sample Type B

Description:

Brownish grey slightly silty gravelly fine to medium SAND
with occasional shell fragments. Gravel is fine to medium.

Specimen: 2**Shear Stage**

Tested by JJR
Checked and Approved by
[Redacted]

C F Wallace - Technical Director
19/09/2023

Project Number:

GEO / 38551

Project Name:

**ARDERSIER PORT
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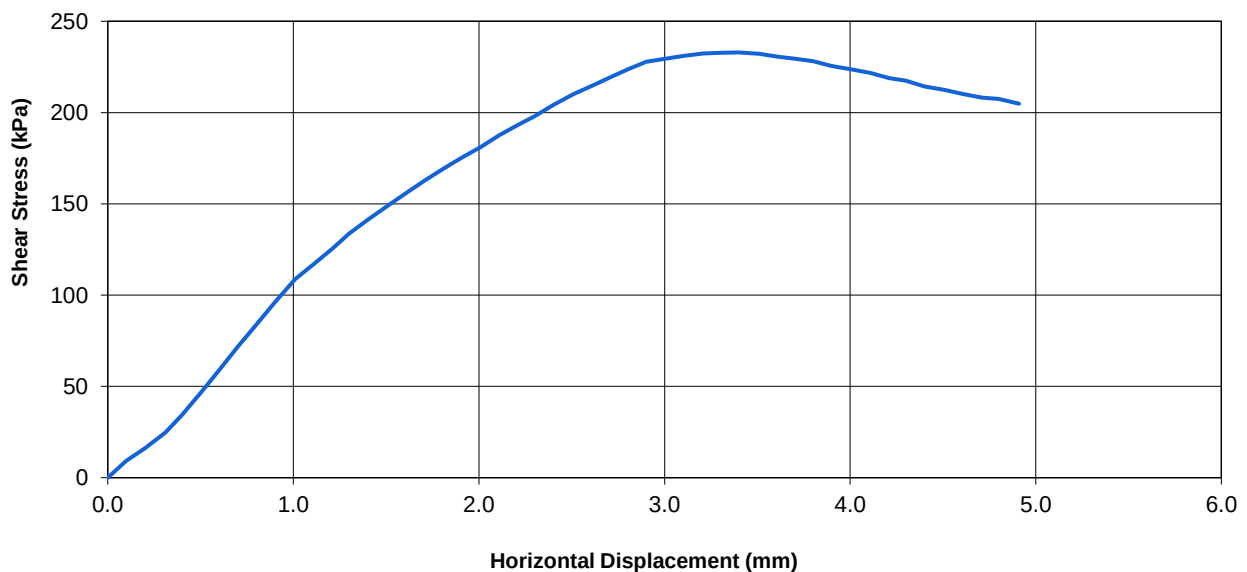
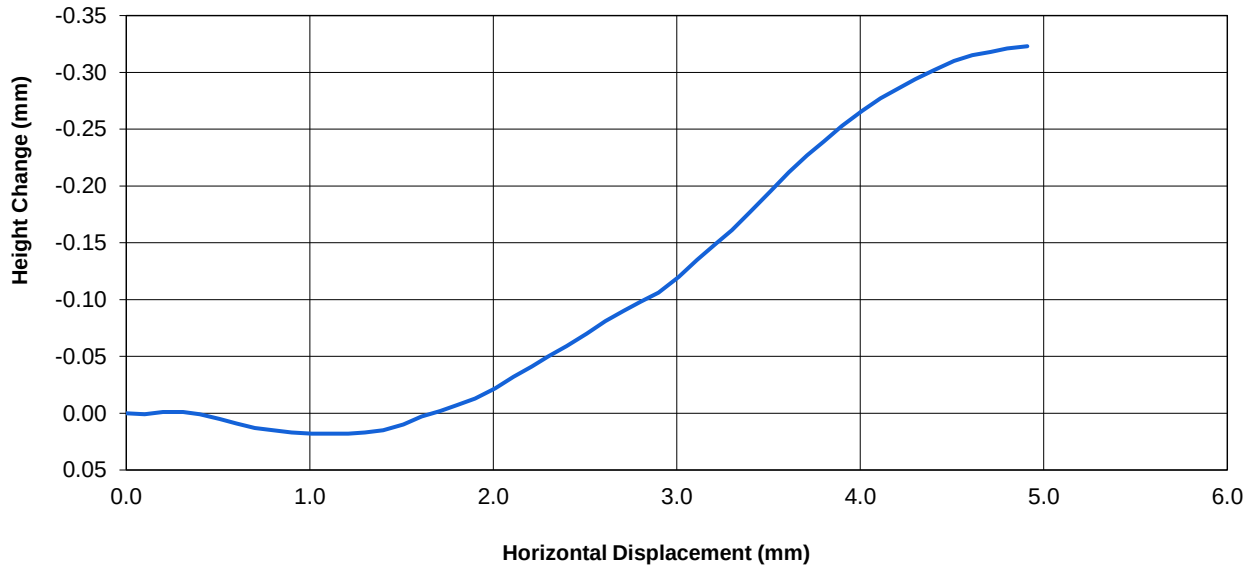
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP06
Depth (m) 22.50-22.95
Sample Type B

Description:

Brownish grey slightly silty gravelly fine to medium SAND
with occasional shell fragments. Gravel is fine to medium.

Specimen: 3**Shear Stage**

Tested by JJR
Checked and Approved by
[Redacted]

C F Wallace - Technical Director
19/09/2023

Project Number:

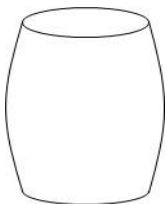
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Project Name:

**ARDERSIER PORT
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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.:	BHSP06	Description: Brownish grey slightly silty fine to medium SAND with rare fine to medium gravel. .
Depth (m):	19.50-19.95	

SPECIMEN DETAILS Depth within original sample Orientation within original sample		20 mm from top Vertical		
TEST DETAILS Specimen Type and Preparation Cell Preparation Specimen Number Initial Diameter Initial Length Initial Water Content Initial Wet Density Drainage Conditions		B (Remoulded) Checks performed in accordance with Clause 3.5		
		Multistage 70.22 139.49 10.4 1.48		
		One end and radial boundary		
SATURATION STAGE Final Cell Pressure Final Pore Pressure Final Pore Pressure Parameter B Duration		Method: Clause 5.2 665 656 0.99 6		
CONSOLIDATION STAGE Cell Pressure Back Pressure Effective Pressure Final Pore Pressure Final Pore Pressure Dissipation Duration		Stage No 1 665 600 65 600 100 1	Stage No 2 730 600 130 600 100 1	Stage No 3 800 600 200 600 100 1
SHEARING STAGE Cell Pressure Rate of Axial Displacement Initial Pore Pressure Initial Effective Stress		665 0.015 600 65	730 0.021 600 130	800 0.016 600 200
CONDITIONS AT FAILURE Pore Pressure Minor Effective Principal Stress Deviator Stress Major Effective Principal Stress Volume Change Volumetric Strain Axial Strain Membrane & filter correction applied to Deviator Stress Duration		Maximum deviator stress 600 65 134 199 1.40 0.3 2.6 6 1		
		600 130 297 427 1.15 0.2 3.2 5 1	600 130 297 427 1.15 0.2 3.2 5 1	600 200 595 795 1.29 0.2 4.8 5 1
Final Water Content Final Wet Density		31.6 1.80		
EFFECTIVE STRESS PARAMETERS Cohesion Angle of Shear Resistance		0 35.5		
FAILURE SKETCH				

Checked and Approved by [Redacted]	Project Number: GEO / 38551	
P Heritage - Project Manager 02/10/2023	Project Name: ARDERSIER PORT S23053	

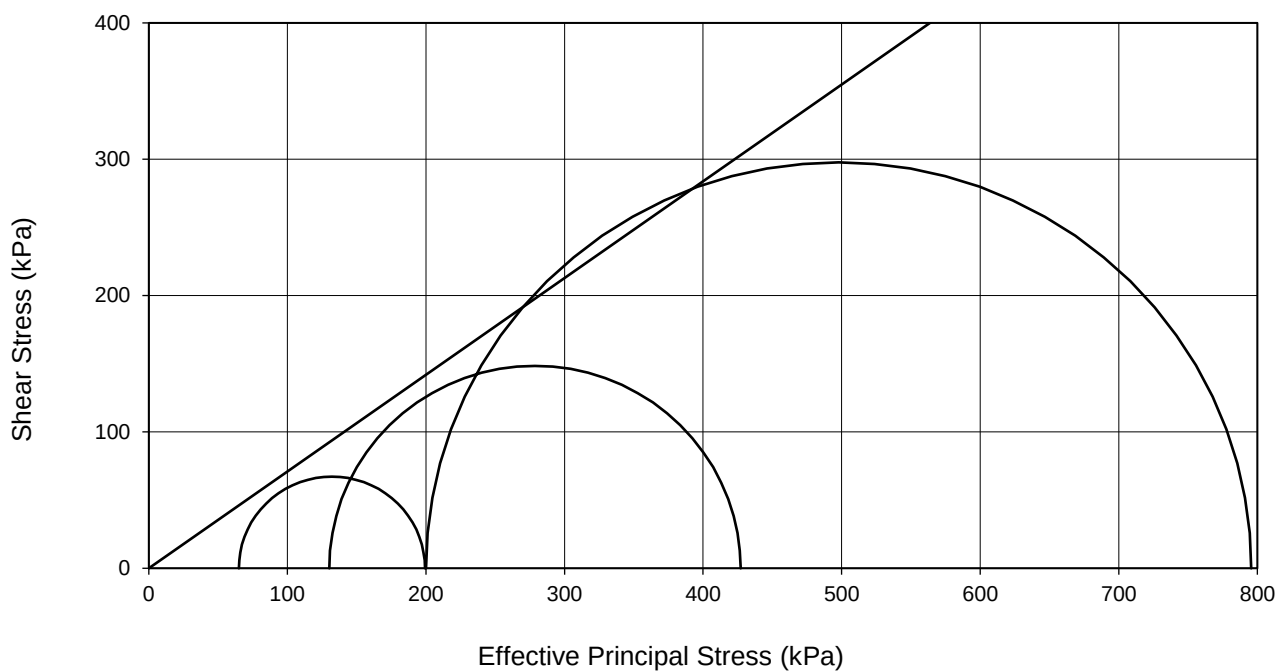
Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP06

Depth (m): 19.50-19.95

Description:

Brownish grey slightly silty fine to medium SAND with rare fine to medium gravel. .

Checked and Approved by
[Redacted]P Heritage - Project Manager
02/10/2023

Project Number:

GEO / 38551

Project Name:

ARDERSIER PORT
S23053

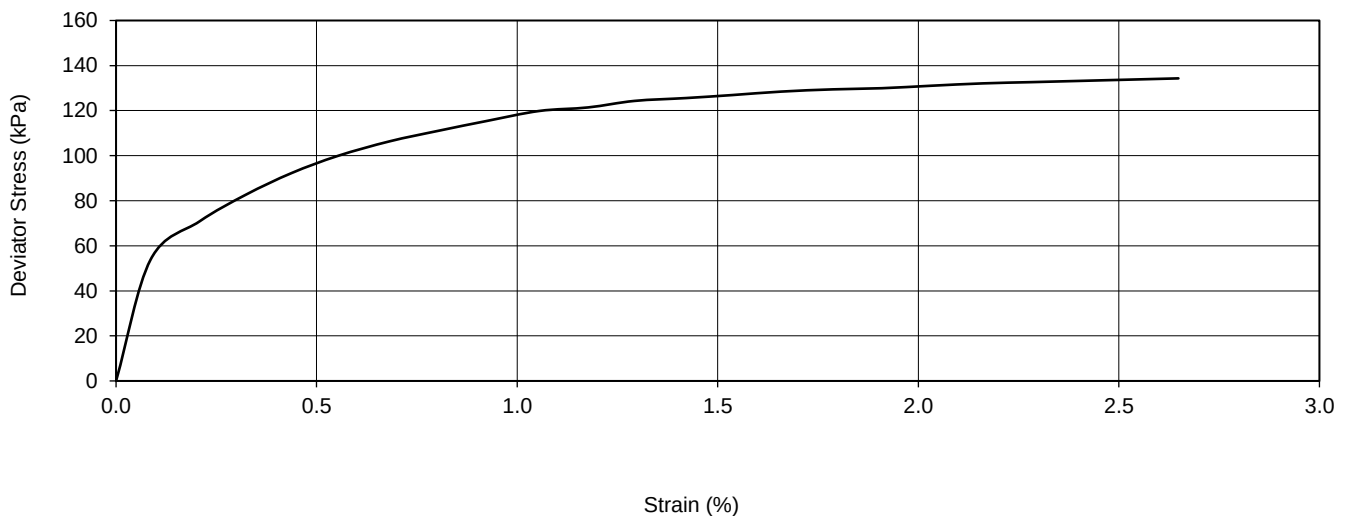
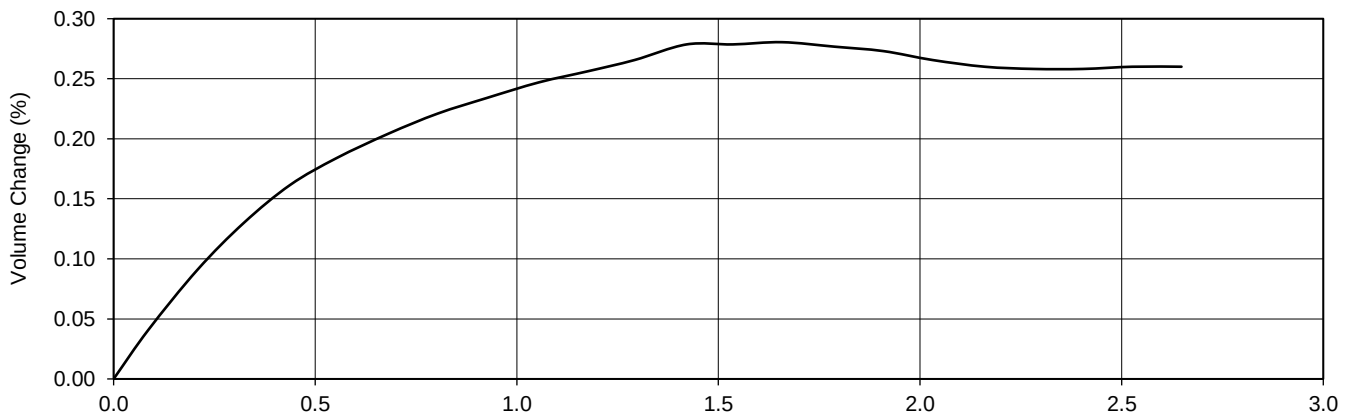
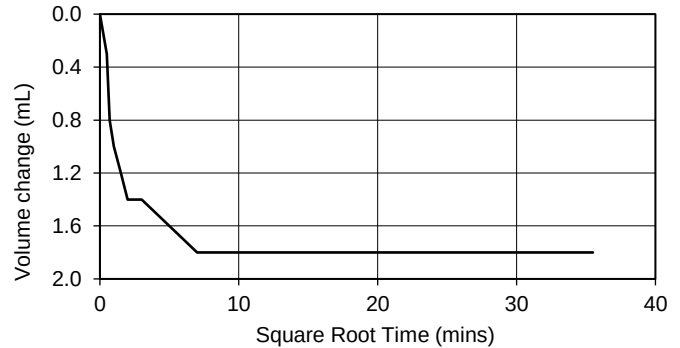
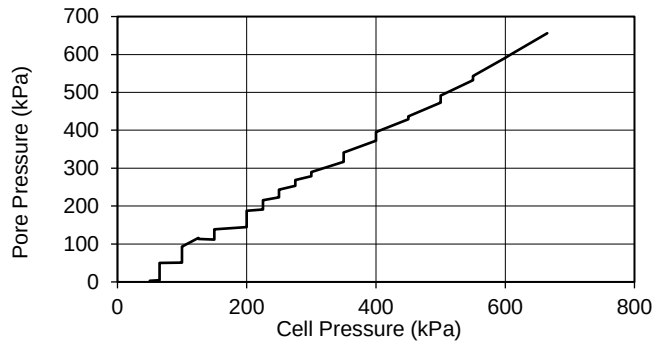
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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP06
Depth (m): 19.50-19.95

Stage No 1



Checked and Approved by
[Redacted]

P Heritage - Project Manager
02/10/2023

Project Number:

GEO / 38551

Project Name:

ARDERSIER PORT
S23053

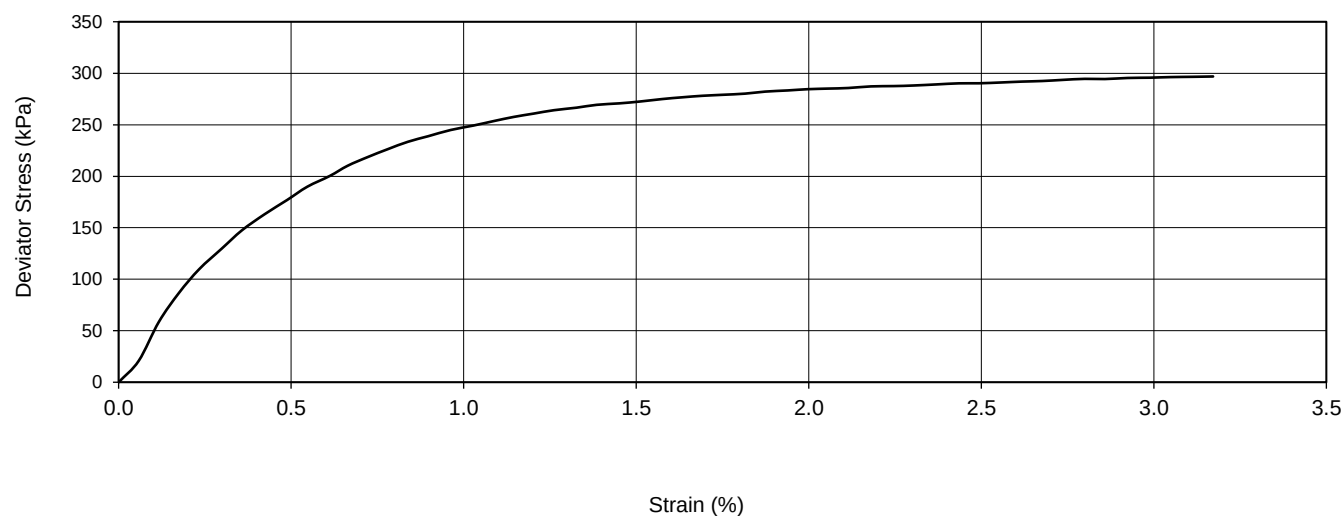
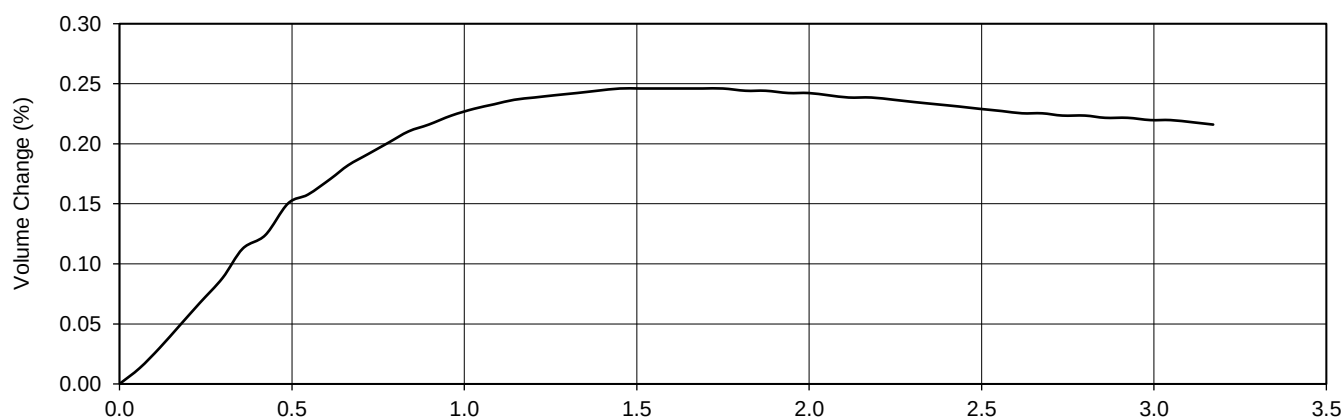
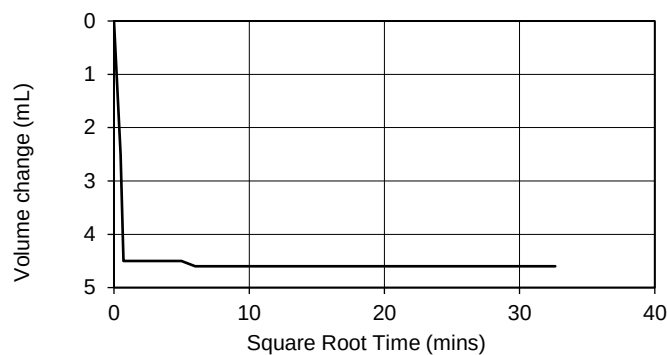
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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP06
Depth (m): 19.50-19.95

Stage No 2



Checked and Approved by
[Redacted]

P Heritage - Project Manager
02/10/2023

Project Number:

GEO / 38551

Project Name:

ARDERSIER PORT
S23053

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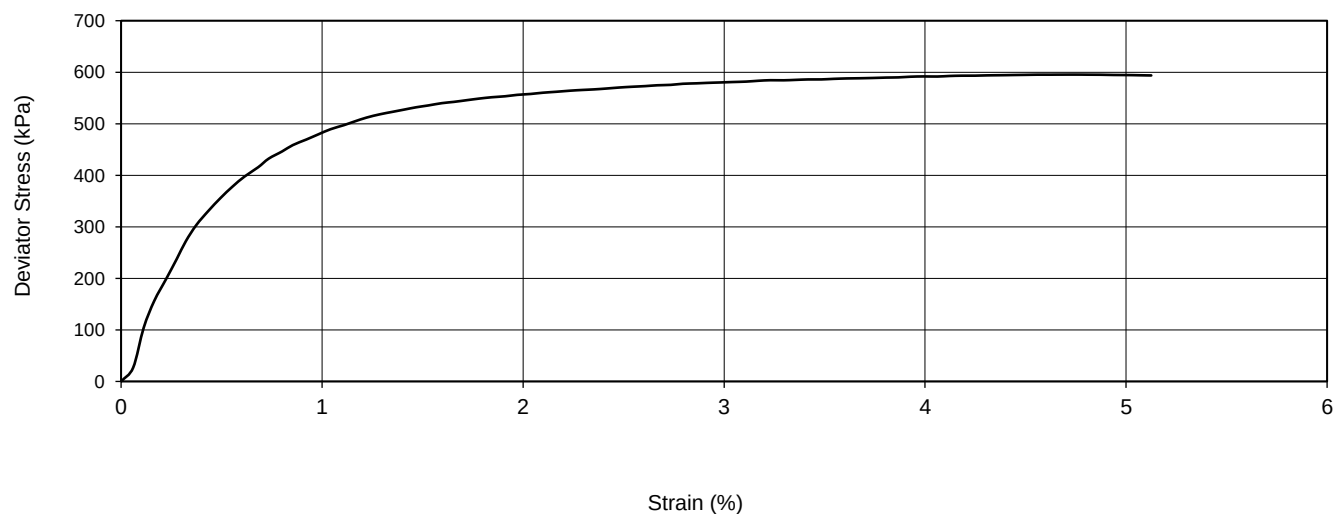
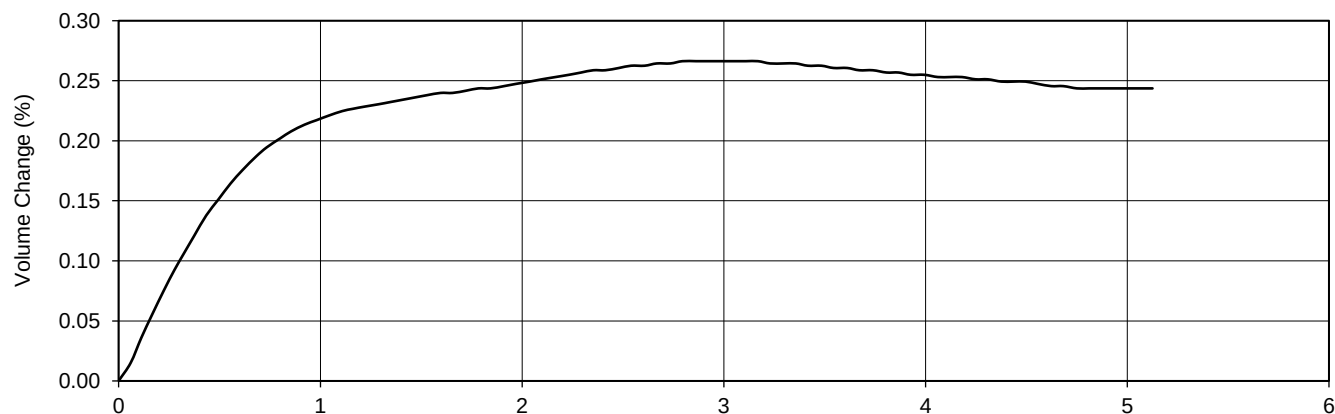
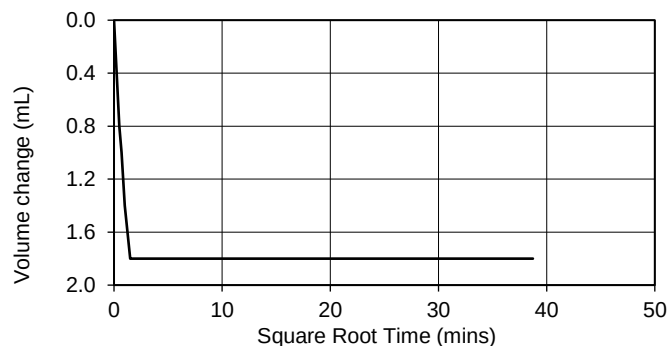


Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP06

Depth (m): 19.50-19.95

Stage No 3

Checked and Approved by
[Redacted]P Heritage - Project Manager
02/10/2023

Project Number:

GEO / 38551

Project Name:

ARDERSIER PORT
S23053

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GEOLABS Limited
Bucknalls Lane
Garston
Watford
Hertfordshire
WD25 9XX

Tel: +44(0) 1923 892 190
Fax: +44(0) 1923 892 191
email: admin@geolabs.co.uk
web: www.geolabs.co.uk

Solmek
12 Yarm Road
Stockton-on-Tees
TS18 3NA

03 October 2023

Report No : GEO/38552/01

Page 1 of 1

For the attention of Mr A Cutts

Our ref **GEO / 38552**
Your Ref **S23053**

Date samples received 27/07/2023
Date written instructions received 28/07/2023
Date testing commenced 29/07/2023
Date of sample disposal 31/10/2023

Project **ARDERSIER PORT**

Further to your instructions we have pleasure in enclosing the results of the tests you requested in the attached figures.

LABORATORY TEST REPORT

Item No	Test Quantity	Description
1	4	Maximum & Minimum Density
2	2	Shear Strength by Direct Shear
3	2	Isotropic Consolidated Drained Multistage Triaxial Compression (CIDM) - Remoulded

Any opinions or interpretations expressed herein are outside the scope of UKAS accreditation. All results contained in this report are provisional unless signed by an approved signatory. The results contained in this report relate only to samples received in the laboratory and are tested 'as received' unless otherwise stated. This report should not be reproduced, except in full, without the written approval of the laboratory. The results reported are applicable only to the test items received by the laboratory.

All the necessary data required by the documented test procedures has been recorded and will be stored for a period of not less than 6 years. This data will be issued to yourselves at your request. All samples will be disposed of after the date shown above. Written confirmation will be required to retain the samples beyond this period and a storage charge may be applied.

We trust that the above meets your requirements and should you require any further information or assistance, please do not hesitate to contact us.

Yours faithfully
on behalf of **GEOLABS Limited**
[Redacted]

J Sturges
Operations Manager



Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP07
Depth (m) 5.00-5.45
Sample Type B

Description:

Light brown fine to medium SAND with rare fine gravel.

Percentage of material retained on the 2 mm test sieve 0.2 %

The fines content was measured to be 1.1 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.60 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.591	g/cm ³
Maximum dry density after surcharge application	1.602	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.592	g/cm ³
Maximum dry density after surcharge application	1.605	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.27 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.11 g

Mass of sand	Run		
	1	561.11	g
	2	562.00	g
	3	562.89	g
	4	562.93	g
	5	561.87	g
	Minimum	562.16	g

Checked and Approved by
[Redacted]

J Powell - Technical Consultant
22/08/2023

Project Number:

38552

Project Name:

**ARDERSIER PORT
S23053**

GEOLABS®

Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP07
Depth (m) 7.00-7.45
Sample Type B

Description:

Light brown gravelly fine to medium SAND.

Percentage of material retained on the 2 mm test sieve 7.7 %

The fines content was measured to be 2.7 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.58 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.573	g/cm ³
Maximum dry density after surcharge application	1.580	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.576	g/cm ³
Maximum dry density after surcharge application	1.585	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.22 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.12 g

Mass of sand	Run		
	1	543.05	g
	2	544.60	g
	3	542.86	g
	4	542.54	g
	5	542.99	g
	Minimum	543.21	g

Checked and Approved by
[Redacted]

J Powell - Technical Consultant
22/08/2023

Project Number:

38552

Project Name:

**ARDERSIER PORT
S23053**

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Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP07
Depth (m) 10.50-10.95
Sample Type B

Description:

Greyish brown fine to medium SAND with rare fine to medium gravel and shell fragments.

Percentage of material retained on the 2 mm test sieve 0.3 %

The fines content was measured to be 3.1 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.56 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.546	g/cm ³
Maximum dry density after surcharge application	1.557	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.552	g/cm ³
Maximum dry density after surcharge application	1.564	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.19 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.12 g

Mass of sand	Run		
	1	529.66	g
	2	530.03	g
	3	529.95	g
	4	530.99	g
	5	529.86	g
	Minimum	530.10	g

Checked and Approved by
[Redacted]

J Powell - Technical Consultant
22/08/2023

Project Number:

38552

Project Name:

**ARDERSIER PORT
S23053**

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Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP07
Depth (m) 15.00-15.45
Sample Type B

Description:

Brownish grey fine to medium SAND with frequent gravel and shell fragments.

Percentage of material retained on the 2 mm test sieve 10.6 %

The fines content was measured to be 2.5 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.55 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.548	g/cm ³
Maximum dry density after surcharge application	1.560	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.542	g/cm ³
Maximum dry density after surcharge application	1.548	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.21 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.11 g

Mass of sand	Run		
	1	533.47	g
	2	536.90	g
	3	536.35	g
	4	536.28	g
	5	535.06	g
	Minimum	535.61	g

Checked and Approved by
[Redacted]

J Powell - Technical Consultant
22/08/2023

Project Number:

38552

Project Name:

**ARDERSIER PORT
S23053**

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DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP07
 Depth (m) 7.00-7.45
 Sample Type B

Description:

Light brown gravelly fine to medium SAND.

Specimen Details

Depth within original sample *m* n/a
 Orientation within original sample n/a
 Test condition Submerged
 Preparation < 2 mm material remoulded at existing water content to a relative density of 75% ¹

Particle density *Mg/m³* 2.65 (assumed)

Specimen Number		1	2	3
Length	<i>mm</i>	59.78	59.78	59.78
Width	<i>mm</i>	59.77	59.77	59.77
Height	<i>mm</i>	23.70	23.70	23.62
Initial water content	%	20.4	20.4	20.4
Initial bulk density	<i>Mg/m³</i>	1.77	1.77	1.78
Initial dry density	<i>Mg/m³</i>	1.47	1.47	1.48
Initial voids ratio		0.802	0.802	0.796
Degree of Saturation	%	67.5	67.5	68.1

Shearing Stage

Normal stress	<i>kPa</i>	40	80	160
Peak Conditions:				
Rate of horizontal displacement	<i>mm/min</i>	0.18	0.18	0.18
Maximum shear stress	<i>kPa</i>	36.9	56.8	118.7
Horizontal displacement at MSS	<i>mm</i>	1.3	5.4	2.8
Vertical Displacement at Peak	<i>mm</i>	-0.22	0.32	-0.07

Final water content	%	22.1	24.9	23.8
Duration	<i>day(s)</i>	1	1	1

Shear Strength Parameters

		Peak Condition
Apparent Cohesion	<i>kPa</i>	6
Angle of Shearing Resistance	<i>degrees</i>	35.0

Notes: ¹ Maximum dry density = 1.58 Mg/m³ and minimum dry density = 1.22 Mg/m³

Tested by JJR
 Checked and Approved by

[Redacted]

20/09/2023

Project Number:

GEO / 38552

Project Name:

ARDERSIER PORT
S23053

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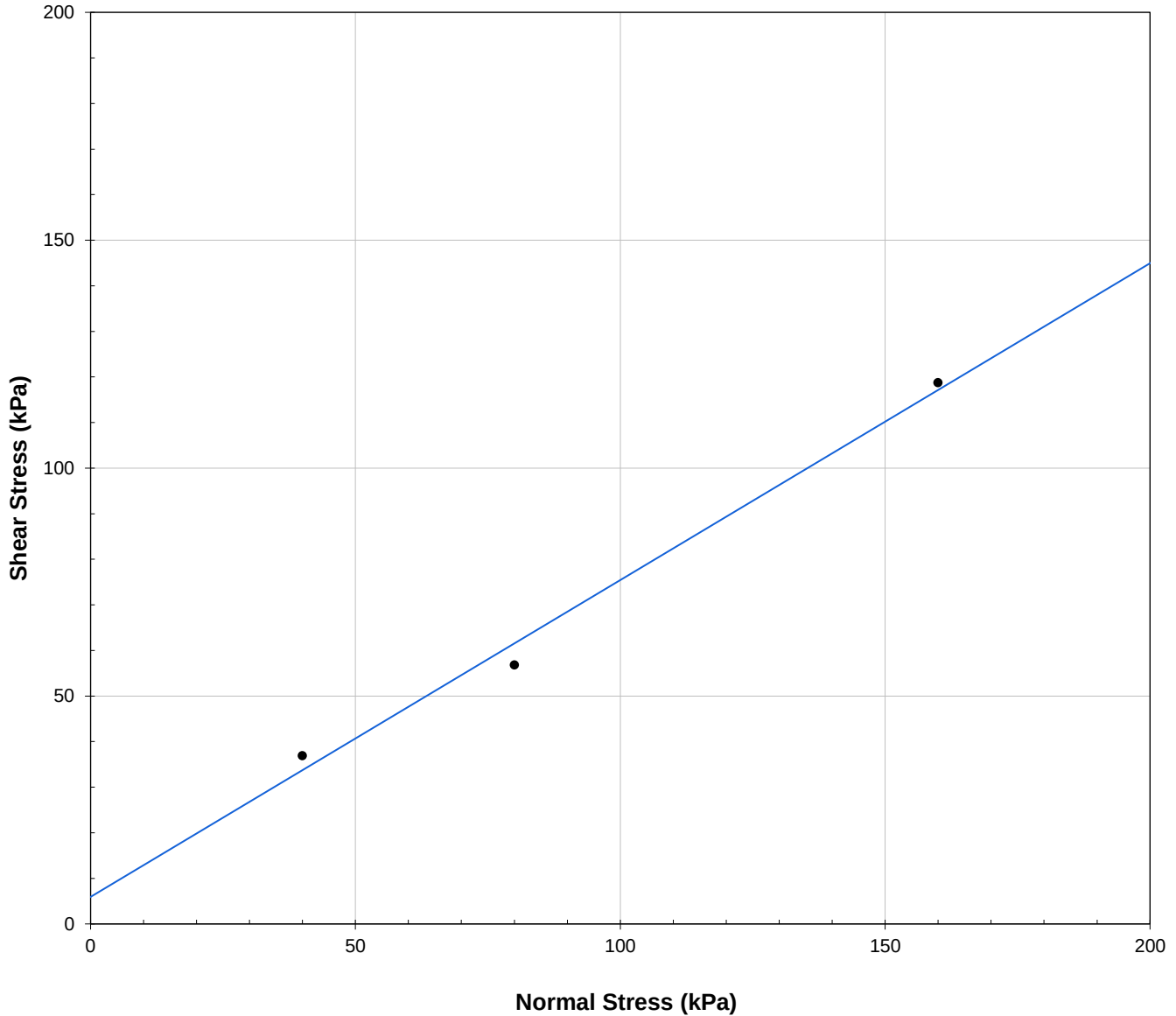
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP07
Depth (m) 7.00-7.45
Sample Type B

Description:

Light brown gravelly fine to medium SAND.

Shear Stress v Normal Stress

Tested by JJR
Checked and Approved by

[Redacted]

C F Wallace - Technical Director
20/09/2023

Project Number:

GEO / 38552

Project Name:

**ARDERSIER PORT
S23053****GEOLABS**®

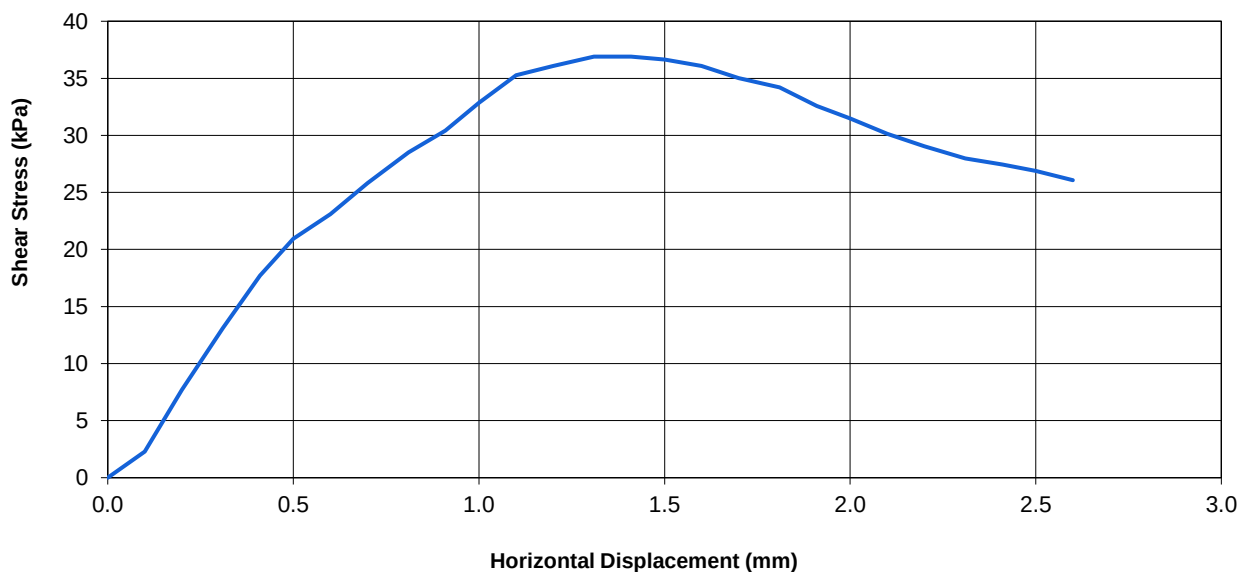
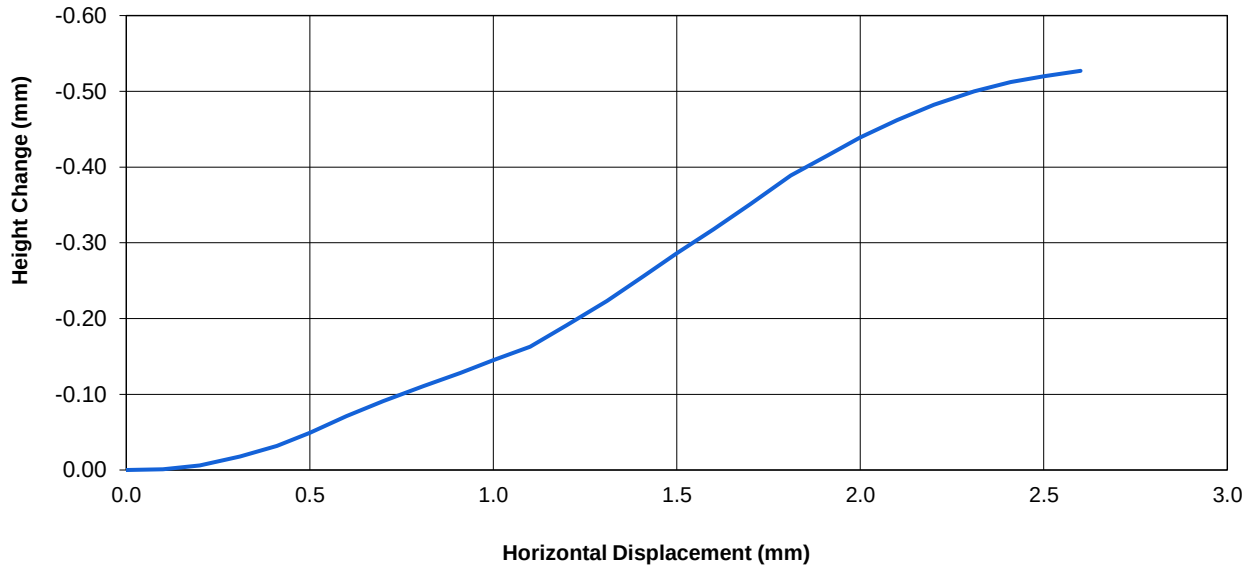
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP07
Depth (m) 7.00-7.45
Sample Type B

Description:

Light brown gravelly fine to medium SAND.

Specimen: 1**Shear Stage**

Tested by JJR
Checked and Approved by

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C F Wallace - Technical Director
20/09/2023

Project Number:

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Project Name:

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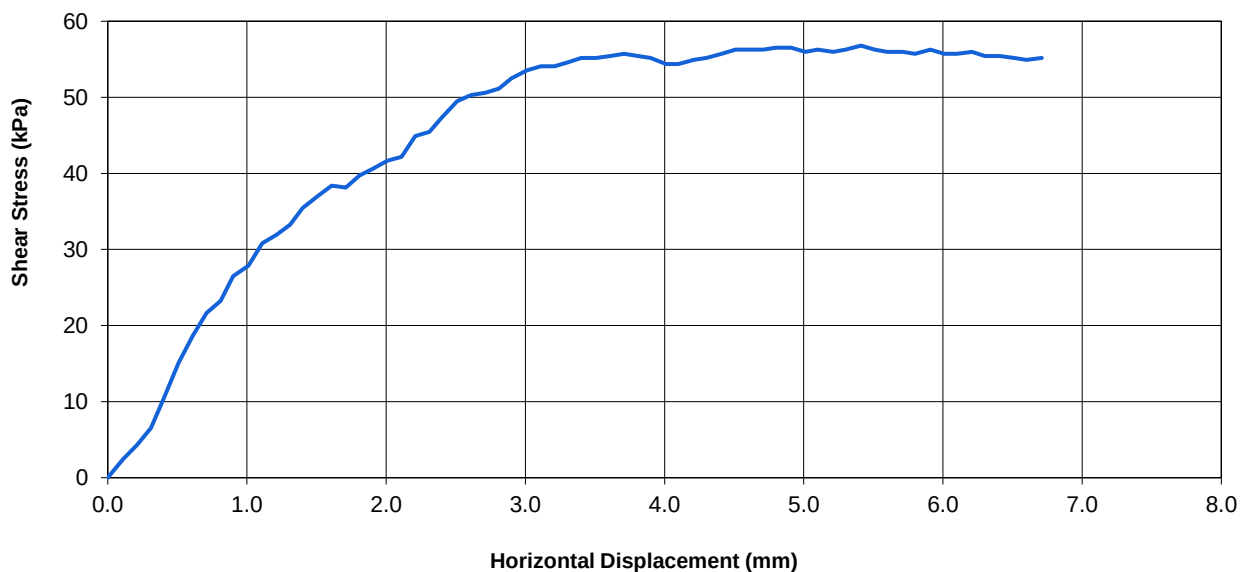
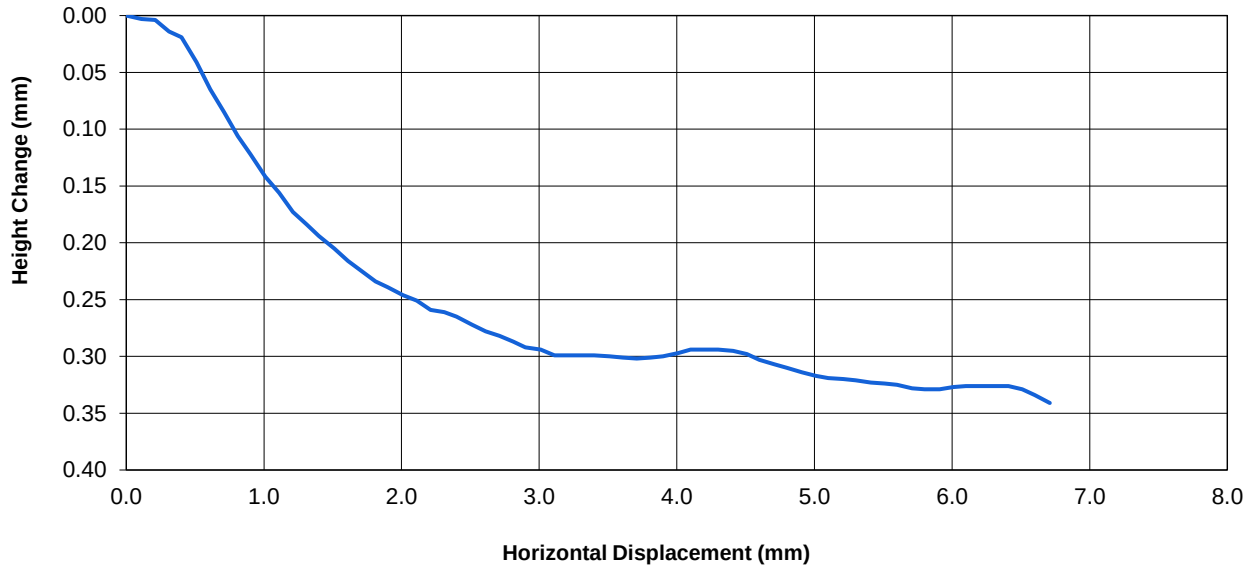
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP07
Depth (m) 7.00-7.45
Sample Type B

Description:

Light brown gravelly fine to medium SAND.

Specimen: 2**Shear Stage**

Tested by JJR
Checked and Approved by
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C F Wallace - Technical Director
20/09/2023

Project Number:

GEO / 38552

Project Name:

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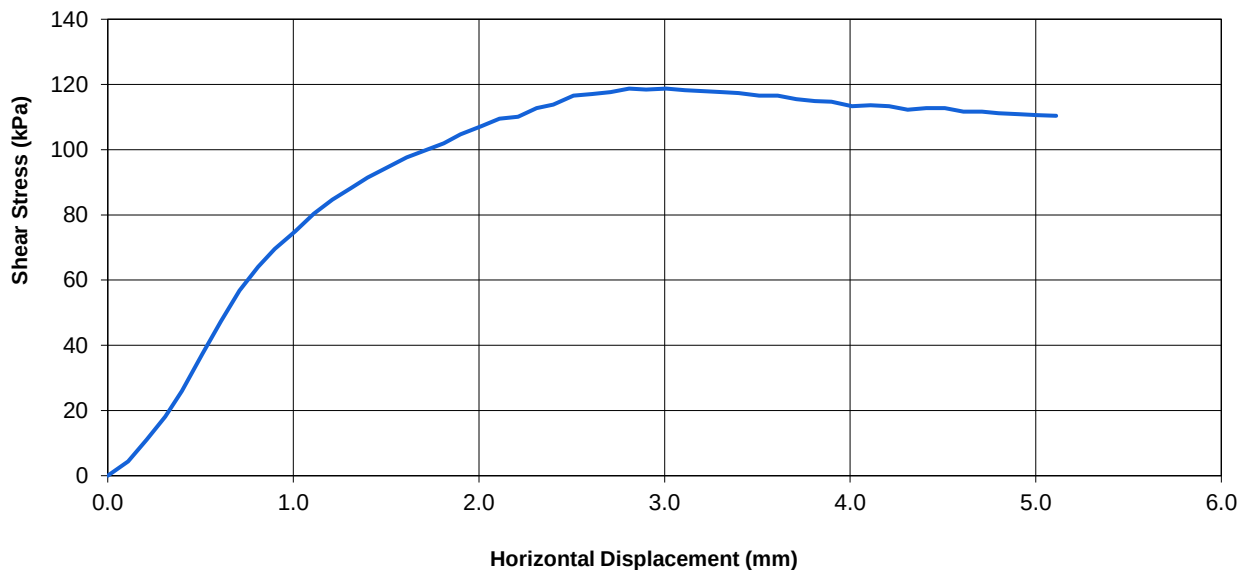
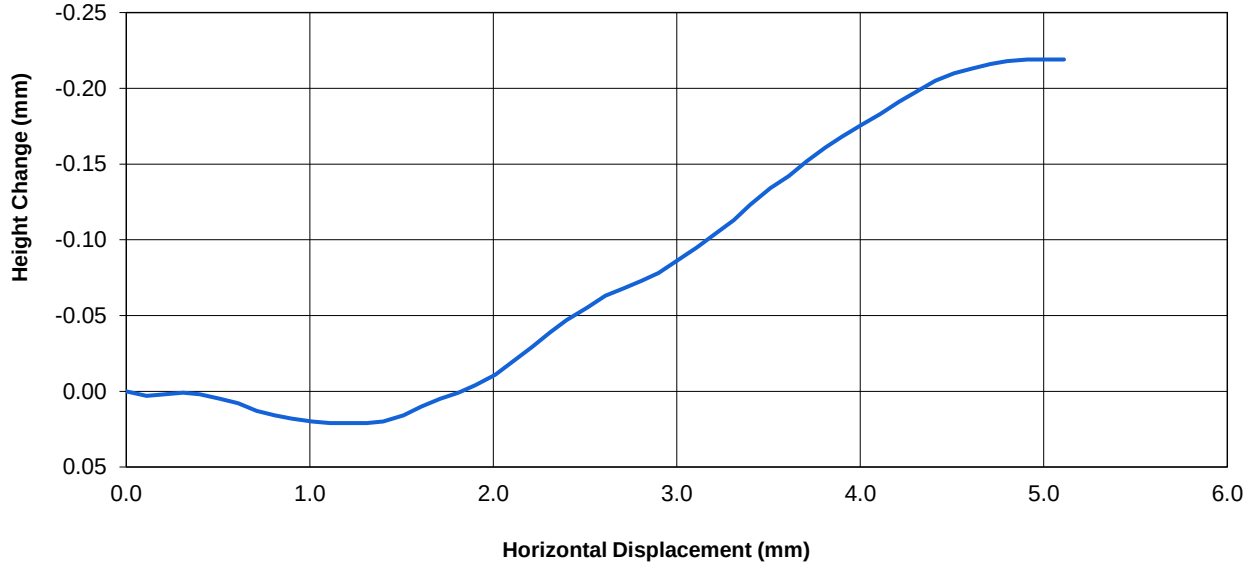
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP07
Depth (m) 7.00-7.45
Sample Type B

Description:

Light brown gravelly fine to medium SAND.

Specimen: 3**Shear Stage**

Tested by JJR
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C F Wallace - Technical Director
20/09/2023

Project Number:

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Project Name:

**ARDERSIER PORT
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DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP07
 Depth (m) 15.00-15.45
 Sample Type B

Description:

Brownish grey gravelly fine to medium SAND with occasional shell fragments.

Specimen Details

Depth within original sample *m* n/a
 Orientation within original sample n/a
 Test condition Submerged
 Preparation < 2 mm material remoulded at existing water content to a relative density of 55% ¹

Particle density *Mg/m³* 2.65 (assumed)

Specimen Number		1	2	3
Length	<i>mm</i>	59.78	60.00	60.06
Width	<i>mm</i>	59.77	59.98	59.99
Height	<i>mm</i>	25.30	25.18	25.08
Initial water content	%	20.2	20.2	20.2
Initial bulk density	<i>Mg/m³</i>	1.66	1.66	1.66
Initial dry density	<i>Mg/m³</i>	1.38	1.38	1.38
Initial voids ratio		0.920	0.925	0.920
Degree of Saturation	%	58.3	58.0	58.3

Shearing Stage

Normal stress	<i>kPa</i>	60	120	240
Peak Conditions:				
Rate of horizontal displacement	<i>mm/min</i>	0.18	0.18	0.18
Maximum shear stress	<i>kPa</i>	38.7	78.3	152.8
Horizontal displacement at MSS	<i>mm</i>	6.7	4.1	7.3
Vertical Displacement at Peak	<i>mm</i>	0.24	0.21	0.33

Final water content	%	29.3	28.9	30.5
Duration	<i>day(s)</i>	1	1	1

Shear Strength Parameters

		Peak Condition
Apparent Cohesion	<i>kPa</i>	1
Angle of Shearing Resistance	<i>degrees</i>	32.5

Notes: ¹ Maximum dry density = 1.55 Mg/m³ and minimum dry density = 1.21 g/m³

Tested by JJR
 Checked and Approved by
 [Redacted]

C. Wallace - Technical Director
 20/09/2023

Project Number:

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Project Name:

ARDERSIER PORT
S23053

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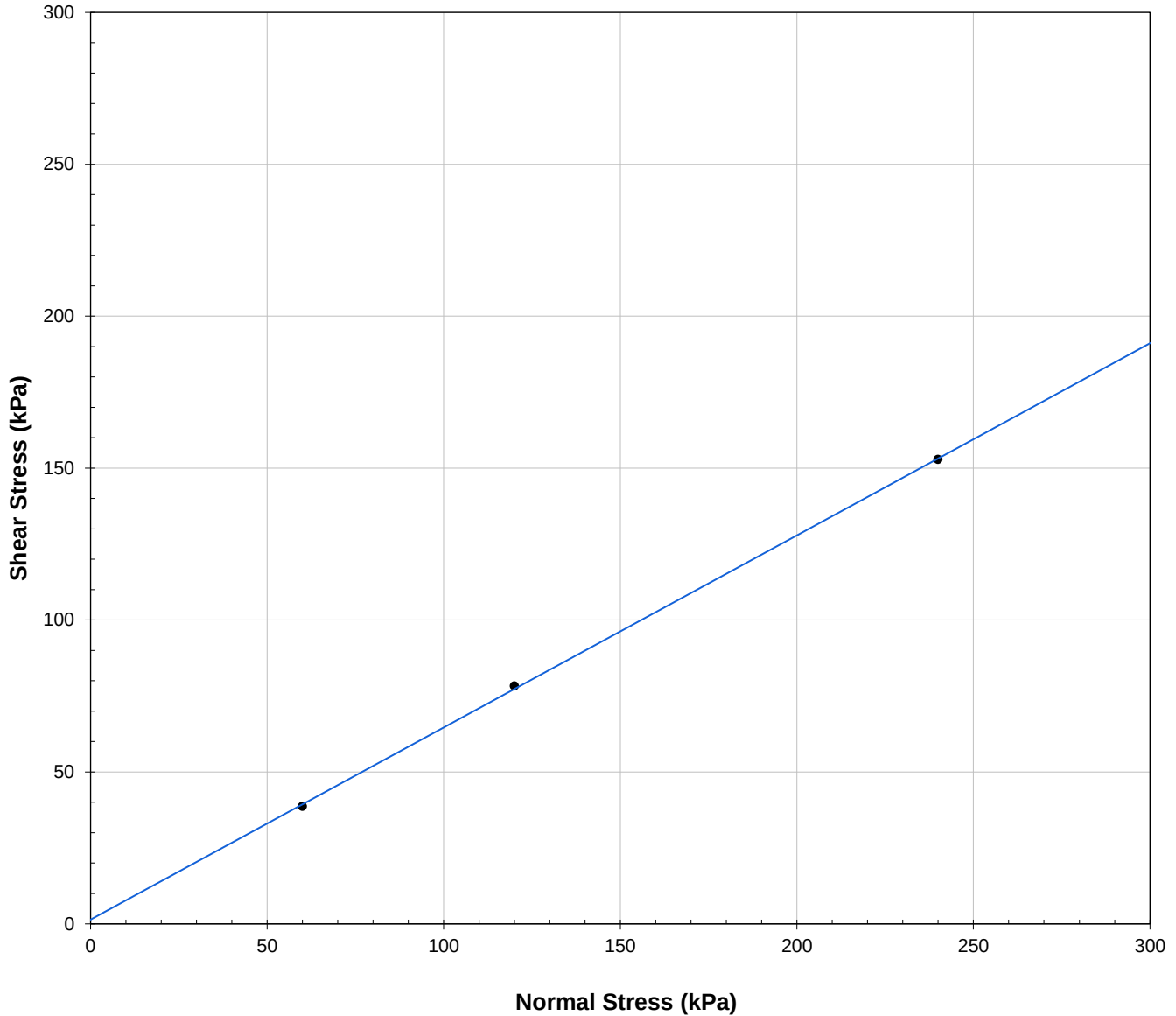
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP07
Depth (m) 15.00-15.45
Sample Type B

Description:

Brownish grey gravelly fine to medium SAND with occasional shell fragments.

Shear Stress v Normal StressPeak: $c' = 1$ $\Phi' = 32.5$

Tested by JJR
Checked and Approved by
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C F Wallace - Technical Director
20/09/2023

Project Number:

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Project Name:

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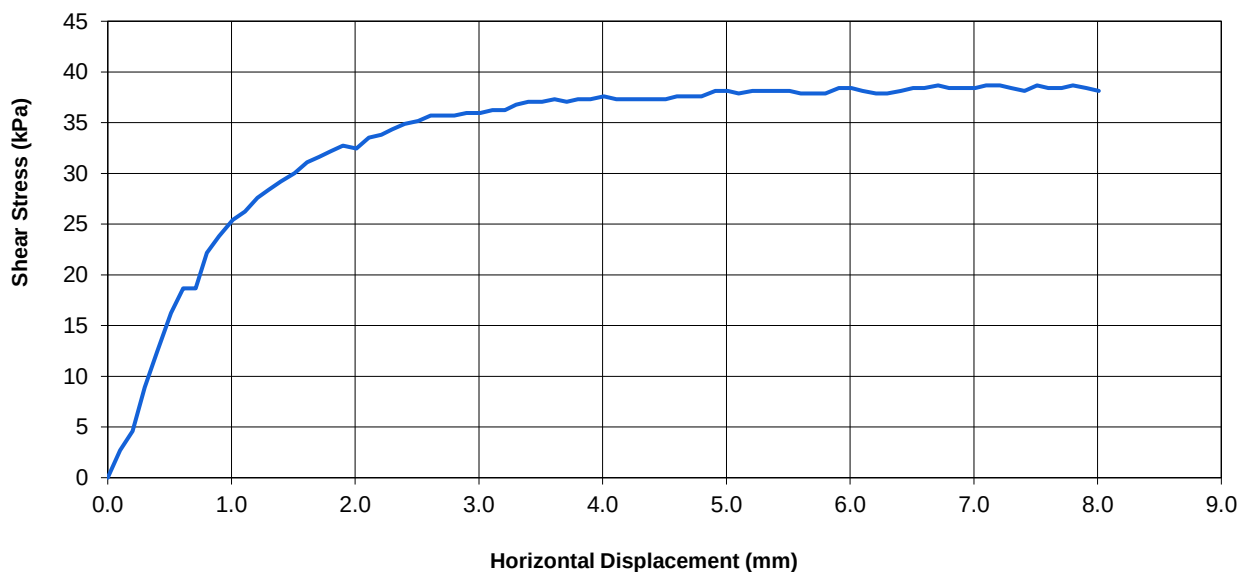
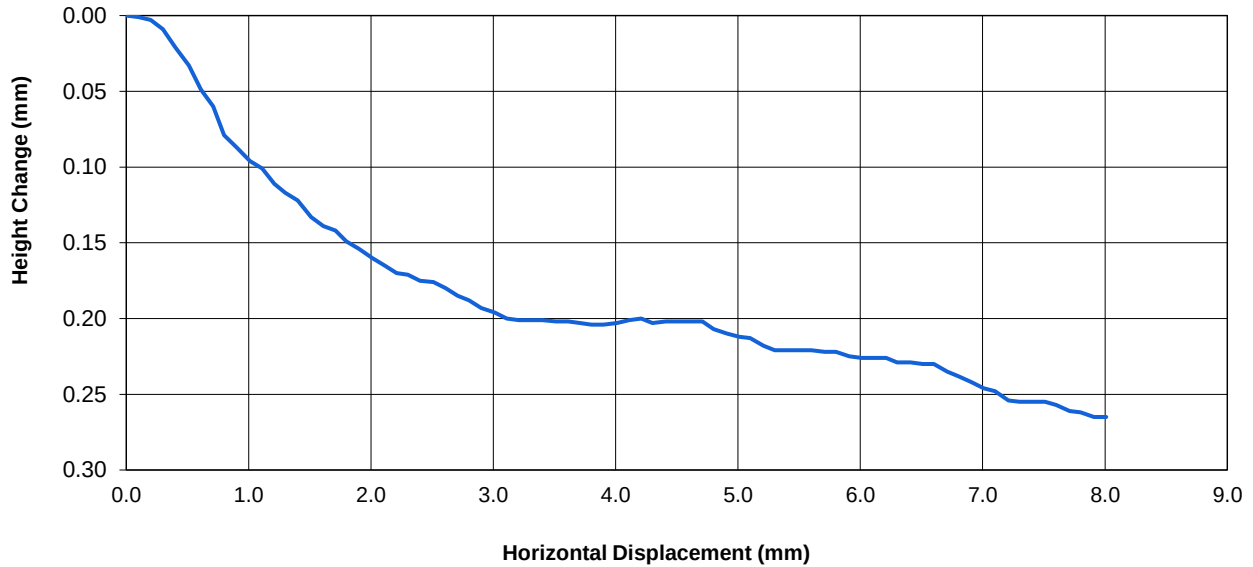
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP07
Depth (m) 15.00-15.45
Sample Type B

Description:

Brownish grey gravelly fine to medium SAND with occasional shell fragments.

Specimen: 1**Shear Stage**

Tested by JJR
Checked and Approved by
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C F Wallace - Technical Director
20/09/2023

Project Number:

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Project Name:

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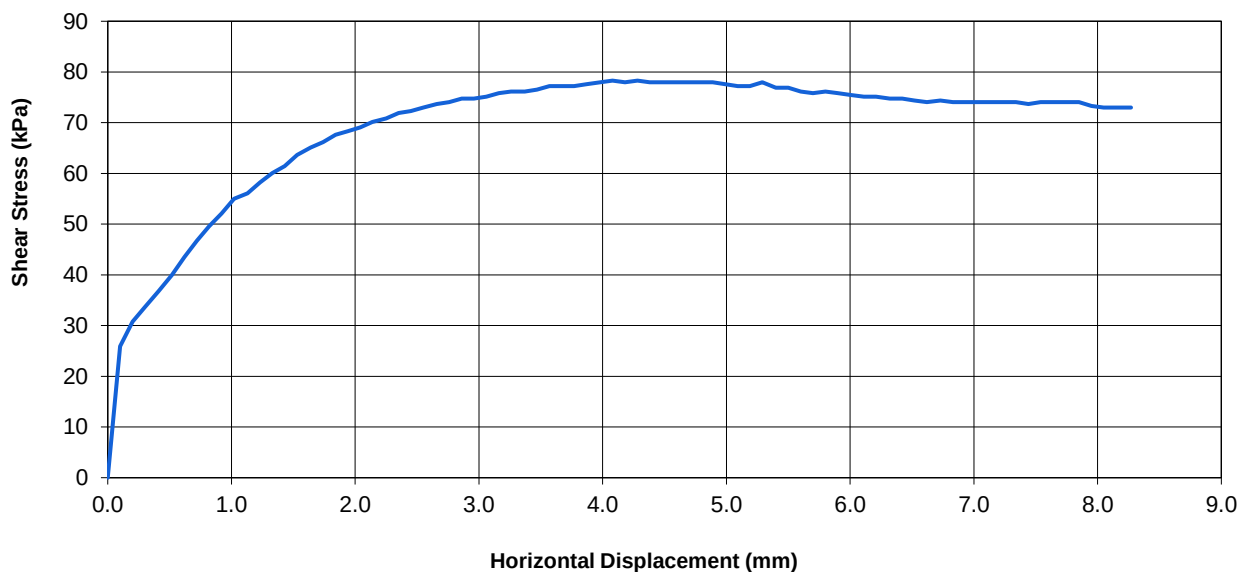
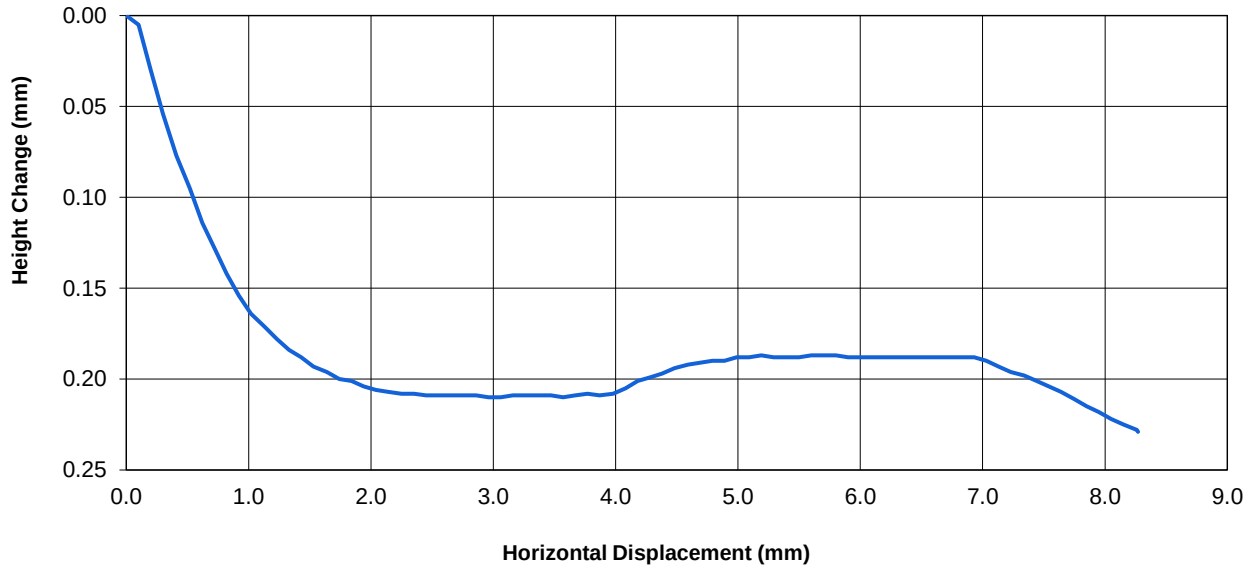
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP07
Depth (m) 15.00-15.45
Sample Type B

Description:

Brownish grey gravelly fine to medium SAND with occasional shell fragments.

Specimen: 2**Shear Stage**

Tested by JJR
Checked and Approved by
[Redacted]

C. F. Wallace - Technical Director
20/09/2023

Project Number:

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Project Name:

**ARDERSIER PORT
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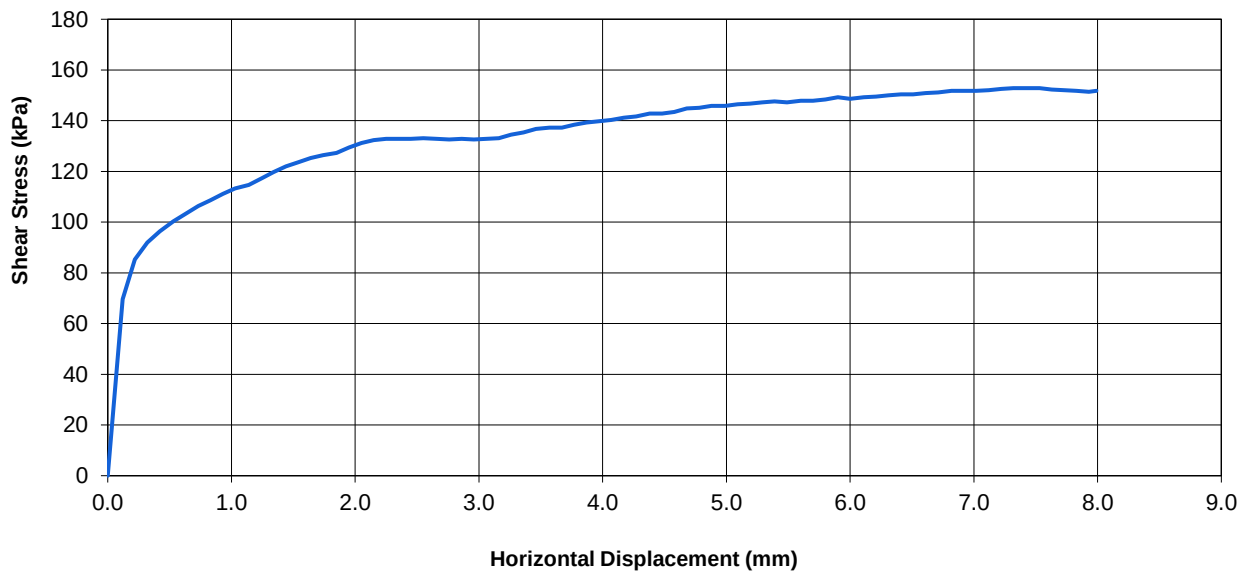
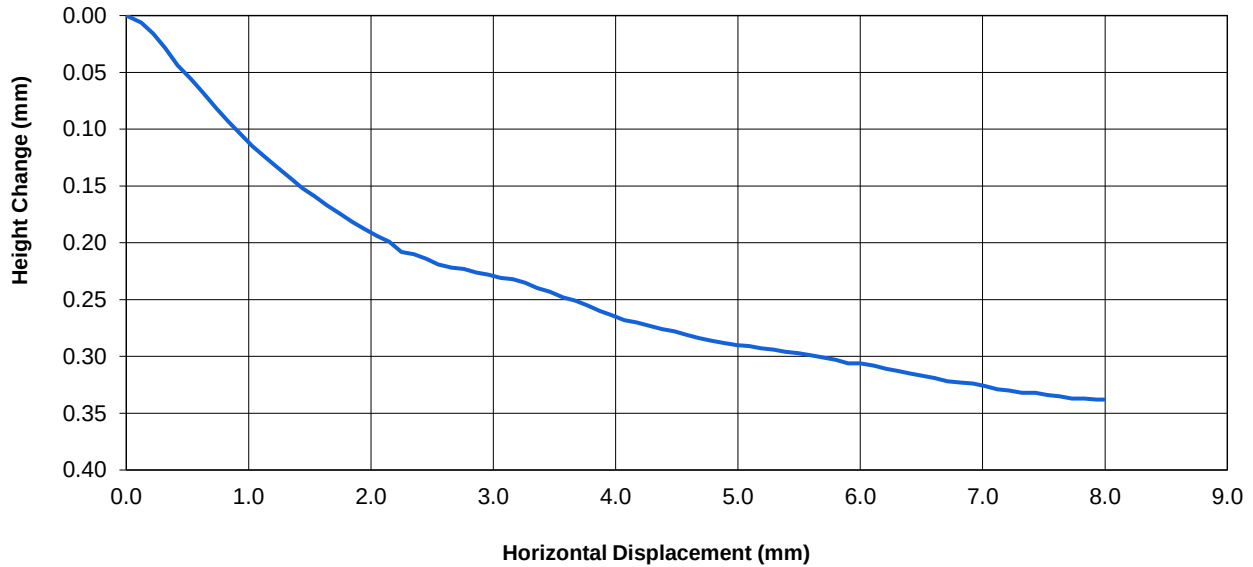
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP07
Depth (m) 15.00-15.45
Sample Type B

Description:

Brownish grey gravelly fine to medium SAND with occasional shell fragments.

Specimen: 3**Shear Stage**

Tested by JJR
Checked and Approved by

[Redacted]

C F Wallace - Technical Director
20/09/2023

Project Number:

GEO / 38552

Project Name:

**ARDERSIER PORT
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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP07	Description: Light brown fine to medium SAND with rare fine gravel.
Depth (m): 5.00-5.45	

SPECIMEN DETAILS Depth within original sample Remarks	NA Orientation within original sample: NA Remoulded to a target 10 % MC and a target dry density of 1.521 Mg/m ³		
TEST DETAILS Specimen Type and Preparation Cell Preparation Specimen Number Initial Diameter mm Initial Length mm Initial Water Content % Initial Wet Density Mg/m ³ Drainage Conditions	B (Remoulded) Checks performed in accordance with Clause 3.5 Multistage 70.22 139.49 9.9 1.67 One end only		
SATURATION STAGE Final Cell Pressure kPa Final Pore Pressure kPa Final Pore Pressure Parameter B Duration day(s)	Method: Clause 5.2 635 619 1.00 6		
CONSOLIDATION STAGE Cell Pressure kPa Back Pressure kPa Effective Pressure kPa Final Pore Pressure kPa Final Pore Pressure Dissipation % Duration day(s)	Stage No 1 635 600 35 600 100 1	Stage No 2 670 600 70 600 100 1	Stage No 3 740 600 140 600 100 1
SHEARING STAGE Cell Pressure kPa Rate of Axial Displacement mm/min Initial Pore Pressure kPa Initial Effective Stress kPa	635 0.015 600 35	670 0.020 600 70	740 0.016 600 140
CONDITIONS AT FAILURE criteria Pore Pressure kPa Minor Effective Principal Stress kPa Deviator Stress kPa Major Effective Principal Stress kPa Volume Change mL Volumetric Strain % Axial Strain % Membrane correction applied to Deviator Stress kPa Duration day(s)	Maximum deviator stress 600 35 106 141 -3.60 -0.7 2.6 1 1		
Final Water Content % Final Wet Density Mg/m ³	23.4 1.90		
EFFECTIVE STRESS PARAMETERS Cohesion kPa Angle of Shear Resistance degrees	3.3 36		
FAILURE SKETCH			

Checked and Approved by [Redacted] P Heritage - Project Manager 02/10/2023	Project Number: GEO / 38552 Project Name: ARDERSIER PORT S23053	GEOLABS 

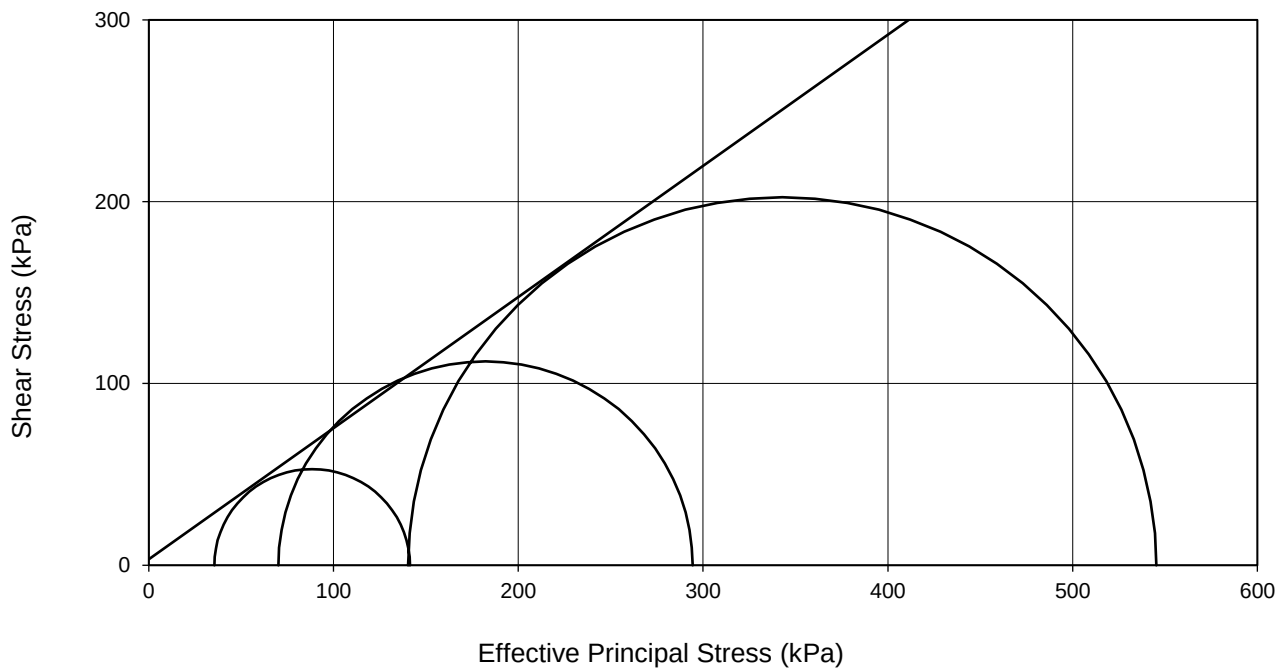
Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP07

Depth (m): 5.00-5.45

Description:

Light brown fine to medium SAND with rare fine gravel.

Checked and Approved by
[Redacted]P Heritage - Project Manager
02/10/2023

Project Number:

GEO / 38552

Project Name:

ARDERSIER PORT
S23053

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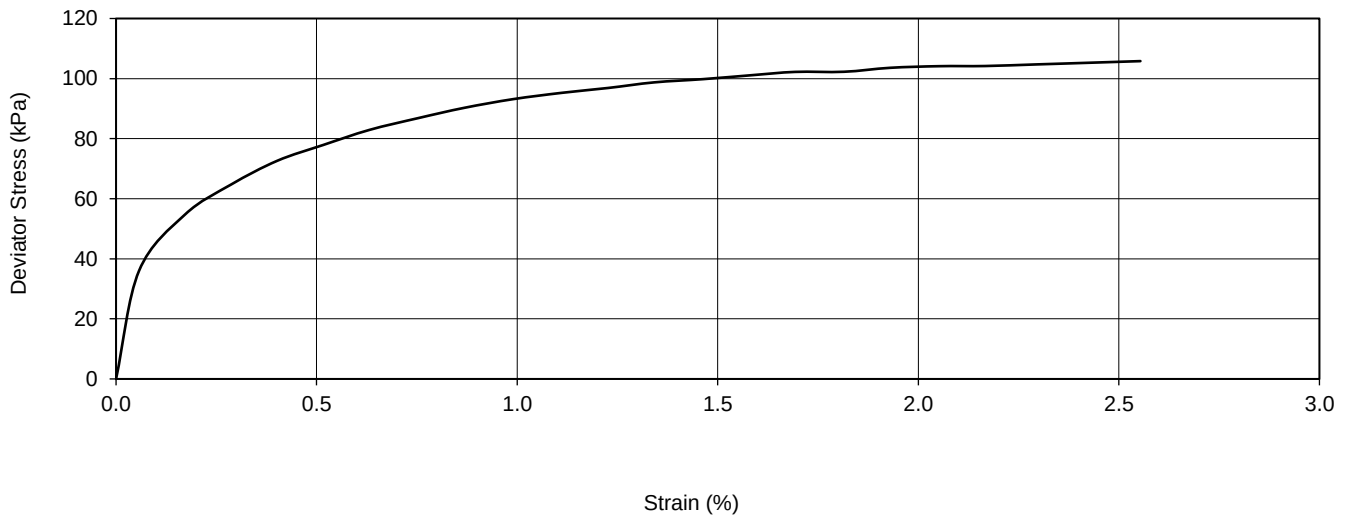
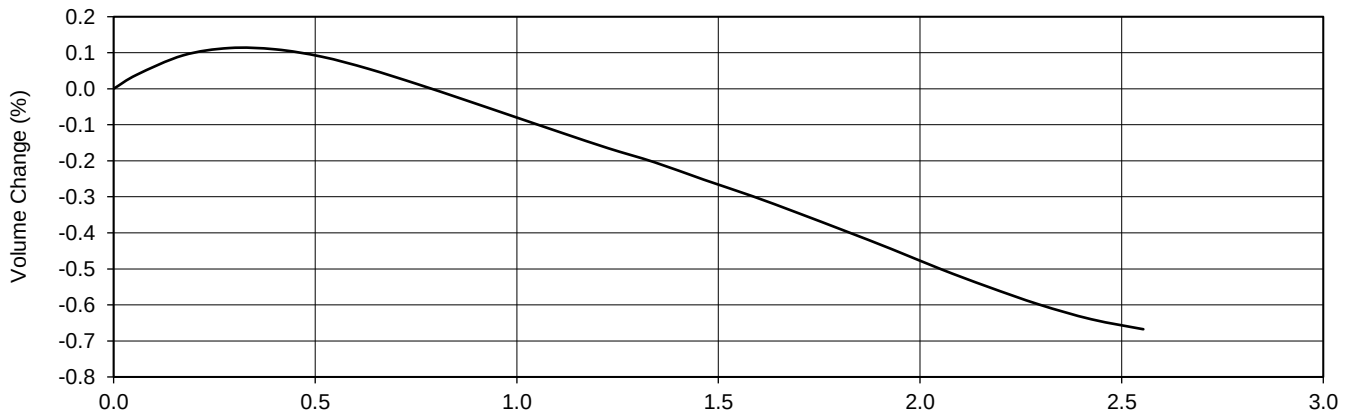
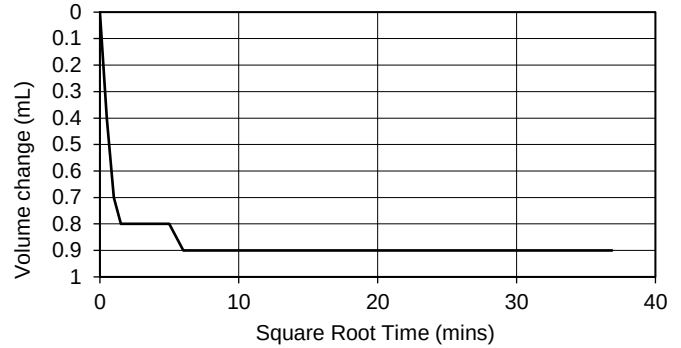
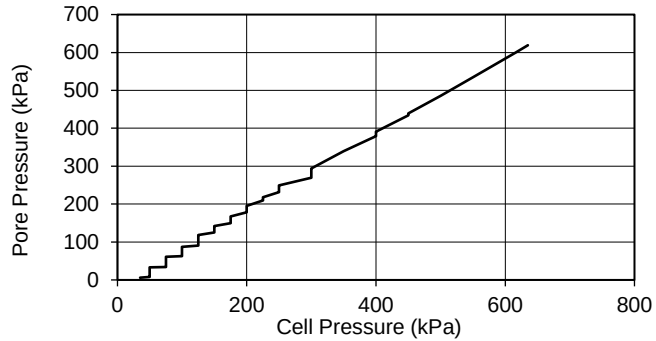


Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP07

Depth (m): 5.00-5.45

Stage No 1

Checked and Approved by
[Redacted]P Heritage - Project Manager
02/10/2023

Project Number:

GEO / 38552

Project Name:

ARDERSIER PORT
S23053

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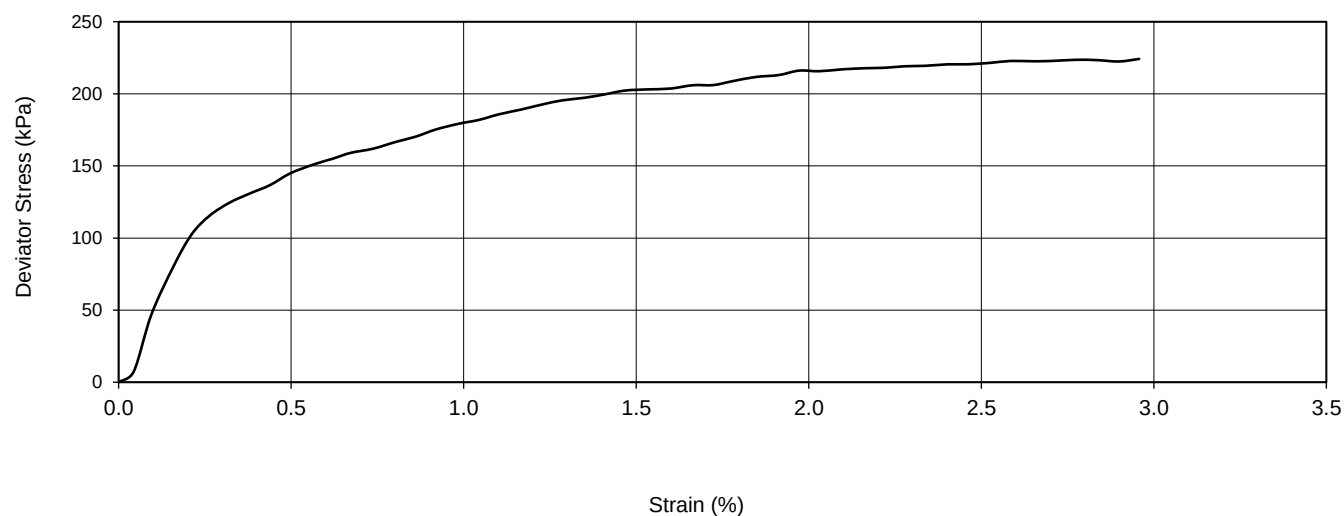
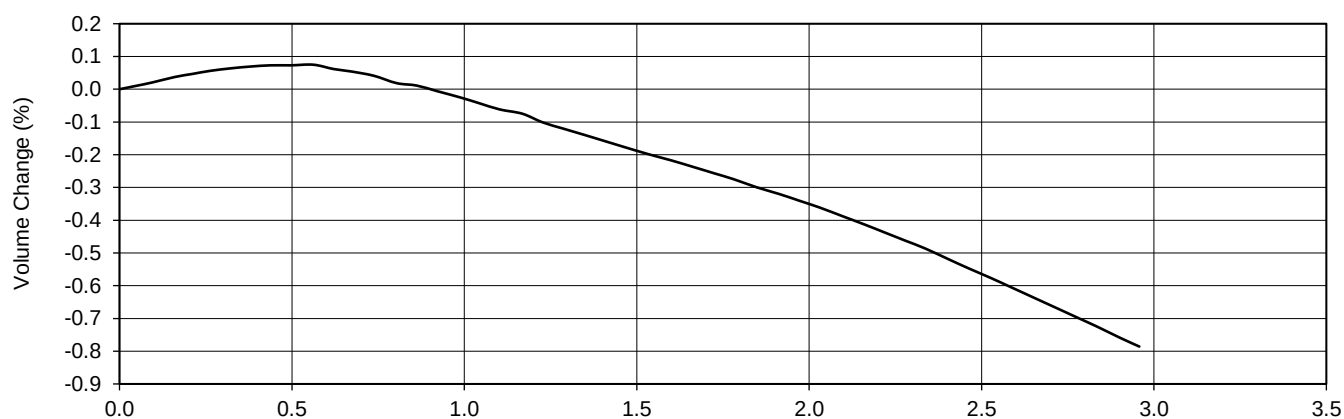
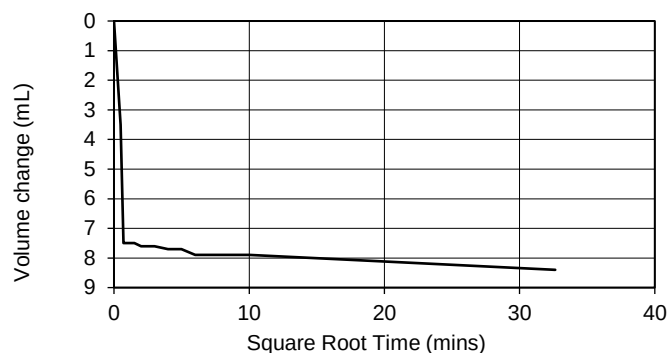


Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP07

Depth (m): 5.00-5.45

Stage No 2

Checked and Approved by
[Redacted]P Heritage - Project Manager
02/10/2023

Project Number:

GEO / 38552

Project Name:

ARDERSIER PORT
S23053

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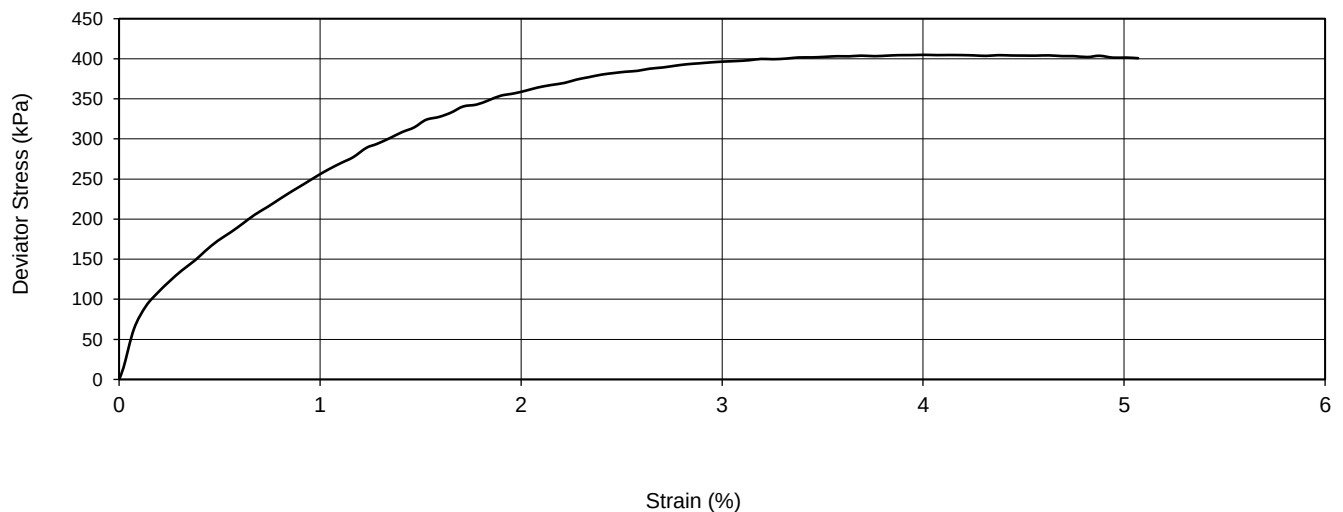
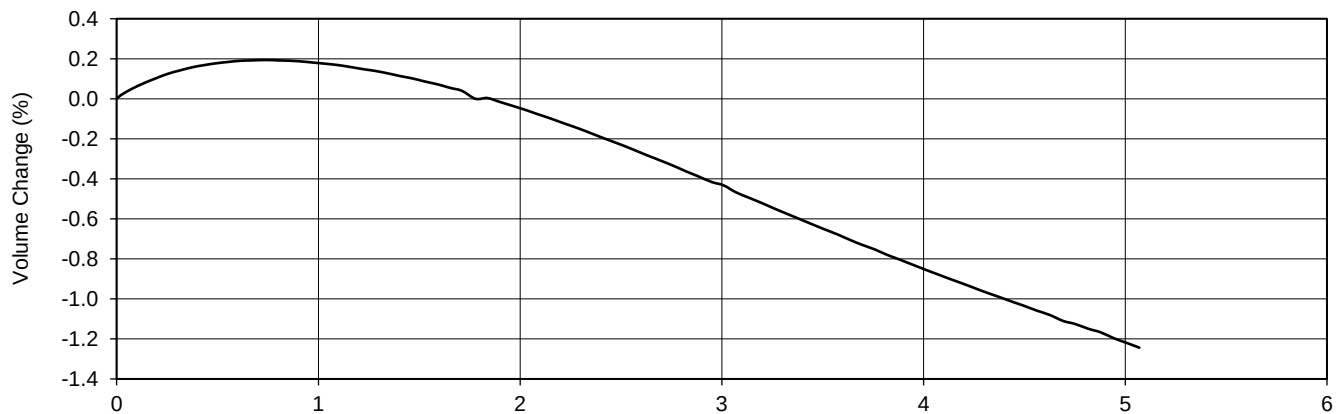
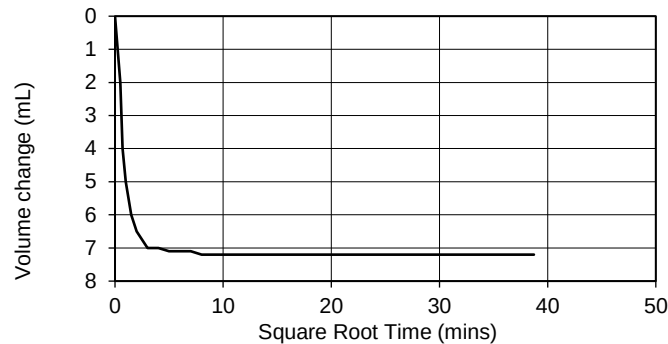


Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP07

Depth (m): 5.00-5.45

Stage No 3

Checked and Approved by
[Redacted]P Heritage - Project Manager
02/10/2023

Project Number:

GEO / 38552

Project Name:

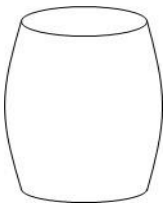
ARDERSIER PORT
S23053

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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.:	BHSP07	Description: Greyish brown fine to medium SAND with rare fine to medium gravel and shell fragments.
Depth (m):	10.50-10.95	

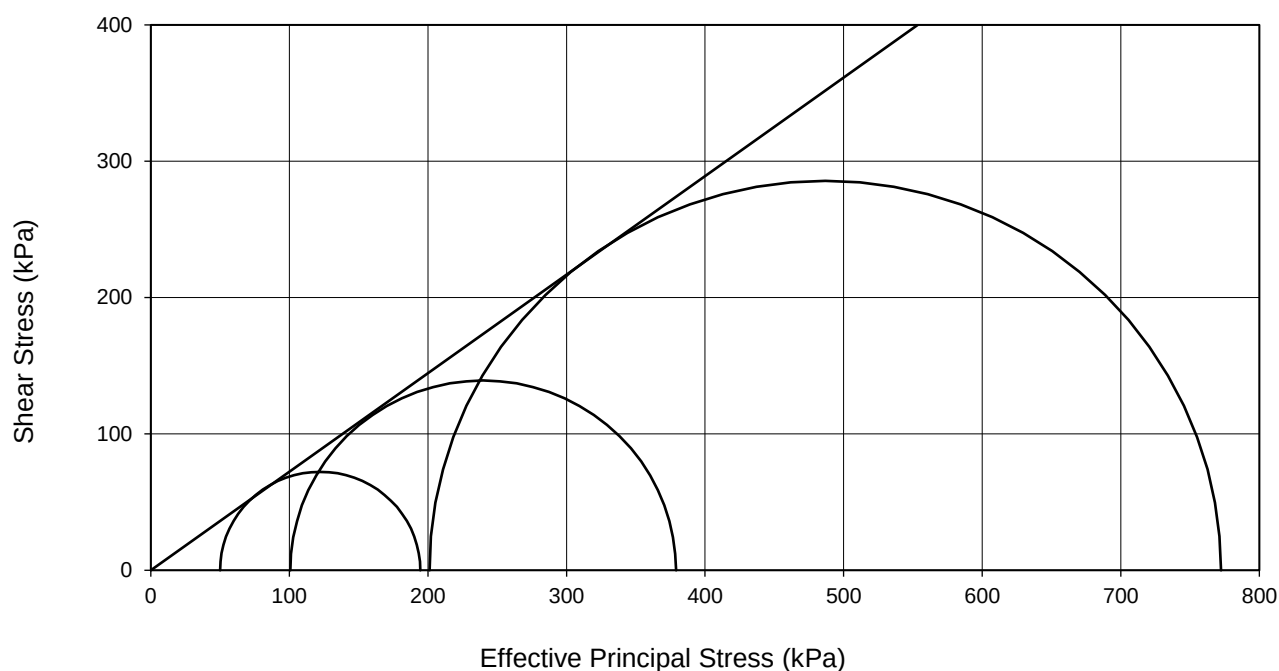
SPECIMEN DETAILS Depth within original sample Remarks		NA Orientation within original sample: NA Remoulded to a target 10 % MC and a target dry density of 1.427 Mg/m ³		
TEST DETAILS Specimen Type and Preparation Cell Preparation Specimen Number Initial Diameter Initial Length Initial Water Content Initial Wet Density Drainage Conditions		B (Undisturbed) Checks performed in accordance with Clause 3.5		
		Multistage 70.22 139.49 10.4 1.57		
		One end only		
SATURATION STAGE Final Cell Pressure Final Pore Pressure Final Pore Pressure Parameter B Duration		Method: Clause 5.2 650 645 1.00 6		
CONSOLIDATION STAGE Cell Pressure Back Pressure Effective Pressure Final Pore Pressure Final Pore Pressure Dissipation Duration		Stage No 1 650 600 50 600 100 1	Stage No 2 700 600 100 600 100 1	Stage No 3 800 600 200 600 100 1
SHEARING STAGE Cell Pressure Rate of Axial Displacement Initial Pore Pressure Initial Effective Stress		650 0.015 600 50	700 0.020 600 100	800 0.016 600 200
CONDITIONS AT FAILURE Pore Pressure Minor Effective Principal Stress Deviator Stress Major Effective Principal Stress Volume Change Volumetric Strain Axial Strain Membrane correction applied to Deviator Stress Duration		Maximum deviator stress 600 50 144 194 -2.90 -0.5 2.1 1 1		
		599 101 278 379 -1.81 -0.3 3.1 0 1		
		599 201 571 772 -4.09 -0.8 4.5 1 1		
Final Water Content Final Wet Density		28.6 1.86		
EFFECTIVE STRESS PARAMETERS Cohesion Angle of Shear Resistance		0 36		
FAILURE SKETCH				

Checked and Approved by [Redacted] P Heritage - Project Manager 02/10/2023	Project Number: GEO / 38552 Project Name: ARDERSIER PORT S23053	GEOLABS 

Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP07
Depth (m): 10.50-10.95

Description:
Greyish brown fine to medium SAND with rare fine to medium gravel and shell fragments.



Checked and Approved by
[Redacted]

P Heritage - Project Manager
02/10/2023

Project Number:

GEO / 38552

Project Name:

**ARDERSIER PORT
S23053**

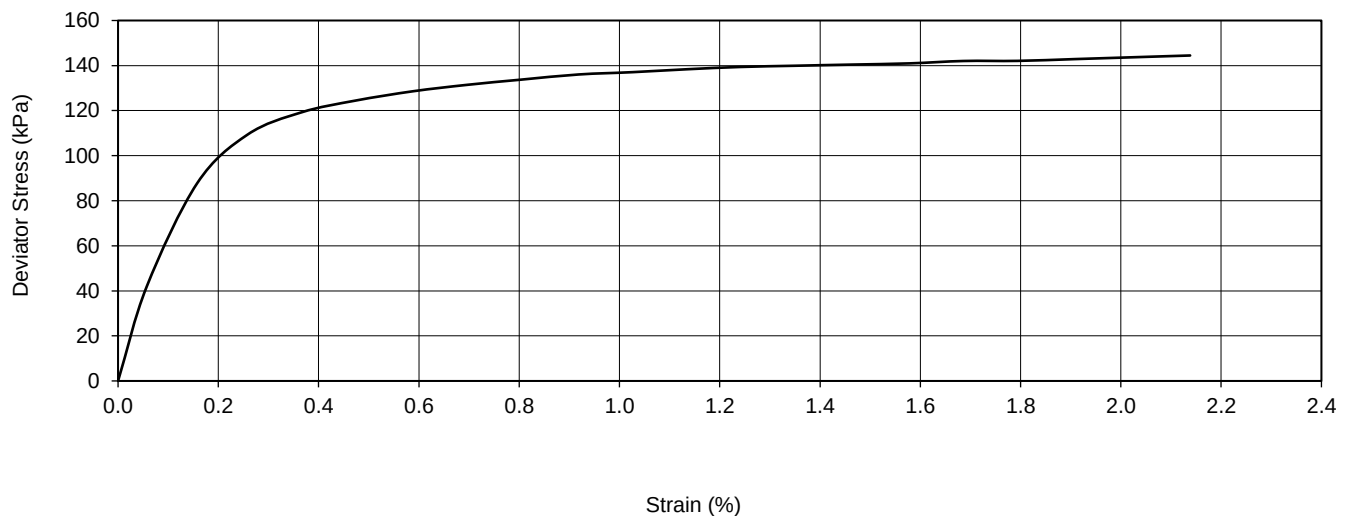
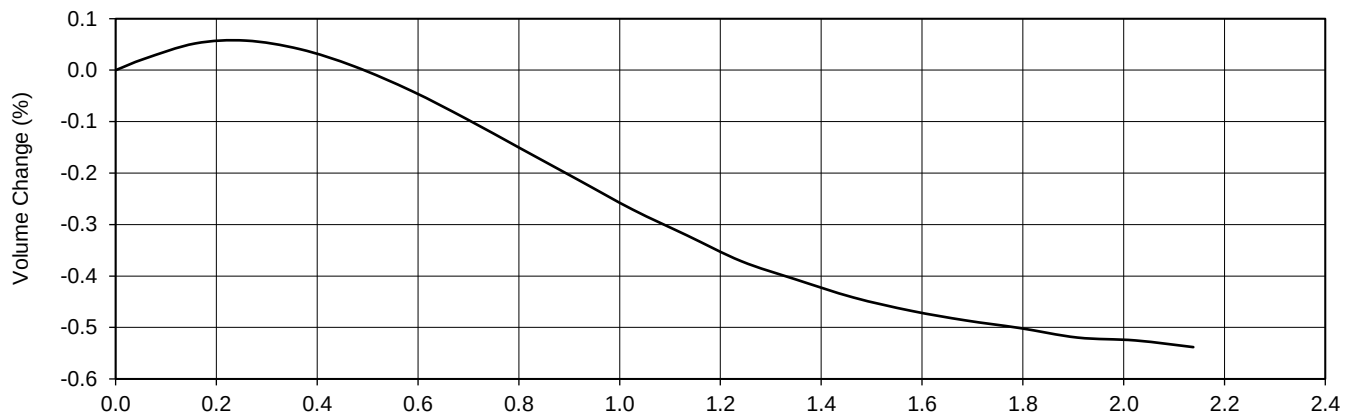
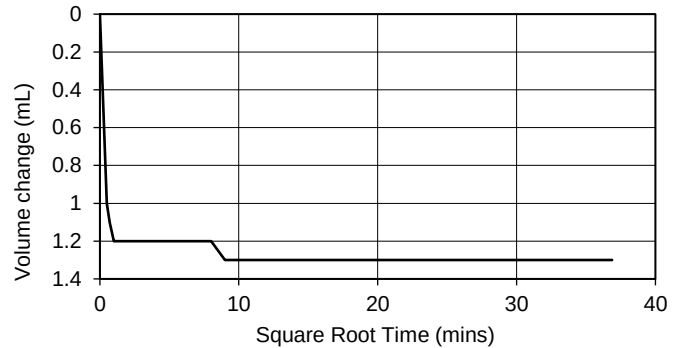
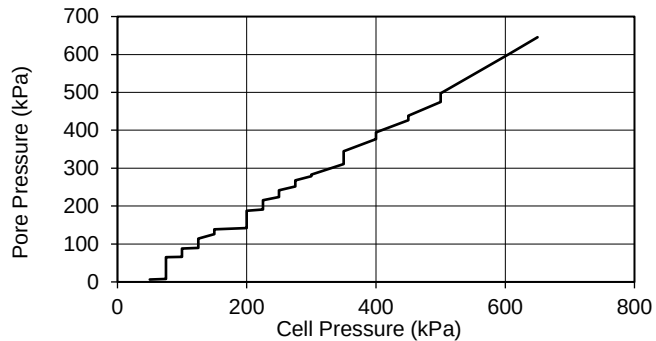
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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP07
Depth (m): 10.50-10.95

Stage No 1



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P Heritage - Project Manager
02/10/2023

Project Number:

GEO / 38552

Project Name:

ARDERSIER PORT
S23053

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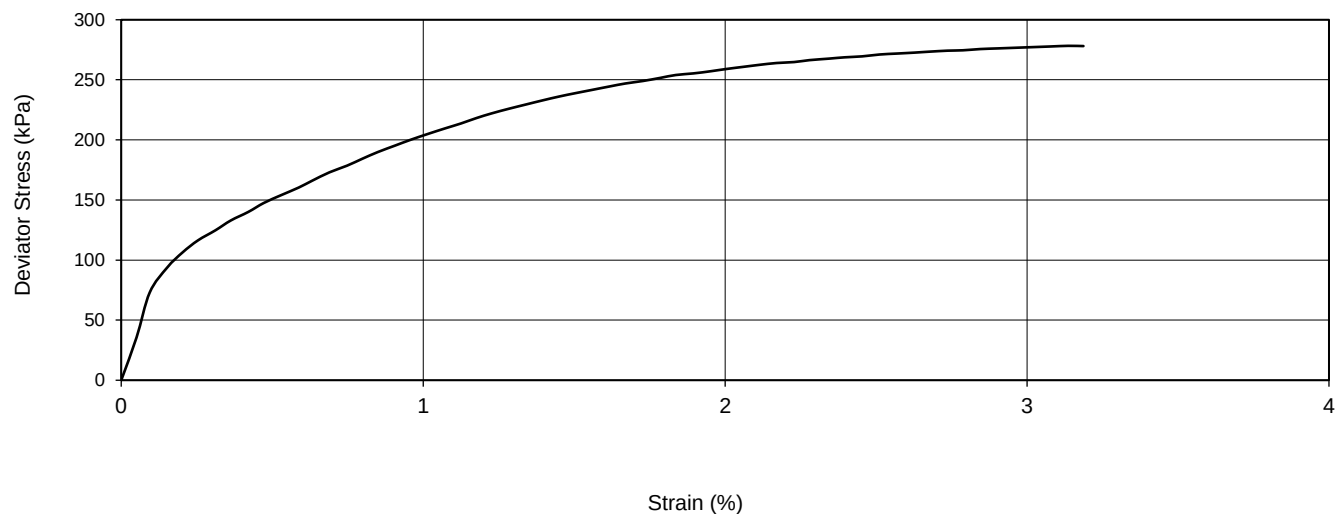
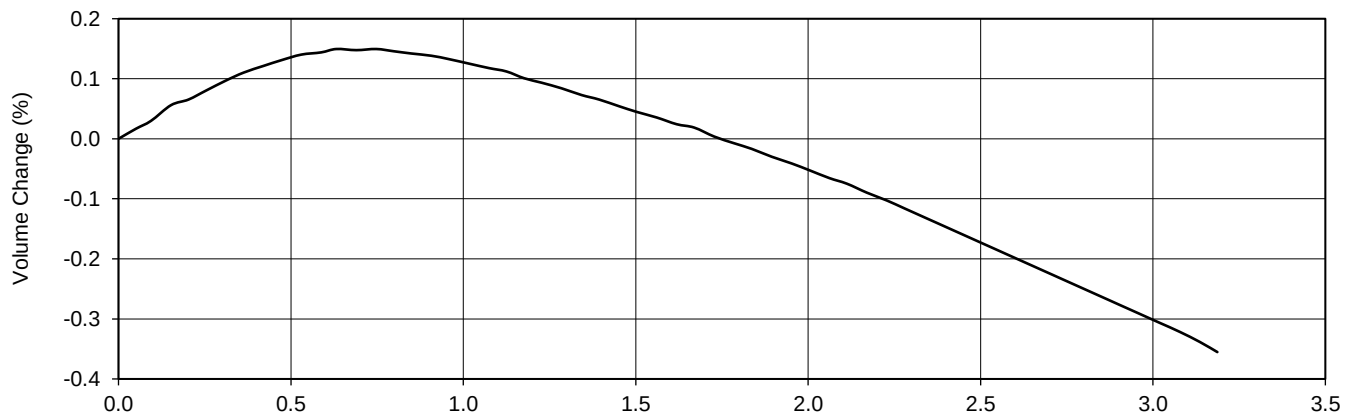
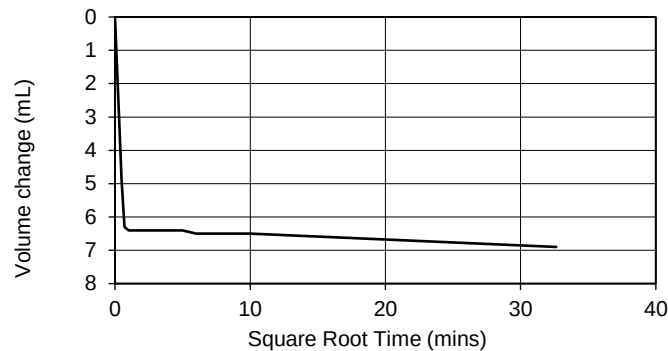


Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP07

Depth (m): 10.50-10.95

Stage No 2

Checked and Approved by
[Redacted]P Heritage - Project Manager
02/10/2023

Project Number:

GEO / 38552

Project Name:

ARDERSIER PORT
S23053

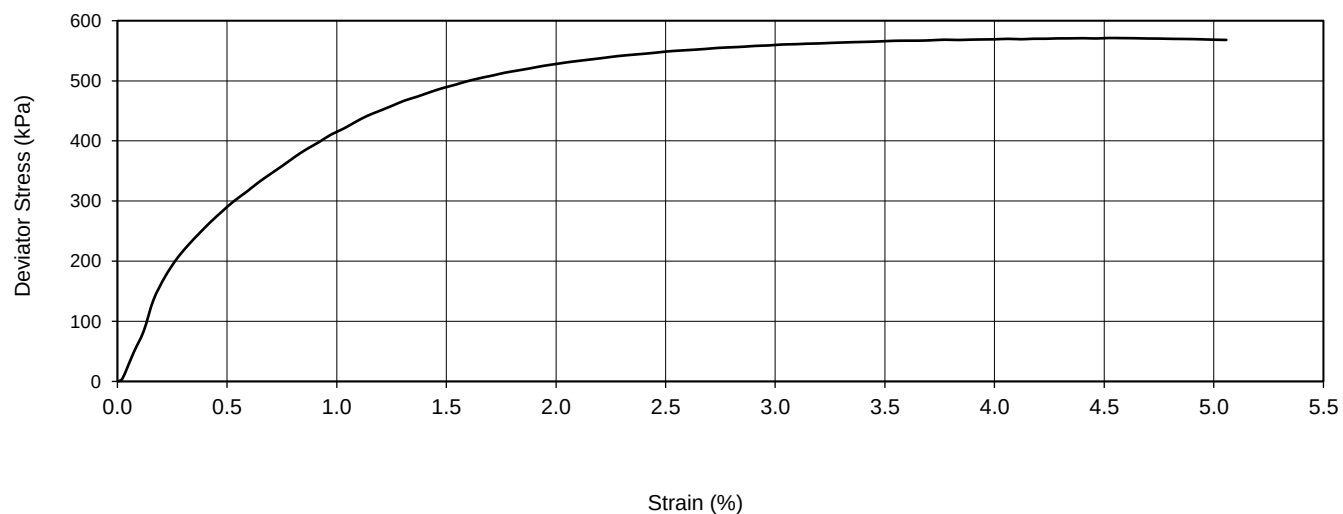
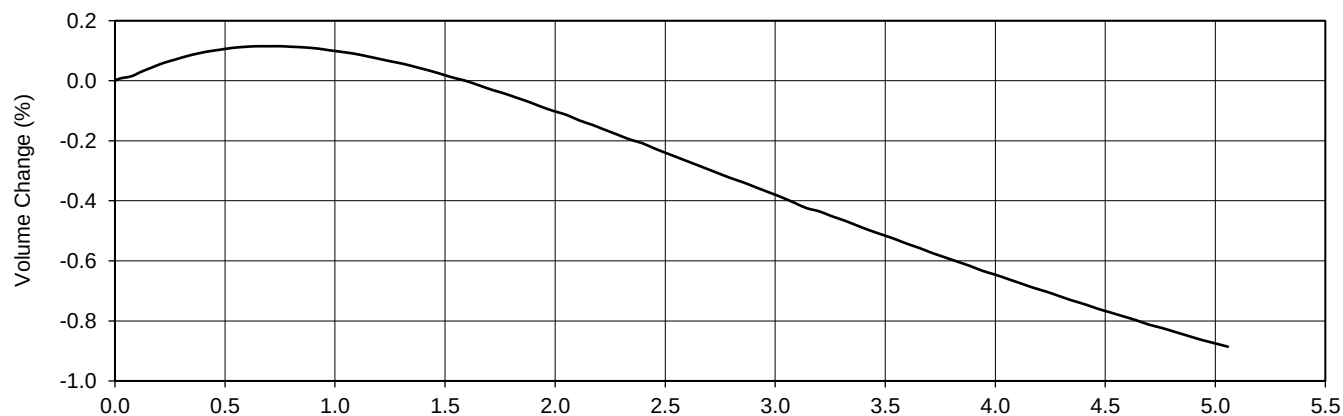
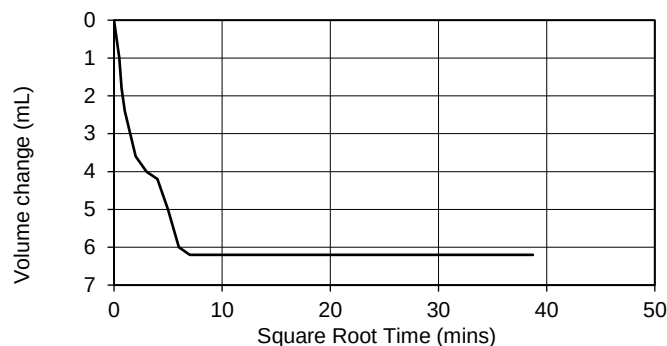
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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP07
Depth (m): 10.50-10.95

Stage No 3



Checked and Approved by
[Redacted]

P Heritage - Project Manager
02/10/2023

Project Number:

GEO / 38552

Project Name:

**ARDERSIER PORT
S23053**

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GEOLABS Limited
Bucknalls Lane
Garston
Watford
Hertfordshire
WD25 9XX

Tel: +44(0) 1923 892 190
Fax: +44(0) 1923 892 191
email: admin@geolabs.co.uk
web: www.geolabs.co.uk

Solmek
12 Yarm Road
Stockton-on-Tees
TS18 3NA

06 September 2023

Report No : GEO/38343/01

Page 1 of 1

For the attention of Mr A Cutts

Our ref **GEO / 38343**
Your Ref **S23053**

Date samples received 22/06/2023
Date written instructions received 26/06/2023
Date testing commenced 27/06/2023
Date of sample disposal 04/10/2023

Project **ARDERSIER PORT**

Further to your instructions we have pleasure in enclosing the results of the tests you requested in the attached figures.

LABORATORY TEST REPORT

Item No	Test Quantity	Description
1	5	Maximum & Minimum Density
2	3	Shear Strength by Direct Shear
3	2	Isotropic Consolidated Drained Multistage Triaxial Compression (CIDM)

Any opinions or interpretations expressed herein are outside the scope of UKAS accreditation. All results contained in this report are provisional unless signed by an approved signatory. The results contained in this report relate only to samples received in the laboratory and are tested 'as received' unless otherwise stated. This report should not be reproduced, except in full, without the written approval of the laboratory. The results reported are applicable only to the test items received by the laboratory.

All the necessary data required by the documented test procedures has been recorded and will be stored for a period of not less than 6 years. This data will be issued to yourselves at your request. All samples will be disposed of after the date shown above. Written confirmation will be required to retain the samples beyond this period and a storage charge may be applied.

We trust that the above meets your requirements and should you require any further information or assistance, please do not hesitate to contact us.

Yours faithfully
on behalf of **GEOLABS Limited**

[Redacted]

S Burke
Senior Technician

Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP08
Depth (m) 6.00-6.45
Sample Type B

Description:

Light brown fine to medium SAND with numerous mica crystals and occasional fine to medium gravel.

Percentage of material retained on the 2 mm test sieve 1.5 %

The fines content was measured to be 0.6 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.64 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.616	g/cm ³
Maximum dry density after surcharge application	1.644	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.628	g/cm ³
Maximum dry density after surcharge application	1.646	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.30 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.12 g

Mass of sand	Run		
	1	578.23	g
	2	580.33	g
	3	577.80	g
	4	577.48	g
	5	576.78	g
	Minimum	578.12	g

Checked and Approved by
[Redacted]

J Powell - Technical Consultant
14/07/2023

Project Number:

38343

Project Name:

**ARDERSIER PORT
S23053**

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Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP08
Depth (m) 7.00-7.45
Sample Type B

Description:

Light brown fine to medium SAND with occasional fine to medium gravel.

Percentage of material retained on the 2 mm test sieve 1.0 %

The fines content was measured to be 0.9 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.61 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.591	g/cm ³
Maximum dry density after surcharge application	1.606	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.595	g/cm ³
Maximum dry density after surcharge application	1.620	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.26 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.12 g

Mass of sand	Run		
	1	560.51	g
	2	560.90	g
	3	562.88	g
	4	561.48	g
	5	560.02	g
	Minimum	561.16	g

Checked and Approved by
[Redacted]

J Powell - Technical Consultant
14/07/2023

Project Number:

38343

Project Name:

**ARDERSIER PORT
S23053**

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Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP08
Depth (m) 18.00-18.45
Sample Type B

Description:

Brownish grey fine to medium SAND with rare shell fragments, numerous mica and rare fine gravel.

Percentage of material retained on the 2 mm test sieve 0.4 %

The fines content was measured to be 3.5 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.59 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.567	g/cm ³
Maximum dry density after surcharge application	1.582	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.572	g/cm ³
Maximum dry density after surcharge application	1.593	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.14 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.11 g

	Run		
Mass of sand	1	508.19	g
	2	507.36	g
	3	509.00	g
	4	508.49	g
	5	507.81	g
	Minimum	508.17	g

Checked and Approved by
[Redacted]

J Powell - Technical Consultant
14/07/2023

Project Number:

38343

Project Name:

**ARDERSIER PORT
S23053**

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Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP08
Depth (m) 19.50-19.95
Sample Type B

Description:

Brownish grey fine to medium SAND with occasional fine to medium gravel and numerous of mica crystals.

Percentage of material retained on the 2 mm test sieve 1.4 %

The fines content was measured to be 2.4 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.58 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.567	g/cm ³
Maximum dry density after surcharge application	1.582	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.571	g/cm ³
Maximum dry density after surcharge application	1.582	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.15 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.11 g

Mass of sand	Run		
	1	508.28	g
	2	510.43	g
	3	510.90	g
	4	511.30	g
	5	508.88	g
	Minimum	509.96	g

Checked and Approved by
[Redacted]

J Powell - Technical Consultant
14/07/2023

Project Number:

38343

Project Name:

**ARDERSIER PORT
S23053**

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Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP08
Depth (m) 25.50-25.95
Sample Type B

Description:

Grey fine to medium SAND with occasional medium to coarse gravel and shell fragments.

Percentage of material retained on the 2 mm test sieve 3.0 %

The fines content was measured to be 5.0 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.61 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.595	g/cm ³
Maximum dry density after surcharge application	1.606	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.594	g/cm ³
Maximum dry density after surcharge application	1.604	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.13 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.11 g

Mass of sand	Run		
	1	500.06	g
	2	502.90	g
	3	503.03	g
	4	501.53	g
	5	502.94	g
	Minimum	502.09	g

Checked and Approved by
[Redacted]

J Powell - Technical Consultant
14/07/2023

Project Number:

38343

Project Name:

**ARDERSIER PORT
S23053**

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DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP08
 Depth (m) 6.00-6.45
 Sample Type B

Description:

Light brown gravelly fine to medium SAND.
 Gravel is fine to medium.

Specimen Details

Depth within original sample *m* n/a
 Orientation within original sample n/a
 Test condition Submerged
 Preparation < 2 mm material remoulded at existing water content to a relative density of 80%¹

Particle density *Mg/m³* 2.65 (assumed)

Specimen Number		1	2	3
Length	<i>mm</i>	59.78	59.78	59.78
Width	<i>mm</i>	59.77	59.77	59.77
Height	<i>mm</i>	23.99	24.13	24.17
Initial water content	%	19.1	19.1	19.1
Initial bulk density	<i>Mg/m³</i>	1.87	1.86	1.85
Initial dry density	<i>Mg/m³</i>	1.57	1.56	1.56
Initial voids ratio		0.691	0.701	0.704
Degree of Saturation	%	73.3	72.2	71.9

Shearing Stage

Normal stress	<i>kPa</i>	30	60	120
Peak Conditions:				
Rate of horizontal displacement	<i>mm/min</i>	0.4	0.4	0.4
Maximum shear stress	<i>kPa</i>	28.1	46.5	99.5
Horizontal displacement at MSS	<i>mm</i>	1.8	2.9	2.2
Vertical Displacement at Peak	<i>mm</i>	-0.23	-0.21	-0.19

Final water content	%	24.7	24.2	24.6
Duration	<i>day(s)</i>	1	1	1

Shear Strength Parameters

		Peak Condition
Apparent Cohesion	<i>kPa</i>	2
Angle of Shearing Resistance	<i>degrees</i>	39.0

Notes: ¹ Maximum dry density = 1.64 Mg/m³ and minimum dry density = 1.30 Mg/m³

Tested by SRA
 Checked and Approved by
 [Redacted]

C F Wallace - Technical Director
 20/07/2023

Project Number:

GEO / 38343

Project Name:

ARDERSIER PORT
S23053

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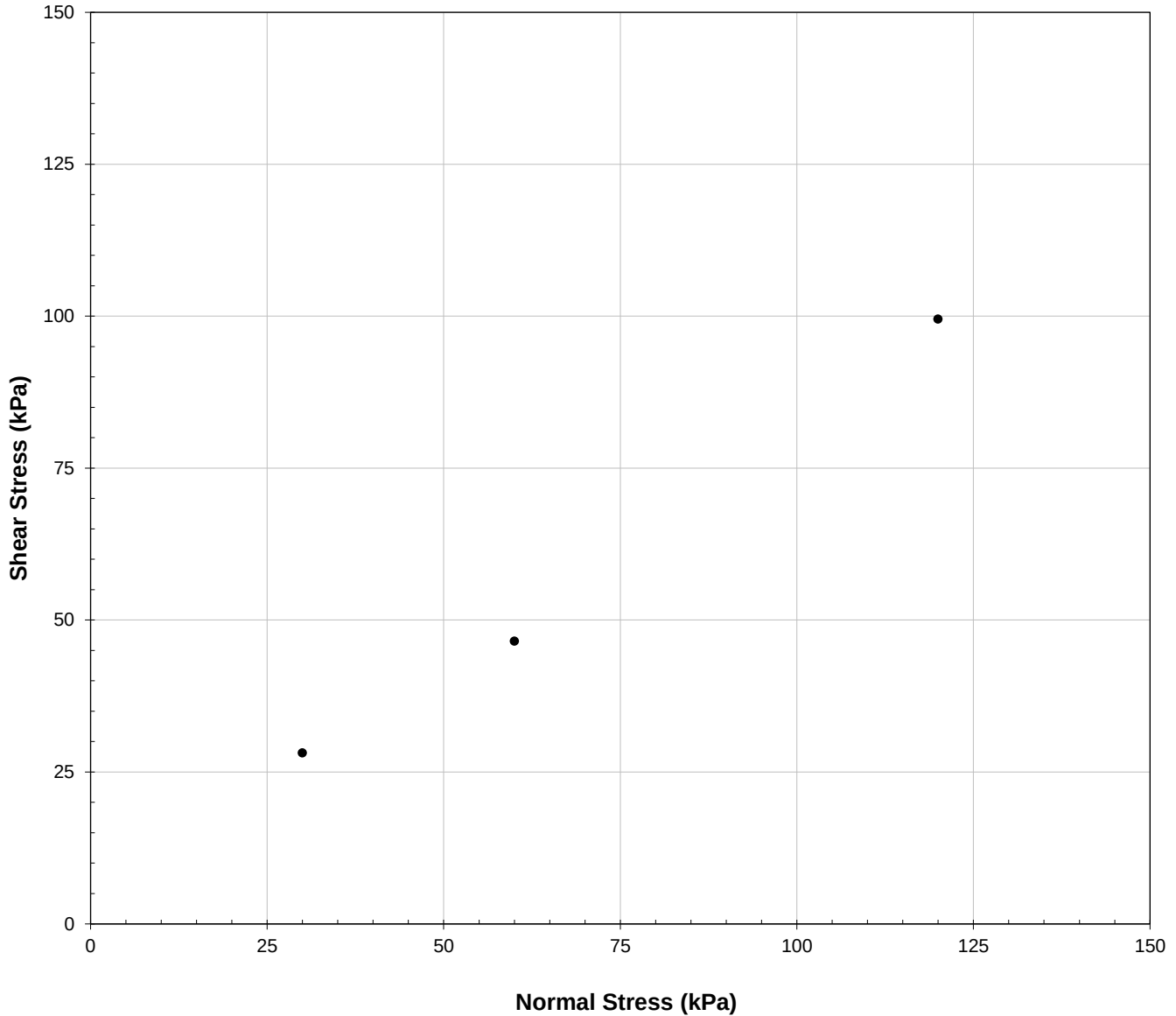
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP08
 Depth (m) 6.00-6.45
 Sample Type B

Description:

Light brown gravelly fine to medium SAND.
 Gravel is fine to medium.

Shear Stress v Normal StressPeak: $c' = 2$ $\Phi' = 39.0$

Tested by SRA
 Checked and Approved by
 [Redacted]

C F Wallace - Technical Director
 20/07/2023

Project Number:

GEO / 38343

Project Name:

ARDERSIER PORT
S23053

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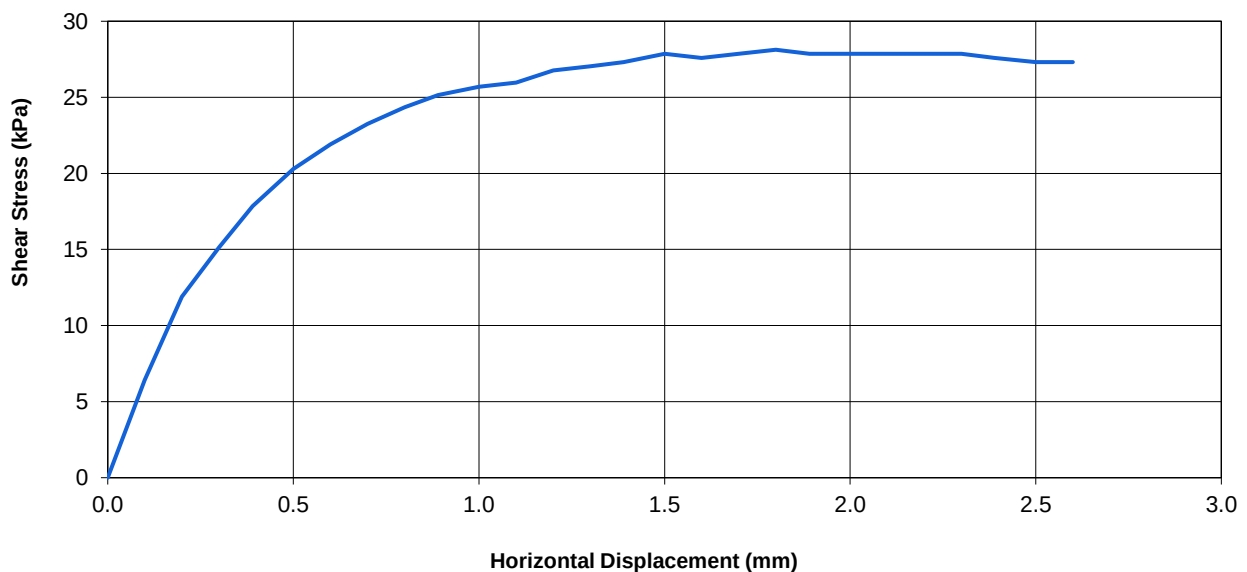
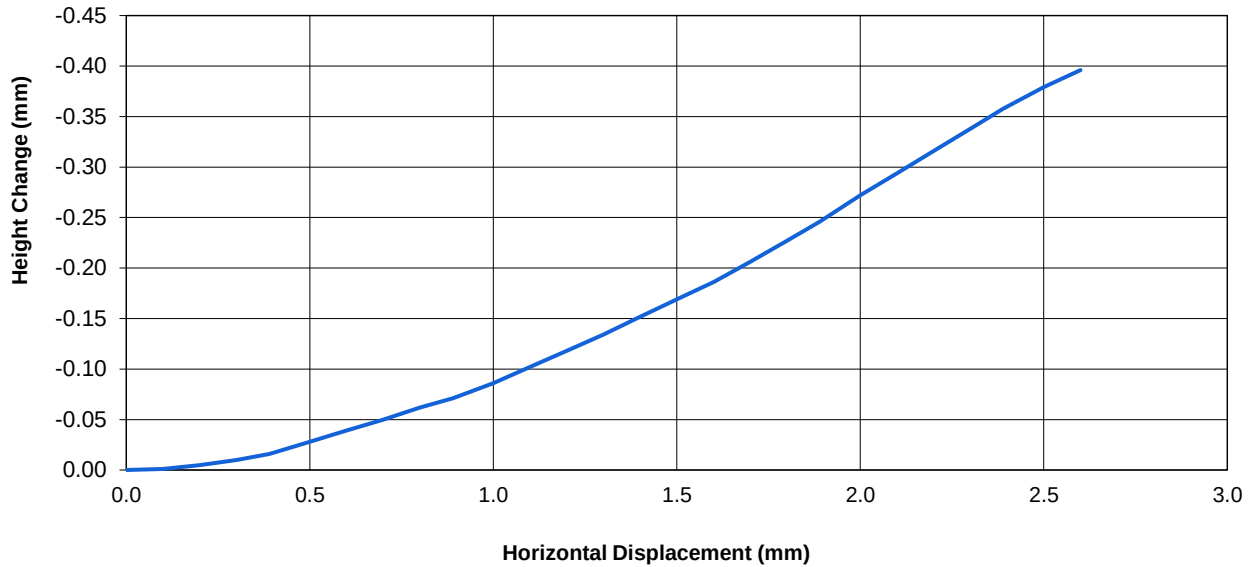
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP08
Depth (m) 6.00-6.45
Sample Type B

Description:

Light brown gravelly fine to medium SAND.
Gravel is fine to medium.

Specimen: 1**Shear Stage**

Tested by SRA
Checked and Approved by

[Redacted]

C. F. Wallace - Technical Director
20/07/2023

Project Number:

GEO / 38343

Project Name:

**ARDERSIER PORT
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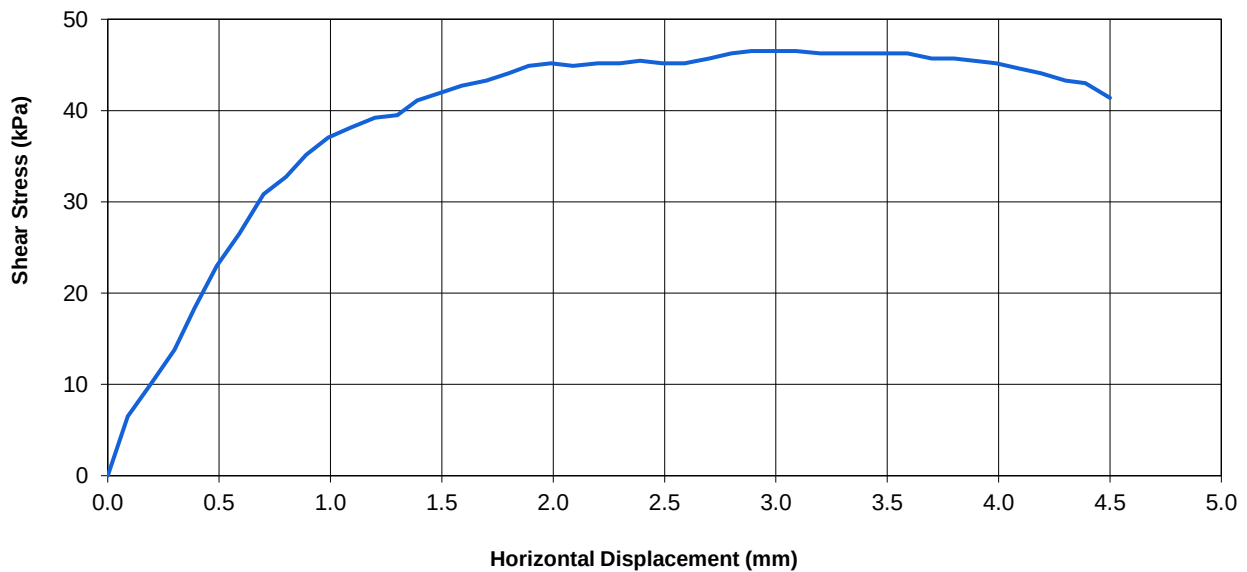
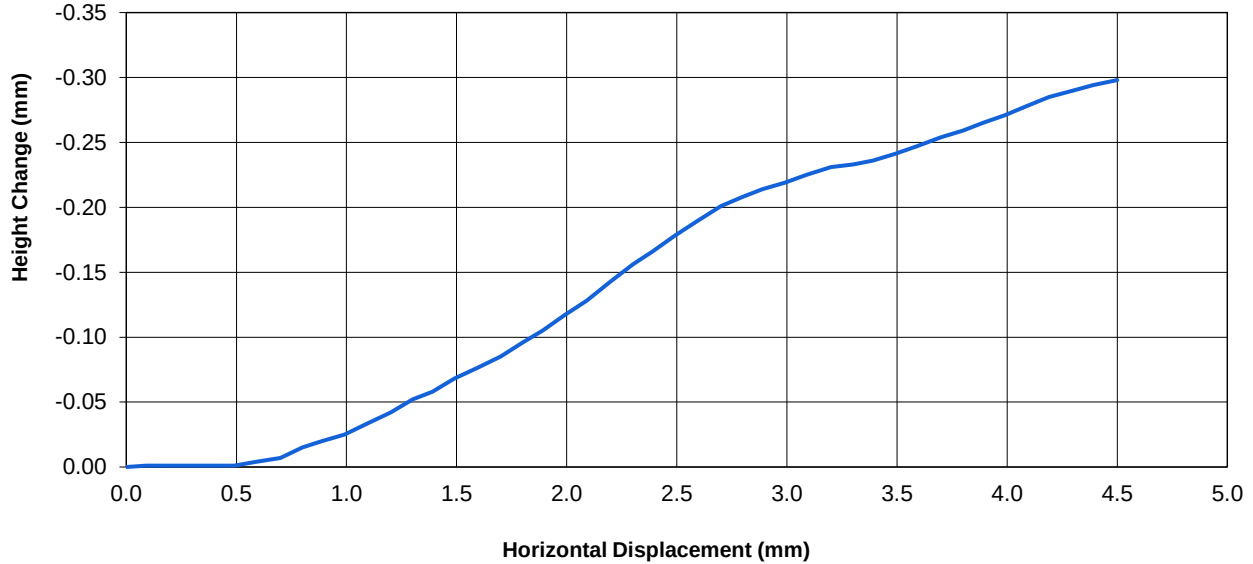
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP08
Depth (m) 6.00-6.45
Sample Type B

Description:

Light brown gravelly fine to medium SAND.
Gravel is fine to medium.

Specimen: 2**Shear Stage**

Tested by SRA
Checked and Approved by

[Redacted]

C F Wallace - Technical Director
20/07/2023

Project Number:

GEO / 38343

Project Name:

**ARDERSIER PORT
S23053**

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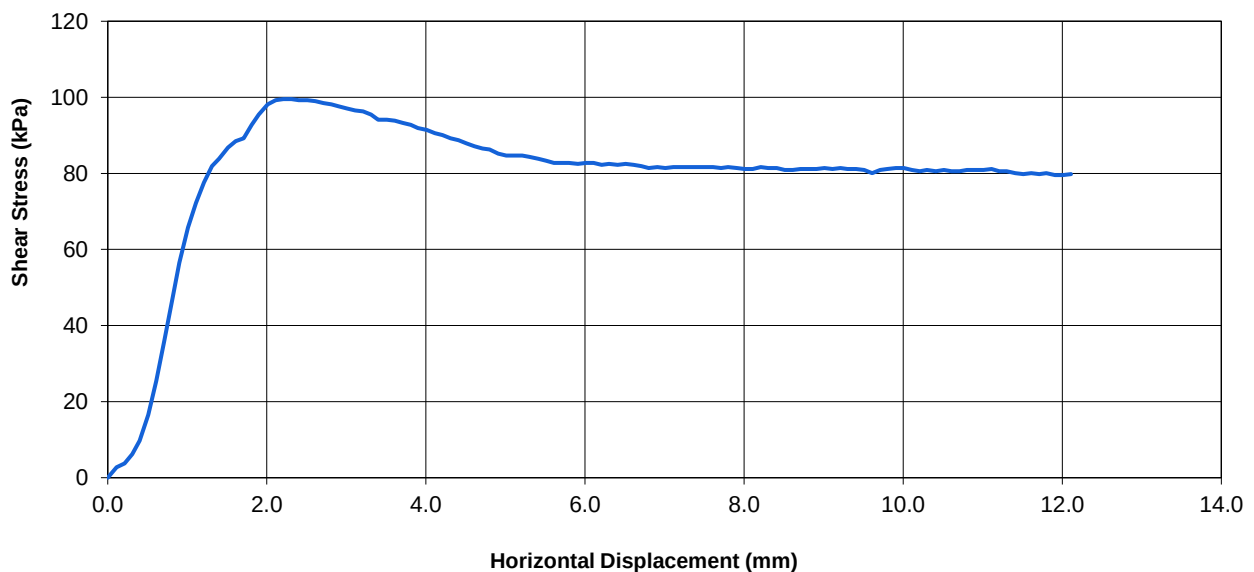
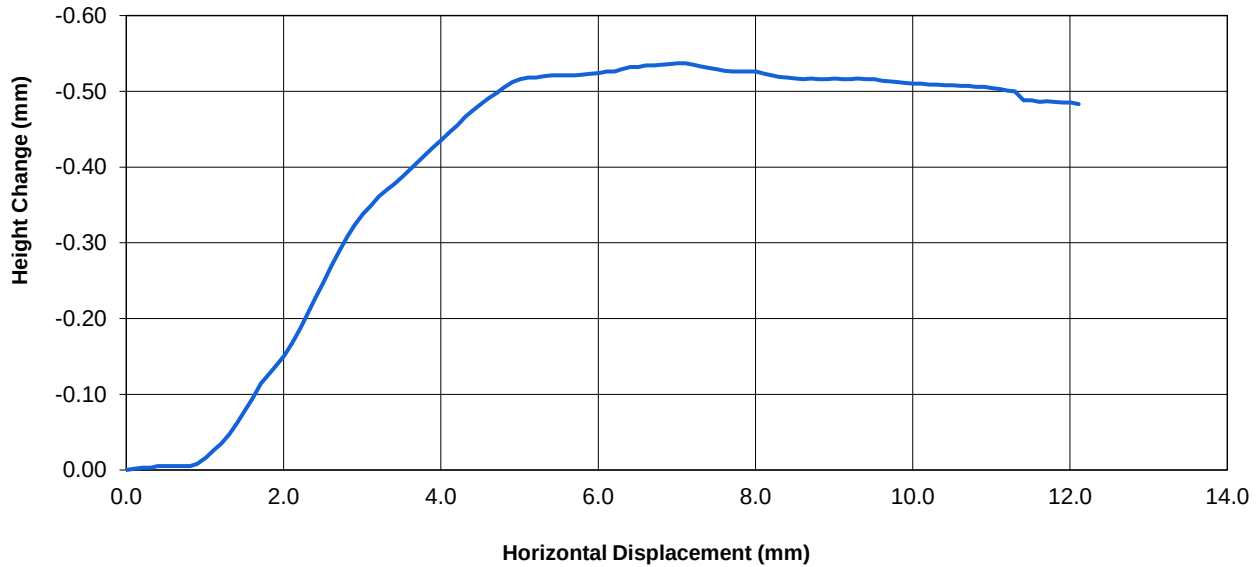
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP08
Depth (m) 6.00-6.45
Sample Type B

Description:

Light brown gravelly fine to medium SAND.
Gravel is fine to medium.

Specimen: 3**Shear Stage**

Tested by SRA
Checked and Approved by
[Redacted]

C F Wallace - Technical Director
20/07/2023

Project Number:

GEO / 38343

Project Name:

**ARDERSIER PORT
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DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP08
 Depth (m) 19.50-19.95
 Sample Type B

Description:

Grey gravelly SAND with rare mica crystals.
 Gravel is fine to medium.

Specimen Details

Depth within original sample *m* n/a
 Orientation within original sample n/a
 Test condition Submerged
 Preparation < 2 mm material remoulded at existing water content to a relative density of 60% ¹

Particle density *Mg/m³* 2.65 (assumed)

Specimen Number		1	2	3
Length	<i>mm</i>	60.04	60.05	60.05
Width	<i>mm</i>	60.00	60.00	60.01
Height	<i>mm</i>	25.54	25.42	25.39
Initial water content	%	21.5	21.5	21.5
Initial bulk density	<i>Mg/m³</i>	1.63	1.64	1.64
Initial dry density	<i>Mg/m³</i>	1.34	1.35	1.35
Initial voids ratio		0.975	0.966	0.964
Degree of Saturation	%	58.5	59.0	59.1

Shearing Stage

Normal stress	<i>kPa</i>	60	120	240
Peak Conditions:				
Rate of horizontal displacement	<i>mm/min</i>	0.4	0.4	0.4
Maximum shear stress	<i>kPa</i>	41.6	86.1	168.0
Horizontal displacement at MSS	<i>mm</i>	5.0	4.9	6.6
Vertical Displacement at Peak	<i>mm</i>	-0.02	0.43	0.65

Final water content	%	26.6	25.9	26.5
Duration	<i>day(s)</i>	1	1	1

Shear Strength Parameters

		Peak Condition
Apparent Cohesion	<i>kPa</i>	1
Angle of Shearing Resistance	<i>degrees</i>	35.0

Notes: ¹ Maximum dry density = 1.58 Mg/m³ and minimum dry density 1.15 Mg/m³

Tested by JJR
 Checked and Approved by
 [Redacted]

P Heritage - Project Manager
 26/07/2023

Project Number:

GEO / 38343

Project Name:

ARDERSIER PORT
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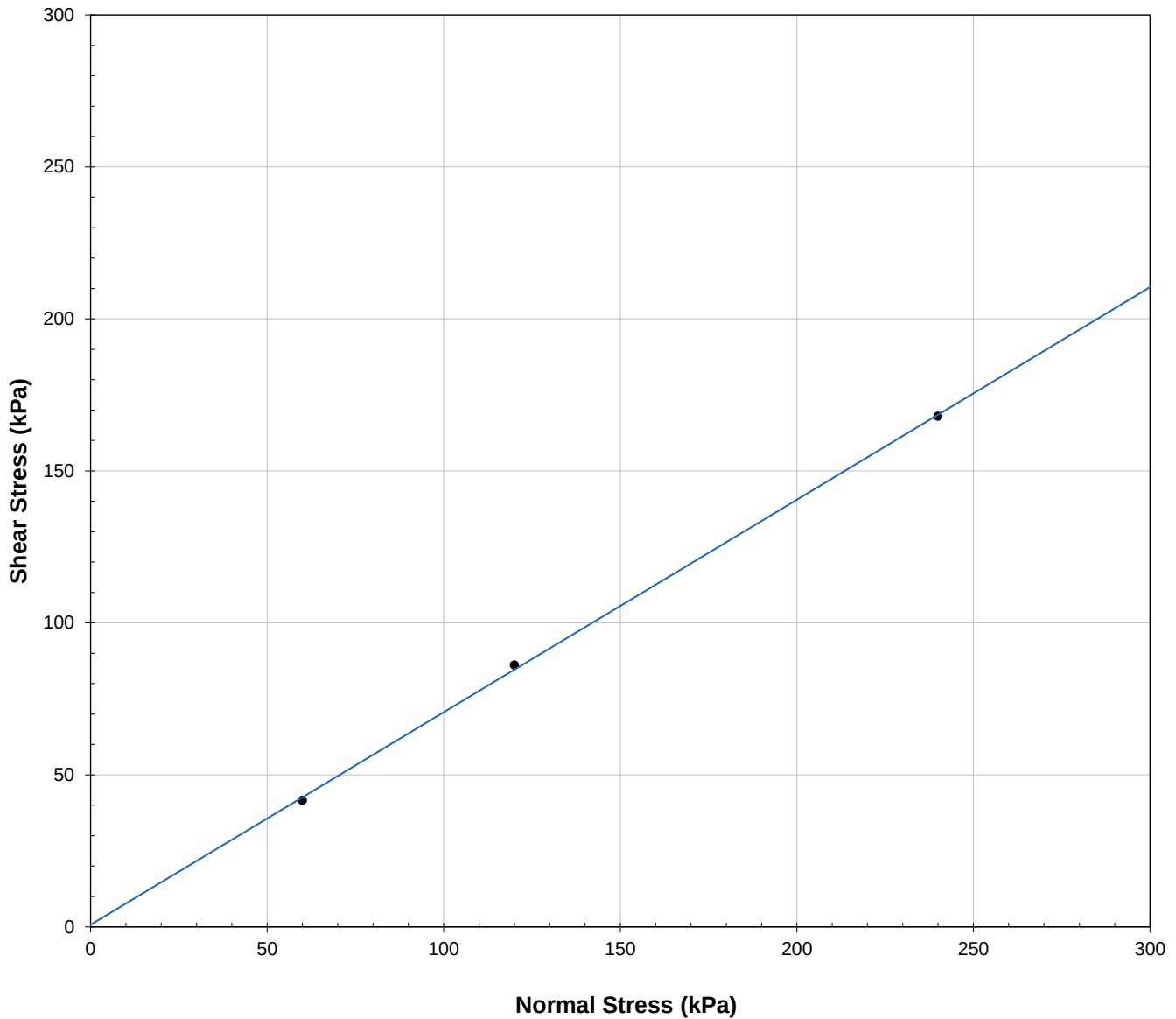
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP08
Depth (m) 19.50-19.95
Sample Type B

Description:

Grey gravelly SAND with rare mica crystals.
Gravel is fine to medium.

Shear Stress v Normal Stress

Peak: $c' = 1$
 $\Phi' = 35.0$

Tested by JJR
Checked and Approved by

[Redacted]

P Heritage - Project Manager
26/07/2023

Project Number:

GEO / 38343

Project Name:

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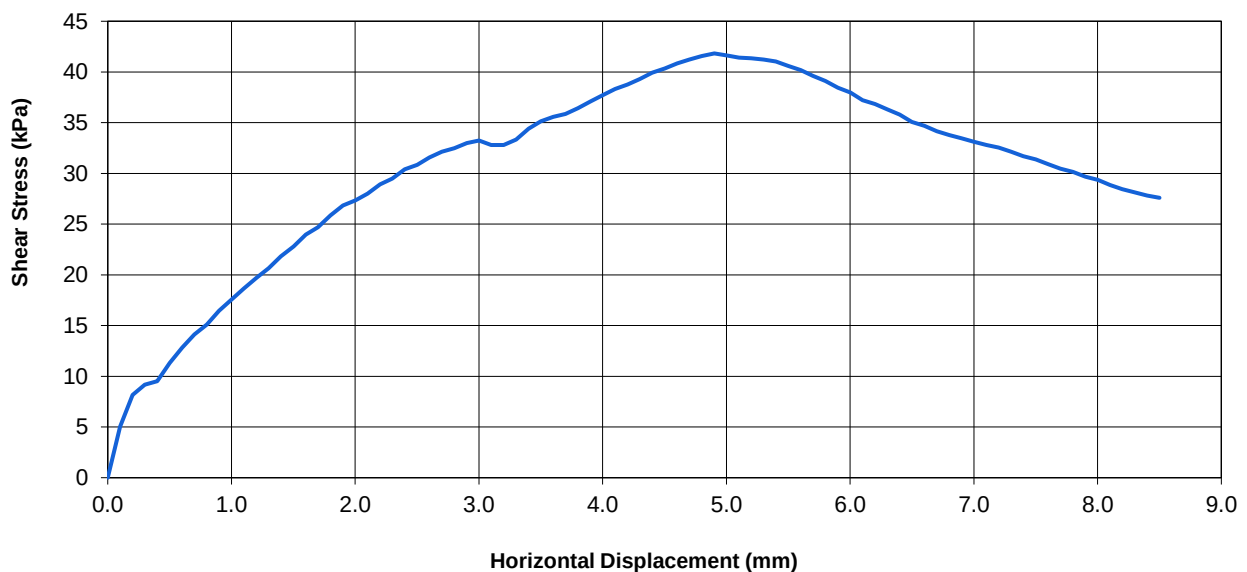
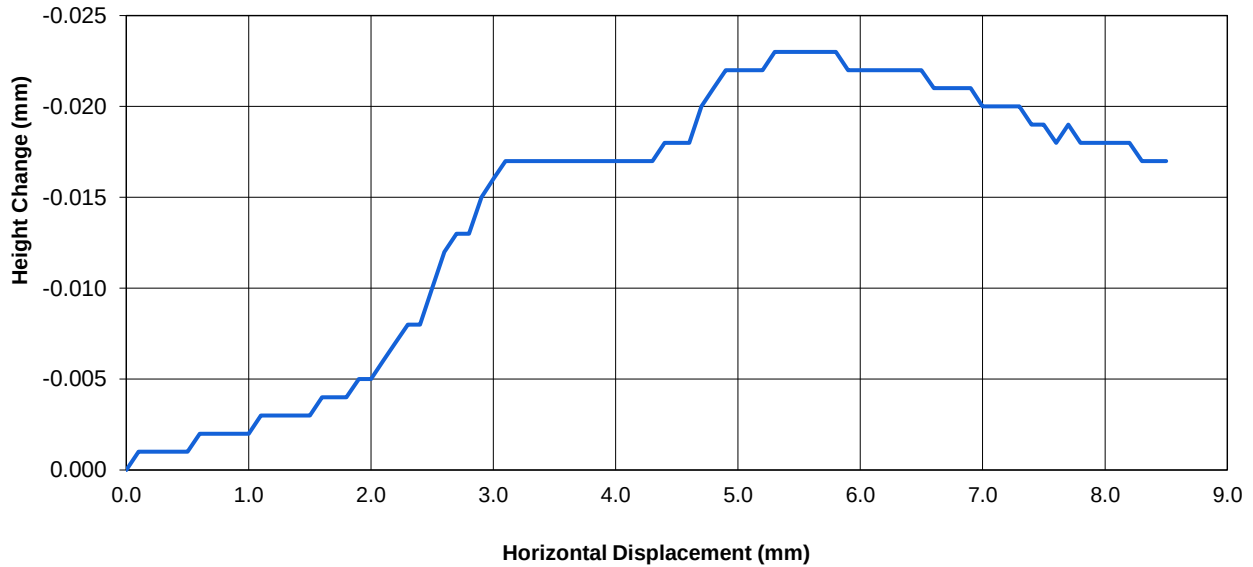
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP08
Depth (m) 19.50-19.95
Sample Type B

Description:

Grey gravelly SAND with rare mica crystals.
Gravel is fine to medium.

Specimen: 1**Shear Stage**

Tested by JJR
Checked and Approved by
[Redacted]

P Heritage - Project Manager
26/07/2023

Project Number:

GEO / 38343

Project Name:

**ARDERSIER PORT
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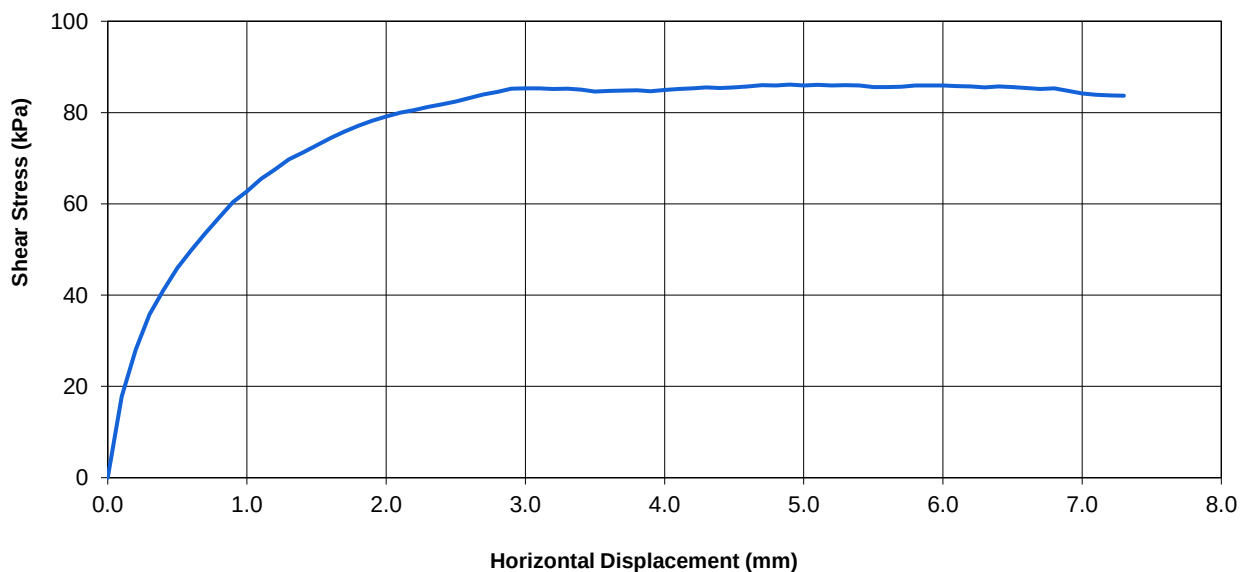
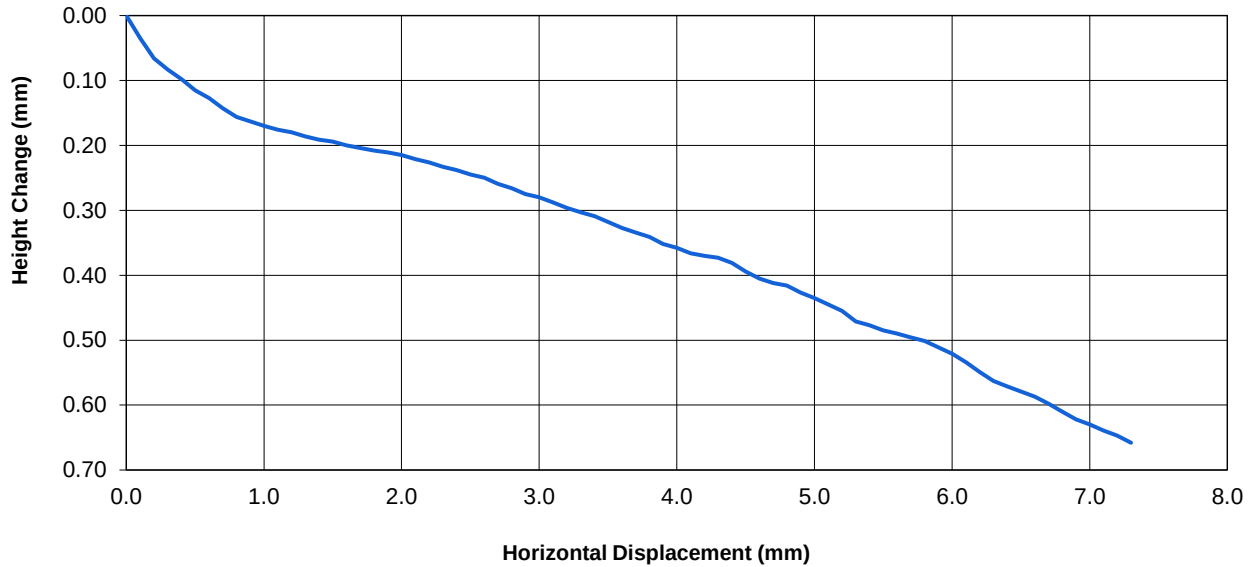
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP08
Depth (m) 19.50-19.95
Sample Type B

Description:

Grey gravelly SAND with rare mica crystals.
Gravel is fine to medium.

Specimen: 2**Shear Stage**

Tested by JJR
Checked and Approved by
[Redacted]

P Heritage - Project Manager
26/07/2023

Project Number:

GEO / 38343

Project Name:

**ARDERSIER PORT
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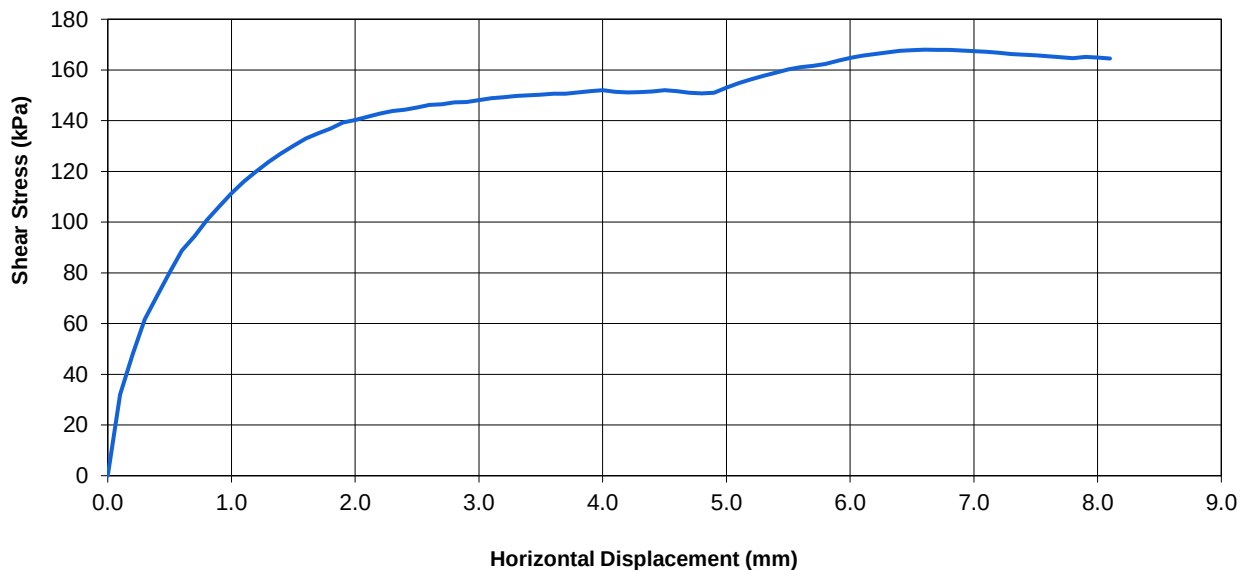
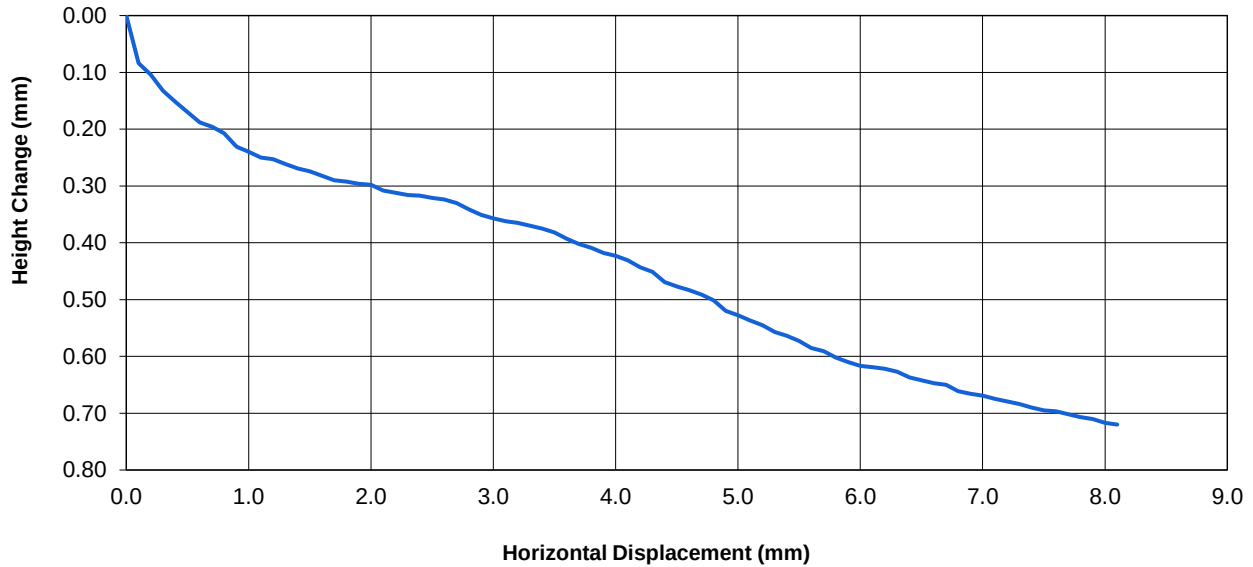
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP08
Depth (m) 19.50-19.95
Sample Type B

Description:

Grey gravelly SAND with rare mica crystals.
Gravel is fine to medium.

Specimen: 3**Shear Stage**

Tested by JJR
Checked and Approved by
[Redacted]

P Heritage - Project Manager
26/07/2023

Project Number:

GEO / 38343

Project Name:

**ARDERSIER PORT
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DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP08
 Depth (m) 25.50-25.95
 Sample Type B

Description:

Grey gravelly fine to medium SAND with rare shell fragments.

Specimen Details

Depth within original sample *m* n/a
 Orientation within original sample n/a
 Test condition Submerged
 Preparation < 2 mm material remoulded at existing water content to a relative density of 50% ¹

Particle density *Mg/m³* 2.65 (assumed)

Specimen Number		1	2	3
Length	<i>mm</i>	59.78	60.05	60.03
Width	<i>mm</i>	59.77	60.03	60.03
Height	<i>mm</i>	25.08	25.06	25.13
Initial water content	%	24.5	24.5	24.5
Initial bulk density	<i>Mg/m³</i>	1.67	1.66	1.66
Initial dry density	<i>Mg/m³</i>	1.34	1.33	1.33
Initial voids ratio		0.971	0.987	0.992
Degree of Saturation	%	66.9	65.8	65.5

Shearing Stage

	<i>kPa</i>	75	150	300
Normal stress				
Peak Conditions:				
Rate of horizontal displacement	<i>mm/min</i>	0.4	0.4	0.4
Maximum shear stress	<i>kPa</i>	51.9	103.9	199.4
Horizontal displacement at MSS	<i>mm</i>	6.9	8.8	9.1
Vertical Displacement at Peak	<i>mm</i>	0.38	0.34	0.84

	%	24.8	25.7	25.9
Final water content				
Duration	<i>day(s)</i>	1	1	1

Shear Strength Parameters

	<i>kPa</i>	Peak Condition
Apparent Cohesion		4
Angle of Shearing Resistance	<i>degrees</i>	33.0

Notes: ¹ Maximum dry density = 1.61 Mg/m³ and minimum dry density = 1.13 Mg/m³

Tested by JJR
 Checked and Approved by

[Redacted]

P Heritage - Project Manager
 26/07/2023

Project Number:

GEO / 38343

Project Name:

ARDERSIER PORT
S23053

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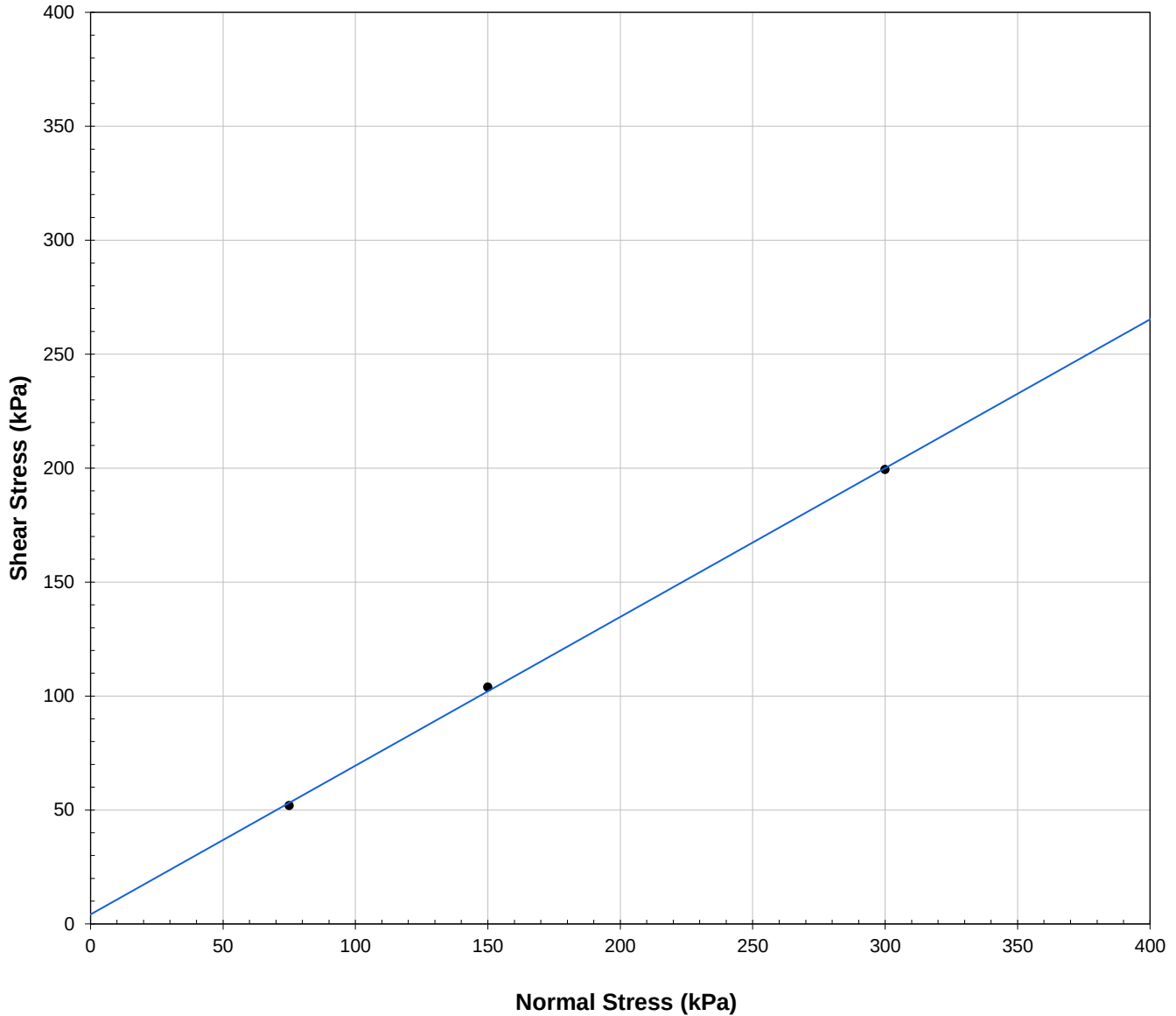
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP08
Depth (m) 25.50-25.95
Sample Type B

Description:

Grey gravelly fine to medium SAND with rare shell fragments.

Shear Stress v Normal Stress

Tested by JJR
Checked and Approved by
[Redacted]

P Heritage - Project Manager
26/07/2023

Project Number:

GEO / 38343

Project Name:

**ARDERSIER PORT
S23053****GEOLABS**®

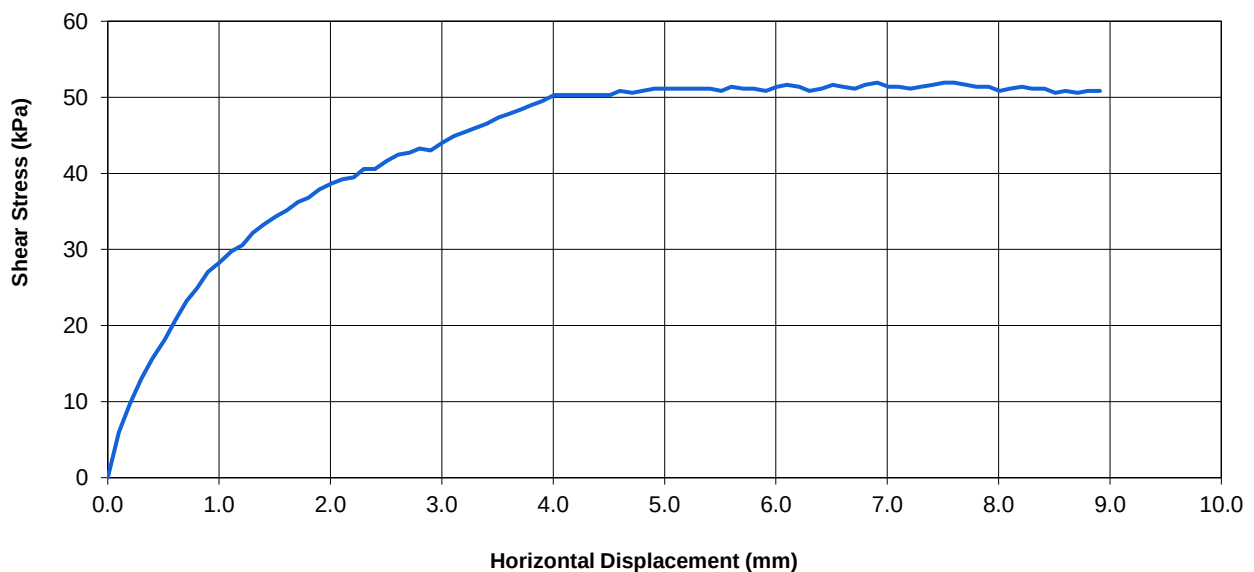
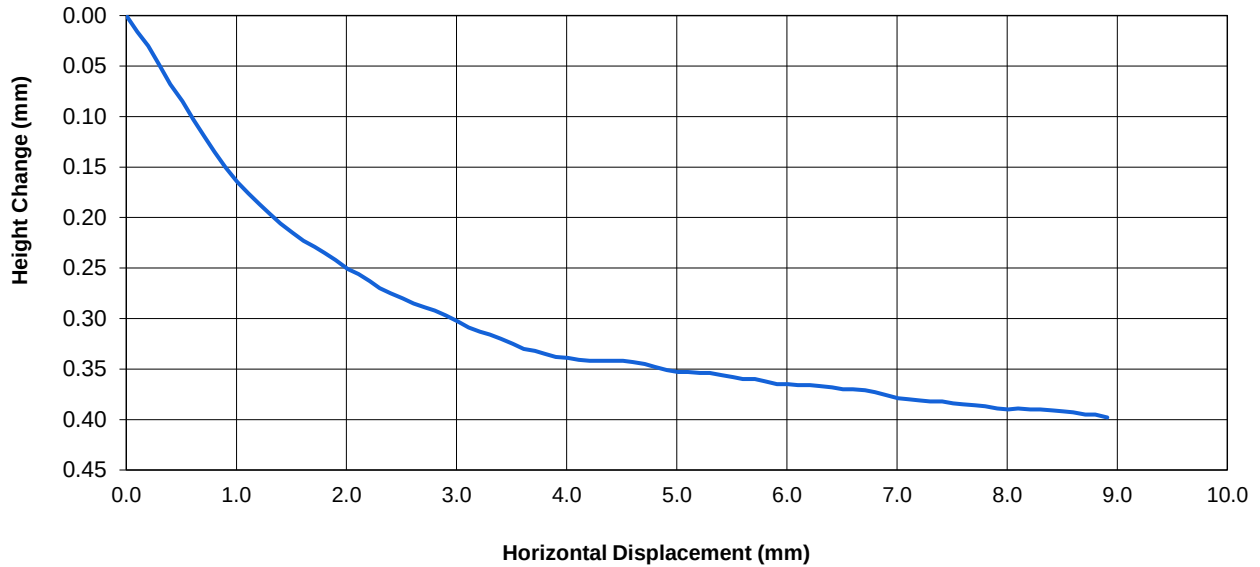
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP08
Depth (m) 25.50-25.95
Sample Type B

Description:

Grey gravelly fine to medium SAND with rare shell fragments.

Specimen: 1**Shear Stage**

Tested by JJR
Checked and Approved by
[Redacted]

P Heritage - Project Manager
26/07/2023

Project Number:

GEO / 38343

Project Name:

**ARDERSIER PORT
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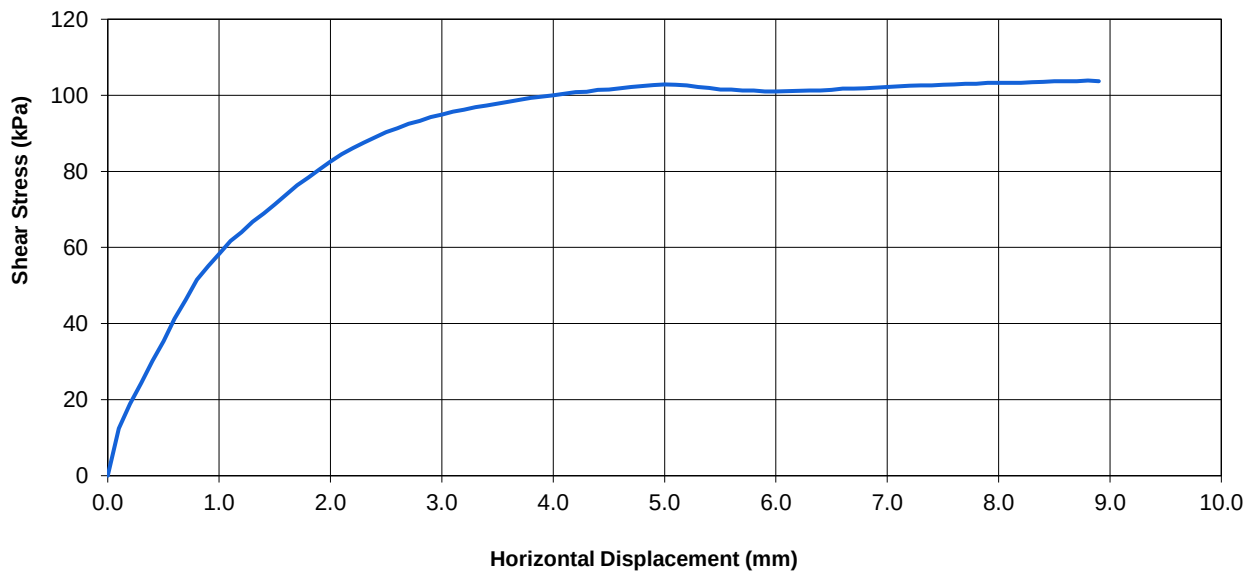
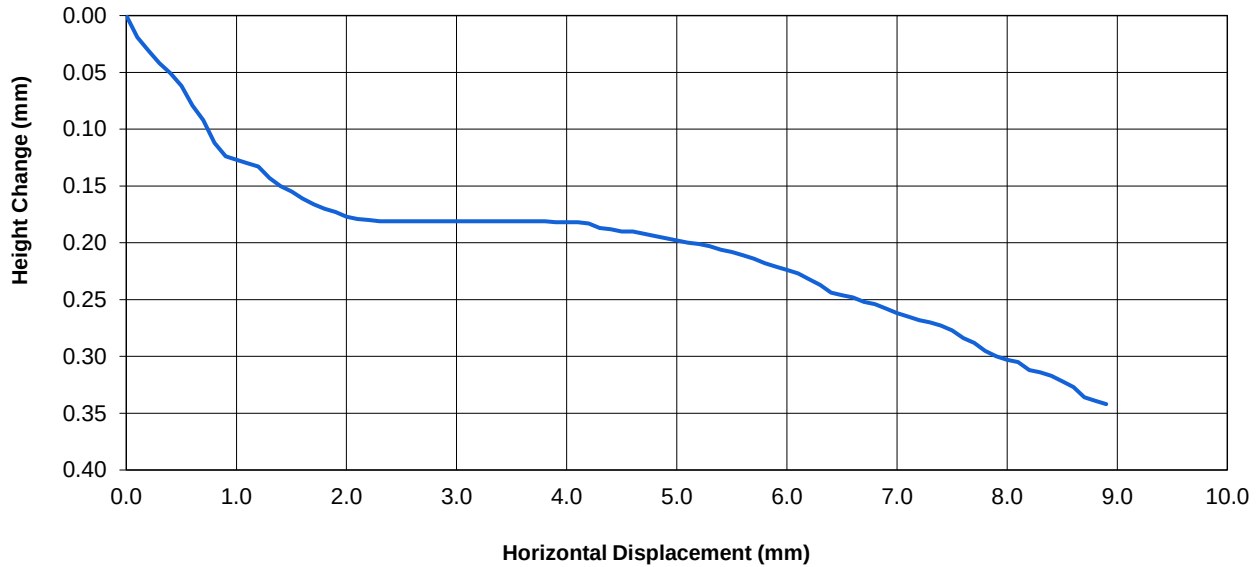
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP08
Depth (m) 25.50-25.95
Sample Type B

Description:

Grey gravelly fine to medium SAND with rare shell fragments.

Specimen: 2**Shear Stage**

Tested by JJR
Checked and Approved by
[Redacted]

P Heritage - Project Manager
26/07/2023

Project Number:

GEO / 38343

Project Name:

**ARDERSIER PORT
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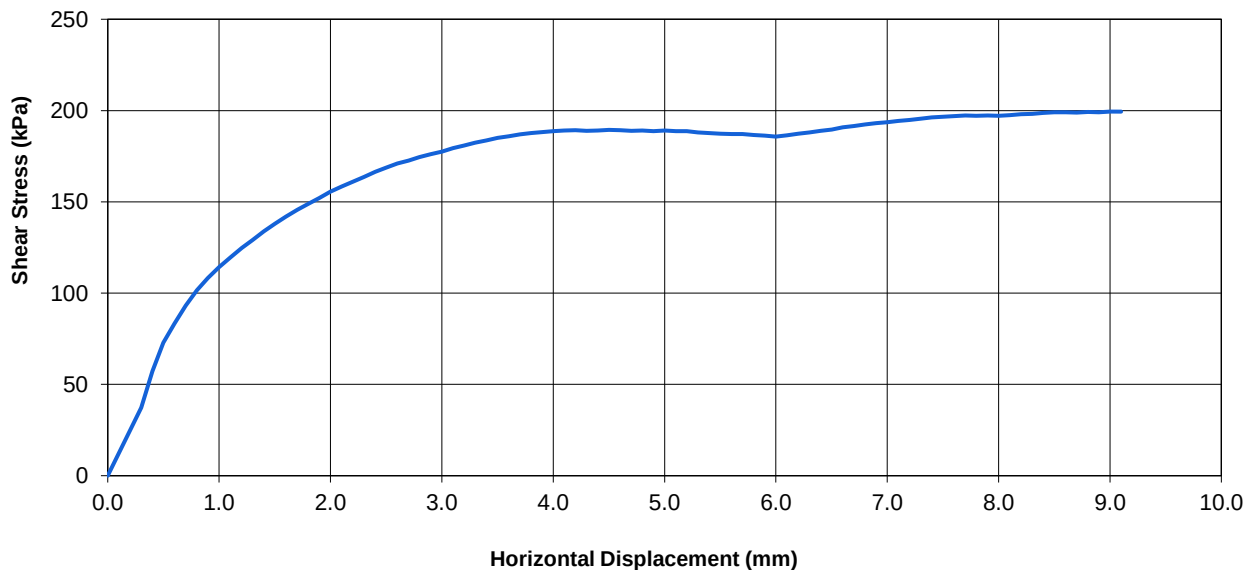
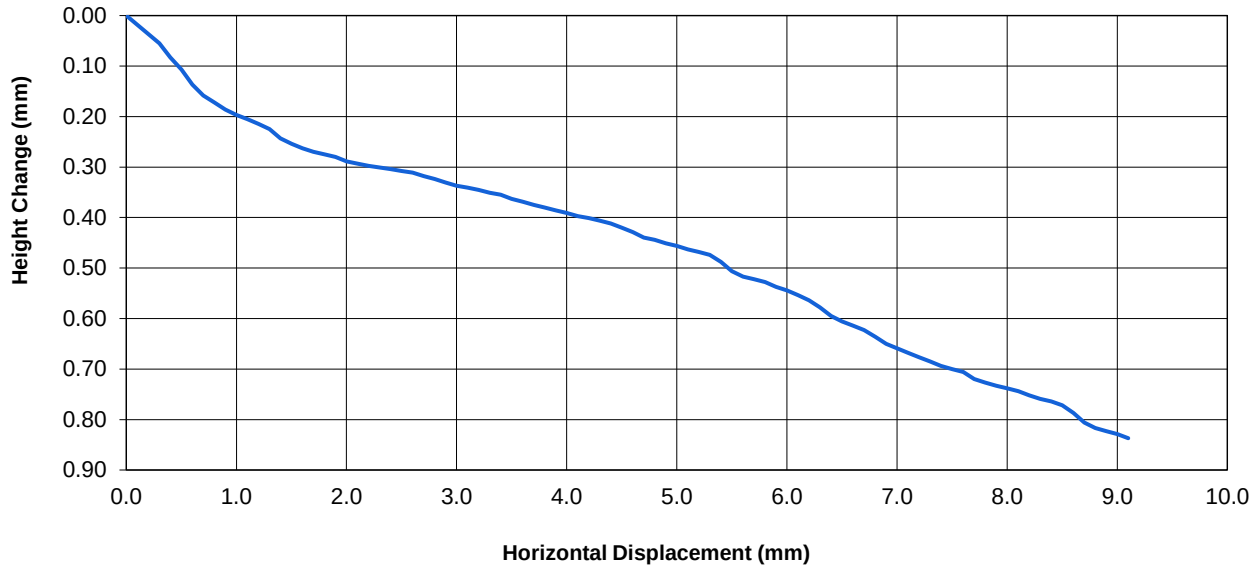
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP08
Depth (m) 25.50-25.95
Sample Type B

Description:

Grey gravelly fine to medium SAND with rare shell fragments.

Specimen: 3**Shear Stage**

Tested by JJR
Checked and Approved by
[Redacted]

P Heritage - Project Manager
26/07/2023

Project Number:

GEO / 38343

Project Name:

**ARDERSIER PORT
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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP08	Description: Yellowish brown slightly gravelly SAND. Gravel is fine.
Depth (m): 7.00-7.45	

SPECIMEN DETAILS Depth within original sample Remarks	NA Orientation within original sample: NA Remoulded to a target 10.0 % MC and a target dry density of 1.525 Mg/m ³		
TEST DETAILS Specimen Type and Preparation Cell Preparation Specimen Number Initial Diameter mm Initial Length mm Initial Water Content % Initial Wet Density Mg/m ³ Drainage Conditions	B (Remoulded) Checks performed in accordance with Clause 3.5 Multistage 69.54 140.19 10.4 1.68 One end only		
SATURATION STAGE Final Cell Pressure kPa Final Pore Pressure kPa Final Pore Pressure Parameter B Duration day(s)	Method: Clause 5.2 630 615 1.00 6		
CONSOLIDATION STAGE Cell Pressure kPa Back Pressure kPa Effective Pressure kPa Final Pore Pressure kPa Final Pore Pressure Dissipation % Duration day(s)	Stage No 1 630 600 30 600 100 1	Stage No 2 660 600 60 600 100 2	Stage No 3 720 600 120 601 100 0
SHEARING STAGE Cell Pressure kPa Rate of Axial Displacement mm/min Initial Pore Pressure kPa Initial Effective Stress kPa	630 0.015 600 30	660 0.012 600 60	720 0.015 601 119
CONDITIONS AT FAILURE criteria Pore Pressure kPa Minor Effective Principal Stress kPa Deviator Stress kPa Major Effective Principal Stress kPa Volume Change mL Volumetric Strain % Axial Strain % Membrane correction applied to Deviator Stress kPa Duration day(s)	Maximum deviator stress 600 30 131 161 -2.78 -0.5 1.1 0 1		
Final Water Content % Final Wet Density Mg/m ³	26.0 1.95		
EFFECTIVE STRESS PARAMETERS Cohesion kPa Angle of Shear Resistance degrees	3.3 39.5		
FAILURE SKETCH			

Checked and Approved by [Redacted] P Heritage - Project Manager 05/09/2023	Project Number: GEO / 38343 Project Name: ARDERSIER PORT S23053	GEOLABS 

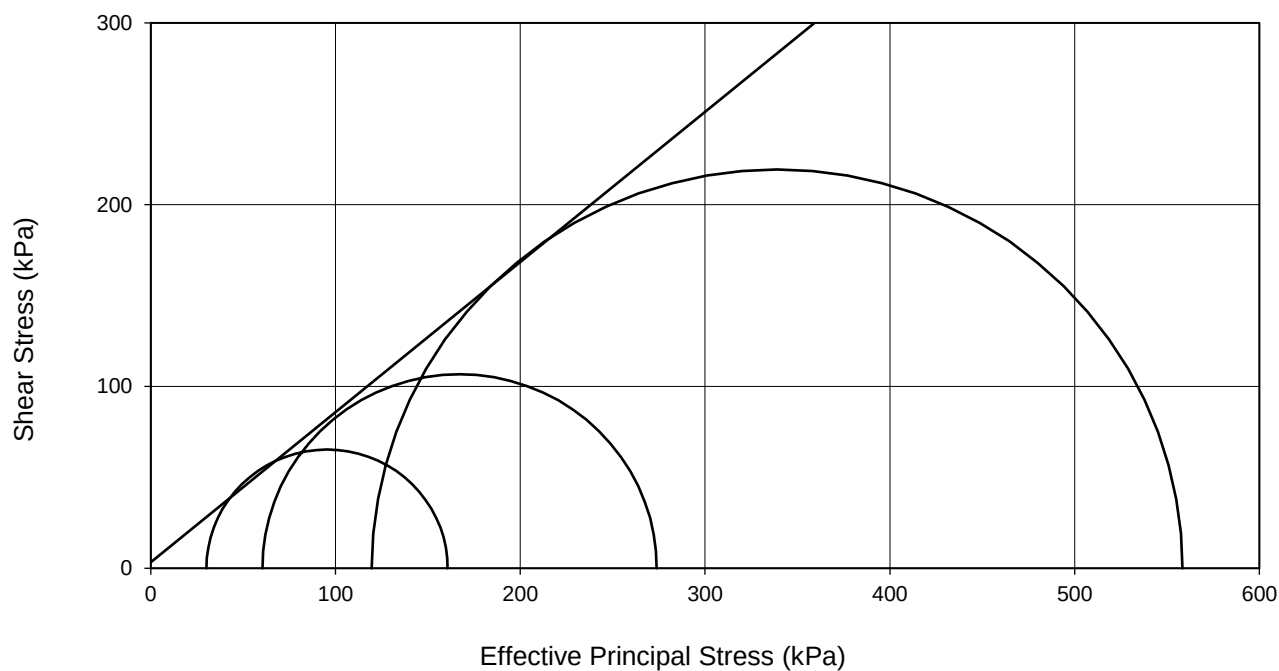
Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP08

Depth (m): 7.00-7.45

Description:

Yellowish brown slightly gravelly SAND. Gravel is fine.



Checked and Approved by

[Redacted]

P Heritage - Project Manager
05/09/2023

Project Number:

GEO / 38343

Project Name:

ARDERSIER PORT
S23053

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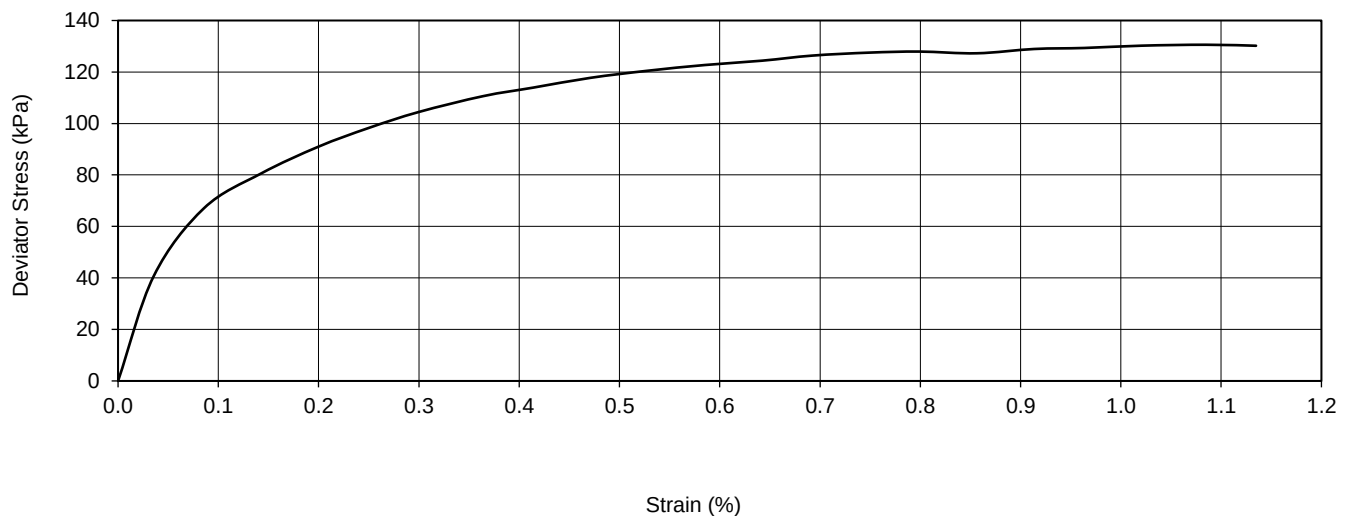
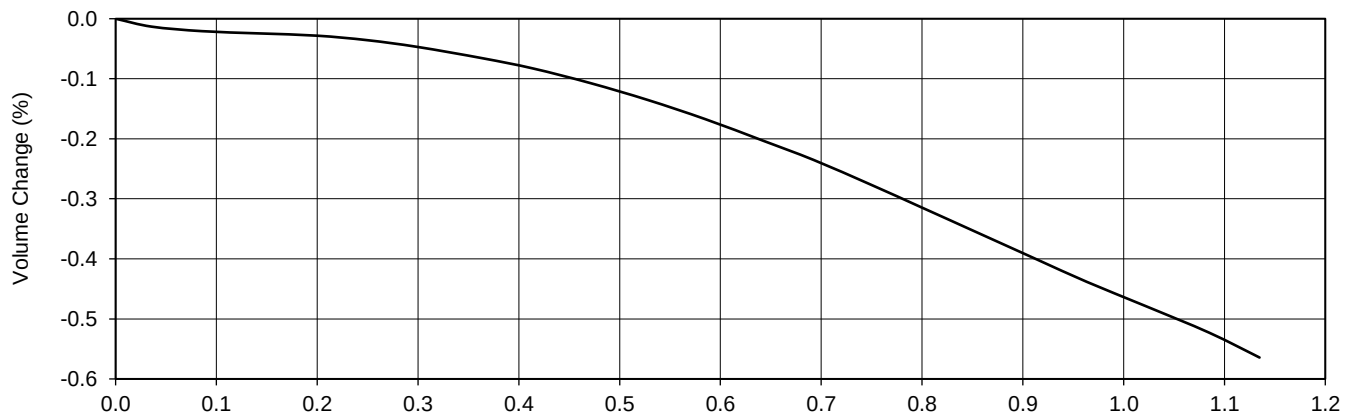
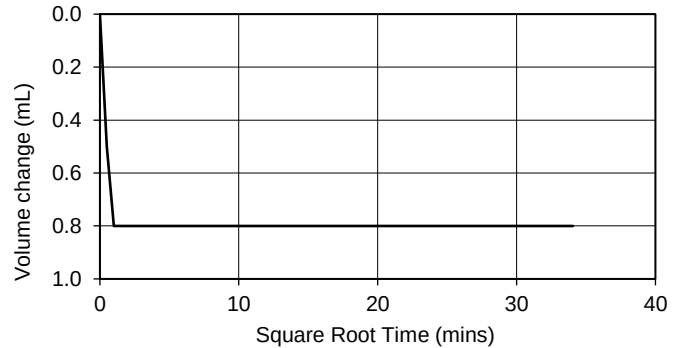
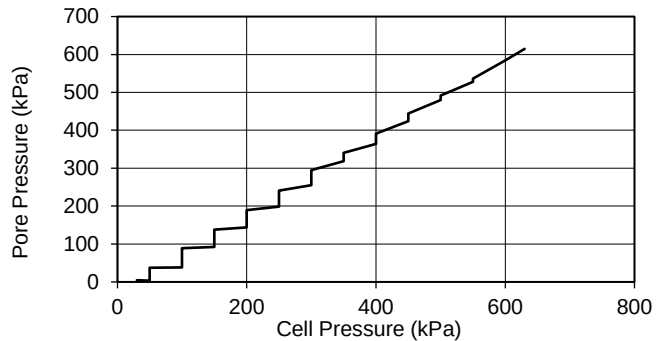


Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP08

Depth (m): 7.00-7.45

Stage No 1



Checked and Approved by

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P Heritage - Project Manager
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Project Number:

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Project Name:

ARDERSIER PORT
S23053

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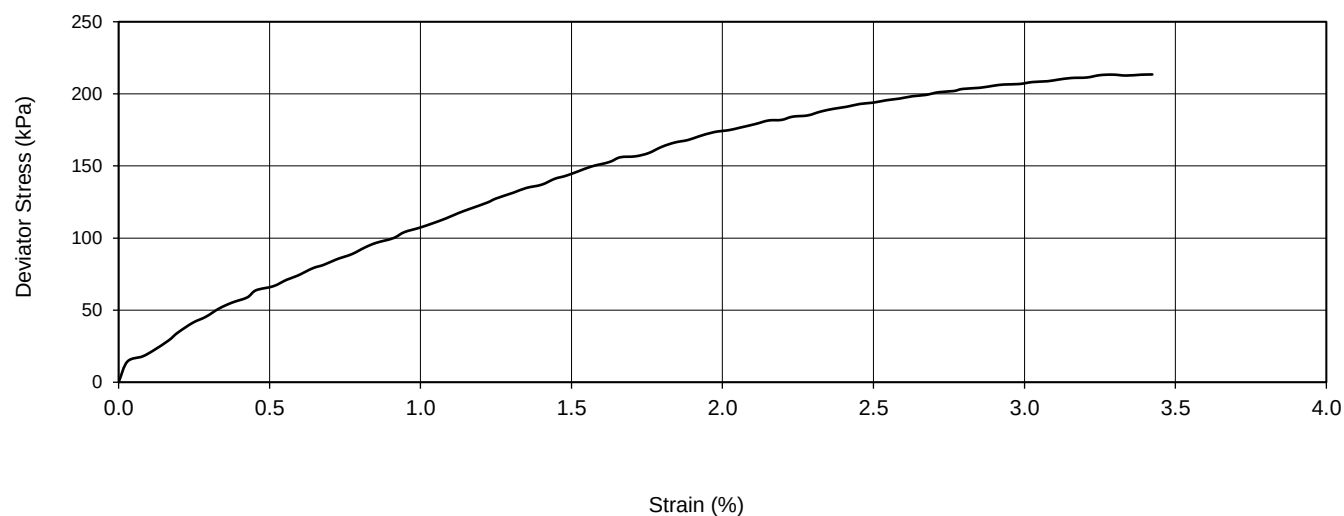
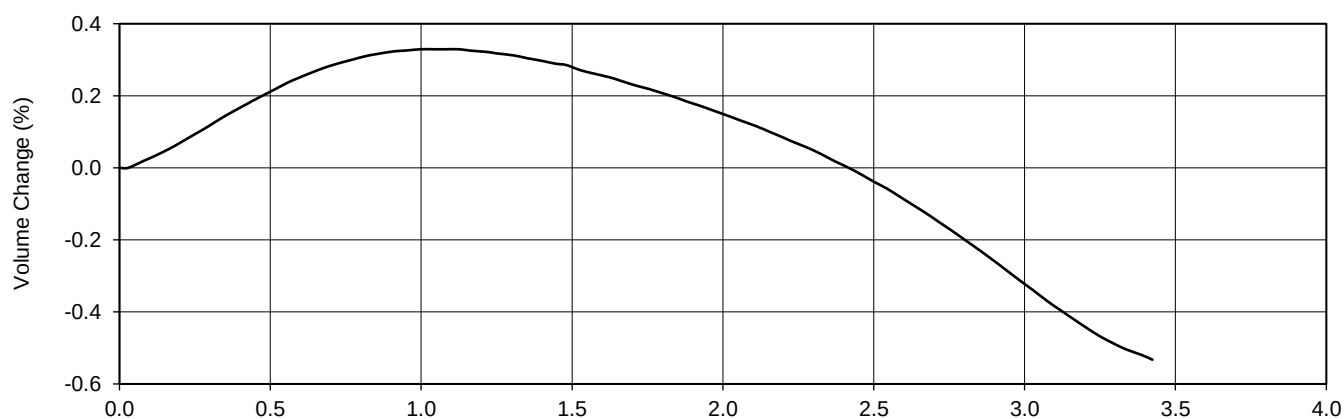
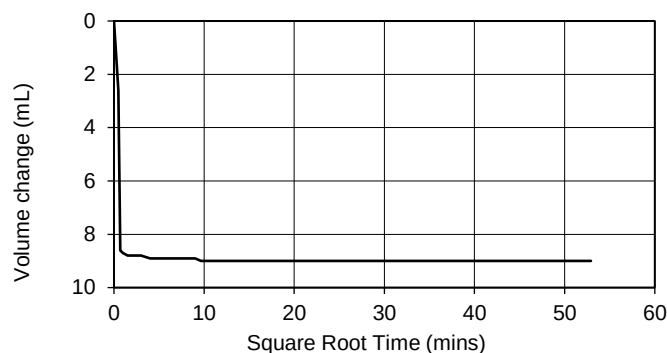


Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP08

Depth (m): 7.00-7.45

Stage No 2



Checked and Approved by

[Redacted]

P Heritage - Project Manager
05/09/2023

Project Number:

GEO / 38343

Project Name:

ARDERSIER PORT
S23053

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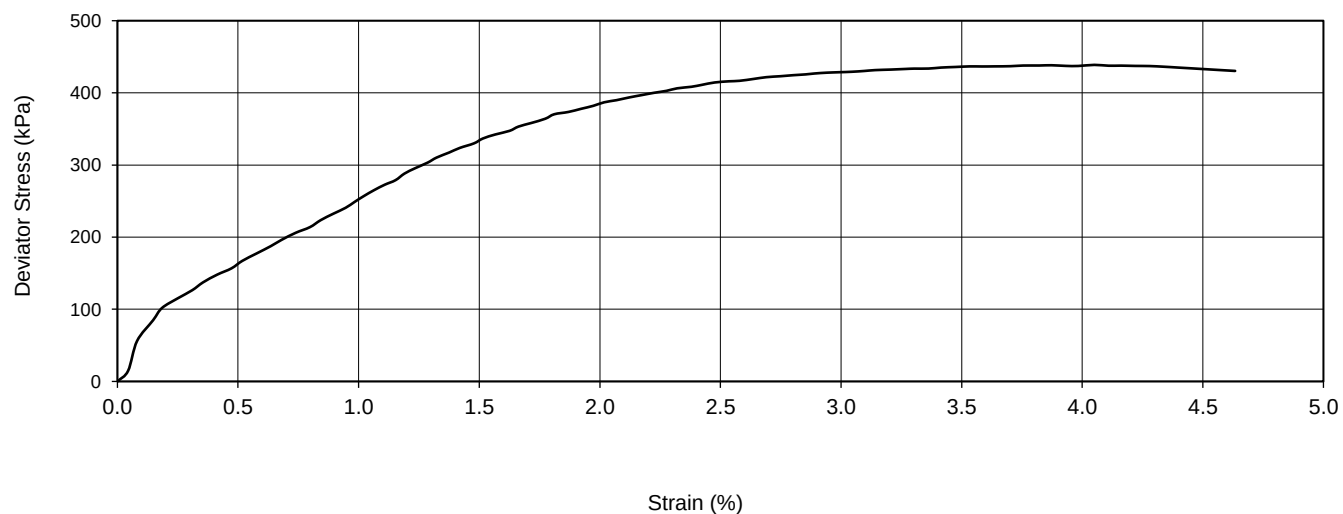
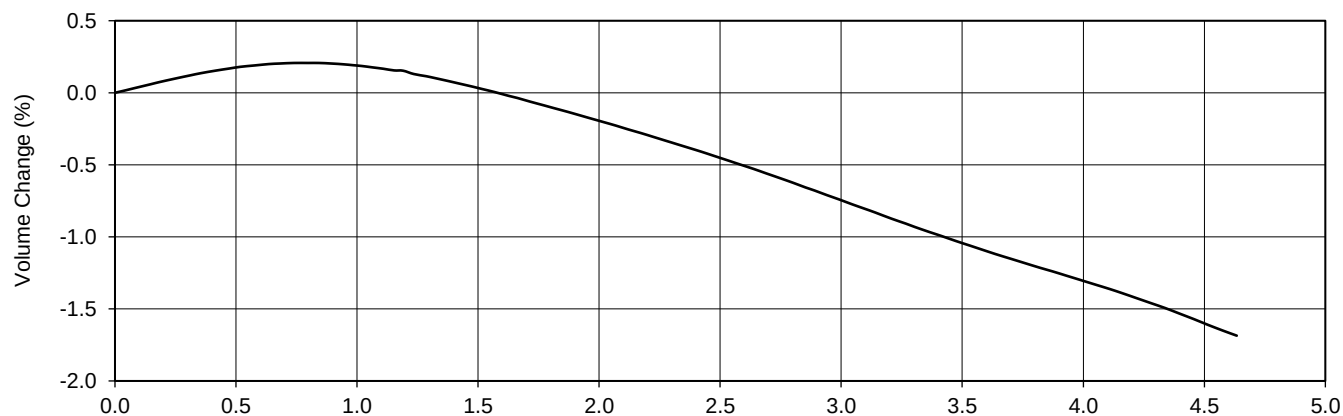
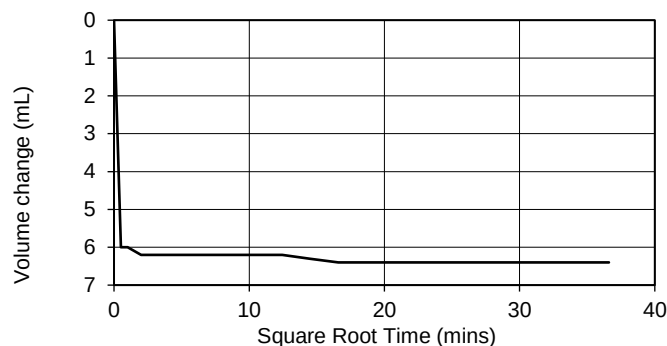


Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP08

Depth (m): 7.00-7.45

Stage No 3

Checked and Approved by
[Redacted]P Heritage - Project Manager
05/09/2023

Project Number:

GEO / 38343

Project Name:

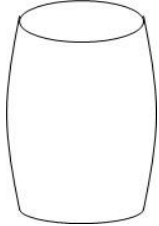
ARDERSIER PORT
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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP08	Description:
Depth (m): 18.00-18.45	Dark grey slightly gravelly SAND. Gravel is fine.

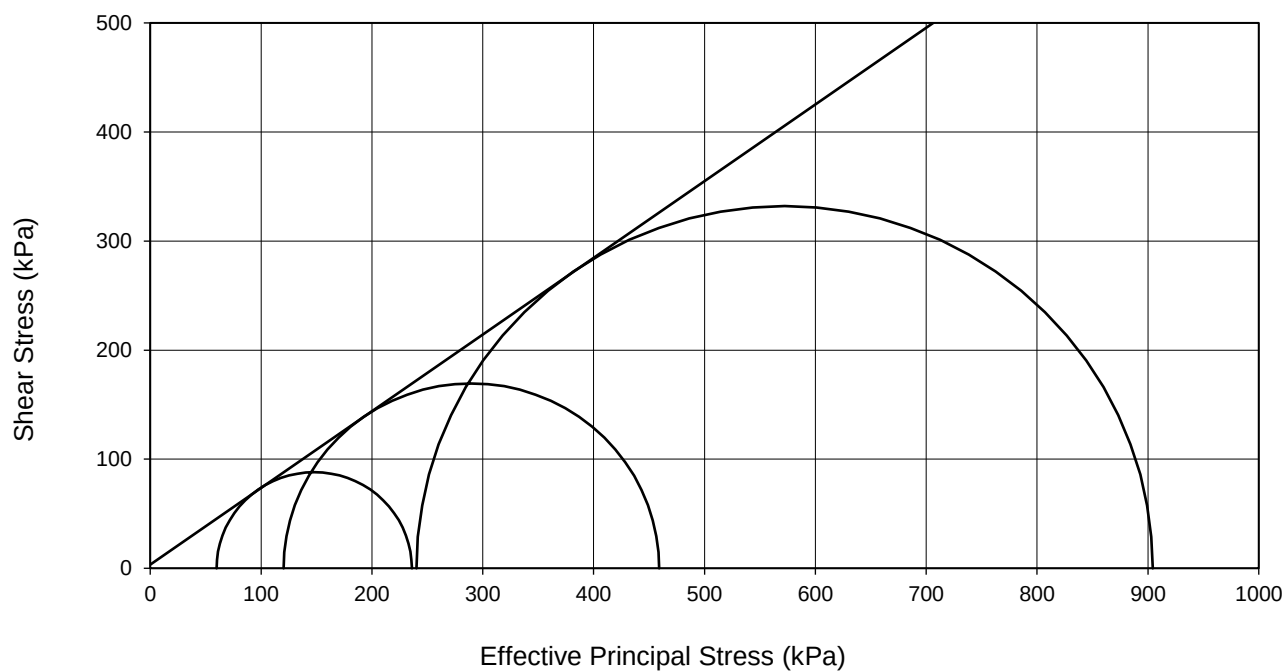
SPECIMEN DETAILS Depth within original sample Remarks	NA Orientation within original sample: NA Remoulded to a target 10.0 % MC and a target dry density of 1.373 Mg/m ³		
TEST DETAILS Specimen Type and Preparation Cell Preparation Specimen Number Initial Diameter mm Initial Length mm Initial Water Content % Initial Wet Density Mg/m ³ Drainage Conditions	B (Remoulded) Checks performed in accordance with Clause 3.5 Multistage 69.54 140.19 10.5 1.52 One end only		
SATURATION STAGE Final Cell Pressure kPa Final Pore Pressure kPa Final Pore Pressure Parameter B Duration day(s)	Method: Clause 5.2 660 644 1.00 6		
CONSOLIDATION STAGE Cell Pressure kPa Back Pressure kPa Effective Pressure kPa Final Pore Pressure kPa Final Pore Pressure Dissipation % Duration day(s)	Stage No 1 660 600 60 600 100 1	Stage No 2 720 600 120 600 100 1	Stage No 3 840 600 240 600 100 1
SHEARING STAGE Cell Pressure kPa Rate of Axial Displacement mm/min Initial Pore Pressure kPa Initial Effective Stress kPa	660 0.015 600 60	720 0.015 600 120	840 0.020 600 240
CONDITIONS AT FAILURE criteria Pore Pressure kPa Minor Effective Principal Stress kPa Deviator Stress kPa Major Effective Principal Stress kPa Volume Change mL Volumetric Strain % Axial Strain % Membrane correction applied to Deviator Stress kPa Duration day(s)	Maximum deviator stress 600 120 339 459 -1.61 -0.3 2.5 0 1		
Final Water Content % Final Wet Density Mg/m ³	31.2 1.84		
EFFECTIVE STRESS PARAMETERS Cohesion kPa Angle of Shear Resistance degrees	3.3 35		
FAILURE SKETCH			

Checked and Approved by [Redacted] P Heritage - Project Manager 05/09/2023	Project Number: GEO / 38343 Project Name: ARDERSIER PORT S23053	GEOLABS 

Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP08
Depth (m): 18.00-18.45

Description:
Dark grey slightly gravelly SAND. Gravel is fine.



Checked and Approved by

[Redacted]

P Heritage - Project Manager
05/09/2023

Project Number:

GEO / 38343

Project Name:

**ARDERSIER PORT
S23053**

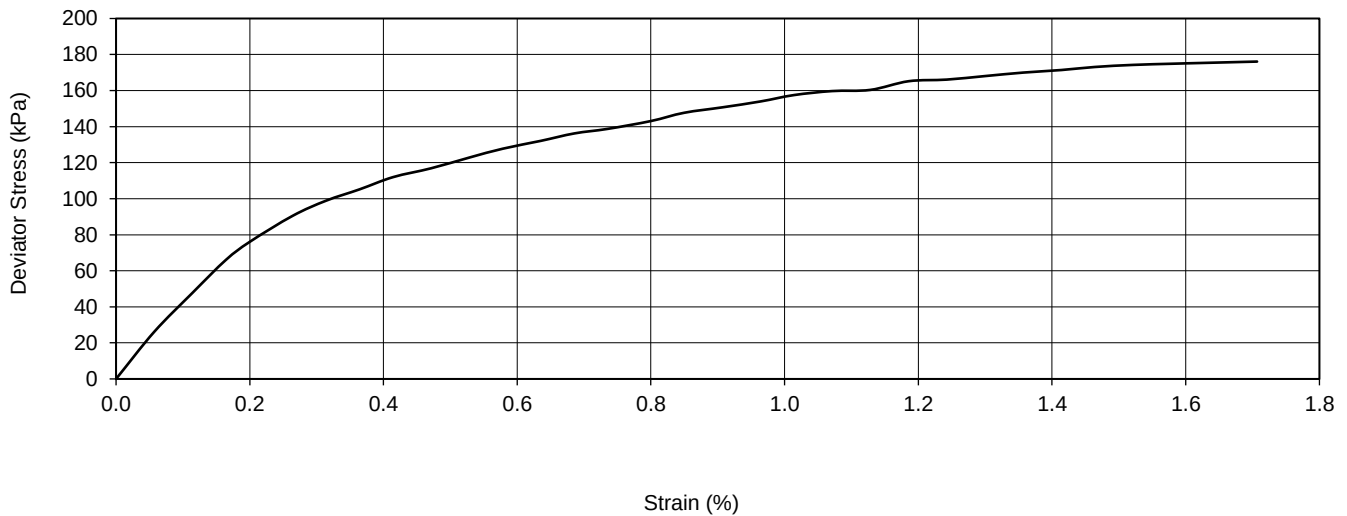
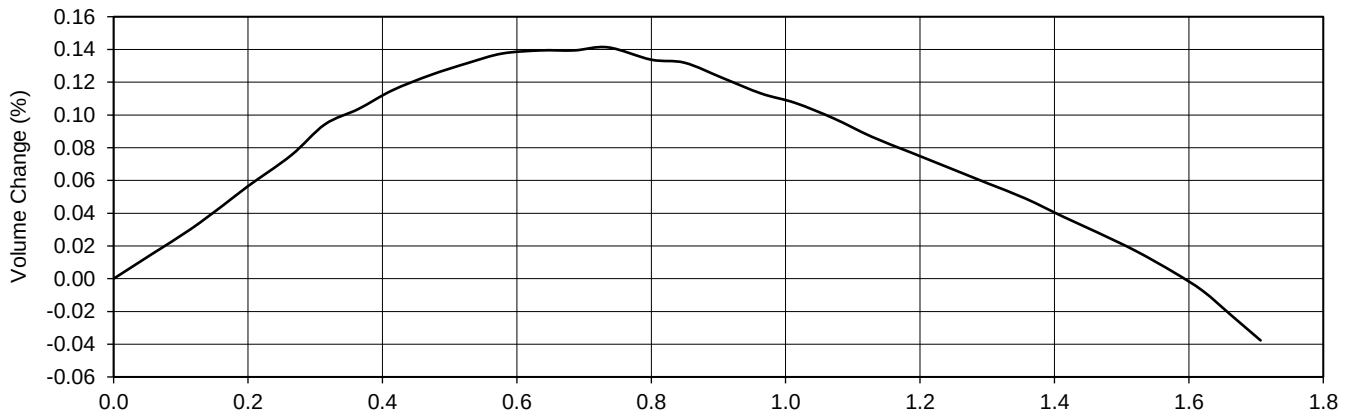
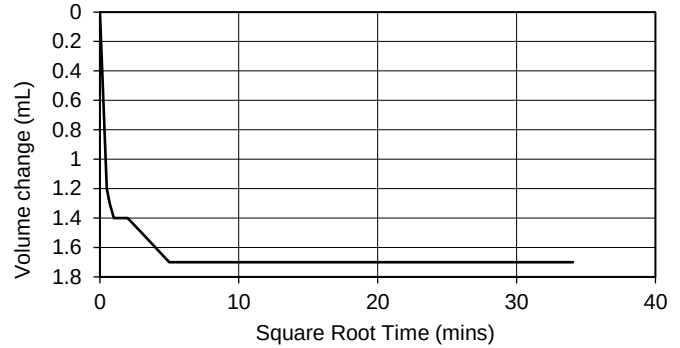
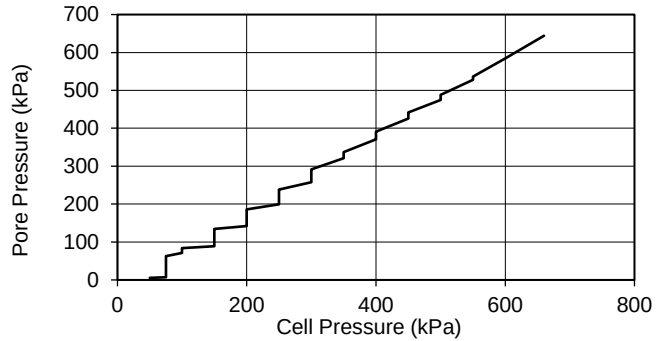
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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP08
Depth (m): 18.00-18.45

Stage No 1



Checked and Approved by

[Redacted]

P Heritage - Project Manager
05/09/2023

Project Number:

GEO / 38343

Project Name:

ARDERSIER PORT
S23053

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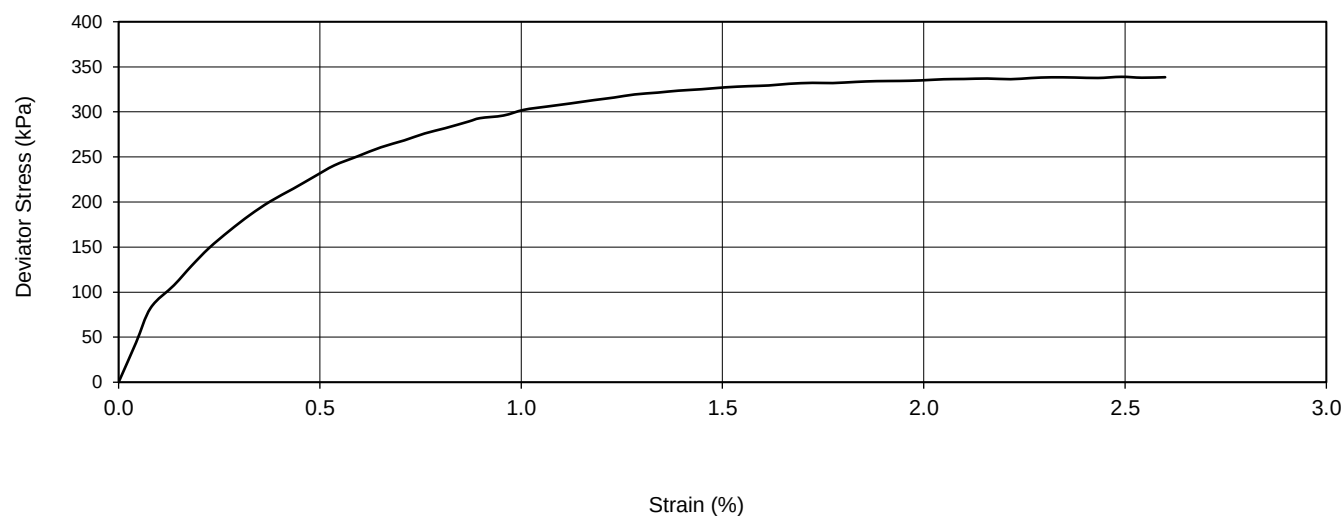
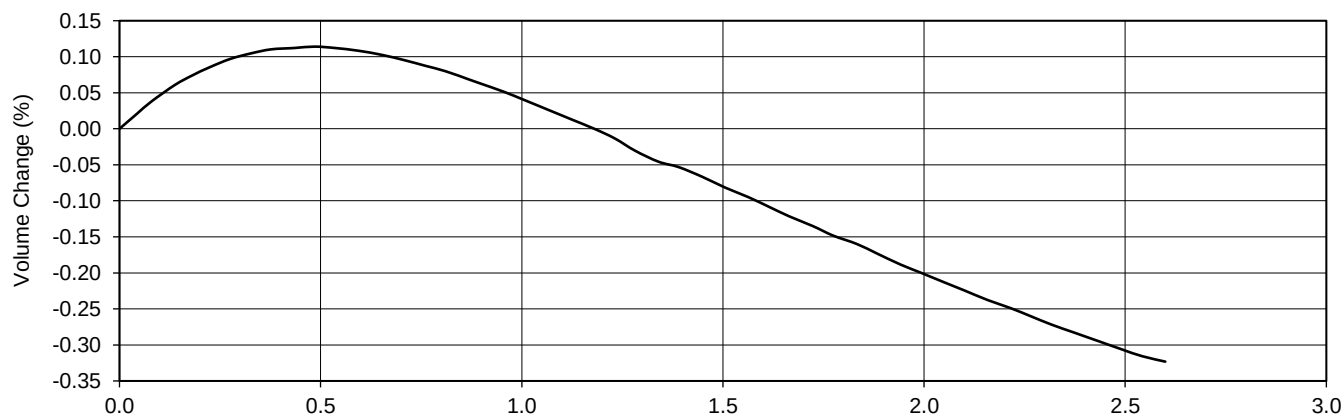
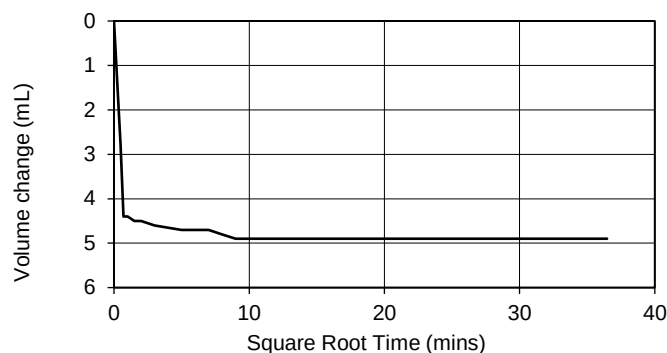


Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP08

Depth (m): 18.00-18.45

Stage No 2

Checked and Approved by
[Redacted]P Heritage - Project Manager
05/09/2023

Project Number:

GEO / 38343

Project Name:

ARDERSIER PORT
S23053

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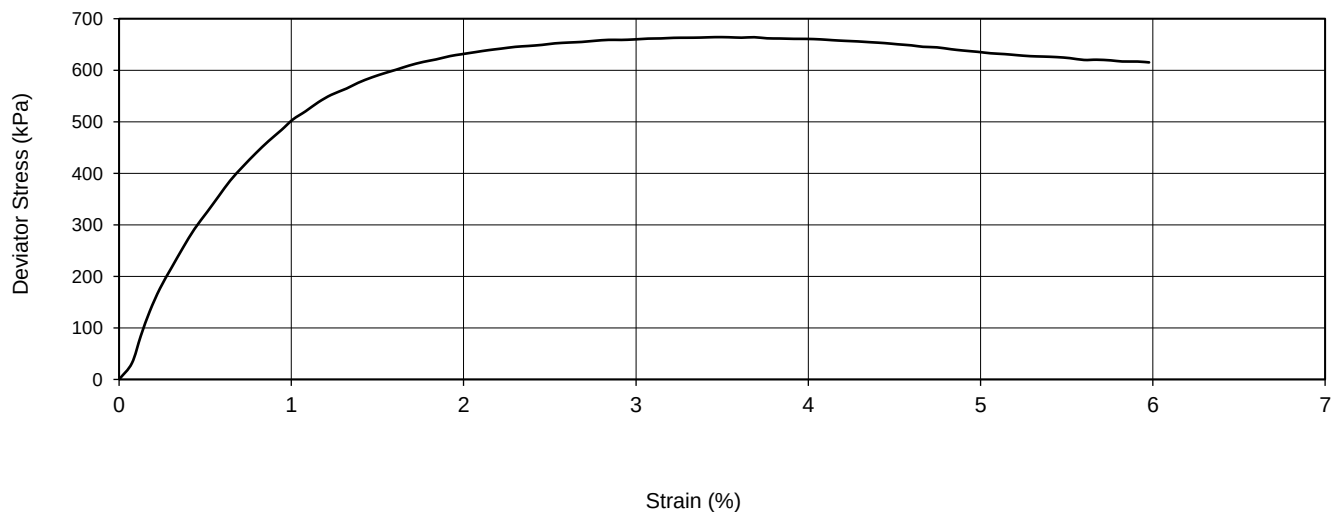
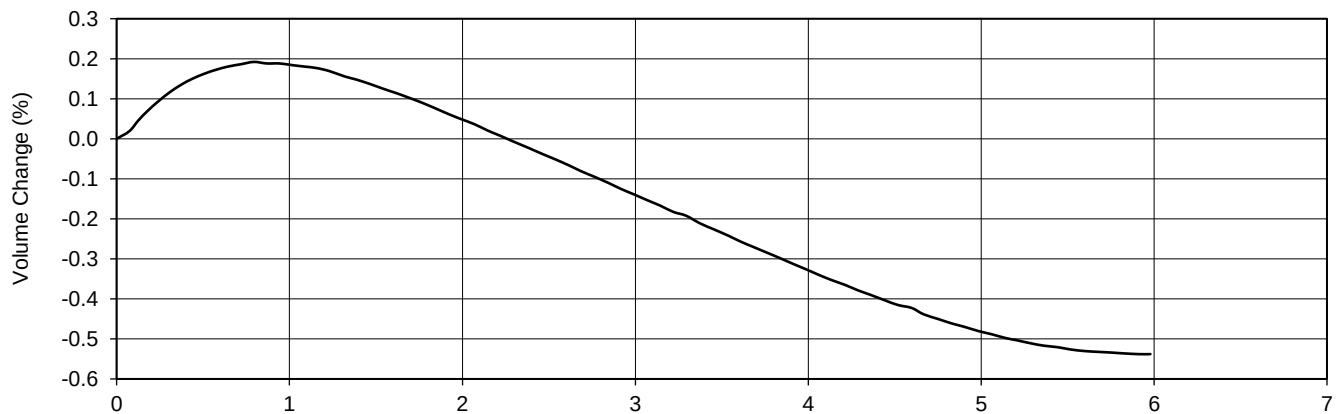
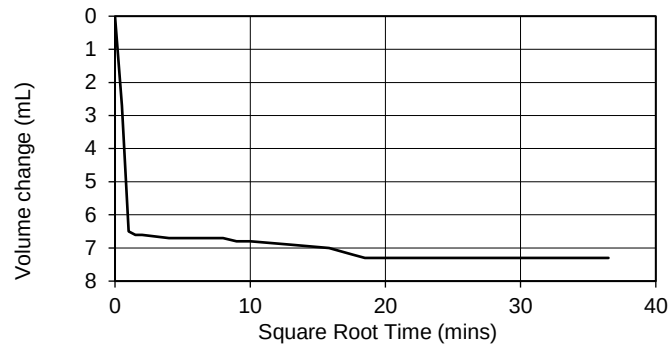


Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP08

Depth (m): 18.00-18.45

Stage No 3

Checked and Approved by
[Redacted]P Heritage - Project Manager
05/09/2023

Project Number:

GEO / 38343

Project Name:

ARDERSIER PORT
S23053

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GEOLABS Limited
Bucknalls Lane
Garston
Watford
Hertfordshire
WD25 9XX

Tel: +44(0) 1923 892 190
Fax: +44(0) 1923 892 191
email: admin@geolabs.co.uk
web: www.geolabs.co.uk

Solmek
12 Yarm Road
Stockton-on-Tees
TS18 3NA

06 September 2023

Report No : GEO/38342/01

Page 1 of 1

For the attention of Mr A Cutts

Our ref **GEO / 38342**
Your Ref **S230503**

Date samples received 22/06/2023
Date written instructions received 27/06/2023
Date testing commenced 28/06/2023
Date of sample disposal 04/10/2023

Project **ARDERSIER PORT**

Further to your instructions we have pleasure in enclosing the results of the tests you requested in the attached figures.

LABORATORY TEST REPORT

Item No	Test Quantity	Description
1	5	Maximum & Minimum Density
2	3	Shear Strength by Direct Shear
3	2	Isotropic Consolidated Drained Multistage Triaxial Compression (CIDM)

Any opinions or interpretations expressed herein are outside the scope of UKAS accreditation. All results contained in this report are provisional unless signed by an approved signatory. The results contained in this report relate only to samples received in the laboratory and are tested 'as received' unless otherwise stated. This report should not be reproduced, except in full, without the written approval of the laboratory. The results reported are applicable only to the test items received by the laboratory.

All the necessary data required by the documented test procedures has been recorded and will be stored for a period of not less than 6 years. This data will be issued to yourselves at your request. All samples will be disposed of after the date shown above. Written confirmation will be required to retain the samples beyond this period and a storage charge may be applied.

We trust that the above meets your requirements and should you require any further information or assistance, please do not hesitate to contact us.

Yours faithfully
on behalf of **GEOLABS Limited**

[Redacted]

S Burke
Senior Technician



Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP09
Depth (m) 6.00-6.45
Sample Type B

Description:

Brown and greyish brown gravelly fine to medium SAND. Gravel is medium to coarse.

Percentage of material retained on the 2 mm test sieve 11.3 %

The fines content was measured to be 3.2 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.65 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.646	g/cm ³
Maximum dry density after surcharge application	1.658	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.636	g/cm ³
Maximum dry density after surcharge application	1.649	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.20 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.12 g

Mass of sand	Run		
	1	532.97	g
	2	534.62	g
	3	534.78	g
	4	533.87	g
	5	534.88	g
	Minimum	534.22	g

Checked and Approved by

[Redacted]

C F Wallace - Technical Director
19/07/2023

Project Number:

38342

Project Name:

**ARDERSIER PORT
S230503**

GEOLABS®

Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP09
Depth (m) 12.00-12.45
Sample Type B

Description:

Brown and brownish grey slightly silty gravelly fine to medium SAND.

Percentage of material retained on the 2 mm test sieve 12.3 %

The fines content was measured to be 1.7 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.64 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.607	g/cm ³
Maximum dry density after surcharge application	1.630	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.627	g/cm ³
Maximum dry density after surcharge application	1.643	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.22 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.12 g

Mass of sand	Run		
	1	541.32	g
	2	542.99	g
	3	543.35	g
	4	542.18	g
	5	543.86	g
	Minimum	542.74	g

Checked and Approved by
[Redacted]

C F Wallace - Technical Director
19/07/2023

Project Number:

38342

Project Name:

**ARDERSIER PORT
S230503**

GEOLABS®

Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP09
Depth (m) 15.00-15.45
Sample Type B

Description:

Brown and greyish brown gravelly fine to medium SAND.

Percentage of material retained on the 2 mm test sieve 11.3 %

The fines content was measured to be 3.2 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.65 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.646	g/cm ³
Maximum dry density after surcharge application	1.658	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.636	g/cm ³
Maximum dry density after surcharge application	1.649	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.20 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.12 g

Mass of sand	Run		
	1	532.97	g
	2	534.62	g
	3	534.78	g
	4	533.87	g
	5	534.88	g
	Minimum	534.22	g

Checked and Approved by

[Redacted]

C F Wallace - Technical Director
19/07/2023

Project Number:

38342

Project Name:

**ARDERSIER PORT
S230503**

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Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP09
Depth (m) 21.00-21.45
Sample Type B

Description:

Grey and greyish brown slightly silty gravelly fine to medium SAND.

Percentage of material retained on the 2 mm test sieve 26.1 % **(please note)**

The fines content was measured to be 2.6 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.71 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.694	g/cm ³
Maximum dry density after surcharge application	1.710	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.690	g/cm ³
Maximum dry density after surcharge application	1.705	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.24 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.11 g

Mass of sand	Run		
	1	551.11	g
	2	550.69	g
	3	553.71	g
	4	552.05	g
	5	553.00	g
	Minimum	552.11	g

Checked and Approved by
[Redacted]

C F Wallace - Technical Director
19/07/2023

Project Number:

38342

Project Name:

**ARDERSIER PORT
S230503**

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Determination of Maximum and Minimum Dry Density of Sands

NGI-Geolabs Recommended Method Statement (As published in 'Development of new robust procedures for the determination of maximum and minimum dry densities of sand' by Knudsen.S et al at ISFOG 2020 {delayed publication})

Location BHSP09
Depth (m) 23.00
Sample Type B

Description:

Brownish grey gravelly fine to medium SAND. Gravel is medium to coarse.

Percentage of material retained on the 2 mm test sieve 5.4 %

The fines content was measured to be 2.3 %, so within the 12 % permitted fines

Maximum Dry Density

Mean Maximum Dry Density **1.60 g/cm³**
(after surcharge application)

Determination No 1

Maximum dry density before surcharge application	1.590	g/cm ³
Maximum dry density after surcharge application	1.602	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Determination No 2

Maximum dry density before surcharge application	1.590	g/cm ³
Maximum dry density after surcharge application	1.602	g/cm ³
Shaker amplitude setting before surcharge application	2	
Shaker amplitude setting after surcharge application	2	

Minimum Dry Density

Minimum Dry Density **1.21 g/cm³**

Water calibrated volume of the mould 443.90 cm³

Mass of the mould 897.12 g

Mass of sand	Run		
	1	537.27	g
	2	538.16	g
	3	538.88	g
	4	539.02	g
	5	538.80	g
	Minimum	538.43	g

Checked and Approved by

[Redacted]

C F Wallace - Technical Director
19/07/2023

Project Number:

38342

Project Name:

**ARDERSIER PORT
S230503**

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DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP09
 Depth (m) 6.00-6.45
 Sample Type B

Description:

Brown gravelly fine to medium SAND. Gravel is fine.

Specimen Details

Depth within original sample *m* n/a
 Orientation within original sample n/a
 Test condition Submerged
 Preparation < 2 mm material remoulded at existing water content to a relative density of 80% ¹

Particle density *Mg/m³* 2.65 (assumed)

Specimen Number		1	2	3
Length	<i>mm</i>	59.94	59.94	59.94
Width	<i>mm</i>	60.04	60.04	60.04
Height	<i>mm</i>	21.80	21.84	21.92
Initial water content	%	7.8	7.8	7.8
Initial bulk density	<i>Mg/m³</i>	1.66	1.65	1.65
Initial dry density	<i>Mg/m³</i>	1.54	1.53	1.53
Initial voids ratio		0.724	0.727	0.734
Degree of Saturation	%	28.6	28.4	28.2

Shearing Stage

	<i>kPa</i>	25	50	100
Normal stress				
Peak Conditions:				
Rate of horizontal displacement	<i>mm/min</i>	0.18	0.18	0.18
Maximum shear stress	<i>kPa</i>	21.0	41.1	80.7
Horizontal displacement at MSS	<i>mm</i>	0.3	0.6	0.7
Vertical Displacement at Peak	<i>mm</i>	-0.10	-0.13	-0.13

	%	20.2	19.7	19.5
Final water content				
Duration	<i>day(s)</i>	1	1	1

Shear Strength Parameters

	<i>kPa</i>	Peak Condition
Apparent Cohesion		1
Angle of Shearing Resistance	<i>degrees</i>	38.5

Notes: ¹ Maximum dry density = 1.65 Mg/m³ and minimum dry density = 1.20 Mg/m³

Tested by JJR
 Checked and Approved by
 [Redacted]

P Heritage - Project Manager
 03/08/2023

Project Number:

GEO / 38342

Project Name:

ARDERSIER PORT
S230503

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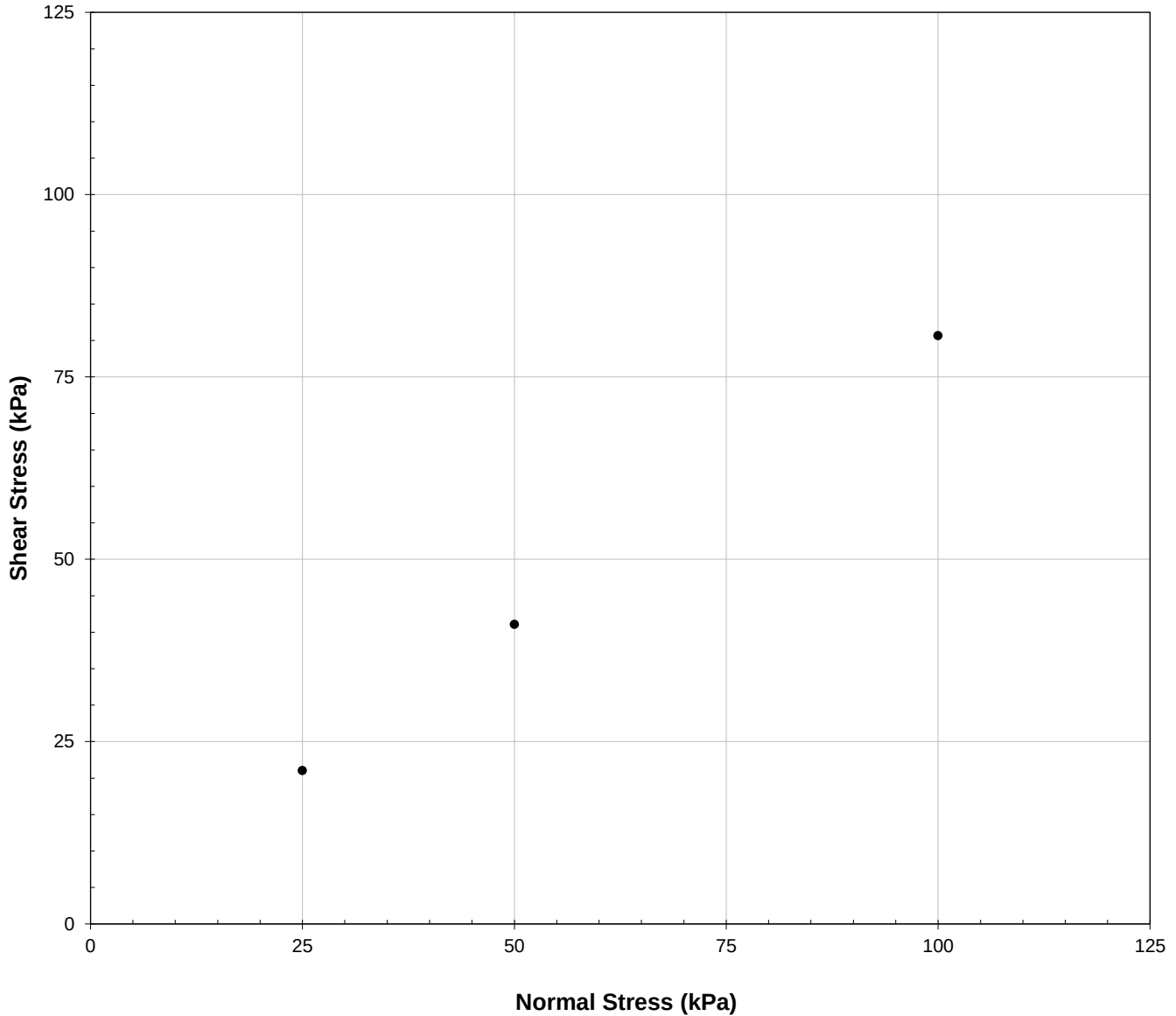
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP09
Depth (m) 6.00-6.45
Sample Type B

Description:

Brown gravelly fine to medium SAND. Gravel is fine.

Shear Stress v Normal Stress**Peak: $c' = 1$** **$\Phi' = 38.5$**

Tested by JJR
Checked and Approved by
[Redacted]

P Heritage - Project Manager
03/08/2023

Project Number:

GEO / 38342

Project Name:

**ARDERSIER PORT
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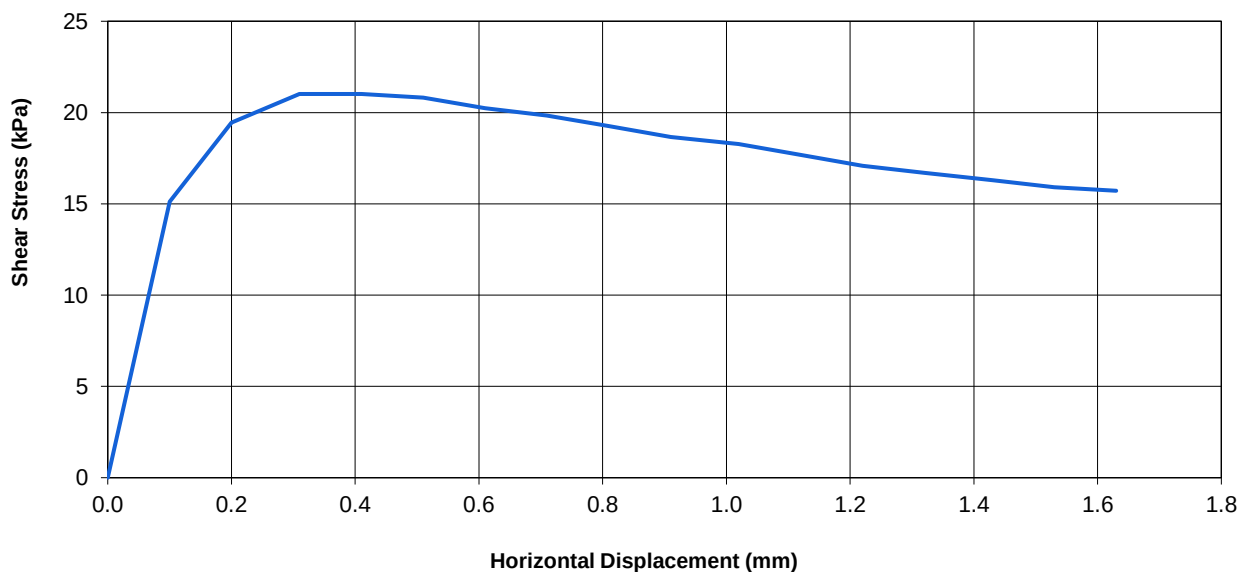
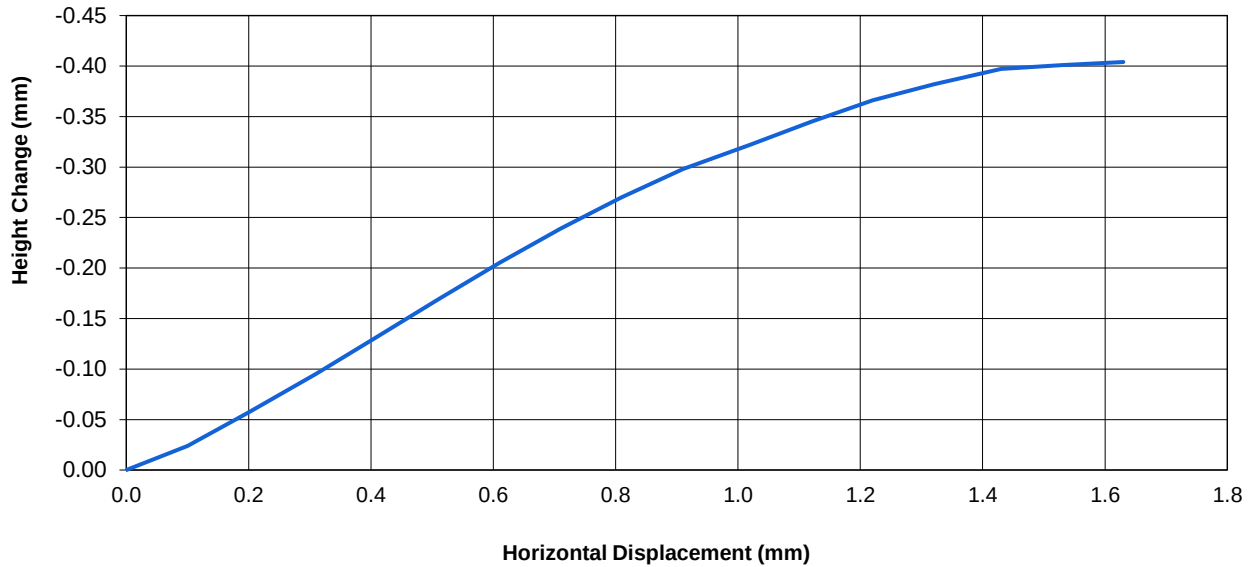
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP09
Depth (m) 6.00-6.45
Sample Type B

Description:

Brown gravelly fine to medium SAND. Gravel is fine.

Specimen: 1**Shear Stage**

Tested by JJR
Checked and Approved by
[Redacted]

P Heritage - Project Manager
03/08/2023

Project Number:

GEO / 38342

Project Name:

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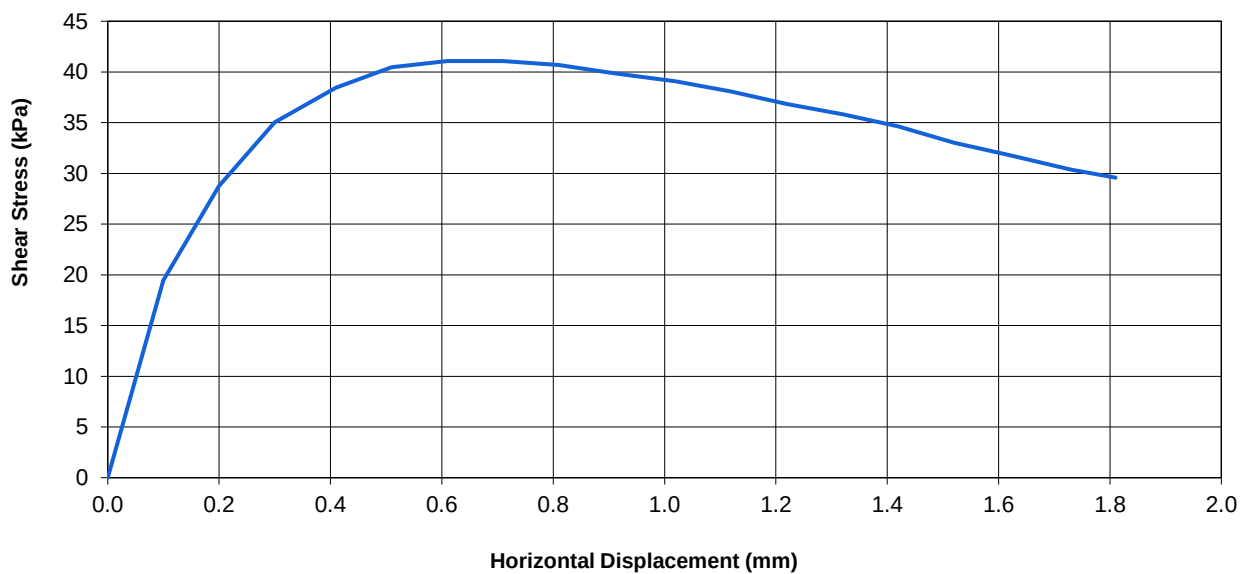
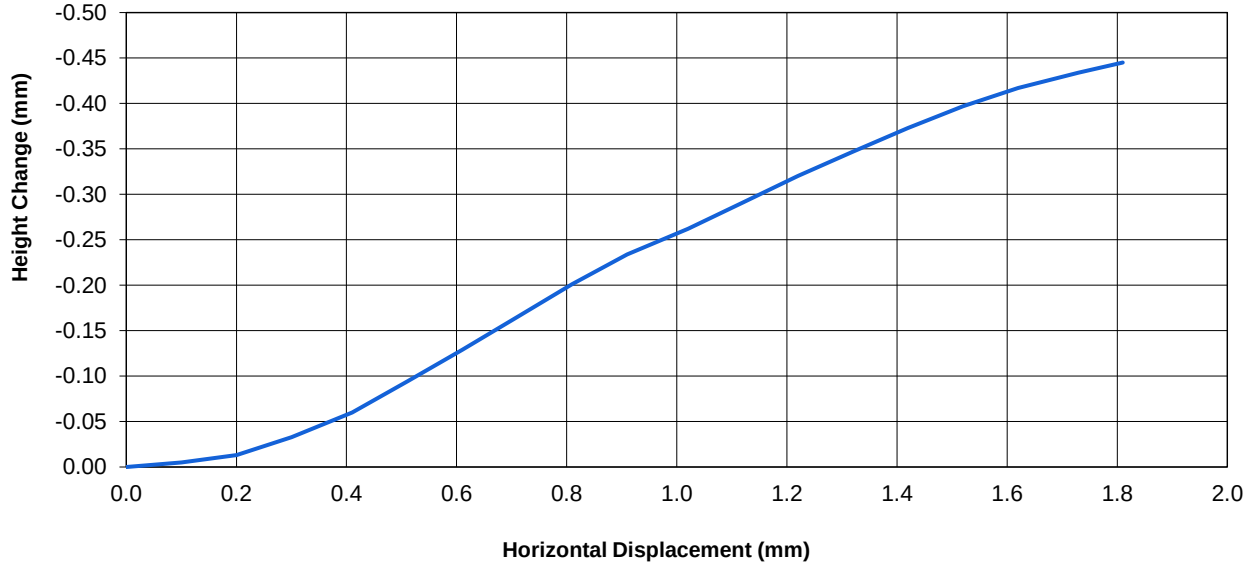
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP09
Depth (m) 6.00-6.45
Sample Type B

Description:

Brown gravelly fine to medium SAND. Gravel is fine.

Specimen: 2**Shear Stage**

Tested by JJR
Checked and Approved by
[Redacted]

P Heritage - Project Manager
03/08/2023

Project Number:

GEO / 38342

Project Name:

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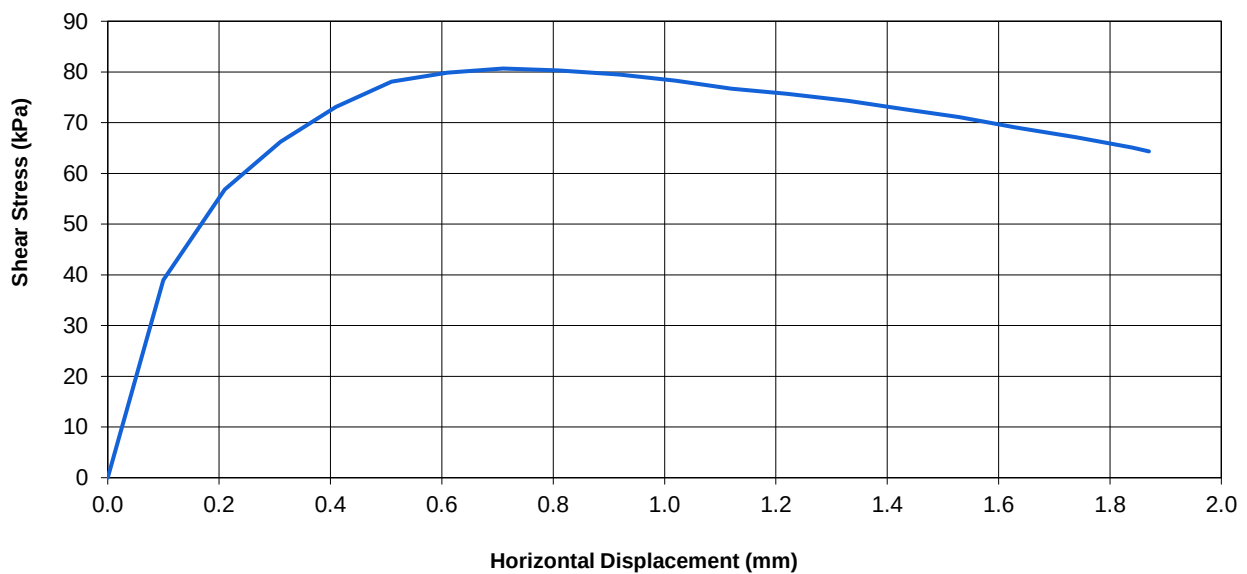
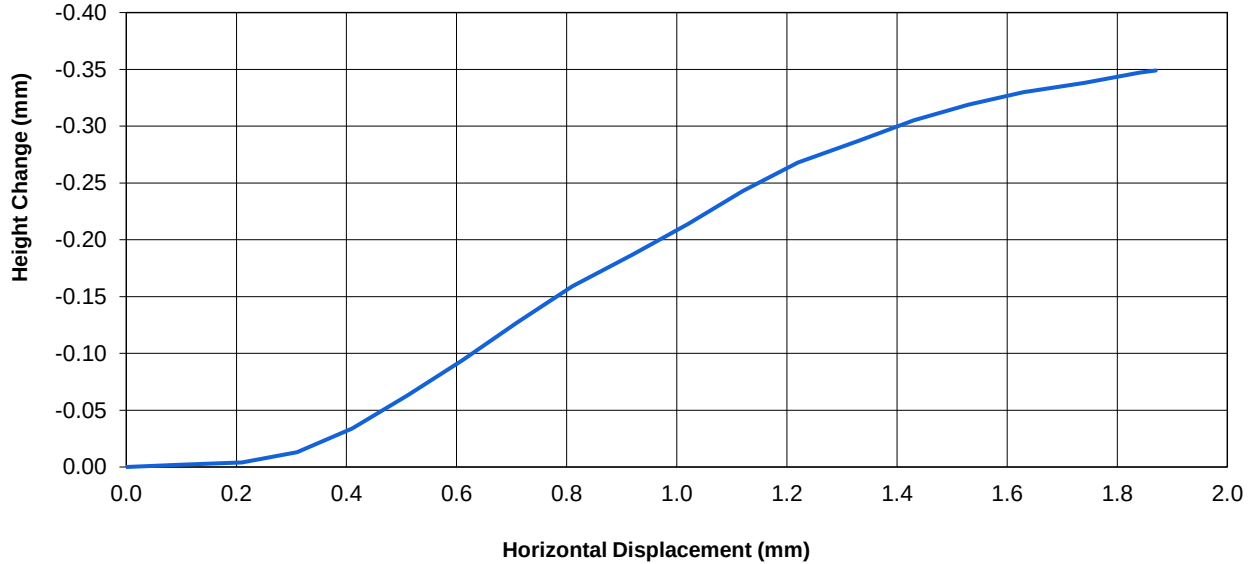
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP09
Depth (m) 6.00-6.45
Sample Type B

Description:

Brown gravelly fine to medium SAND. Gravel is fine.

Specimen: 3**Shear Stage**

Tested by JJR
Checked and Approved by
[Redacted]

P Heritage - Project Manager
03/08/2023

Project Number:

GEO / 38342

Project Name:

**ARDERSIER PORT
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DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP09
 Depth (m) 15.00-15.45
 Sample Type B

Description:

Greyish brown gravelly fine to medium SAND.

Specimen Details

Depth within original sample *m* n/a
 Orientation within original sample n/a
 Test condition Submerged
 Preparation < 2 mm material remoulded at existing water content to a relative density of 75% ¹

Particle density *Mg/m³* 2.65 (assumed)

Specimen Number		1	2	3
Length	<i>mm</i>	60.04	60.05	60.05
Width	<i>mm</i>	60.00	60.00	60.01
Height	<i>mm</i>	23.10	22.93	23.16
Initial water content	%	20.1	20.1	20.1
Initial bulk density	<i>Mg/m³</i>	1.80	1.82	1.80
Initial dry density	<i>Mg/m³</i>	1.50	1.51	1.50
Initial voids ratio		0.766	0.753	0.771
Degree of Saturation	%	69.6	70.8	69.2

Shearing Stage

Normal stress	<i>kPa</i>	45	90	180
Peak Conditions:				
Rate of horizontal displacement	<i>mm/min</i>	0.18	0.18	0.18
Maximum shear stress	<i>kPa</i>	38.7	69.6	130.0
Horizontal displacement at MSS	<i>mm</i>	4.2	6.8	3.5
Vertical Displacement at Peak	<i>mm</i>	0.02	0.59	0.20

Final water content	%	26.1	24.8	25.6
Duration	<i>day(s)</i>	1	1	1

Shear Strength Parameters

		Peak Condition
Apparent Cohesion	<i>kPa</i>	9
Angle of Shearing Resistance	<i>degrees</i>	34.0

Notes: ¹ Maximum dry density = 1.65 Mg/m³ and minimum dry density = 1.20 Mg/m³

Tested by JJR
 Checked and Approved by

[Redacted]

P Heritage - Project Manager
 04/08/2023

Project Number:

GEO / 38342

Project Name:

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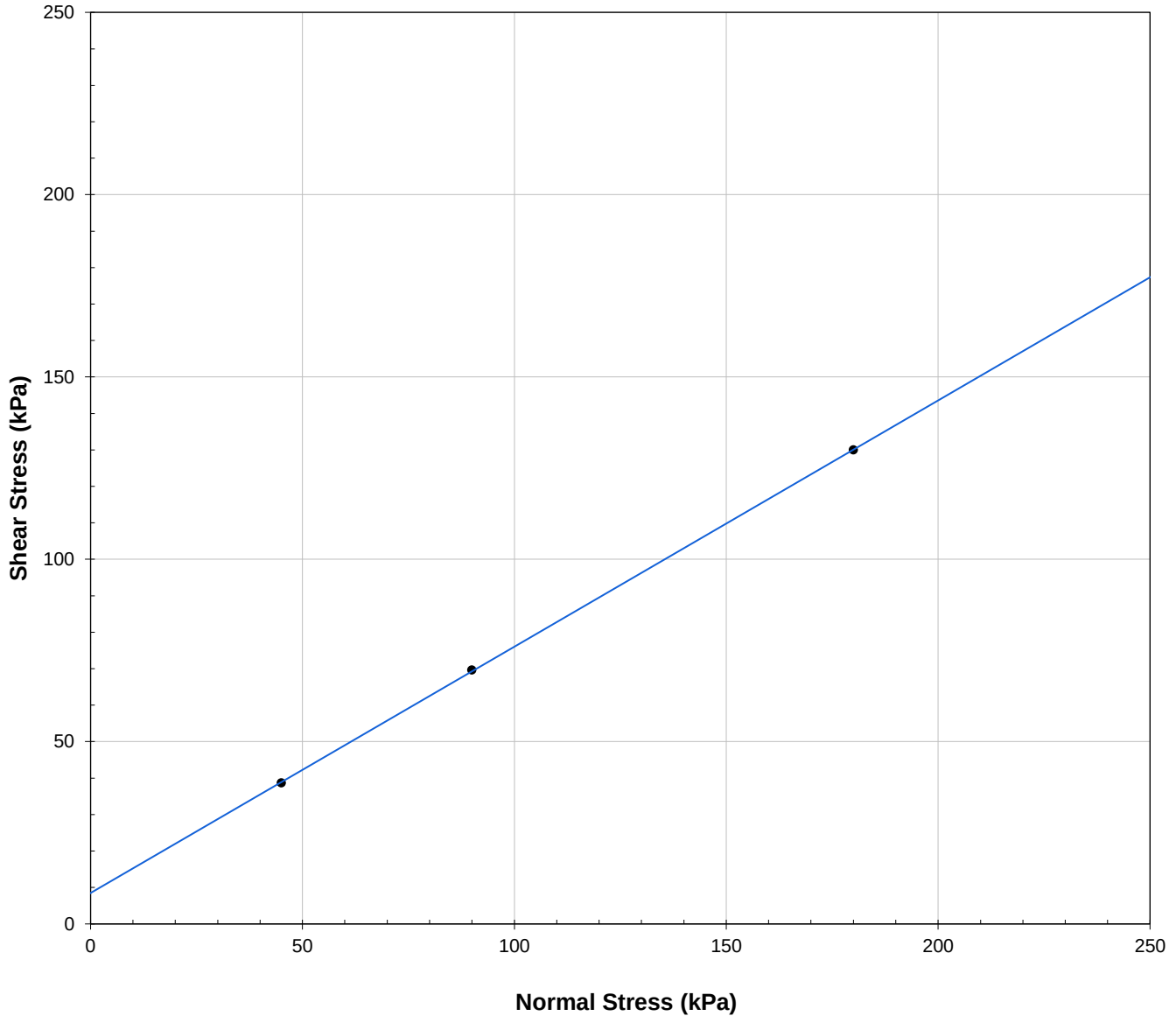
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP09
Depth (m) 15.00-15.45
Sample Type B

Description:

Greyish brown gravelly fine to medium SAND.

Shear Stress v Normal Stress

Tested by JJR
Checked and Approved by
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P Heritage - Project Manager
04/08/2023

Project Number:

GEO / 38342

Project Name:

**ARDERSIER PORT
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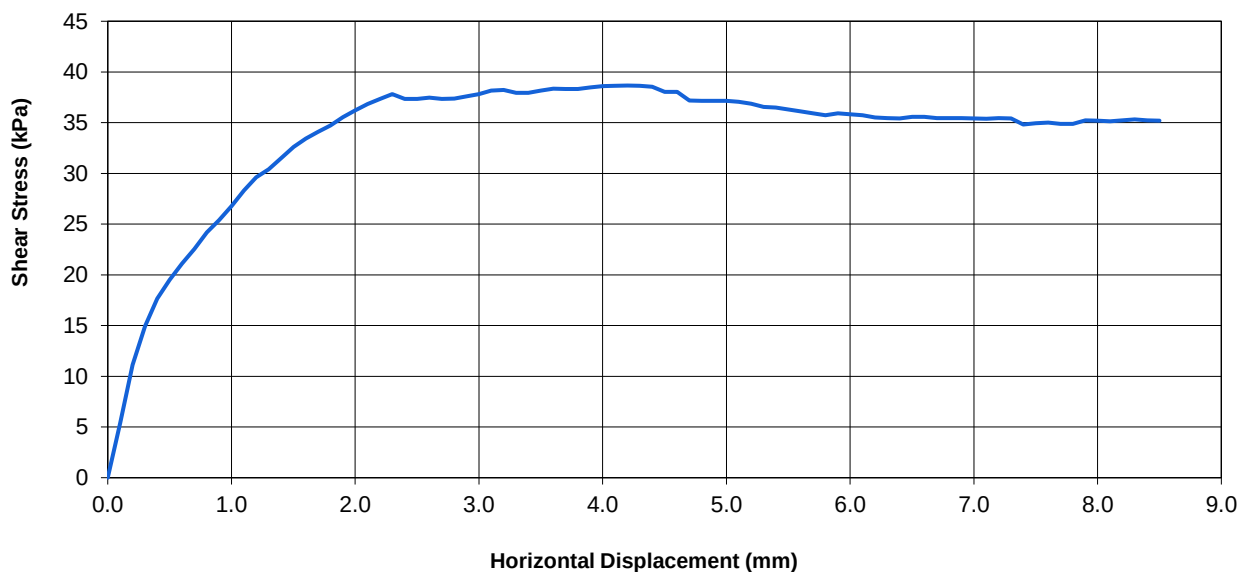
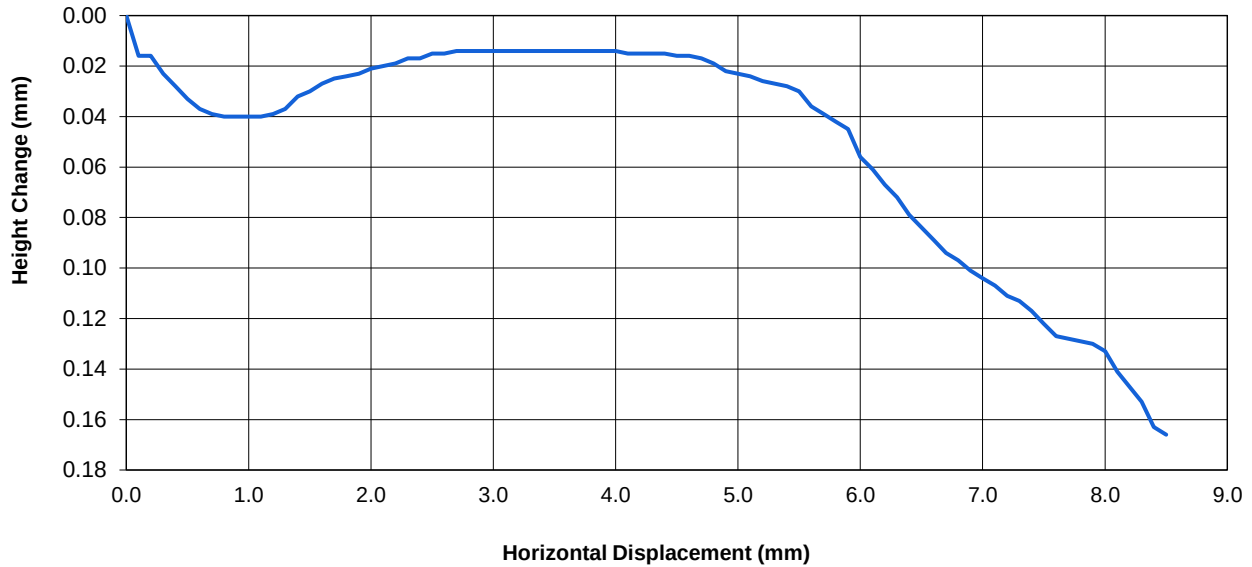
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP09
Depth (m) 15.00-15.45
Sample Type B

Description:

Greyish brown gravelly fine to medium SAND.

Specimen: 1**Shear Stage**

Tested by JJR
Checked and Approved by

[Redacted]

P Heritage - Project Manager
04/08/2023

Project Number:

GEO / 38342

Project Name:

**ARDERSIER PORT
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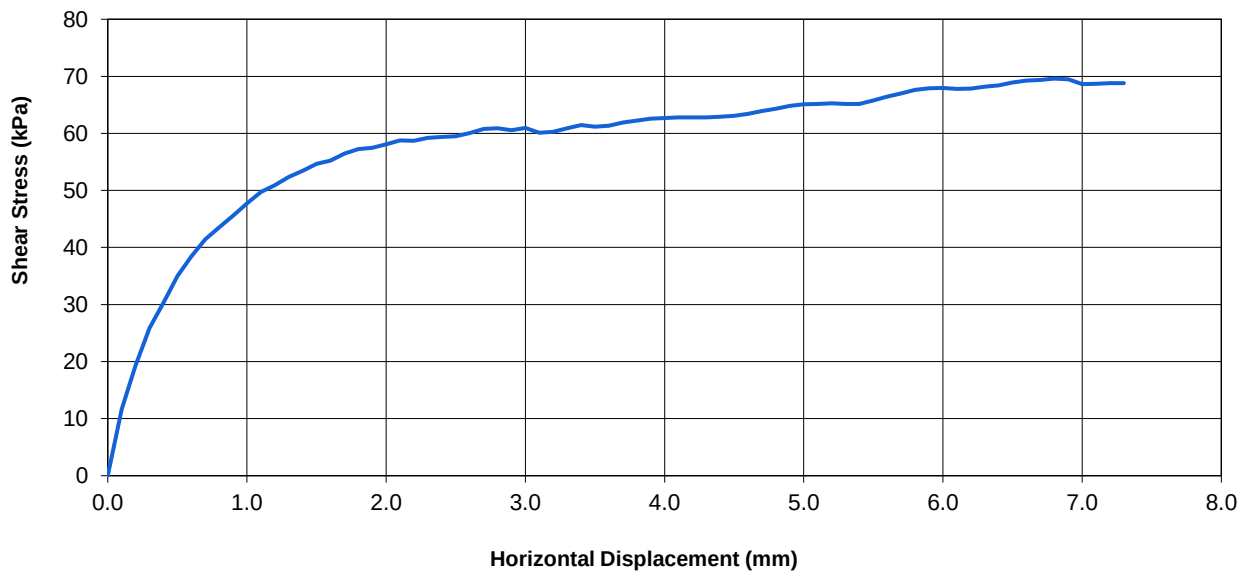
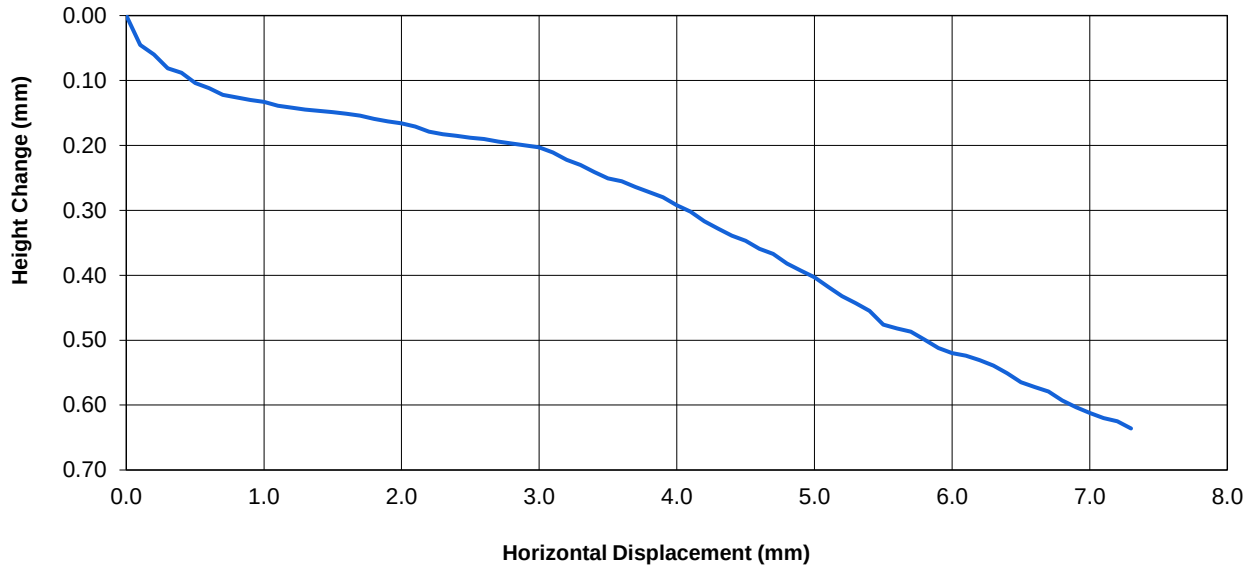
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP09
Depth (m) 15.00-15.45
Sample Type B

Description:

Greyish brown gravelly fine to medium SAND.

Specimen: 2**Shear Stage**

Tested by JJR
Checked and Approved by
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P Heritage - Project Manager
04/08/2023

Project Number:

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Project Name:

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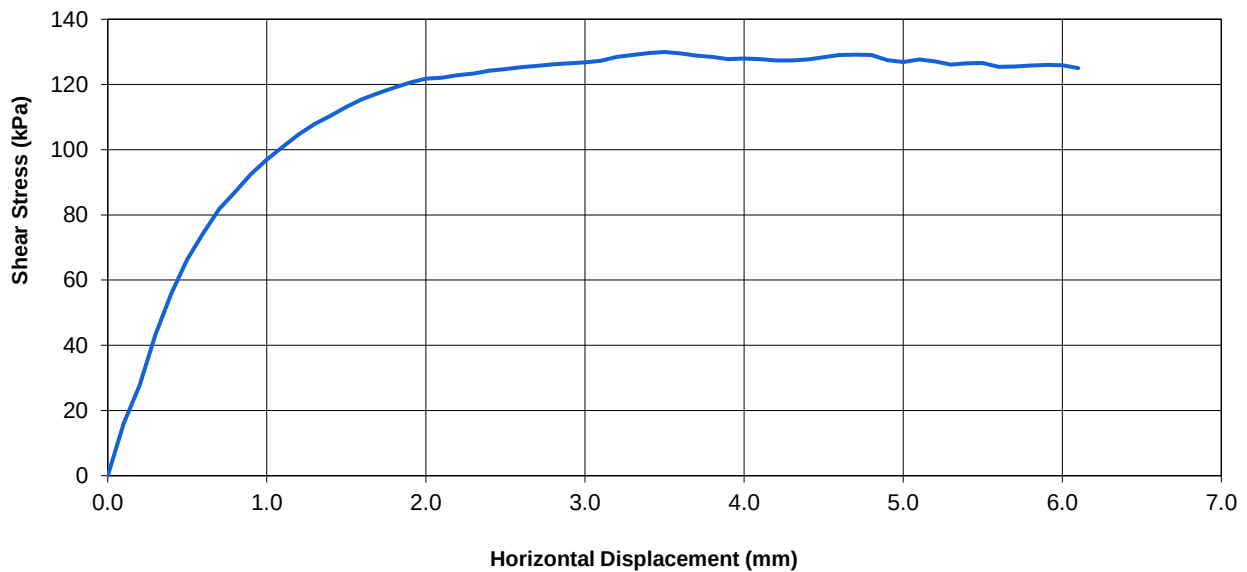
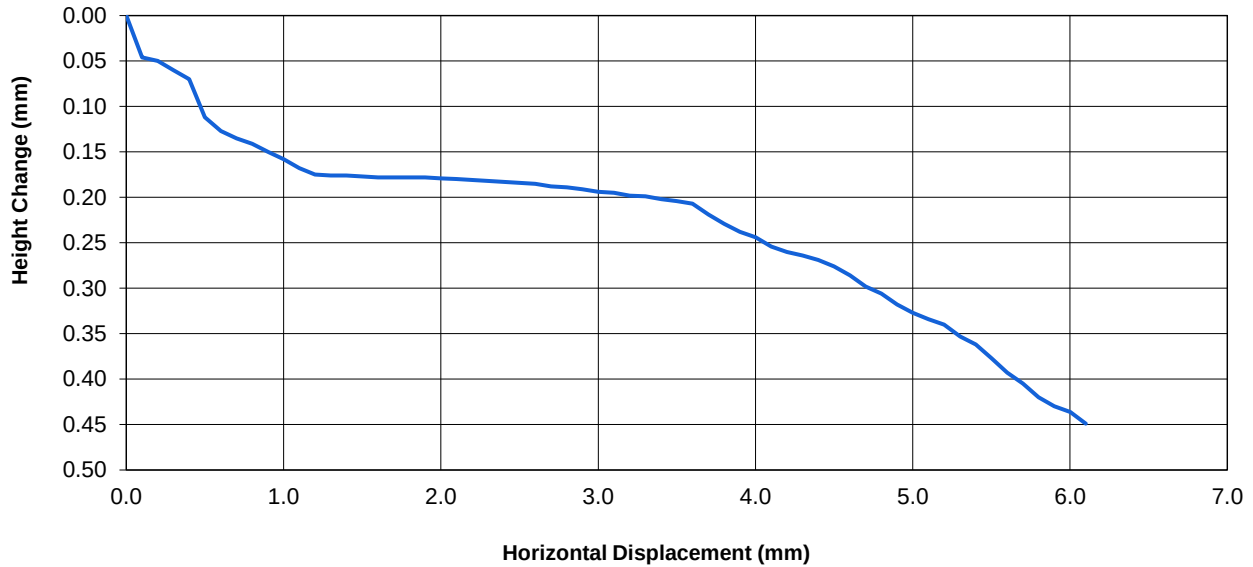
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP09
Depth (m) 15.00-15.45
Sample Type B

Description:

Greyish brown gravelly fine to medium SAND.

Specimen: 3**Shear Stage**

Tested by JJR
Checked and Approved by
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P Heritage - Project Manager
04/08/2023

Project Number:

GEO / 38342

Project Name:

**ARDERSIER PORT
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DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP09
Depth (m) 23.00
Sample Type B

Description:

Brownish grey gravelly fine SAND. Gravel is medium to coarse.

Specimen Details

Depth within original sample *m* n/a
Orientation within original sample n/a
Test condition Submerged
Preparation < 2 mm material remoulded at existing water content to a relative density of 50% ¹

Particle density *Mg/m³* 2.65 (assumed)

Specimen Number		1	2	3
Length	<i>mm</i>	60.05	60.05	60.03
Width	<i>mm</i>	60.05	60.03	60.03
Height	<i>mm</i>	25.36	25.17	25.32
Initial water content	%	19.8	19.8	19.8
Initial bulk density	<i>Mg/m³</i>	1.64	1.65	1.64
Initial dry density	<i>Mg/m³</i>	1.37	1.38	1.37
Initial voids ratio		0.935	0.921	0.931
Degree of Saturation	%	56.1	57.1	56.4

Shearing Stage

	<i>kPa</i>	60	120	240
Normal stress				
Peak Conditions:				
Rate of horizontal displacement	<i>mm/min</i>	0.18	0.18	0.18
Maximum shear stress	<i>kPa</i>	46.2	94.2	168.5
Horizontal displacement at MSS	<i>mm</i>	3.3	5.2	6.2
Vertical Displacement at Peak	<i>mm</i>	-0.04	0.23	0.24

	%	24.6	25.2	26.1
Final water content				
Duration	<i>day(s)</i>	1	1	1

Shear Strength Parameters

	<i>kPa</i>	Peak Condition
Apparent Cohesion		9
Angle of Shearing Resistance	<i>degrees</i>	34.0

Notes: ¹ Maximum dry density = 1.60 Mg/m³ and minimum dry density = 1.21 Mg/m³

Tested by JJR
Checked and Approved by
[Redacted]

P Heritage - Project Manager
04/08/2023

Project Number:

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Project Name:

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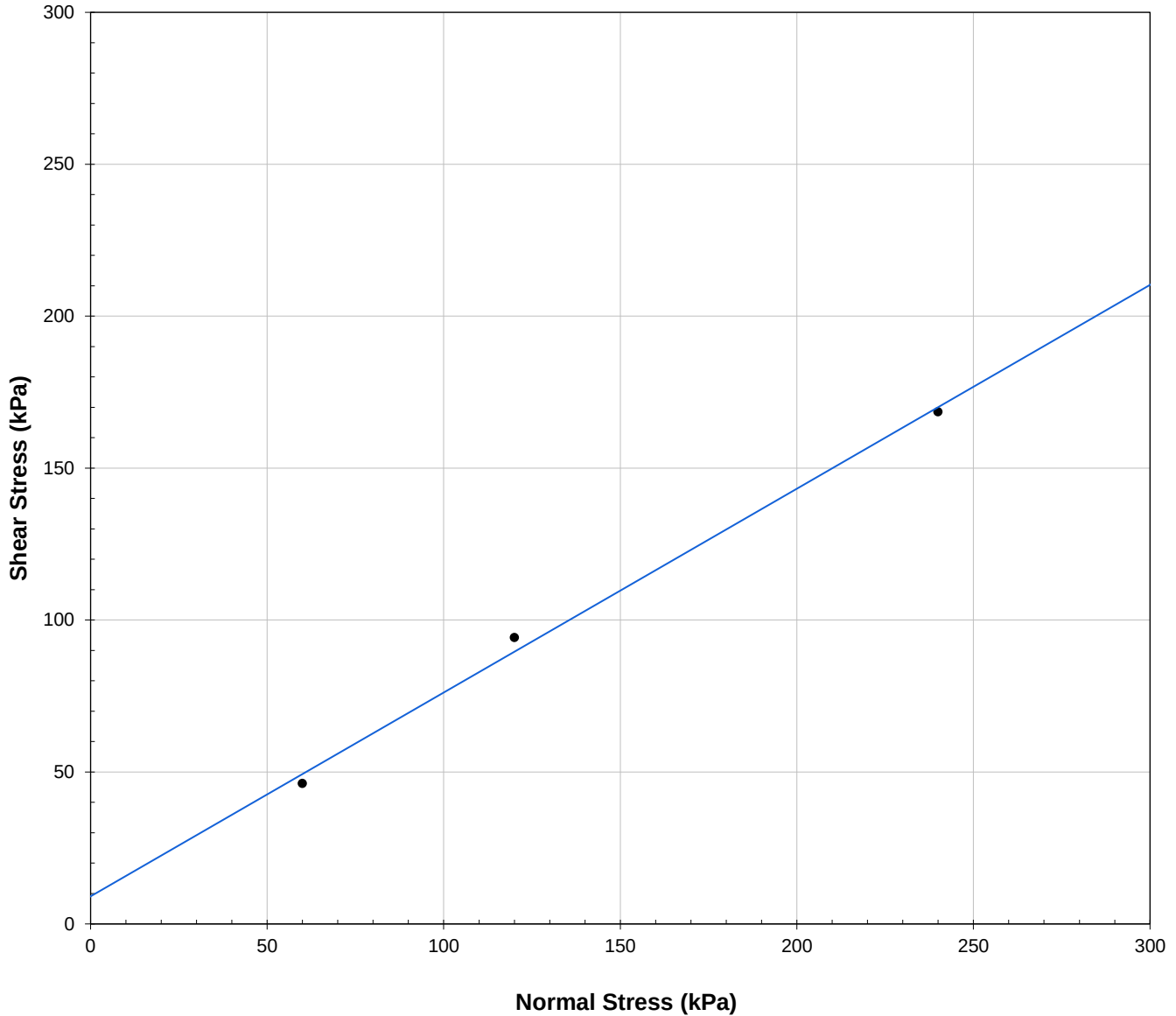
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP09
Depth (m) 23.00
Sample Type B

Description:

Brownish grey gravelly fine SAND. Gravel is medium to coarse.

Shear Stress v Normal Stress

Peak: $c' = 9$
 $\Phi' = 34.0$

Tested by JJR
Checked and Approved by
[Redacted]

P Heritage - Project Manager
04/08/2023

Project Number:

GEO / 38342

Project Name:

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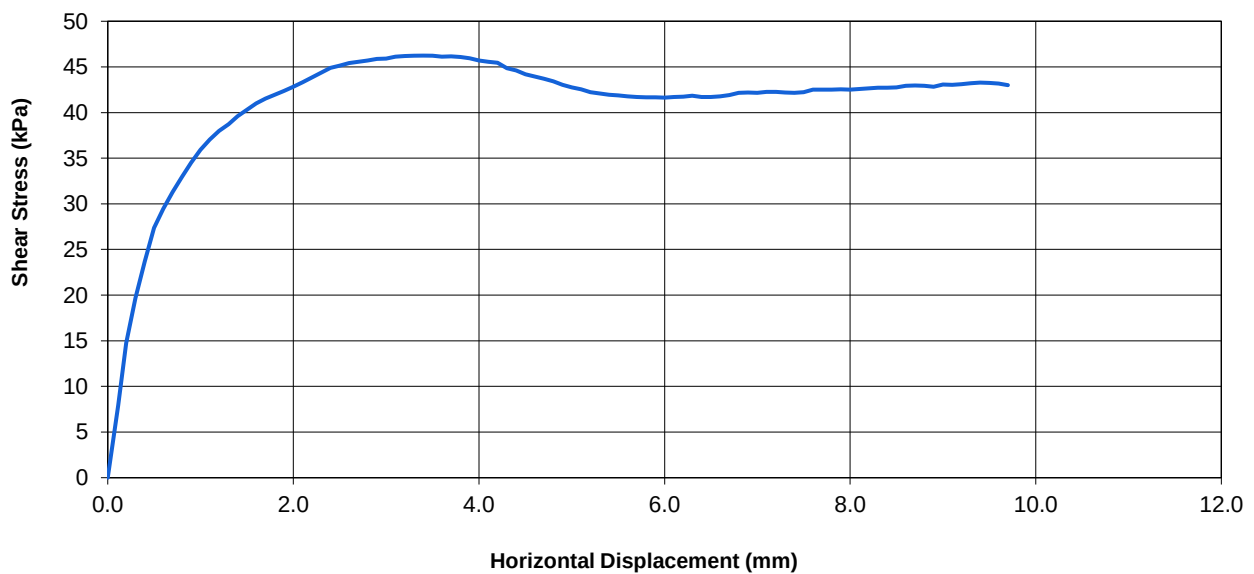
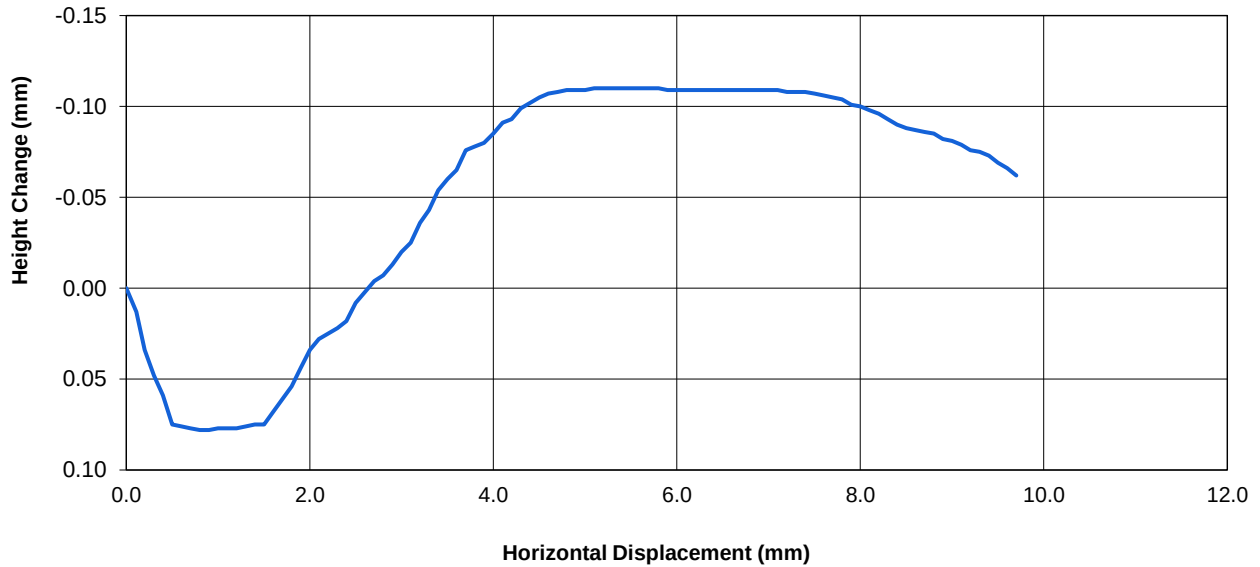
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP09
Depth (m) 23.00
Sample Type B

Description:

Brownish grey gravelly fine SAND. Gravel is medium to coarse.

Specimen: 1**Shear Stage**

Tested by JJR
Checked and Approved by
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P Heritage - Project Manager
04/08/2023

Project Number:

GEO / 38342

Project Name:

**ARDERSIER PORT
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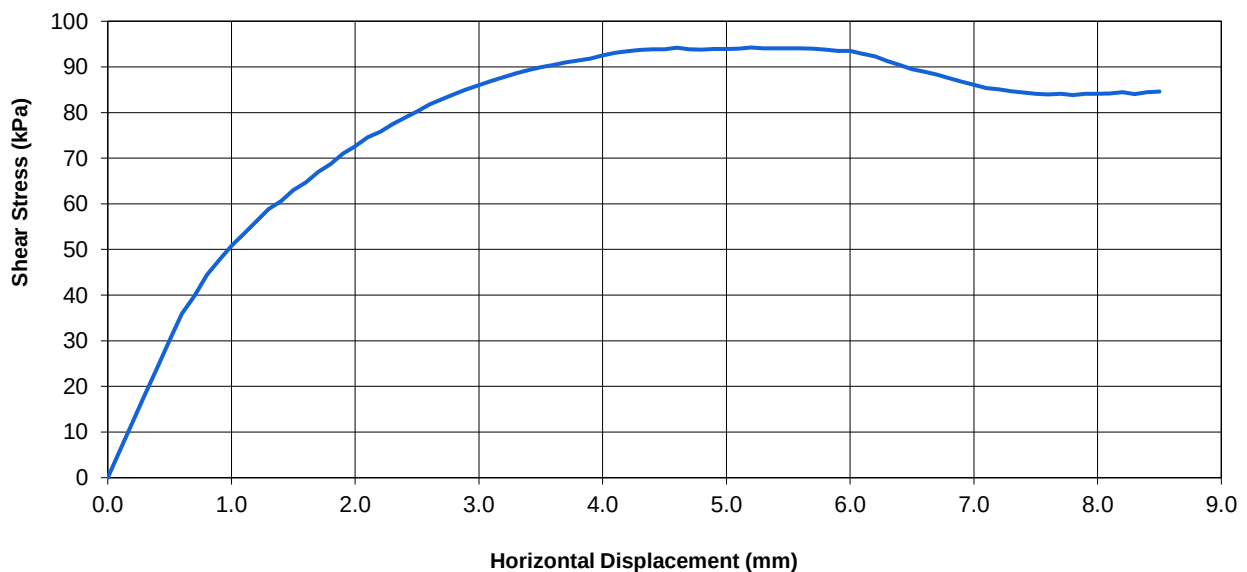
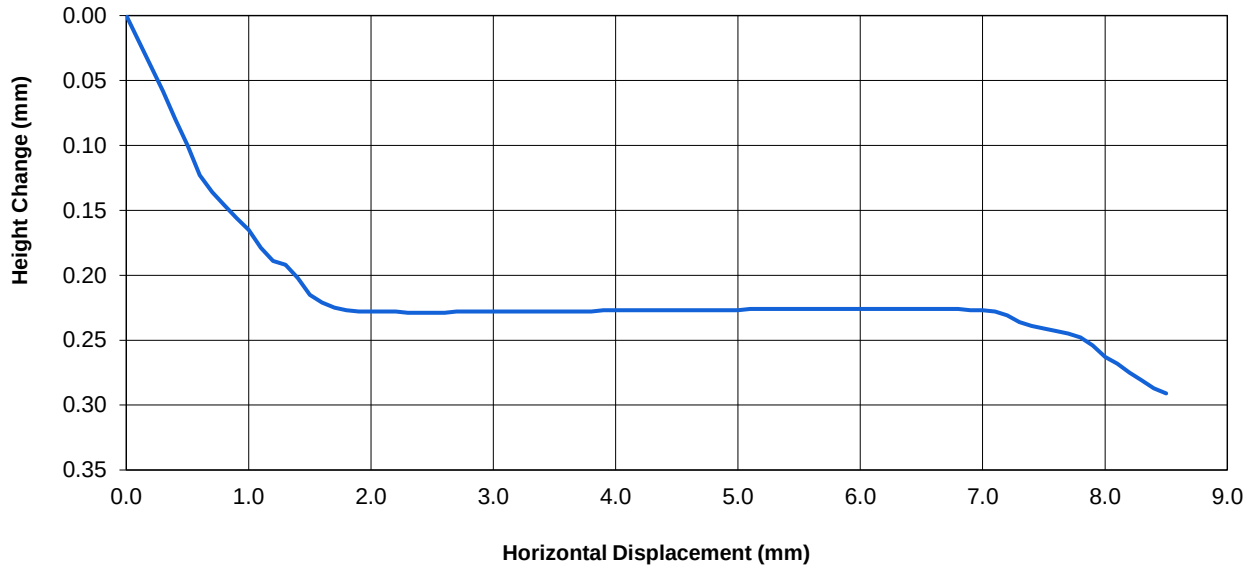
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP09
Depth (m) 23.00
Sample Type B

Description:

Brownish grey gravelly fine SAND. Gravel is medium to coarse.

Specimen: 2**Shear Stage**

Tested by JJR
Checked and Approved by

[Redacted]

P Heritage - Project Manager
04/08/2023

Project Number:

GEO / 38342

Project Name:

**ARDERSIER PORT
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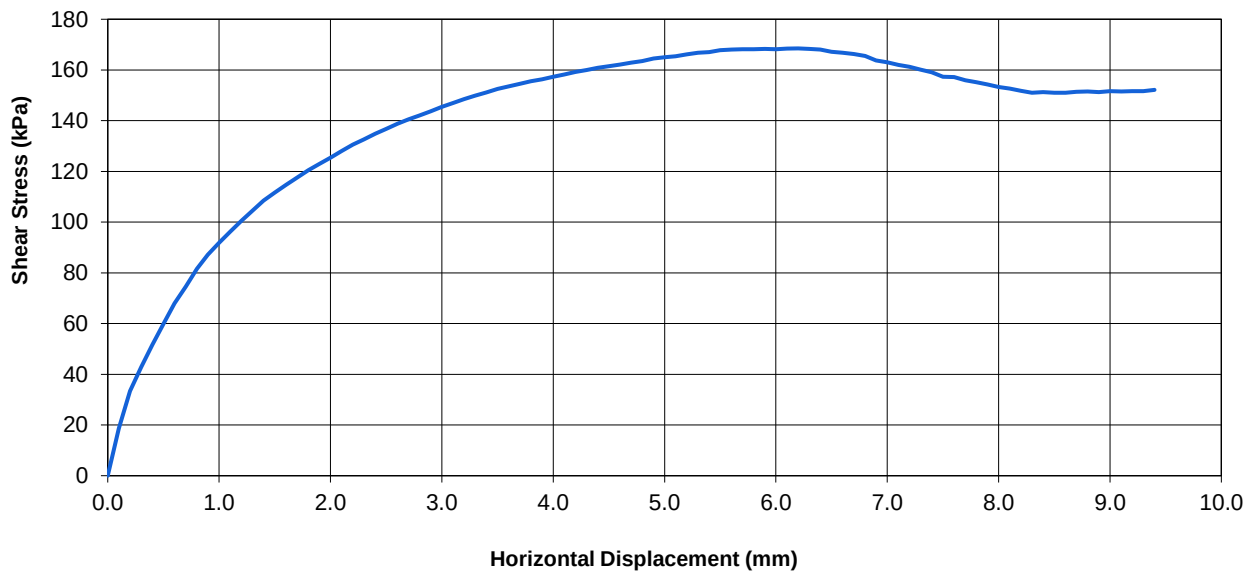
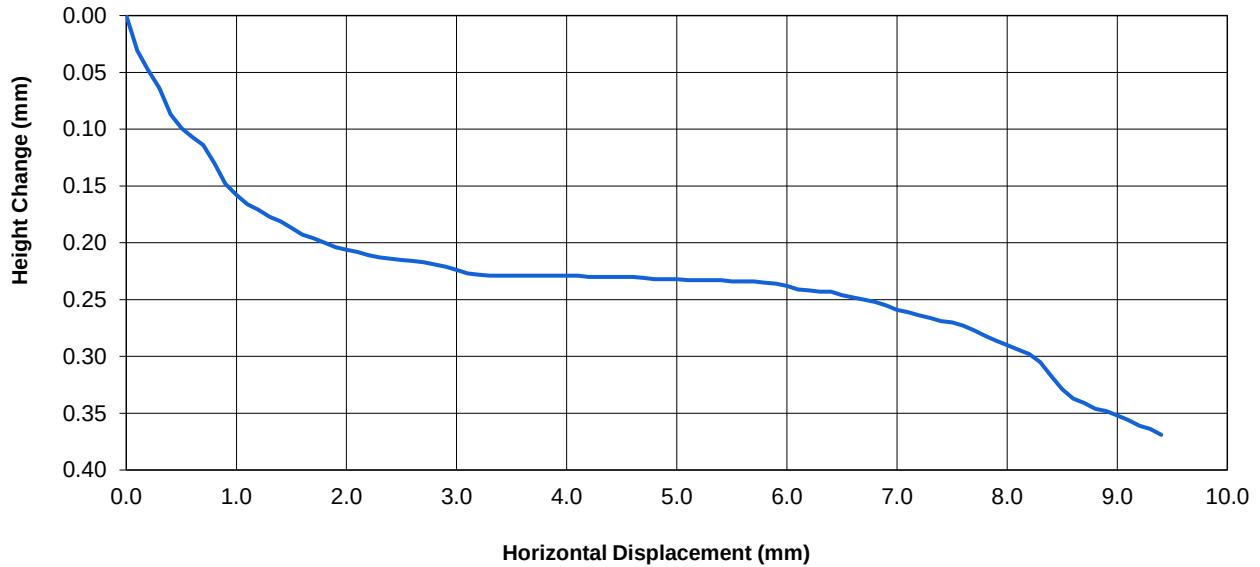
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No BHSP09
Depth (m) 23.00
Sample Type B

Description:

Brownish grey gravelly fine SAND. Gravel is medium to coarse.

Specimen: 3**Shear Stage**

Tested by JJR
Checked and Approved by

[Redacted]

P Heritage - Project Manager
04/08/2023

Project Number:

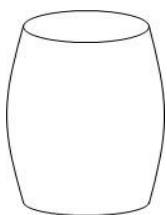
GEO / 38342

Project Name:

**ARDERSIER PORT
S230503****GEOLABS**®

Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP09	Description:
Depth (m): 12.00-12.45	Greyish brown slightly gravelly SAND.

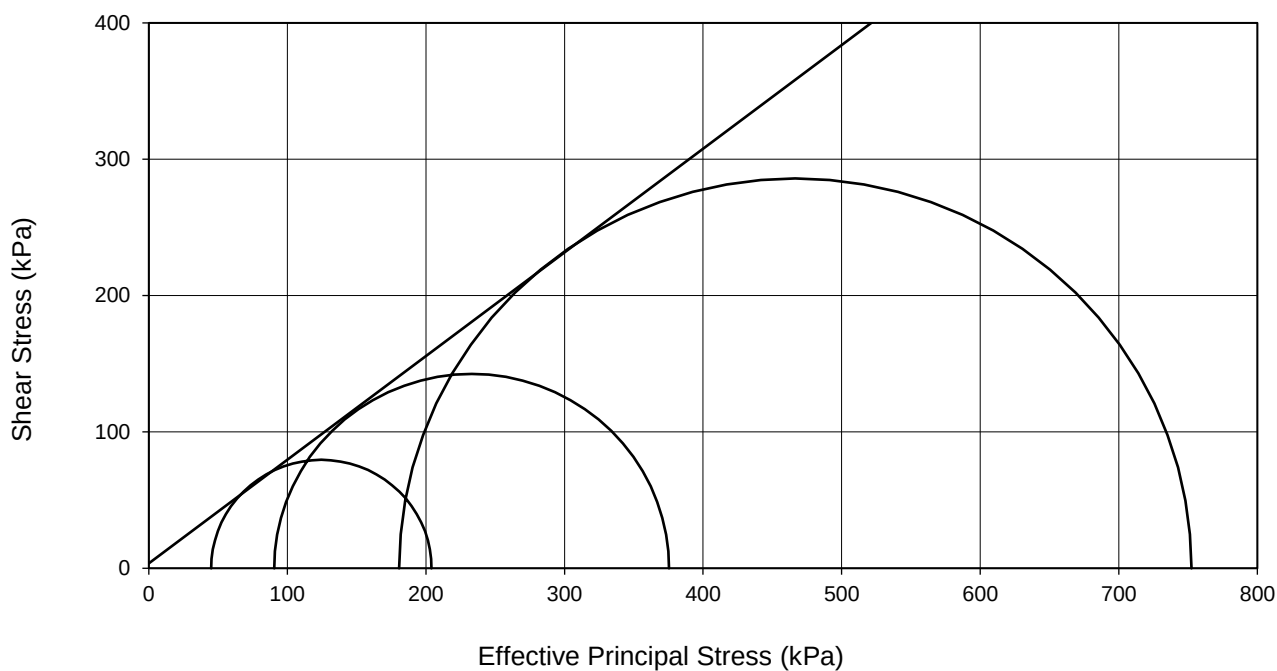
SPECIMEN DETAILS Depth within original sample Remarks	NA Orientation within original sample: NA Remoulded to a target 10.0 % MC and a target dry density of 1.51 Mg/m ³		
TEST DETAILS Specimen Type and Preparation Cell Preparation Specimen Number Initial Diameter Initial Length Initial Water Content Initial Wet Density Drainage Conditions	B (Remoulded) Checks performed in accordance with Clause 3.5		
	Multistage		
	69.59		
	140.22		
	10.2		
	1.65		
	One end only		
SATURATION STAGE Final Cell Pressure Final Pore Pressure Final Pore Pressure Parameter B Duration	Method: Clause 5.2 545 536 0.95 6		
CONSOLIDATION STAGE Cell Pressure Back Pressure Effective Pressure Final Pore Pressure Final Pore Pressure Dissipation Duration	Stage No 1 545 500 45 500 100 1	Stage No 2 590 500 90 500 100 1	Stage No 3 680 500 180 500 100 1
SHEARING STAGE Cell Pressure Rate of Axial Displacement Initial Pore Pressure Initial Effective Stress	545 0.020 500 45	590 0.020 500 90	680 0.020 500 180
CONDITIONS AT FAILURE Pore Pressure Minor Effective Principal Stress Deviator Stress Major Effective Principal Stress Volume Change Volumetric Strain Axial Strain Membrane correction applied to Deviator Stress Duration	Maximum deviator stress		
	500	500	499
	45	90	181
	159	285	572
	204	375	753
	-1.09	0.00	1.32
	-0.2	0.0	0.3
	2.0	2.6	6.0
	0	0	1
	1	1	1
Final Water Content Final Wet Density	24.6 1.90		
EFFECTIVE STRESS PARAMETERS Cohesion Angle of Shear Resistance	3.6 37		
FAILURE SKETCH			

Checked and Approved by [Redacted] P Heritage - Project Manager 04/09/2023	Project Number: GEO / 38342 Project Name: ARDERSIER PORT S230503	GEOLABS 

Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP09
Depth (m): 12.00-12.45

Description:
Greyish brown slightly gravelly SAND.



Checked and Approved by
[Redacted]

P Heritage - Project Manager
04/09/2023

Project Number:

GEO / 38342

Project Name:

**ARDERSIER PORT
S230503**

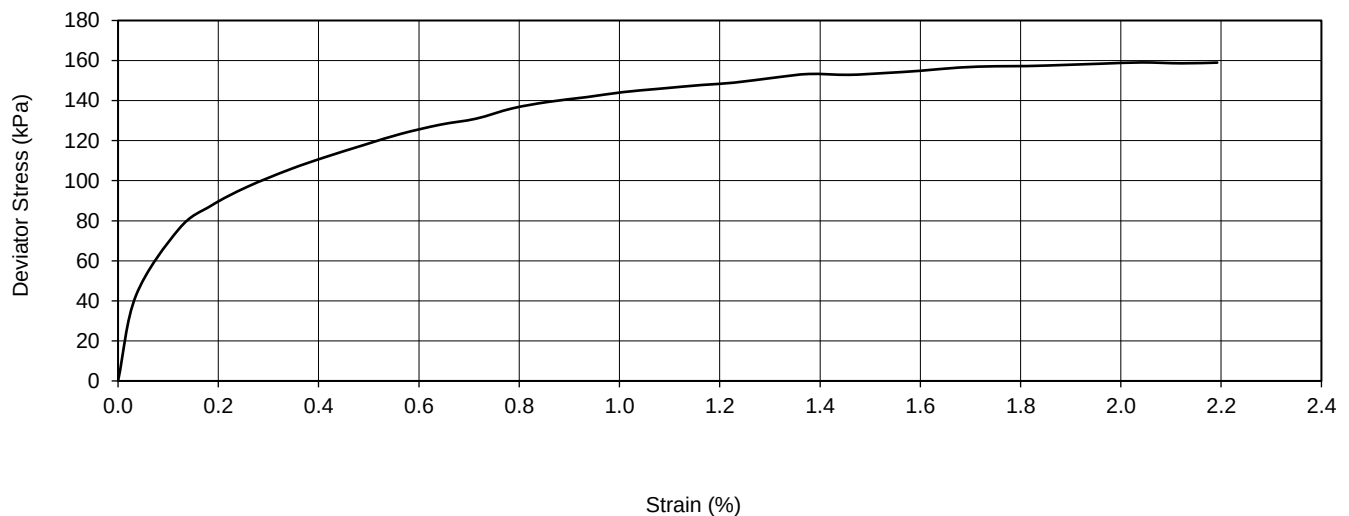
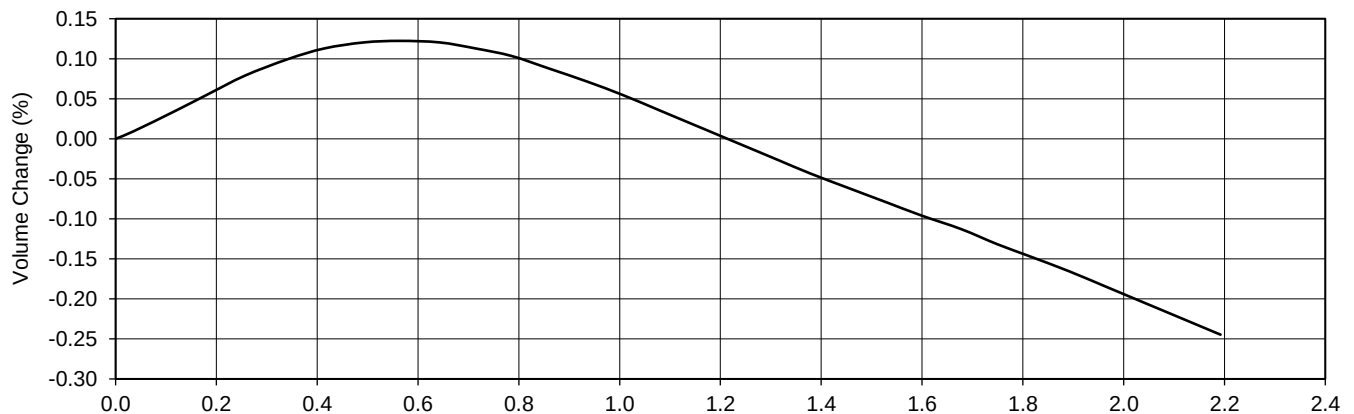
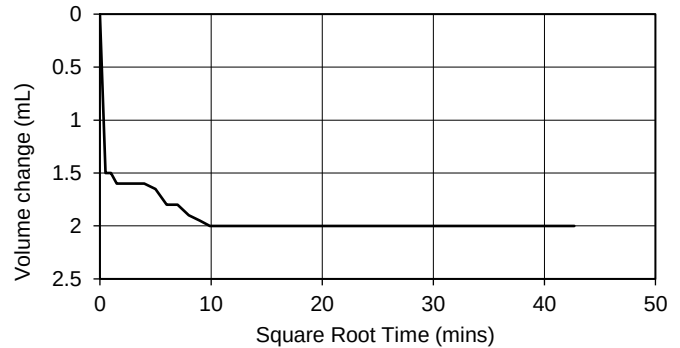
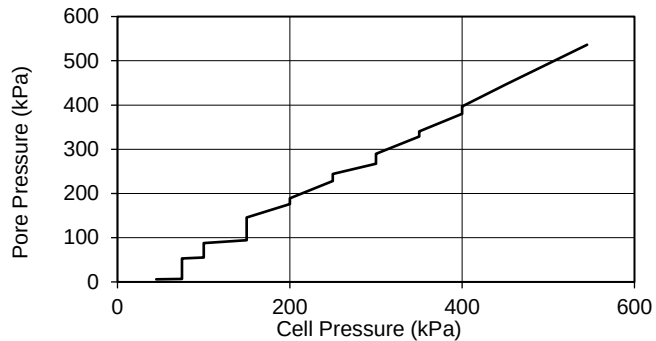
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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP09
Depth (m): 12.00-12.45

Stage No 1



Checked and Approved by

[Redacted]

P Heritage - Project Manager
04/09/2023

Project Number:

GEO / 38342

Project Name:

ARDERSIER PORT
S230503

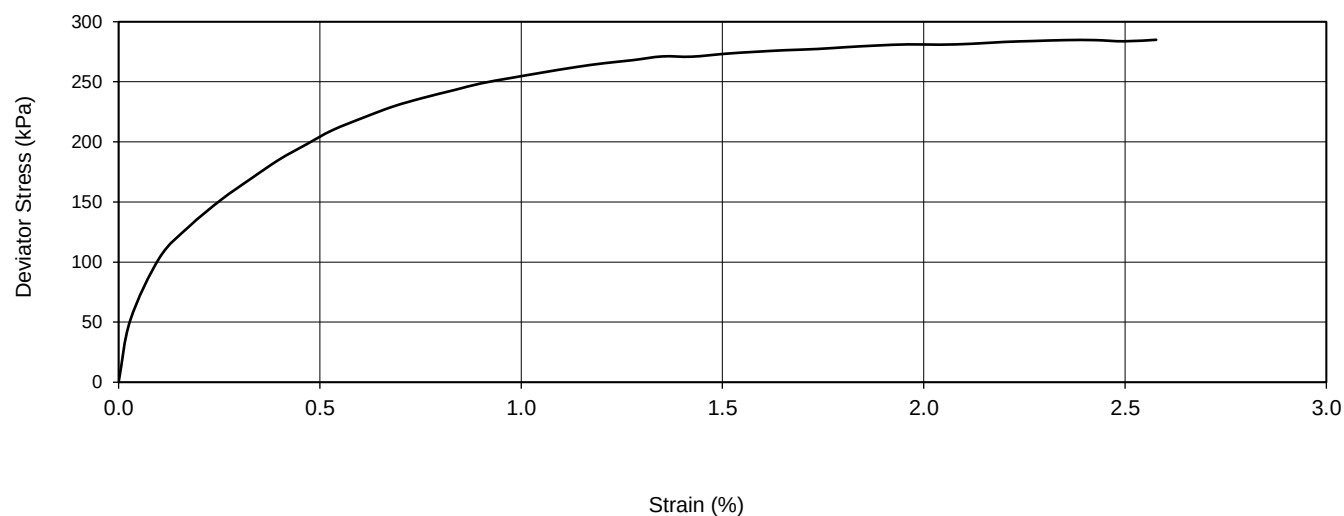
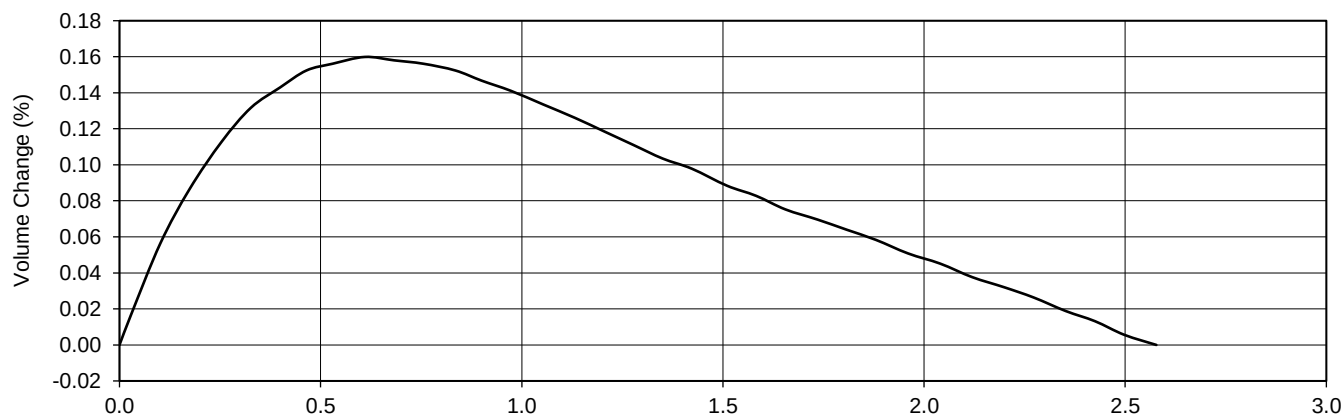
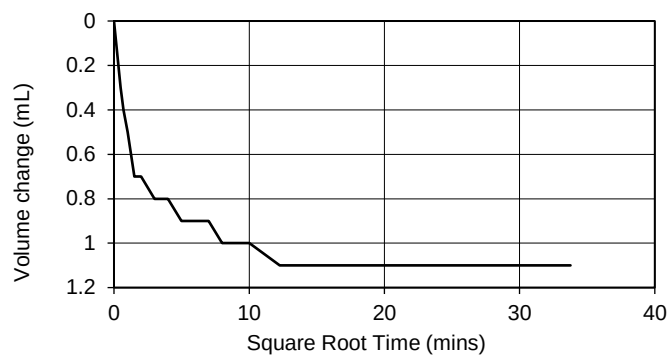
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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP09
Depth (m): 12.00-12.45

Stage No 2



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P Heritage - Project Manager
04/09/2023

Project Number:

GEO / 38342

Project Name:

ARDERSIER PORT
S230503

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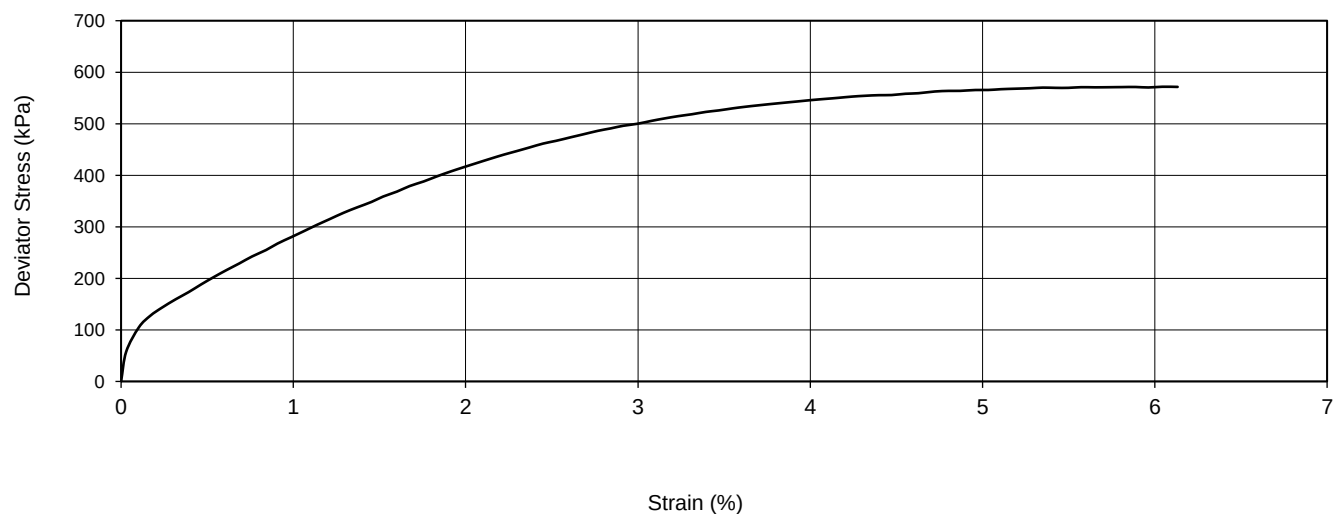
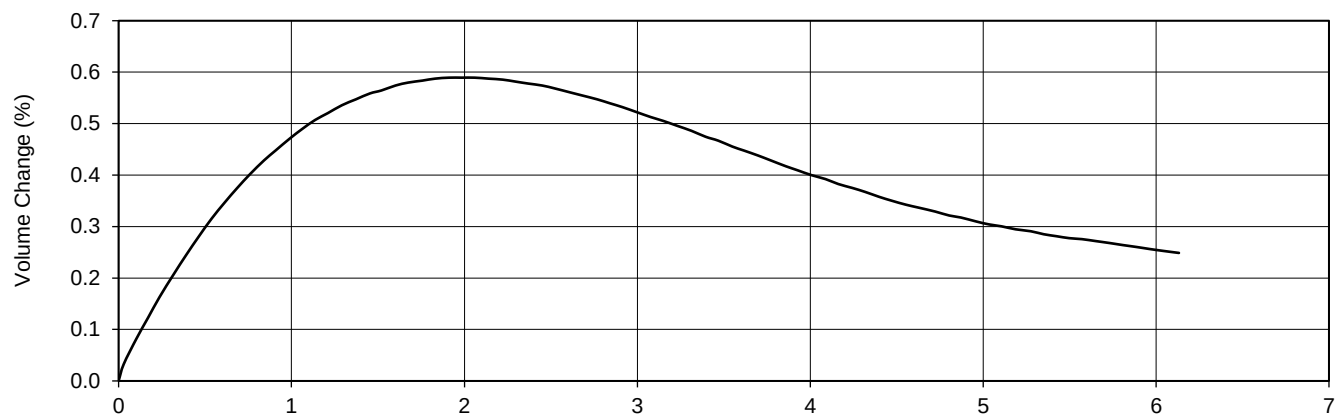
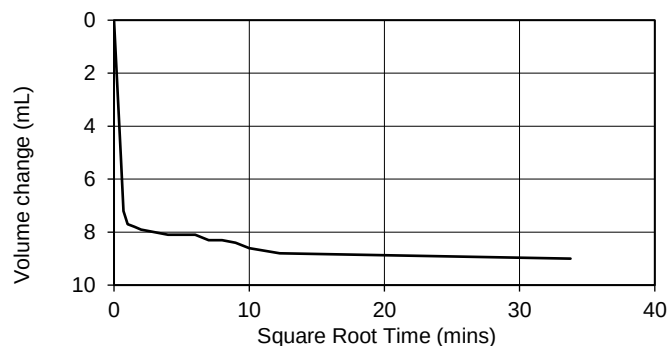


Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP09

Depth (m): 12.00-12.45

Stage No 3

Checked and Approved by
[Redacted]P Heritage - Project Manager
04/09/2023

Project Number:

GEO / 38342

Project Name:

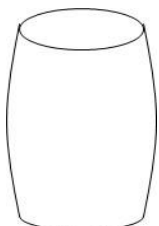
ARDERSIER PORT
S230503

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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.:	BHSP09	Description: Grey and greyish brown slightly silty gravelly fine to medium SAND.
Depth (m):	21.00-21.45	

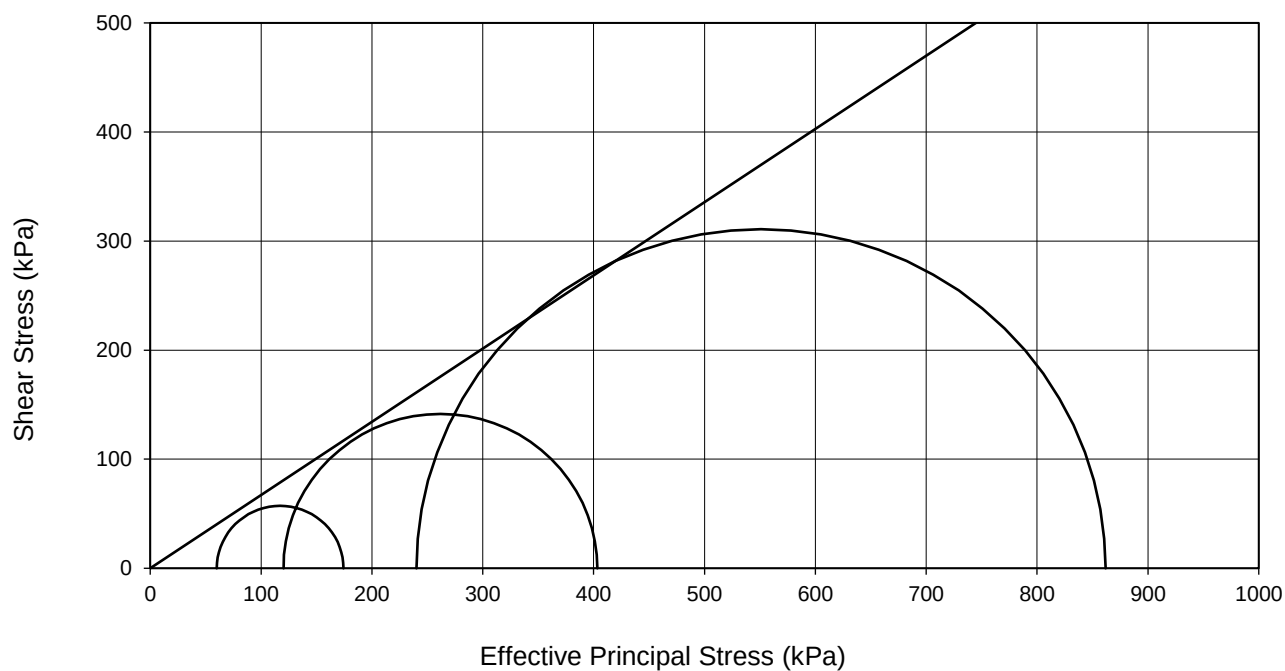
SPECIMEN DETAILS Depth within original sample Remarks		NA Orientation within original sample: NA Remoulded to a target 10.0% MC and a target dry density of 1.44 Mg/m ³		
TEST DETAILS Specimen Type and Preparation Cell Preparation Specimen Number Initial Diameter <i>mm</i> Initial Length <i>mm</i> Initial Water Content % Initial Wet Density <i>Mg/m³</i> Drainage Conditions		B (Remoulded) Checks performed in accordance with Clause 3.5 Multistage 69.26 140.22 9.7 1.59 One end and radial boundary		
SATURATION STAGE Final Cell Pressure <i>kPa</i> Final Pore Pressure <i>kPa</i> Final Pore Pressure Parameter B Duration <i>day(s)</i>		Method: Clause 5.2 460 448 0.97 6		
CONSOLIDATION STAGE Cell Pressure <i>kPa</i> Back Pressure <i>kPa</i> Effective Pressure <i>kPa</i> Final Pore Pressure <i>kPa</i> Final Pore Pressure Dissipation % Duration <i>day(s)</i>		Stage No 1 460 400 60 400 100 1	Stage No 2 520 400 120 400 100 1	Stage No 3 640 400 240 400 100 1
SHEARING STAGE Cell Pressure <i>kPa</i> Rate of Axial Displacement <i>mm/min</i> Initial Pore Pressure <i>kPa</i> Initial Effective Stress <i>kPa</i>		460 0.015 400 60	520 0.020 400 120	640 0.020 400 240
CONDITIONS AT FAILURE <i>criteria</i> Pore Pressure <i>kPa</i> Minor Effective Principal Stress <i>kPa</i> Deviator Stress <i>kPa</i> Major Effective Principal Stress <i>kPa</i> Volume Change <i>mL</i> Volumetric Strain % Axial Strain % Membrane & filter correction applied to Deviator Stress <i>kPa</i> Duration <i>day(s)</i>		Maximum deviator stress 400 60 114 174 4.06 0.8 2.7 6 1		
Final Water Content % Final Wet Density <i>Mg/m³</i>		19.6 1.78		
EFFECTIVE STRESS PARAMETERS Cohesion <i>kPa</i> Angle of Shear Resistance <i>degrees</i>		0 34		
FAILURE SKETCH				

Checked and Approved by [Redacted] 04/09/2023	Project Number: GEO / 38342 Project Name: ARDERSIER PORT S230503	GEOLABS 

Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP09
Depth (m): 21.00-21.45

Description:
Grey and greyish brown slightly silty gravelly fine to medium SAND.



Checked and Approved by
[Redacted]

P Heritage - Project Manager
04/09/2023

Project Number:

GEO / 38342

Project Name:

**ARDERSIER PORT
S230503**

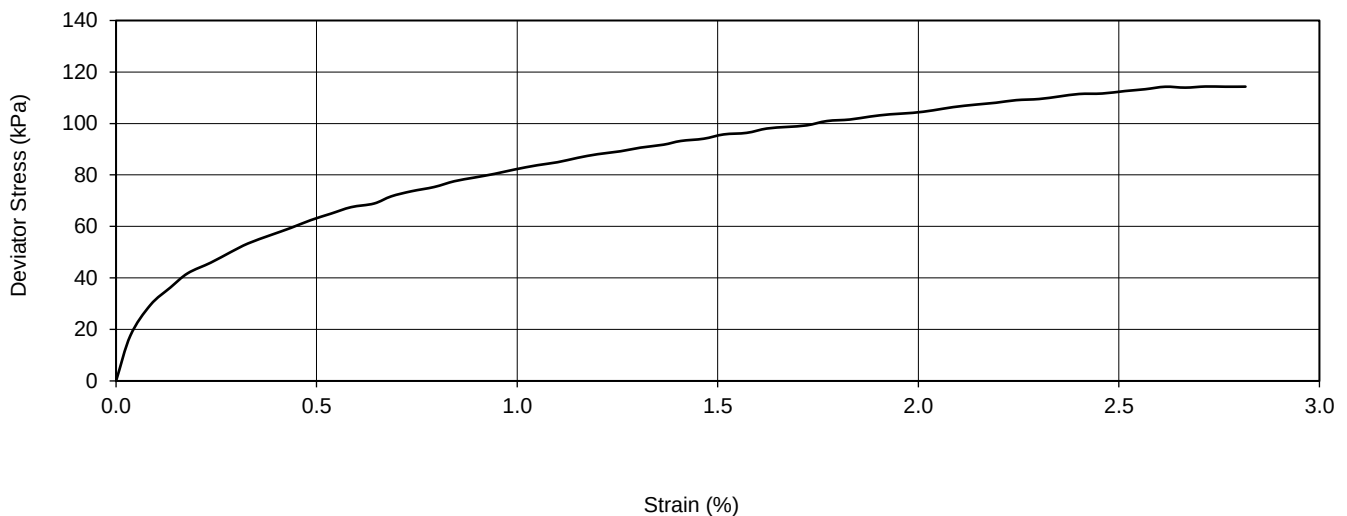
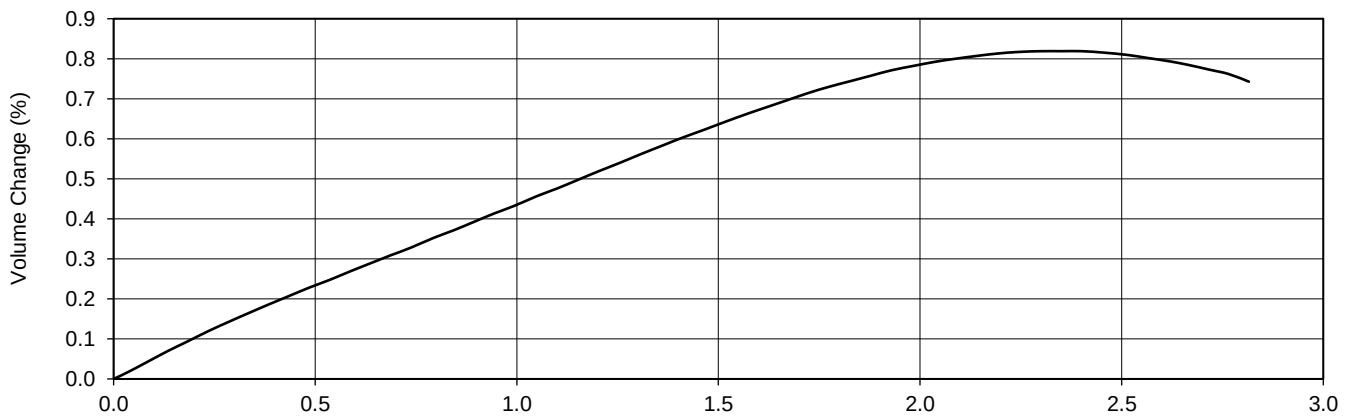
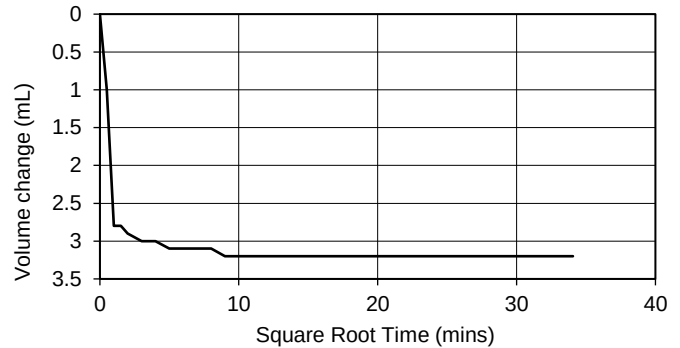
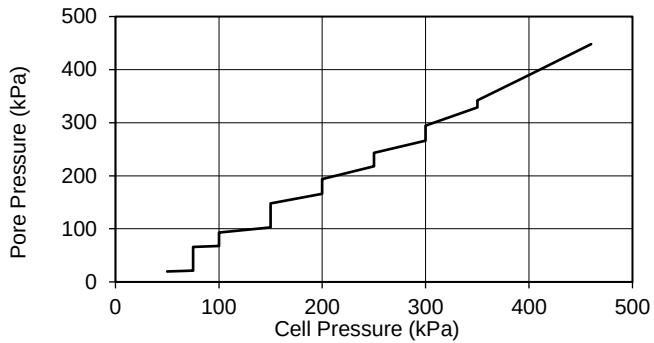
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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP09
Depth (m): 21.00-21.45

Stage No 1



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[Redacted]

P Heritage - Project Manager
04/09/2023

Project Number:

GEO / 38342

Project Name:

ARDERSIER PORT
S230503

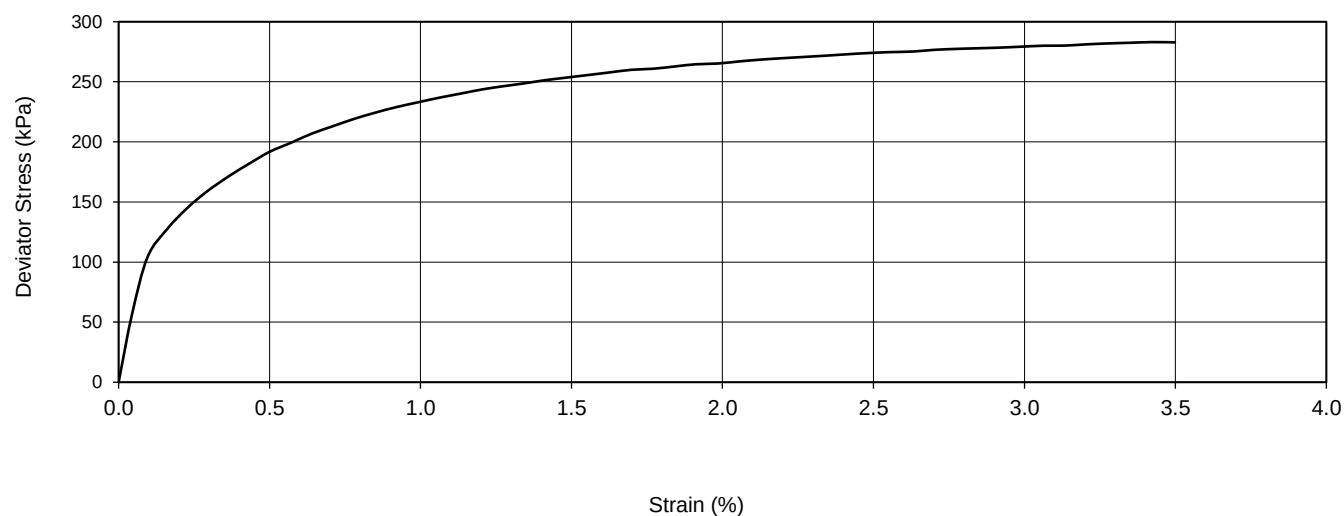
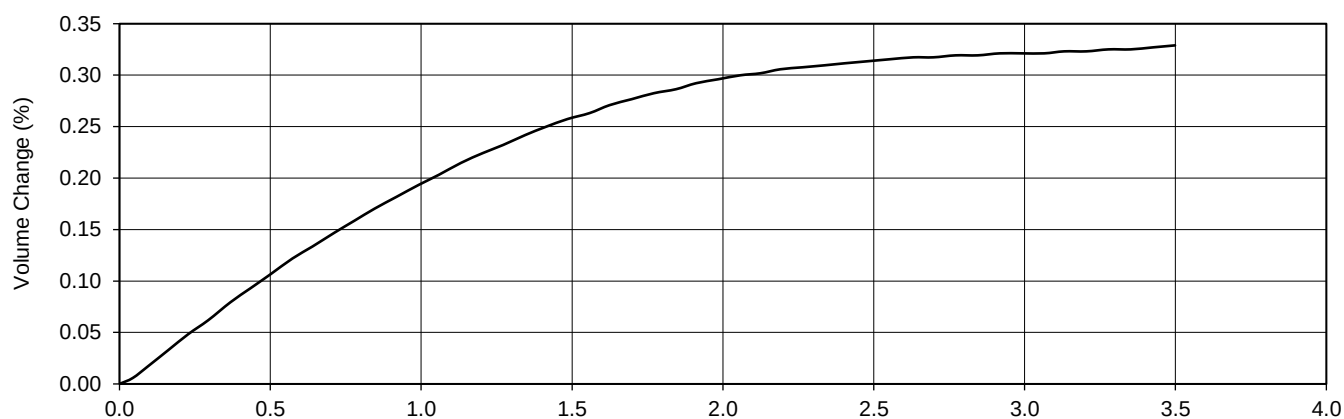
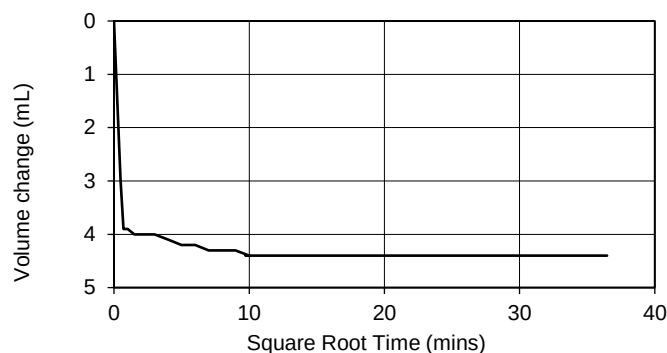
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Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP09
Depth (m): 21.00-21.45

Stage No 2



Checked and Approved by
[Redacted]

P Heritage - Project Manager
04/09/2023

Project Number:

GEO / 38342

Project Name:

ARDERSIER PORT
S230503

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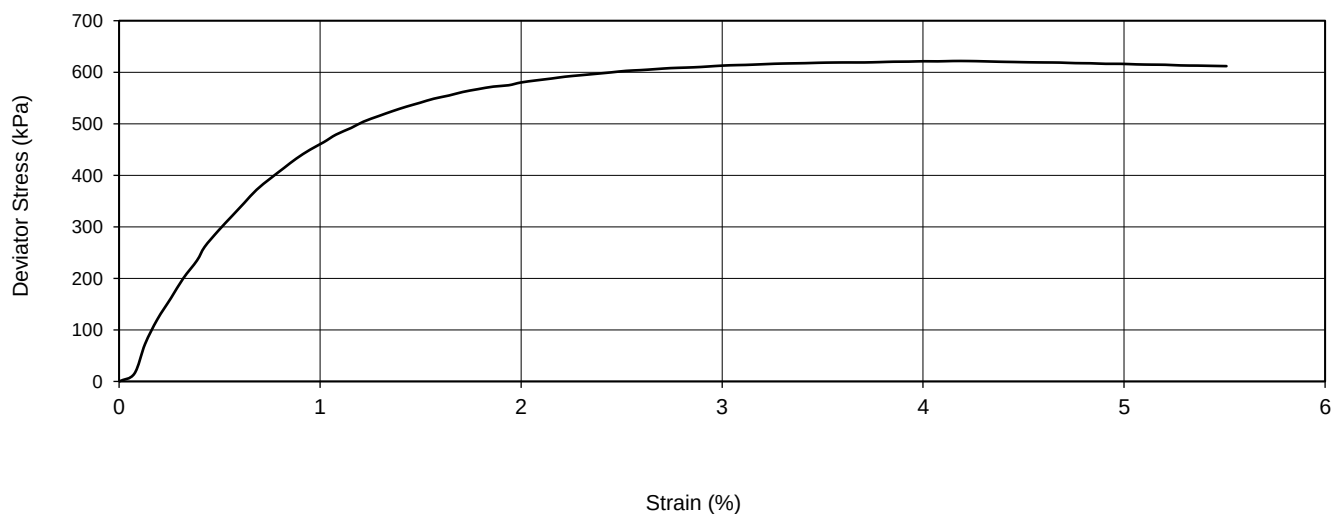
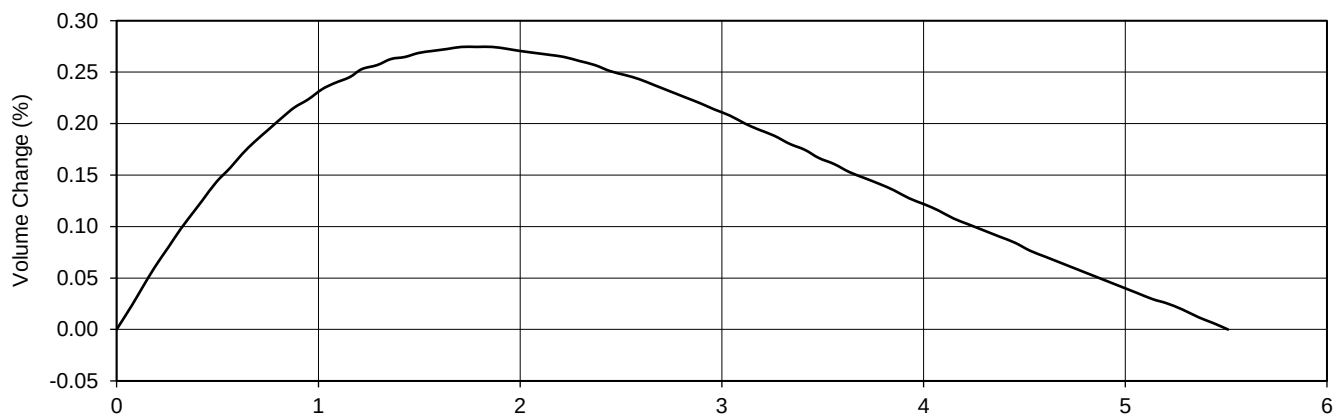
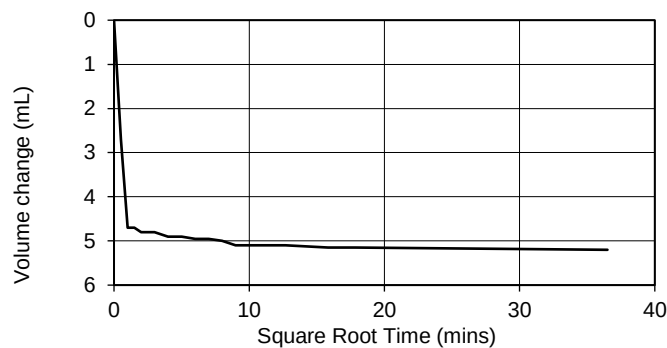


Consolidated Drained Multistage Triaxial Compression Test with Measurement of Volume Change

Borehole No.: BHSP09

Depth (m): 21.00-21.45

Stage No 3



Checked and Approved by

[Redacted]

P Heritage - Project Manager
04/09/2023

Project Number:

GEO / 38342

Project Name:

ARDERSIER PORT
S230503

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APPENDIX D



12 Yarm Road • Stockton-on-Tees • TS18 3NA

Tel: 01642 607083 • Email: info@solmek.com

SOIL INFILTRATION RATE

Project: S230503

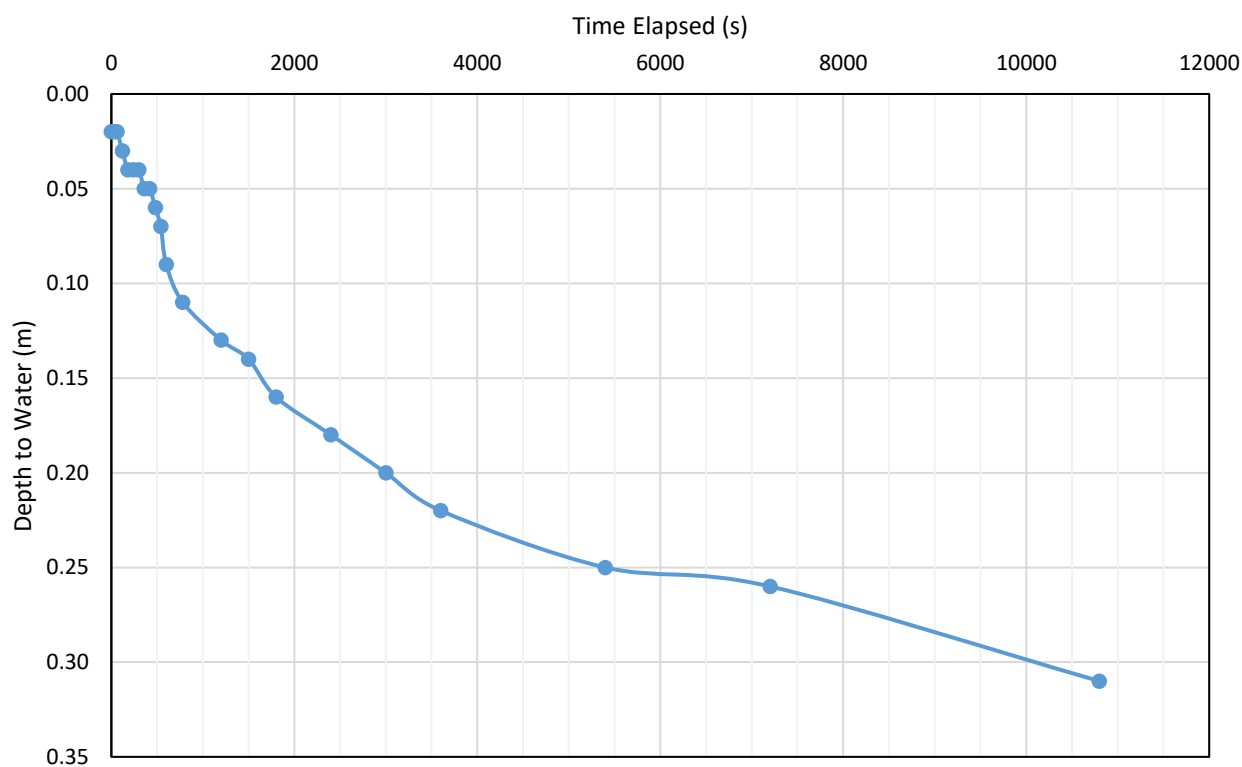
Project name: Ardersier Port Falling Head RT

Report date: 05/07/2023

Test date: 27/06/2023

Test location: BHSP07

Falling Head Test BS22282-1(2012) Geohydraulic Testing



Internal borehole diameter 0.2500 m

Base depth of borehole 10.00 m

Cross-sectional area of borehole 0.0491 m²

Linear regression slope 3.02E-06

Shape Factor 14.3385

Permeability Coefficient (k) 1.03E-08 m/s

Produced by	Dated	Checked by	Dated
S.MCNIFF	05/07/23	A.CUTTS	12/07/23



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SOIL INFILTRATION RATE

Project: S230503

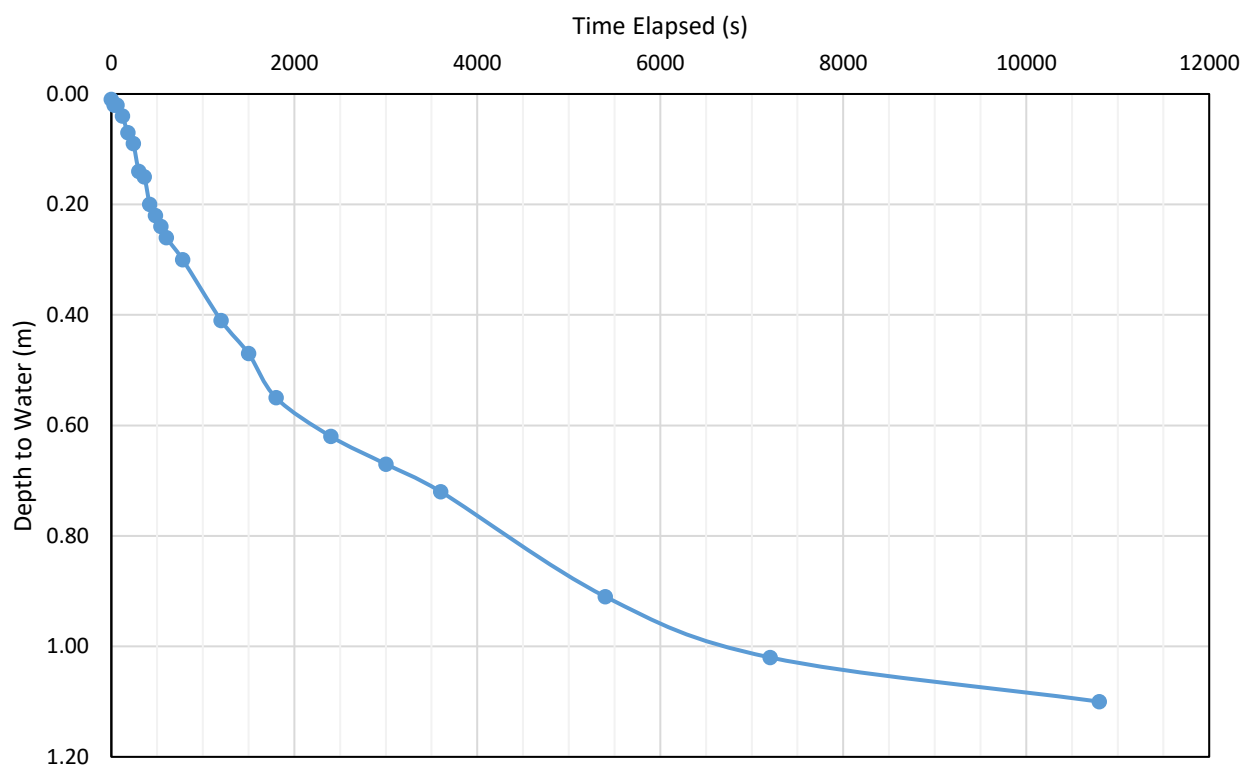
Project name: Ardersier Port Falling Head Test LT

Report date: 05/07/2023

Test date: 27/06/2023

Test location: BHSP07

Falling Head Test BS22282-1(2012) Geohydraulic Testing



Internal borehole diameter 0.2030 m

Base depth of borehole 20.00 m

Cross-sectional area of borehole 0.0324 m²

Linear regression slope 5.84E-06

Shape Factor 23.7845

Permeability Coefficient (k) 7.95E-09 m/s

Produced by	Dated	Checked by	Dated
S.MCNIFF	05/07/23	A.CUTTS	12/07/23



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SOIL INFILTRATION RATE

Project: S230503

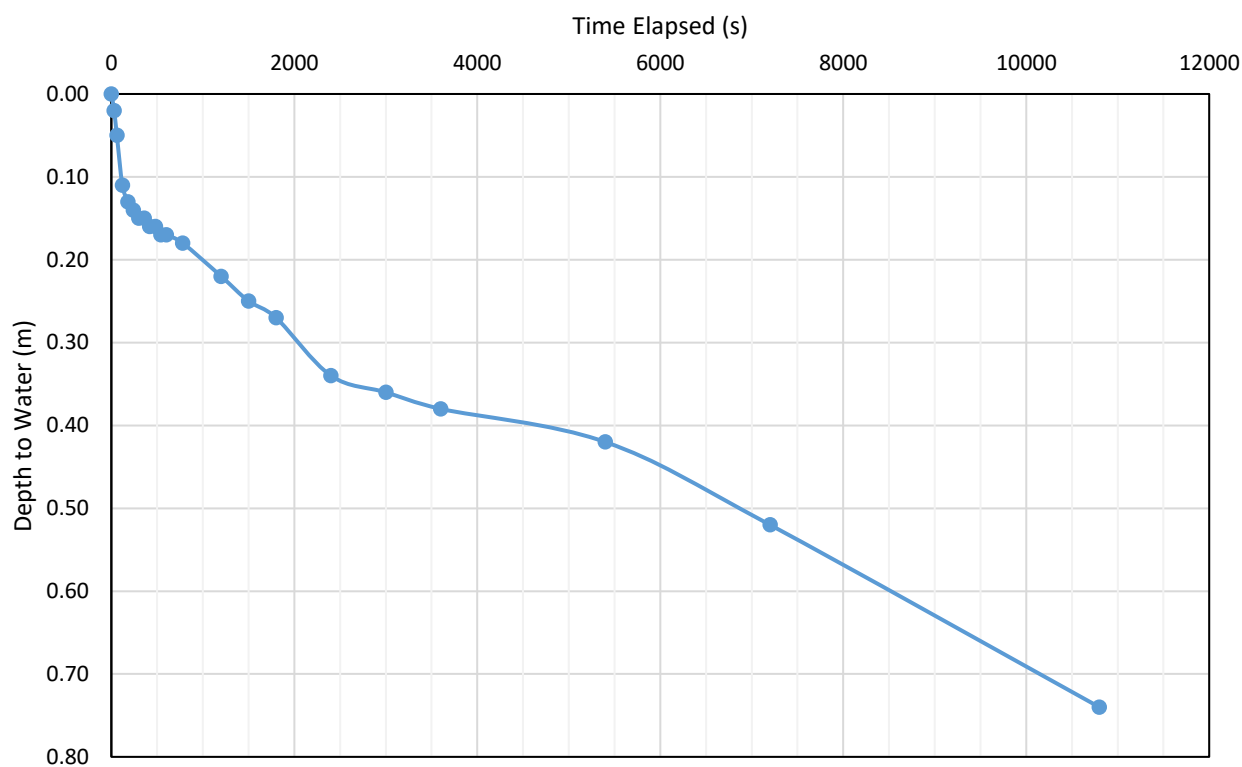
Project name: Ardersier Port Falling Head Test LT

Report date: 05/07/2023

Test date: 29/06/2023

Test location: BHSP07

Falling Head Test BS22282-1(2012) Geohydraulic Testing



Internal borehole diameter 0.1530 m

Base depth of borehole 35.00 m

Cross-sectional area of borehole 0.0184 m²

Linear regression slope 1.75E-06

Shape Factor 35.8992

Permeability Coefficient (k) 8.95E-10 m/s

Produced by	Dated	Checked by	Dated
S.MCNIFF	05/07/23	A.CUTTS	12/07/23



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SOIL INFILTRATION RATE

Project: S230503

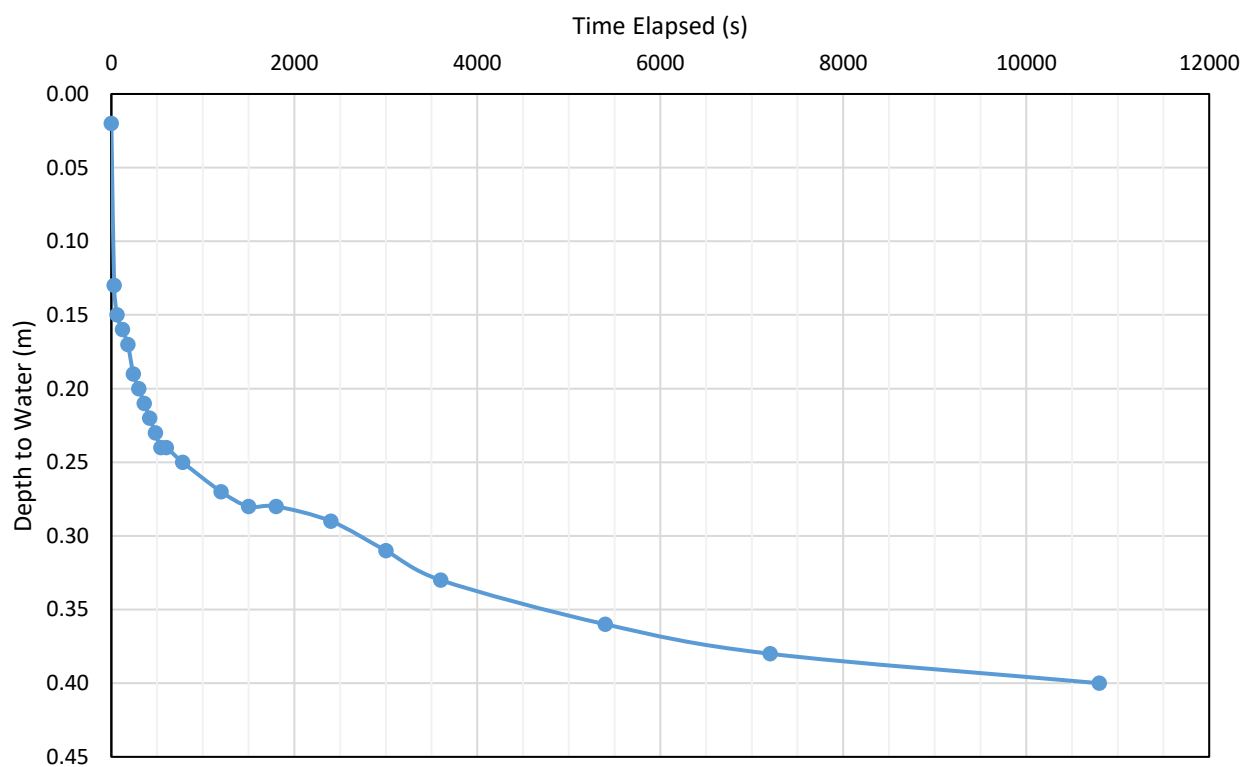
Project name: Ardersier Port Falling Head Test RTRisi

Report date: 05/07/2023

Test date: 08/06/2023

Test location: BHSP08

Falling Head Test BS22282-1(2012) Geohydraulic Testing



Internal borehole diameter 0.2540 m

Base depth of borehole 10.00 m

Cross-sectional area of borehole 0.0507 m²

Linear regression slope 2.66E-06

Shape Factor 14.3907

Permeability Coefficient (k) 9.35E-09 m/s

Produced by	Dated	Checked by	Dated
S.MCNIFF	05/07/23	A.CUTTS	12/07/23



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SOIL INFILTRATION RATE

Project: S230503

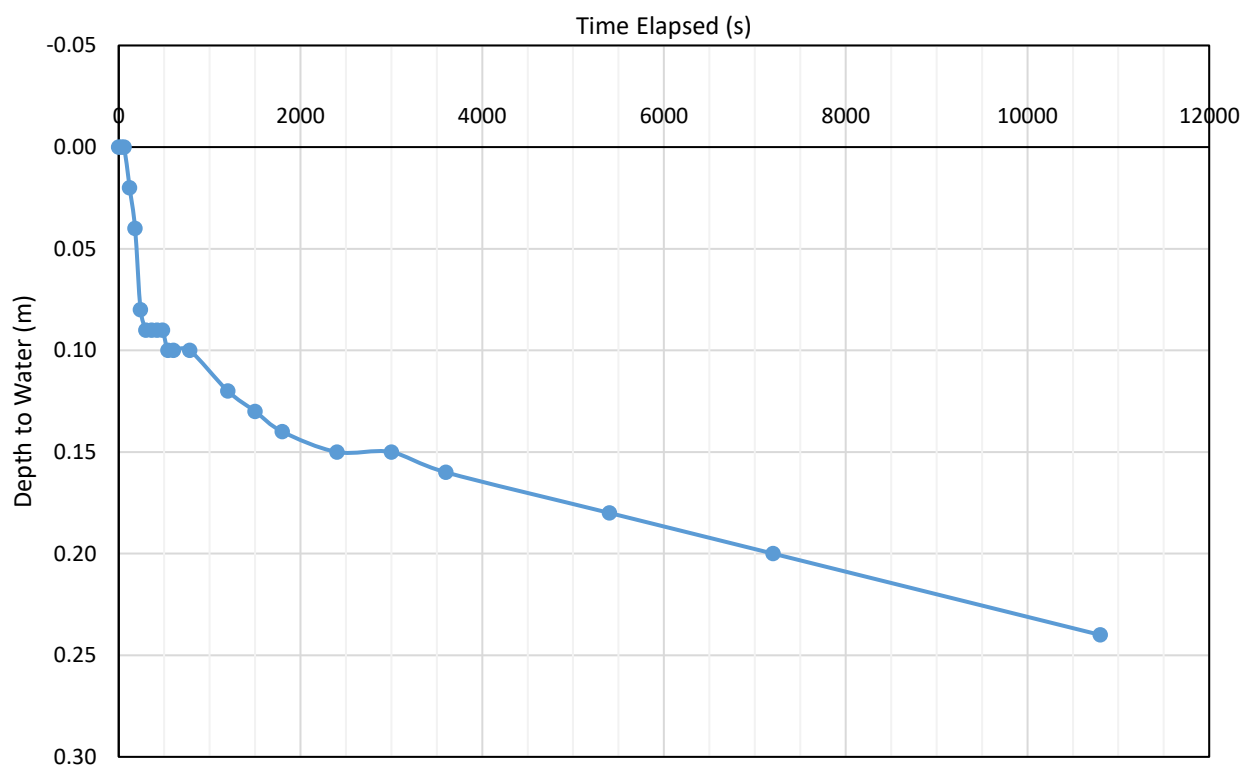
Project name: Ardersier Port Falling Head Test RT

Report date: 05/07/2023

Test date: 08/06/2023

Test location: BHSP08

Falling Head Test BS22282-1(2012) Geohydraulic Testing



Internal borehole diameter 0.2000 m

Base depth of borehole 21.00 m

Cross-sectional area of borehole 0.0314 m²

Linear regression slope 9.44E-07

Shape Factor 24.6763

Permeability Coefficient (k) 1.20E-09 m/s

Produced by	Dated	Checked by	Dated
S.MCNIFF	05/07/23	A.CUTTS	12/07/23

APPENDIX E



GROUNDWATER DATA LOGGER SUMMARY 25 October 2023 – 01 February 2024

From 11.00am 25/10/2023 to 11.00am 01/02/2024

BHSP07 GW Data

	Temperature (C)		Pressure (mBar)	Water Level (mbgl)
Min	4.144		955.395	-0.358
Mean	7.466		1005.316	0.95
Max	11.837		1070.959	1.727

BHSP08 GW Data

	Temperature (C)		Pressure (mBar)	Water Level (mbgl)
Min	4.577		955.395	0.24
Mean	8.42		1005.316	1.417
Max	12.524		1070.959	2.275

APPENDIX F

♣Solmek conditions of offer, notes on limitations & basis for contract (ref: version1/2024)

These conditions accompany our tender and supercede any previous conditions issued. Solmek will prepare a report solely for the use of the Client (the party invoiced) and its agent(s). No reliance should be placed on the contents of this report, in whole or in part by 3rd parties. The report, its content and format and associated data are copyright, and the property of Solmek. Photocopying of part or all of the contents, transfer or reproduction of any kind is forbidden without written permission from Solmek. A charge may be levied against such approval, the same to be made at the discretion of Solmek.

Solmek cannot be held liable and do not warrant, or otherwise guarantee the validity of information provided by third parties and subsequently used in our reports. Solmek are not responsible for the action negligent of otherwise of subcontractors or third parties.

Site investigation is a process of sampling. The scope and size of an investigation may be considered proportional to levels of confidence regarding the ground and groundwater conditions. The exploratory holes undertaken investigate only a small volume of the ground in relation to the overall size of the site, and can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions as encountered within each of the exploratory holes. There may be different ground conditions elsewhere on the site which have not been identified by this investigation and which therefore have not been taken into account in this report. Reports are generally subject to the comments of the local authority and Environment Agency. The comments made on groundwater conditions are based on observations made at the time that site work was carried out. It should be noted that mobile contamination, ground gas levels and groundwater levels may vary owing to seasonal, tidal and/or weather related effects. Solmek cannot be held liable for any unrecorded or unforeseen obstructions between exploratory boreholes and trial pits. This includes instances where previous structures on the site (buried man made structures) or the presence of boulder clay (cobbles and/or boulder obstructions) have been anticipated. All types of piling operations should make allowance for obstructions within the construction budget to accommodate this. Unrecorded ancient mining may occur anywhere where seams that have been worked and influence the rock and soil above. Dissolution cavities can occur where gypsum or chalk is present. Rotary drilling is the recommended technique to prove the integrity of the rock.

Where the scope of the investigation is limited via access to information, time constraints, equipment limitations, testing, interpretation or by the client or his agents budgetary constraints, elements not set out in the proposal and excluded from the report are deemed to be omitted from the scope of the investigation.

Desk studies are generally prepared in accordance with RICS guidelines. Environmental site investigations are generally undertaken as 'exploratory investigations' in accordance with the definitions provided in paragraph 5.4 of BS 10175:2011 in order to confirm the conceptual assumptions. You are advised to familiarize yourself with the typical scope of such an investigation. No pumping of water will be undertaken unless a licence or facilities/equipment have been arranged by others.

Where the type, number or/and depth of exploratory hole is specified by others, Solmek cannot and will not be responsible for any subsequent shortfall or inadequacy in data, and any consequent shortfall in interpretation of environmental and geotechnical aspects which may be required at a later date in order to facilitate the design of permanent or temporary works.

All information acquired by Solmek in the course of investigation is the property of Solmek, and, only also becomes the joint property of the Client only on the complete settlement of all invoices relating to the project. Solmek reserve the right to use the information in commercial tendering and marketing, unless the Client expressly wishes otherwise in writing. The quoted rates do not include VAT, and payment terms are 30 days from dispatch of invoice from our offices. Quotes are subject to a site visit.

We have allowed for 1 mobilisation and normal working hours unless otherwise stated. The scope of the investigation may be reviewed following the desk study and/or fieldwork. The presence or otherwise of Japanese Knotweed or other invasive plants can be difficult to identify especially during winter months. If Japanese Knotweed or other invasive species are suspect, it should be confirmed by an ecologist. We have not allowed for acquiring services information, and cannot be responsible for damage to underground services or pipes not shown to us or not clearly shown on plans. Costs incurred will be passed on to you, and in commissioning Solmek you understand and accept that you/your agent have a contractual relationship with Solmek & you accept this. Our rates assume unobstructed, reasonably level and firm access to the exploratory positions and adequate clear working areas and headroom. We have priced on the basis that you or your client have the necessary permissions, wayleaves and approvals to access land. All boreholes and pits are backfilled with arisings except where gas monitoring pipes are installed with stopcock covers. Solmek are not responsible for any uneven surfaces as a result of siteworks and rutting and backfilled excavations may require re-levelling and/or making good by others after fieldwork is complete, and Solmek has not allowed for this. No price has been provided or requested for a return visit to remove pipework and covers. Hourly rates apply to consultancy only and do not include expenses unless otherwise shown. If warranties are required, legal costs incurred will be passed on to you assuming Solmek agree to complete such warranties, modified or otherwise and you understand and agree to pay all costs.

We reserve the right to pursue full payment of the invoice prior to release of any information including reports. We advise you/your client that we may elect to pursue our statutory rights under late payment legislation, and will apply 8% to the base rate for unreasonably late payments. Solmek are exempt from the CIS Scheme. Solmek offer to undertake work only in strict accordance with conditions covered by our current insurances, which are available for inspection. Solmek are not responsible for acts, negligent or otherwise of subcontractors and as a matter of policy cannot indemnify any other parties. Professional indemnity Insurance is limited to ten times the invoice net total except where stated otherwise by Solmek. Solmek give notice that consequential loss as a direct or indirect result of Solmek's activities or omission of the same are excluded.

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FAIRHURST

ARDERSIER PORT ENERGY TRANSITION FACILITY PORT EXTENSION



November 2025

Appendix 3.2 Outline Construction Environmental
Management Document

Ardersier Port Extension

Issue No.	Date	Author (Name / Role)	Approved by (Name / Role)	Issue status	Distribution	Remarks
001	11.11.25	Becky McLean	Campbell Fleming	Draft	Submitted with application	Outline

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1 INTRODUCTION

This outline Construction Environmental Management Document (CEMD) has been produced by Ardersier Port in conjunction with Civic.

The CEMD has been produced using the principles within The Highland Council Guidance Note on Construction Environmental Management Process for Large Scale Projects (August 2010).

The primary purpose of this document is to ensure that the mitigation described and defined in the 2025 Environmental Impact Assessment Report (EIAR) is implemented during the main construction activities.

The Schedule of Mitigation taken from the finalised EIAR (post-consultation) is provided within **Appendix A**.

This CEMD replaces the 2018 CEMD that was prepared for the previous planning consent.

1.1 APPROACH TO ENVIRONMENTAL MANAGEMENT

The adopted CEMD will contain the following specific mitigation plans. Those in **bold** have been drafted as part of this application and are provided in draft in EIAR Chapter 5 of the EIAR. Other appendices are currently in development:

- Appendix A – EIA Schedule of Mitigation¹ – included in this version
- Appendix B – Site Noise Management Plan
- **Appendix C – Construction Dust Management Plan**
- **Appendix D – Travel Plan Framework**
- **Appendix E – Interim Biosecurity Plan**
- Appendix F – Habitat Management Plan
- Appendix G – Marine Mammal Mitigation Plan
- **Appendix H – Site Waste Management Plan**

The main delivery component for the mitigation identified within these plans will be the production of detailed Construction and Environmental Management Plans (CEMPs) prior to specific elements of construction work commencing. These will relate to individual specific site/aspects of the construction work and will apply the principles of the agreed mitigation to show how the mitigation is implemented effectively down to the specific site level.

¹ Port of Ardersier Limited (November 2025), Ardersier Port Expansion – Environmental Impact Assessment Report – Chapter 15 – Mitigation

1.2 CHANGE CONTROL AND DOCUMENT CONTROL

The CEMD and associated plans, will be subject to approval from Statutory Authorities and will be updated as the various plans that form part of the CEMD evolve. All documents will be reviewed periodically to ensure they are kept up to date and relevant throughout the construction phase.

Where a change is proposed we will implement our Management of Change Procedure (part of our International Organisation for Standardisation (ISO) systems) which includes:

- Define the proposed change.
- Establish a review group internally.
- Assess the change according to potential impact on people, environment, assets and reputation (PEAR framework).
- Consult with relevant Regulators.
- Document the process and consultation.

The CEMD will be updated as appropriate during the progress of the works.

Document control procedures will be implemented to ensure all correspondence, drawings and technical data received are recorded, distributed, filed and archived in an efficient and controlled manner. Document control activities shall include:

- Review of documents and drawings prior to release to ensure that requirements are clearly stated and that they are authorised for issue.
- Identification of documents to be controlled.
- Review and approval of changes to documents and drawings; and
- Control of documents, including approved changes to preclude inadvertent use of obsolete or superseded documents.

2 PROJECT OVERVIEW

For a full description of the proposed development refer to the 2025 EIAR and appendices. A synopsis is given below for context.

2.1 SITE DESCRIPTION

Ardersier Port is located on the Moray Firth. The site is bordered by the Moray Firth to the north, Carse of Delnies to the east, Carse Wood to the south, and the sand dunes and tidal sandflats of Whiteness Sands to the west. Fort George's live firing range is to the southwest, and Whiteness Head Spit, which shelters a harbour.

The site has a long industrial history, having been a hub of activity for the energy sector in Scotland. In the 1970s a substantial area of land was reclaimed from the foreshore and utilised for industrial purposes for the fabrication and construction of offshore platforms for the oil and gas industry, employing in the region of 4,500 people.

Activity ceased in early 2000 and it was vacant for approximately 18 years. Once closed, it became one of the largest brownfield sites in the UK and the site has undergone significant decontamination works since operations ceased.

The proposed extension site is located adjacent to the consented port as shown in **Figure 1** (the area outlined in orange).

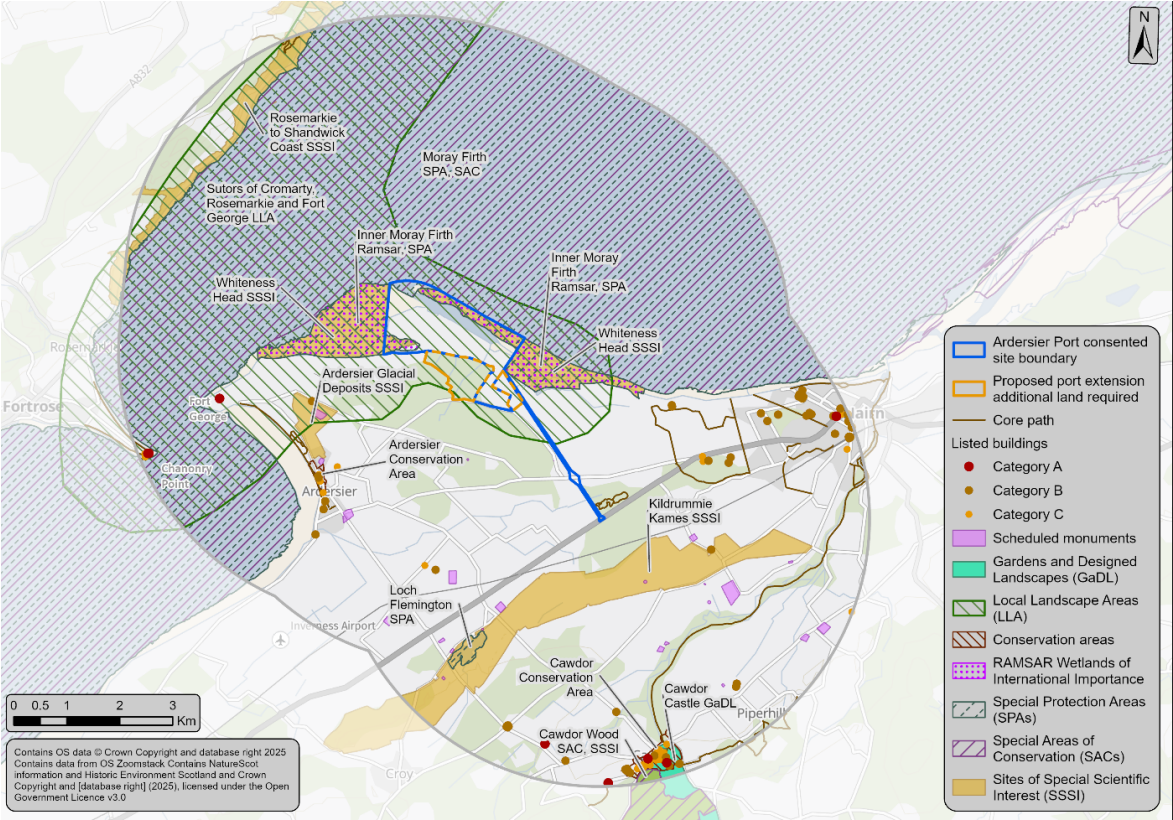
2.2 ENVIRONMENTAL SENSITIVITIES

Key environmental considerations include the sensitive marine and terrestrial habitats, potential impacts on landscape and cultural heritage, and the need to minimise water environment, air quality, noise, carbon, and transport impacts during construction and operation, all key designations and areas of sensitivity are shown in **Figure 2**.

Figure 1: Proposed Extension Site



Figure 2: Environmental Designations & Constraints



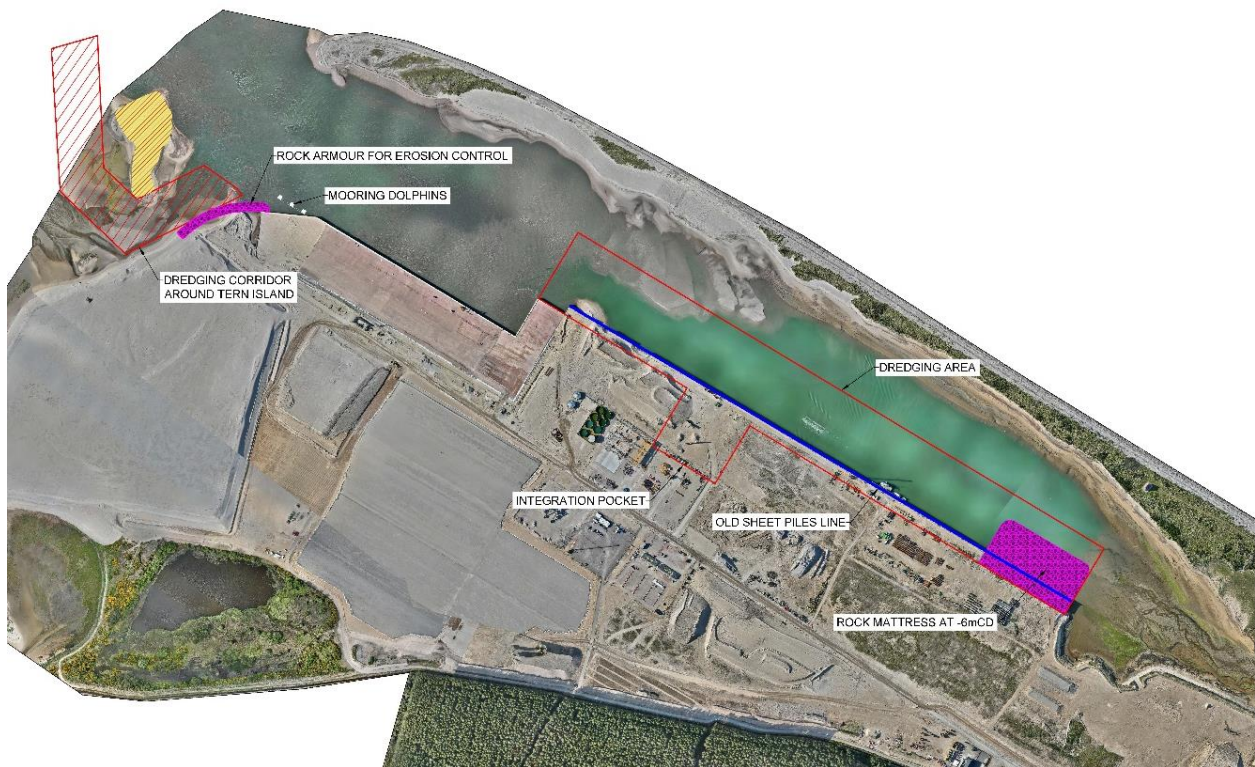
2.3 WORKS OVERVIEW

The construction works relevant to this CEMD include the following terrestrial and marine works.

Marine (Figure 3)

- Construction of an integration pocket for wind turbine assembly
- Removal of old sheet piles with possible use of temporary sand berm.
- Dredging to deepen the harbour to generally -12.4m Chart Datum (CD) in the western harbour extension area and to up to -6mCD in the easternmost part of the harbour (up to 2,000,000m³).
- Disposal of dredgings at licenced disposal ground if no beneficial re-use identified.
- Dredging to west of Tern Island.
- Rock armour for erosion control and rock mattress on seabed in -6mCD area.
- Installation of three mooring dolphins (piled berthing structures).

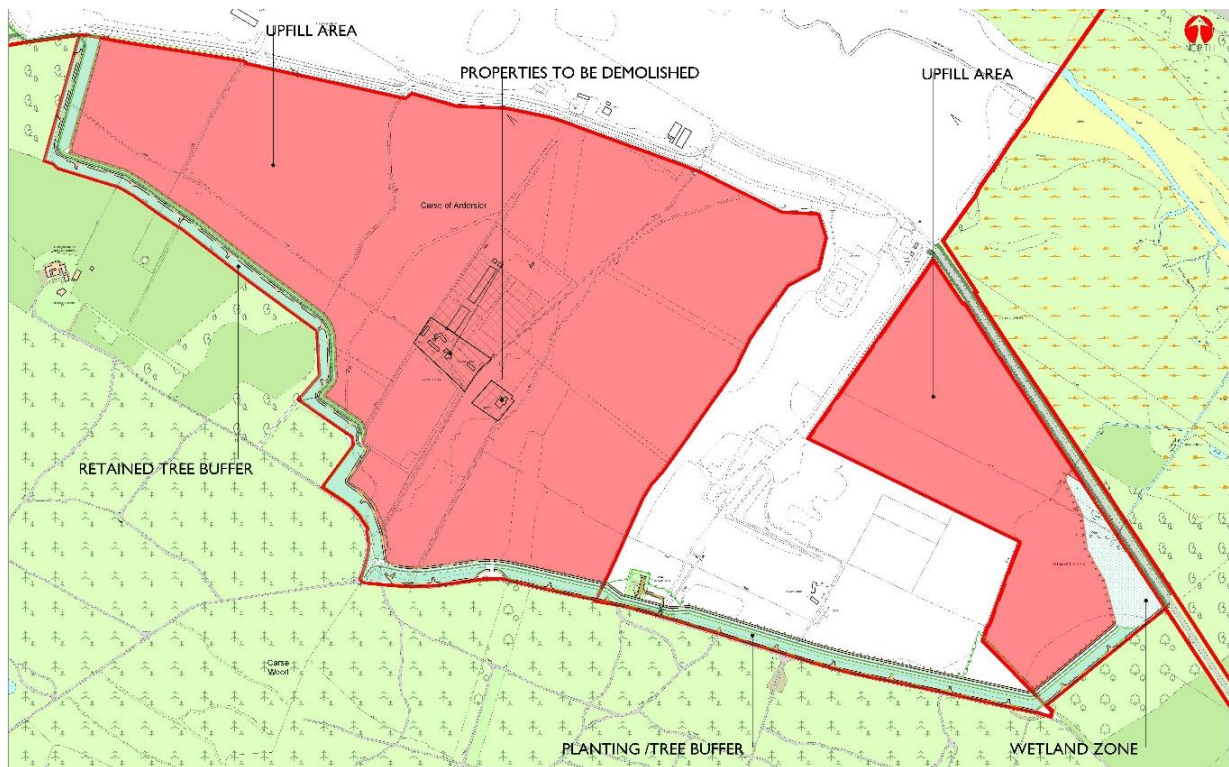
Figure 3: Marine Works Layout



Terrestrial (Figure 4)

- Site clearance of extension area comprising tree felling and clearing.
- Demolition of existing buildings.
- Land raising (upfill) and levelling of extension area to suitable height with previously dredged sand.
- Creation of working platform through stone placement.
- Surface water management during construction; and
- Installation of new permanent watercourses to extension land southern perimeters.

Figure 4: Site Clearance Areas (West - Scots Pine plantation, East - Scrub and Birch) - Terrestrial Works



2.4 WORKS PROGRAMME

With regards to high level timelines, the construction phase is expected to take place between mid-2026 and end 2029. This could take place in discrete phases within that overall time period.

3 ROLES & RESPONSIBILITIES

During construction, Ardersier Port Limited has overall responsibility for delivering the commitments in the CEMD and associated plans.

Ardersier Port Limited will halt any activity where environmental commitments are not being successfully delivered, where legal requirements are being breached or where there is a significant risk to the environment.

Any significant deviations from agreed methods of work will be formally agreed with the relevant parties in advance of the changes and CEMP revised if applicable/necessary.

3.1 ENVIRONMENTAL ROLES AND RESPONSIBILITIES

Roles and responsibilities are outlined below and will be refined during the appointment of Contractor(s).

3.1.1 Head of Consenting / Env. Project Director

The Head of Consenting (HoC) /Project Director has specific environmental responsibilities including:

Demonstrate positive environmental commitment through actively supporting the initial set-up of systems and sustaining effective environmental management and monitoring measures.

- Ensure adequate provision of competent resources.
- Review and sign off of any CEMP's or changes to the CEMD.
- Ensure all consents and licenses are in place prior to work commencing and monitor progress against the Schedule of Mitigation commitments.
- High level engagement with external Stakeholders and Regulators.

3.1.2 Environmental Site Manager / Environmental Advisor

An Environmental Site Manager for the construction phase will be nominated from within Ardersier Port personnel. This person's responsibilities will include:

- Day to day liaison with Contractors on environmental matters and implementation of their CEMP's.
- Arranging audits of the Contractor on an appropriate frequency.
- Conduct or arrange ecological and environmental surveys as required by planning or marine licencing;
- Engage suitable external support when required such as licenced bat workers, and any Environmental Clerk of Work (EnvCoW)/ Ecology Clerk of Work (ECoW) support deemed necessary for specific tasks.
- Arranging toolbox talks for site personnel and Contractors as necessary.
- Stakeholder/Regulator engagement.
- Record keeping of audits and inspections.

3.1.3 Site EnvCow/ECoW

Ardersier Port have a suitably qualified and experienced EnvCoW/ECoW on site full time. This allows day-to-day observations on site and therefore greater continuity and consistency of inspection and auditing. The site EnvCoW will audit and record findings for general construction works at a suitable frequency.

3.1.4 Environmental Clerk of Works (EnvCoW) Role/External Consultants

Where workload dictates or specialist works are required (such as bat work or other works requiring to be carried out under licence) such external support will be engaged.

3.1.5 Marine Mammal Observer (MMO)

The Marine Mammal Mitigation Plan (MMMP) defines monitoring and mitigation to protect marine mammals through the marine works. This requires MMOs to be deployed for certain activities.

The MMO roles will include personnel as follows:

- Suitably trained or experienced MMO on dredging vessels (barges/dredger), likely dredging company crew.
- Suitably trained or experienced MMO to observe piling works or other noisy construction works as defined in the MMMP.
- Ardersier MMO/Environmental Manager to provide oversight of Contractor MMOs and carry out spot audits and record checks.

3.1.6 All Site Personnel

All personnel will be made aware of the key commitments in the CEMD and briefed on the requirements of any relevant CEMPs to their Work.

3.1.7 Contractors

The Contractor(s) will be provided copy of the CEMD. They will then be required to prepare detailed CEMPs for their scope of Works. The Contractors CEMP's will be reviewed and agreed with Ardersier Port prior to major construction works commencing. The finalised CEMPs will provide the basis for auditing of the Contractors Works through their contract.

Contractors will be contractually obliged to have a nominated point of contact for all environmental matters (Contractor Environmental Manager) to provide regular feedback and information to Ardersier Port Limited on the progress and success in delivering all conditions, mitigation and commitments on site.

3.2 KEY CONTACT

Dr. C Fleming
Head of Consenting
Ardersier Port
Port Approach
Ardersier
Inverness
IV2 7QX

4 COMMUNICATION, MONITORING AND TRAINING

4.1.1 Communication

There are two key aspects to communications, internal (site team and contractors) and external (stakeholders and regulators).

With regard to internal communications, the site Environmental Manager and Contractors environmental manager(s) will convene a monthly meeting to discuss forthcoming works (month ahead), review any incidents, non-compliance, good practice or improvements that have occurred or are possible looking forward.

This meeting will be formally recorded and distributed to the Head of Consenting/Project Director.

For external communication, in any circumstances that require a change to the CEMD the following process will be followed:

- Informally advise The Highland Council (THC) and other relevant Stakeholders (NatureScot/SEPA) of the intended change.
- Draft and review proposed changes.
- Formally submit to THC for consultation.

4.1.2 Monitoring and Auditing

As part of defining and agreeing a CEMP for a discrete package of Work or Contractor, a schedule of audits will be agreed between Ardersier Port and the Contractor(s). This will include the Contractors own audit schedule, and audits carried out on the Contractor, against their CEMP content, by Ardersier Port.

Copies of all audits will be retained for inspection by The Highland Council or other Regulators if required.

4.1.3 Environmental Training and Awareness

The Ardersier Port environmental teams' competence and experience to deliver the various roles described above shall be appraised continually by the Head of Consenting.

The Ardersier Port general site induction package includes environmental awareness aspects. Awareness training for all site personnel will be provided where they are involved in waste management, working in or near watercourses, surface water pollution and control, dust management measures and noise management measures.

Records of all training required and provided to all employees will be maintained and made available for inspection if required.

5 APPENDICES

APPENDIX A - EIA SCHEDULE OF MITIGATION

Final Schedule of Mitigation to be added following determination

APPENDIX B - SITE NOISE MANAGEMENT PLAN

APPENDIX C - CONSTRUCTION DUST MANAGEMENT PLAN

APPENDIX D – TRAVEL PLAN

APPENDIX E – INTERIM BIOSECURITY PLAN

APPENDIX F - HABITAT MANAGEMENT PLAN

APPENDIX G - MARINE MAMMAL MITIGATION PLAN

APPENDIX H - SITE WASTE MANAGEMENT PLAN

ARDERSIER PORT ENERGY TRANSITION FACILITY PORT EXTENSION



November 2025

Appendix 3.3: Socio-economic Assessment

Economic Impact Assessment of Ardersier Port Extension

A report to



October 2025



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1.

Executive Summary

This report assesses the current and future socio-economic impacts of the development and operation of Ardersier Port Extension.

Situated in the Moray Firth with direct access to the North Sea and part of the Green Freeport allocation, the existing Ardersier Port is a deep-water, sheltered port with 153 hectares of brownfield land available for development. Once completed it will provide facilities to support floating and fixed offshore wind developers to carry out staging and integration, foundation fabrication, component manufacturing and maintenance requirements. It will be the largest dedicated offshore wind deployment port facility in Scotland, capable of hosting and supporting gigawatt scale projects. Ardersier Port Extension development will significantly expand the site's capacity to support offshore wind projects. It adds nearly 200 acres of operational land, new quay infrastructure and facilities for assembly and storage.

Strategic national economic and offshore wind industry policy advocates and supports investment to enable port infrastructure supporting offshore wind industry growth. Ardersier Port will be a major contributor to the infrastructural development required to deliver offshore wind projects, actualising economic benefits, jobs and skills growth, and development opportunities promised in the net zero transition.

It is located within the Highland region, a rural economy with limited job opportunities of scale and an aging population. The port development, and particularly the extension project, holds transformative potential for the region and will be important for generating employment opportunities. In conjunction with wider development of the Green Freeport throughout the Highland and Moray regions it will contribute to the retention of the working-age population. It also serves as an excellent project to attract new workers to the region, across all stages of the offshore wind project lifecycle.

The economic impact of the extension project has been split into 3 distinct areas:

- Port Extension development and construction;
- Port Extension operations; and
- Offshore wind impact.

1.1 Port Development and Construction

It is estimated that the total economic impact (including indirect and induced) generated from the development and construction phase of Ardersier Port Extension would be up to:

- £53.8 million GVA and 464 years of employment in Moray & Highland;
- £119.0 million GVA and 1,019 years of employment across Scotland; and

- £284.9 million GVA and 2,662 years of employment in the UK.

As the development and construction of Ardersier Port Extension will take place over a period of time, the economic impacts generated will occur over time, with the largest share of impact is expected to occur during 2027/2028, subject to potential development timelines.

1.2 Port Operations

Economic activity will also be generated on an annual basis from the on-site operations of the Ardersier Port Extension. It is estimated that the total annual economic impact generated from the operation stage of the Ardersier Port Extension (after displacement) would be up to:

- £45.2 million GVA and 445 jobs in Moray & Highland;
- £58.3 million GVA and 569 jobs in Scotland; and
- £95.1 million GVA and 888 jobs across the UK.

These figures exclude impact associated with the offshore wind sector.

1.3 Offshore Wind Impacts

The occupation of the facilities after the completion of the extension at the port would support further the delivery of fixed offshore wind and ScotWind floating offshore wind projects (from 2028/29). The activities at the port are part of the wider offshore wind development impacts considered. Figures are indicative and are based on assumptions for the wider offshore wind sector by ORE Catapult¹ and the previous economic impact assessment BiGGAR Economics has undertaken for the port for consistency.

The Ardersier Port including the extension would contribute to the development of the offshore wind sector. Scottish organisations are expected to secure contracts worth £16 billion to support this deployment by 2040. Of this, about £4 billion is expected to be attributed to the extension project.

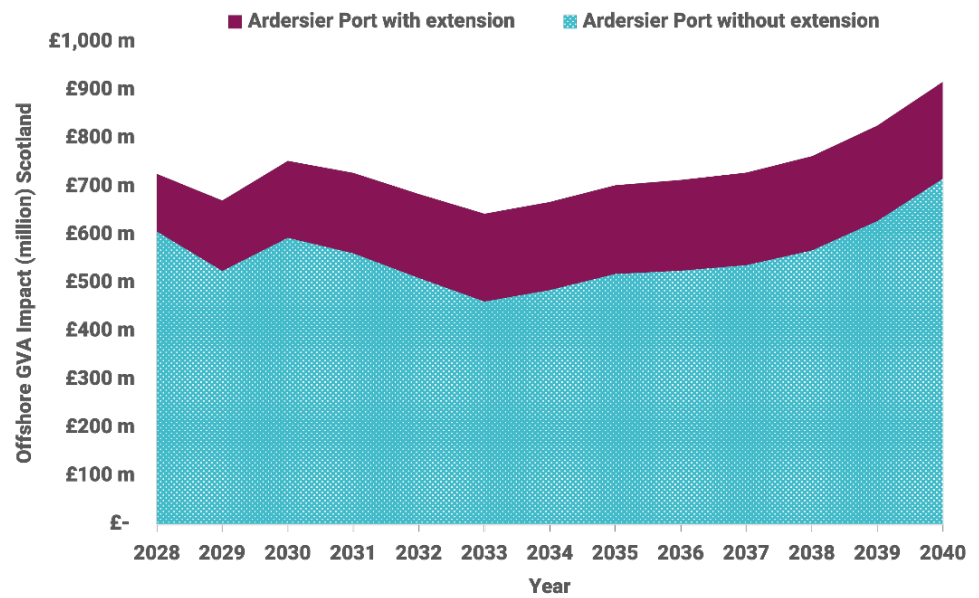
This expenditure will drive economic activity that will support employment and generate Gross Value Added (GVA). Employment and GVA are expected to grow throughout the 2030s. In 2040, the additional deployment of offshore wind that is supported by Ardersier Port Extension alone is expected to generate approximately:

- £720 million GVA and support c.800 jobs in Moray & Highland;
- £1.8 billion GVA and support c.2,000 jobs in Scotland; and
- £6.1 billion GVA and support c.7,100 jobs across the UK;

¹ Floating Offshore Wind Industrialisation Roadmap – Deployment Scenarios produced by ORE Catapult in 2022.

The following figure illustrates the difference in the Scottish GVA outcomes across time with and without the Ardersier Port Extension, highlighting the significance of this project in enhancing economic impact associated with the offshore wind sector.

Figure 1-1: Scottish GVA Impacts Over Time due to Ardersier Port Extension



Source: BiGGAR Economics Analysis

By 2040, approximately half of the employment and GVA impacts will be within companies that are directly contracted onto these projects and half will be in the wider supply chain and induced.

1.4 Wider Socio-Economic Implications

The Ardersier Port Extension will increase further port's capacity to influence the social vitality of the immediate area and the Inner Moray Firth, contributing to a more sustainable and prosperous future for the region. A key driver of depopulation in rural areas is the lack of high-quality employment opportunities which would attract working age people and work to retain current residents as they enter the workforce. With the capability to enable approximately 3,000 long-term on-site jobs, Ardersier Port including the extension is positioned to make a significant contribution toward reversing depopulation trends and supporting the sustainability of the regional economy.

Ardersier Port has the potential to be the largest single site of private sector employment in Highland

Overall, the development, construction, and ongoing operation of Ardersier Port Extension has the potential to provide additional socio-economic benefit to the local community, Highland and Scottish economies, as well as enabling growth of the offshore wind industry in the UK.



2.

Introduction

BiGGAR Economics has been commissioned to undertake an economic impact assessment of Ardersier Port Extension.

2.1 Project Background

2.1.1 Existing Ardersier Port Development

Ardersier Port has a rich history in serving the energy sector and was home to McDermott's Fabrication Yard from the 1970s through to 2001. Many North Sea oil and gas platforms were manufactured here but the site has been vacant since the early 2000s. It is now identified as prime for development to deliver critical infrastructure required by the offshore wind industry.

Situated in the Moray Firth with direct access to the North Sea, Ardersier Port is located approximately 15 miles east of Inverness, 3 miles east of the village of Ardersier, and 6 miles to the west of the town of Nairn. It is approximately 9 miles from Inverness airport, with good road transportation links being close to the A96, which connects Inverness to Aberdeen.

Ardersier Port is a deep-water, sheltered port with 153 hectares of brownfield land available for development. Once the development is completed, it will provide facilities to support fixed and floating offshore wind developers to carry out staging and integration, foundation fabrication, component manufacturing and maintenance requirements. It will be the largest dedicated offshore wind deployment port facility in Scotland, capable of hosting and supporting gigawatt scale projects.

The site is owned by Haventus (Ardersier) Limited and the development is supported by investors Quantum Capital Group, Scottish National Investment Bank and UK Infrastructure Bank.

The proposition for the site is closely aligned with the Inverness and Cromarty Firth Green Freeport's strategic focus on the facilitation of new high-value jobs, contributing to the local skills ecosystem and helping to deliver a fair transition to net zero. Ardersier works collaboratively with other ports in the Green Freeport area to strengthen the area's potential as an offshore wind cluster. Dependent on the site's customer mix, there is high potential for activities delivered at Ardersier to contribute to innovation, both in existing and new energy technologies.

2.1.2 Ardersier Port Extension

The proposed extension of the Ardersier Port Energy Transition Facility builds on the existing consented development by adding nearly 200 acres of new operational land, expanded quay infrastructure and enhanced capacity of offshore wind-related

activities. It includes deeper dredging of the harbour, land-raising and platform creation and facilities for storage, assembly and partial manufacturing of turbine components. The extension will support increased vessel traffic and provides the additional space and flexibility needed to facilitate large-scale offshore wind deployment, strengthening Scotland's role in energy transition.

The figure below shows the consented site and the proposed extension, highlighting the size of this development overall.

Figure 2-1: Ardersier Port Site



Source: Haventus (Ardersier) Limited (2025).

Despite the potential scale of the offshore wind sector, and the investment that has already been made at Ardersier Port, the realisation of the economic opportunity added due to the extension is vital. This study has been commissioned to:

- estimate the economic impacts of the proposed development; and
- explain the impact and the implications within the current socio-economic context.

The impacts and implications are assessed at a local, regional and national level.

2.2 Report Structure

The remainder of this report is structured as follows:

- Chapter 3 presents the strategic economic case for the development;
- Chapter 4 sets the proposed development within the local, regional and national socio-economic context;

-
-
- Chapter 5 explains the approach and methodology used to assess the economic impact of Ardersier Port Extension;
 - Chapter 6 estimates the economic impact of the development; and
 - Chapter 7 discusses some of the wider socio-economic implications.

3.

Strategic Context

Offshore wind has been established as a central resource in achieving both energy security and net zero targets, with Scotland at the forefront in championing both offshore wind policy and investment. The extension at Ardersier will allow the port to benefit further from the opportunities created by offshore wind, delivering high-quality jobs to the Local Area.

Offshore wind technology provides a renewable, low-carbon, energy source that converts the power of wind into electricity without the greenhouse gas emissions associated with traditional energy sources. Offshore wind has grown rapidly in Scotland in recent years, contributing 15.3GW of electricity generation to Scotland in 2023, an 8.6GW increase since 2013².

Due to its larger scale, offshore wind holds a higher generation capacity and is cost efficient. Offshore wind's Contracts for Difference (CfD) strike price cost per unit was £37.35/MW (in 2012 prices) for Allocation Round 4 (AR4), almost 70% lower than its cost in the first CfD AR1 in 2015 at £119.89/MWh. Improvements in efficiency, innovation and supply chains has reduced the CfD price and has led to a considerable saving for consumers³.

The UK and Scotland have consistently grown and expanded their offshore wind capabilities with 2023 setting new records of 49TWh offshore wind green electricity generation. This saved 18.5m tonnes of CO2 emissions annually⁴. Through this expansion in offshore wind the UK now boasts 17% of its electricity generation from this technology, houses 43% of European offshore wind capacity, and is home to the world's largest offshore windfarm, Dogger Bank, which powers the equivalent of 6 million homes annually⁵.

² Scottish Government (2024) *All-Energy conference: speech by Energy Secretary*. Accessed: <https://www.gov.scot/publications/energy-conference-speech-energy-secretary/>

³ UK Government (2023) *Offshore Wind Net Zero Investment Roadmap*. Accessed: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1167856/offshore-wind-investment-roadmap.pdf

⁴ The Crown Estate (2024) *UK offshore industry gearing up for a new era of sustainable growth*. Accessed: <https://www.thecrownestate.co.uk/news/uk-offshore-wind-industry-gearing-up-for-a-new-era-of-sustainable-growth>

⁵ Dogger Bank Wind Farm (2024) *Building the world's largest offshore wind farm*. Accessed: <https://doggerbank.com/>

This expansion has been facilitated by national and local policies that have encouraged, advanced and nurtured offshore wind growth.

3.1 National Strategies

The Climate Change Act 2008 served as an important catalyst to the expansion of the UK renewable base as it provided a legally binding target of net zero greenhouse gas emissions for the UK by 2050⁶, and Scotland by 2045⁷. Offshore wind has been selected as a favourable technology to achieve net zero given its lower cost, lower impact on communities, considerable potential for economic growth, and suitability to Scotland's geographical resource advantages of high wind levels and vast sea area⁸.

Under the UK government's Ten Point Plan for a Green Industrial Revolution 2020, advancing offshore wind is central in accelerating net zero and boosting sustainable economic growth setting an ambitious target of 40GW of offshore wind by 2030⁹. This plan further targets £160m of investment into UK ports and manufacturing infrastructure recognising the role ports will play in delivering this expansion. The UK and Scottish Governments encourage local supply chain content through Supply Chain Plans (SCP), Supply Chain Development Statements (SCDS), and the planned Sustainable Industry Reward (SIR) framework, which are designed to stimulate a much-needed UK based supply chain¹⁰.

This ambition was later updated in 2023 in the UK Net Zero Offshore Wind Roadmap increasing the ambition to 50GW of offshore wind by 2030¹¹. This roadmap details a range of policies and investments across innovation, jobs and skills, strengthening supply chains, streamlining planning processes, collaboration, and infrastructure. Of this 50GW target, 5GW is committed to floating offshore wind. The Department of Energy Security and Net Zero (DESNZ) is supporting this ambition through the Floating Offshore Wind Manufacturing Investment Scheme (FLOWMIS) that provides £160m of competitive funding to assist floating offshore wind through UK port and

⁶ Climate Change Committee (2008) *A legal duty to act*. Accessed: <https://www.theccc.org.uk/what-is-climate-change/a-legal-duty-to-act/#:~:text=The%20Climate%20Change%20Act%202008,to%20deliver%20on%20these%20requirements>

⁷ Scottish Government (2020) *Securing a green recovery on a path to net zero: climate change plan 2018 – 2032 – update*. Accessed: <https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/>

⁸ Scottish Government (2022) *Scotland's National Strategy for Economic Transformation*. Accessed: <https://www.gov.scot/publications/scotlands-national-strategy-economic-transformation/pages/5/>

⁹ UK Government (2020) *The ten point plan for a green industrial revolution*. Accessed: <https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution>

¹⁰ Crown Estate Scotland (2023) *Supply Chain Development Strategy*. Accessed: <https://www.crownestatescotland.com/sites/default/files/2023-07/foi-259-supply-chain-development-statement-summary.pdf>

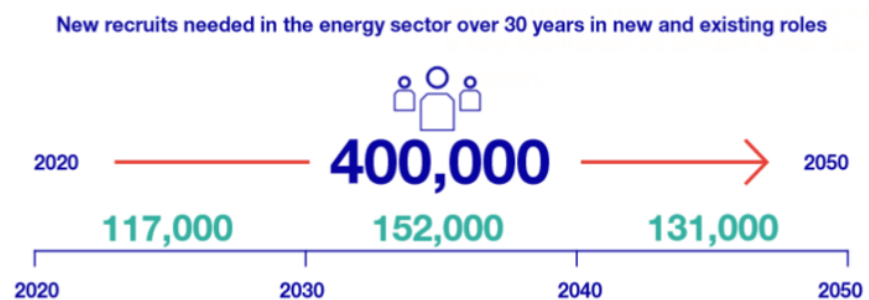
¹¹ UK Government (2023) *Offshore Wind Net Zero Investment Roadmap*. Accessed: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1167856/offshore-wind-investment-roadmap.pdf

manufacturing investments¹². Expected port developments under the Offshore Wind Roadmap seek to support the supply chain in full, from manufacturing, to installation, and operation and maintenance of fixed foundation offshore wind turbines. It also seeks to develop large-scale deepwater ports designed to fabricate, assemble, store and deploy floating offshore wind turbines.

Through these investments it is predicted that offshore wind sector growth will generate 90,000 direct and indirect jobs by 2030. This will offer a more sustainable industry both environmentally and socio-economically to regions dependent on otherwise seasonal and in some cases declining sectors.

Job creation across the supply chain will be a large output of the offshore wind expansion. The National Grid's *Building the Net Zero Energy Workforce Report* predicts a requirement for a total of 400,000 energy sector jobs across the next three decades to deliver net zero by 2050 – see Figure 1¹³.

Figure 3-1: National Grid Recruitment Projection (2020)



In a world-leading partnership between industry and government, the North Sea Transition Deal (2023) was devised to support oil and gas workers, businesses, and supply chains to decarbonise¹⁴. Through utilising existing competencies, infrastructure, and investment to transition to new industries offshore wind will be utilised in a way that both decarbonises and supports oil and gas production. Under the INTOG¹⁵ leasing round released by Crown Estate Scotland (CES), 13 projects were issued totalling 5.5GW of capacity. These projects are the first of their kind as they are designed to develop floating offshore wind through a series of commercial

¹² Department of Energy Security and Net Zero (2022) *Floating Offshore Wind Manufacturing Investment Scheme: request for information*. Accessed: <https://www.gov.uk/government/calls-for-evidence/floating-offshore-wind-manufacturing-investment-scheme-request-for-information>

¹³ National Grid (2020) *Building the Net Zero Energy Workforce Report*. Accessed: <https://www.nationalgrid.com/stories/journey-to-net-zero/net-zero-energy-workforce>

¹⁴ UK Government (2021) *North Sea Transition Deal*. Accessed: <https://www.gov.uk/government/publications/north-sea-transition-deal>

¹⁵ Crown Estate Scotland (2023) *INTOG: 13 projects selected to support green innovation and help decarbonise North Sea*. Accessed: <https://www.crownestatescotland.com/news/intog-13-projects-selected-to-support-green-innovation-and-help-decarbonise-north-sea>



pilot innovation projects (less than 100MW) and directly reduce emissions of oil and gas production in the North Sea¹⁶.

Under the North Sea Transition Deal an integrated People and Skills Plan was designed to equip the oil and gas workforce with the relevant skills required to move into adjacent offshore energy industries. By combining floating offshore wind and oil and gas production through INTOG projects this vision is supported and mitigates the exit of skilled workers in the labour force. Through learning and understanding renewable technologies alongside oil and gas, re-skilling of the energy labour force can be better managed as we phase out fossil fuels enabling a smoother transition between industries for existing workers.

These projects came just one year after the 2022 ScotWind licencing round that awarded 20 projects with seabed option agreements and a predicted generation capacity of 30GW¹⁷. 13 out of the 20 projects are to be floating rather than fixed turbines seeking to capitalise on Scotland's strength in floating offshore wind testing through commercial scale projects.

Based on areas of the seabed identified by the Scottish Government's Sectoral Marine Plan for Offshore Wind, ScotWind is 'plan-led' with seabed options placed in pre-determined areas found suitable for future commercial scale offshore wind. These sites were selected to accommodate deep water technologies and turbines for inshore and offshore waters¹⁸.

Given its long-established legacy in offshore engineering ScotWind provides a platform to reshape Scotland's oil and gas legacy towards a green and sustainable economic future with supply chain commitments required from the start from developers. The first of its kind, applicants were required to include a SCDS and Outlook which detailed the planned location and type of supply chain requirements for all stages of their project. Intended to provide indications of full life cycle needs – development, manufacturing and construction, operations and maintenance – early analysis indicates an average investment outcome of £1.5bn per project in Scotland¹⁹. Further, having secured £755m for public spending through ScotWind CES anticipates £4m per GW pa output for public spending over the coming 10 years which will be passed directly to the Scottish Government.

¹⁶ Offshore Renewable Energy Catapult (2024) *Leading technology centres create network to drive innovation in floating offshore wind*. Accessed: [https://ore.catapult.org.uk/press-releases/leading-technology-centres-create-network-to-drive-innovation-in-floating-offshore-wind/#:~:text=The%20INTOG%20leasing%20round%2C%20managed,%20innovation%20projects%20\(IN\)](https://ore.catapult.org.uk/press-releases/leading-technology-centres-create-network-to-drive-innovation-in-floating-offshore-wind/#:~:text=The%20INTOG%20leasing%20round%2C%20managed,%20innovation%20projects%20(IN)

¹⁷ Offshore Wind Scotland (2022) ScotWind Licensing Round. Accessed: <https://www.offshorewindscotland.org.uk/the-offshore-wind-market-in-scotland/scotwind-leasing-round/>

¹⁸ Scottish Government (2020) *Sectoral marine plan for offshore wind*. Accessed: <https://www.gov.scot/publications/sectoral-marine-plan-offshore-wind-energy/>

¹⁹ Crown Estate Scotland (2022) *ScotWind leasing round*. Accessed: <https://www.crownestatescotland.com/scotlands-property/offshore-wind/scotwind-leasing-round>



3.2 Inverness and Cromarty Green Freeport

Inverness and Moray Firth are favourably located to service and supply many of the ScotWind and INTOG projects. These projects bring much needed economic diversification and stability to the region and reduce reliance on seasonal industries and generate sustainable growth paths that could span decades.

A major win for the region was the accreditation of Green Freeport status by the UK and Scottish Government²⁰. Freeports seek to serve as national hubs for global trade and investment, provide hotbeds for innovation, and create regeneration for communities most in need through high-skilled job creation²¹. This is done by identifying specific areas – *zones* – to receive ‘economic levers’ designed to boost investments and generate meaningful economic growth in regions that otherwise remain overlooked by industrial strategies²². These levers include trade and investment support; customs and trade tariff benefits; tax reliefs; planning regulations; regeneration and infrastructure funding; and funding to support innovation.

After the appointment of 7 UK Freeports, a separate bidding process was undertaken in Scotland run jointly by both the UK and Scottish Governments to identify two Freeport zones. The Scottish Green Freeport model adapts the UK Government’s model seeking to achieve five objectives: (1) Promote regeneration and job creation through inclusive sustainable growth; (2) Establish hubs for global trade and investment; (3) Contribute to a just transition and net zero economy; (4) Drive fair work practice; and (5) Foster an innovation environment²³.

To ensure an equitable distribution of benefits from this model, Greenport operators and businesses are required to adopt the Fair Wage First approach that includes paying the real Living Wage (£12/hour 2024²⁴); implement the Scottish Business Pledge; commit and supporting sustainable and inclusive growth in local communities; and contribute to Scotland’s just transition and net zero.

The Inverness and Cromarty Green Freeport gained status in 2023 and constitutes a cross-sector partnership between the five ports in the region - Port of Cromarty Firth, Port of Nigg, Port of Inverness, Ardersier and Highland Deephaven. This union could be transformative to the economic development of the Scottish Highlands and to the Scottish economy as a whole. Through planned construction projects, science,

²⁰ The Highland Council (2021) *Inner Moray Firth Local Development Plan (IMFLDP)*. Accessed: https://www.highland.gov.uk/info/178/development_plans/202/inner_moray_firth_local_development_plan

²¹ UK Government (2022) *UK Freeports Programme Annual Report 2022*. Accessed: <https://www.gov.uk/government/publications/uk-freeports-programme-annual-report-2022/uk-freeports-programme-annual-report-2022>

²² UK Government (2021) *Freeports*. Accessed: <https://www.gov.uk/guidance/freeports>

²³ Scottish Government (2023) *Green Freeports*. Accessed: <https://www.gov.scot/policies/cities-regions/green-ports/>

²⁴ Scottish Government (2024) *Fair work milestone*. Accessed: <https://www.gov.scot/news/fair-work-milestone/>

technology, engineering, arts and mathematics (STEAM) skills engagement and advancement, renewable activities and cluster network development Inverness and Cromarty Firth Green Freeport currently predict up to 10,250 jobs to the region and a further 16,500 jobs across the UK ²⁵ that could generate £690million GVA per year for the Scottish Economy²⁶ as direct outcomes of the alliance.

Ardersier Port is well located to support the 35GW of ScotWind and INTOG projects given its proximity to many of these projects and its participation in the Inverness and Cromarty Firth Green Freeport. As a tax site within a Green Freeport, Ardersier is ideally situated to support offshore wind developers and manufacturers of offshore wind equipment and components. Ardersier Port expansion and re-development constitutes the largest dedicated offshore wind deployment facility in Scotland that will be capable of supporting gigawatt scale projects through quayside access suitable for infrastructure manufacturing, assembly, marshalling, and integration of offshore wind components²⁷

In addition to the awarding of Green Freeport status, further support was won for the region by the Scottish Government through the support of their £500m Just Transition Fund²⁸. This fund seeks to scale up renewable energy production, increase investment in net zero energies, and deliver a stable energy environment with fairer consumer costs. This investment will work in tandem with the Green Freeport to develop the region into a centre for excellence for energy transition.

Initial investments at Ardersier contribute strongly to this regional strategy; with the £300m investment from Quantum Capital Group, and a further £100m loan from the Scottish National Investment Bank and UK Investment Bank.

3.3 Summary

The north of Scotland is in an exciting position in the offshore wind market and is uniquely placed to take advantage of its geographical assets to generate meaningful and sustained economic development.

Ardersier Port will be a major contributor to the infrastructural development required to deliver offshore wind projects and actualise the economic benefits, jobs and skills growth, and development opportunities promised in the transition to net zero. The extension will allow Ardersier to increase its ability to support the sector, increasing the number and longevity of high quality jobs in the Local Area.

²⁵ Inverness and Cromarty Green Freeport (2023) *Inverness and Cromarty Green Freeport*. Accessed: <https://greenfreeport.scot/>

²⁶ BiGGAR Economics (2022) *Opportunity Cromarty Forth: Economic Impact and Baseline Report*.

²⁷ The Scottish National Investment Bank (2023) *Ardersier Port*. Accessed: <https://www.thebank.scot/ardersier-port>

²⁸ Scottish Government (2023) *Scotland's Energy Strategy Transition Plan: Ministerial Statement*. Accessed: <https://www.gov.scot/publications/scotlands-energy-strategy-transition-plan-ministerial-statement/>

4.

Socio-Economic Context

This section discusses the socio-economic context of Ardersier Port Extension.

This section sets the development within its socio-economic context, including data on population trends, industrial structure, labour market activity, tourism overview, and the Scottish Index for Mass Deprivation (SIMD). The baseline focuses on the following study areas:

- Local area: The electoral wards of Culloden & Ardersier, Tain & Easter Ross, Cromarty Firth, Dingwall & Seaforth, Aird & Loch Ness, Inverness South, Inverness West, Inverness Milburn, Inverness Central, Inverness Ness-Side, Black Isle, Nairn & Cawdor;
- Highland and Moray;
- Scotland; and
- The UK.

4.1 Population

4.1.1 Population Estimates

In 2022, the population of Highland and Moray was 334,500 or 6.1% of the total population of Scotland. The population of the Local Area was 141,937, equivalent to 42.4% of the population of Highland and Moray.

The proportion of residents aged 16-64 years old (61.3%) in the Local Area is in line with the average for Highland and Moray (60.9%) but is below average compared to Scotland as a whole (63.8%) and the UK (62.8%). This lower share average of working age population in the Local Area and Highland and Moray indicates a lack of employment opportunities, generating outward migration of this demographic.

The share of people aged 65 and over is higher in both the Local Area (21.7%) and Highland and Moray (22.9%) compared to Scotland and the UK, where this demographic accounts for 19.6% and 18.8% of the population, respectively.

Table 4-1: Population Estimates, 2022

	Local Area	Highland and Moray	Scotland	UK
Aged 0-15	17.0%	16.1%	16.6%	18%
Aged 16-64	61.3%	60.9%	63.8%	63%
Aged 65+	21.7%	22.9%	19.6%	19%
Total	141,937	334,500	5,479,900	67,652,999

Source: ONS (2023), Population estimates and National Records of Scotland (2023), Mid-2022 Population Estimates

4.1.2 Population Projections

It is expected that, between 2022 and 2043, the total population of Highland and Moray will fall from 334,500 to 326,216, a reduction of 2%, while it is expected that the populations of Scotland and the UK will increase over the same period, by 2% and 7%, respectively.

It is expected that the share of people aged 65 and over will increase in Highland and Moray from 22.9% in 2022 to 30.2% in 2043. It is expected that the share of the population accounted for by this demographic in 2043 will be significantly above average compared to Scotland (24.9%) and the UK as a whole (24.0%).

Over the same period, projections predict a 10.6% reduction of in the working age population (aged 16-64) in Highland and Moray, representing a total reduction of 21,670 people of working age in the region. This suggests a lack of employment opportunities leading to outmigration, with potential consequences for the sustainability of the region's economy as well as local services as a declining working age population will have to support a growing ageing population.

Table 4-2: Population Projections

	Highland & Moray		Scotland		UK	
Year	2022	2043	2022	2043	2022	2043
Total	334,500	326,216	5,479,900	5,574,819	67,652,999	72,563,415
Aged 0-15	16.1%	14.1%	16.6%	14.8%	18.4%	17.0%
Aged 16-64	60.9%	55.8%	63.8%	60.3%	62.8%	58.9%
Aged 65+	22.9%	30.2%	19.6%	24.9%	18.8%	24.0%

Source: ONS (2018), Population Projections – Local Authority Based by Single Year of Age, National Records of Scotland (2020), Population Projections for Scottish Areas (2018-based), Welsh Government (2021), National Population projections 2021-based and NISRA (2025), Projected Future population of Northern Ireland by Age and Sex.

4.2 Industrial Structure

In 2023, 73,325 people were employed in the Local Area. Human health and social work activities constitute the largest employer in the Local Area (19.6%), accounting for an above average share of employment compared to Highland and Moray (15.4%), Scotland (15.6%), and the UK (13.6%).

The construction sector employs 6.9% of workers in the Local Area and 6.1% of workers in Highland and Moray. Employment in this sector in the Local Area and Highland and Moray is above the average in Scotland (5.1%) and the UK (4.9%), suggesting opportunities in the region from the Ardersier Port extension and the resulting activities.

Manufacturing accounts for 7.1% of employment in Highland and Moray, average compared to Scotland (6.7%) and the UK (7.4%). The Ardersier Port extension is also expected to result in benefits for this sector in the region, targeting the expansion of offshore wind manufacturing and thus providing long-term work in this sector.

The extension of Ardersier Port has the potential to help address the ageing population profile of the Local Area and Highland and Moray by generating opportunities for the local workforce in construction and manufacturing, attracting inward migration of workers.

Table 4-3 Industrial Structure, 2023

	Local Area	Highland & Moray	Scotland	UK
Health health & social work activities	19.6%	15.4%	15.6%	13.6%
Retail	10.0%	8.9%	8.7%	8.3%
Accommodation & food services	9.1%	11.3%	8.6%	7.9%
Education	7.4%	7.4%	8.2%	8.3%
Construction	6.9%	6.1%	5.1%	4.9%
Public administration & defence	6.2%	5.0%	6.2%	4.6%
Business administration & support services	6.1%	4.2%	6.8%	8.5%
Transport & storage	6.0%	4.6%	4.5%	4.9%
Professional, scientific & technical	5.3%	4.5%	7.2%	9.3%
Manufacturing	5.0%	7.1%	6.7%	7.4%

Arts, entertainment, recreation & other services	4.2%	4.6%	4.4%	4.6%
Wholesale	3.2%	2.6%	2.8%	3.6%
Motor trades	2.5%	2.0%	1.7%	1.7%
Information & communication	2.4%	1.5%	3.1%	4.4%
Mining, quarrying & utilities	2.3%	2.7%	2.5%	1.2%
Agriculture, forestry & fishing	2.0%	10.1%	3.4%	1.4%
Property	1.2%	1.3%	1.5%	2.0%
Financial & insurance	0.6%	0.7%	3.2%	3.3%
Total	73,325	168,450	2,657,000	32,259,000

Source: ONS (2025), Business Register and Employment Survey 2023

4.3 Labour Market Indicators

As shown in Table 4-4, in 2024, the share of working age people in Highland and Moray who are economically active (80.2%) is above average compared to both Scotland (77.0%) and the UK as a whole (78.5%). The unemployment rate in the 12 months to September 2023 was 3.4% in Highland and Moray, average compared to Scotland (3.4%) and slightly below the UK average of 3.8%.

In 2024, the median annual gross wage of Highland and Moray residents was £37,888, below median wages across Scotland (£38,286). This was largely driven by Moray, where the median annual gross wage was £34,849, compared to £38,823 in Highland.

Table 4-4 Labour Market Indicators

	Highland & Moray	Scotland	UK
Economic Activity Rate	80.2%	77.0%	78.5%
Unemployment Rate*	3.4%	3.4%	3.8%
Medium Annual Gross Income (all residents)	£37,888	£38,286	£37,430

Source: ONS (2025), Annual Population Survey - Data for January 2024-December 2024 and ONS (2025), Annual Survey of Hours and Earnings – Resident Analysis. *Data for October 2022-September 2023

4.4 Tourism

Table 4-5 details the number of visits and expenditure of domestic and international overnight visitors to Highland, Grampian (comprised of Aberdeen, Aberdeenshire, and Moray Speyside) and Scotland in 2023.

There were 1.8 million domestic overnight visitors to Highland in 2023, with a total expenditure of £437 million. This is equivalent to a spend per trip of £243. The same year, Grampian received 1.1 million domestic overnight visitors, with a total expenditure of £252 million, equivalent to an average spend per trip of £229. The average spend per trip to both areas was below average compared to Scotland as a whole, where the 12.4 million domestic overnight visitors spent a total £3,189 million, equivalent to £257 per trip.

There were 0.5 million international overnight visitors to Highland in 2023, accounting for 13% of the total 4.0 million international overnight trips in Scotland. This group spent a total £325 million, an average spend per trip of £650. Grampian received 0.3 million visitors, 9% of total international overnight trips in Scotland. International visitors to Grampian spent an average £527 each trip, totalling £158 million. Spend per trip by international overnight visitors was also lower than average in these regions compared to Scotland as a whole (£898).

Table 4-5 Visitor Numbers and Expenditure, 2023

Number of Visitors	Highland	Grampian	Scotland
Visitor Numbers (Million)			
Domestic Overnight Visitors	1.8	1.1	12.4
International Overnight Visitors	0.5	0.3	4.0
Expenditure (£ million)			
Domestic Overnight Visitors	£437	£252	£3,189
International Overnight Visitors	£325	£158	£3,593

Source: Kantar TNS (2024), Great Britain Tourism Survey 2023 and ONS (2024), International Passenger Survey.

4.5 Scottish Index of Multiple Deprivation (SIMD)

The SIMD is a measure of relative deprivation that ranks small areas of Scotland across seven dimensions: income, employment, education, health, access to services, crime, housing. These areas are ranked based on which quintile (fifth of the

distribution) they belong to, ranging from the first 20% (quintile) being the most deprived to the fifth the least.

There are 438 small areas in Highland and Moray, 8% of which are in Quintile 1, meaning 8% of the small areas in Highland and Moray are in the 20% most deprived small areas in Scotland, suggesting lower than average levels of severe deprivation in Highland and Moray.

Levels of severe deprivation are also below average in the Culloden & Ardersier and the as a whole Local Area, where 0% and 13% of small areas are located in Quintile 1, respectively.

In Culloden and Ardersier 29% of small areas are in Quintile 5, the 20% least deprived areas of Scotland, while 12% and 9% of small areas were in this quintile in the Local Area and Highland and Moray, respectively. This demonstrates that levels of deprivation Culloden and Ardersier overall are lower than in the Local Area and Highland and Moray.

Table 4-6 Scottish Index of Multiple Deprivation

	Culloden & Ardersier	Local Area	Highland & Moray
1 (20% most deprived)	0%	13%	8%
2	29%	17%	17%
3	21%	26%	34%
4	21%	31%	32%
5 (20% least deprived)	29%	12%	9%
Total Small Areas	14	180	438

Source: Scottish Government (2020), Scottish Index of Multiple Deprivation 2020

4.6 Socio-Economic Context Summary

With a smaller share of the working-age population supporting a higher proportion of those aged over 65 years, the port development will be important for generating employment opportunities in the immediate area. The extension will primarily contribute to the retention of the working-age population by attracting new workers to the region, helping to address the projected decline in this demographic in Highland and Moray.

5.

Methodology

This section describes the approach and methodology used to assess the economic impacts associated with Ardersier Port Extension.

5.1 Approach to Port Impacts

Ardersier Port Extension will generate economic activity in both the short and long-term. This would arise from the port **development and construction** phase (short-term) and from the long-term **operation** of the port. The primary metrics of assessment used to estimate this activity are:

- **Gross Value Added (GVA)** – a measure of economic value added by an organisation or industry;
- **Years of employment** – a measure of employment which is equivalent to one person being employed for a full year. It is typically used when considering short-term employment impacts, such as those associated with construction; and
- **Jobs (FTEs)** – a measure of headcount employment supported by an organisation or industry.

Data on development and capital expenditure was used as the basis of the input-output modelling exercise to estimate the economic impact associated with the Ardersier Port Extension. These costs represent an increase in turnover, supporting economic activity.

Construction costs were then categorised to one of the industrial sectors used by the Scottish and UK Governments in official statistics, e.g. construction. This sector was used as the basis for estimating GVA and employment impacts. Information on turnover, GVA and employment is sourced from the UK Annual Business Survey (ABS)²⁹, which is published by the ONS.

For the sector, GVA can be presented as a percentage of turnover and therefore, to estimate the direct GVA impact, turnover is multiplied by the GVA/turnover ratio. Similarly, to estimate the direct employment impacts, turnover in each contract is divided by turnover/employee in the relevant sector.

As well as **direct** GVA and employment impacts, there will also be **indirect** and **induced** impacts associated with spending in the wider supply chain and employees' spending. These impacts were estimated by applying sector-specific Type I (indirect) and Type II (indirect and induced) multipliers to the direct impact. These multipliers

²⁹ Office for National Statistics (ONS) (2024), Annual Business Survey.

were sourced from the Scottish Government Input-Output Tables³⁰. The total impact associated with a project encompasses the direct, indirect and induced impacts.

Operations costs were categorised to a sector which was created using averages from all the relevant port-related sub-sectors used by the Scottish and UK Government in official statistics e.g., warehousing and support activities for transportation. To calculate operations impacts, a similar approach was followed to the construction phase, but employment multipliers were applied to job figures to calculate turnover and GVA.

For the purpose of this report, impacts have been assessed for the study areas of:

- Moray & Highland;
- Scotland; and
- The UK.

All figures are presented in 2024 prices, accounting for inflation.

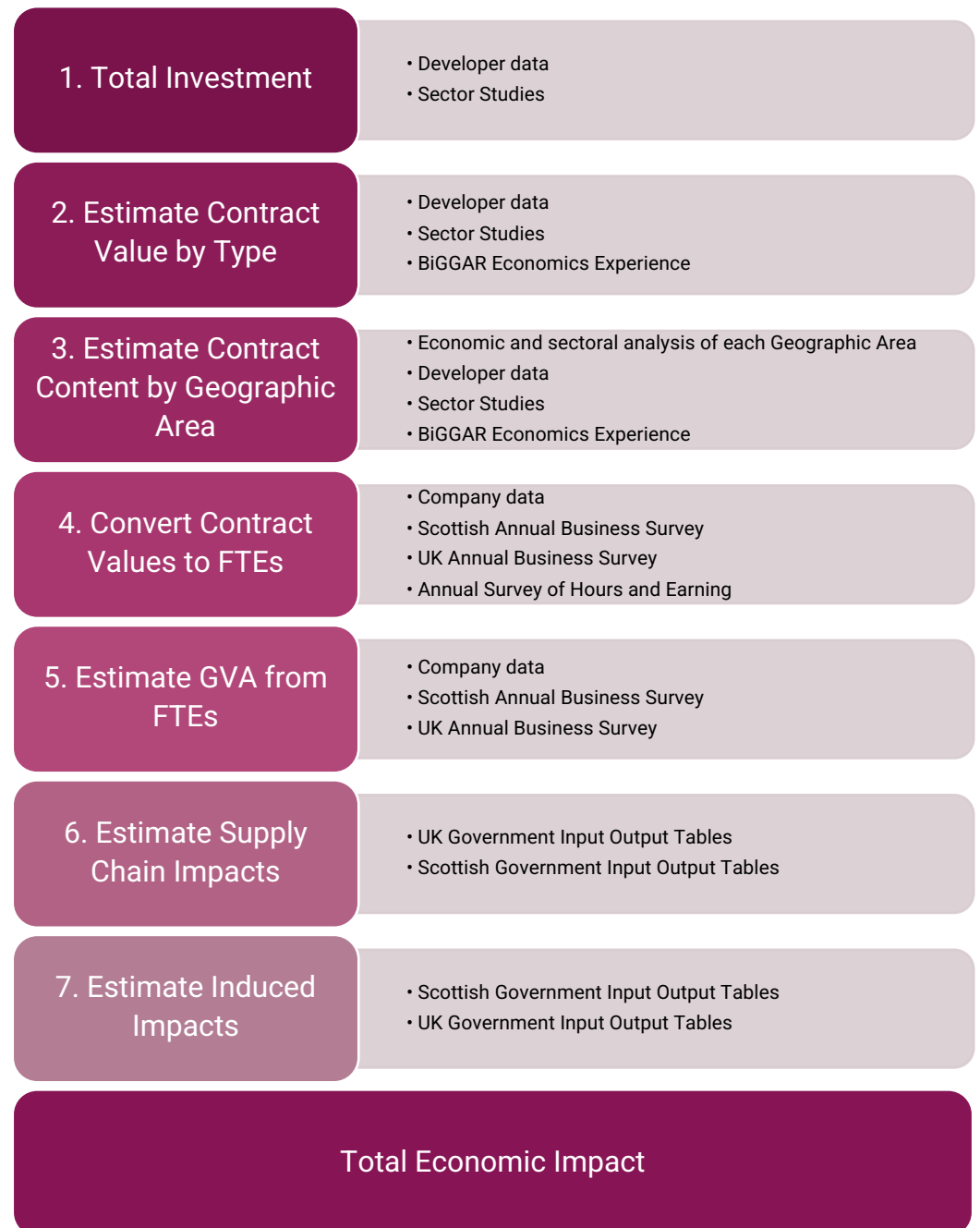
5.2 Approach to Offshore Wind Impacts

Having selected the study areas for which GVA and employment impacts are considered, it is then possible to gather relevant information and estimate economic impacts on the offshore wind sector. The estimation of the economic benefits from an offshore wind project is based on a purposely-built tool developed by BiGGAR Economics. As set out in the figure below, the analysis is also based on an Input-Output methodology built upon the following steps in line with the approach taken to the Contracts for Difference Supply Chain Plan assessments:

- estimation of the total investment associated with the project (construction and development and operations and maintenance);
- estimation of contract value by type;
- estimation of contract content by geographical area;
- conversion of contracts into the direct employment supported by the project;
- estimation of direct GVA based on direct employment supported;
- estimation of supply chain (indirect) impacts on GVA and employment; and
- estimation of the staff spending (induced) impacts on GVA and employment.

³⁰Scottish Government (2020), Supply, Use and Input-Output Tables.

Figure 5-1: Economic Impact Methodology and Data Sources



This assessment is based on BiGGAR Economics' economic impact assessments of several Scotwind and INTOG offshore wind projects, including several that are considering using Ardersier Port. Our work has included the assessment of the economic impacts of local effects in and around ports to be used as bases for construction and for operations. The economic impact that is enabled by the Ardersier Port Extension investment is driven by the additional capacity of offshore wind that could be deployed in the Scotland and the UK.

5.2.1 Discounting

The analysis, where appropriate, also provides estimates based on the Net Present Value (NPV) of activity. This is based on His Majesty Treasury's guidance on economic appraisal as included in the Green Book³¹, where it is recommended that impacts occurring over long periods of time are discounted to account for the different value people give to present compared to future consumption. The HMT's suggested discount factor of **3.5%** is applied.

5.2.2 Learning Rate

It is assumed that the offshore wind sector will experience a reduction in costs as the sector learns and develops through deployment. The cost reductions are based on analysis by the Offshore Renewable Energy Catapult³² and the level of deployment of floating offshore wind in UK waters. This analysis estimates that with innovation, the costs of floating offshore wind would reduce by 9.5% for every doubling of installed capacity above 1 GW. Similarly, the National Renewable Energy Laboratory (NREL)³³ has estimated that the learning rate for offshore wind would be 11.5% for floating and 8.8% for fixed bottom. For the purposes of this assessment, it is assumed that the learning rate is approximately 10%.

The additional port capacity through the extension will enable the offshore wind sector to achieve cost reductions quicker. The reduced costs have been taken into consideration when calculating the projected economic impact of the capital expenditure.

5.2.3 Additionality

The HM Treasury Green Book recommends taking account of the following factors to assess what would have happened if an investment or development did not take place (the net impact). These include:

- **Deadweight** – the outcomes that would have taken place without the intervention under consideration. Specifically, in this example the outcomes that would occur without the construction of the extension project. In this case, the business-as-usual would be represented by the existing Ardersier Port development calculated finding the difference between the 150GW and 100 GW scenarios (see below);
- **Displacement** – the extent to which activity generated might replace activity elsewhere in the study areas;
- **Substitution** – where one type of labour or factor of production, such as capital equipment, is substituted for another but there is no increase in employment or output. This is not considered to be relevant to this assessment; and
- **Leakage** – the proportion of activity that might take place outside of the main study areas. The economic impact considers the impact in Moray & Highland, Scotland and the UK as a whole to capture leakage effects.

³¹ HM Treasury (2022), The Green Book 2022.

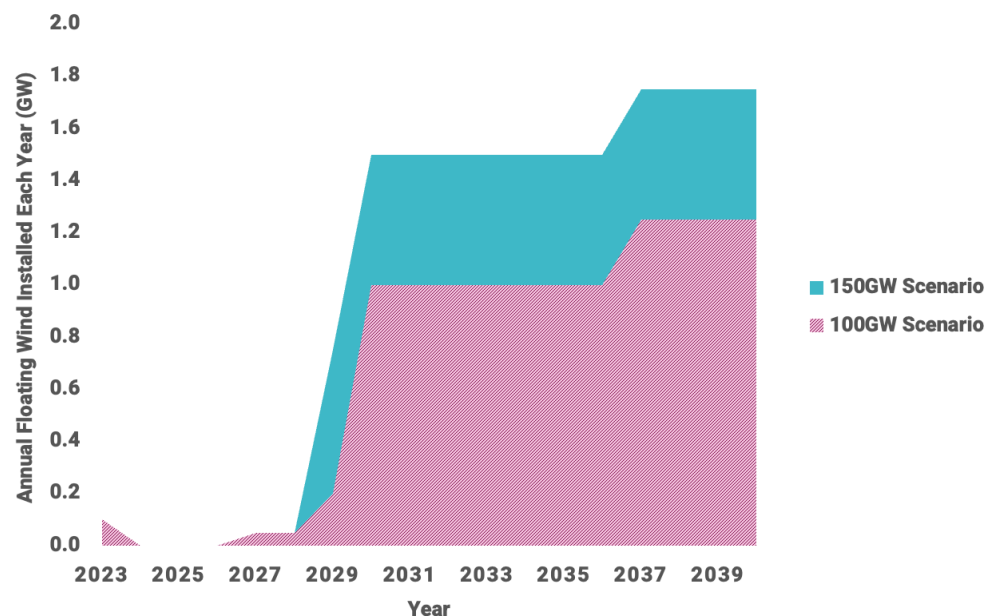
³² ORE Catapult (2021) Floating Offshore Wind Cost Reduction Pathway to Subsidy Free

³³ National Renewable Energy Laboratory (2022) A systematic framework for projecting the future cost of offshore wind energy

Deadweight

The figure below shows that the installed capacity deployed to floating offshore wind locations due to the Ardersier Port development, would be approximately equal to the difference between the 150GW and the 100GW Scenarios for Scotland from 2028 onwards. This shows that the 150GW scenario would see about 1.8 GW of floating offshore wind installed in 2040 in Scotland as a result of the Ardersier Port investment. This 50 MW difference in the scenarios is attributed to the port's facilitation of turbine handling and logistics, serving as a proxy for the port's contribution to sector growth.

Figure 5-2: Additional Floating Offshore Wind Capacity considered - Scotland



Source: BIGGAR Economics Analysis using Floating Offshore Wind Industrialisation Roadmap – Deployment Scenarios produced by ORE Catapult in 2022.

Cumulatively this would result in about 6 GW of additional floating offshore wind in Scotland by 2040 that would otherwise have occurred, without the development of the Ardersier Port.

The analysis considers the economic impacts of the additional capacity. The first step is to calculate the economic impacts of the Ardersier Port as a whole with and without the extension project from the difference between the two scenarios depicting a scenario where the port is developed, compared to the scenario where Scottish ports do not have the necessary facilities and capacity (deadweight). The difference between the economic impacts of Ardersier Port with and without the extension would then represent the impact of the Ardersier Port Extension. These are computed accounting for the offshore wind supply chain content in each study area. Based on information provided by Haventus, the extension provides operational capacity for the offshore wind sector as a whole which could support the floating capability, however the additional floating offshore wind capacity is expected to

remain unchanged with the Ardersier Port Extension project and therefore, no additional capacity is expected to be attributed to the extension.

For fixed offshore wind, a total of up to 100 units were expected to be passing through the facility over a period of 12 months without the extension project. It was anticipated that one third of the installed capacity would be additional due to the potential for this activity taking place in other ports such as Dundee, Leith and Cromarty. This would result in a total installed capacity of c.500 MW per year and a similar approach was considered to the floating offshore wind. With the extension, this figure is expected to double over a period of 12 months.

Considering this increase in the number of fixed turbine units passing through the port due to the extension, a **proportional scaling approach** is adopted based on the previously derived impact figures for the Ardersier Port investment. The impacts are scaled in proportion to the updated turbine volumes, under the assumption that:

- Only the number of turbine units have increased and all other factors including how the port operates and how much each turbine contributes remain unchanged;
- Each additional turbine adds the same level of impact as it did in the original estimate of Ardersier Port; and
- The port can manage the extra turbine units without new limitations e.g. no additional delays or bottlenecks have been introduced since the previous assessment.

This approach ensures continuity of original analysis and provides consistent estimates of the port's extension increased impacts.

5.2.4 Offshore Wind Expenditure

The share of the total expenditure of the offshore wind sector that occurs in Scotland and the UK is based on analysis by BVG Associates³⁴ of the potential for organisations to meet the requirements of the offshore wind sector. As part of this study, the distribution of contracts required to meet the 60% UK content ambition was considered for the offshore wind sector as a whole.

This analysis found that both fixed and floating offshore wind projects were likely to have a higher level of UK content, as there would be a greater demand to install turbines onto the floating foundations within the UK. The split by contract type is shown in the table below and the share of Scottish and UK content for fixed and floating offshore projects is used as the basis for the analysis of the scenarios.

³⁴ BVG Associates (2021) UK and Scottish content baseline and roadmap: A report for the Scottish Offshore Wind Energy Council

Table 5-1: Scottish and UK Content by Contract Area, 60% Local Content Scenario

	Scottish Content		UK Content	
	Fixed	Floating	Fixed	Floating
Development and project management	24%	53%	88%	88%
Turbine	3%	4%	22%	12%
Substations	26%	32%	51%	51%
Foundations	25%	61%	68%	61%
Cables	1%	3%	32%	32%
Turbine and foundation installation	6%	43%	0%	47%
Cable installation	10%	10%	6%	13%
Installation other	25%	57%	76%	78%
Operations and maintenance	29%	65%	86%	86%
Decommissioning	21%	69%	40%	90%
Total	20%	47%	60%	62%

Source: BVG Associates (2021).

6. Economic Impact Assessment

This section outlines the findings of the economic impact assessment.

6.1 Ardersier Port Extension Development and Construction

The development and construction of the Ardersier Port Extension is associated with:

- Deepening of the inner harbour by dredging (approximately 2,000,000 m³);
- Removal of old sheet piles in front of the new quay wall along with possible temporary sand bunds;
- Possible local scour protection (rock armour) in inner harbour;
- Localised rock mattress for east of harbour;
- Site clearance of extension lands (tree felling, stump and topsoil removal);
- Land raising and levelling of extension lands to suitable height with dredged sand;
- Creation of working surface through stone placement; and
- Installation of new drainage to extension land southern perimeter.

The port is set to open in Autumn 2025, with decisions on the extension applications expected in early 2026. Construction is expected to take about two years to complete, with works anticipated to be finished in 2028/29, depending on the timing of an investment decision.

Based on information provided by Haventus, the total cost associated with the development and construction of the full extension project is projected to be around £365.0 million.

Of this total, it is expected that around 71% on construction and civil engineering works and 29% on development. For each category of spend, a breakdown of the types of contracts required is estimated based on a share of the total value. These categories of spend were then assigned to a relevant economic sector, with the majority of contracts relating to construction, manufacturing and civil engineering.

The share of spend of each of these contracts going to businesses in each of the study areas was then assessed. Of the total expenditure, 69% is expected to be located within the UK. The largest areas of spend were estimated to be that relating to the integration of quay wall and dredging. Based on the location of suppliers, it was assumed this spend would take place within the UK.

In this way, it is estimated that 25% of development and construction contracts would go to Moray & Highland, totalling £93.1 million. Across the UK, total spend is estimated to be £253.0 million (69%) whereas £166.5 million would be located in Scotland (46%).

Table 6-1: Development and Construction Expenditure by Study Area

	Moray & Highland		Scotland		UK	
	£m	%	£m	%	£m	%
Turnover	93.1	25%	166.5	46%	253.0	69%

Source: BiGGAR Economics Analysis

Applying sectoral turnover/GVA and turnover/employee ratios to each category of spend, it is estimated that the direct economic impact generated from the development and construction of Ardersier Port Extension would be £37.3 million GVA and 347 years of employment in Moray & Highland, £66.4 million GVA and 616 years of employment across Scotland and £98.1 million GVA and 899 years of employment in the UK as a whole.

Applying the relevant Type 1 and Type 2 multipliers to the direct impact, it is estimated that the total economic impact (including indirect and induced) generated from the development and construction phase of Ardersier Port Extension would be:

- £53.8 million GVA and 464 years of employment in Moray & Highland;
- £119.0 million GVA and 1,019 years of employment across Scotland; and
- £284.9 million GVA and 2,662 years of employment in the UK.

A breakdown of the GVA and Employment impacts is shown in the tables below.

Table 6-2: GVA Impacts (£m) of the Development and Construction

	Moray & Highland	Scotland	UK
Direct GVA (£m)			
Development	17.4	30.5	39.2
Civil Engineering (marine)	15.6	28.4	48.2
Civil Engineering (onshore)	4.3	7.5	10.8
Equipment	-	-	-
Total Direct	37.3	66.4	98.1
Indirect GVA (£m)			
Development	1.9	8.1	35.2
Civil Engineering (marine)	3.4	15.6	59.8
Civil Engineering (onshore)	1.0	4.5	14.0

Equipment	-	-	-
Total Indirect	6.3	28.2	109.0
Induced GVA (£m)			
Development	3.6	8.3	36.4
Civil Engineering (marine)	5.2	12.7	34.2
Civil Engineering (onshore)	1.4	3.3	7.1
Equipment	-	-	-
Total Induced	10.2	24.3	77.8
Total GVA	53.8	119.0	284.9

Source: BiGGAR Economics Analysis. Note: Sums may not add up due to rounding.

Table 6-3: Employment Impacts (Years of Employment) of the Development and Construction

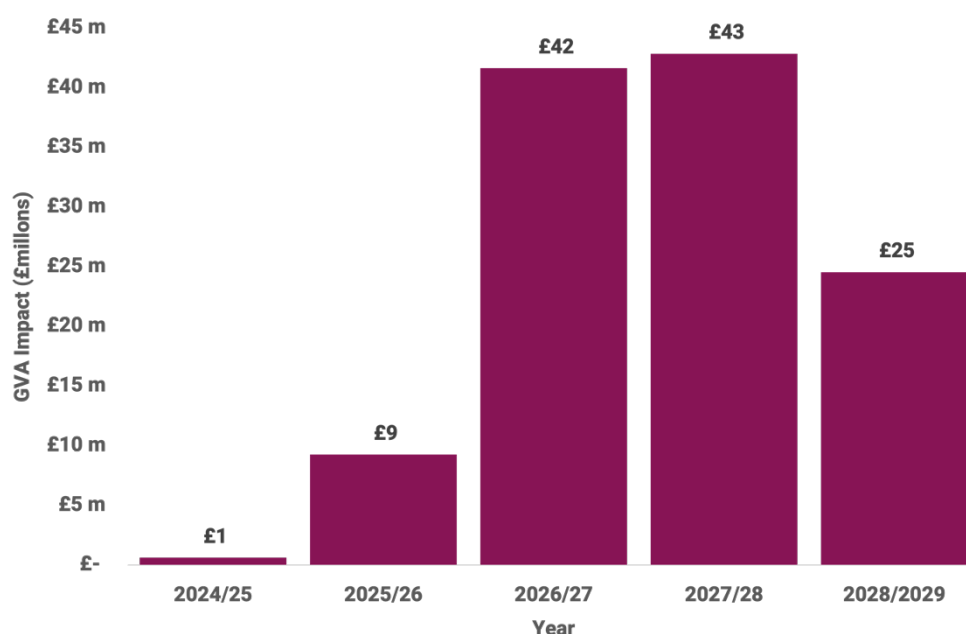
	Moray & Highland	Scotland	UK
Direct Employment			
Development	176	309	397
Civil Engineering (marine)	129	236	399
Civil Engineering (onshore)	41	72	103
Equipment	-	-	-
Total Direct	347	616	899
Indirect Employment			
Development	17	73	285
Civil Engineering (marine)	32	147	590
Civil Engineering (onshore)	10	43	168
Equipment	-	-	-
Total Indirect	59	264	1043
Induced Employment			
Development	25	57	334
Civil Engineering (marine)	26	64	309
Civil Engineering (onshore)	8	18	78
Equipment	-	-	-
Total Induced	58	139	721
Total Employment	464	1,019	2,662

Source: BiGGAR Economics Analysis. Note: Sums may not add up due to rounding.

6.1.1 Impact Over Time

The development and construction of Ardersier Port Extension will take place over a period of time (approximately 5 years). As shown in Figure 6-1, the largest share of impact is expected to occur during 2027/28, depending on the timing of the proposed development.

Figure 6-1: GVA Impact of Ardersier Port Extension, Scotland



Source: BiGGAR Economics Analysis

6.2 Ardersier Port Extension Operations

Economic activity will also be generated on an annual basis from the on-site operations of the Ardersier Port Extension. Based on information provided by Haventus, assumptions on displacement and wider multiplier effects were applied on on-site job figures. It is estimated that the operations of the Ardersier Port Extension would be associated with up to £84.0 million spending per year in the UK as a whole. The largest areas of spend are associated with sectors such as warehousing and support activities for transportation.

Applying relevant Type 1 and Type 2 multipliers to the direct impact, it is estimated that the total annual economic impact generated from the operation stage of the Ardersier Port development (after displacement) would be up to:

- £45.0 million GVA and 442 jobs in Moray & Highland;
- £58.0 million GVA and 566 jobs in Scotland; and
- £95.1 million GVA and 888 jobs across the UK.

A breakdown of these figures is shown in the tables below.

Table 6-4: Annual Economic Impact of Operation – GVA (£m)

	Moray & Highland	Scotland	UK
Direct GVA (£m)	40.4	40.4	40.4
Indirect GVA (£m)	5.4	13.4	32.0
Induced (£m)	4.3	10.6	33.5
Total GVA (after displacement)	45.0	58.0	95.1

Source: BIGGAR Economics Analysis. Note: Sums may not add up due to rounding.

Table 6-5: Annual Economic Impact of Operation – Employment (jobs)

	Moray & Highland	Scotland	UK
Direct Employment	400	400	400
Indirect Employment	52	130	275
Induced Employment	40	100	312
Total Employment (after displacement)	442	566	888

Source: BIGGAR Economics Analysis. Note: Sums may not add up due to rounding.

6.3 Offshore Wind Impacts

The occupation of the new facilities due to the extension project would support the delivery of fixed wind and ScotWind floating wind projects (from 2028/29). The activities at the port are part of the wider offshore wind development impacts considered in this section. Figures are indicative and are based on assumptions for the wider offshore wind sector by ORE Catapult.

6.3.1 Deployment and Ardersier Port Site

This analysis considers two deployment scenarios to initially derive the impacts of the Ardersier Port site as a whole, one which describes the level of activity in the sector and another which describes the activity that would have occurred regardless of the Ardersier Port investment. These deployment scenarios are:

- 150GW Scenario – This is the level of activity in the floating offshore wind sector that is described by the high case. It forms part of a wider deployment scenario in which 150GW of offshore wind is deployed in UK waters by 2050, of which floating wind accounts for 50% of capacity. In this scenario, 5GW of floating offshore wind is deployed by 2030 of which 3GW is in Scotland, and 34GW is deployed by 2040 of which 20GW is in Scotland;
- 100GW Scenario – This is the level of activity in the floating offshore wind sector that is described by the base case. It forms part of a wider deployment scenario in which 100GW of offshore wind is deployed in UK waters by 2050, of which

floating wind accounts for 33% of capacity. In this scenario, 3GW of floating offshore wind is deployed by 2030 of which 1GW is in Scotland, and 20GW is deployed by 2040 of which 12GW is in Scotland.

The level of installed capacity of floating offshore wind in each of the scenarios for Scotland is outlined in the table below. This shows that by 2040, there would be about 8GW of additional floating offshore wind deployed in Scotland of which about 6GW would be associated with the Ardersier Port investment as a whole. This indicates that the port is expected to have a large impact on the sector overall.

Table 6-6: Cumulative Scottish Installed Floating Capacity by Scenario and Additivity

	2028	2030	2035	2040
100GW Scenario	0.2	1.4	6.4	12.4
150GW Scenario	0.2	2.5	10.0	20.0
Additional Capacity	-	1.1	3.6	7.6

Source: BIGGAR Economics Analysis using Floating Offshore Wind Industrialisation Roadmap – Deployment Scenarios produced by ORE Catapult in 2022.

The economic impact that is enabled by the Ardersier Port investment is driven by the additional capacity of floating offshore wind that could be deployed in Scotland (see also Figure 5-2). This shows that the sector would grow quicker to 2040 due to the Ardersier Port investments and is used as the basis to extract the impacts associated with the Ardersier Port Extension project.

More details about the deployment scenarios are provided in Floating Offshore Wind Industrialisation Roadmap – Deployment Scenarios, produced by ORE Catapult in 2022. The results of this report are indicative and come from the difference between the two scenarios and proportional adjustments to accommodate the alterations due to the Ardersier Port Extension project based on assumptions considered for the sector. Similar assumptions are made for the fixed offshore.

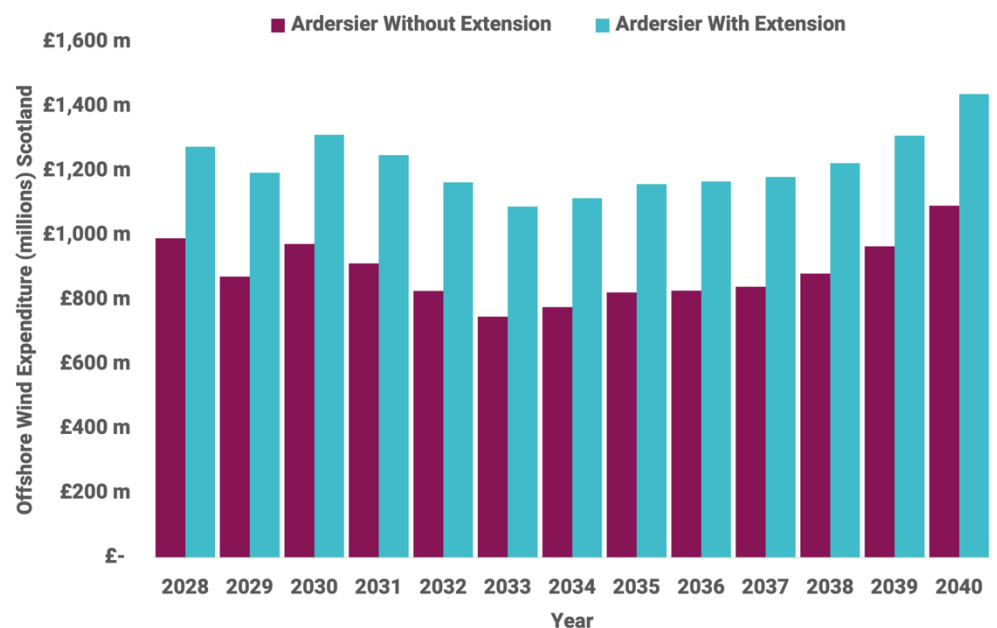
6.3.2 Offshore Wind Expenditure

The development of offshore wind sector associated with the Ardersier Port Extension will stimulate additional investment in the UK energy sector across the CAPEX and OPEX phases. The level of expenditure by contract type was estimated using the deployment scenarios, expected cost levels and the share of expenditure that is likely to occur in each study area.

This expenditure is expected to peak initially in 2030. In 2040, the offshore wind sector is projected to spend about £764.7 million in the UK whereas £178 million would be spend in Moray & Highland and about £346.0 million in Scotland as a result of the Ardersier Port Extension. The net present value of this expenditure in Scotland is £3.4 billion.

Figure 6-2 shows the expenditure in Scotland with and without the Ardersier Port Extension.

Figure 6-2: Additional Scottish Expenditure in Offshore Wind due to Ardersier Port Extension



Source: BiGGAR Economics Analysis

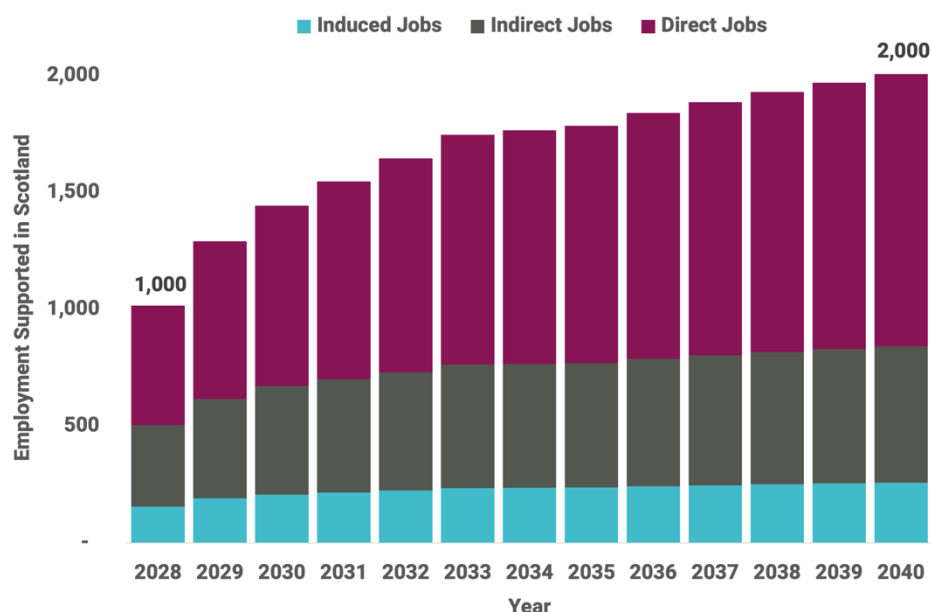
6.3.3 Employment Impacts over Time

This expenditure will drive economic activity that will support employment and generate Gross Value Added (GVA).

Employment is expected to grow steadily from 2028 as the level of annual deployment increases and there is a greater demand for O&M activities to service the growing installed capacity and manufacturing activities due to the occupation of the Ardersier Port Extension facilities. In 2028, the offshore wind sector could support almost 2,900 jobs across the UK, 1,000 in Scotland and 300 in Moray & Highland. This will include the jobs that will be supported in the preparation and construction of the port facilities (see Section 6.1).

Over the medium term, to 2040, the offshore wind sector will support about 7,100 jobs across the UK, 2,000 in Scotland and 800 in Moray & Highland. By 2040, approximately half of those jobs will be associated with those directly commissioned on these projects and half would be elsewhere in the wider supply chain and induced.

Figure 6-3: Additional Scottish Employment Impacts Over Time due to Ardersier Port Extension



Source: BiGGAR Economics Analysis

Of the total employment in 2040, more than half would be attributed to operations and maintenance activities in each study area and about 14% to manufacturing and fabrication activities in Moray & Highland, 16% in Scotland and 14% in the UK as a whole.

This is because the extension facilities primarily provide additional operational areas within the existing energy transition facility. The extension focuses on expanding quay access, improving operational flexibility and supporting turbine logistics which are key factors of offshore wind operations and maintenance. Whilst the existing site is anticipated to host the main manufacturing facilities, additional benefits provided by the extension are mainly related to operational activities but may also include assembly operations and logistics.

Table 6-7: Employment Impacts Over Time, Split by Activity (Jobs), 2040

	Moray & Highland	Scotland	UK
DEVEX Jobs	20	100	500
CAPEX Jobs	200	400	1,000
MANEX Jobs	100	300	1,000
OPEX Jobs	500	1,100	4,700
Total GVA	800	2,000	7,100

Source: BiGGAR Economics Analysis. Note: Sums may not add up due to rounding.

6.3.4 GVA over Time

As with the employment figures, the level of Gross Value Added is expected to increase stably from 2028, as the sector ramps up deployment to reach the targets

for 2030. At this point the offshore wind sector will generate about £40.0 million to Moray & Highland, £120.0 million to Scotland and around £300.0 million to the UK economy.

By 2040, the sector is expected to generate approximately £700.0 million GVA in the UK, £200.0 million in Scotland and £90.0 million in Moray & Highland as a result of the Ardersier Port Extension activities. Over the period, it is estimated that the Net Present Value of the GVA of the sector will be about £700.0 million in Moray & Highland, £1.8 billion in Scotland and £6.0 billion in the UK as a whole.

Table 6-8: GVA Impacts Over Time, Split by Source (£m)

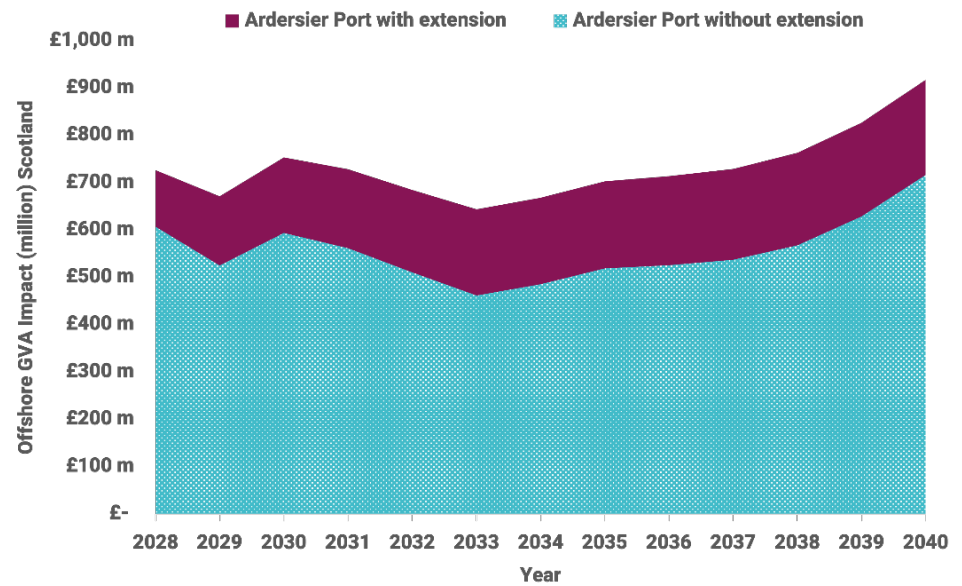
	Moray & Highland (NPV)	Scotland (NPV)	UK (NPV)
Turnover	1,700	3,400	7,100
Direct GVA	500	1,000	2,200
Indirect GVA	100	400	2,100
Induced GVA	100	400	1,700
Total GVA	700	1,800	6,000

Source: BiGGAR Economics Analysis. Note: Sums may not add up due to rounding.

As with the employment impacts, by 2040, more than half of the GVA will be within companies that are directly contracted onto these projects and the remaining will be in the wider supply chain and induced.

Figure 6-4 shows the GVA impact in Scotland with and without the Ardersier Port Extension.

Figure 6-4: Scottish GVA Impacts Over Time due to Ardersier Port Extension



Source: BiGGAR Economics Analysis

Of the total GVA, between 33-45% would be attributed to operations and maintenance activities in each study area and about 14% to manufacturing and fabrication activities in Moray & Highland, 22% in Scotland and 20% in the UK as a whole. The following table includes a breakdown of the GVA impacts by activity and study area.

Table 6-9: GVA Impacts Over Time, Split by Activity (£m)

	Moray & Highland (NPV)	Scotland (NPV)	UK (NPV)
DEVEX GVA	40	200	700
CAPEX GVA	200	600	1,500
MANEX GVA	100	400	1,200
OPEX GVA	300	600	2,700
Total GVA	700	1,800	6,000

Source: BiGGAR Economics Analysis. Note: Sums may not add up due to rounding.

7. Wider Socio-Economic Implications

The expansion of Ardersier Port will deliver long-term, high-quality jobs to the Local Area, helping to address depopulation

Wider socio-economic benefits and implications of Ardersier Port investment as a whole include:

- supply chain development;
- skills by bringing jobs, providing work placements and supporting education;
- improved and expanded housing through support on strategic housing plans;
- tourism and recreation by enabling path networks and connecting communities;
- other infrastructure and services improvements; and
- the local community through meaningful engagement to aid community wealth building, including provision of a community benefit fund.

The extension of Ardersier Port holds a further transformative potential for the region. It seeks to create a larger working platform to improve efficiency and enable the expansion of Ardersier's activities, particularly in relation to providing services for the offshore wind sector. It is expected that the extension will support the number and size of shipping vessels travelling to and docking at the port and generate additional operational activities on site to support the assembly of offshore wind components.

7.1 Employment and Population Retention

It is expected that, by the early 2030s, there is the potential for more than 3,000 long-term operational jobs on site at Ardersier Port, of which 400 could be enabled by the extension (as outlined in Section 6). This represents a significant increase in the number of jobs located in the Local Area, where there were 73,325 jobs in 2023. Employment in the Local Area grew by 2% between 2015 and 2023, and the expected jobs at Ardersier Port represent a 4% increase on total employment in the area in 2023.

The development of Ardersier Port and the extension also represents an important opportunity for Highland and Moray as a whole. In 2023, total employment in Highland and Moray was 168,450, a 6% increase since 2015. The potential operational jobs at Ardersier Port are estimated to account for 2% of the region's 2023 workforce. Current major private sector employers include LifeScan, a medical technology manufacturer which employed around 850 people in Highland as of

2017³⁵, and Mowi Scotland, an aquaculture company with approximately 1,500 employees split between Highland and Fife³⁶. Major employers in Moray include Baxters Food Group, a food manufacturer, which employed approximately 700 staff in Moray as of 2016³⁷. SSE Renewables is also a significant employer in the region, with 1,800 staff and contractors in the Highlands and Islands, highlighting the strategic importance of the renewable energy sector and the potential for Ardersier Port to support its continued growth. With a potential 3,000 operational jobs at Ardersier Port, this would make the port the largest site of private sector employment in the region in the early 2030s.

Delivering significant employment opportunities such as those created by Ardersier Port and the extension is vital for areas like Highland and Moray where declining and ageing populations present major challenges. As outlined in Section 4, it is expected that the working age population of Highland and Moray will fall by 10.6% between 2022 and 2043, a reduction of 21,670 people of working age. The Scottish Government has identified tackling depopulation in rural areas as a national strategic priority, recognising that current demographic trends risk increasing pressure on local infrastructure and services as ageing populations are supported by a shrinking workforce. As identified by a number of local stakeholders^{38 39}, a key driver of depopulation in rural areas is the lack of high-quality employment opportunities which would attract working age people and work to retain current residents as they enter the workforce. By enabling potentially 3,000 long-term on-site jobs, Ardersier Port is positioned to make a significant contribution toward reversing depopulation trends and supporting the sustainability of the regional economy.

³⁵ Highlands and Islands Enterprise (2017), Life Sciences. Available: <https://www.hie.co.uk/our-region/highlandambition/work-here/>

³⁶ Mowi Scotland (2025), About Mowi Scotland. Available: <https://mowi.com/uk/about/>

³⁷ Press & Journal (2016), Up to 80 jobs at risk as Baxters look to cut costs at Fochabers. Available: <https://www.pressandjournal.co.uk/fp/news/moray/918793/80-jobs-risk-baxters-look-cut-costs-fochabers/>

³⁸ Highlands and Islands Enterprise (2025), Regional Economic Strategy 2025-2035

³⁹ Moray Economic Partnership (2018), The Moray Economic Strategy 2018-2028

BiGGAR Economics, Shandwick House,
67 Shandwick Place, Edinburgh, Scotland EH2 4SD

info@biggareconomics.co.uk

biggareconomics.co.uk

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