GROUND MOVEMENT ASSESSMENT REPORT

10 Glenmore Road
London
NW3 4DB

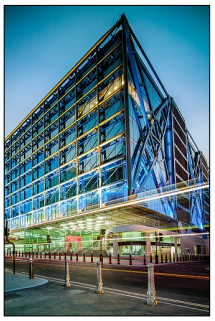
Client: Mr B and Mrs L Walford

Engineer: Structure Workshop

J20026

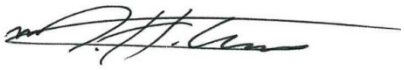
March 2020



GEA

Document Control

Project title	10 Glenmore Road, London NW3 4DB	**Project ref**	J20026
Report prepared by			
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Report approved for issue by			
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Issue No	Status	Amendment Details	Date	Approved for Issue
1	Final		17 February 2020	
2	Final	Amended to include assessment of Thames Water sewer	6 March 2020	
3	Final	Amended to address comments by Campbell Reith	23 March 2020	

This report has been issued by the GEA office indicated below. Any enquiries regarding the report should be directed to the project engineer at the office indicated below or to Steve Branch in our main Herts office.

✓	**Hertfordshire**	tel 01727 824666
	Nottinghamshire	tel 01509 674888
	Manchester	tel 0161 209 3032

Geotechnical & Environmental Associates Limited (GEA) disclaims any responsibility to the Client and others in respect of any matters outside the scope of this work. This report has been prepared with reasonable skill, care and diligence within the terms of the contract with the Client and taking account of the manpower, resources, investigation and testing devoted to it in agreement with the Client. This report is confidential to the Client and GEA accepts no responsibility of whatsoever nature to third parties to whom this report or any part thereof is made known, unless formally agreed beforehand. Any such party relies upon the report at their own risk. This report may provide advice based on an interpretation of legislation, guidance notes and codes of practice. GEA does not however provide legal advice and if specific legal advice is required a lawyer should be consulted.

CONTENTS

Part 1: INVESTIGATION REPORT

1.0 INTRODUCTION

Geotechnical and Environmental Associates (GEA) has been commissioned by Mr and Mrs Walford, to carry out a Ground Movement Analysis (GMA) of the proposed basement structure at 10 Glenmore Road, London NW3 4DB. Structure Workshop are the structural engineers for the project.

The site has been the subject of a ground investigation by Connaughts Site Investigation Ltd (report ref: 0762, dated August 2019), which is referred to where appropriate within this report.

1.1 Proposed Development

It is understood that it is proposed to extend and deepen the existing single level basement below the footprint of the existing house. Formation level for the basement is understood to be 62.70 m AOD, which will require an excavation of 1.50 m and 2.71 m, with the basement retaining walls being constructed through the conventional underpinning of existing foundations. The levels of the existing foundations are as such that the depth of underpinning will vary between 0.40 m and 1.00 m, such that the scale of the work is considered to be very minimal.

This report is specific to the proposed development and the advice herein should be reviewed if the development proposals are amended.

1.2 Purpose of Work

The principal technical objectives of the work carried out were as follows:

- to review and assess the ground conditions and hydrogeological regime; and
- to assess the possible impact of the proposed development on the surrounding structures.

1.3 Limitations

The conclusions and recommendations made in this report are limited to those that can be made on the basis of the investigation. The results of the work should be viewed in the context of the range of data sources consulted, the number of locations where the ground was sampled and the number of soil, gas or groundwater samples tested; no liability can be accepted for information in other data sources or conditions not revealed by the sampling or testing. Any comments made on the basis of information obtained from the client or other third parties are given in good faith on the assumption that the information is accurate; no independent validation of such information has been made by GEA.

2.0 THE SITE

2.1 Site Description

The site is located in the area of Hampstead within the London Borough of Camden, northwest London, approximately 320 m southwest of Belsize Park London Underground station. It may be additionally located by National Grid Reference (NGR) 527199,184911.

The site forms a rectangular shaped area with maximum dimensions of approximately 20 m east-west by 6 m north-south and is occupied by a three-storey terraced property with a partial basement below the front third of the building footprint and a small courtyard garden in the west of the site. It is bordered to the north and south by Nos 8 and 12 Glenmore Road respectively, which are of similar construction to the house occupying the site and it is understood that both include similar basements. The site is bordered to the west by private gardens of properties fronting Glenloch Road.

2.2 Geology

The Geological Survey map of the area (sheet 256) indicates that the site is directly underlain by the London Clay Formation.

The Connaughts investigation comprised a number of manually excavated trial pits adjacent to existing elevations, to determine the configuration of existing foundations, and a single window sample borehole advanced to a depth of 5.1 m within the rear garden. The borehole encountered made ground to a depth of 1.6 m, whereupon London Clay was encountered and was described as comprising firm becoming stiff medium strength brown with some light grey veining. The borehole was terminated at 5.1 m on a claystone.

GEA has previously carried out a number of investigations close to the site, which confirmed the expected ground conditions and the findings of the Connaughts investigation, in that below a generally moderate thickness of made ground, the London Clay was encountered and extended to the maximum depth investigated, of 25.0 m.

2.3 Hydrogeology

The London Clay Formation is classified as an Unproductive Stratum and non-aquifer with negligible significance for water supply or river base flow. This means that a continuous groundwater table will not exist below the site.

Groundwater was not encountered during the previous investigation and although a groundwater monitoring standpipe was installed, it is understood that no monitoring has been undertaken to date.

3.0 GROUND MOVEMENT ANALYSIS

The sides of a basement excavation will move to some extent regardless of how they are supported. The movement will typically be both horizontal and vertical and will be influenced by the engineering properties of the ground, groundwater level and flow, the efficiency of the various support systems employed during underpinning and the efficiency or stiffness of any support structures used.

An analysis has been carried out of the likely movements arising from the proposed basement excavation and the results of this analysis have been used to predict the effect of these movements on surrounding structures.

3.1 Basis of Ground Movement Assessment

3.1.1 Nearby Sensitive Structures

Sensitive structures relevant to this assessment are the neighbouring Nos 8 and 12 Glenmore Road to the north and south respectively. Based on the proposed size and depth of excavation, all other surrounding buildings and structures are considered to be outside of the zone of influence of the proposed basement.

A plan showing the locations of the site and neighbouring buildings is included in the appendix, which also indicates the individual elevations assessed for associated building damage and the referencing used within the analysis.

The founding levels of the party walls with the two neighbouring properties were determined in part by the previous investigation and provided by Structure Workshop within their Basement Impact Assessment (BIA) document (ref: 19029.R01.P2, dated November 2019). Therefore, it is understood that No 8 Glenmore is bearing at a level of 63.71 m AOD, whilst No 12 is bearing at a level of 63.09 m AOD and these levels have been adopted for the analysis. Survey drawings for the existing house indicates varying eave levels due to the shape of the roof. Therefore, a conservative worst-case building height (foundation to top of eaves) of 9m has been adopted for each of the neighbouring elevations.

In addition to the neighbouring properties, a combined sewer is indicated by Thames Water as being present below Glenmore Road at a depth of approximately 2.90m and it has been estimated to be approximately 6.00m from the front elevation of the site. The Thames Water asset drawing is included in the appendix.

The following drawings have been referred to, where relevant, to model the sensitive structures and proposed excavation.

Drawing Reference	Drawing Title
19029.SK02 (undated)	Foundation Loads
18495 – 10 Glenmore Road – G, dated November 2018	Measured Survey – Ground Floor
18495 – 10 Glenmore Road – B, dated November 2018	Measured Survey – Basement
18495 – 10 Glenmore Road – S, dated December 2018	Measured Survey – Sections

3.2 Construction Sequence

The following sequence of operations is detailed in Structure Workshop BIA document:

1. Install sacrificial sheet piles to support existing lightwell;
2. Underpin front elevation;
3. Install RC retaining wall against sheet piles for lightwell;
4. Prop existing ground floor structure;
5. Underpin party walls and rear elevation using a ‘hit and miss’ method of panel widths no more than 1 m;

6. Excavate rear area of extended basement;

7. Remove rear retaining wall of existing basement;

8. Excavate whole basement to new founding level;

9. Install new drainage runs followed by basement slab;

10. Install new load bearing walls in basement and box frames; and

11. Remove temporary propping.

The underpins will be adequately laterally propped and sufficiently dowelled together, and the concrete will be cast and adequately cured prior to excavation of the basement and removal of the formwork and supports. It is assumed that the corners of the excavation will be locally stiffened by cross-bracing or similar and that the new retaining walls will not be cantilevered at any stage during the construction process. It is assumed that adequate temporary propping of the new retaining walls, particularly at the top level, will occur at all times prior to the construction of permanent concrete floor slabs.

4.0 GROUND MOVEMENTS

An assessment of ground movements within and surrounding the excavation has been undertaken using the P-Disp Version 20.0 – Build 12 and X-Disp Version 20.0 software packages licensed from the OASYS suite of geotechnical modelling software from Arup. This program is commonly used within the ground engineering industry and is considered to be an appropriate tool for this analysis. The use of the P-Disp program is based on the assumption that the soils behave elastically, which provides a reasonable approximation of soil behaviour at small strains.

For the purpose of these analyses, the corners have been defined by x and y coordinates, with the x-direction orientated approximately northeast-southwest, whilst the y-direction is orientated approximately northwest-southeast. Vertical movement is in the z-direction. Wall lengths of less than 10 m have been modelled as 1 m long structural elements, while walls greater than 10 m in length have been modelled as 2 m elements to reflect their greater stiffness.

It is assumed that suitable propping will be provided during the construction of the basement and in the permanent condition, such that the walls can be considered to be stiff for the purpose of the ground movement modelling.

The full outputs of all the analyses can be provided on request but samples of the output movement contour plots and the tables of movements are included within the appendix.

4.1 Model Used

Vertical movement, in the form of heave, will arise from the unloading of the London Clay due to the reduction of vertical stress, at least in the short-term. Undrained soil parameters have been used to estimate the potential short-term movements, which include the “immediate” or elastic movements as a result of the basement excavation. Drained parameters have been used to provide an estimate of the total movement, which includes long term swelling or creep that will continue for a number of years.

The elastic analysis requires values of soil stiffness at various levels to calculate displacements. Values of stiffness for the soils at this site are readily available from published data and we have used a well-established method to provide our estimates. Published data[1] indicates stiffness values of 750 x Cu for the London Clay and a ratio of E' to Eu of 0.75, and it is considered that this provides a sensible approach. The profile of the underlying ground conditions used in the analysis has been interpolated from the results of aforementioned nearby GEA site investigations, with a design line of $C_u = 5z + 45$ kN/m^2 adopted for the London Clay.

The soil parameters used in this analysis are tabulated below, which have been estimated from the information contained within the Connaughts Site Investigation Ltd report and assumed parameters interpreted from archive boreholes on the GEA database.

Stratum	Level range (m AOD)	Eu (MPa)	E' (MPa)
Made Ground	65.4 to 63.8	15	11.2
London Clay	63.8 to 25.4	33.75 to 201	25.2 to 150

A rigid boundary for the analysis has been set at 25.4 m AOD, which equates to 40 m below ground level. Below this depth the London Clay is not considered to be affected by the scale of the development and the soils are considered to be essentially incompressible.

The existing basement that will be lowered will result in unloading of approximately 30 kN/m², whilst the proposed single level basement extension will comprise a maximum excavation depth of approximately 2.70 m below the existing ground floor level, which will result in a net unloading of about 50 kN/m².

Proposed line loads have been provided by Structure Workshop, with foundation pressures equating to 57 kPa and 116 kPa, whilst a slab loading of 7.2 kPa will also exist across the area of the basement extension, as indicated by the appended foundation load mark-up. These loads have been taken into account in analysing the vertical movements.

4.2 Results

The full predicted movements are summarised in the contour plots and tables within appendix; the results are presented to the degree of accuracy required to allow predicted variations in ground movements around the structure(s) to be illustrated, but may not reflect the anticipated accuracy of the predictions.

The P-Disp analysis indicates that less 5mm of heave can be expected at the centre of the proposed basement excavation, whilst along a number of the underpinned elevations, settlements of less than 5mm can be expected to occur due to the proposed loadings.

If a compressible material is used beneath the slab, it will need to be designed to be able to resist the potential uplift forces generated by the ground movements. In this respect, potential heave pressures are typically taken to equate to around 40% of the total unloading pressure.

1 Burland JB, Standing, JR, and Jardine, FM (2001) *Building response to tunnelling, case studies from construction of the Jubilee Line Extension* CIRIA Special Publication 200

5.0 BUILDING DAMAGE ASSESSMENT

Published data for ground movements associated with underpinned retaining walls and the subsequent excavation of a new basement is limited compared to other types of retaining wall. It is possible to use the well-documented predictions and movement curves for embedded retaining walls contained within CIRIA C760[2], although this approach is considered to be conservative. However, in order to model potential movements associated with the installation of the underpins, the movement curves for 'installation of planar diaphragm wall in stiff clay' has been adopted.

For the excavation phase following the underpinning, as the existing building will be in place during the construction of the proposed basement extension, the walls being underpinned, in addition to the use of temporary propping, will provide a level of restraint to the underpins, which would generally be expected to result in negligible movement. The magnitude of the any movement will also be controlled to a large extent by the quality of workmanship. For the horizontal movements, a ground movement curve assuming that horizontal settlement behind the wall will be equivalent to 0.15% of the retained height, with movement that diminishes with distance from the wall according to the trend line set by a wall within clay (see Fig 6.15a of CIRIA C760), has been adopted. These movements have been combined the vertical movements derived from the P-Disp model. For the purpose of this analysis, the total vertical movements derived from the P-Disp model have been adopted as the most critical case in terms of potential damage to the neighbouring properties.

In order to address the potential impact of the proposed underpinning, the movements from both the installation and excavation phases have been combined to enable a damage assessment to be undertaken of all the potential movements.

5.1 Damage to Neighbouring Structures

The Camden Planning Guidance for Basements and Lightwells (CPG Basements; March 2018) states that "applicant must demonstrate in the Basement Impact Assessment that the basement scheme has a risk of damage to neighbouring properties no higher than Burland Scale 1'very slight."

As a result of the limited movements expected to arise from the relatively small-scale excavation, the assessment has indicated that the predicted damage to all of the neighbouring elevations will fall within Category 0 and Negligible building damage and is therefore within allowable limits.

5.2 Movements along Thames Water Sewer

The ground movement assessment has indicated that negligible movements are expected to arise from the proposed basement excavation, with movements of less than 5mm occurring outside of the basement footprint. Given the depth and distance of the sewer from the basement excavation, the proposed development is not considered likely to have an impact on the asset, such that a detailed assessment is not required.

5.3 Monitoring of Ground Movements

The predictions of ground movement based on the ground movement analysis should be checked by monitoring of adjacent properties and structures. The structures to be monitored

[2] Gaba, A, Hardy, S, Powrie, W, Doughty, L and Selemetas, D (2017) *Embedded retaining walls – guidance for economic design* CIRIA Report C760.

during the construction stages should include all of the sensitive structures included within the assessment.

The precise monitoring strategy will be developed at a later stage and it will be subject to discussions and agreements with the owners of the adjacent properties and structures. Contingency measures will be implemented if movements of the adjacent structures exceed predefined trigger levels. Both contingency measures and trigger levels will need to be developed within a future monitoring specification for the works.

6.0 CONCLUSIONS

The analysis has concluded that the predicted damage to the neighbouring properties from the construction of the underpins and excavations would be 'Negligible' or less and therefore the damage that would occur would fall within the acceptable limits.

Whilst it is recommended that movement monitoring is carried out on all structures prior to and during the proposed excavation and construction, it is unlikely that specification of these works will be required as part of the planning conditions, but may be required in order to satisfy party wall awards.

APPENDIX

Proposed Foundation Loads

Plan of proposed basement and sensitive structures

Thames Water Asset Drawing

P-DISP ANALYSIS:

Input Data

Short Term Movement Plot

Total Movement Plot

X-DISP ANALYSIS

Input Data

Contour Plots of Combined Vertical Movements

Contour Plots of Combined Horizontal Movements

BUILDING DAMAGE ASSESSMENT – RESULTS TABLE

NOTES:

This drawing is to be read in conjunction with all other Architects and Engineers drawings, details and specifications.

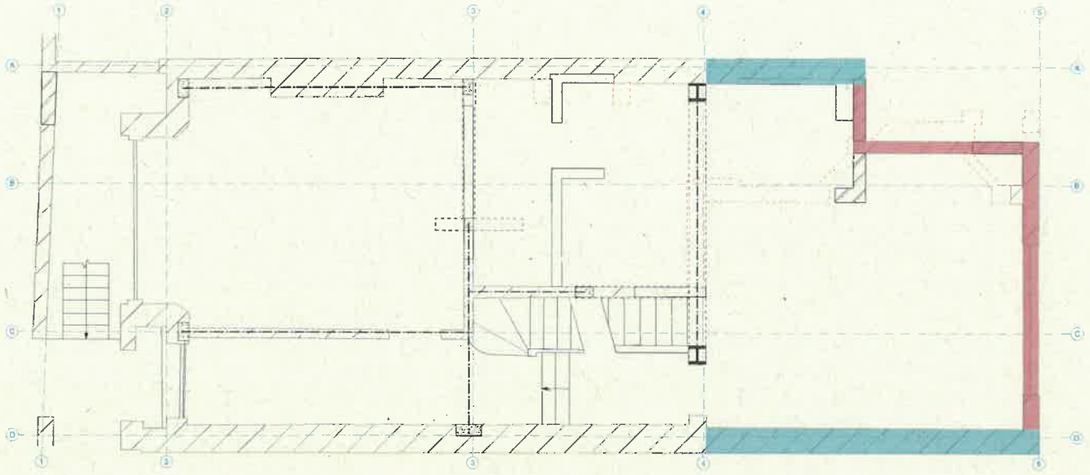
Any discrepancies in the arrangement and details discovered on site, or otherwise, are to be reported to the Architect or Engineer immediately.

All dimensions in mm.

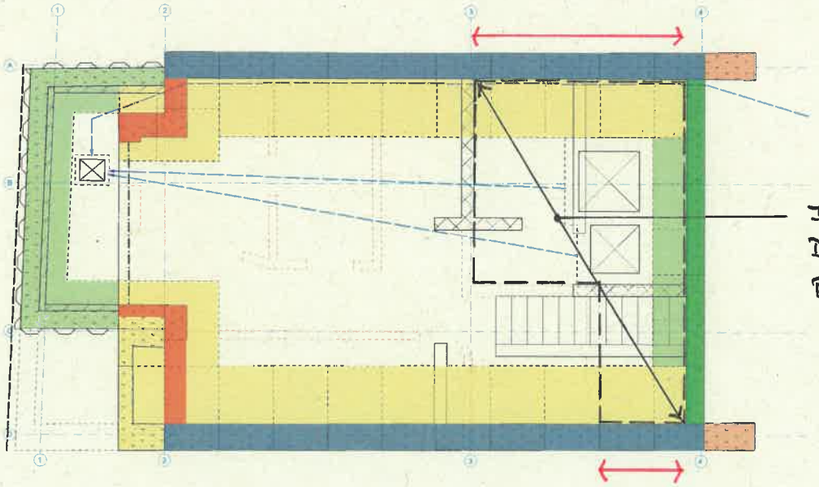
Do not scale from this drawing. Setting out to Architect's details.

KEY:

1. GFL party walls
2. GFL rear wall
3. BFL underpin (incl. spine wall weight)
4. BFL retaining wall
5. BFL front wall



Ex: DL: 140kn/m LL = 18kn/m



INCREASED DEAD LOAD DUE TO ADDITION OF BASEMENT SLAB : 7.2kn/m²

Ex DL = 140kn/m LL 18 kn/m

	EXISTING (U.N.O)		PROPOSED	
WALL TYPE	DL	LL	DL	LL
1.	70 kn/m	5 kn/m	70 kn/m	5 kn/m
2.	40 kn/m	11 kn/m	40 kn/m	11 kn/m
3.	165 kn/m	28 kn/m	155 kn/m	28 kn/m
4.	~~51 kn/m~~ 64 kn/m	19 kn/m	~~67.5 kn/m~~ 79.9 kn/m	19 kn/m
5.	100 kn/m	13 kn/m	110 kn/m	13 kn/m

ALL LOADS PROVIDED ARE UNFACTORED

PRELIMINARY

STRUCTURE WORKSHOP
Engineering & Technical Design
4 Illiffe Yard
London SE17 3QA
020 7701 2616
www.structureworkshop.co.uk

project	Glenmore Road
title	Foundation Loads
scale	1:50 @ A1
drawn	WW
appr.	SR
drg. no.	19029.SK02
rev.	P1

Oasys

10 Glenmore Road, London NW3 4DB

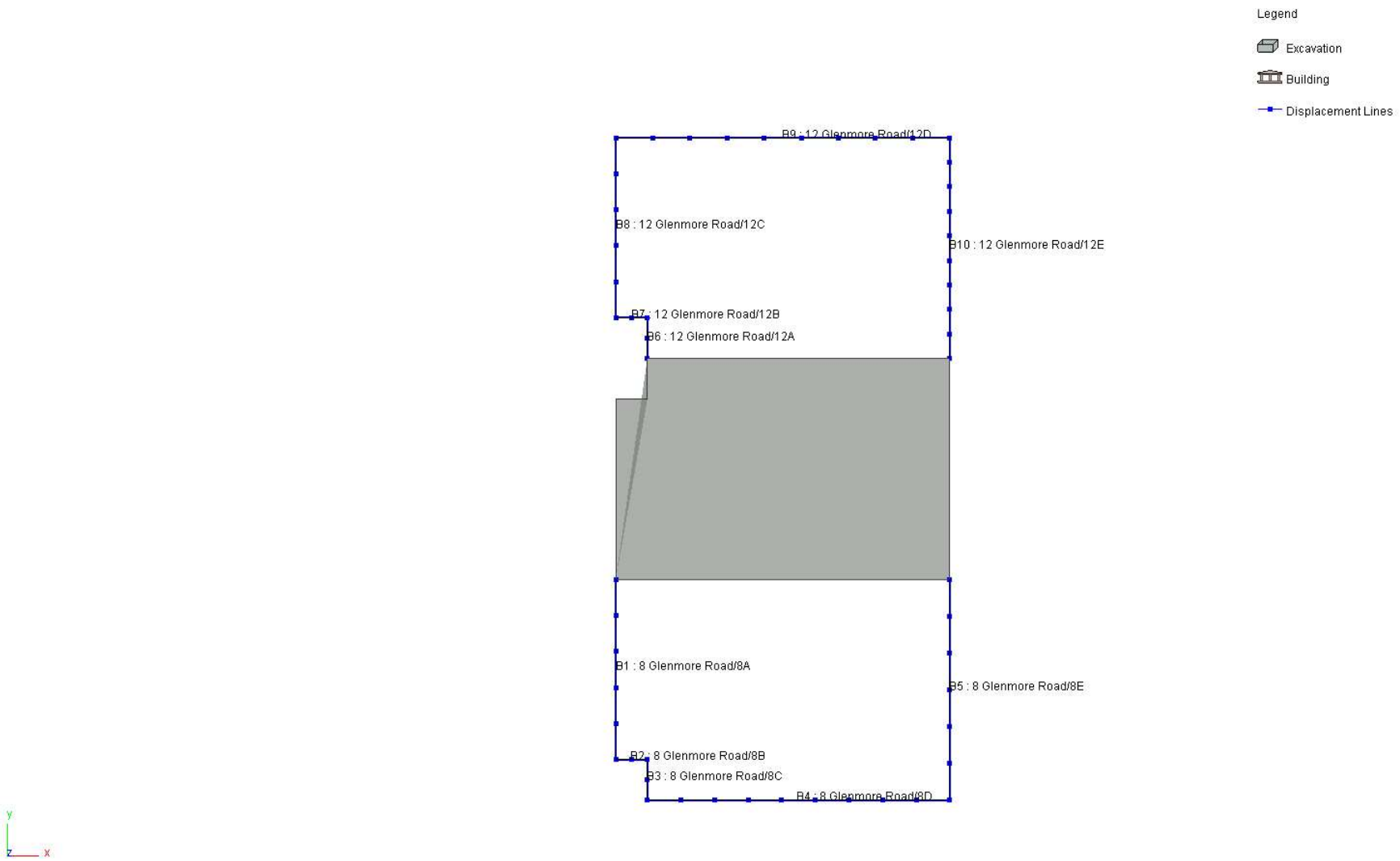
Vertical and Horizontal Movements from Underpinning

Plan of proposed basement and nearby sensitive structures

Job No.	Sheet No.	Rev.
J20026		

Drg. Ref.

Made by	Date	Checked
ML		



Asset location search

Property Searches

Genever & Partners
Keyes House Keyes House

LONDON
SW1V 3NA

Search address supplied 10
Glenmore Road
London
NW3 4DB

Your reference 5022

Our reference ALS/ALS Standard/2019_4001196

Search date 13 May 2019

Keeping you up-to-date

Notification of Price Changes

From 1 September 2018 Thames Water Property Searches will be increasing the price of its Asset Location Search in line with RPI at 3.23%.

For further details on the price increase please visit our website: www.thameswater-propertysearches.co.uk
Please note that any orders received with a higher payment prior to the 1 September 2018 will be non-refundable.

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0845 070 9148

searchcode

Asset location search

Property Searches

Search address supplied: 10, Glenmore Road, London, NW3 4DB

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

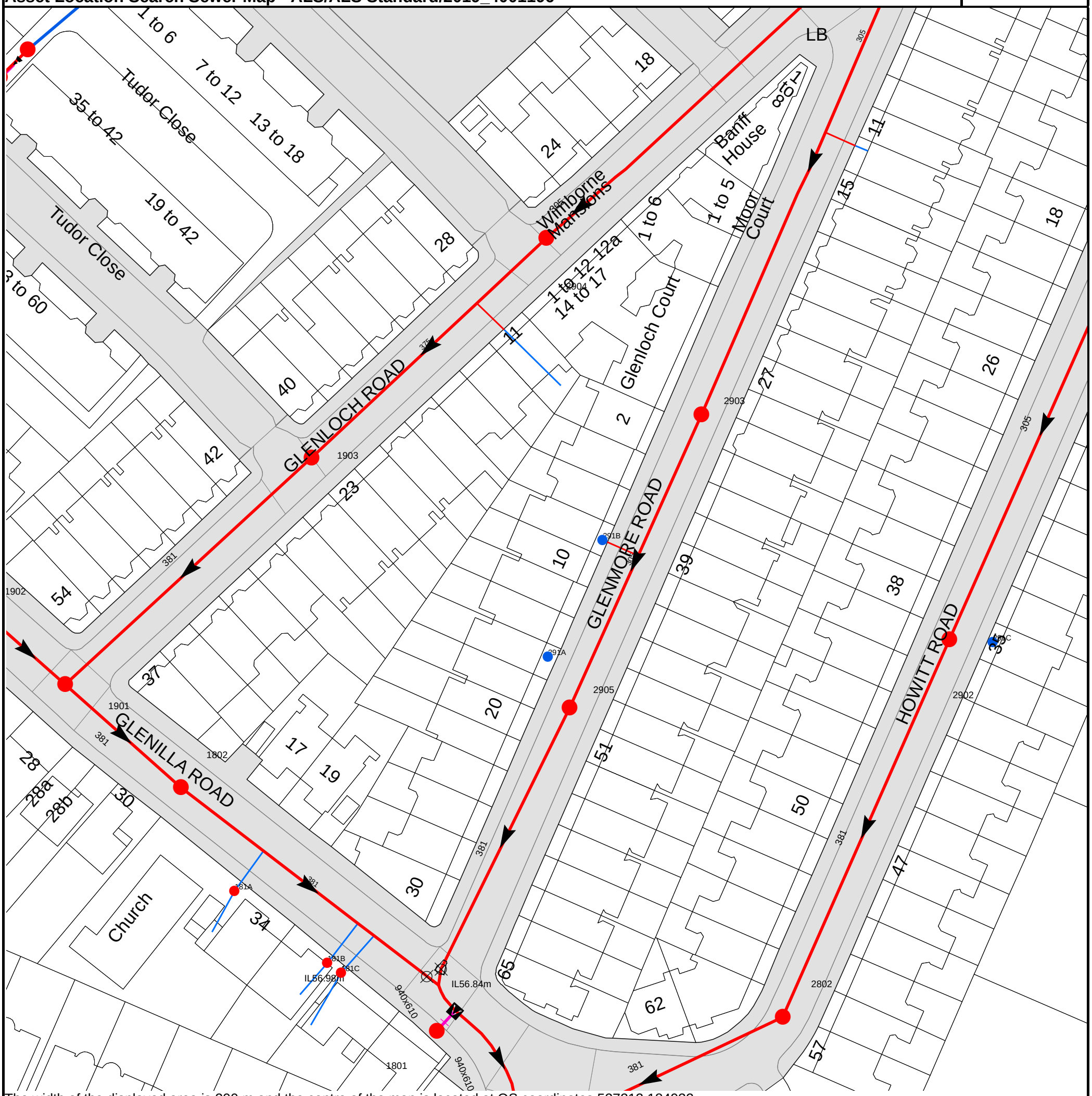
Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2019_4001196



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 527212,184932

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
181A	n/a	n/a
1903	64.43	60.02
181B	n/a	n/a
181C	n/a	n/a
1801	n/a	n/a
2904	67.6	62.19
291A	n/a	n/a
2905	64.04	59.84
291B	n/a	n/a
2903	67.27	62.74
2802	64.04	58.75
2902	66.47	62.08
291C	n/a	n/a
10AB	n/a	n/a
1901	61.97	57.88
1802	61.84	57.63

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

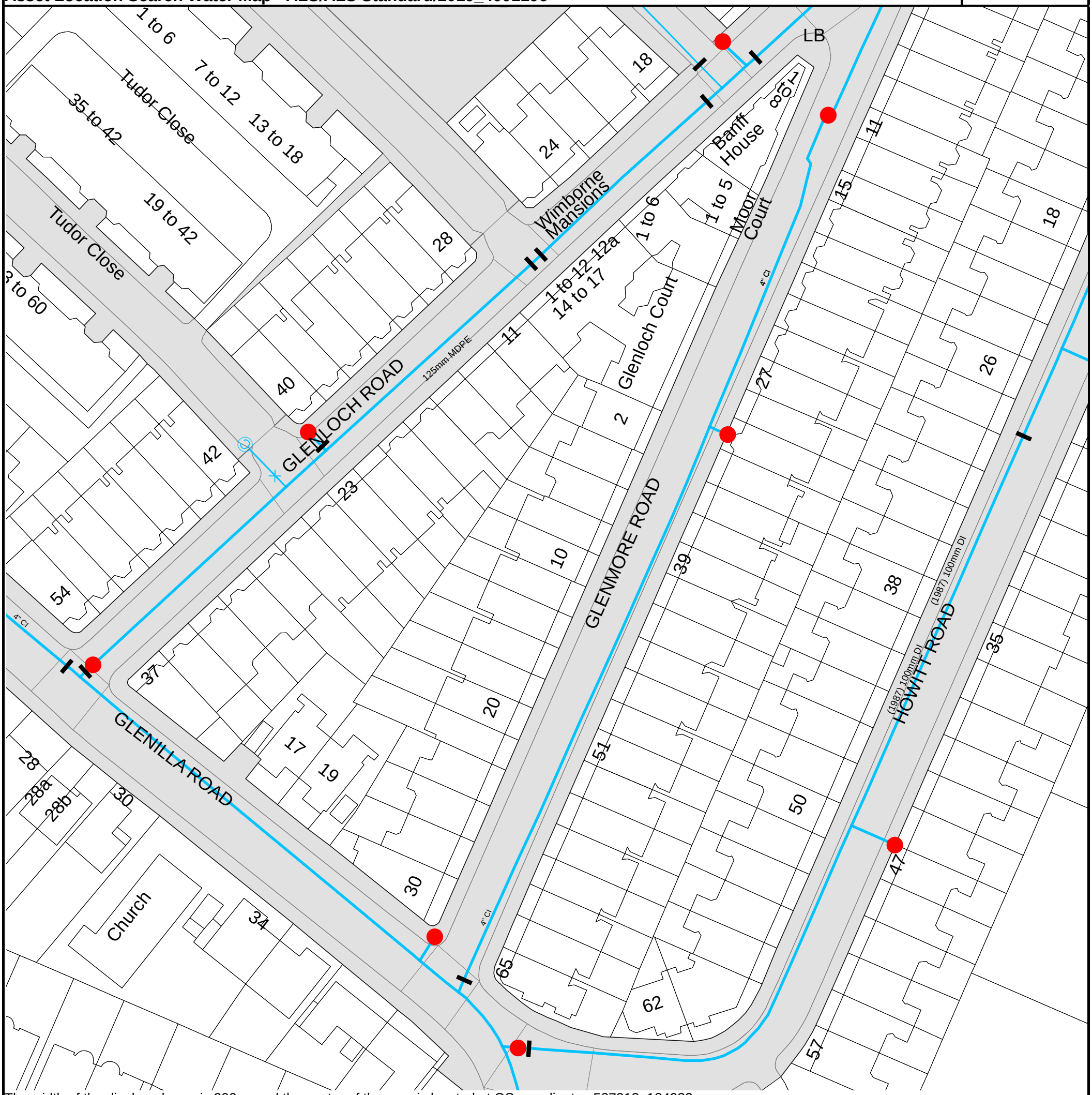
Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plans are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole level indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Asset Location Search Water Map - ALS/ALS Standard/2019_4001196



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 527212, 184932.

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0845 070 9148** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.

Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if the Ombudsman finds that you have suffered actual loss and/or aggravation, distress or inconvenience as a result of your search provider failing to keep to the code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Web site: www.tpos.co.uk
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

Titles

Job No.: J20026
Job Title: 10 Glenmore Road, London NW3 4DB
Sub-title: Vertical Movements from Basement Excavation
Calculation Heading: Drained Total Condition
Initials: ML
Checker:
Date Saved:
Date Checked:
Notes:
File Name: J20026 Total Vertical Movements.pdd
File Path: G:\CURRENT\20-\J20026 - 10 Glenmore Road\APPENDIX

History

Date	Time	By	Notes
14-Feb-2020	13:32	Matt Legg	New
14-Feb-2020	14:47	Matt Legg	
16-Feb-2020	21:03	Matt Legg	
16-Feb-2020	22:03	Matt Legg	
17-Feb-2020	13:46	Matthew Penfold	Open

Analysis Options

General
Global Poisson's ratio: 0.20
Maximum allowable ratio between values of E: 1.5
Horizontal rigid boundary level: 25.40 [m OD]
Displacements at load centroids: Yes
GSA piled raft data : No

Elastic
Elastic : Yes
Analysis: Boussinesq
Stiffness for horizontal displacement calculations: Weighted average
Using legacy heave correction factor: No

Consolidation
Consolidation : No

Soil ProfilesShort-term

Layer ref.	Name	Level at top [mOD]	Number of intermediate displacement levels	Youngs Modulus : Top [kN/m²]	Youngs Modulus : Btm. [kN/m²]	Poissons ratio	Non-linear curve
1	Made Ground	65.400	2	15000.	15000.	0.50000	None
2	L.Clay	63.800	2	33750.	37500.	0.50000	None
3	L.Clay	62.900	2	37500.	45000.	0.50000	None
4	L.Clay	61.400	2	45000.	54000.	0.50000	None
5	L.Clay	59.400	3	54000.	67500.	0.50000	None
6	L.Clay	56.400	6	67500.	103500.	0.50000	None
7	L.Clay	50.400	10	103500.	142500.	0.50000	None
8	L.Clay	40.400	15	142500.	201000.	0.50000	None

Soil ProfilesTotal

Layer ref.	Name	Level at top [mOD]	Number of intermediate displacement levels	Youngs Modulus : Top [kN/m²]	Youngs Modulus : Btm. [kN/m²]	Poissons ratio	Non-linear curve
1	Made Ground	65.400	2	11200.	11200.	0.20000	None
2	L.Clay	63.800	2	25200.	28000.	0.20000	None
3	L.Clay	62.900	2	28000.	33600.	0.20000	None
4	L.Clay	61.400	2	33600.	40320.	0.20000	None
5	L.Clay	59.400	3	40320.	50400.	0.20000	None
6	L.Clay	56.400	6	50400.	77280.	0.20000	None
7	L.Clay	50.400	10	77280.	106400.	0.20000	None
8	L.Clay	40.400	15	106400.	150080.	0.20000	None

Soil Zones

Zone	Name	X min [m]	X max [m]	Y min [m]	Y max [m]	Profile
1	Soil Zone 1	5.0000	25.000	0.0	28.000	Total

Polygonal Load Data

Load ref.	Name	Position : Level [m]	Position : Polygon : Coords. [m]	Position : Polygon : Rect. tolerance [%]	No. of Rectangles	Value : Normal (local z) [kN/m²]
1	Excavation 1	62.70000	(10,10) (10,15.3) (10.9,15.3) (10.9,16.5) (15.8,16.5) (15.8,12.7) (17.8,12.7) (17.8,10) (10,10)	10.000	3	-30.000
2	Excavation 2	62.70000	(15.8,16.5) (19.8,16.5) (19.8,10) (17.8,10) (17.8,12.7) (15.8,12.7) (15.8,16.5)	10.000	2	-46.000
3	No. 8 party wall	62.70000	(10,10) (10,11.4) (19.8,11.4) (19.8,10) (10,10)	10.000	1	57.000
4	No. 12 party wall	62.70000	(10.9,15.1) (10.9,16.5) (19.8,16.5) (19.8,15.1) (10.9,15.1)	10.000	1	57.000
5	Rear elevation	62.70000	(19,11.4) (19,15.1) (19.8,15.1) (19.8,11.4) (19,11.4)	10.000	1	116.00
6	Front elevation	62.70000	(10,11.4) (10,15.1) (11.4,15.1) (11.4,11.4) (10,11.4)	10.000	1	88.000

Polygonal Loads' Rectangles

No.	Centre : Centre x [m]	Centre : Centre y [m]	Angle of local x from global X [Degrees]	Width x [m]	Depth y [m]
Load 1 : Excavation 1					
(Edge 2 optimal)					
1	13.91500	11.35000	90.000	2.7000	7.8300
2	12.91500	14.00000	90.000	2.6000	5.8300
3	13.38000	15.90000	90.000	1.2000	4.9000
Load 2 : Excavation 2					

No.	Centre : Centre : Angle of local x from global X		Width x	Depth y
	x	y		
(Edge 2 optimal)				
1	16.83000	14.60000	0.0	2.0000	3.8000
2	18.83000	13.25000	0.0	2.0000	6.5000
Load 3 : No. 8 party wall					
(Edge 2 optimal)					
1	14.91500	10.70000	90.000	1.4000	9.8300
Load 4 : No. 12 party wall					
(Edge 2 optimal)					
1	15.38000	15.80000	90.000	1.4000	8.9000
Load 5 : Rear elevation					
(Edge 2 optimal)					
1	19.43000	13.25000	90.000	3.7000	0.80000
Load 6 : Front elevation					
(Edge 2 optimal)					
1	10.70000	13.25000	90.000	3.7000	1.4000

Displacement Lines

Name	X1 [m]	Y1 [m]	Z1 [m]	X2 [m]	Y2 [m]	Z2 [m]	Intervals [No.]	Calculate	Detailed Results
8A	10.00000	10.00000	63.71000	10.00000	4.70000	63.71000	5	Yes	Yes
8B	10.00000	4.70000	63.71000	10.93000	4.70000	63.71000	2	Yes	Yes
8C	10.93000	4.70000	63.71000	10.93000	3.50000	63.71000	2	Yes	Yes
8D	10.93000	3.50000	63.71000	19.83000	3.50000	63.71000	9	Yes	Yes
8E	19.83000	3.50000	63.71000	19.83000	10.00000	63.71000	6	Yes	Yes
12A	10.93000	16.50000	63.09000	10.93000	17.70000	63.09000	2	Yes	Yes
12B	10.93000	17.70000	63.09000	10.00000	17.70000	63.09000	2	Yes	Yes
12C	10.00000	17.70000	63.09000	10.00000	23.00000	63.09000	5	Yes	Yes
12D	10.00000	23.00000	63.09000	19.83000	23.00000	63.09000	9	Yes	Yes
12E	19.83000	23.00000	63.09000	19.83000	16.50000	63.09000	9	Yes	Yes

Displacement Grids

Name	Extrusion: Direction	X1 [m]	Y1 [m]	Z1 [m]	X2 [m]	Y2 [m]	Z2 [m]	Intervals Along Line [No.]	Extrusion: Distance [m]	Extrusion: Intervals Along [No.]	Calculate	Detailed Results
Displacement Grid 1	Global X	5.00000	0.00000	62.70000	-	28.00000	62.70000	10	20.00000	10	Yes	Yes

Oasys

GEOTECHNICAL AND ENVIRONMENTALASSOCIATES LTD

10 Glenmore Road, London NW3 4DB

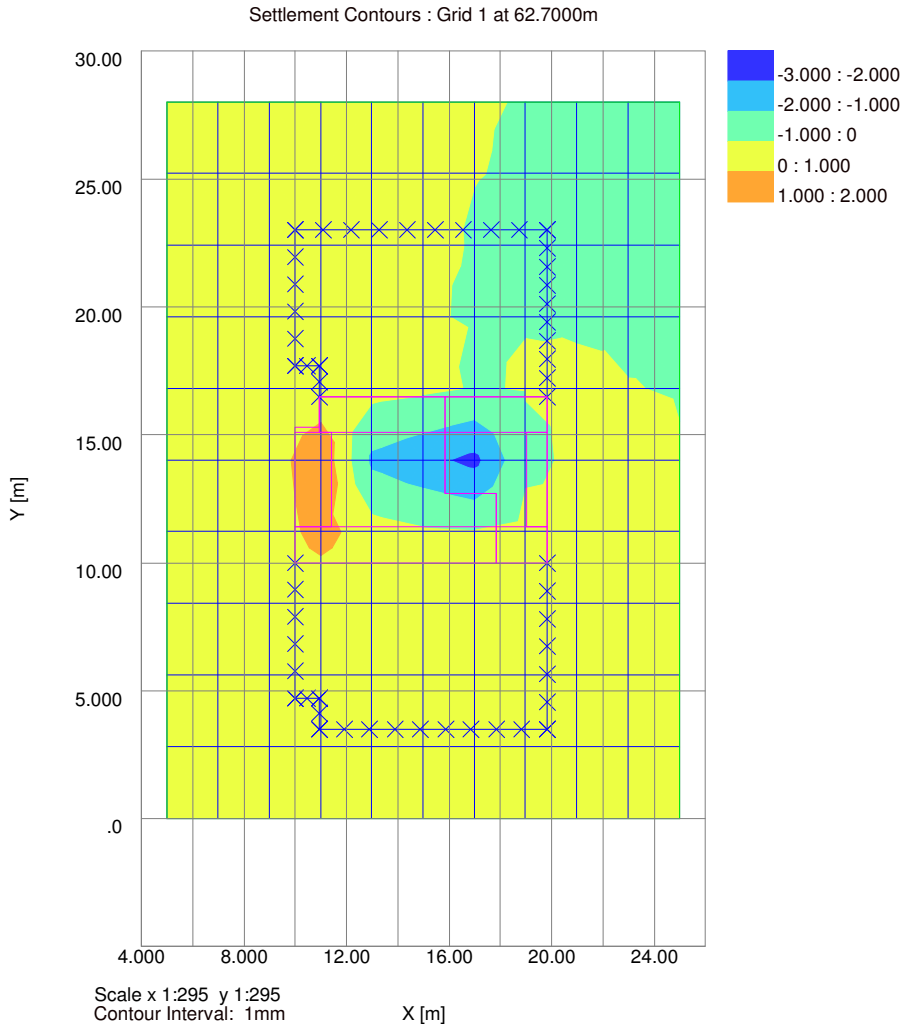
Vertical Movements from Basement Excavation

Undrained Short-term Condition

Job No.	Sheet No.	Rev.
J20026		

Drg. Ref.

Made by	Date	Checked
ML		



Oasys

GEOTECHNICAL AND ENVIRONMENTALASSOCIATES LTD

10 Glenmore Road, London NW3 4DB

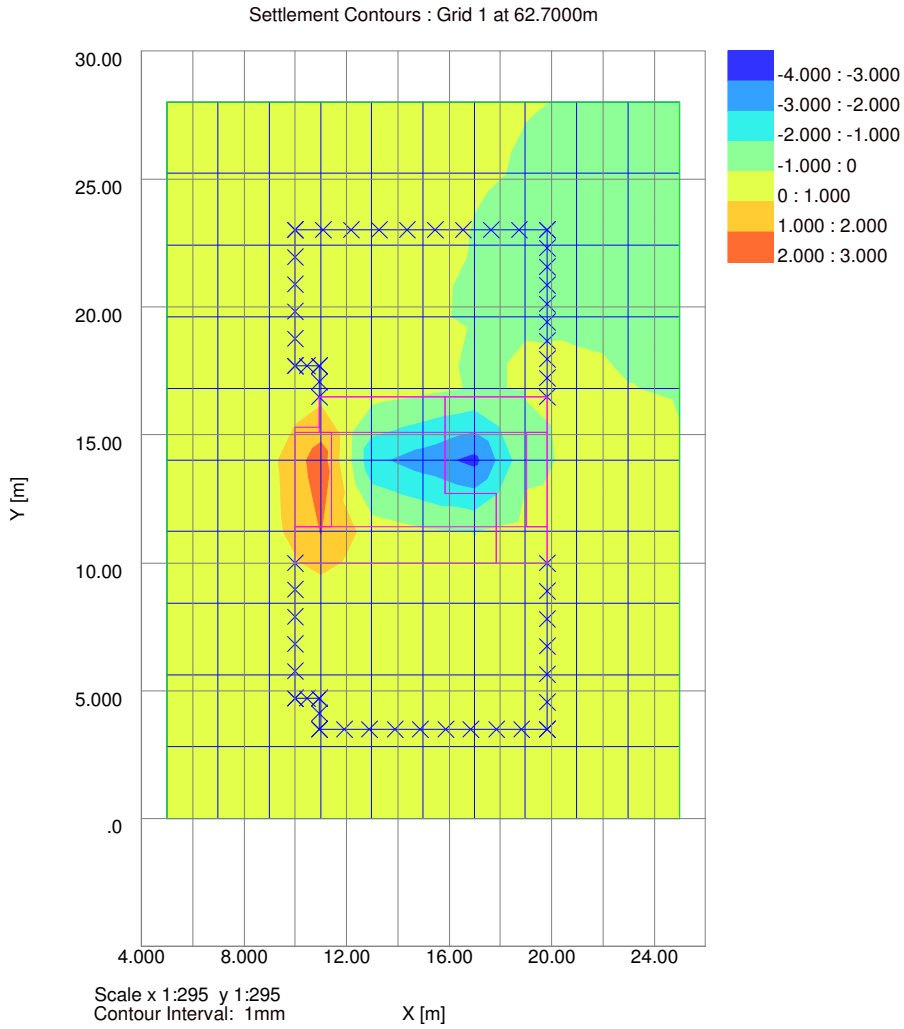
Vertical Movements from Basement Excavation

Drained Total Condition

Job No.	Sheet No.	Rev.
J20026		

Drg. Ref.

Made by	Date	Checked
ML		



Titles

Job No.: J20026
Job Title: 10 Glenmore Road, London NW3 4DB
Sub-title: Vertical and Horizontal Movements from Underpinning
Calculation Heading: Combined P-Disp and X-Disp Models
Initials: ML
Checker:
Date Saved:
Date Checked:
Notes:
File Name: J20026 Building Damage - incl installation.xdd
File Path: C:\Users\Matt Legg\Desktop

History

Date	Time	By	Notes
14-Feb-2020	14:51	Matt Legg	New
14-Feb-2020	15:16	Matt Legg	
16-Feb-2020	21:11	Matt Legg	
23-Mar-2020	17:16	Matt Legg	

Displacement Lines

Ref.	Name	x1 [m]	y1 [m]	z1 [m]	x2 [m]	y2 [m]	z2 [m]	Intervals [No.]	Calculate	Surface type for tunnels
1	8A	10.00000	10.00000	63.71000	10.00000	4.70000	63.71000	5	Surface	Yes
2	8B	10.00000	4.70000	63.71000	10.93000	4.70000	63.71000	2	Surface	Yes
3	8C	10.93000	4.70000	63.71000	10.93000	3.50000	63.71000	2	Surface	Yes
4	8D	10.93000	3.50000	63.71000	19.83000	3.50000	63.71000	9	Surface	Yes
5	8E	19.83000	3.50000	63.71000	19.83000	10.00000	63.71000	6	Surface	Yes
6	12A	10.93000	16.50000	63.09000	10.93000	17.70000	63.09000	2	Surface	Yes
7	12B	10.93000	17.70000	63.09000	10.00000	17.70000	63.09000	2	Surface	Yes
8	12C	10.00000	17.70000	63.09000	10.00000	23.00000	63.09000	5	Surface	Yes
9	12D	10.00000	23.00000	63.09000	19.83000	23.00000	63.09000	9	Surface	Yes
10	12E	19.83000	23.00000	63.09000	19.83000	16.50000	63.09000	9	Surface	Yes
11	8A	10.00000	10.00000	63.71000	10.00000	4.70000	63.71000	5	Surface	Yes
12	8B	10.00000	4.70000	63.71000	10.93000	4.70000	63.71000	2	Surface	Yes
13	8C	10.93000	4.70000	63.71000	10.93000	3.50000	63.71000	2	Surface	Yes
14	8D	10.93000	3.50000	63.71000	19.83000	3.50000	63.71000	9	Surface	Yes
15	8E	19.83000	3.50000	63.71000	19.83000	10.00000	63.71000	6	Surface	Yes
16	12A	10.93000	16.50000	63.09000	10.93000	17.70000	63.09000	2	Surface	Yes
17	12B	10.93000	17.70000	63.09000	10.00000	17.70000	63.09000	2	Surface	Yes
18	12C	10.00000	17.70000	63.09000	10.00000	23.00000	63.09000	5	Surface	Yes
19	12D	10.00000	23.00000	63.09000	19.83000	23.00000	63.09000	9	Surface	Yes
20	12E	19.83000	23.00000	63.09000	19.83000	16.50000	63.09000	9	Surface	Yes

Displacement Grids

Ref.	Name	Extrusion: Direction	Base line start: X [m]	Base line start: Y [m]	Base line start: Z(level) [m]	Base line end: X [m]	Base line end: Y [m]	Base line end: Z(level) [m]	Base line: Intervals [No.]	Extrusion: Distance [m]	Extrusion: Intervals [No.]	Surface type for tunnels	Calculate
1	Displacement Grid 1	Global X	5.00000	0.00000	62.70000	-	28.00000	62.70000	20	20.00000	20	Surface	Yes
2	Displacement Grid 2	Global X	5.00000	0.00000	63.71000	-	28.00000	63.71000	20	20.00000	20	Surface	Yes
3	Displacement Grid 1	Global X	5.00000	0.00000	62.70000	-	28.00000	62.70000	10	20.00000	10	Surface	Yes

Imported Displacements

The following data points and displacements were found in the import file .

Ref.	Coordinates: x [m]	Coordinates: y [m]	Coordinates: z [m]	Displacements: x [mm]	Displacements: y [mm]	Displacements: z [mm]	
1	10.000	10.000	63.710	0.0	0.0	0.88754	1,2,6
2	10.000	8.9400	63.710	0.0	0.0	0.36127	1,2,6
3	10.000	7.8800	63.710	0.0	0.0	0.20694	1,2,6
4	10.000	6.8200	63.710	0.0	0.0	0.13156	1,2,6
5	10.000	5.7600	63.710	0.0	0.0	0.089331	1,2,6
6	10.000	4.7000	63.710	0.0	0.0	0.063611	1,2,6
7	10.000	4.7000	63.710	0.0	0.0	0.063611	1,2,6
8	10.465	4.7000	63.710	0.0	0.0	0.063681	1,2,6
9	10.930	4.7000	63.710	0.0	0.0	0.063124	1,2,6
10	10.930	4.7000	63.710	0.0	0.0	0.063124	1,2,6
11	10.930	4.1000	63.710	0.0	0.0	0.052722	1,2,6
12	10.930	3.5000	63.710	0.0	0.0	0.044531	1,2,6
13	10.930	3.5000	63.710	0.0	0.0	0.044531	1,2,6
14	11.919	3.5000	63.710	0.0	0.0	0.042273	1,2,6
15	12.908	3.5000	63.710	0.0	0.0	0.038664	1,2,6
16	13.897	3.5000	63.710	0.0	0.0	0.034117	1,2,6
17	14.886	3.5000	63.710	0.0	0.0	0.029137	1,2,6
18	15.874	3.5000	63.710	0.0	0.0	0.024200	1,2,6
19	16.863	3.5000	63.710	0.0	0.0	0.019660	1,2,6
20	17.852	3.5000	63.710	0.0	0.0	0.015719	1,2,6
21	18.841	3.5000	63.710	0.0	0.0	0.012438	1,2,6
22	19.830	3.5000	63.710	0.0	0.0	0.0097781	1,2,6
23	19.830	3.5000	63.710	0.0	0.0	0.0097781	1,2,6
24	19.830	4.5833	63.710	0.0	0.0	0.011271	1,2,6
25	19.830	5.6667	63.710	0.0	0.0	0.013561	1,2,6
26	19.830	6.7500	63.710	0.0	0.0	0.017885	1,2,6
27	19.830	7.8333	63.710	0.0	0.0	0.027931	1,2,6
28	19.830	8.9167	63.710	0.0	0.0	0.057055	1,2,6
29	19.830	10.000	63.710	0.0	0.0	0.22181	1,2,6
30	10.930	16.500	63.090	0.0	0.0	0.75837	1,2,6
31	10.930	17.100	63.090	0.0	0.0	0.38739	1,2,6
32	10.930	17.700	63.090	0.0	0.0	0.25360	1,2,6
33	10.930	17.700	63.090	0.0	0.0	0.25360	1,2,6
34	10.465	17.700	63.090	0.0	0.0	0.23834	1,2,6
35	10.000	17.700	63.090	0.0	0.0	0.21978	1,2,6
36	10.000	17.700	63.090	0.0	0.0	0.21978	1,2,6
37	10.000	18.760	63.090	0.0	0.0	0.13283	1,2,6
38	10.000	19.820	63.090	0.0	0.0	0.085092	1,2,6
39	10.000	20.880	63.090	0.0	0.0	0.057263	1,2,6
40	10.000	21.940	63.090	0.0	0.0	0.040159	1,2,6
41	10.000	23.000	63.090	0.0	0.0	0.029161	1,2,6
42	10.000	23.000	63.090	0.0	0.0	0.029161	1,2,6
43	11.092	23.000	63.090	0.0	0.0	0.026741	1,2,6
44	12.184	23.000	63.090	0.0	0.0	0.022765	1,2,6
45	13.277	23.000	63.090	0.0	0.0	0.017561	1,2,6
46	14.369	23.000	63.090	0.0	0.0	0.011756	1,2,6
47	15.461	23.000	63.090	0.0	0.0	0.0061242	1,2,6
48	16.553	23.000	63.090	0.0	0.0	0.0013634	1,2,6
49	17.646	23.000	63.090	0.0	0.0	-0.0020985	1,2,6
50	18.738	23.000	63.090	0.0	0.0	-0.0041906	1,2,6
51	19.830	23.000	63.090	0.0	0.0	-0.0051371	1,2,6
52	19.830	23.000	63.090	0.0	0.0	-0.0051371	1,2,6
53	19.830	22.278	63.090	0.0	0.0	-0.0068742	1,2,6
54	19.830	21.556	63.090	0.0	0.0	-0.0090193	1,2,6
55	19.830	20.833	63.090	0.0	0.0	-0.011575	1,2,6
56	19.830	20.111	63.090	0.0	0.0	-0.014404	1,2,6
57	19.830	19.389	63.090	0.0	0.0	-0.016996	1,2,6
58	19.830	18.667	63.090	0.0	0.0	-0.017855	1,2,6
59	19.830	17.944	63.090	0.0	0.0	-0.012714	1,2,6

Ref.	Coordinates: x [m]	Coordinates: y [m]	Coordinates: z [m]	Displacements: x [mm]	Displacements: y [mm]	Displacements: z [mm]	
60	19.830	17.222	63.090	0.0	0.0	0.011854	1,2,6
61	19.830	16.500	63.090	0.0	0.0	0.14559	1,2,6
62	5.0000	0.0	62.700	0.0	0.0	0.017418	1
63	7.0000	0.0	62.700	0.0	0.0	0.019295	1
64	9.0000	0.0	62.700	0.0	0.0	0.020128	1
65	11.000	0.0	62.700	0.0	0.0	0.019475	1
66	13.000	0.0	62.700	0.0	0.0	0.017314	1
67	15.000	0.0	62.700	0.0	0.0	0.014152	1
68	17.000	0.0	62.700	0.0	0.0	0.010748	1
69	19.000	0.0	62.700	0.0	0.0	0.0077142	1
70	21.000	0.0	62.700	0.0	0.0	0.0053241	1
71	23.000	0.0	62.700	0.0	0.0	0.0035777	1
72	25.000	0.0	62.700	0.0	0.0	0.0023560	1
73	5.0000	2.8000	62.700	0.0	0.0	0.028674	1
74	7.0000	2.8000	62.700	0.0	0.0	0.033955	1
75	9.0000	2.8000	62.700	0.0	0.0	0.037352	1
76	11.000	2.8000	62.700	0.0	0.0	0.036906	1
77	13.000	2.8000	62.700	0.0	0.0	0.032025	1
78	15.000	2.8000	62.700	0.0	0.0	0.024453	1
79	17.000	2.8000	62.700	0.0	0.0	0.016860	1
80	19.000	2.8000	62.700	0.0	0.0	0.010907	1
81	21.000	2.8000	62.700	0.0	0.0	0.0068293	1
82	23.000	2.8000	62.700	0.0	0.0	0.0041799	1
83	25.000	2.8000	62.700	0.0	0.0	0.0024921	1
84	5.0000	5.6000	62.700	0.0	0.0	0.048519	1
85	7.0000	5.6000	62.700	0.0	0.0	0.064847	1
86	9.0000	5.6000	62.700	0.0	0.0	0.080298	1
87	11.000	5.6000	62.700	0.0	0.0	0.084554	1
88	13.000	5.6000	62.700	0.0	0.0	0.071026	1
89	15.000	5.6000	62.700	0.0	0.0	0.048454	1
90	17.000	5.6000	62.700	0.0	0.0	0.028977	1
91	19.000	5.6000	62.700	0.0	0.0	0.016727	1
92	21.000	5.6000	62.700	0.0	0.0	0.0096797	1
93	23.000	5.6000	62.700	0.0	0.0	0.0053216	1
94	25.000	5.6000	62.700	0.0	0.0	0.0026944	1
95	5.0000	8.4000	62.700	0.0	0.0	0.080097	1
96	7.0000	8.4000	62.700	0.0	0.0	0.13120	1
97	9.0000	8.4000	62.700	0.0	0.0	0.21811	1
98	11.000	8.4000	62.700	0.0	0.0	0.28954	1
99	13.000	8.4000	62.700	0.0	0.0	0.22954	1
100	15.000	8.4000	62.700	0.0	0.0	0.13789	1
101	17.000	8.4000	62.700	0.0	0.0	0.079047	1
102	19.000	8.4000	62.700	0.0	0.0	0.047214	1
103	21.000	8.4000	62.700	0.0	0.0	0.025746	1
104	23.000	8.4000	62.700	0.0	0.0	0.010449	1
105	25.000	8.4000	62.700	0.0	0.0	0.0037073	1
106	5.0000	11.200	62.700	0.0	0.0	0.11245	1
107	7.0000	11.200	62.700	0.0	0.0	0.22699	1
108	9.0000	11.200	62.700	0.0	0.0	0.61563	1
109	11.000	11.200	62.700	0.0	0.0	2.0269	1
110	13.000	11.200	62.700	0.0	0.0	0.55097	1
111	15.000	11.200	62.700	0.0	0.0	0.12594	1
112	17.000	11.200	62.700	0.0	0.0	-0.0071015	1
113	19.000	11.200	62.700	0.0	0.0	0.31124	1
114	21.000	11.200	62.700	0.0	0.0	0.12604	1
115	23.000	11.200	62.700	0.0	0.0	0.023875	1
116	25.000	11.200	62.700	0.0	0.0	0.0052264	1
117	5.0000	14.000	62.700	0.0	0.0	0.11468	1
118	7.0000	14.000	62.700	0.0	0.0	0.23684	1
119	9.0000	14.000	62.700	0.0	0.0	0.68666	1
120	11.000	14.000	62.700	0.0	0.0	2.5158	1
121	13.000	14.000	62.700	0.0	0.0	-1.7683	1
122	15.000	14.000	62.700	0.0	0.0	-2.4993	1
123	17.000	14.000	62.700	0.0	0.0	-3.3162	1
124	19.000	14.000	62.700	0.0	0.0	-0.21650	1
125	21.000	14.000	62.700	0.0	0.0	0.16114	1
126	23.000	14.000	62.700	0.0	0.0	0.022456	1
127	25.000	14.000	62.700	0.0	0.0	0.0029774	1
128	5.0000	16.800	62.700	0.0	0.0	0.083324	1
129	7.0000	16.800	62.700	0.0	0.0	0.14213	1
130	9.0000	16.800	62.700	0.0	0.0	0.25743	1
131	11.000	16.800	62.700	0.0	0.0	0.51162	1
132	13.000	16.800	62.700	0.0	0.0	0.48057	1
133	15.000	16.800	62.700	0.0	0.0	0.22346	1
134	17.000	16.800	62.700	0.0	0.0	-0.070960	1
135	19.000	16.800	62.700	0.0	0.0	0.040117	1
136	21.000	16.800	62.700	0.0	0.0	0.016936	1
137	23.000	16.800	62.700	0.0	0.0	649.16E-6	1
138	25.000	16.800	62.700	0.0	0.0	-0.0025848	1
139	5.0000	19.600	62.700	0.0	0.0	0.049603	1
140	7.0000	19.600	62.700	0.0	0.0	0.067906	1
141	9.0000	19.600	62.700	0.0	0.0	0.086893	1
142	11.000	19.600	62.700	0.0	0.0	0.092604	1
143	13.000	19.600	62.700	0.0	0.0	0.066207	1
144	15.000	19.600	62.700	0.0	0.0	0.018261	1
145	17.000	19.600	62.700	0.0	0.0	-0.016253	1
146	19.000	19.600	62.700	0.0	0.0	-0.019568	1
147	21.000	19.600	62.700	0.0	0.0	-0.011936	1
148	23.000	19.600	62.700	0.0	0.0	-0.0072954	1
149	25.000	19.600	62.700	0.0	0.0	-0.0049279	1
150	5.0000	22.400	62.700	0.0	0.0	0.028028	1
151	7.0000	22.400	62.700	0.0	0.0	0.033019	1
152	9.0000	22.400	62.700	0.0	0.0	0.035467	1
153	11.000	22.400	62.700	0.0	0.0	0.032416	1
154	13.000	22.400	62.700	0.0	0.0	0.022605	1
155	15.000	22.400	62.700	0.0	0.0	0.0093310	1
156	17.000	22.400	62.700	0.0	0.0	-0.0013322	1
157	19.000	22.400	62.700	0.0	0.0	-0.0060627	1
158	21.000	22.400	62.700	0.0	0.0	-0.0064003	1
159	23.000	22.400	62.700	0.0	0.0	-0.0052110	1
160	25.000	22.400	62.700	0.0	0.0	-0.0039401	1
161	5.0000	25.200	62.700	0.0	0.0	0.016134	1
162	7.0000	25.200	62.700	0.0	0.0	0.017392	1
163	9.0000	25.200	62.700	0.0	0.0	0.017213	1
164	11.000	25.200	62.700	0.0	0.0	0.015032	1
165	13.000	25.200	62.700	0.0	0.0	0.010949	1
166	15.000	25.200	62.700	0.0	0.0	0.0060020	1
167	17.000	25.200	62.700	0.0	0.0	0.0016576	1
168	19.000	25.200	62.700	0.0	0.0	-0.0011305	1
169	21.000	25.200	62.700	0.0	0.0	-0.0023577	1
170	23.000	25.200	62.700	0.0	0.0	-0.0025768	1
171	25.000	25.200	62.700	0.0	0.0	-0.0023340	1
172	5.0000	28.000	62.700	0.0	0.0	0.0096537	1
173	7.0000	28.000	62.700	0.0	0.0	0.0098995	1
174	9.0000	28.000	62.700	0.0	0.0	0.0094462	1
175	11.000	28.000	62.700	0.0	0.0	0.0081966	1
176	13.000	28.000	62.700	0.0	0.0	0.0062796	1
177	15.000	28.000	62.700	0.0	0.0	0.0040607	1
178	17.000	28.000	62.700	0.0	0.0	0.0019978	1
179	19.000	28.000	62.700	0.0	0.0	428.88E-6	1
180	21.000	28.000	62.700	0.0	0.0	-545.91E-6	1
181	23.000	28.000	62.700	0.0	0.0	-0.0010209	1
182	25.000	28.000	62.700	0.0	0.0	-0.0011637	1

1 - Data point coincident with displacement location. Its displacement has been added to those calculated by Xdisp.
2 - Data point coincident with horizontal movement calculation point for a specific building. Its displacement has been added before performing building damage calculations.
6 - Data point coincident with vertical movement calculation point for a specific building. Its displacement has been added before performing building damage calculations.

Polygonal Excavations

Ref. 1
Excavation Name: **Excavation 1**
Surface level [m]: 63.710
Contribution: Positive

Corner	x [m]	y [m]	Base Level [m]	Arc Enabled	Stiffened	Prev. Side: d [m]	Prev. Side: p1 [%]	Prev. Side: p2* [%]	Next Side: d [m]	Next Side: p1 [%]	Next Side: p2* [%]

Corner	x [m]	y [m]	Base Level [m]	Arc Enabled	Stiffened	Prev. Side: d [m]	Prev. Side: p1 [%]	Prev. Side: p2* [%]	Next Side: d [m]	Next Side: p1 [%]	Next Side: p2* [%]
1	10.000	10.000	62.700	Yes	Yes	0.0	67.000	25.000	0.0	67.000	25.000
2	10.000	15.300	62.700	Yes	Yes	0.0	67.000	25.000	0.0	67.000	25.000
3	10.930	15.300	62.700	Yes	No	-	-	-	-	-	-
4	10.930	16.500	63.320	Yes	Yes	0.0	67.000	25.000	0.0	67.000	25.000
5	19.830	16.500	63.320	Yes	Yes	0.0	67.000	25.000	0.0	67.000	25.000
6	19.830	10.000	62.700	Yes	Yes	0.0	67.000	25.000	0.0	67.000	25.000
7	10.000	10.000	62.700	Yes	Yes	0.0	67.000	25.000	0.0	67.000	25.000

Side	x1 [m]	y1 [m]	x2 [m]	y2 [m]	G.M. Curve: Vertical	G.M. Curve: Horizontal
1	10.000	10.000	10.000	15.300	No vertical ground movement	Underpinning
2	10.000	15.300	10.930	15.300	No vertical ground movement	Half underpinning for re-entrant corner
3	10.930	15.300	10.930	16.500	No vertical ground movement	Half underpinning for re-entrant corner
4	10.930	16.500	19.830	16.500	No vertical ground movement	Underpinning
5	19.830	16.500	19.830	10.000	No vertical ground movement	Underpinning
6	19.830	10.000	10.000	10.000	No vertical ground movement	Underpinning
7	10.000	10.000	10.000	10.000	No vertical ground movement	No horizontal ground movement

Ref. 2
Excavation Name: **Installation Phase**
Surface level [m]: 63.710
Contribution: Positive

Corner	x [m]	y [m]	Base Level [m]	Arc Enabled	Stiffened	Prev. Side: d [m]	Prev. Side: p1 [%]	Prev. Side: p2* [%]	Next Side: d [m]	Next Side: p1 [%]	Next Side: p2* [%]
1	10.000	10.000	62.700	Yes	Yes	0.0	67.000	25.000	0.0	67.000	25.000
2	10.000	15.300	62.700	Yes	Yes	0.0	67.000	25.000	0.0	67.000	25.000
3	10.930	15.300	62.700	Yes	No	-	-	-	-	-	-
4	10.930	16.500	63.320	Yes	Yes	0.0	67.000	25.000	0.0	67.000	25.000
5	19.830	16.500	63.320	Yes	Yes	0.0	67.000	25.000	0.0	67.000	25.000
6	19.830	10.000	62.700	Yes	Yes	0.0	67.000	25.000	0.0	67.000	25.000
7	10.000	10.000	62.700	Yes	Yes	0.0	67.000	25.000	0.0	67.000	25.000

Side	x1 [m]	y1 [m]	x2 [m]	y2 [m]	G.M. Curve: Vertical	G.M. Curve: Horizontal
1	10.000	10.000	10.000	15.300	Inst. of planar diaphragm wall in stiff clay (CIRIA C760 Fig. 6.9(b))	Inst. of planar diaphragm wall in stiff clay (CIRIA C760 Fig. 6.9(a))
2	10.000	15.300	10.930	15.300	Half Inst. of planar diaphragm wall in stiff clay for re-entrant corner	Half Inst. of planar diaphragm wall in stiff clay for re-entrant corner
3	10.930	15.300	10.930	16.500	Half Inst. of planar diaphragm wall in stiff clay for re-entrant corner	Half Inst. of planar diaphragm wall in stiff clay for re-entrant corner
4	10.930	16.500	19.830	16.500	Inst. of planar diaphragm wall in stiff clay (CIRIA C760 Fig. 6.9(b))	Inst. of planar diaphragm wall in stiff clay (CIRIA C760 Fig. 6.9(a))
5	19.830	16.500	19.830	10.000	Inst. of planar diaphragm wall in stiff clay (CIRIA C760 Fig. 6.9(b))	Inst. of planar diaphragm wall in stiff clay (CIRIA C760 Fig. 6.9(a))
6	19.830	10.000	10.000	10.000	Inst. of planar diaphragm wall in stiff clay (CIRIA C760 Fig. 6.9(b))	Inst. of planar diaphragm wall in stiff clay (CIRIA C760 Fig. 6.9(a))
7	10.000	10.000	10.000	10.000	No vertical ground movement	No horizontal ground movement

Circular Excavations

Vertical Ground Movement Curves

Curve Name: **No vertical ground movement**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Settlement / wall depth or max. excavation depth (z)(%)]

[0.000,0.000,0.025][1.000,0.000,0.000][0.000,1.000,0.000][1.000,1.000,0.000]

Curve Fitting Method: Polynomial
x Order: 1
y Order: 0
Polynomial: z = -1.25E-2x + 1.25E-2
Coeff. of Determination: 3.33E-1

Curve Name: **Inst. of planar diaphragm wall in stiff clay (CIRIA C760 Fig. 6.9(b))**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Settlement / wall depth or max. excavation depth (z)(%)]

[0.000,0.000,0.050][0.050,0.000,0.047][0.100,0.000,0.043][0.150,0.000,0.040]
[0.200,0.000,0.037][0.250,0.000,0.034][0.300,0.000,0.031][0.350,0.000,0.028]
[0.400,0.000,0.025][0.450,0.000,0.022][0.500,0.000,0.020][0.550,0.000,0.018]
[0.600,0.000,0.015][0.650,0.000,0.013][0.700,0.000,0.012][0.750,0.000,0.010]
[0.800,0.000,0.008][0.850,0.000,0.007][0.900,0.000,0.006][0.950,0.000,0.005]
[1.000,0.000,0.004][1.050,0.000,0.003][1.100,0.000,0.003][1.150,0.000,0.002]
[1.200,0.000,0.002][1.250,0.000,0.001][1.300,0.000,0.001][1.350,0.000,0.001]
[1.400,0.000,0.001][1.450,0.000,0.000][1.500,0.000,0.000]

Curve Fitting Method: Polynomial
x Order: 4
y Order: 0
Polynomial: z = $-1.2355E-2x^4 + 3.4814E-2x^3 - 2.8885E-3x^2 - 6.5618E-2x + 4.9987E-2$
Coeff. of Determination: 1.0000

Curve Name: **Half Inst. of planar diaphragm wall in stiff clay for re-entrant corner**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Settlement / wall depth or max. excavation depth (z)(%)]

[0.000,0.000,0.025][0.050,0.000,0.023][0.100,0.000,0.022][0.150,0.000,0.020]
[0.200,0.000,0.019][0.250,0.000,0.017][0.300,0.000,0.015][0.350,0.000,0.014]
[0.400,0.000,0.013][0.450,0.000,0.011][0.500,0.000,0.010][0.550,0.000,0.009]
[0.600,0.000,0.007][0.650,0.000,0.006][0.700,0.000,0.006][0.750,0.000,0.005]
[0.800,0.000,0.004][0.850,0.000,0.004][0.900,0.000,0.003][0.950,0.000,0.003]
[1.000,0.000,0.002][1.050,0.000,0.002][1.100,0.000,0.002][1.150,0.000,0.001]
[1.200,0.000,0.001][1.250,0.000,0.001][1.300,0.000,0.001][1.350,0.000,0.001]
[1.400,0.000,0.001][1.450,0.000,0.000][1.500,0.000,0.000]

Curve Fitting Method: Polynomial
x Order: 4
y Order: 0
Polynomial: z = $-7.2134E-3x^4 + 2.0629E-2x^3 - 4.4648E-3x^2 - 3.2016E-2x + 2.5043E-2$
Coeff. of Determination: 9.9943E-1

Horizontal Ground Movement Curves

Curve Name: **No horizontal ground movement**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Horizontal movement / wall depth or max. excavation depth (z)(%)]
[0.000,0.000,0.000][1.000,0.000,0.000][0.000,1.000,0.000][1.000,1.000,0.000]
Curve Fitting Method: Polynomial
x Order: 0
y Order: 0
Polynomial: z = 0.0
Coeff. of Determination:

Curve Name: **Inst. of planar diaphragm wall in stiff clay (CIRIA C760 Fig. 6.9(a))**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall

Side	x1 [m]	y1 [m]	x2 [m]	y2 [m]	G.M. Curve: Vertical	G.M. Curve: Horizontal

depth or max. excavation depth (y), Horizontal movement / wall depth or max. excavation depth (z)(%)]
[0.000,0.000,0.050][1.500,0.000,0.000]
Curve Fitting Method: Polynomial
x Order: 1
y Order: 0
Polynomial: z = -3.33E-2x + 5.00E-2
Coeff. of Determination: 1.00

Curve Name: **Underpinning**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Horizontal movement / wall depth or max. excavation depth (z)(%)]
[0.000,0.000,0.150][4.000,0.000,0.000]
Curve Fitting Method: Polynomial
x Order: 1
y Order: 0
Polynomial: z = -3.75E-2x + 1.50E-1
Coeff. of Determination: 1.00

Curve Name: **Half underpinning for re-entrant corner**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Horizontal movement / wall depth or max. excavation depth (z)(%)]
[0.000,0.000,0.075][4.000,0.000,0.000]
Curve Fitting Method: Polynomial
x Order: 1
y Order: 0
Polynomial: z = -1.88E-2x + 7.50E-2
Coeff. of Determination: 1.00

Curve Name: **Half Inst. of planar diaphragm wall in stiff clay for re-entrant corner**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Horizontal movement / wall depth or max. excavation depth (z)(%)]
[0.000,0.000,0.050][1.500,0.000,0.000]
Curve Fitting Method: Polynomial
x Order: 1
y Order: 0
Polynomial: z = -3.33E-2x + 5.00E-2
Coeff. of Determination: 1.00

Damage Category Strains

Ref.	Name	0 (Negligible) to 1 (Very Slight)	1 (Very Slight) to 2 (Slight)	2 (Slight) to 3 (Moderate)	3 (Moderate) to 4 (Severe)
1	Burland Strain Limits	0.0	500.00E-6	750.00E-6	0.0015000

Specific Buildings - Geometry

Ref.	Building Name	Sub-Building Name	Displacement Line	Distance Along Line: Start [m]	Distance Along Line: End [m]	Vertical Offsets from Line for Vertical Movement Calculations [m]	Vertical Displacement Limit Sensitivity [mm]	Damage Category Strains	Poisson's Ratio	E/G
1	8 Glenmore Road	8A	8A	0.00000	5.30000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
2	8 Glenmore Road	8B	8B	0.00000	0.90000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
3	8 Glenmore Road	8C	8C	0.00000	1.20000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
4	8 Glenmore Road	8D	8D	0.00000	8.80000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
5	8 Glenmore Road	8E	8E	0.00000	6.50000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
6	12 Glenmore Road	12A	12A	0.00000	1.10000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
7	12 Glenmore Road	12B	12B	0.00000	0.90000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
8	12 Glenmore Road	12C	12C	0.00000	5.30000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
9	12 Glenmore Road	12D	12D	0.00000	9.80000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
10	12 Glenmore Road	12E	12E	0.00000	6.50000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000

Specific Buildings - Bending Parameters

Ref.	Building Name	Sub-Building Name	Height [m]	Default	Hogging: 2nd Mom. of Area (per unit width) [m³]	Hogging: Dist. of Bending Strain from N.A. [m]	Hogging: Dist. of N.A. from Edge of Beam in Tension [m]	Sagging: 2nd Mom. of Area (per unit width) [m³]	Sagging: Dist. of Bending Strain from N.A. [m]	Sagging: Dist. of N.A. from Edge of Beam in Tension [m]
1	8 Glenmore Road	8A	9.0000	Yes	243.00	9.0000	9.0000	60.750	4.5000	4.5000
2	8 Glenmore Road	8B	9.0000	Yes	243.00	9.0000	9.0000	60.750	4.5000	4.5000
3	8 Glenmore Road	8C	9.0000	Yes	243.00	9.0000	9.0000	60.750	4.5000	4.5000
4	8 Glenmore Road	8D	9.0000	Yes	243.00	9.0000	9.0000	60.750	4.5000	4.5000
5	8 Glenmore Road	8E	9.0000	Yes	243.00	9.0000	9.0000	60.750	4.5000	4.5000
6	12 Glenmore Road	12A	9.0000	Yes	243.00	9.0000	9.0000	60.750	4.5000	4.5000
7	12 Glenmore Road	12B	9.0000	Yes	243.00	9.0000	9.0000	60.750	4.5000	4.5000
8	12 Glenmore Road	12C	9.0000	Yes	243.00	9.0000	9.0000	60.750	4.5000	4.5000
9	12 Glenmore Road	12D	9.0000	Yes	243.00	9.0000	9.0000	60.750	4.5000	4.5000
10	12 Glenmore Road	12E	9.0000	Yes	243.00	9.0000	9.0000	60.750	4.5000	4.5000

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10 Glenmore Road, London NW3 4DB

Vertical and Horizontal Movements from Underpinning

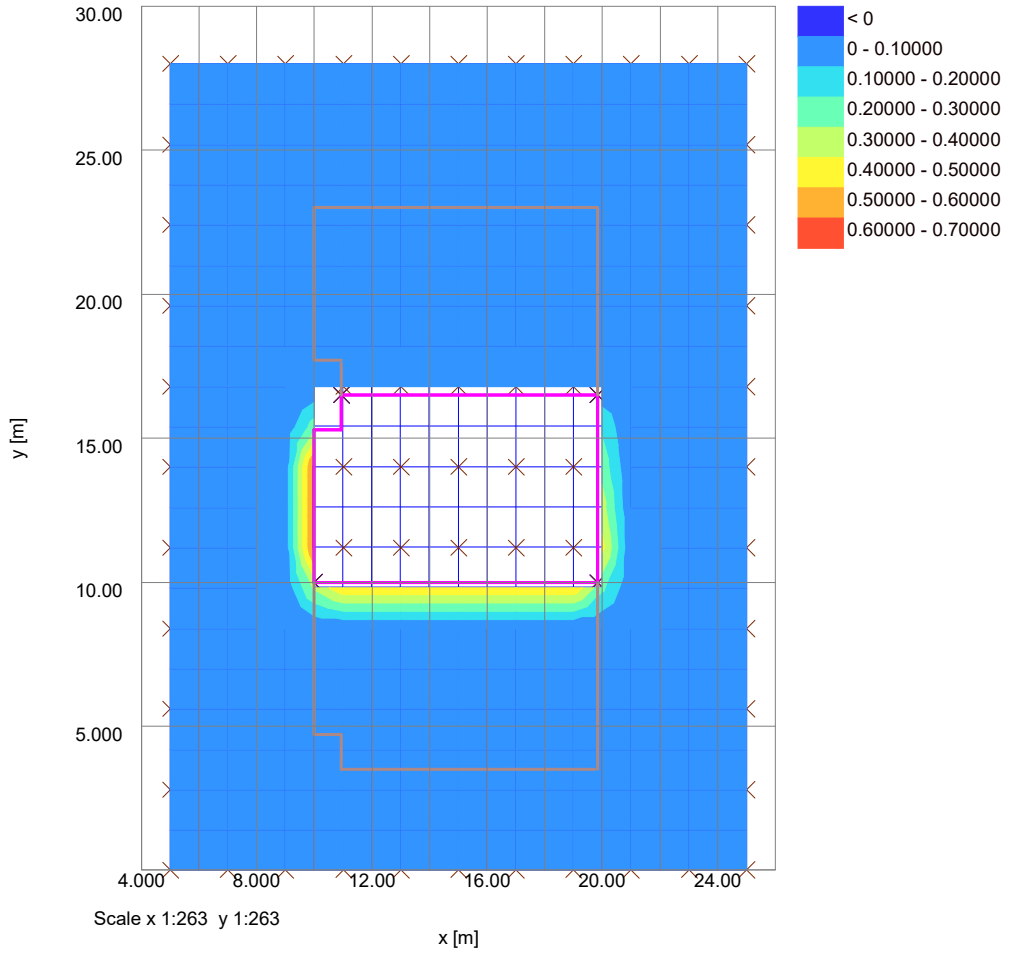
Combined P-Disp and X-Disp Models

Job No.	Sheet No.	Rev.
J20026		

Drg. Ref.

Made by	Date	Checked
ML		

Vertical Settlement Contours: Grid 2 (level 63.710m) (Interval 0.1mm)



Scale x 1:263 y 1:263

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Vertical and Horizontal Movements from Underpinning

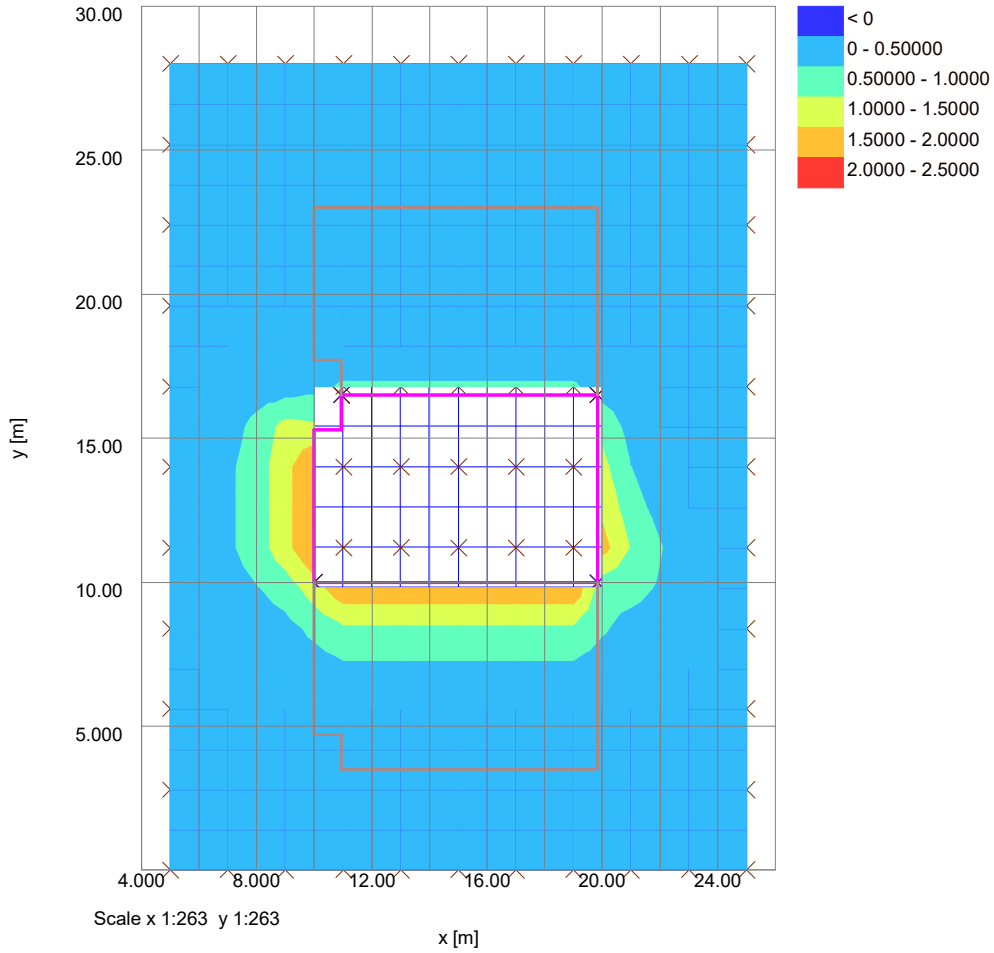
Combined P-Disp and X-Disp Models

Job No.	Sheet No.	Rev.
J20026		

Drg. Ref.

Made by	Date	Checked
ML		

Horizontal Displacement Contours: Grid 2 (level 63.710m) Interval 0.5mm



Scale x 1:263 y 1:263

Specific Building Damage Results - Detail

Stage: Ref.	Stage: Name	Specific Building: Ref.	Specific Building: Name	Sub-building Name	Vertical Offset from Line for Vertical Movement Calculations [m]	Segment	Start [m]	Length [m]	Curvature	Deflection Ratio [%]	Average Horizontal Strain [%]	Max Tensile Strain [%]	Max Gradient of Horizontal Displacement Curve	Max Gradient of Vertical Displacement Curve	Min Radius of Curvature [m]	Damage Category
0	Base Model	1	8 Glenmore Road	8A	0.0	1	0.0	5.3000	Hogging	0.013023	0.012768	0.019973	-346.99E-6	875.16E-6	1228.7	0 (Negligible)
		2	8 Glenmore Road	8B	0.0	1	0.0	0.90000	Hogging	0.0067527	0.0	0.0067483	0.0	136.65E-6	1659.3	0 (Negligible)
		3	8 Glenmore Road	8C	0.0	1	0.0	0.0	None	0.0	0.0	35.763E-9	0.0	122.54E-6	3276.7	0 (Negligible)
		4	8 Glenmore Road	8D	0.0	All vertical displacements are less than the limit sensitivity.										
		5	8 Glenmore Road	8E	0.0	1	6.5000	0.0	None	0.0	0.0	35.763E-9	150.09E-6	-524.43E-6	1834.9	0 (Negligible)
		6	12 Glenmore Road	12A	0.0	1	0.0	1.1000	Hogging	0.020281	0.0	0.020262	0.0	618.31E-6	672.36	0 (Negligible)
		7	12 Glenmore Road	12B	0.0	1	0.0	0.90000	Hogging	0.025171	0.0	0.025155	0.0	578.20E-6	445.14	0 (Negligible)
		8	12 Glenmore Road	12C	0.0	1	0.0	1.0600	Sagging	0.0	0.0	35.763E-9	0.0	289.37E-6	3525.0	0 (Negligible)
		9	12 Glenmore Road	12D	0.0	All vertical displacements are less than the limit sensitivity.										
		10	12 Glenmore Road	12E	0.0	1	6.5000	0.0	None	0.0	0.0	35.763E-9	0.0	-185.17E-6	3963.4	0 (Negligible)

Tensile horizontal strains are +ve, compressive horizontal strains are -ve.

Geotechnical & Environmental Associates
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