NOTE TO FILE

JBA Project Code	2026s0580
Client	Mining Remediation Authority
Date	27/07/2026
Author	DW/JB
Checker	JT
Reviewer / Sign off	
Subject	Ground Investigation Methodology

1 Site Overview

The site is located within Whitehaven Harbour, and the proposed borehole locations are situated along the harbour promenade. Previous ground investigations, geological maps and drawings have been inspected (Engineering Assessment of Whitehaven Harbour 1993, BGS 1:10,000 map NX91NE, SLZ-JBA-00-00-DR-GT-4601.pdf) and show that the site is likely to be underlain by a significant thickness of Made Ground, on top of Sandstone and/or Mudstone bedrock. Because of this, the following drilling rigs shall be used for the collection of soil samples.

- Cable Percussion Drilling Rig
- Rotary Drilling Rig

To enable the design of wall fixings for the potential wall mounted pipework, the structural thickness of the existing Quayside walls needs to be determined in both the North Harbour and Queens Dock. This will require coring into the face of the quayside walls by use of a handheld rotary 20mm core drill at 4 locations. The cores will be taken at the proposed pipe level of between 5m and 6m below existing coping level. Access will be by MEWP as shown on drawing SLZ-JBA-00-00-DR-GT-4601.pdf. HC01 to HC04. Core holes will be reinstated on completion.

Summary of investigation.

Sample Name	Location	Sample Depth	Method
BH01	Queens Dock Car Park	10mbgl	Percussive with rotary follow on
BH02	Queens Dock Car Park	6mbgl	Percussive only expected
BH03	Running surface of Quayside	6mbgl	Percussive only expected
BH04	Running surface of Quayside	10mbgl	Percussive with rotary follow on
BH05	Running surface of Quayside on North Wall of North Harbour	6mbgl	Percussive only expected

BH06	Running surface of Quayside on North Wall of North Harbour	6mbgl	Percussive only expected
BH07	Running surface of Quayside on North Wall of North Harbour	10mbgl	Percussive with rotary follow on
BH08 (optional client to specify)	Running surface of Quayside on North Wall of North Harbour	10mbgl	Percussive with rotary follow on
TP01	Running surface of Quayside of North Wall of North Harbour	2 to 3mbgl	Machine excavated- (2m x 1m) plan footprint expected
TP02	Running surface of Quayside of North Wall of North Harbour	2 to 3mbgl	Machine excavated- (2m x 1m) plan footprint expected
HC01	Face of Northern Wall in North Harbour	500mm depth @ 5 to 6m below coping	Handheld core rig
HC02	Face of Eastern Wall in North Harbour	500mm depth @5 to 6m below coping	Handheld core rig
HC03	Face of Northern Wall in Queens Dock	500mm depth @5 to 6m below coping	Handheld core rig
HC04	Face of Northern Wall in Queens Dock	500mm depth @5 to 6m below coping	Handheld core rig

2 Site Establishment

2.1 Welfare Compound

The site compound shall be set up in Whitehaven Queens Dock Car Park, which shall be closed for the duration of the works. This compound will be where site vehicles will be parked for all staff and operatives. The compound will be enclosed by 2m high Heras type fence, complete with chapter eight signage and demarcation to warn public of site operations. The site facilities shall consist of a fully contained eco welfare unit with battery energy storage to reduce CO2 emissions and minimise noise pollution from generators. A double bunded fuel tank shall also be located within the secure compound. The compound shall be accessed via the existing car park entranceway, and the work area shall be accessed via the boat yard as shown. Appropriate signage shall be displayed to direct site traffic to the compound and to warn public of plant movements. The compound shall be accessed by a vehicle gate that will remain securely locked when not in use. All plant when not in use shall be parked over a plant nappy and all work sites shall have a spill response kit located within them.

The management and supervision of site establishment and the full ground investigation works shall be carried out by our full-time site manager. See Figure 2-1 below detailing site access and proposed welfare compound layout.

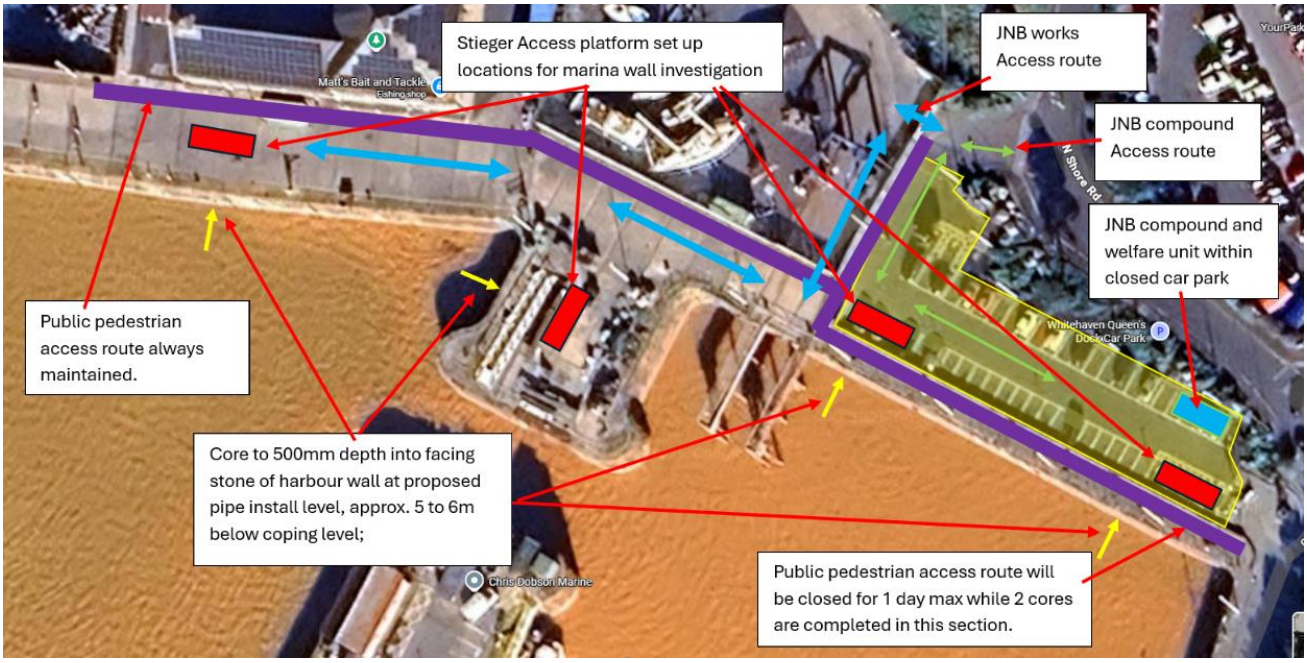


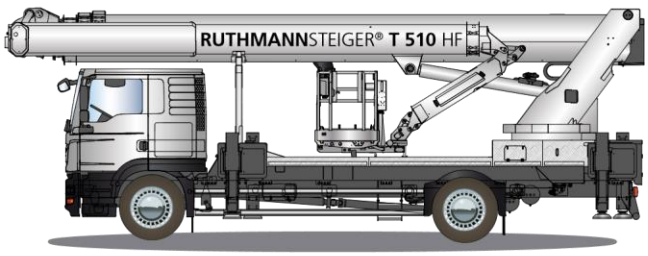
Figure 2-1. Site access and compound layout

2.2 Protection of Public

The individual work sites shall be secured with Heras type fencing with CDM signage posted. We shall always maintain a public pedestrian access route along the Quayside, as shown in figure 2-1. This will maintain access for pedestrians to the Bait and Tackle shop and the Western extent of the Quayside to the North Pier lighthouse. The routes will be guarded by use of pedestrian barrier and signed to warn of heavy plant operations. The exception to this full time provided access, will be when the Stieger access platform is set up in the two locations shown within Queens dock car park. During these works the boom of the access platform is required to reach over the wall and Quayside pedestrian route. The 2 number cores in this area are expected to take no longer than one day to complete. A pedestrian diversion to direct pedestrians around the works via North Shore Road will be provided during this phase of works. Where plant is required to move between work areas along the quayside, they shall be marshalled front and rear to control pedestrian/plant interface.

2.3 Phasing

The trial hole and coring works shall be a linear process followed by reinstatement, so individual work sites shall progress along the quayside. The coring works to the quayside wall are intended to take no longer than two days, so the set-up locations on site layout above, for the Stieger access platform, are short duration requirements. The specification for this access unit is shown below. The unit is sized to enable us to locate it away from the quayside walls and thus prevent excessive loading. Protection to buried services shall be assessed by our in-house temporary works designers in advance of mobilisation to ensure correct outrigger pad sizing is implemented. The onsite implementation and checking of the design compliance will be carried out by our site manager who will be trained as a temporary works co-ordinator.



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Working height	51.00 m	Total height	≥ 3.75 m
Lifting height	49.00 m	Total length	10.40 m
Outreach*	33.00 m	Permissible inclination	2°
Working cage size	2.42 x 0,97 m	Permissible total weight ≤	18,000 kg
Max. working cage size	3.82 x 0.97 m	Range of rotation	500°
Working cage load	600 kg	Swivelling angle of the jib/RÜSSEL®	220°
* depending on load, angle of rotation and outfit		Swivelling angle of upper boom	180°

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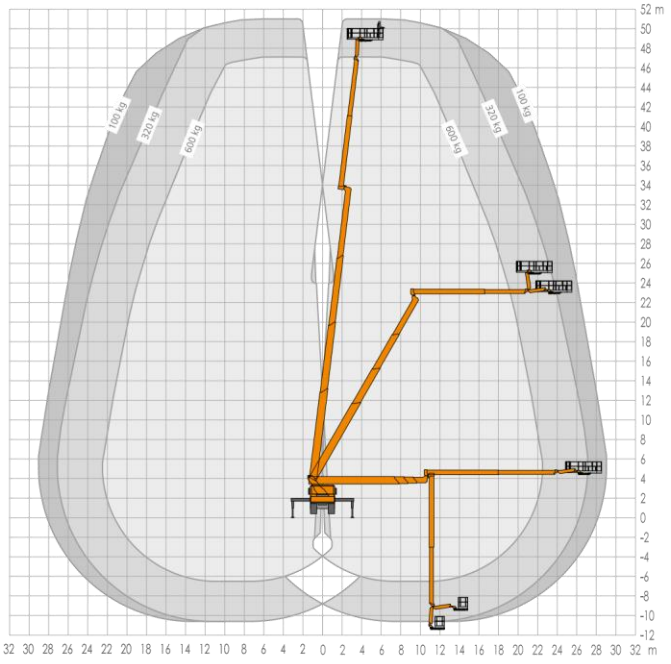

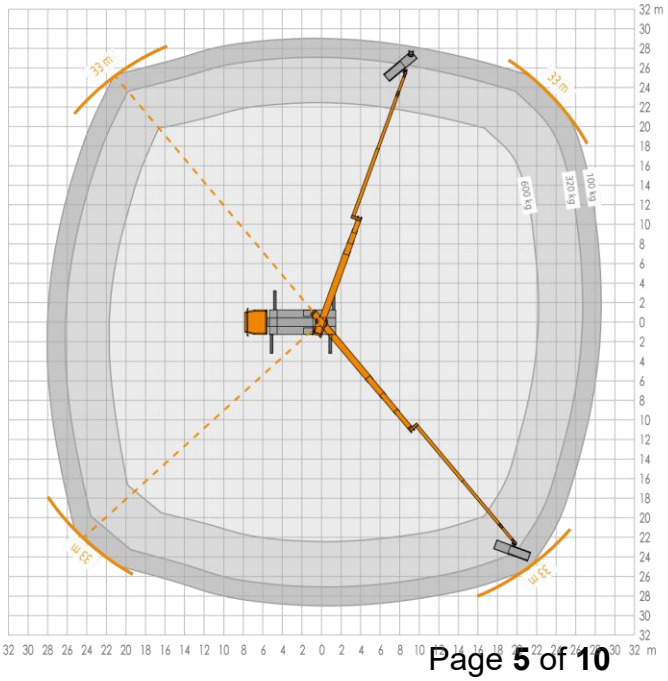

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3 Cable Percussion Drilling Rig

3.1 Overview

The cable percussion (CP) drilling rig (also called a “shell and auger” rig) is used to efficiently drill boreholes through drift soils. It is a tripod style drilling rig that uses a diesel engine to pull a cable which repeatedly raises and drops drilling tools into the ground.

The CP rig is able to easily recover both disturbed and undisturbed samples of soil and carry out Standard Penetration Tests (SPTs) to determine the strength of cohesive soils (clay and silt) and the density of granular soils (sand and gravel). When set up, a typical CP rig stands between 6.5 to 7m tall and is operated by a crew of 2 to 3 drillers. CP rigs are capable of drilling to depths of up to 50m through drift soils however they are unable to penetrate through bedrock.

3.2 Access Requirements and Working Area

The drilling rig is towed by a 4x4 vehicle and can easily be manoeuvred between borehole locations. The most commonly used CP rigs are the Dando 2000 (see Figure 3-1), however the choice of plant used for the Ground Investigation is to be decided by the Ground Investigation Contractor in conjunction with the Specialist Ground Investigation Supervisor.

A minimum 5m x 5m or 6m x 4m working area is required around a CP rig and it should be fenced off to create an exclusion zone for members of the public.

Figure 3-1. Dando 2000 cable percussion rig

Typical dimensions of a cable percussion drilling rig are listed in Table 3-1 below, however may vary slightly between specific models.

Table 3-1. Cable percussion rig dimensions

Dimensions	Transported (m)	Set up (m)
Length	7.5	4.5
Width	1.8	2.1
Height	1.4	6.9

3.3 Use in the Ground Investigation (GI)

During the GI, the surface hardstand will be broken out and then the CP rig will be set up on the borehole location. A hand-dug pit will be excavated to 1.2m to check for any services and then drilling will commence. Drilling casing will be installed during the drilling process to ensure the borehole does not collapse in on itself. Standard Penetration Testing (SPT) tests will be carried out every metre during drilling to determine the strength or density of the underlying soils. Samples will be recovered at the top of every new stratum.

The purpose of a cable percussion rig in this ground is assist in the drilling and sampling of made ground material, expected to be present adjacent to the harbour wall. It is believed that the ground beneath the promenade comprises significant granular material and a CP rig would be best suited for the drilling and sampling of these soils.

3.4 Operator Requirements

All drillers who operate a CP rig must hold at least a level 2 NVQ in land drilling and hold CSCS cards. Drilling operations must follow the guidelines set out in the British Drilling Association's "Guidance for the Operation of Cable Percussion Rigs" to ensure good practice and the health and safety of all operatives and protection of the environment is maintained at all times.

4 Rotary Drilling Rig

4.1 Overview

A rotary drilling rig is most commonly used to drill boreholes through solid rock. A spinning drill bit is slowly pushed into the ground and grinds its way through the rock. These drilling rigs can be used to drill through rock quickly with no sample collection (rotary open holing) or more slowly but producing a sample of undisturbed solid rock core (rotary coring).

Rotary drilling requires the use of a "flush", a fluid that is pumped down the borehole during drilling to cool the drilling bit and flush crushed rock back to the surface. Drilling flush shall be water as the presence of mine workings cannot be fully excluded. Arisings and wastewater will be contained at the drill head and removed and disposed of following correct waste disposal procedures.

When water flush is being used, hoses will be connected from the drilling rig to a bowser (towed to site by a 4x4 vehicle) filled from an imported water supply or from a nearby fire hydrant.

4.2 Access Requirements and Working Area

For a ground investigation of this nature, it is anticipated that a small, rubber tracked rotary drilling rig will be used. A common rubber tracked drill rig is the Comacchio Geo 205 (shown in Figure 4-1), however, the choice of plant used for the Ground Investigation is that of the Ground Investigation Contractor in consultation with the Specialist Ground Investigation Supervisor. Small rigs can be towed to site on a trailer or transported inside a van. When on site, the rig can be slowly moved around by the lead driller using controls attached to the rig, and in some cases by remote control.

Figure 4-1. Comacchio GEO 205 rotary drilling rig

A typical working area for a rotary drilling rig will be approximately 6m x 14m to accommodate the drilling rig, air compressor, support van and space for the drilling rods and tools to be stored on trestles. If water flush is being used, a compressor will not be needed, and the size of the working area can be reduced to approximately 6m x 6m. The working area should be fenced off to create an exclusion zone for members of the public.

Common dimensions for rigs like the Comacchio Geo 205 are listed in Table 4-1 below.

Table 4-1. Typical rubber tracked rotary drilling rig dimensions

Dimensions	Transported/tracking (m)	Set up (m)
Length	4.7	3.3
Width	1.1	1.1
Height	2.1	4.7

4.3 Use in the Ground Investigation

A rotary drilling rig will be set up on a borehole location once the CP drilling has reached bedrock. The drilling will continue at the base of the borehole and continue into bedrock to recover samples of rock core. Upon completion of drilling, the borehole will be backfilled to the surface, details of backfilling are outlined below in Section 5.

A rotary drilling rig will allow the retrieval of samples of solid rock core from beneath the harbour wall. The recovery of high quality rock samples is not possible without the use of a rotary drilling rig. The small size of a rubber tracked rig would also be most suitable when accessing and working on the harbour promenade.

4.4 Operator Requirements

All drillers who operate a rotary rig must hold at least a level 2 NVQ in land drilling and hold CSCS cards. Drilling operations must follow the guidelines set out in the British Drilling Association's "Manual for Rotary Drilling" to ensure good practice and the health and safety of all operatives and protection of the environment is maintained at all times.

5 Reinstatement

Reinstatement of each borehole will be undertaken once the target depth has been reached. The majority of boreholes will be backfilled from base to near surface with Ordinary Portland Cement (OPC) and bentonite grout. This is a blend of cement and bentonite (a clay material that expands when wet to form a highly impermeable seal that prevents fluid migration). This will fill the void left by any drilling activities. The top of the borehole will be reinstated as per the existing ground conditions.

A total of three boreholes will have monitoring wells installed during backfilling. These will be used to record groundwater levels and to check whether there are any hazardous gases associated with nearby mine workings affecting the ground in the vicinity of the respective boreholes. The three wells will be backfilled around a 50mm diameter piezometer pipe that will extend down to a particular depth of interest within the borehole.

The pipe will have slots over a prescribed length in it to allow ground water and any gases to enter. It will also be surrounded by a permeable material, such as gravel or sand. Above the slotted length, the pipe will be solid. The non-slotted 'solid' section of pipe will be surrounded by cement bentonite grout.

At the surface, the monitoring wells will be backfilled with a flush well cover and reinstated as per the existing ground conditions. Beneath the well cover, a precast chamber with a reinforced concrete slab base will house the top of the well pipe, rubber stopper with gas tap and a data logger to collect the monitoring information. A cross section of a typical monitoring well reinstatement and a surface view are shown in Figure 5-1.

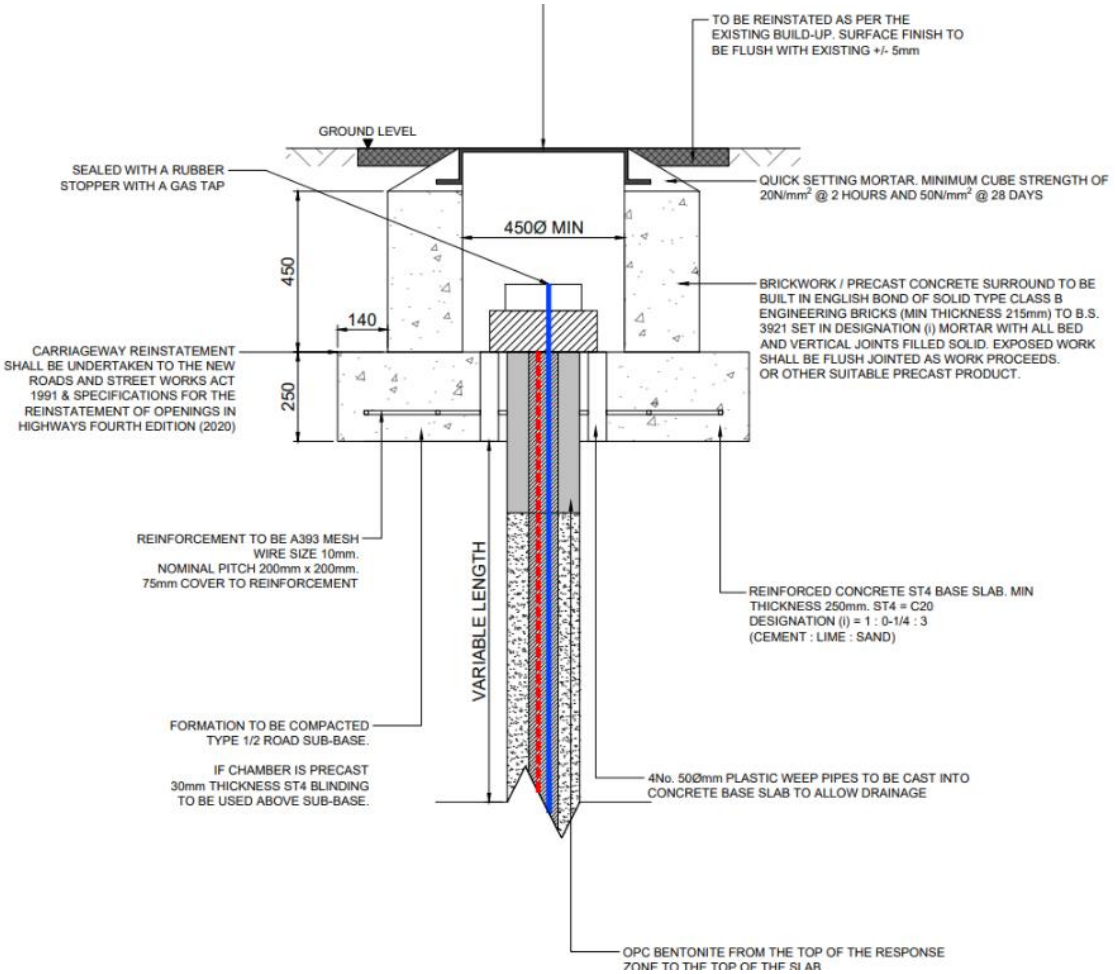

Figure 5-1. Reinstatement detail