CONISBEE

102 CAMLEY STREET

IMPACT OF DEVELOPMENT ON HS1 NORTH ABUTMENT

DRAFT

AUGUST 2015

GEOTECHNICAL CONSULTING GROUP
52A Cromwell Road
London SW7 5BE
United Kingdom

Tel: +44 (0) 20 7581 8348
Fax: +44 (0) 20 7584 0157
Email: admin@gcg.co.uk

Geotechnical Consulting Group LLP is a partnership registered in England No OC356005 the registered address of which is as above.

CONISBEE

102 CAMLEY STREET

IMPACT OF DEVELOPMENT ON HS1 NORTH ABUTMENT

DRAFT

AUGUST 2015

DISCLAIMER

REVISION HISTORY

Revision	Date	Description
Draft	August 2015	Demolition and Basement Excavation

CONISBEE

102 CAMLEY STREET

IMPACT OF DEVELOPMENT ON HS1 NORTH ABUTMENT

DRAFT

AUGUST 2015

TABLE OF CONTENTS **Page No.**

1 Introduction

It is proposed that a 10 to 13 storey residential building be constructed at 102 Camley Street. The proposed development involves the demolition of an existing building, the excavation of a single basement level and the construction of a new building.

Adjacent to the site, there is a High Speed 1 (HS1) railway bridge. The bridge's north abutment is approximately 5 m from the southeast corner of the development. The bridge abutment is supported by a piled foundation with the nearest foundation pile approximately 7.5 m from the southeast corner of the development. The foundation piles have a pile cap level of approximately 26.3 mOD and toe levels ranging from 5.5 mOD to -15 mOD.

Geotechnical Consulting Group LLP (GCG) has been retained by Consibee to undertake an assessment of the impact of the proposed redevelopment on the north abutment of the HS1 Bridge.

This assessment is based in part on information on excavations and structural loads provided by Conisbee, the structural engineers for the development. It is outside the scope of this report to consider the adequacy of the works as proposed or to consider the impact of the scheme on any other utilities.

2 The site

2.1 Location

The site is located at 102 Camley Street, Camden, NW1 0NF (Figure 1). The approximate National Grid Reference is TQ 530 184. The site is bordered by Camley Street to the west, Regents Canal to the south and High Speed 1 (HS1) to the east (Figure 2).

The rectangular site is approximately 60 m long and 35 m wide with the longer dimension oriented in the northwest – southeast direction. Currently there is an approximately 40 m by 25 m warehouse (Marigold Building) and a smaller refrigeration unit on the site. The location of the structures is shown on Figure 3.

The topography of the site is relatively level. The elevation is approximately 28.0 m above Ordnance Datum (mOD). To the south of the site, there is a lower footpath along the Regents Canal. The elevation of the footprint is approximately 23.7 mOD. The drop in level occurs over a retaining wall situated along the south edge of the site. Figure 3 shows the site level, the location of the footpath and the location of the retaining wall.

2.2 Proposed redevelopment

It is proposed that a 10 to 13 storey residential building be constructed at 102 Camley Street. The proposed development involves the demolition of an existing building, the excavation of a single basement level and the construction of a new building. The basement will be formed with a propped secant pile wall. The new building will be constructed using piled foundations. The analysis discussed here only considers the demolition and the excavation of the basement.

2.3 High Speed 1 Infrastructure

Adjacent to the site, there is a High Speed 1 (HS1) Railway Bridge. The bridge's north abutment is approximately 5 m from the southeast corner of the development. The bridge abutment is supported by a piled foundation with the nearest foundation pile approximately 7.5 m from the southeast corner of the development. The foundation piles have a pile cap level of approximately 26.8 mOD and toe levels ranging from 5.5 mOD to -15 mOD.

Figures 4 and 5 shows the as-built drawings for the HS1 Railway Bridge including the pile layouts. Figure 3 shows the piles relative to the existing structures. Table 1 summarises the pile information for the North Abutment.

Table 1: HS1 North Abutment Pile Summary

Pile	*Pile Diameter (mm)*	*Level (mOD)*		
		Top of Pile Cap	*Top of Pile*	*Toe of Pile*
NP1	1200	26.8	24.5	5.5
NP2	1200	26.8	24.5	5.5
NP3	1200	26.8	24.5	3.0
NP4	1200	26.8	24.5	3.0
NP5	1200	26.8	24.5	3.0
NP6	1200	26.8	24.5	-0.5
NP7	1800	26.8	24.5	-15.0
NP8	1800	26.9	24.5	-15.0
NP9	1200	26.9	24.5	-0.5
NP10	1200	26.9	24.5	5.5

3 Ground Conditions

3.1 Regional geology

The geology of the area is shown on the 1920 British Geological Survey (BGS) 1:10560 sheet NV NW (Figure 6).

The site is underlain by Made Ground overlying the London Clay Formation. The London Clay Formation is then underlain by the Lambeth Group, the Thanet Sand Formation and Chalk Group in the same order of succession.

A Geotechnical Desk Study (Arup 2014) summarises the investigations from the Channel Tunnel Rail Link (CTRL) which was carried out to the East of the site. These investigations indicated that the Upnor Formation at the bottom of the Lambeth Group and the Thanet Sand Formation was approximately 6 m thick. The 1920 BGS geology map (BGS 1920) indicated similar thicknesses of the Thanet Sand Formation in nearby boreholes. The BGS map also indicated that the level of the Chalk was approximately -30 mOD.

3.2 Local geology

A Phase II Geo-Environmental Site Assessment was conducted between April 2014 and February 2015 (REC, 2015). The borehole locations from this study are presented on Figure 7. The investigation proved the top of the London Clay and the Lambeth Group but was not deep enough to confirm the depths of the Thanet Sand and Chalk.

Using the site specific data and the regional geological data from the desk study and BGS mapping, the following stratigraphic model was developed:

Made Ground	0.7 m to 5.3 m thick
London Clay	25.0 m thick (+23.0 to -2.0 mOD)
Lambeth Group	22.0 m thick (-2.0 to –24.0 mOD)
Thanet Sand Formation	6.0 m thick (-24.0 to –30.0 mOD)
Chalk	Unknown thickness (-30.0 mOD)

The groundwater table in the Made Ground was taken as approximately 26.3 mOD. The water level in the Thanet Sand Formation was taken as -30 mOD (E.A. 2015).

4 Soil Properties

GCG has compiled the in-situ data and the laboratory testing results from the site specific investigation (REC, 2015). The results are plotted on Figure 8.

Analyses have been carried out for both short-term (undrained) and long-term (drained) conditions. The adopted soil stiffness values are presented in Table 2. These were derived on the following basis:

- For the Made Ground, the drained Young's modulus (E') value was taken as 10,000 kPa and is assumed to be constant with depth.

- For the London Clay and Lambeth Group, a SPT profile was derived based on the site specific SPT data shown in Figure 8 and on this and undrained strength (c_u) profile was derived using an empirical correlation of c_u equal to 4.5 times the SPT N value. This gave a relationship of c_u = 45+6.8z kPa; where z is the depth below the top of London Clay (23.0 mOD). The undrained Young's modulus (E_u) was assumed to vary with depth and was taken to be 450c_u. and the drained Young's modulus (E') was taken as 0.8E_u.

The values of Young's modulus used in the analysis are presented in Table 2.

Table 2: Soil stratigraphy and stiffness parameters adopted in Pdisp model

Strata	*Level at top (mOD)*	*Short-term (undrained)*			*Long-term (drained)*		
		E_u *(top), kPa*	E_u *(base), kPa*	*Poisson's ratio*	*E' (top), kPa*	*E' (base), kPa*	*Poisson's ratio*
Made Ground	+30.0	10,000	10,000	0.2	10,000	10,000	0.2
London Clay	+23.0	20,300	95,300	0.5	16,240	76,240	0.2
Lambeth Group	-2.0	95,300	161,300	0.5	76,240	129,040	0.2

Notes:

1. Rigid boundary taken as -24.0 mOD (top of Thanet Sand)

5 Results of analyses

The ground movements and stress changes associated with the proposed development have been calculated using the Oasys program PDISP. The program assumes a linear elastic behaviour of the soil and a completely flexible structure. The finite stiffness of HS1 bridge foundations will tend to redistribute or smooth out the movements when compared to the PDISP predicted movements.

The analysis was conducted for the following stages:

- Stage 1 - Demolition of the existing structures; and
- Stage 2 - Excavation of the basement.

5.1 Stage 1 – Demolition of the Existing Structures

The first stage is the demolition of the existing structures which are shown on Figure 9. The existing building loads were provided by Conisbee and are listed below:

- Marigold Building – 19 kPa
- Refrigeration Unit Housing – 25 kPa

This unloading was applied at the ground surface (28 mOD).

5.2 Stage 2 – Basement Excavation

The excavation was applied within the secant pile wall and the existing retaining wall. It was assumed that soil was excavated from the ground surface (28 mOD) to the formation level (23.3 mOD). Given a soil unit weight of 20 kN/m^3, this would result in a uniform unloading across the excavation footprint of 94 kPa.

Movements as a result of the secant pile wall installation and the movement of the secant pile wall during excavation were not considered. This is discussed further in Section 6.

5.3 Results

PDISP analyses were run using short-term and long term parameters at the end of Stage 2. The short-term parameters represent the most likely scenario as construction of the new structure should occur immediately after the excavation of the basement.

However, if the project is put on hold after the basement is excavated, the long-term parameters will be more representative.

Displacements were calculated at the top, middle and toe of each of the piles on the HS1 North Abutment.

Figure 11 presents the displacements for the short-term condition. The maximum ground heave at any point on the piles does not exceed 1.5 mm. The settlements at any point around the piles do not exceed 1 mm.

Figure 12 presents the displacements for the long-term condition. The maximum ground heave at any point around the piles does not exceed 4 mm. The heave is greatest at NP1 and consistently reduces to no heave towards NP10.

It should be noted that PDISP has been used to estimate the vertical movements of the ground assuming free field conditions (i.e. the analysis assumes that the piles move freely with the ground). However, the stiffness of the piles and the rigid pile cap connecting the piles will restrict the movements and the estimated movements are likely conservative.

6 Discussion of results

The majority of the basement excavation will be formed by bored secant pile wall. However, the south side of the basement is already at formation level so the soil to the south of the footprint does not need to be retained. The closest HS1 Northern Abutment Pile (NP1) is 7.5 m from the edge of the secant pile wall.

The following two sections discuss the ground movements caused by the installation of the secant pile wall and the movement of the secant pile wall due to the basement excavation.

6.1 Movements due to the installation of the secant pile wall

Guidance on likely ground movements from the installation of piled walls are given in CIRIA publication C580. Movements from the secant pile wall installation are given as being proportional to the pile length, with maximum horizontal and vertical movements of the ground surface at the wall being 0.08% and 0.05% of the pile length respectively.

It is assumed that the installation depth of the secant pile wall is approximately 4 m below the ground level at the footpath and 4 m below the top of the HS1 Northern Abutment Piles. Therefore the expected horizontal and vertical movements are 3 mm and 2 mm respectively.

The CIRIA guide indicates that horizontal movements can extent up to 1.5 times the pile length from the wall (i.e. 6m), with vertical movements occurring up to 2 times the pile length (i.e. 8m), but typically, movements are concentrated close to the wall. Given that the nearest HS1 pile (NP1) is 7.5 m from the corner of the secant pile wall, the movements at the HS1 piles due to the installation of the secant pile wall should be negligible.

6.2 Movements due to the excavation behind the secant pile wall

The magnitude and extent of ground movements resulting from the excavation in front of the piled wall are typically estimated based on the guidance given in the CIRIA publication C580. This guidance is based on the behaviour of embedded walls at numerous sites in London.

In this case, the HS1 North Abutment piles are a minimum of 7.5 m away from the secant pile wall. Also, the basement excavation only extends 1 m below the top of the

HS1 piles. As such, it expected that there will be negligible horizontal and vertical movement of the HS1 piles due to the movement of the secant pile wall during the excavation.

6.3 Movements due to demolition and basement excavation

The movements due to the demolition and excavation of the basement are presented in Section 5. The results indicate that:

- The piles will tend to compress in the short-term condition as a result of the unloading. The maximum heave of the piles (NP1) is approximately 1.5 mm. This is likely to be the maximum heave the pile will experience as the new structure will be constructed immediately after the basement is excavated.

- If the excavation remains open for a long period of time, the long-term conditions will apply. In this case, the top of the pile and the toe of the pile will move more uniformly. The maximum heave of the piles (NP1) is approximately 4 mm in this case.

These estimated movements are based on free-field conditions. In reality, the pile cap will restrict the movement of the piles. It is therefore likely that the movements presented above are conservative.

7 Conclusions

The demolition of an existing buildings, and the excavation of a single basement level at 102 Camely street have been considered in the context of their impact on the Northern Abutment of the HS1 Railway Bridge.

This assessment has considered the potential for heave of the piles based on a free-field analysis. It is unlikely that the building demolitions and the basement excavation will have an adverse impact on the Northern Abutment of the HS1 Railway Bridge.

8 References

Arup. Geotechnical Desk Study – 102 Camley Street, London N1C 4PF, June 2014

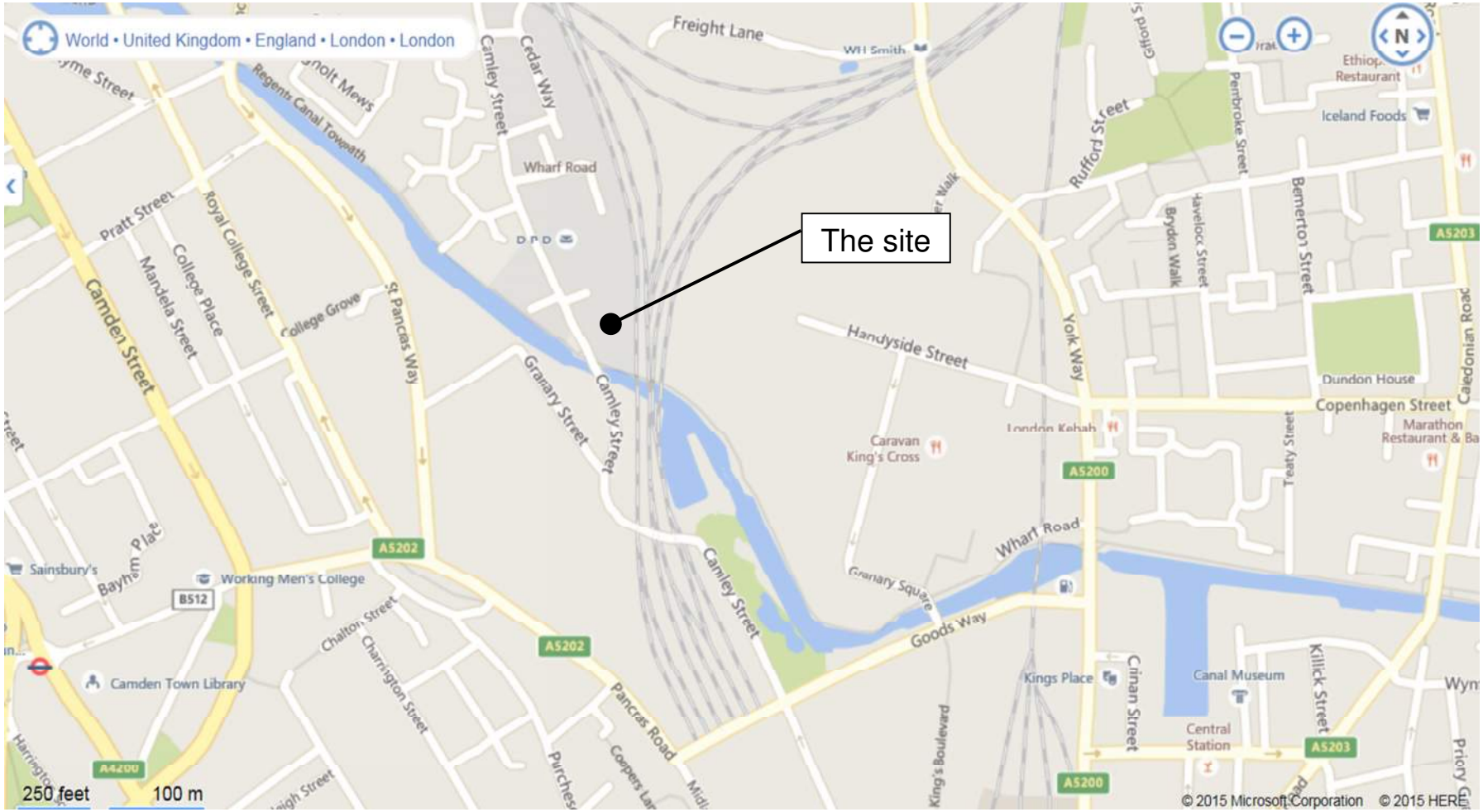
British Geological Survey. 1920. London Sheet *NV NW*. 1:10,560.

British Geological Survey. (1998). England and Wales Sheet 257: Romford. 1:50,000.

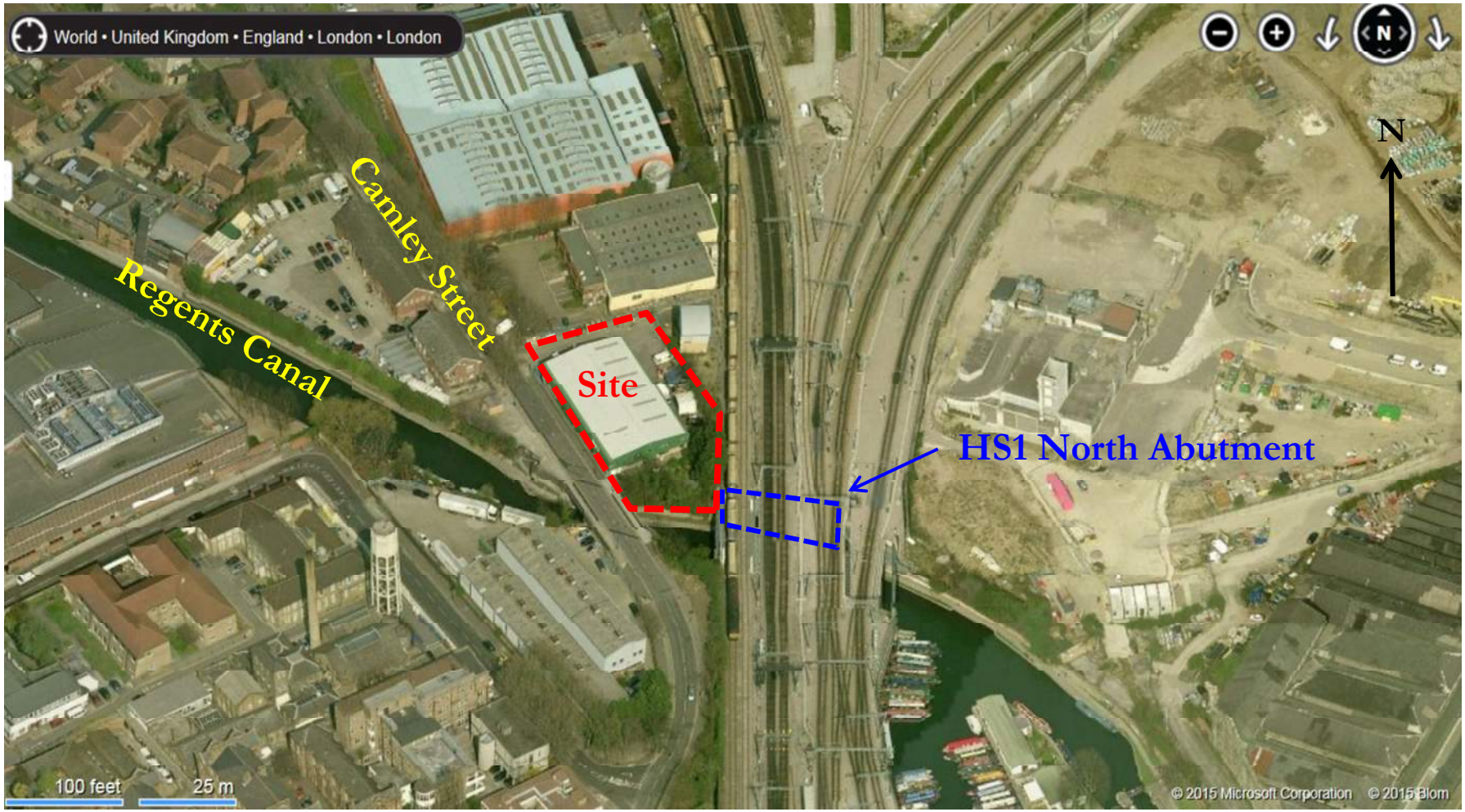
Environment Agency. 2015. *Management of the London Basin Chalk Aquifer* (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/429468/2015_London_GWL_Report_online.pdf, downloaded on 18 August 2015)

Resource and Environmental Consultants Ltd. Geo-Environmental Site Investigation – 102 Camley Street, London, Prepared for: Taylor Wimpey, March 2015.

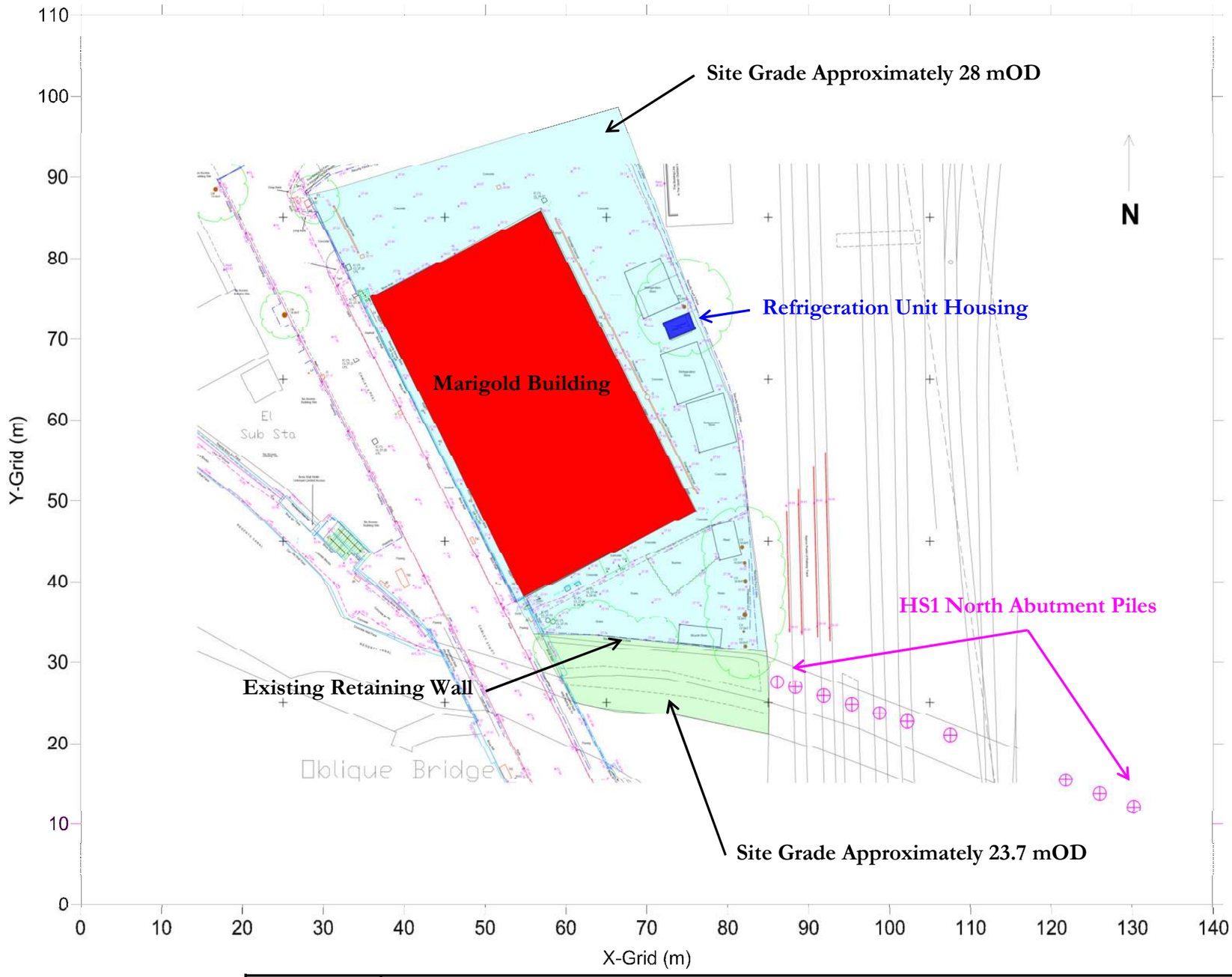
FIGURES



	Conisbee 102 Camley Street	**Figure** **1**
	Site location	



	Conisbee 102 Camley Street	**Figure** **2**
	Site plan (Bing Maps)	



Conisbee

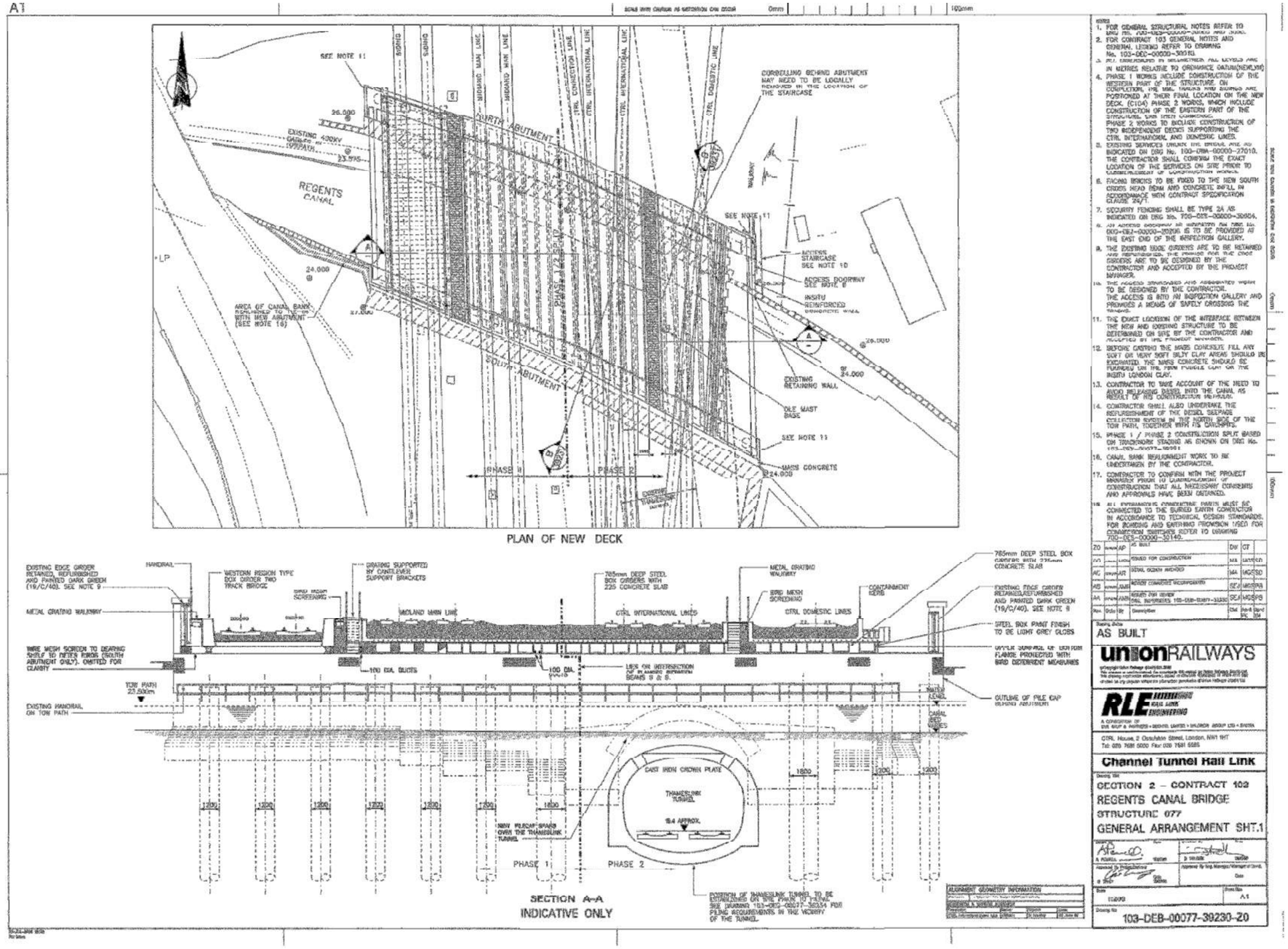
102 Camley Street

Site Plan

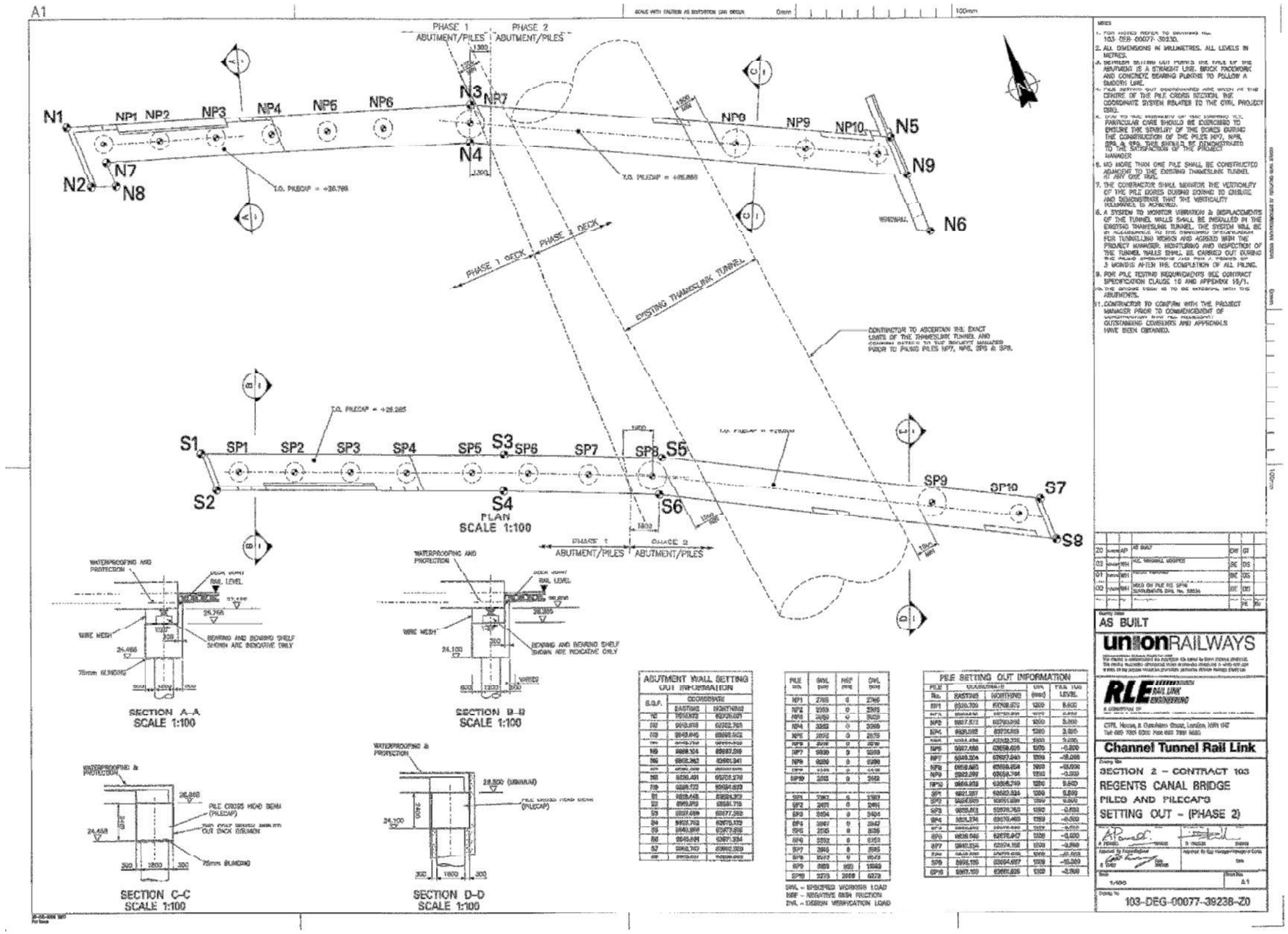
Existing Site Plan

Figure

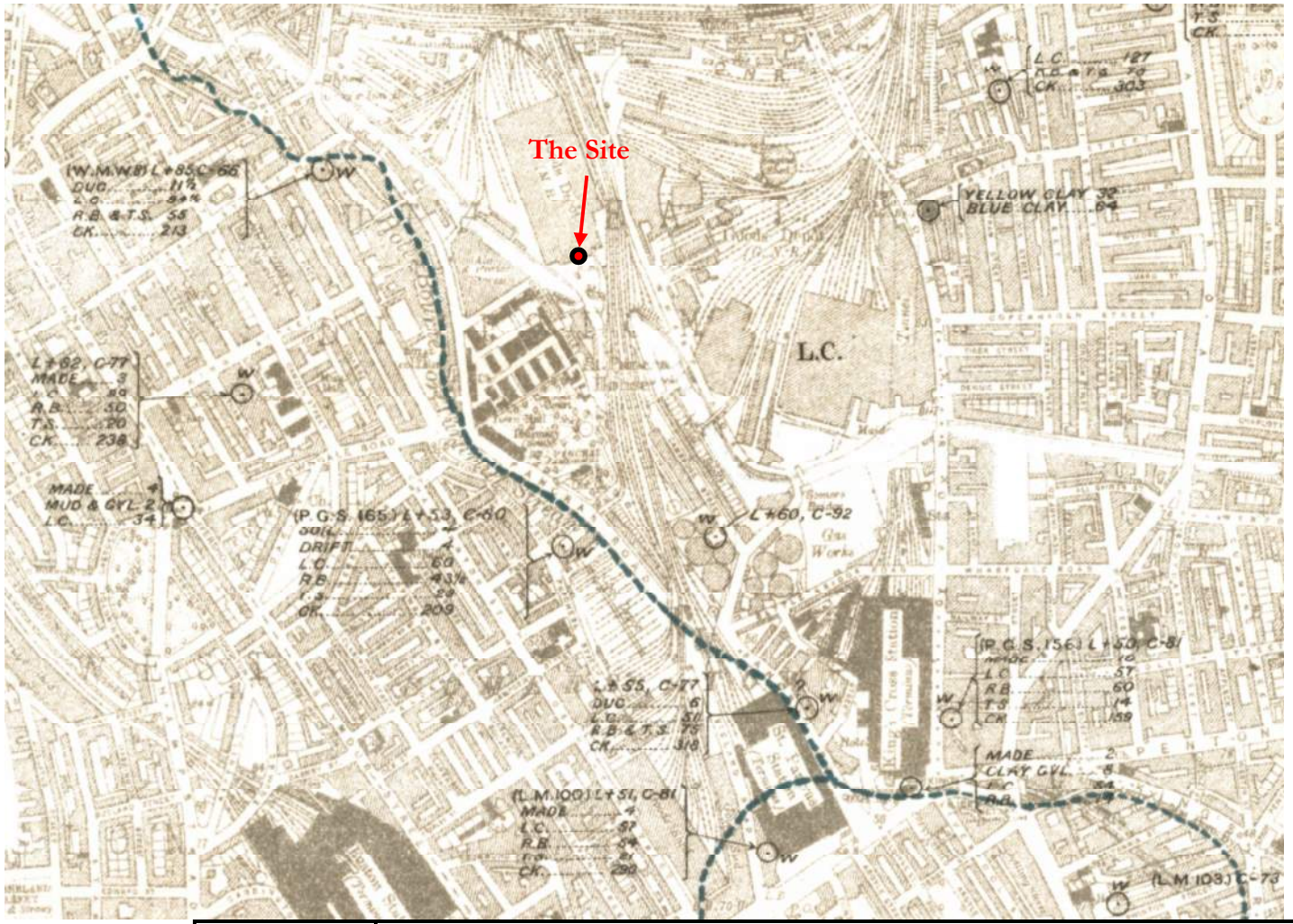
3



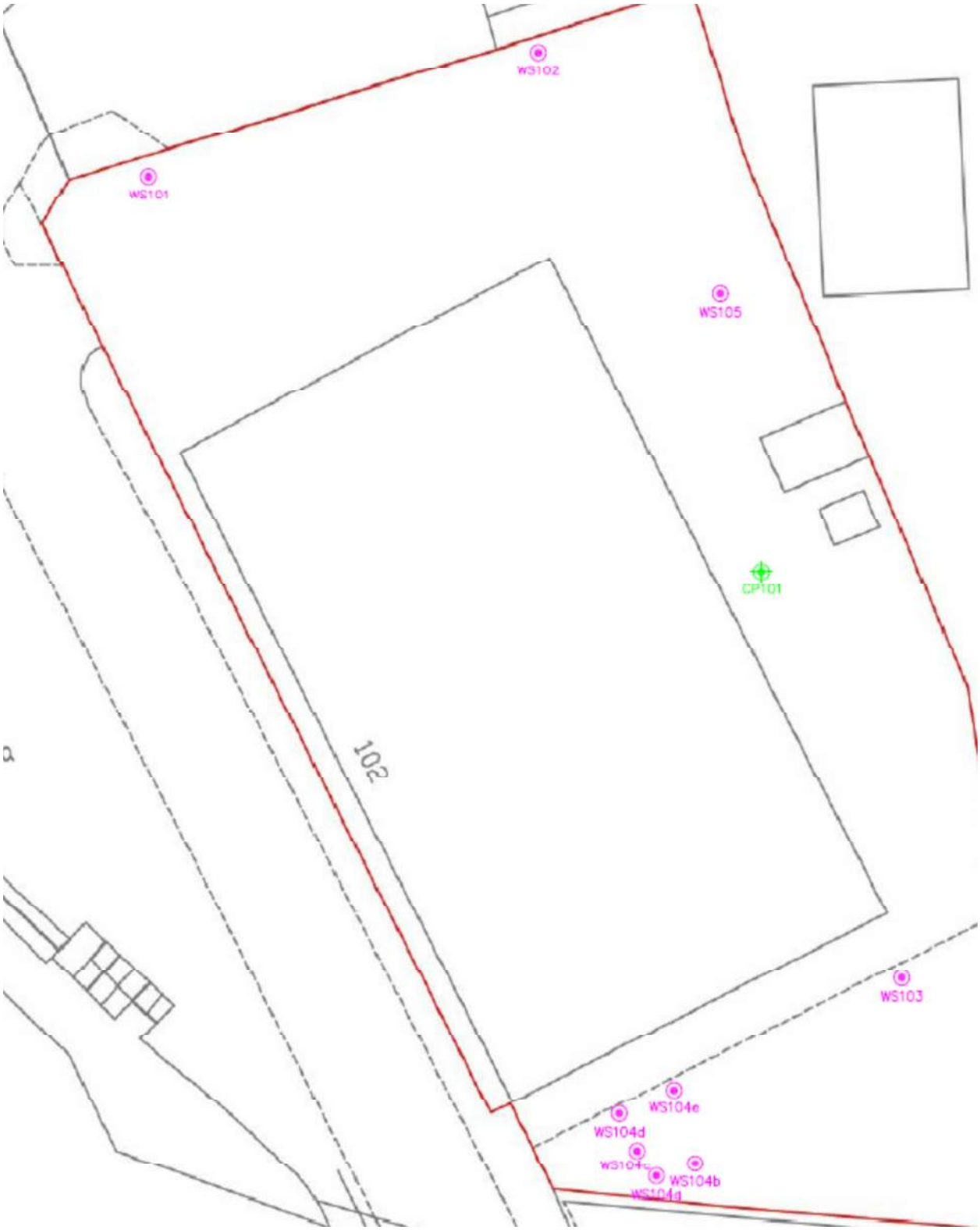
	Conisbee 102 Camley Street	**Figure** **4**
	HS1 Regents Canal Bridge Plan	



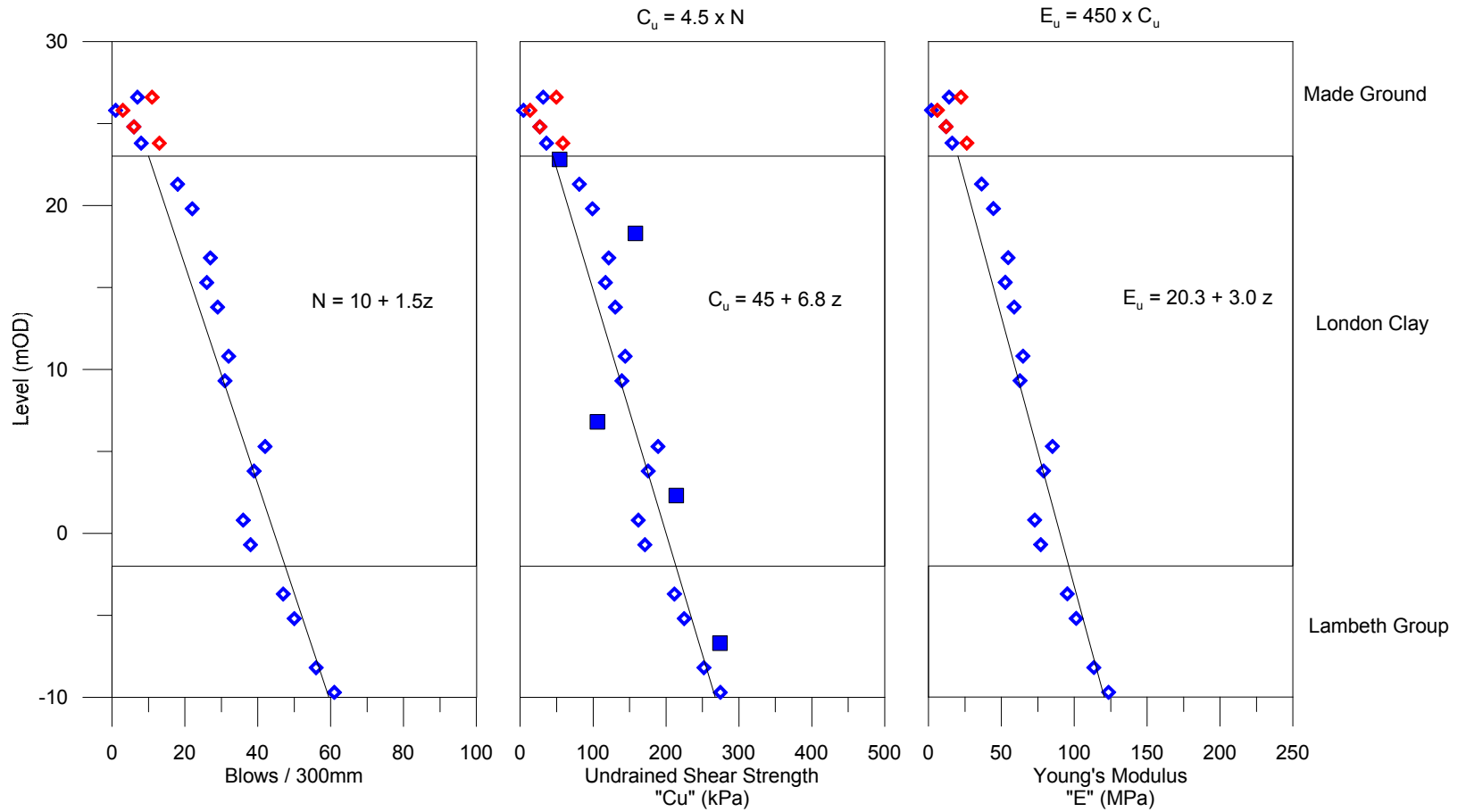
	Conisbee 102 Camley Street	**Figure** **5**
	HS1 Regents Canal Bridge Pile Layout	



	Conisbee 102 Camley Street	**Figure** **6**
	1:10560 BGS Map Sheet NVI S.W. (1920)	



	Conisbee 102 Camley Street	**Figure** **7**
	<Main Caption> <Sub Caption>	



Note: z is depth below top of London Clay (23.0 mOD)

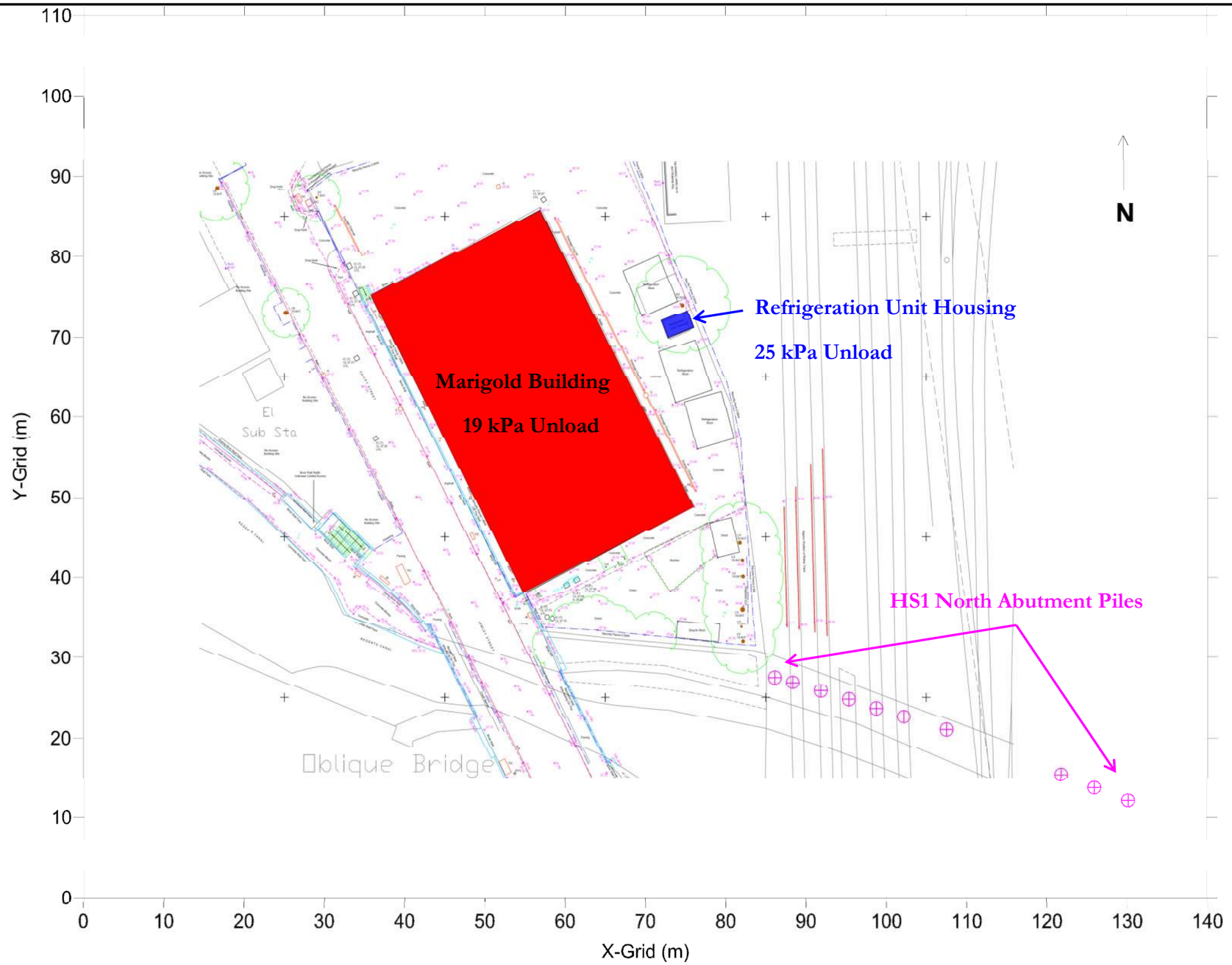
BH 101
WS 103
Triaxial BH 101

Conisbee

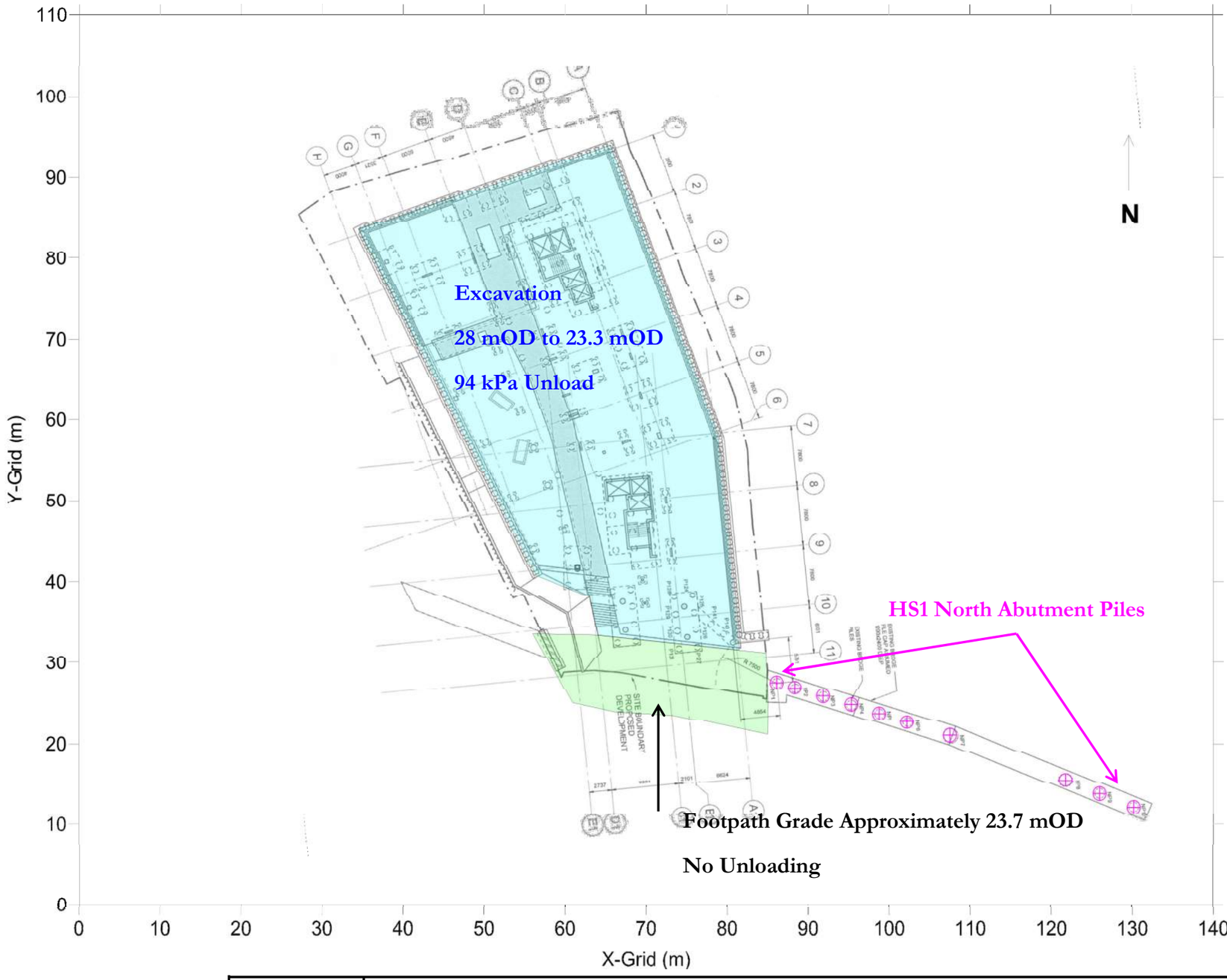
102 Camley Street

In-Situ and Laboratory Testing Data

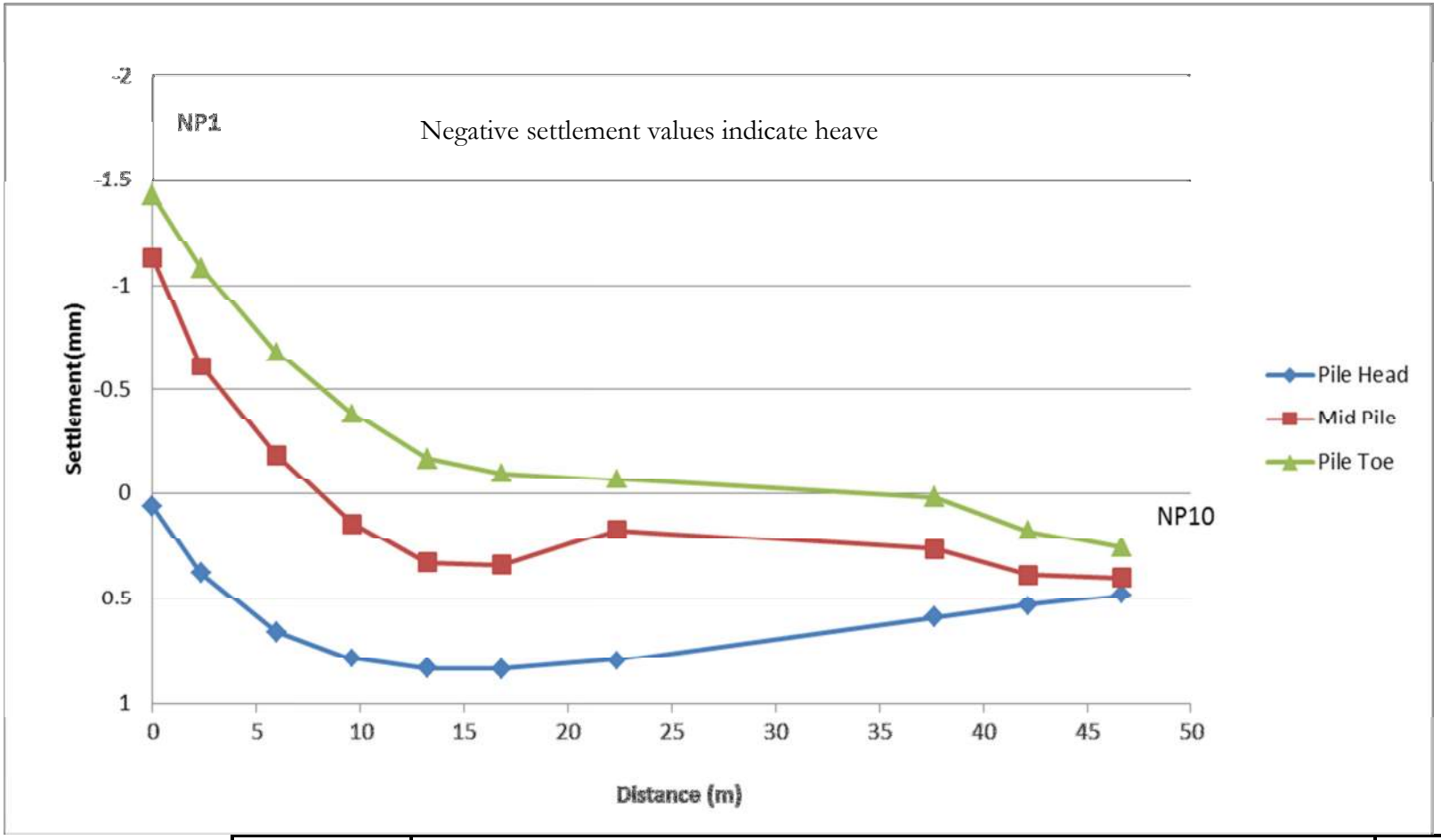
Figure 8



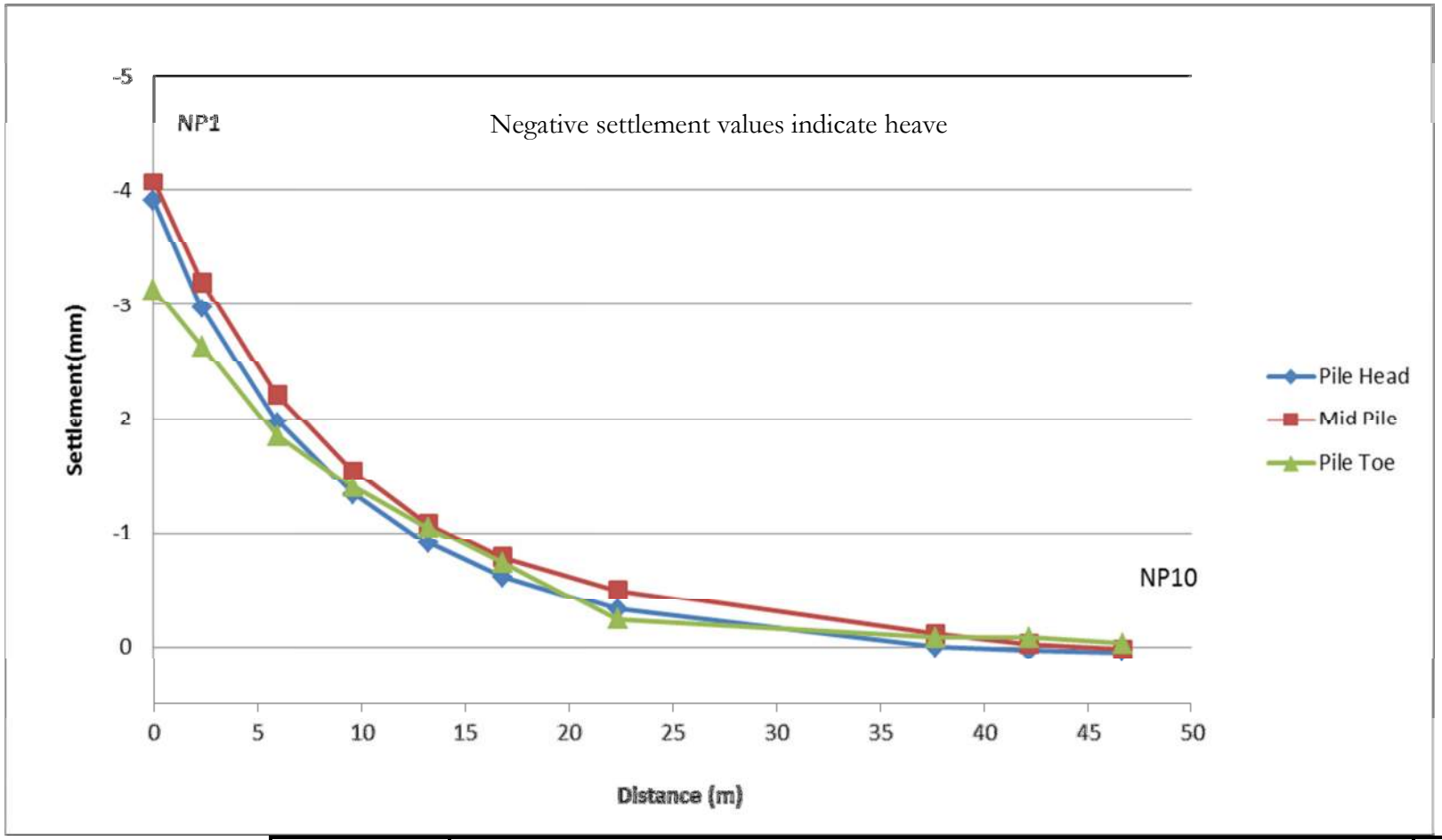
	Conisbee 102 Camley Street	**Figure** **9**
	Stage 1 - Demolition Unloading Plan	



	Conisbee 102 Camley Street	**Figure** **10**
	Stage 2 – Basement Excavation Unloading Plan	



	Conisbee 102 Camley Street	**Figure** **11**
	Predicted Vertical Ground Movements End of Stage 2 (Demolition and Basement Excavation) – Short Term	



Conisbee

102 Camley Street

Predicted Vertical Ground Movements
End of Stage 2 (Demolition and Basement Excavation) – Long Term

Figure

12