



Whitby Cliff Lift – Lift Shaft and Tunnel Structures Options Report

North Yorkshire Council

31st January 2025

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Revision 01

Whitby Cliff Lift – Lift Shaft and Tunnel

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Document history and status

Revision	Date	Description	Originator	Checked	Approved
01	31/01/2025	First Issue for Client Comment	J Ellis	D Ho	P Burrell

1. Introduction

1.1 Scheme Brief

The Client, North Yorkshire Council (NYC), has identified that the maintenance liability of the Whitby Cliff Lift is anticipated to increase significantly in the coming years and are therefore considering options to address this potential long-term liability.

Align Property Partners has been appointed by the Client to undertake a feasibility assessment to determine long-term options that will effectively address the growing maintenance needs while ensuring the continued safety and serviceability of the lift and tunnel structures. Currently, the lift system is out of service, and due to the substantial costs associated with the necessary repairs, reinstating the system is not considered a viable option. This structures options report will focus on identifying sustainable solutions for the future of the structure, balancing both practical and financial considerations.

1.2 Structure Location & Description

The Whitby Cliff Lift, built circa 1929, is located to the west of the town centre on the north shore OS Map grid reference: 489304, 511376, (Ref: Figure 1: Location Plan). It is situated near three Grade II listed Art Nouveau Shelters, although the structure itself is not listed.

The structure comprises a single-storey masonry building above the top of the shaft, housing the mechanical and electrical equipment for operation. It features a 35.6m deep vertical lift shaft, connected to a 67.8-meter-long tunnel extending north towards the beach. Both the shaft and tunnel have an outer diameter of 4.57m and an internal diameter of 4.27m. The shaft is lined with 0.95m deep cast iron rings, each with a 25mm thick lining. Similarly, the tunnel was constructed using segmental cast iron panels bolted together to form a continuous structure. The shaft was constructed using a top-down method, with sections being sunk as excavation progressed. The tunnel was created using a pilot tunnelling method, then enlarged to the required size before bolting cast iron panels into place. Pressure grouting was used to ensure that the structure remains watertight, with cement injected to seal the structure effectively. A historical record of the construction methodology is included in Appendix B.

A topographical survey was undertaken to establish the levels around the site along with the profile of the tunnel. This survey will form the basis of the existing and proposed drawings and any detailed assessment going forward.



Figure 1 - Structure Location Plan

1.3 Structure Condition

The shaft section is accessible via the emergency staircase where the internal aspect can be visually inspected. The lift system is not currently in a serviceable condition.

Details of the overall condition of the tunnel section is largely unknown; the tunnel is lined with a proprietary render on cement board or similar (assumed). The tunnel is used for storage of beach huts during the winter off-peak season. Several small areas of the tunnel finishes were removed to expose the cast iron ring sections for investigation purposes. The tunnel appeared to be in a better condition than the main lift shaft, which is showing more water ingress generally across the majority of the joints.

Non-intrusive investigation works were undertaken in October 2023 by Ian Farmer Associates (IFA) (Appendix D), where the thickness of the steelwork panels was recorded using an ultrasonic thickness gauge at several locations in the lift shaft and tunnel.

Ten thickness readings were taken in the shaft, ranging from 25.0mm to 26.1mm; at the landings on the staircase, with an average thickness of 25.6mm recorded. This is similar to the original shaft liner thickness of 25mm which indicates minimal section loss.

Similarly, eight readings were taken in the tunnel, ranging from 29.1mm to 32.5mm, with an average thickness of 30.1mm recorded. Referring to page 874 of the historical report (Appendix B) where the text implies that the tunnel lining thickness was different “*The tunnel was designed to be the same size as the shaft – namely, 15 ft. diameter outside and 14 ft. diameter inside, but the lining was 1 in. thick.*” This looks to be an error in the report as the thickness measured by IFA would suggest that 1 1/4in.(31.75mm) is more likely to be the original tunnel lining thickness. Based on this assumption, this indicates a 5.2% average section loss and an 8.4% max. section loss. However, this is an unknown and the initial thickness noted in the historical report at 1 inch (25.4mm) could be correct and the panels have been cast significantly thicker than this.

Both the lift shaft and tunnel readings vary from that of the original design thickness which is not an uncommon feature of the casting process where cast items have varying thickness or there can be significant variation between parts.

1.4 Previous Maintenance / Repair Works

Based on site discussions with John Woodhead, it is known that a scheme has been undertaken to replace the original bolts between the cast iron segments with stainless steel bolts of an equivalent size. Specific details are largely unknown as to the bolting arrangement and if any isolation sleeves were fitted to prevent bi-metallic corrosion of dissimilar metals otherwise known as the 'battery effect'.

Little information is known about the works only that it was carried out in the past 5 years or so and only the bolts within the shaft section were replaced.

1.5 Key Site Constraints

This is not an exhaustive list but aims to cover the key constraints which are likely to affect design decisions or constructability when the scheme is brought to site.

- Proximity to adjacent listed buildings/shelters
- Unknown condition of hidden elements of the lift shaft and main tunnel section
- NYC requirement to retain accessibility to the beachfront due to non-Disability Discrimination Act (DDA) compliant access paths
- Ecology survey to rule of the presence of any nesting birds or Bats.
- Ventilation requirements should the lift shaft and tunnel be left insitu and not infilled.

1.6 Key Stakeholders

- North Yorkshire Country Council
- North Yorkshire Planning and Conservation Officer inc. Listed Buildings Consent
- Whitby Town Council
- Statutory Undertakers relevant to the location
- Public interest.

2. Options Development

A summary of the options considered are discussed in this section:

1. **Option 1a (Retain building)** – Remove and/or make safe any M&E equipment and capping the shaft off with a steel bar grille or similar. Retain the tunnel in its existing usage as winter storage area. Topside building to be retained. Ventilation requirements (natural and/or mechanical) would need to be considered in the assessment/design process.
2. **Option 1b (Remove building)** – All details outlined in Option 1a apply, with the addition of removing the topside building and capping the shaft with a concrete slab, allowing a monument which would twin as a ventilation stack for the retained shaft below, subject to ventilation requirements.
3. **Option 2** – Infill all aspects of the tunnel and shaft and remove the topside building.
4. **Option 3** – Infill lift shaft and retain the tunnel for storage. Topside building to be removed.

2.1 Option 1a – Remove M&E Equipment and Seal Off Main Shaft with Topside Building Retained

2.1.1 Description of Works

This option involves the partial removal of the top section of lift equipment as deemed necessary to ensure the system is safe and prevent any future failures that could compromise the structure.

Sealing up of the existing access to the lift and emergency staircase into the tunnel will be required. It is proposed that both top and bottom access to the lift shaft would be secured with a permanent steel grille arrangement. The smaller access to the staircase would be secured with a vertical steel bar arrangement fixed to the existing steelwork.

Ventilation (natural or mechanical) requirements will need to be carefully considered to maintain airflow through the lift shaft and tunnel to prevent excess moisture and humidity. However, it is expected that with an open steel grille arrangement this wouldn't change the current atmospheric conditions within the shaft.

The sump pump, believed to be in place, would need to be retained and operational. This may need to be relocated with associated pipework to an accessible location outside to allow for maintenance.

The tunnel section would remain in its current state for use as storage during the off-peak season. It is proposed that a more thorough inspection of the lining would be required in order to provide confidence that there are no serious issues underlying the existing render finish to the intrados. The trial holes in the render are anticipated to be located at approximately three points around the arch radius, spaced at roughly 10m centres. The extent of additional survey including exact locations and quantity would need confirmation during the detailed design stage.

The existing shaft is likely to also require some additional survey and investigation work in order to provide sufficient data in order to carry out a structural assessment. A structural assessment of both shaft and tunnel would be required following the additional survey, in order to provide confidence in the residual life of the existing lining.

Minimal works to the topside building would be required and none that would alter the visual appearance of it. Internally, removal of M&E equipment as required would be undertaken. A galvanised steel grille would be required on the topside.

The tunnel would be retained as is, as part of this option.

2.1.2 Scheme Appraisal

Scheme Advantages	Scheme Disadvantages
<ul style="list-style-type: none"> • Storage space retained in the tunnel. • Minor site works only. • Landscape on the topside unaffected. • Low capital cost, assuming no issues are discovered during the tunnel survey. • Heritage asset retained. 	<ul style="list-style-type: none"> • Asset management liability for the structure remains, however at a reduced capacity compared to the existing requirements. • Temporary works required in order to facilitate the works over a deep shaft. • Ventilation requirements and maintenance liability for a redundant structure could be significant. • Further investigations (material testing or NDT methods) and detailed assessment required to justify the existing structure could be extensive.

2.1.3 Cost and Programme.

The outline costings for this option is £89,000 based on a 21-week overall programme inclusive of a 2-week site programme.

Refer to Appendix G for further detail on the cost estimate.

2.2 Option 1b – Remove M&E Equipment and RC Capping to Main Shaft with Topside Building Removed

2.2.1 Description of Works

All details outlined in Option 1 apply, with the inclusion of demolition of the topside building and capping slab.

To facilitate the removal of the building, it is likely that additional sections of the lift system and upper section of emergency staircase would require removal. The construction type of the steel stairs is unknown but assumed to be modular such that only the required sections can be removed.

A reinforced concrete capping slab would be required to close off the top of the main shaft. It is suggested that a number of ring sections of the shaft would require removal to allow an acceptable depth for the concrete cap to be constructed. The design of a capping slab would provide a 120-year design life where the crack limits can be closely controlled preventing the rate of deterioration due to the moist atmosphere below ground level. In order to maintain ventilation through the shaft, a vent would be installed on the topside. The installation of a monument to provide the ventilation requirements would be subject to M&E design and client approval.

The installation of a capping slab to the shaft would still retain residual risk of deterioration of the shaft lining. However, the staircase could be retained to allow access to the underside of the capping slab to undertake inspections as required, approximately at 2 to 6-year intervals.

The tunnel would be retained as is, as part of this option.

2.2.2 Scheme Appraisal

Scheme Advantages	Scheme Disadvantages
<ul style="list-style-type: none"> • Storage space retained in the tunnel. • Landscape on the topside cleared of existing building and any associated maintenance liability. • Heritage asset retained, excluding the topside building. 	<ul style="list-style-type: none"> • Asset management liability for the structure remains, however at a reduced capacity compared to the existing requirements. • Increased complexity of site works to remove the existing infrastructure. • Removal of existing shaft ring sections. • Temporary works required in order to facilitate the works over a deep shaft. • Ventilation requirements and maintenance liability for a redundant structure could be significant. • Further investigations (material testing or NDT methods) and details assessment required to justify the existing structure could be extensive.

2.2.3 Cost and Programme.

The outline costings for this option is £122,000 based on a 26-week overall programme inclusive of a 4-week site programme.

Refer to Appendix G for further detail on the cost estimate.

2.3 Option 2: Tunnel and Shaft Infill

2.3.1 Description of Works

This option would require complete removal of all M&E equipment within the main shaft and tunnel along with any sub floor at the base of the main shaft such that the fill material is bearing directly on the sub-strata of base slab within the shaft where the condition is deemed appropriate.

Shaft Infill: It is proposed that a low carbon foamed concrete is pumped into the void up to finished level then topped with a Bitumen Macadam surface to match the existing footway. The shaft volume is ~500m³.

Tunnel infill: It is proposed that Expanded Polystyrene (EPS) blocks with a final grouted construction would be specified to the main tunnel section which are noted by multiple manufacturers to show a negligible deterioration over a lifespan >100 years, the approximate volume is ~625m³. Investigations into the precast floor on fill would be required to ensure no voids underneath would cause an issue during infilling.

The sustainability aspects of this option are deemed to be poor, insofar as the high carbon cost required to transport large quantities of foamed concrete to site.

The topside building would be fully demolished for this option.

2.3.2 Scheme Appraisal

Scheme Advantages	Scheme Disadvantages
<ul style="list-style-type: none"> • All maintenance liability for the structure removed. • Landscape on the topside cleared of existing building and any associated maintenance liability. • Zero ongoing maintenance costs. 	<ul style="list-style-type: none"> • Increased complexity of site works to remove the existing M&E infrastructure and stairs. • Large amount of foamed concrete required including transport to site and associated carbon emissions and environmental impact. • Potentially difficult grouting up procedure for grouting the tunnel section. • High Capital cost. • Heritage asset lost. • Storage area for beach huts lost.

2.3.3 Cost and Programme.

The outline costings for this option is £478,000 based on a 28-week overall programme inclusive of a 12-week site programme.

Refer to Appendix G for further detail on the cost estimate.

2.4 Option 3 – Shaft Infill and retain the Tunnel for storage.

2.4.1 Description of Works

This option would require complete removal of all M&E equipment within the main shaft and tunnel along with any sub floor at the base of the main shaft such that the fill material is bearing directly on the sub-strata of base slab within the shaft where the condition is deemed appropriate.

Shaft Infill: It is proposed that a foamed concrete is pumped into the void up to finished level then topped with a Bitumen Macadam surface to match the existing footway. The shaft volume is ~500m³.

The tunnel section is retained as is for use as storage. Some additional survey works to remove the existing lining and confirm the conditions of the lining is recommended if this is proposed for retention as a storage space. A structural assessment in order to provide confidence in the residual life of the existing tunnel lining would be required following the additional survey.

The topside building would be fully demolished for this option.

2.4.2 Scheme Appraisal

Scheme Advantages	Scheme Disadvantages.
<ul style="list-style-type: none"> • Storage space retained in the tunnel. 	<ul style="list-style-type: none"> • Increased complexity of site works to remove the existing M&E infrastructure and stairs.

<ul style="list-style-type: none"> • Landscape on the topside cleared of existing building and any associated maintenance liability. • Heritage asset partially retained (Tunnel only), • Residual life determined to provide structural assurance to the asset owner 	<ul style="list-style-type: none"> • Asset management liability for the structure remains, however at a reduced capacity compared to the existing requirements. • Maintenance liability for tunnel section retained, albeit minor due to condition. • Large amount of foamed concrete required including transport to site and associated carbon emissions and environmental impact.
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2.4.3 Cost and Programme.

The outline costings for this option is £251,000 based on a 25-week overall programme inclusive of an 8-week site programme.

Refer to Appendix G for further detail on the cost estimate.

3. Viability Assessment

Several key assessment criteria have been listed below that provide a simple comparison between the options considered and their outcomes.

3.1.1 Viability Assessment:

Key Assessment Criteria	Option 1a – Grilles (building retained)	Option 1b – Capping (building removed)	Option 2 – Full infill (building removed)	Option 3 – Partial Infill (building removed)
Visual Impact on Surrounding area	Low	Low/Medium (topside building removed)	Low/Medium (topside building removed)	Low/Medium (topside building removed)
Sustainability & Ecological Impact	Low	Low	Very High	High
Capital Cost	£89,000	£122,000	£478,000	£251,000
Health & Safety Aspects of the construction works	Medium Risk (working over a shaft)	Medium Risk (working over a shaft)	Medium Risk (removing M&E equipment and stairs)	Medium Risk (removing M&E equipment and stairs)
Technical Justification (Investigation/Design/Assessment)	Complex	Complex	Simple	Moderate (tunnel only)
Programme	21 Weeks	26 Weeks	28 Weeks	25 Weeks
Maintenance liability/cost	High	High	Low	Low/Medium

3.1.2 Additional Information Required

- Full condition survey – for lift shaft and/or tunnel retention options.
- Intrusive Testing (possible) – for lift shaft and/or tunnel retention options.
- Material Testing (possible) – for lift shaft and/or tunnel retention options.
- Statutory Undertakers Enquiries. (certain).
- Ecology Survey (certain).

4. Programme.

An estimate of the design/tender/construction programme is shown in Appendix F.

The programme is indicative only and has not been subject to input from a contractor.

5. Discussion

The key viability assessment criteria are discussed below and compared for each option with the intent of developing an understanding of how the recommended option has been down selected. As a guide, the assessment criteria will be compared against the two major option types i.e. retaining the structure with capping/sealing off versus complete/partial infilling.

The visual impact on the surrounding area, i.e., retaining versus removal of the topside building is not considered to be significant in the viability assessment.

To determine a sound technical basis for the options there are two key considerations:

Firstly, the options relating to retaining the structure with an open shaft and capping/sealing off that shaft are more technically challenging. To provide an acceptable level of assurance on the residual life of the structure further investigation and numerical assessment is required to compare the static loading (earth pressure) against the structure's capacity. Although the earth pressure loading on the structure can be easily determined, the capacity of the cast iron ring sections may prove difficult to justify. As identified from the thickness testing completed by Ian Farmer Associates, overall thickness variations of the lining are apparent along with these items being cast the original lining thickness and uniformity of the material is largely unknown. These unknowns mean that it is difficult to achieve a justifiable rate of deterioration for the lining based on past performance. Furthermore, the capacity of the sections is limited by the potential variation in the material quality where possible slag inclusions could cause weaknesses. Consequently, a significant design programme could be inevitable.

Secondly, the options involving infilling the shaft and/or tunnel are vastly simplified. The iron structure when infilled becomes redundant as the earth pressure is resisted by the backfill. Minimal permanent and temporary works design would be required. In the option where the tunnel is retained, and should the client wish to understand the residual lifespan, the issues raised above will apply. Alternatively, an inspection regime could be implemented to monitor any degradation of the existing tunnel with a structural assessment undertaken as required by inspection.

The ongoing maintenance liability for both options are significantly different insofar as, for option 1b where we propose capping off using a reinforced concrete slab this requires regular (2 and 6 yearly) surveys of the underside to check its condition. This brings separate challenges for access and working in confined spaces, which are undesirable. The condition of the shaft and tunnel lining would also need to be inspected on both options 1a and 1b. Therefore, it is deemed that these options provide minimal benefit in reducing the client's management & maintenance burden. Whereas the infilling options have minimal ongoing maintenance liability and are therefore the preferred option.

Regarding the overall sustainability of the two options, the infilling option creates a much higher carbon footprint given the volume of cement, production/transportation and placing of approximately 500m³ of foamed concrete for the lift shaft. Infilling of the tunnel requires 600m³ of polystyrene based material should this option be taken forward. The sustainability & environmental aspects of producing a very large quantity are undesirable and should be considered by the client as part of their overall environmental strategy. In comparison the capping options have significantly reduced carbon footprint over infilling options.

Some key challenges which must be considered is the removal of the lift shaft and emergency staircase when looking to infill the lift shaft. The M&E equipment and stairs would need to be removed to infill properly with foamed concrete. The complexity of removing these items will likely increase the construction programme to keep the workforce safe. In contrast, the capping options require fewer temporary works to block off the shaft and to locally remove the top sections of the lift shaft and stairs to crane into position a prefabricated grille or capping slab. The remaining lift shaft and stairs could be left in situ.

Where the tunnel section is to be infilled, EPS lightweight blocks will be placed prior to grouting. Voids below the subfloor could pose a potential future issue however should any movement occur post grouting; this would be minimal and have a negligible effect to the embankment above.

Should the tunnel section be retained as a storage facility, it would be prudent to remove the existing finishes/cladding, at several sections to regularly inspect the condition of the existing tunnel lining to ensure the existing structure is in good condition.

The outline costings need to be considered by the client for each option against their available budgets, value engineering may be possible on some options which would need to be determined by during a full costing exercise by a suitable contractor. The programmes for each option are broadly similar given the variation in design and construction programmes needed for each option.

Other Considerations

Public perception towards the council once such a scheme is made public should be carefully considered. It is likely that local historic groups/societies may have strong feelings towards the retention of such a historical structure. Given that the adjacent tram stops are listed as grade II status some may believe that the cliff lift should be similarly listed and look to involve Natural England where either option is considered but especially a full infilling option where the structure and its historical value would be lost. A similar point may be made around the existing patrons who utilise the space for the storage of beach huts over the winter period, they may seek the council to provide an alternative arrangement.

6. Recommendations

One of the key drivers for this scheme from the council's perspective is the current ongoing maintenance liability. The capping options do not offer a significant improvement to this and introduce a different set of maintenance challenges, like accessing the soffit for inspection purposes.

Based on the other key points discussed above the recommended option is:

Option 3. To infill the shaft with a foamed concrete or similar during detailed design and retain the tunnel section as a storage space following the removal of the existing internal finishes/cladding and confirmation that the condition of the existing tunnel lining is acceptable.

This is subject to confirmation by a detailed condition survey of the tunnel lining before commencing any construction works.

Appendix A. Existing Structure Drawings

Appendix B. Extract from Historical documentation

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57. > .Si . . ■ 'SG<1 — 879.

Vol. Lvn.

No. 16—February 3rd. 1931.

THE CONSTRUCTION OF A CLIFF LIFT AT WHITBY.

By -J. R. SEWAitn, Assoc.Af.Inst.G.E. (*Member*), Engineer and Surveyor
to the Whitby Urban District Council.

SO provide easy access from the promenade at the top of the 120 ft. high cliffs to the beach below, Whitby now has an electric lift, and therewith has solved a problem which has exercised successive Councils during the past forty years.

Prior to the War a scheme had almost been adopted, but with the outbreak of hostilities the plans were dropped, and it was not until 1925 that a new project was put forward. This was for an inclined tramway similar to those installed at several other seaside resorts, but this proposal was eventually vetoed.

In the latter part of 1928 the subject was again brought up, and this time the scheme suggested was an electric lift running in a shaft, with a tunnel at the bottom leading on to the lower promenade.

The following reasons were put forward, and led to the adoption of the tube lift scheme, as against an inclined tramway:—

1. *Foundations.*—The cliff face on this coast is chiefly of boulder clay, and there are innumerable springs which tend to turn the clay into a running bog, so that while there would have been difficulty in obtaining a good foundation for the permanent track, no attention to the cliff face would be necessary in the tube lift scheme.

2. *Upkeep.*—The upkeep of an inclined tramway exposed to the north, the bad foundation of the cliffs and the annual painting of the cars would have been a considerable expense, whereas in the case of the shaft lift every part would be totally enclosed, there would be no track to maintain and very little painting would be necessary.

3. *General Appearance.*—Whitby is an old-world town with red-tiled roofs and cliffs sloping to the sea, so that tramcars running up and down to the foreshore would have been a great eyesore.

From borings taken and general observations made, it appeared that the cliff face at the point at which it was finally decided to sink the shaft had not appreciably altered since 1849. The sub-soil was mainly clay, with a small stratum of gravel and sand, and there was no reason to believe that any blasting would be necessary.

The site chosen was approximately 183 yards west of the west entrance of the Spa Grounds and 92 yards east of the centre of Argyle Road, and at the following distances from the edge of the cliff face:—

On the surface	...	.....	51 ft.
At a depth of 10 ft.		.....	66 ft.
„ „ „ „ 20 ft.		.....	82 ft.
„ „ „ „ 30 ft.		.....	96 ft.
„ „ „ „ 40 ft.		.....	109 ft.

increasing at an average of 141 ft. for every 10 ft. of depth, the bottom of the shaft being 230 ft. from the edge of the cliff face at the top.

Plans were in due course approved by the Council, tenders invited and a public inquiry was held by the Ministry of Health. After several months' delay, sanction was obtained for borrowing the necessary money, and a start was made in February of this year, but, unfortunately, it was too late to obtain any revenue from the scheme for the season just past.

Plan No. 531/1 shows a block plan of the position on the cliff top, together with a section through the cliff.



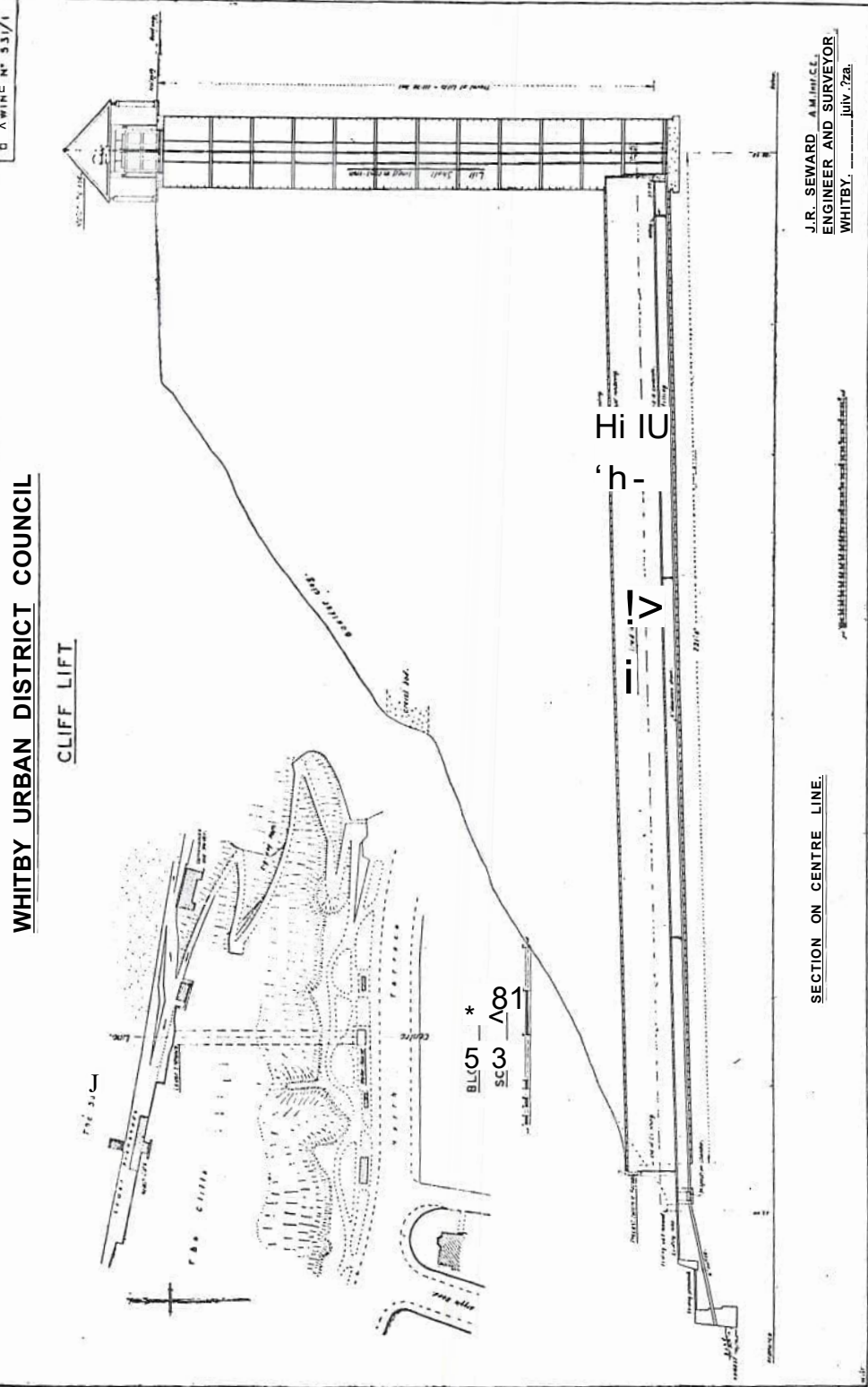
L⁴ Northern Echo **photograph.
LOOKING DOWN SHAFT, 59 FT. DEEP.

Both the shaft and the tunnel are 15 ft. diameter outside, and 14 ft. diameter between the flanges. The lining of the shaft consists of cast iron rings 3 ft. 1½ in. deep, divided equally into ten segments, the lining being 1 in. thick and the horizontal and vertical flanges 5 in. wide. A 5 in. horizontal flange is also cast midway between the top and bottom flanges, which are in turn strengthened by lugs on to the lining. The top and bottom flanges of each segment are drilled for six 1½ in. bolts, arranged at equal distances around the ring, and the vertical flanges of each segment were drilled for four 1½ in. bolts, thus there are 100 nuts, bolts and washers to every ring.



by j. R. SEWARD.

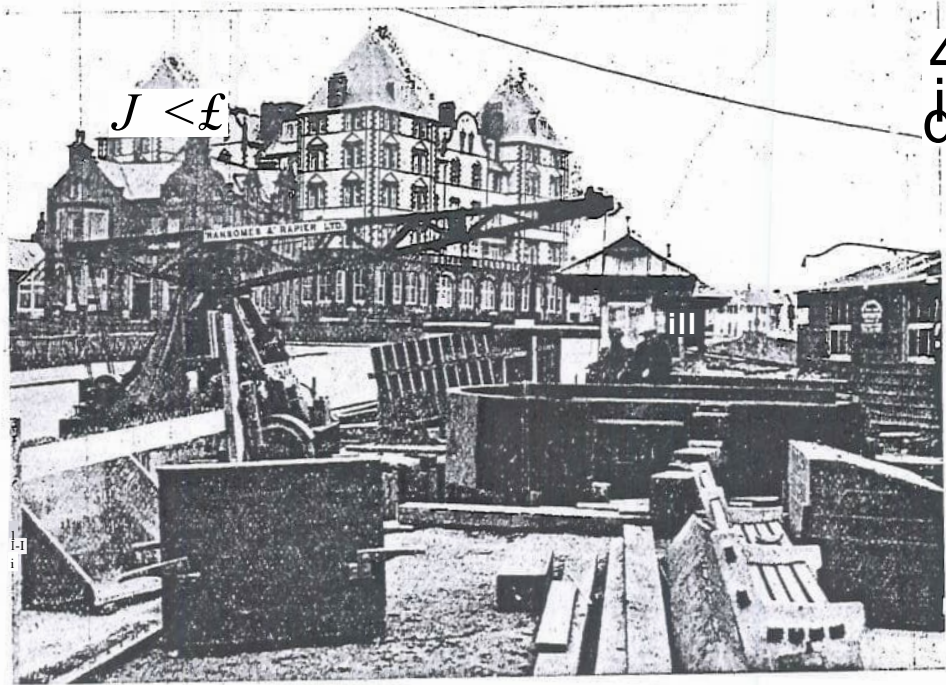
871



The total depth of excavation in the shaft is 118 ft. 2| in., which is made up as follows:—

Starting at the top :

	ft. in.
6 in. x 3 in. angle iron	6
13 in. x 5 in. R. S. J.	1 1
37 No. Rings of 3 ft. 1| in.	114 10|
35 No. Lead joints	3|
Concrete in foundation	1 6
	118 2|



["Northern Echo" photograph.

GENERAL VIEW OF WORKS. TOP OF SHAFT.

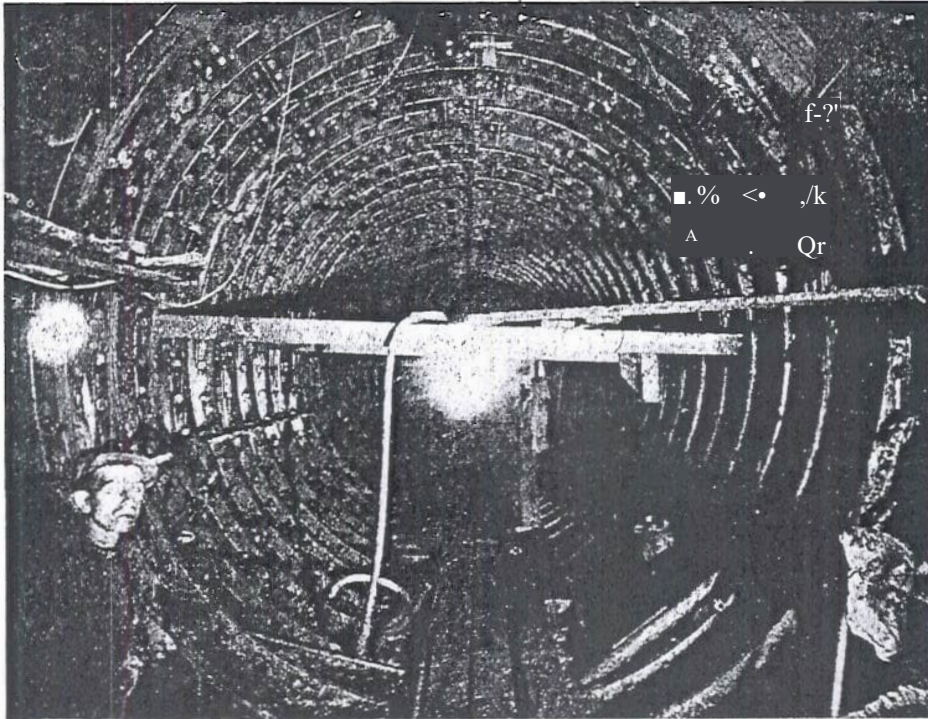
A start was made with a 15 ft. 1 in. diameter cutting ring, which sank by its own weight as the excavation was cut away from beneath it, and the cast-iron segments were bolted to the top of the cutting ring as the excavation was removed. The contractors used a Ransomes and Rapier 2-ton portable crane at the shaft top, and this proved its worth very forcibly considering that it was working 24 hours a day for six days a week.

The First Check.

All went well with this method of sinking the shaft for about 90 ft. when the lining stuck. Every known method was employed to sink this casing, but without avail, and eventually steel hawsers were placed round the portion standing above ground and were attached to two heavy steam rollers (with additional lorries on their own), the method being to shake the casing by



Inking "flying runs" with the steam rollers and lorries. After several hours work in this manner the situation appeared rather hopeless, and all rollers and lorries were detached when, suddenly, the casing dropped of its own accord about 2 ft. No time was lost in proceeding with the excavation, and although the casing dropped a further foot, it again stuck. It was then found that the whole casing was badly out of plumb, and the only procedure possible was to sling the casing with heavy baulks of timber and steel ropes at the top, carry on the excavation to the required depth, put in the concrete foundation, set the bottom ring and build up from this, removing each segment from the casing above and fixing them on the new casing at



Fr.ASTU.TGnT PHOTOGRAPH IN TUNNEL., LOOKING TO FORESHORE.

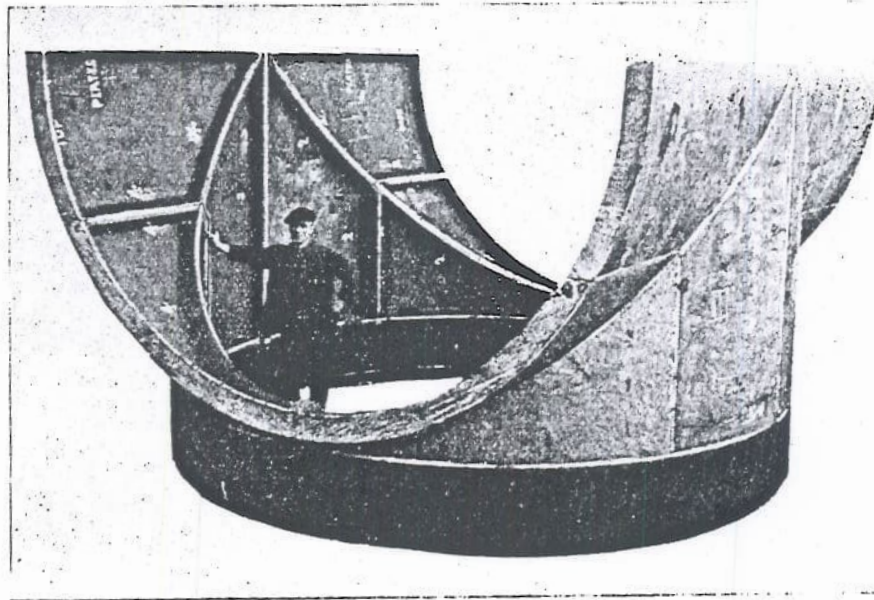
the bottom. It so happened that each ring had to be dropped only a matter of two or three inches on to the lower one. This delayed the work somewhat, but it appeared to be the only satisfactory way of dealing with the situation.

Smart Work by Miners.

At the same time as the work of sinking the shaft was in progress a pilot tunnel was started from the foreshore, and a temporary shaft was sunk at about the middle of the line of the tunnel, half-way down the cliff side, with a petrol engine winch at the top of the temporary shaft for hauling up the excavation. By this method the pilot tunnel was being worked from three points. Miners were employed on this work, using only their small

picks, and they completed it in an extraordinarily short time, long before the main shaft reached the bottom. This pilot tunnel was driven on the centre line of the proposed larger tunnel, and only had to be enlarged to the required size when driving out again from the main shaft. The total length of the tunnel was 221 ft.

The tunnel was designed to be the same size as the shaft—namely, 15 ft. diameter outside and 14 ft. diameter inside, but the lining was 1½ in. thick. Each ring was 20 in. wide, and consisted of six large segments, two smaller and a key of 10 in. There were eighty-two No. 1½-in. nuts and bolts to every ring. Four pneumatic spades were used to enlarge the pilot tunnel to the full diameter, and the whole of the excavation was in very hard clay, with the exception of three large rocks, which had to be blasted.



JUNCTION PLATES, SIXTEEN IN NUMBER, WEIGHT 101 TONS.

Owing to the close proximity of the works to the cliff face, it was considered necessary to “lock” the bottom of the shaft to the commencement of the tunnel, and for this purpose special castings were made for the junction of the shaft and tunnel. These special plates presented no little difficulty in casting, while also they were not easy to handle and fix at the bottom of the shaft. The accompanying photograph gives a very good idea of this junction, which was cast in 16 pieces and weighed 10½ tons. No water was encountered in the tunnel, but it followed the work down the shaft. Although no actual spring was encountered, a gravel bed of 4 or 5 ft. was met about half-way down the shaft, but this did not appreciably hinder the work.

Grouting under Pressure.

Every cast-iron segment was cast with a 1-in. diameter hole through the casing to take the nozzle of the cement gun, and these holes were ultimately filled with cement and were thus sealed. As the driving of the main tunnel proceeded the work of grouting the shaft under pressure was started, and many tons of cement were forced through the, grout-holes, but still water appeared to be dripping, and as each drip landed on the next flange below there was a regular shower of fine rain in the bottom of the pit. However, although there seemed to be so much coming down, the actual flow of water from the pit bottom, which was taken out to the foreshore through a 6-in. stoneware pipe laid on the bottom of the tunnel lining, was very small in quantity. The grouting of the tunnel presented no difficulty, and it was soon apparent that this part of the work was watertight.

Owing to the entrance of the tunnel being on the foreshore, it was practically impossible to transport any material along the sands, so that all material had to be lowered by the crane to the bottom of the shaft, placed on jubilee track and run along the tunnel. Excavations had to be brought out of the tunnel in a similar way, and this meant that the work of building the motor house at the top of the shaft had to be delayed until the last. Some 500 tons of rubble filling had to be lowered down the shaft for making up the floor of the tunnel, and on top of this filling a concrete floor 4 in. thick was laid, with a fall of 1 in. to the sides.

The height of the finished floor was 4 ft. 7 in. above the bottom of the inside of the tunnel rings, which gave a chord of 13 ft. 11 in. The walls of the tunnel were covered with a small-mesh expanded metal and fastened to the bolts with wire, and the whole of the surface was then cement rendered in two coats. The shaft was not lined in any way.

As soon as the greater part of the handling of material down the shaft was completed a start was made to fix the rolled steel trimmers, or buntons, in the shaft to carry the runner guides for the lifts and the balance weights. There were twelve sets in all, separated by approximately 10-ft. intervals, and there was a 10 in. x 8 in. centre trimmer, with two 10 in. x 5 in. trimmers—one on each side of the centre one. These trimmers had to be placed on a dead plumb line from the top to the bottom of the shaft and drilled in this position for bolting to the centre flange of the segment. By using the centre flange they did not foul any of the inch-bolts holding the cast-iron rings together.

Motor House Construction.

A start was then made on the foundations of the motor house. The top of the cast-iron shaft was fixed at 19 in. below the finished surface. In order to make the square top for the landing two 13 in. x 5 in. rolled steel joists were laid across the top of the shaft and bolted to the top flange of the first ring, and the first set of trimmers were bolted with cleats to the inside of the webs of the rolled steel joists, thus making two rectangular openings

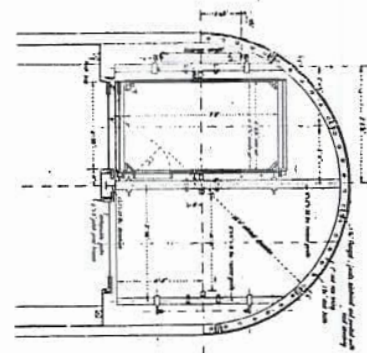
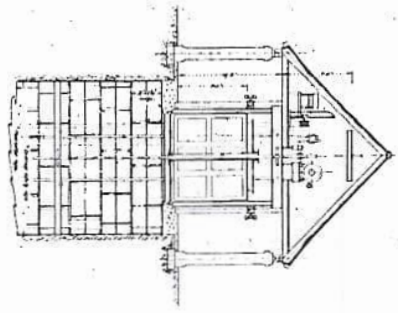


WHITBY URBAN DISTRICT COUNCIL

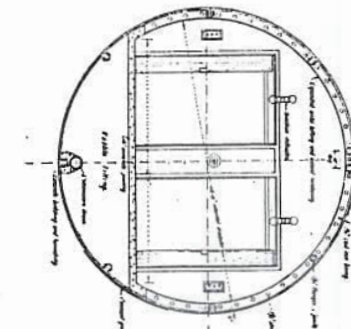
CLIFF LIFT

DETAIL OF SHAFT AND TUNNEL

DRAWING No. 531/3

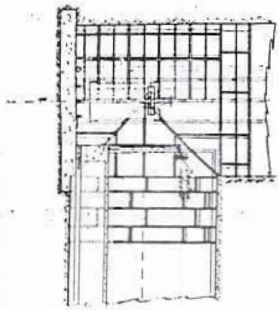


PLAN OF LOWER LANDING

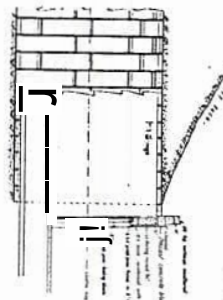


CROSS SECTION OF TUNNEL

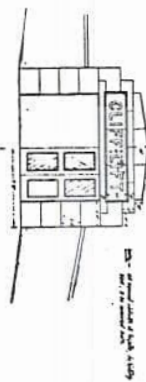
SCALE - 2 FEET TO 1 INCH



SECTION THROUGH SHAFT AND TUNNEL

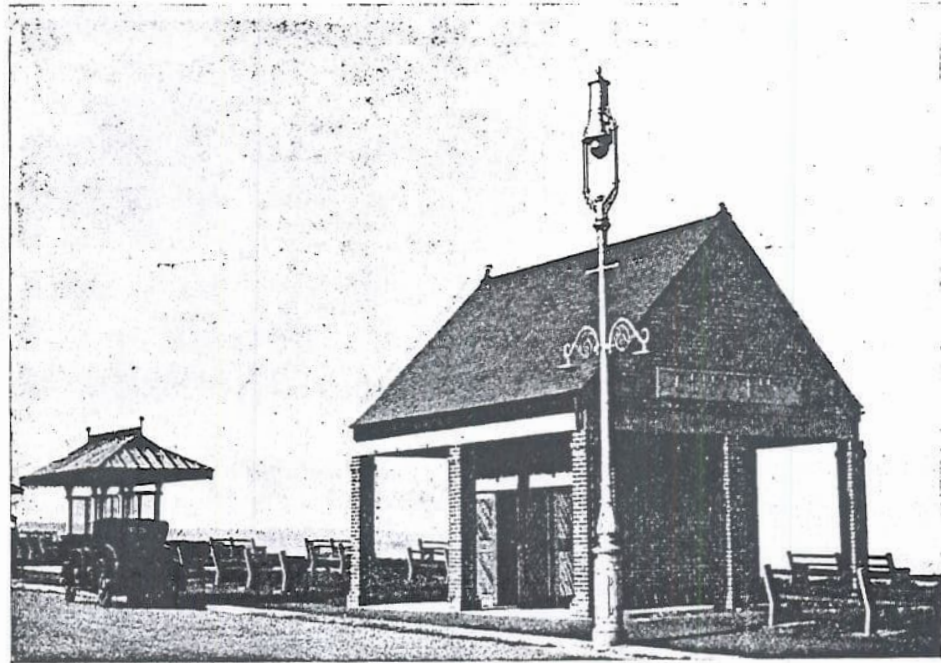


ELEVATION OF LOWER LANDING



J.R. SEWARD, A.M.I.C.E.
ENGINEER AND SURVEYOR
WHITBY, YUKON

for each lift to ascend to the top. Drawing No. 531/2 shows this arrangement. A concrete raft reinforced with angle iron was constructed around the top of the cast-iron cylinder, and finished off flush with the top flange. The openings between the steel joists and the casing were shuttered from the underside, and a rectangled concrete raft was constructed over this up to within 3 in. of the finished surface level, the raft protruding well over the sides of the shaft. The motor house had to be designed so that there was ample room, for housing all the machinery for the two lifts, and the lift makers insisted on at least 7 ft. head room in the centre of the floor, while a floor area of 400 sq. ft. had to be provided for the various positions of



[“ NortWni Echo ” photograph.]

LIFT House.

the machinery. The actual ground area necessary for the lifts arriving at the street level was only about 120 sq. ft. The motor house above the lifts was, therefore, constructed on eight 14-in. pillars and overhanging the lift entrance.

The main walls are 14 in. thick and built of engineering bricks faced with a selected multi-coloured hand-made brick. The 14-in. pillars were also built of the same facing brick, the roof being covered with tiles to match. All doors and frames are made of pitch pine, sized and varnished.

The lifts themselves are constructed of panelled pitch pine, the internal measurements of each car being 8 ft. long by 4 ft. 3 in. wide and 7 ft. high, and they each carry a load of 15 passengers.

JY J. R. SEWARD.

Method of Control.

The method of control is by the usual switch with detachable handle in the car, and each car is capable of being controlled from the top or bottom of the shaft by a series of push-button switches at each landing. The winding gear consists of a worm and worm-wheel gear, the worm-wheel having a cast-iron centre with rim of hard phosphor-bronze and machine-cut teeth.

The bearings of the worm-shaft are brass lined, the thrust being taken by a double ball-thrust-bearing.

The whole gear runs partially submerged in oil, and the rim of the winding pulley is specially grooved to suit the steel wire ropes. The 18-h.p. electric motors, made by Mawdsley, run at 475/950 revolutions per minute smoothly and sparklessly. Each car is fitted under the floor with brake shoes, which act on steel guides, which come into operation immediately the car runs over a certain speed. Direction limit switches and ultimate limit switches are also provided. The actual travel of the lifts is 111 ft. 8½ in. from floor to floor, the following extracts from one of the test sheets showing the time taken for the lift to travel up and down, the starting kick on the motors and the average current consumed with the lift empty, half-load, full-load and over-load, the over-load being approximately 20 per cent, over full load.

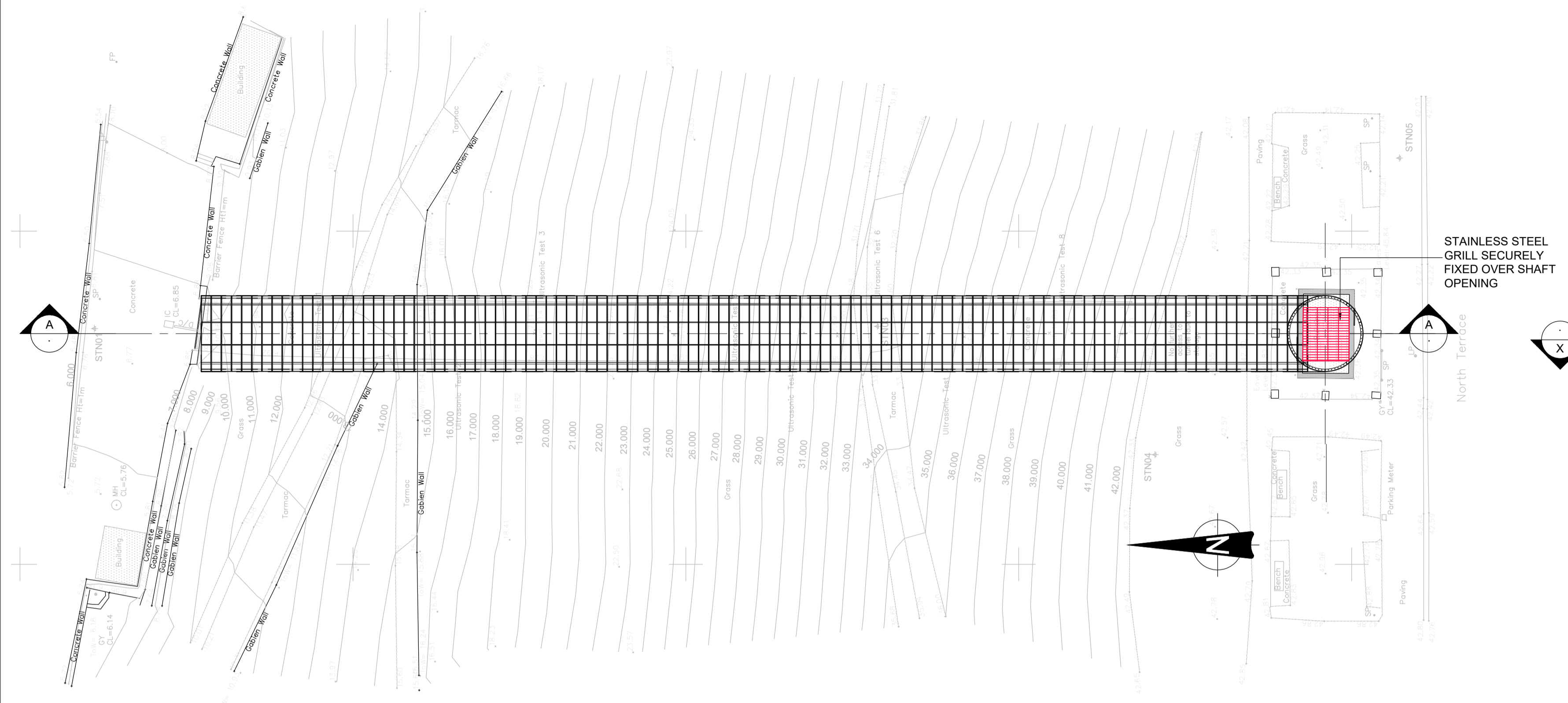
	Up.				Down.			
	—	0	+	4-4-	+	0	—	—
	Emp-ty.	Half Load.	Full Load.	Over Load.	Emp-ty.	Half Load.	Full Load.	Over Load.
Load in Car—cwt.		H1	22½	26½		11½	22½	26½
Time in seconds	33½	35½	36½	37	36½	35½	33½	33½
Starting kick—Amp.	34	48	64	64	52	48	32	32
Average current—Amjis.		18	38	47	28	16	0	0
Voltage.	460	460	460	460	460	460	460	460

My thanks are due to the "Northern Echo" and to the contractor (Mr. Win. Geo. Armstrong, of Newcastle) for the accompanying photographs, and also to the lift contractors (Messrs. Win. Wadsworth and Sons, Ltd., of Bolton) for the particulars contained in the test sheet.

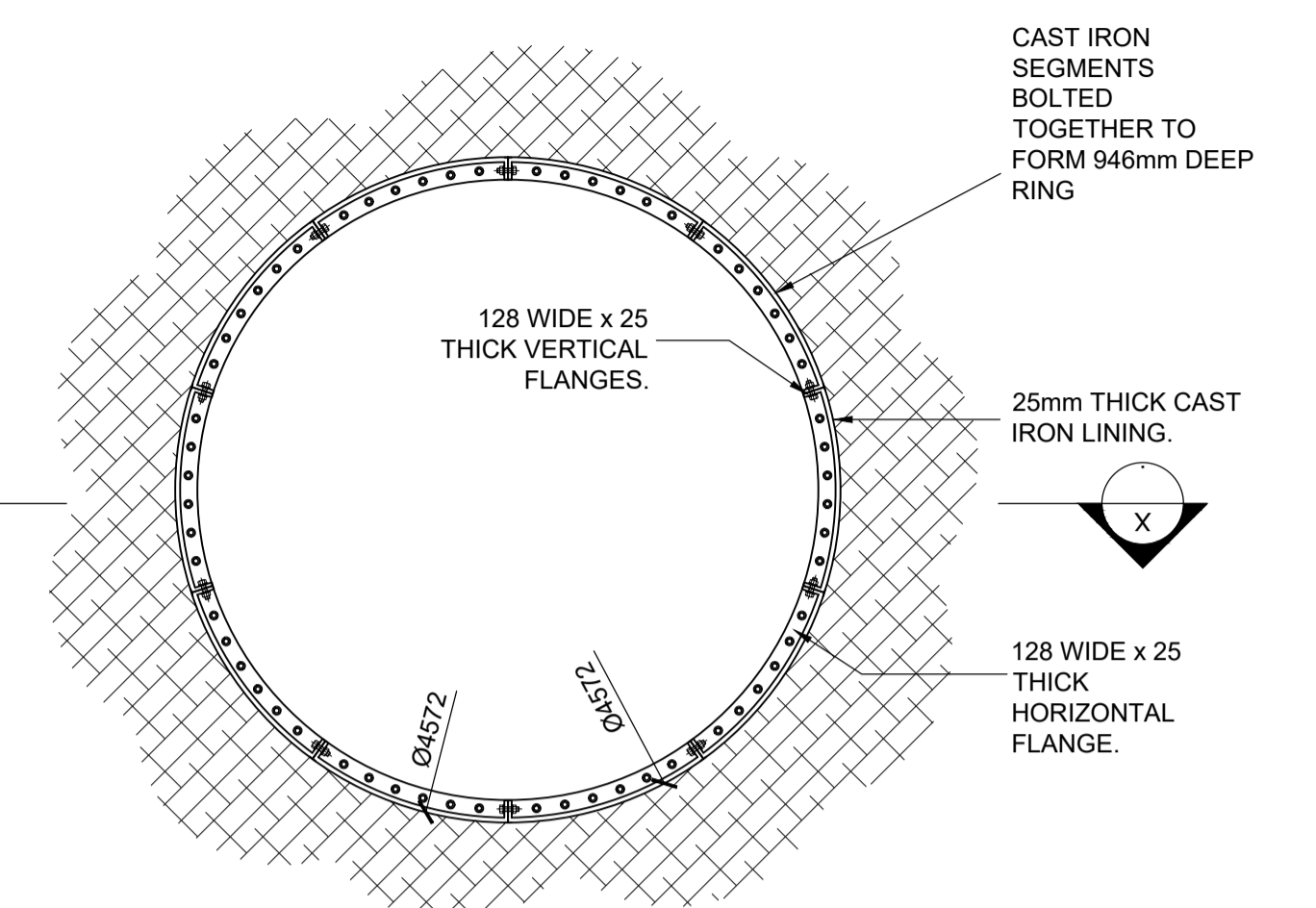
Appendix C. Structure Options Drawings

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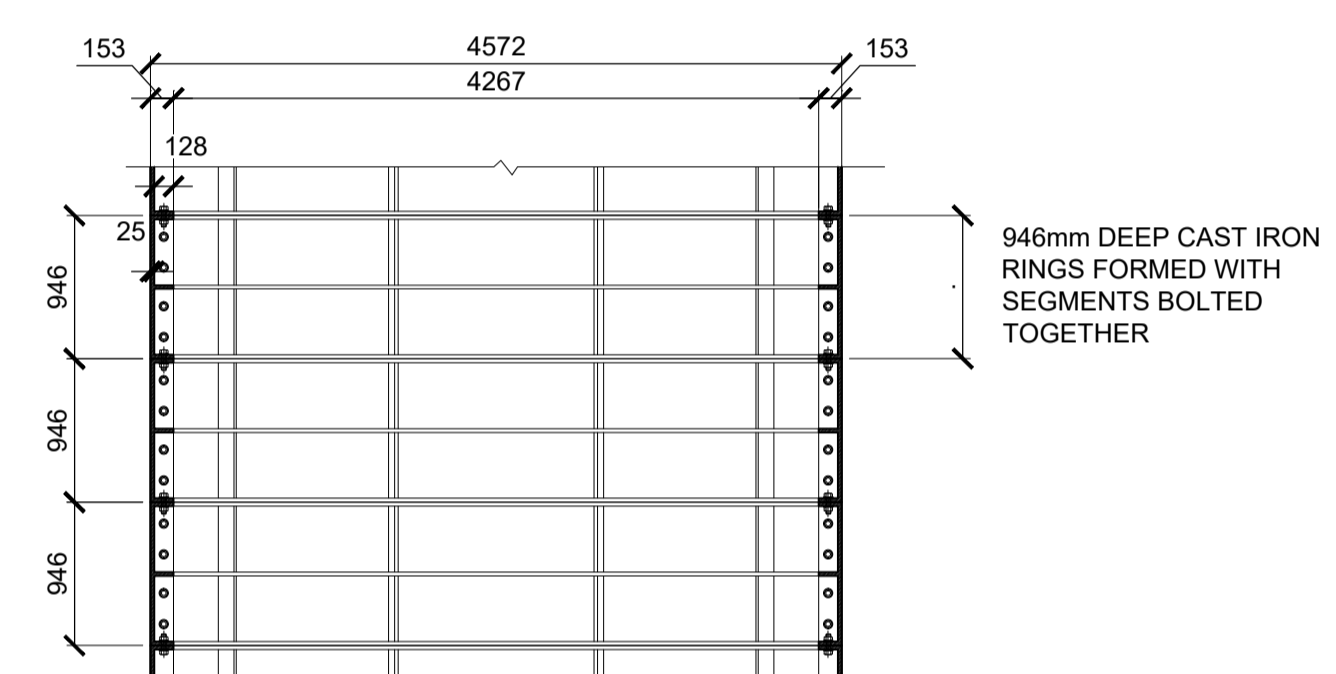
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 2. Ian Farmer Associates Report No 2254086 dated 22nd October 2024. This report contains information relating to the thickness and condition of the existing cast iron tunnel and shaft linings obtained using Ultra-sonic thickness testing.
 3. Topographical Survey information taken from Align Property Services drawing ref. NY2455-2-APS-XX-XX-DR-Y-001



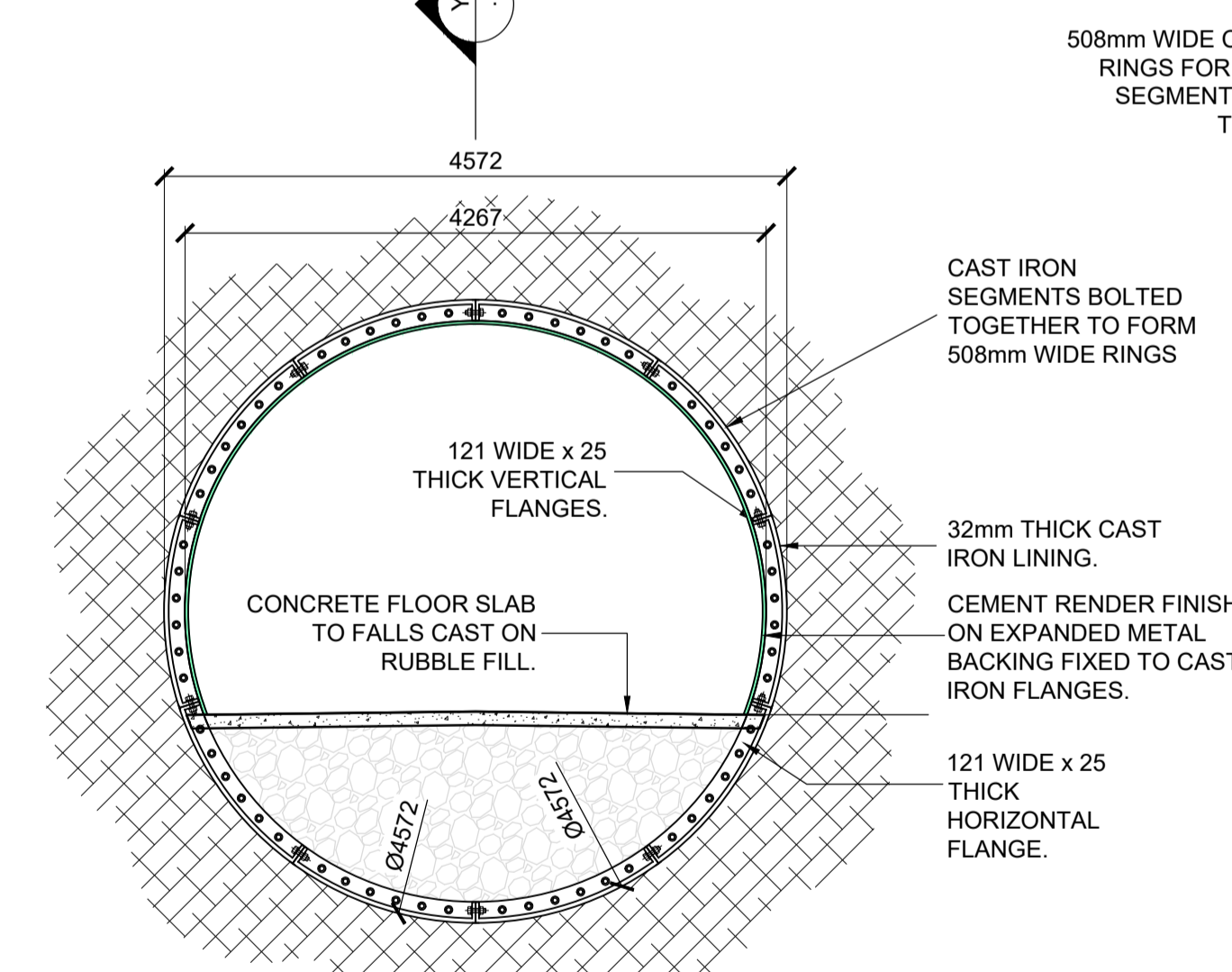
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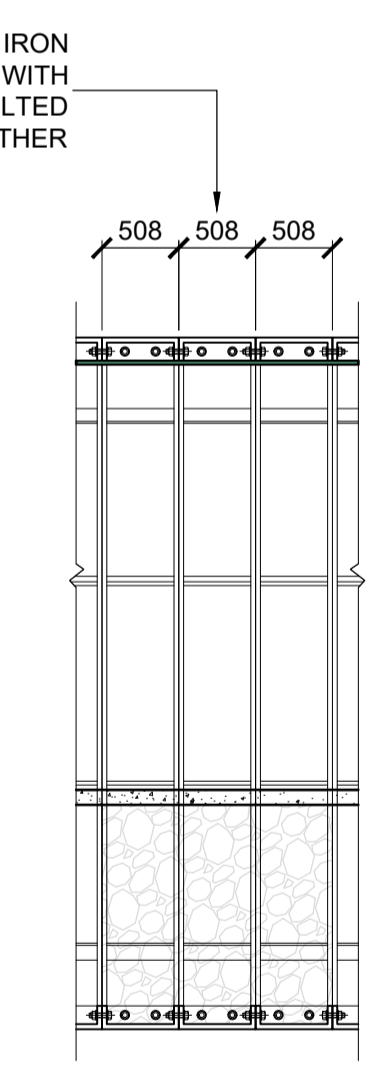
SECTION C-C
VERTICAL SHAFT DETAIL
(SCALE 1:50)



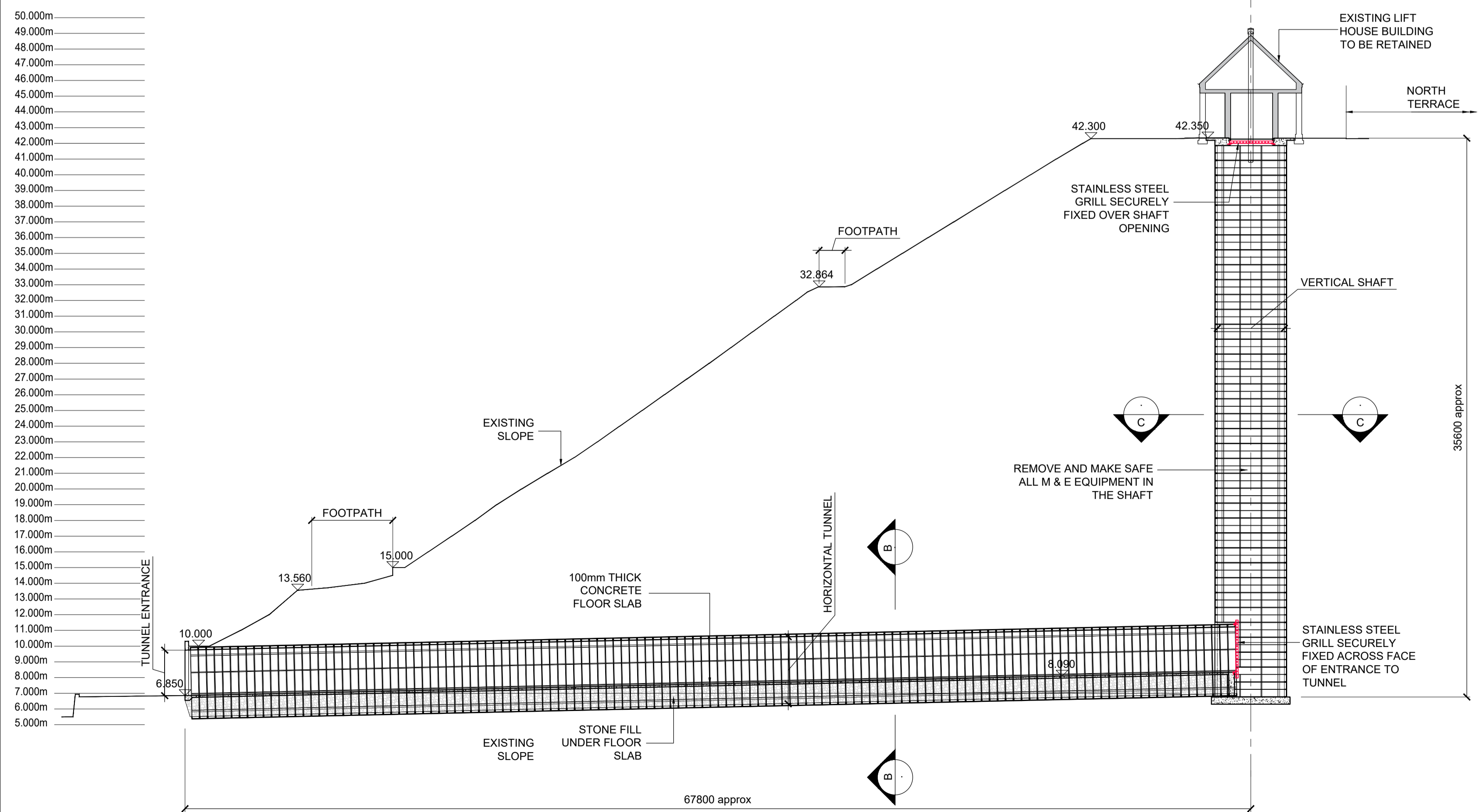
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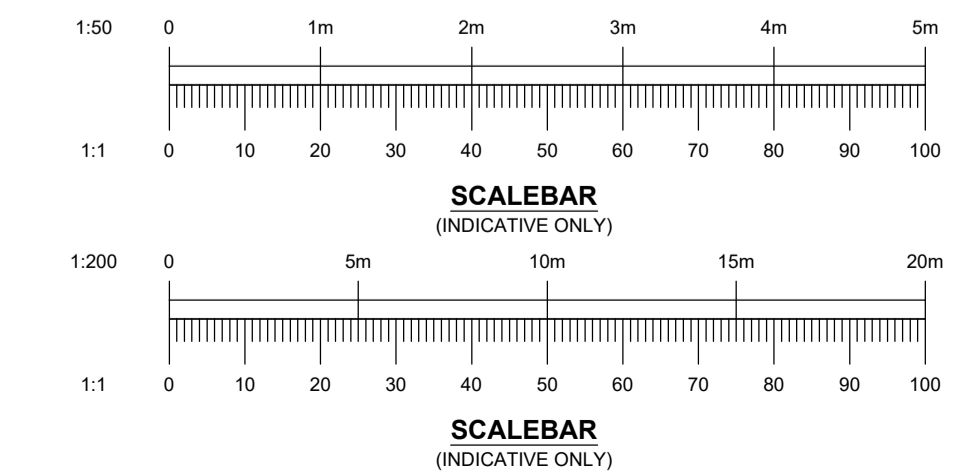
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TUNNEL DETAIL
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Y-Y
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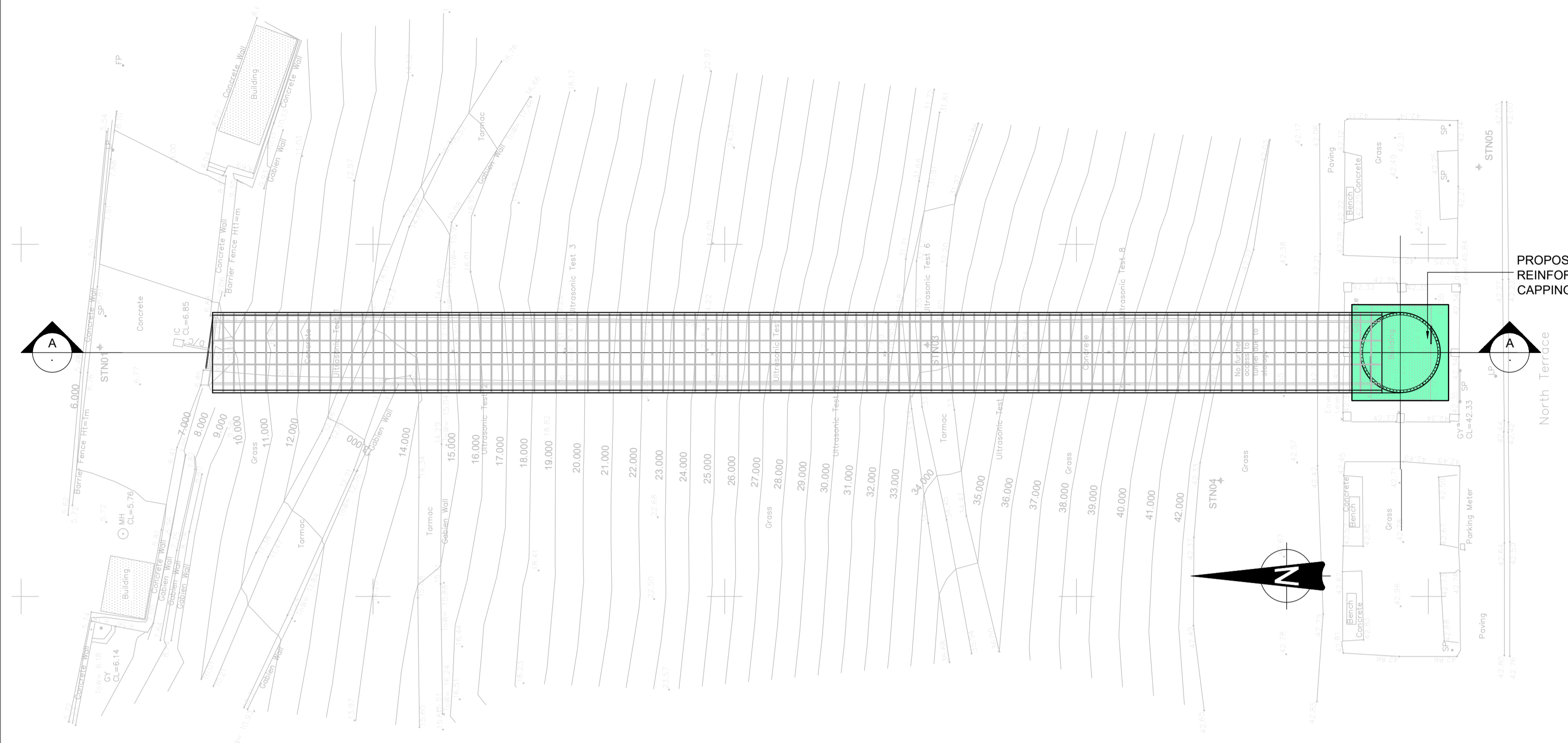
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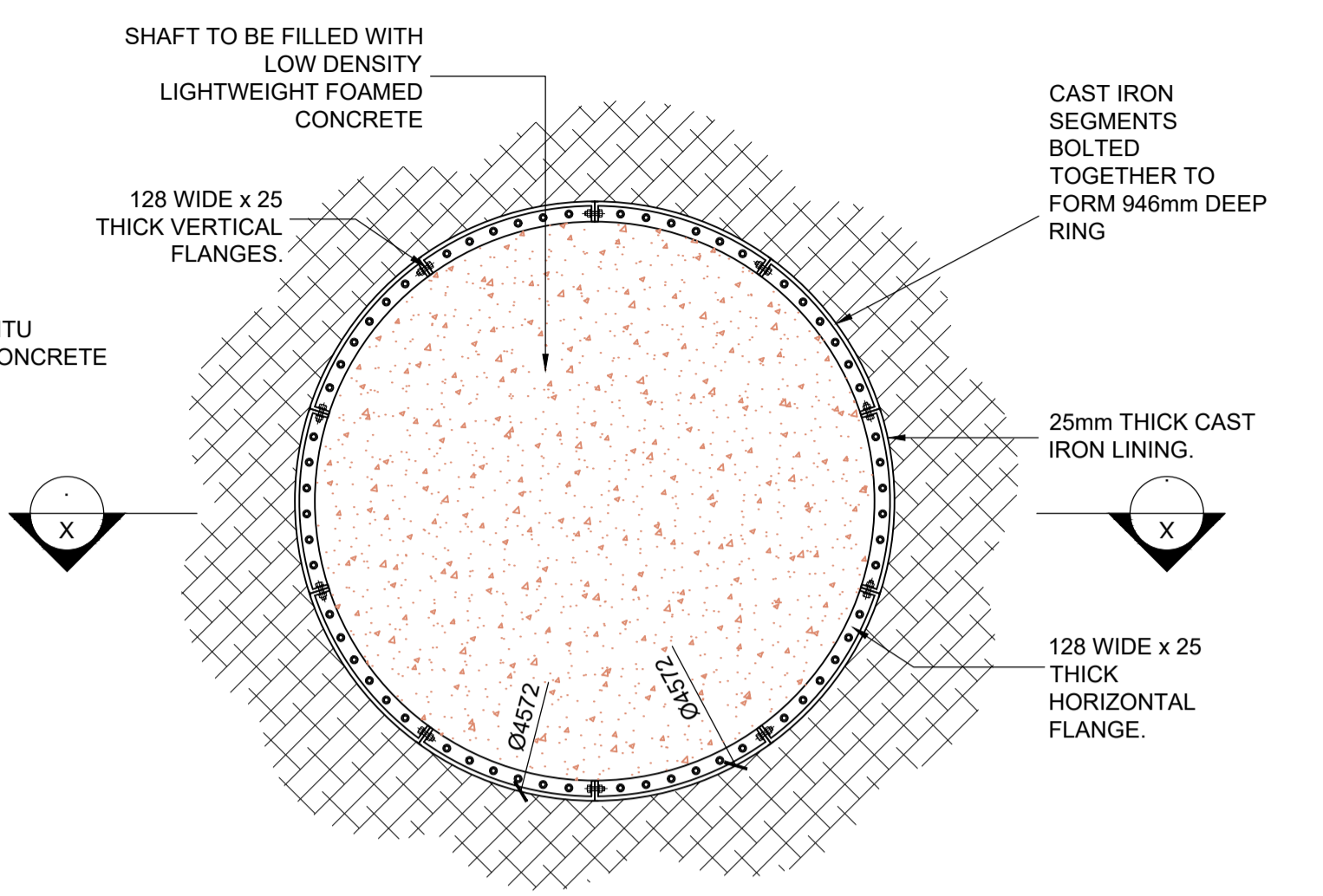
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Client: NORTH YORKSHIRE COUNCIL				
Project name: WHITBY CLIFF LIFT				
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Purpose: PRELIMINARY				
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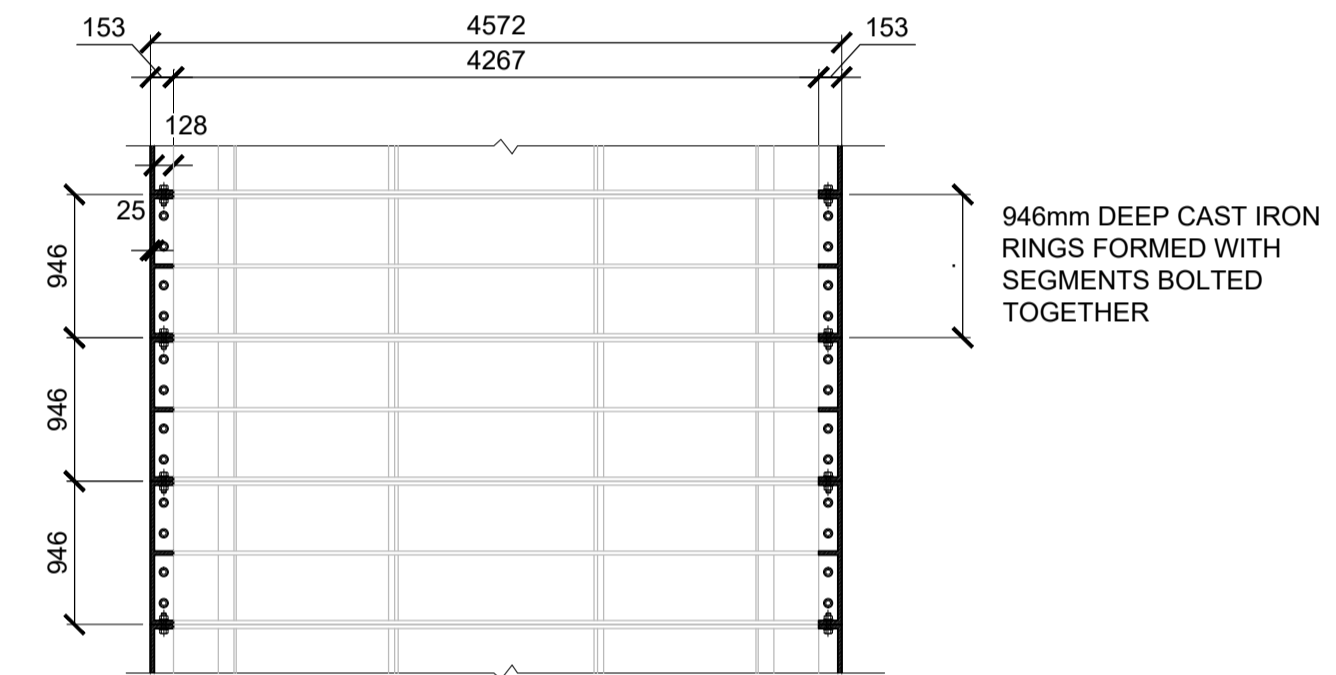
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 2. Ian Farmer Associates Report No 2254086 dated 22nd October 2024. This report contains information relating to the thickness and condition of the existing cast iron tunnel and shaft linings obtained using Ultra-sonic thickness testing.
 3. Topographical Survey information taken from Align Property Services drawing ref. NY2455-2-APS-XX-XX-DR-Y-001



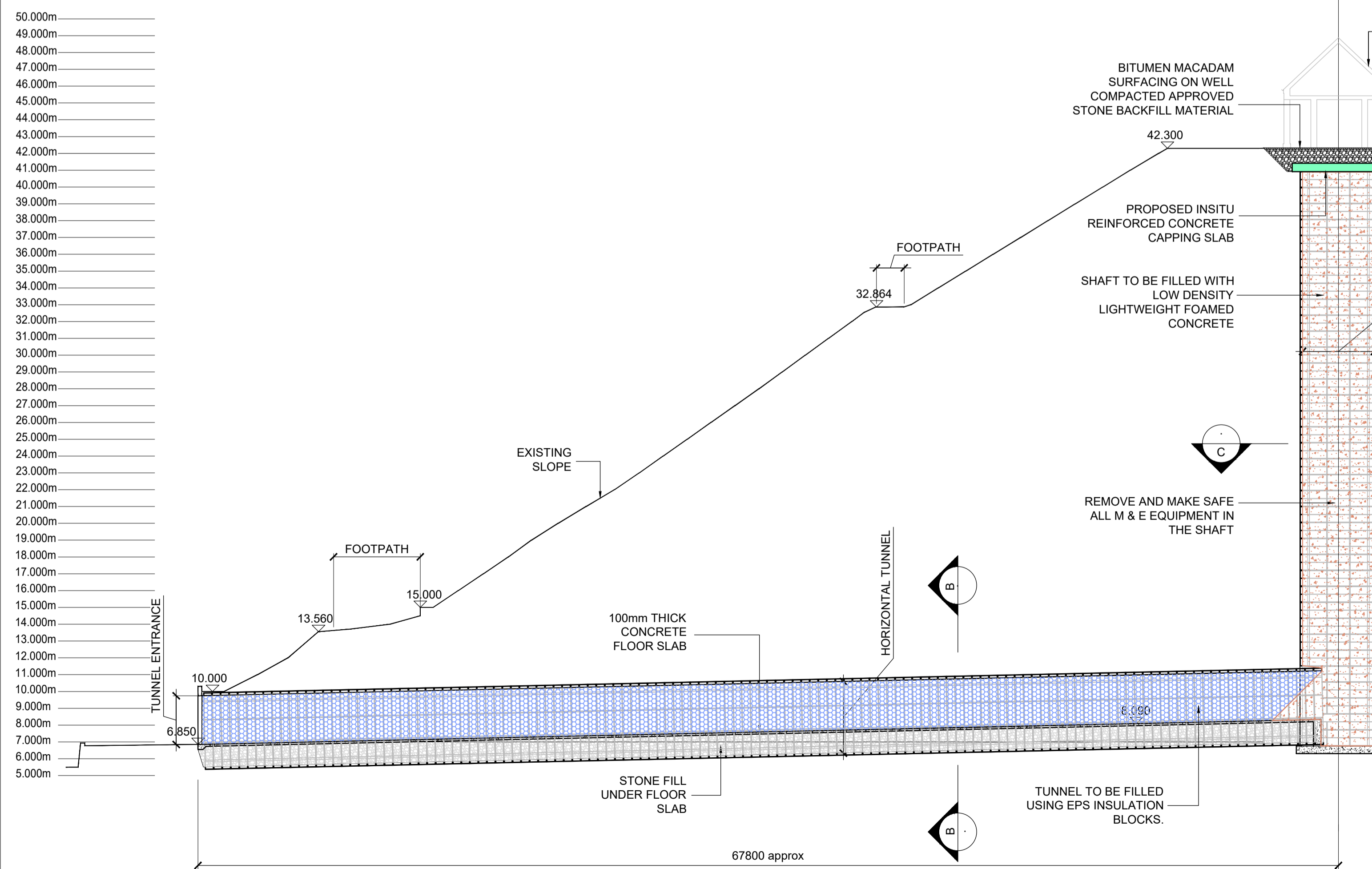
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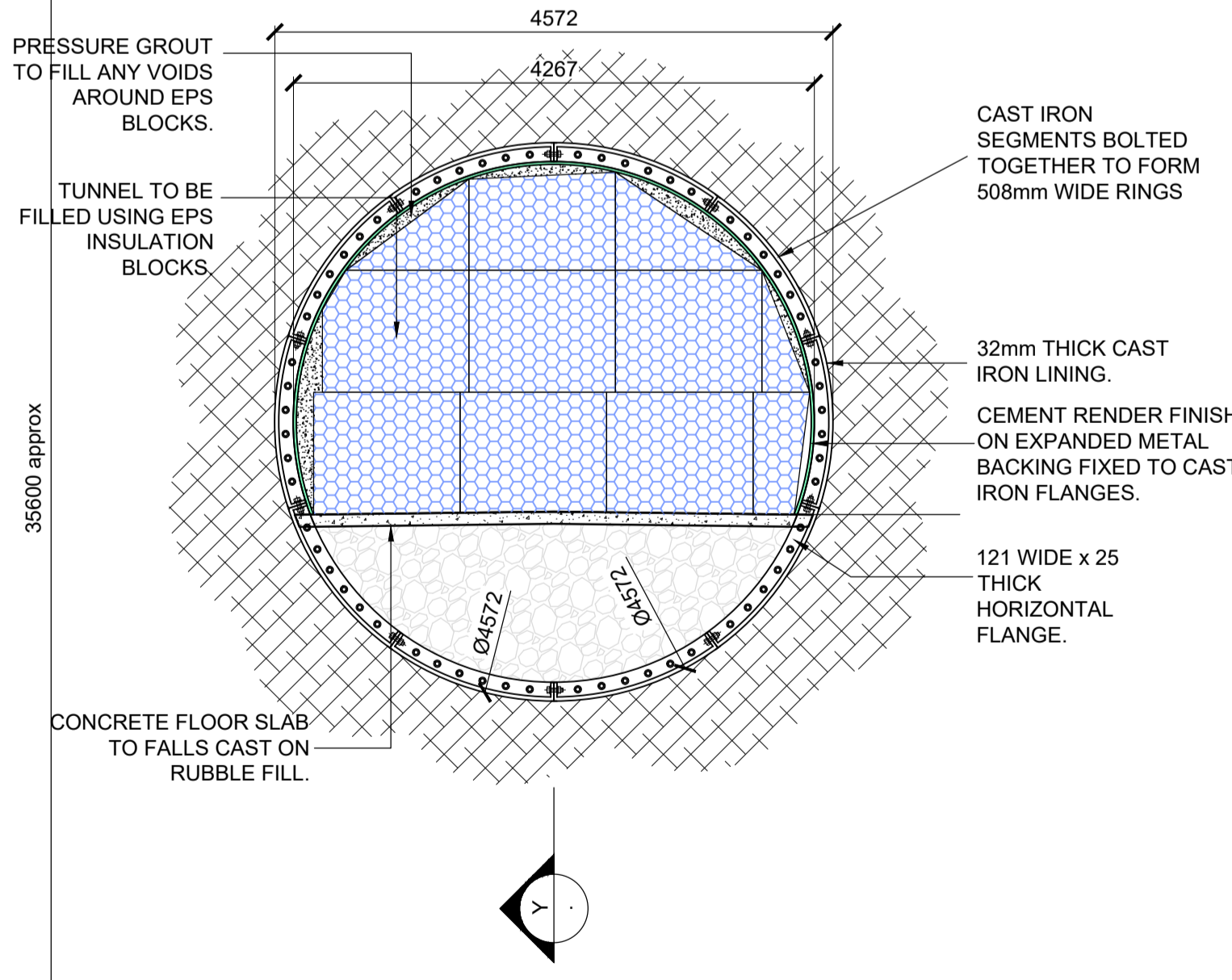
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VERTICAL SHAFT DETAIL
(SCALE 1:50)



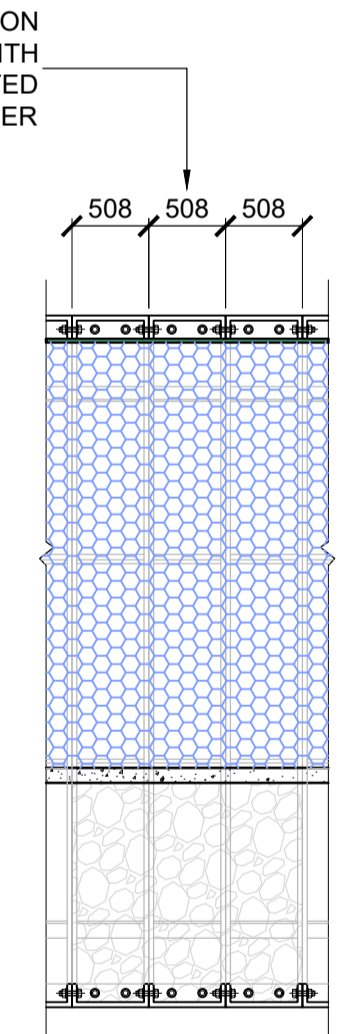
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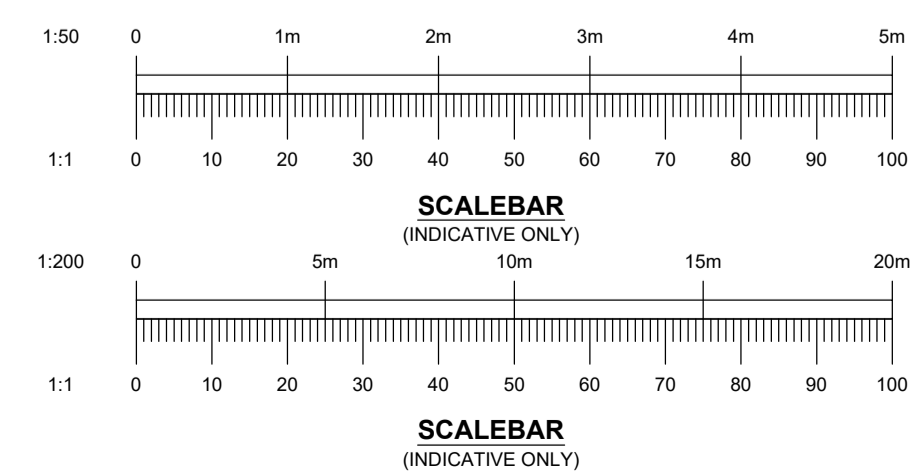
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SECTION B-B
TUNNEL DETAIL
(SCALE 1:50)



Y-Y
(SCALE 1:50)



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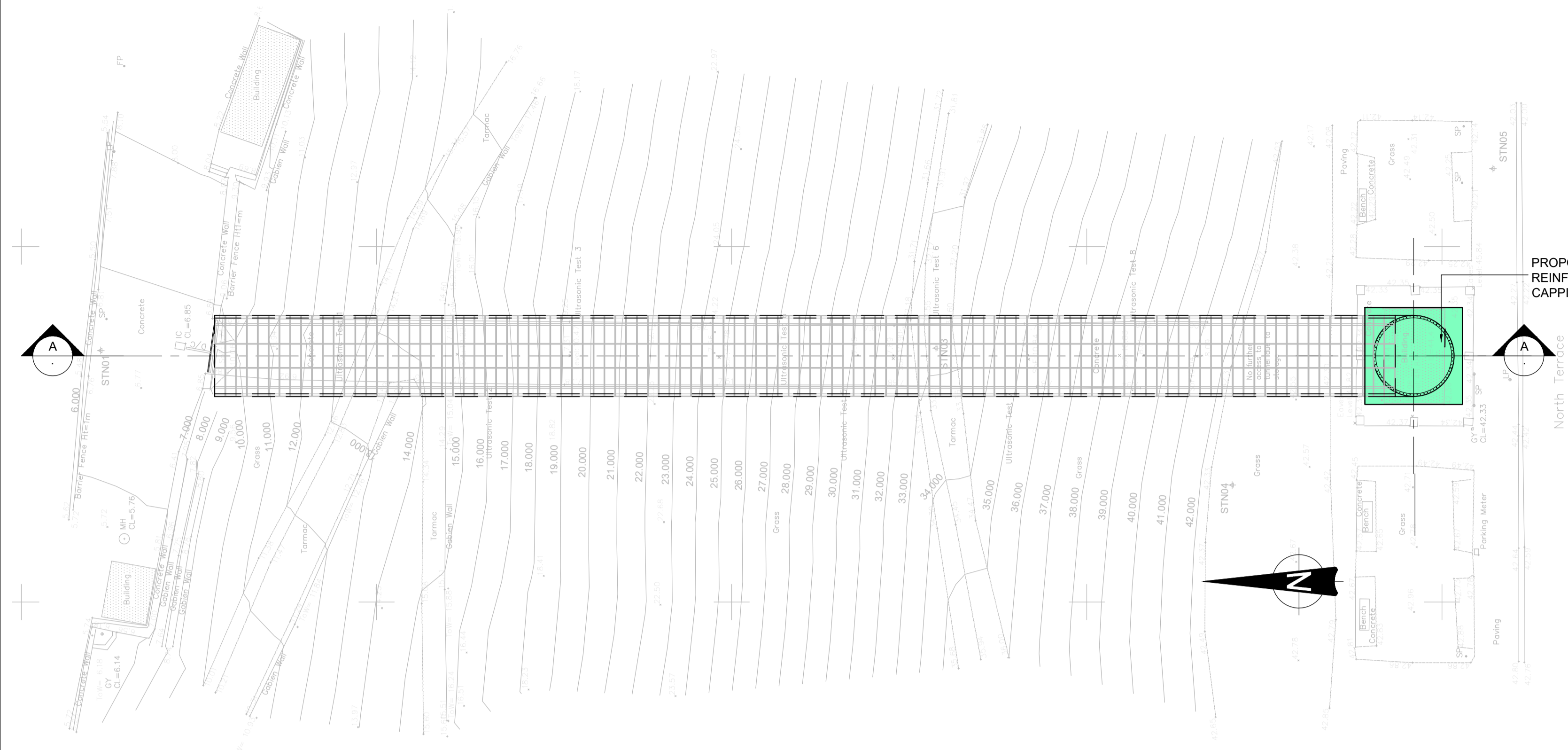


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 Thurston Road, Northallerton, DL5 2NA Tel: 01609 797373
 Client: **NORTH YORKSHIRE COUNCIL**

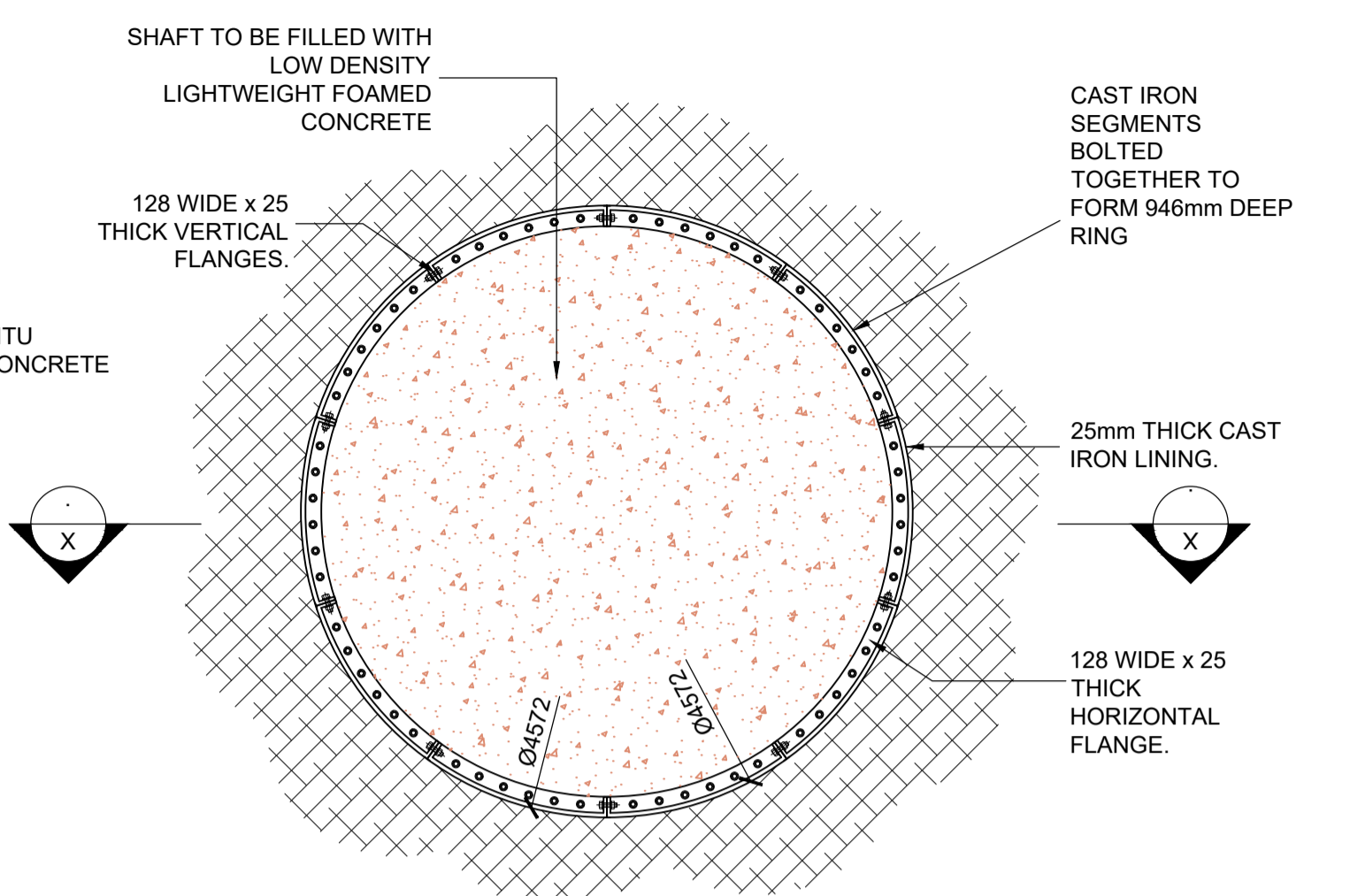
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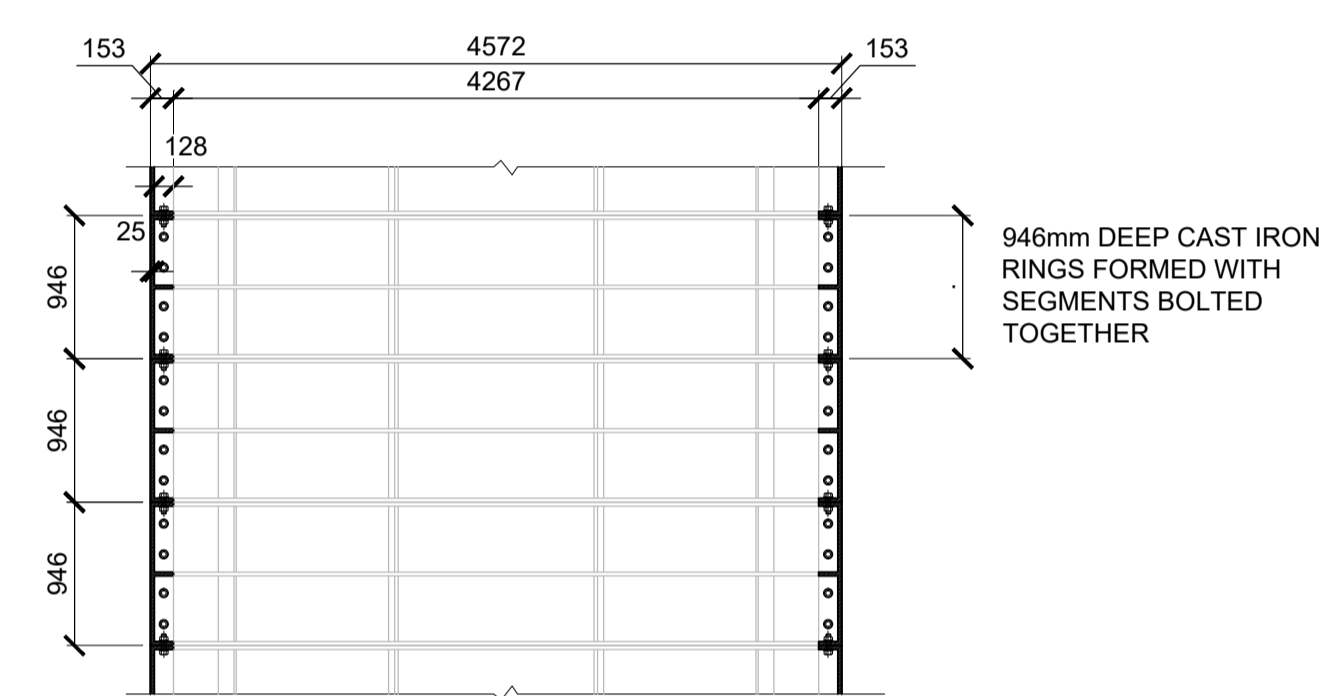
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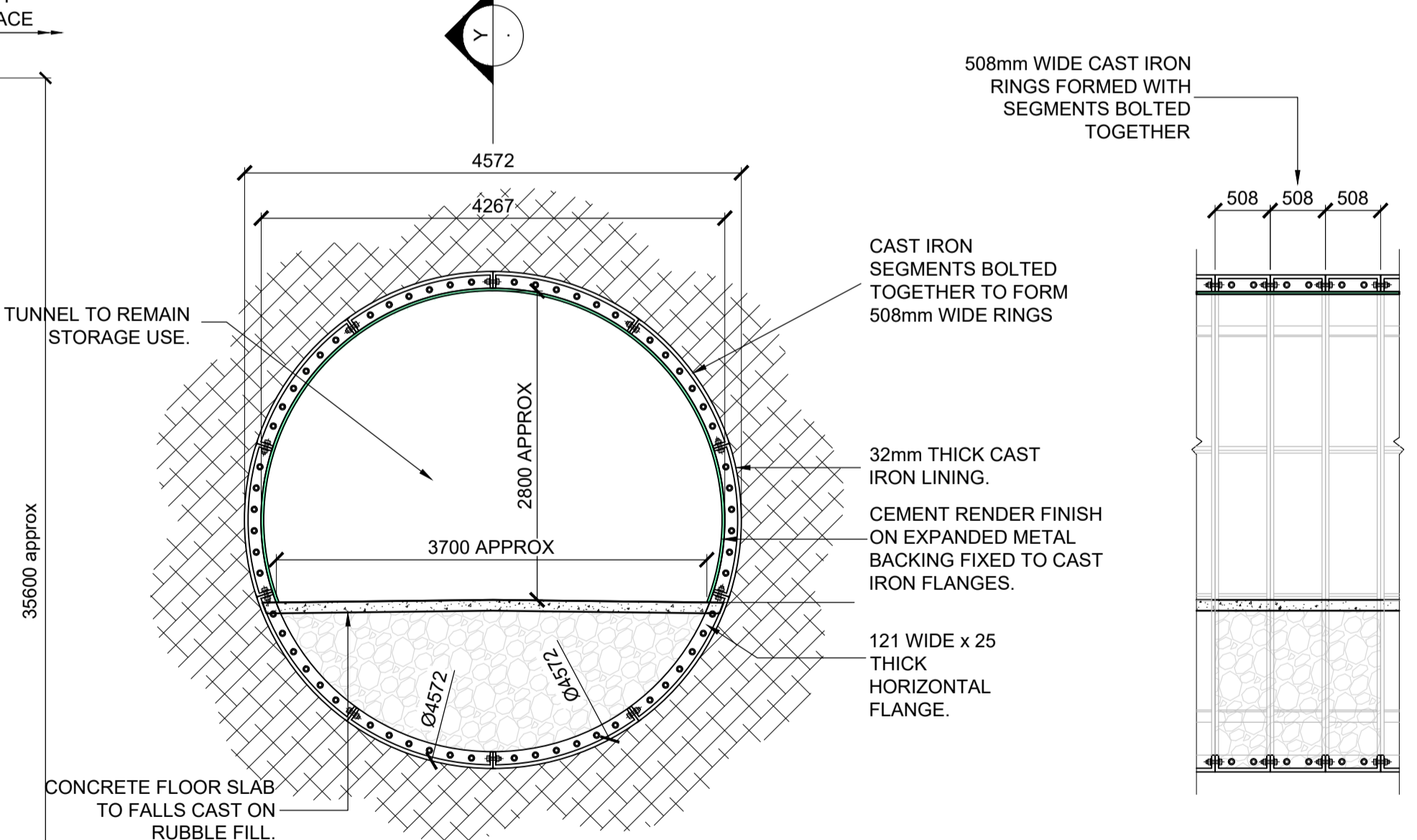
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SECTION C-C
VERTICAL SHAFT DETAIL
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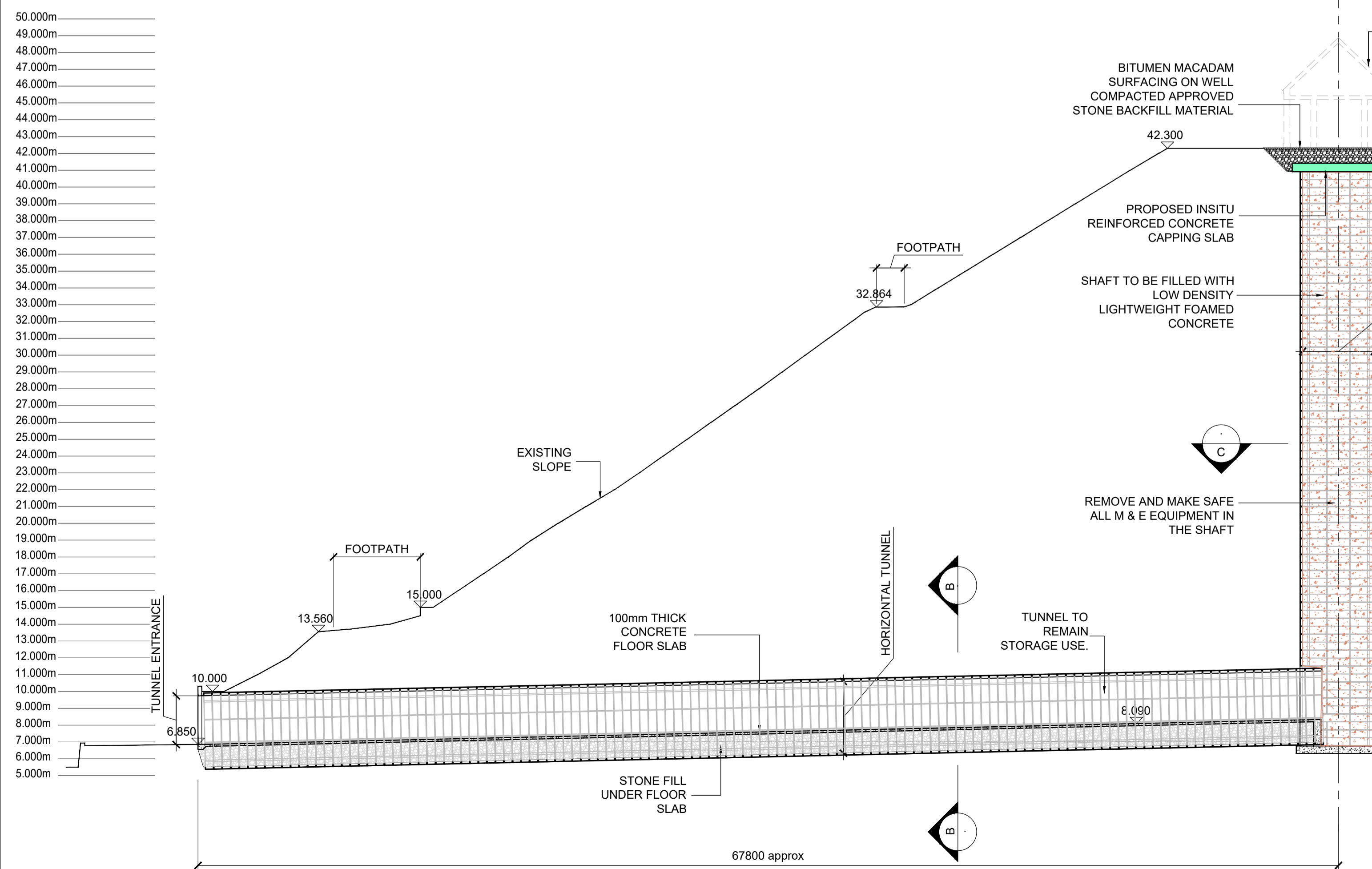


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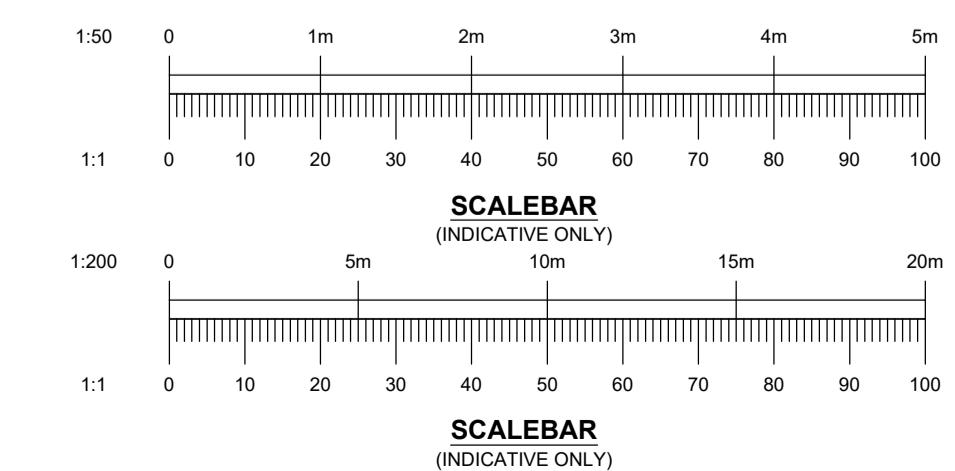


SECTION B-B
TUNNEL DETAIL
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Y-Y
(SCALE 1:50)



SECTION A-A
(SCALE 1:200)



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Drawing Number	Version			
NY2455-2-APS-XX-XX-DR-S-000005	P01			

Appendix D. Ian Farmer Associates – Investigation Report.



Structural Investigation – Whitby Cliff Lift

Report No. 2254086

October 2024

Ian Farmer Associates (1998) Limited

Address: Unit 4, Faraday Close, District 15, Pattinson North Industrial Estate,
Washington, Tyne and Wear, NE38 8QJ

Telephone: 0191 482 8500

Fax: 0191 482 8520

Web: www.ianfarmer.co.uk

Email: ceg@ianfarmer.co.uk

Report Issue Log

Final Issue	Signed By A Todd	Checked By [REDACTED]
	A Todd	D Featherstone
Issue Method E	Date 22/10/2024	Date 22/10/2024

Revision	Signed By	Checked By
Issue Method		

Revision	Signed By	Checked By
Issue Method	Date	Date

Revision	Signed By	Checked By
Issue Method	Date	Date

Issue Method: E = Electronic
P = Paper
D = Disc

DISCLAIMERS

This report has been prepared by Ian Farmer Associates (1998) Limited (IFA) with reasonable skill, care and diligence and taking account of the contract terms and conditions and manpower and resources devoted to it in agreement with the Client. IFA disclaims any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report has been prepared based on the information received during the timescale available and all potential contamination, constraints or liabilities associated with the site may not necessarily have been revealed. Conditions can only be defined with accuracy at the locations investigated and to the extent investigated; whilst in intermediate positions same can only be inferred.

This report is only valid when it is used in its entirety.

This report is confidential to the Client and IFA accepts no responsibility to third parties to whom the report, or any part thereof, is made known. Any such party using information contained within this report does so at their own risk.

This report may not be assigned without prior, written consent from Ian Farmer Associates (1998) Limited.

Structural Investigation – Whitby Cliff Lift

Report 2254086

October 2024

Client

Align Property Services

White Rose House (2nd Floor)
Northallerton Business Park
Thurston Road
Northallerton, DL6 2NA

CONTENTS	Page No
1.0 INTRODUCTION	1
2.0 THE SITE	2
3.0 THE BRIEF	3
3.1 Ultra-sonic thickness testing	3
3.2 Client deliverables	3
4.0 THE SCOPE	4
4.1 Ultra Sonic Thickness Testing	4
4.2 Photographic Evidence	4
5.0 FINDINGS	5
5.1 Summary Table	5

APPENDICES

APPENDIX A	Site Location Plan
APPENDIX B	Site Layout Plan
APPENDIX C	Photographic Plates
APPENDIX C	Calibration Certificate

1.0 INTRODUCTION

Further to the client's instruction, Ian Farmer Associates attended site on the 16th & 17th of October 2024, to carry out investigative works at the Whitby Cliff Lift.

This report provides information on the thickness of the steel/iron liners forming the lift shaft and tunnel.

2.0 THE SITE

The site is predominantly a passenger lift located at West Cliff, Whitby, North Yorkshire.

The lift provides access from the top of west cliff, down to the beach below. The base of the shaft links to a tunnel which provides access to the beach and is used for storage.

The construction of the shaft and tunnel includes bolted circular steel/iron liners. The liners in the lift shaft are exposed, and the liners forming the tunnel are encapsulated with cementitious board.

A site location plan is included in Appendix A and a site layout plan is included in Appendix B.

3.0 THE BRIEF

3.1 The Site works consisted of;

- Ultra-sonic thickness testing.

3.2 Client Deliverables

This report will contain the following:

- Factual report of findings.

4.0 THE SCOPE

4.1 Ultra Sonic Thickness Testing.

Thickness testing to representative locations of the shaft and tunnel were undertaken by using a calibrated, *Cygnus Thickness Gauge*. A Calibration certificate contained in Appendix E.

The areas identified were:

- Lift Shaft
- Tunnel

A table of results is contained in Section 5.0.

4.2 Photographic Evidence.

A selection of photographs taken during the course of the inspection is included in Appendix D.

5.0 FINDINGS

Lift Shaft

Location	Test Number	Measure Thickness
Beach level	1	25.4mm
Landing 1	2	25.5mm
Landing 2	3	26.1mm
Landing 3	4	26.0mm
Landing 4	5	25.4mm
Landing 5	6	25.4mm
Landing 6	7	25.0mm
Landing 7	8	25.7mm
Landing 8	9	25.6mm
Landing 9	10	26.0mm

Tunnel

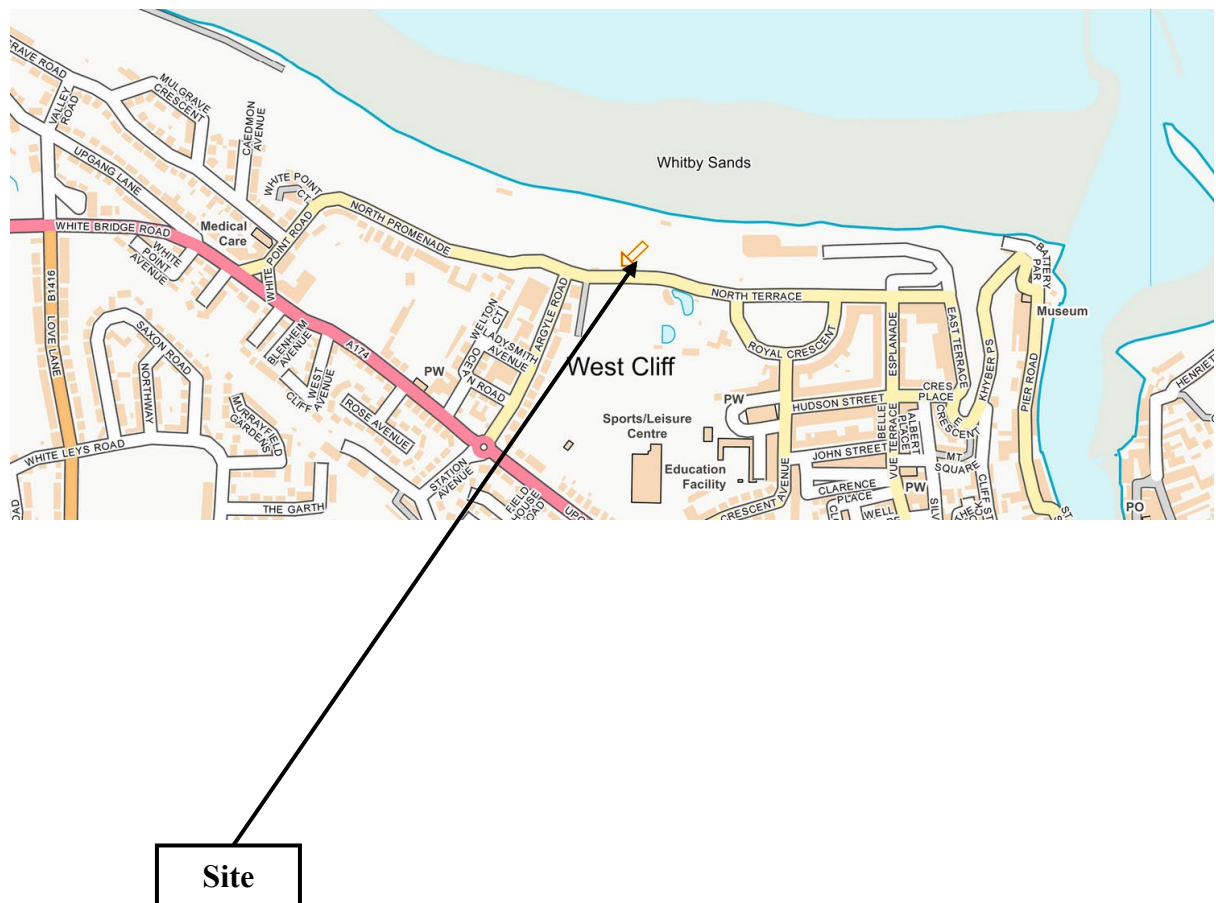
Location	Measure Thickness
Reading 1	29.6mm
Reading 2	29.7mm
Reading 3	31.4mm
Reading 4	29.1mm
Reading 5	32.5mm
Reading 6	30.1mm
Reading 7	29.2mm
Reading 8	29.5mm

APPENDICES

APPENDIX A
Site Location Plan

SITE LOCATION PLAN

Client:	align Property Services	Job No:	2254086
Project:	Whitby Clif Lift	Date:	October 2024



APPENDIX B
Site Layout Plan

SITE LAYOUT PLAN

Client:	Align Property Services	Job No:	2254086
Project:	Whitby Cliff Lift	Date:	October 2024



**Whitby
Cliff Lift**

APPENDIX C
Photographic Plates

PHOTOGRAPHIC PLATES



Plate 1: General View inside lift shaft



Plate 2: General view of test locations within shaft

PHOTOGRAPHIC PLATES



Plate 3: General view of tunnel-towards the lift shaft base



Plate4: General view of tunnel-towards the beach

PHOTOGRAPHIC PLATES



Plate 5: General view of exposed tunnel lining. Test Location 2



Plate 6: General view of exposed tunnel lining. Test Location 1

APPENDIX D
Calibration Certificate



SUNBELT RENTALS
 Unit 5, Malmo Court
 Kirkleatham Business Park
 Redcar
 Cleveland
 TS10 5SQ

D.Harbinson M.Newman Page 1 of 2
 A.Harbinson A.Short Certificate Number
 T.Tate T.Ways H24389
 T.Illingworth Approved Signato

Tel: 0370 330 6021

Email: Instrumentation@sunbeltrentals.co.uk

CERTIFICATE OF CALIBRATION

Customer : SUNBELT RENTALS
 UNIT 5 MALMO COURT
 REDCAR
 CLEVELAND
 TS10 5SQ

Instrument : System ID : ID4025
 Description : ULTRASONIC THICKNESS GAUC
 Manufacturer : CYGNUS
 Model Number : CYGNUS 4 MK5
 Serial Number : 26701
 Asset Number : A1295735

Environmental Conditions

Temperature : 20°C ± 0°C
 Relative Humidity : 50%RH ± 50%RH
 Mains Voltage : 240V ± 40V
 Mains Frequency : 50Hz ± 0Hz

Comments

Traceability Information

Instrument Description	Serial Number	Certificate Number	Cal. Date	Cal. Period (Weeks)
5-25mm PERSPEX 5-25mm LSW	600676	23/5126	07/09/2023	52

Calibrated By : ALEX SHORT

Date of Calibration : 26 March 2024
Calibration Due Date : 25 March 2025

This certificate provides traceability of measurement to recognised National Standards, and to the units of measurement realised at the National Physical Laboratory or other recognised National Standard Laboratories.
 Copyright of this certificate is owned by the issuing laboratory and may not be reproduced except with the prior written approval of the issuing laboratory.

This certificate complies with the requirements of BS EN ISO 10012:2003



CERTIFICATE OF CALIBRATION

Page of 2

Certificate Number :
H24389**AS FOUND RESULTS**

Test Title	Tolerance	Applied Value	Reading	Pass / Fail
Thickness (mm)				
	0.1mm	5.0mm	5.05mm	PASS
	0.1mm	10.0mm	10.05mm	PASS
	0.1mm	15.0mm	15.00mm	PASS
	0.1mm	20.0mm	20.00mm	PASS
	0.1mm	25.0mm	25.00mm	PASS

END OF TEST DATA

Uncertainties

- : -

Appendix E. Local Borehole logs.

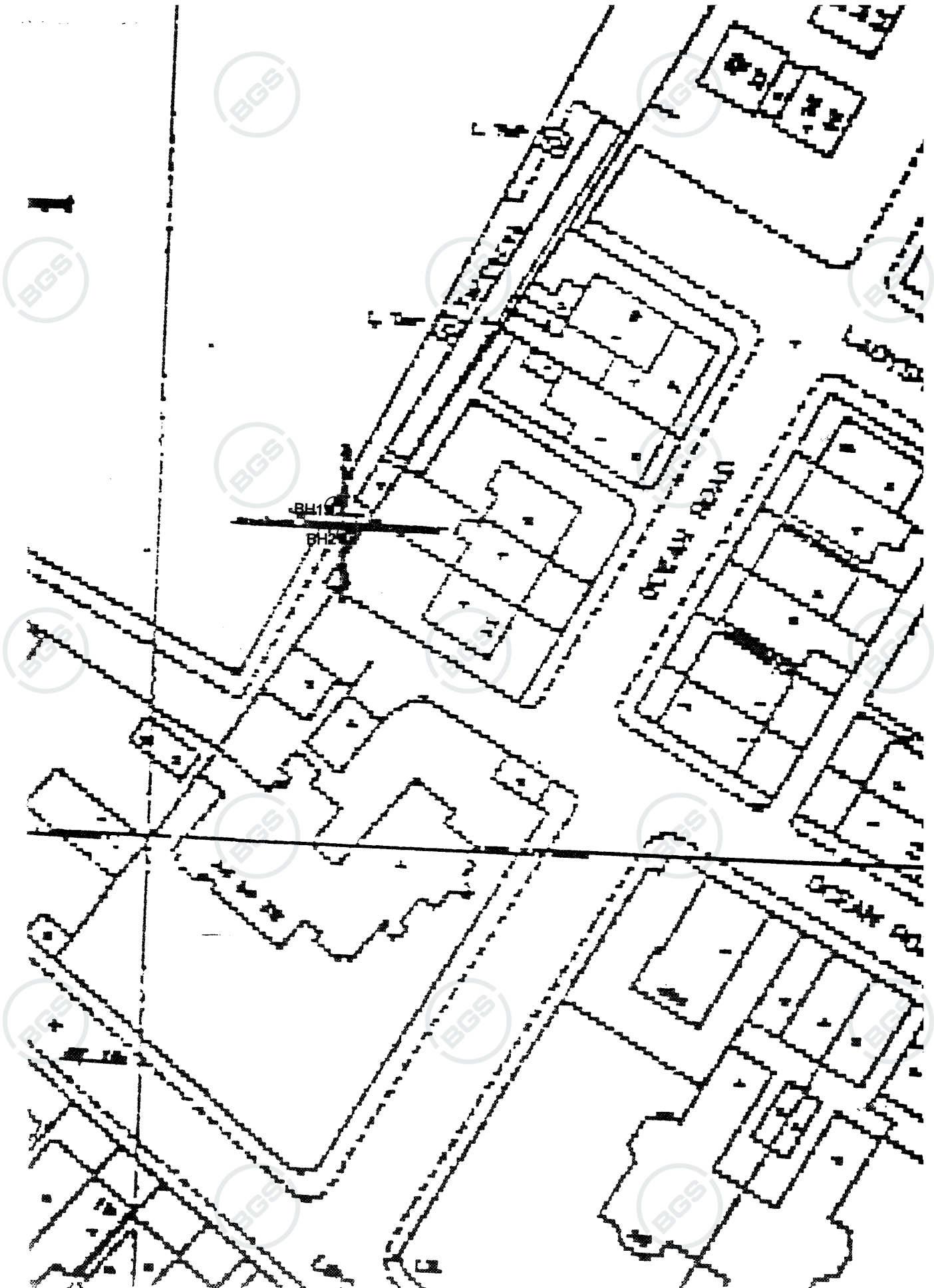


CLIENT JOHN ALLEN ASSOCIATES		JOB NO CB605		LOCATION NYK 0053, WHITBY		BOREHOLE NO BH2	
DATE SEPTEMBER 1996		SCALE 1 to 50		BORING METHOD DYNAMIC PROBING & SAMPLING RIG		Sheet: 1	
Drilling & Casing Progress	SAMPLE/TEST		SPT N - value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
	Type & No.	Depth(M)					
20TH	B	0.00 - 0.50		MADE GROUND--Tarmac surfacing.			0.0 0.10 0.30
	B	0.50 - 1.00		MADE GROUND--Soil ash & stone fill. Firm to stiff brown & orange sandy CLAY.			
	B	1.00 - 1.50	81.00	Firm to stiff becoming stiff brown sandy			1.00
	B	1.50 - 2.00	146.00	fine stoned GLACIAL TILL (Boulder clay).			
	B	2.00 - 2.50	197.00				
	B	2.50 - 3.00	>240.00				
	B	3.00 - 3.50	>240.00				
20TH	U	3.50	220.00				3.50

DUNELM DRILLING COMPANY
TEL 091-528-2534 FAX 091-517-0085

BOREHOLE LOGSHEET

Water Observations, Remarks, Etc
Water struck @ 3.00m
Standing @ 2.50m after 1hr.





(88/4028) Wt. 74170/81 8000 2/40 M. & St., Ltd. Q88

SECTION OF ESKDALE No. 6 (Uppang)
for Imperial Chemical Industries Ltd.

257
NZ 81 SE/2
E 6
35/4

0° 38' 28 W, 54° 29' 37 N

Rotary Table 77.8'

Surface Level 71.5' O.D.

Communicated by G. ARMSTRONG & P. SABINE

Date of boring or sinking 20/3/50 Borer Bremner Well Drilling Co.

One-inch Map 35 Six-inch Map (County and Half-Quarter Sheet) 32 N. YORKS.

	Thickness.			Depth from Surface.		
	Fathoms.	feet.	ins.	Fathoms.	feet.	ins.
Log of cored portion, amended after petrological examination of selected samples.						
Core starts at				2360	0	
<u>Bunter Sandstone</u> Dull red fine-grained mudstone with anhydritic cement and white powdery halite		20	0	2380	0	
No core taken to				2607	0	
Chocolate brown finely micaceous siltstone with intercalations of mudstone and thin sandy partings. Anhydritic siltstone in some cracks		10	0	2617	0	
Chocolate brown silty sandstone with fine siltstone partings		2	0	2619	0	
Red-brown fine to medium grained anhydritic sandstone showing miniature current bedding and fine partings of chocolate brown siltstone. Very irregular lenses of chocolate siltstone. Rare bands of chocolate brown silty mudstone with coarser anhydritic material in cracks. Proportion of siltstone higher towards base		18	0	2637	0	
Chocolate brown silty sandstone and siltstone with micaceous sun cracks and irregular sandy brownish red partings		8	0	2645	0	
Fine to medium grained paler red-brown anhydritic sandstone with small rounded chocolate brown mudstone pellets containing halite. The pellets lie on poorly defined bedding planes. Sandstone becomes finer-grained towards base. Core etched in places		8	0	2653	0	
No core taken to				2794	0	

	Thickness.			Depth from Surface.		
	Fathoms.	feet.	ins.	Fathoms.	feet.	ins.
<p style="text-align: right;">256</p> <p>Fine-grained anhydritic chocolate brown silty sandstone with miniature current-bedding and fine micaceous partings</p>		1	6	2795	6	
<p>Red brown silty sandstone with anhydrite cement and marked halite efflorescence</p>		8	6	2804	0	
<p>Core taken to PERMIAN, UPPER EVAPORITE BED</p>				3775	0	
<p>Red brown anhydritic mudstone silty in places with disseminated halite. Very irregular slightly reddish halite inclusions. Irregular cracks with original and secondary halite, the former connected with larger halite inclusions. Green spots up to 3 c.m. and very irregular wisps and blobs of pink and white anhydrite. Incipient slickensiding along planes infilled with halite.</p>		2	3	3777	3	
<p>Red brown anhydritic mudstone with large irregular pink halite inclusions. Some eroded halite cubes up to 2 c.m. across</p>		3	3	3777	6	
<p>Coarse pink halite with irregular mudstone inclusions and rare wisps of marly anhydrite. Halite cubes up to 2 c.m.</p>		1	0	3778	6	
<p>Do. but halite often clear with streaks of marl. Prominent white anhydrite inclusions, particularly towards base</p>		11	6	3790	0	
<p>Coarse granular water-clear halite with patches of finely disseminated marl and irregular anhydrite inclusions</p>		2	6	3792	6	
<p>Mainly red-brown granular halite crystals up to several c.m. across. Rare water-clear halite. Irregular inclusions of red mudstone filling interstices between crystals and larger irregular inclusions of anhydrite. Red brown colour of halite is due to disseminated marl</p>		2	4	3794	10	

2
NZ81 SE/2 E6
35/4

SECTION OF ESKDALE No. 6 (Uppang)
Six-inch Map (County and Quarter Sheet) 32 N. Yorks.

	Thickness.		Depth from Surface.	
	fathoms	feet. ins.	fathoms	feet. ins.
Red-brown and water-clear granular halite. Crystal boundaries of halite often marked with anhydrite. Many large and small inclusions of grey and white anhydrite which themselves include ramifying wisps and inclusions of red mudstone	2	4	3797	2
Red-brown granular halite with much red mudstone and small compact anhydrite inclusions. Mudstone follows outlines of halite crystals and halite must have crystallised while mudstone was soft. Marl preponderates over halite in top foot	9	10	3807	0
Do. Marl about one-quarter of whole by volume	14	0	3821	0
Do. Amount of marl varies considerably (? 1% - 30%). Anhydrite inclusions consist of (1) interstitial anhydrite and (2) rounded anhydrite blebs	10	0	3831	0
Red silty mudstone with ramifying veins of anhydrite up to 2mm thick with slickensided mudstone surfaces				
One large irregular green patch 7 x 3 cm	6		3831	6
As above 3831	6		3832	0
Ditto	6	0	3838	0
Red-brown pseudo-brecciated red silty mudstone with large irregular angulate wedge shaped halite inclusions filmed by fine skin of anhydrite. Halite crystals in these wedge shaped inclusions are granular or sometimes elongate. Colour: pink. The outer surface of the marl flakes off revealing underlying marl to have become powdery. Some small bright green spots	2	6	3840	6
Coarse brown granular halite with much disseminated marl and many irregular chocolate brown mudstone inclusions. Junctions between halite and marl usually marked by film of anhydrite. About 20% marl. Surface of marl flakey	6	6	3847	0
Do. marl reduced towards base	19	8	3866	8

(68/2881) Wt. 9998/45 500 10/36 M. & St., Ltd. G 88.

	Thickness.		Depth from Surface.	
	feet.	ins.	feet.	ins.
Very coarse granular halite with irregular inclusions of opalescent sylvine, the perimeters of which are pigmented with haematite	4		3867	0
Red haematite-stained opalescent sylvine with large granular halite crystals. Rare irregular anhydrite inclusions in the sylvine	1	4	3868	4
Anhydritic marl with sylvine inclusions	2		3868	6
Mixture of granular opalescent sylvine generally with red haematite-stained perimeters and grey-brown halite. Many fine interstitial inclusions of grey brown anhydritic marl	3	0	3871	6
Do. marl becomes powdery	4	0	3875	6
Coarse granular mixture of opalescent sylvine and halite. Some sylvine crystals coloured red by haematite. Halite crystals sometimes water-clear	7		3876	1
Waterclear halite	2		3876	3
Mixture of granular grey halite and opalescent sylvine the perimeters of which are coloured red by haematite, and scattered crystals of red coloured sylvine. High proportion of red-brown marl. Rare irregular inclusions of anhydrite. Thin scattered bands are locally richer in opalescent sylvine	5	9	3882	0
Finer grained mixture of grey halite and red stained sylvine crystals often with halite inclusions. Many irregular wisps of interstitial anhydrite very prominent towards base	4	0	3886	0

3

NZ81 SE/2 Eb
35/4

SECTION OF _____ ESKDALE No. 6 (Uppang)
Six-inch Map (County and Quarter Sheet) _____ 32 N. Yorks.

	Thickness.		Depth from Surface.	
	feet.	ins.	feet.	ins.
Red-brown silty mudstone with granular stained halite and some small scattered crystals of sylvine. Patches of interstitial grey anhydritic marl	1	3	3887	3
Haematite-pigmented granular sylvine and light and dark grey granular halite. Irregular stringers of grey marly anhydrite. Some halite-sylvine junctions marked by thin films of anhydrite. Marl content low	1	10	3889	1
Very coarse halite crystals up to 3 cm across and clear pink smaller dark grey crystals with scattered haematite-stained sylvine crystals and irregular bands of opalescent sylvine. A very small amount of anhydrite marks junctions of halite and sylvine.	1	5	3890	6
Coarse granular pink halite locally highly pigmented with haematite, very little anhydrite and sylvine	1	6	3892	0
Very coarse granular grey clear halite with interstitial brown marl and marly anhydrite, the latter in very small quantity. Small red-stained sylvine crystals usually with marginal haematite pigmentation	1	4	3893	4
Small granular dark grey halite and brownish red sylvine crystals with interstitial red marl and many fine ramifying grey anhydrite marl inclusions.	1	6	3894	10
Grey and pink granular halite with scattered red-stained sylvine crystals. Very little marl or anhydrite		11	3895	9
Pink and grey granular halite with scattered stained small sylvine crystals. Rare larger opalescent sylvine	3	9	3899	6
Large granular pink and grey halite with very rare small red-stained sylvine crystals. Very little marl and a few irregular anhydrite inclusions	3	6	3903	0
Very large granular pink halite crystals with interstitial red marl. Predominantly pink but mottled patches due to development of grey halite crystals	19	0	3922	0

(88/3895) Wt. 4104/23 2000 6/30 M. & St. Ltd. G 88

	Thickness.		Depth from Surface.	
	feet.	ins.	feet.	ins.
262 Do. Halite becoming water clear particularly below 3926. Nearly pure halite dominant	18	0	3940	0
Pure pink and colourless water-clear halite in large granular crystals with rare anhydrite streaks	4	0	3944	0
Honeycomb of grey marly anhydrite and coarse clear halite		6	3944	6
Pure pink and colourless water-clear halite with rare anhydrite streaks	8	7	3953	1
Grey granular halite with anhydritic inclusions		2	3953	3
Very coarse clear pale pink granular halite with large opalescent sylvite crystals		9	3954	0
Coarse opalescent granular sylvine crystals, very pure		4	3954	4
Coarse water-clear halite with large milky sylvine crystals		11	3955	5
Dark grey anhydrite with many irregular inclusions of lighter grey, probably slightly marly anhydrite. Many irregular inclusions of fine grained red-stained sylvine often containing anhydrite, and local concentrations of coarse granular water clear halite. Sylvine, about 5% at top of core. Lower part of core finer-grained	4	10	3960	3
Irregular banded light and dark grey anhydrite and coarse granular halite with rare small red-stained sylvine		9	3961	0
Irregular banded grey and brown anhydrite with many red-stained halite inclusions often in radiating petal-shaped crystals	4	3	3965	3
Grey-brown irregularly banded anhydrite with fine mudstone partings and thin anhydritic mudstone bands. Nodules incipiently developed in places	3	9	3969	0

4

2A/2 81SE/E6
35/4/2

SECTION OF ESKDALE No. 6 (Uppang)
Six-inch Map (County and Quarter Sheet 32 N. Yorks)

	Thickness.		Depth from Surface.	
	feet.	ins.	feet.	ins.
Grey and brown earthy anhydrite (banded) with many fine silty particles and irregular halite crystals	7	0	3976	0
Hard grey fairly pure anhydrite with thin irregular earthy partings at top and small halite inclusions	4	0	3980	0
Do. with many small red-stained halite inclusions	2	0	3982	0
Dark grey earthy anhydrite with finely disseminated red-stained halite. Lustre mottled with halite	2	0	3984	0
Dark grey slightly dolomitic anhydrite with red-stained veins of halite and finely disseminated halite. Some carbonaceous partings at base, lustre-mottled	2	0	3986	0
CARNALLITIC MARL Red brown silty marl with large inclusions of green marl with finely disseminated carnallite and sylvine and veins of halite with scattered crystals of red-stained sylvine	35	0	4021	0
Compact red marl with finely disseminated carnallite and fine red-stained halite	16	2	4037	2
Mottled grey-green and reddish brown marl with inclusions of granular halite		6	4037	8
MIDDLE EVAPORITE BED Coarse granular pink halite with interstitial grey-green marl and wisps of anhydrite	3	4	4041	0
Coarse granular red-stained halite with dark interstitial mudstone and anhydrite wisps, generally	1	4	4042	4
Grey marly anhydrite and dark anhydritic mudstone with pink halite inclusions		2	4042	6
Medium size red-stained granular halite with dark marl inclusions and rare haematite stained sylvine inclusions	1	6	4044	0
Fairly equal proportions of dark grey granular halite and generally finely crystalline red-stained sylvine. Scattered crystals of opalescent sylvine. Halite contains finely divided argillaceous matter	7	0	4051	0
Do. but granular crystals of clear halite present	1	5	4052	5

(68/2881) Wt. 9998/45 500 10/86 M. & St., Ltd. G 88.

264

	Thickness.		Depth from Surface.	
	feet.	ins.	feet.	ins.
Clear pink and colourless granular coarse halite with disseminated red marl and scattered inclusions of opalescent red-rimmed sylvine	7	1	4059	6
Light grey and colourless coarse granular halite with rare small sylvine inclusions	11	2	4070	8
Coarse granular brown halite		4	4071	0
Do. with rare small sylvine, and mottled bands due to clear halite crystals. Rare haematite staining in halite	7	0	4078	0
Pink and grey granular coarse halite with fine anhydrite wisps and irregular red-stained halite crystals	3	0	4081	0
Do. with rare sylvine inclusions	10	0	4091	0
Coarse pink granular halite with infrequent irregular haematite stained patches and very rare sylvine inclusions	10	0	4101	0
Brown and pink very coarse granular halite with infrequent irregular haematite stained patches	2	0	4103	0
Do. haematite-staining more marked and bands of water clear halite present	12	0	4115	0
Clear pink very coarse granular halite with some dark clay inclusions and rare anhydritic wisps and haematite stained spots. Poorly defined bands of anhydritic mudstone at 4131ft. 6ins. and 4132	20	0	4135	0
Clear light brown coarse granular halite with irregular anhydritic mudstone inclusions and infrequent red-stained patches	10	2	4145	2
Coarse pink halite		2	4145	4

5

SECTION OF ESKDALE No. 6 (Uppang) 2052 81 SE/2 E6
 Six-inch Map (County and Quarter Sheet) 32 N.E. Yorkshire **35/4**

	Thickness.		Depth from Surface.	
	feet.	ins.	feet.	ins.
Clear pink and grey coarse granular halite with wisps of marly anhydrite and fairly large inclusions of dark anhydritic mudstone developing into dark mudstone bands with halite inclusions	49	8	4195	0
Band of water clear halite at 4172				
Grey and pink mottled granular halite with some dark clay inclusions and anhydrite wisps	10	0	4205	0
Do. with some bands of clear halite and very irregular bands of dark mudstone and anhydritic mudstone with halite inclusions	10	0	4215	0
Clear colourless and pink coarse granular halite with dark clay inclusions		2	4215	2
Banded light and dark grey anhydrite and anhydritic mudstone with halite inclusions	1	7	4216	9
Water clear halite		2	4216	11
Pink coarse halite		10	4217	9
Do. with very irregular ramifying anhydrite inclusions		6	4218	3
Light and dark grey banded anhydrite and anhydritic mudstone with grey halite inclusions	2	0	4220	3
Coarse grained pink halite becoming grey towards base with mudstone inclusions	3	0	4223	3
Water clear halite		3	4223	6
Dark and light grey earthy anhydrite with grey halite inclusions	1	9	4225	3
Coarse pink halite with irregular blebs and wisps of earthy anhydrite		9	4226	0
Light and dark grey earthy anhydrite with many small often lenticular halite inclusions	6	0	4232	0
Light and dark grey banded silty anhydrite with bands of mixed dark grey halite and ramifying inclusions of anhydrite with suggestions of slumping and auto-brecciation	6	0	4238	0

(88/8965) Wt. 4194/28 2000 6/30 M. & St. Ltd. 688

266

	Thickness.		Depth from Surface.	
	feet.	ins.	feet.	ins.
Pink and predominantly grey halite with thin irregular silty anhydritic bands and inclusions	6	0	4244	0
Clear colourless and pink coarse granular halite with rare mudstone inclusions	10		4244	10
Pink and dark grey coarse granular halite with irregular silty anhydritic thin bands and inclusions	2	0	4246	10
Pink coarse granular halite with rare dark mudstone inclusions	5	2	4252	0
Coarse pink granular halite with some grey halite bands and bands of silty anhydrite with halite inclusions	10	0	4262	0
Water-clear colourless and grey coarse halite with irregular dark mudstone inclusions	3		4262	3
Honeycomb of silty anhydrite with inclusions of grey halite crystals	3		4262	6
Dark grey slightly argillaceous anhydrite	1	7	4264	1
Very coarse pink halite with rare mudstone inclusions	2	4	4266	5
Grey argillaceous anhydrite with very irregular lenticular dark grey halite inclusions and angulate veins with halite infilling	5		4266	10
Water-clear and pink coarse granular halite with infrequent dark anhydritic inclusions	6	4	4273	2
Grey brecciated anhydrite with many fine-grained dark halite inclusions	1	8	4273	10
Clear halite,	2		4274	0
Light and dark grey finely banded anhydrite with very irregular bands of anhydrite including many halite crystals	2	6	4276	6
Water clear halite	1		4276	7
Mottled and banded light and dark grey anhydrite with irregular dark carbonaceous matter and silty partings. Fine irregular halite inclusions, possibly slightly dolomitic	5	5	4282	0

UPGANG 1" 35

E6

NZ 81SE/2

WHITBY GOLF LINKS.



TO SANDSEND

UPGANG BECK

TO WHITBY

SANDFIELD HOUSE

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PART OS SHEET YORKS XXXII.2

See letter on E.5. file

SCALE 1/2500

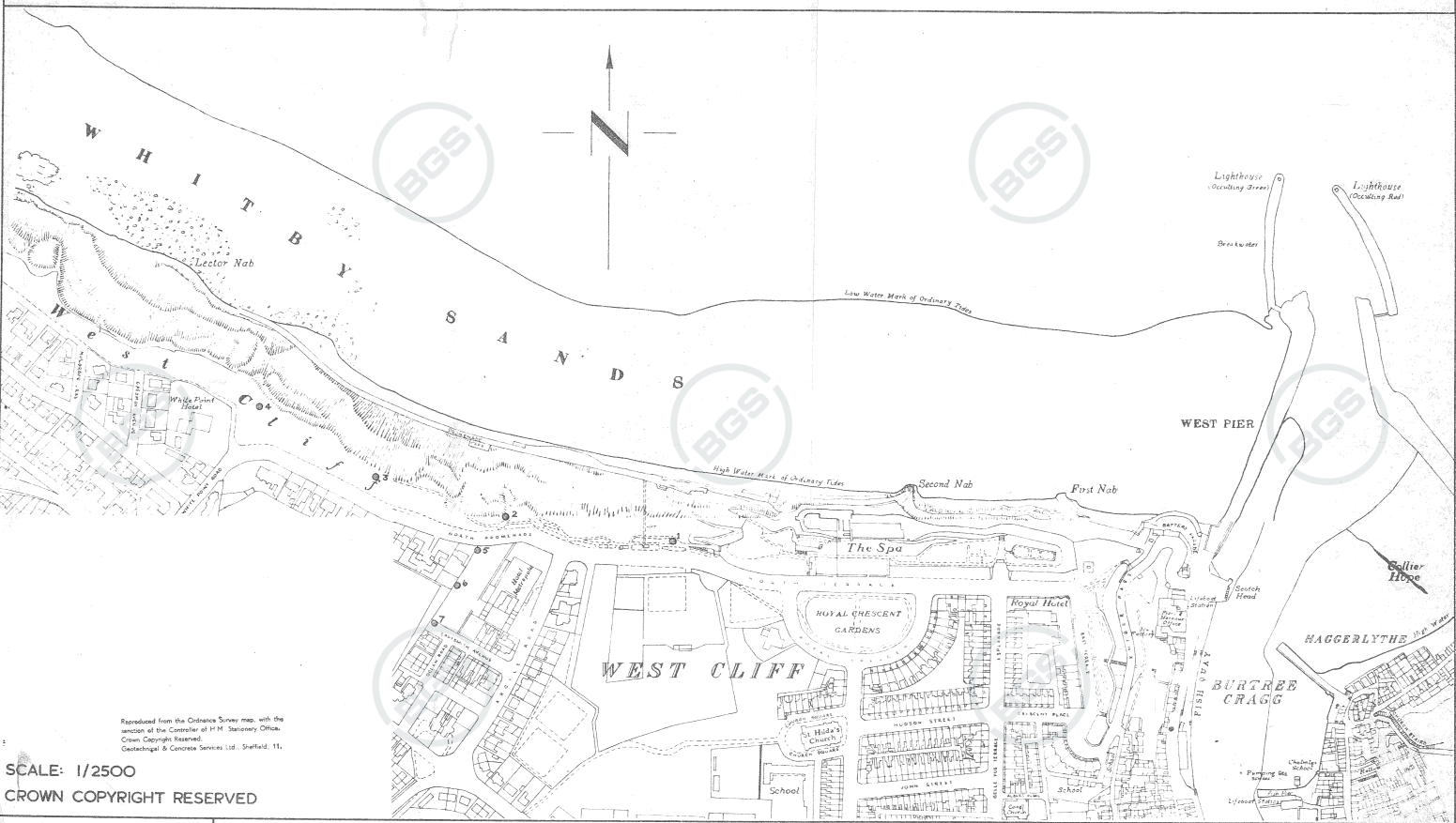
EE.29.



WHITBY U. D. C.

COMMERCIAL-IN CONFIDENCE

COMMERCIAL-IN CONFIDENCE



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SCALE: 1/2500
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DRG.No. 4811/63

WHITBY WEST CLIFF ~ LOCATION PLAN

D.H.MOORE.
B.Sc.M.Inst.CE.
Civil Engineer.
Scarborough.



YORKSHIRE OUSE & HULL RIVER AUTHORITY - Survey of Existing Boreholes

I.G.S. Ref. No. _____ N.G.R. NZ 882 118 approx

OWNER Name W. G. G. M. J. Es'ch'ole no. _____ Y. O. H. R. A. _____
 Address _____ Licence No. _____
 App. No. _____

Borehole/Well diameter depth

Wellsinker:

Strata details:	diameter	depth
120	8	128
Estuarine clays	282	860
Upper lias	80	440
Middle lias (limestone)	140	880
" sandstone	160	940
Lower lias (shale)	420	1360
" shale (lt)	43	1403
Permian	921	2324
Kemper	146	3470
Chalk (base of Kemp)		
Brumby		
Sandstone (wt)	208	3278
Upper Eocene	206	3984
Carboniferous (wt)	65	4039
Middle Eocene	243	4282

Authorised Abstraction:
 g.p.h.
 g.p.d.
 m.g.a.

Purpose:



INSPECTION REPORT

Date of Inspection

Present Owner

Other Comments:-

Access details (answer YES or NO)

Suitable for 1/2" depth probe -----

Suitable for 3" instruments -----

Access by Landrover -----

Owner willing to allow access -----

Sketch Plan of Location

Water level at time of inspection

----- metres below -----



Borehole Log



Soil Mechanics

Drilled by LC Logged by EM Checked by PH		Start 19/09/2003 End 19/09/2003		Equipment, Methods and Remarks Cable percussion boring.		Depth from 0.00m	to 10.00m	Diameter 150mm	Casing Depth 3.00m	Ground Level Coordinates Local Grid		100.29 mD -
Samples and Tests						Strata						
Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level/ (Thickness)	Legend	Backfill/ Instruments				
0.20-0.50	B 1				TARMAC	0.10 +100.19						
0.70-1.20	B 2				Brown mottled grey slightly sandy gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone, sandstone, brick and concrete. Occasional subangular cobbles of concrete. (MADE GROUND)	(0.50)						
1.20-1.65	U 3	35 blows				0.60 +99.69						
1.70	D 4				Firm to stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is angular to subrounded fine to coarse of limestone, mudstone and sandstone. (GLACIAL TILL)							
2.00-2.45 2.00-2.45 2.00-2.45	SPT S D 5 B 6	N=9 (1,1/2,2,2,3)	1.80	dry								
3.00-3.45	U 7	50 blows										
3.50	D 8											
4.00-4.45 4.00-4.45 4.00-4.45	SPT S B 10 D 9	N=12 (1,2/2,3,3,4)	3.00	dry								
5.00-5.45	U 11	50 blows										
5.50	D 12					(9.40)						
6.50-6.95 6.50-6.95 6.50-6.95	SPT S D 13 B 14	N=13 (1,2/2,3,4,4)	3.00	dry								
8.00-8.45	U 15	65 blows										
8.50	D 16											
9.50-9.95 9.50-9.95 9.50-9.95	SPT S D 17 B 18	N=17 (2,3/3,4,5,5)	3.00	dry								
EXPLORATORY HOLE ENDS AT 10.00 m												
Groundwater Entries No. Struck Post strike behaviour (m)			Depth sealed (m)		Depth Related Remarks From to (m)		Chiselling Depths (m)		Time		Tools used	
None observed (see Key Sheet)					0.00 1.20 Inspection pit.							
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.						Project CRESCENT TERRACE, WHITBY			Borehole BH1 Sheet 1 of 1			
Project No. A3144 Carried out for Yorkshire Water Service Limited												

Scale 1:50

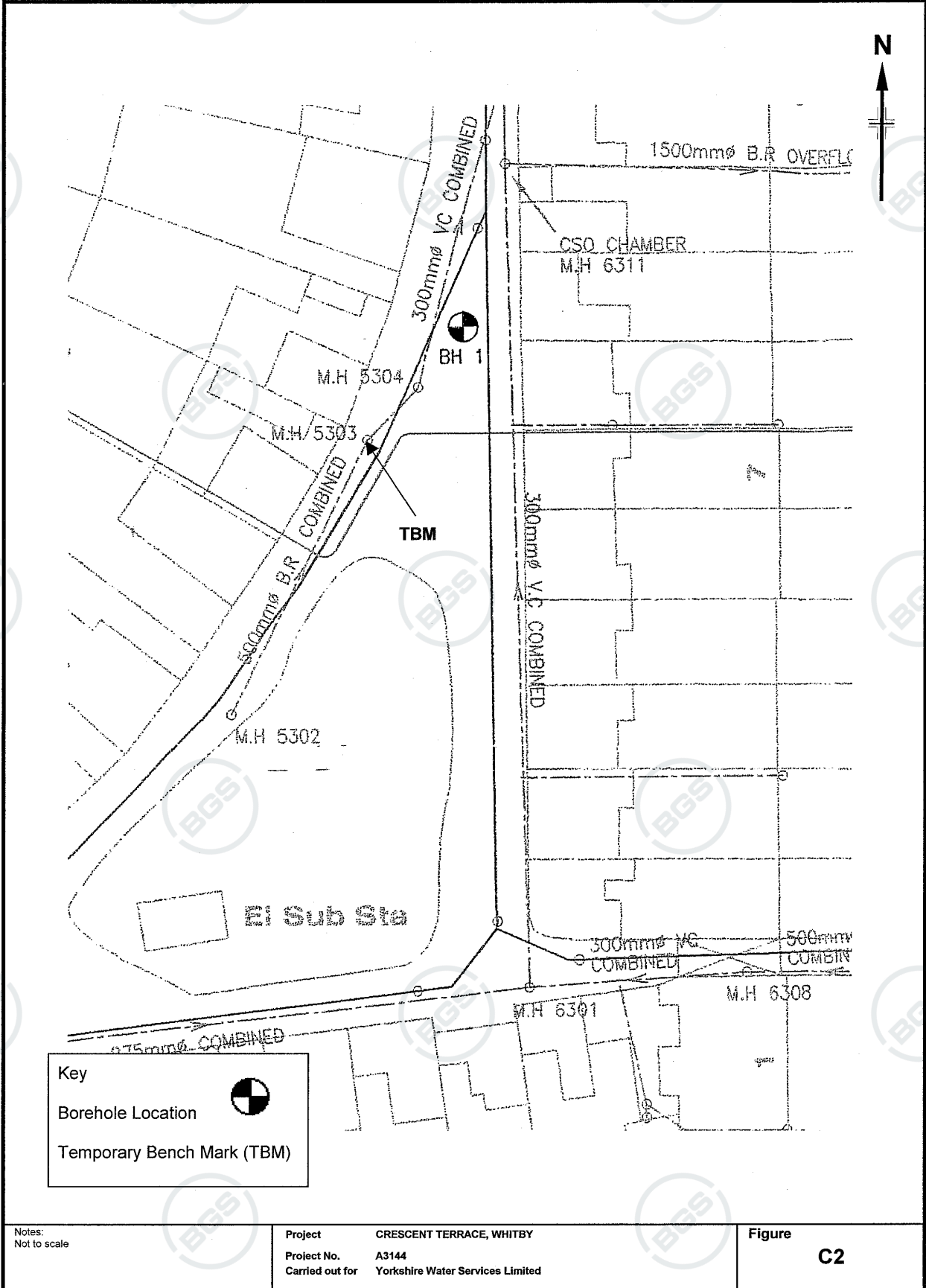
(c) MESH HBIII (298), 12/12/2003 09:43:03



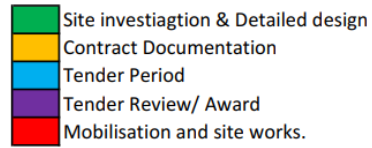
Site Plan



Soil Mechanics



Appendix F. Outline Programme



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		
Option 1a	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Yellow	Blue	Blue	Blue	Blue	Purple	Purple	Purple	Purple	Purple	Red	Red												
Option 1b	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Option 2	Green	Green	Green	Green	Green	Yellow	Yellow	Yellow	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
Option3	Green	Green	Green	Green	Green	Green	Yellow	Yellow	Yellow	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue

Appendix G. Breakdown of Scheme Costings

			Option 1a	Option 1b	Option 2	Option 3
Builders work cost breakdown		£	11,000.00	26,000.00	241,000.00	97,000.00
Provisional Sums		£	40,000.00	40,000.00	40,000.00	40,000.00
Preliminaries	2 wks	£	7,000.00	-	-	-
	4 wks	£	-	14,000.00	-	-
	12 wks	£	-	-	42,000.00	-
	8 wks	£	-	-	-	28,000.00
Contingencies	10%	£	1,000.00	3,000.00	24,000.00	10,000.00
Design Development	5%	£	3,000.00	4,000.00	17,000.00	9,000.00
Contractors Overheads & Profit	12.5%	£	7,000.00	10,000.00	-	-
	10.0%	£	-	-	35,000.00	18,000.00
Inflation to end of proposed construction period	4%	£	3,000.00	4,000.00	15,000.00	8,000.00
TOTAL ESTIMATED BUILDING WORKS		£	72,000.00	101,000.00	414,000.00	210,000.00
RIBA Stages 0 - 1 Professional fees	Budget	£	5,000.00	5,000.00	5,000.00	5,000.00
RIBA Stages 2 - 6 Professional fees	15.20%	£	11,000.00	15,000.00	-	-
RIBA Stages 2 - 6 Professional fees	14.71%	£	-	-	-	31,000.00
RIBA Stages 2 - 6 Professional fees	13.12%	£	-	-	54,000.00	-
Statutory and survey fees	excluded	£	-	-	-	-
Professional fees associated with above surveys	excluded	£	-	-	-	-
Statutory Authority costs	Budget	£	1,000.00	1,000.00	5,000.00	5,000.00
TOTAL ESTIMATED PROJECT COST		£	89,000.00	122,000.00	478,000.00	251,000.00

POTENTIAL DESIGN AND CLIENT RISKS (INCLUSIVE OF FEES)

Notes, Assumptions & Exclusions

Anticipated Contract Dates and Inflation Calculation

	Index
Current Date: 1Q2025	403
Start: 1Q2026	417
Completion: 2Q2026	420

Estimate inflation from now to start on site:	3.47%
Estimate inflation from start on site to completion of construction:	0.72%
	4.19%

Notes

- 1 The figures contained within this document are an indicative Quantity Surveyor's estimate of the project value, associated fees and disbursements and are not to be considered as a "quotation".
- 2 Tender Price Indices are indicating that tenders are expected to rise, therefore for estimating purposes an inflation factor has been used, based on BCIS All-in TPI updated December 2024

Assumptions

- 1 The site will have constant unrestricted access during the works
- 2 The works will be competitively tendered via a procurement exercise to be agreed with the client
- 3 The existing mechanical and electrical installations will be extendable and meet British Standards. An additional survey may be required to establish this.
- 4 The JCT Intermediate Building Contract with Contractors Design 2016 will be appropriate for this project.

Provisional allowances

The following provisional allowances have been included within the cost estimate prepared;

Further Investigative Work	£ 15,000.00
Detailed Structural Assessment	£ 25,000.00

Exclusions

- 1 Inflation beyond the anticipated project completion date
- 2 New loose furniture and furnishings
- 3 Concurrent maintenance works
- 4 Issues raised by a full planning application
- 5 Costs greater than the Provisional Allowance included for undetermined items
- 6 VAT
- 7 Legal fees
- 8 Provision of temporary facilities
- 9 Results of outstanding surveys
- 10 Alteration to Telephone and/or Broadband services
- 11 Work beyond the site boundary
- 12 Works inside the tunnel in the options where it is being retained
- 13 Surveys and associated professional fees

Drawings and documents used in the production of this estimate

- 1 NY2455-2-APS-XX-XX-DR-S-000001/P01 - Existing General Arrangement
- 2 NY2455-2-APS-XX-XX-DR-S-000002/P01 - Proposed General Arrangement - Option 1a
- 3 NY2455-2-APS-XX-XX-DR-S-000003/P01 - Proposed General Arrangement - Option 1b
- 4 NY2455-2-APS-XX-XX-DR-S-000004/P01 - Proposed General Arrangement - Option 2
- 5 NY2455-2-APS-XX-XX-DR-S-000004/P01 - Proposed General Arrangement - Option 3
- 6 Structures Options Report