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# **Express** Preliminary UXO Risk Assessment

Client	GEA Ltd
Project	12 Keats Grove, London
Site Address	12 Keats Grove, London, NW3 2RN
Report Reference	EP9454-00
Date	23/08/19
Originator	HAS

#### **Assessment Objective**

This preliminary risk assessment is a qualitative screening exercise to assess the likely potential of encountering unexploded ordnance (UXO) at the 12 Keats Grove site. The assessment involves the consideration of the basic factors that affect the potential for UXO to be present at a site as outlined in Stage One of the UXO risk management process.

#### Background

This assessment uses the sources of information available in-house to 1<sup>st</sup> Line Defence Ltd to enable the placement of a development site in context with events that may have led to the presence of German air-delivered or Allied military UXO. The report will identify any immediate necessity for risk mitigation or additional research in the form of a Detailed UXO Risk Assessment. It makes use of 1<sup>st</sup> Line Defence's extensive historical archives, library and unique geo-databases, as well as internet resources, and is researched and compiled by UXO specialists and graduate researchers.

The assessment directly follows CIRIA C681 guidelines "Unexploded Ordnance, a Guide for the Construction Industry". The document will therefore assess the following factors:

- Basic Site Data
- Previous Military Use
- Indicators of potential aerial delivered UXO threat
- Consideration of any Mitigating Factors
- Extent of Proposed Intrusive Works
- Any requirement for Further Work

It should be noted that the vast majority of construction sites in the UK will have a low or negligible risk of encountering UXO and should be able to be screened out at this preliminary stage. The report is meant as a common sense 'first step' in the UXO risk management process. The content of the report and conclusions drawn are based on basic, preliminary research using the information available to 1<sup>st</sup> Line Defence at the time this report was produced. It should be noted that the only way to entirely negate risk from UXO to a project would be to support the works proposed with appropriate UXO risk mitigation measures. It is rarely possible to state that there is absolutely 'no' risk from UXO to a project.





Risk Assessment Considera	ations
Site location and description/current use	The site is located within the London Borough of Camden. The area of works is situated within residential area of Hampstead. It is bordered by residential structures to the north, gardens to the east and west and Keats Grove to the south. The site comprises of a residential property and gardens. The site is approximately centred on the OS grid reference: TQ 2713285753.
Are there any indicators of current/historical military activity on/close to the site?	At this stage, records do not indicate that the site had any former military use. The closest HAA battery was situated approximately 580m north east of the site. The conditions in which unexploded anti-aircraft ordnance may have fallen unrecorded within the proposed site are analogous to that of aerially delivered German bombs – see below for further information.
What was the pre- and post- WWII history of the site?	Pre-war OS mapping from 1915 indicates that the site comprised of open ground with one structure in the southern section of the site. The surrounding area comprised of residential properties with gardens adjacent to the site boundary. The 1934 mapping shows no obvious changes within the site boundary but there has been further development to the west of the site. Post-war mapping does not suggests that the site experienced any further changes and the surrounding area also appears to have been relatively unchanged.
Was the area subject to bombing during WWII?	According to Home Office statistics the Metropolitan Borough of Hampstead sustained a very high density bombing campaign during WWII, with an average of 166 items recorded per 1,000 acres. This included 311 high explosive (HE) bombs, 6 parachute mines, 21 oil bombs, 5 phosphorus bombs, 10 V-1 pilotless aircraft and 3 V-2 long range rocket bombs. London Bomb Census mapping does not record any bomb strikes directly on site, although, one HE bomb has been recorded adjacent to the east of the site. Additionally, Incendiary Bombing has been recorded directly on the site.
Is there any evidence of bomb damage on/close to the site?	Consulted OS mapping does not indicate that the site sustained any severe damage but the majority of the site was open ground, meaning damage is not necessarily visible. The London County Council (LCC) mapping highlights the structure on site as being 'General blast damage, not structural in nature'. One structure adjacent to the site, on South End Road, is recorded as 'damage requiring demolition'.
To what degree would the site have been subject to access?	The southern section of the site which comprised of a structure is anticipated to have been accessed regularly due to the anticipated residential nature of the site area. Although, the northern section, which comprised of open ground may not have been regularly accessed. Evidence of UXO is much more likely to go unnoticed and unrecorded in open and unfrequently accessed areas of ground.





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To what degree has the site been developed post-WWII?	The site is not anticipated to have undergone significant post-war redevelopment as the structure within the site boundary was present before the war and is anticipated to still be present. The northern section of the site boundary is not anticipated to have been developed post-war.
What is the nature and extent of the intrusive works proposed?	The nature and extent of works proposed was not available at the time of writing.

### **Summary and Conclusions**

During WWII, the site was situated within the Metropolitan Borough of Hampstead, which sustained a very high density of bombing according to Home Office statistics, with an average of 166 items recorded per 1,000 acres. Consulted London Bomb Census mapping records no incidents directly on site but one HE bomb has been recorded adjacent to the east of the boundary and incendiary bombing has been recorded on site.

The LLC damage mapping highlights that the structure on site was labelled as 'general blast damage'. One structure adjacent to the site, on South End Road, is recorded as 'damage requiring demolition'.

At this stage, it is thought likely that the strike recorded just to the east of the site actually landed to the north-east, in this area of damage. However, it is not possible to know for sure at this preliminary stage.

Further research will be required to determine the level of damage sustained on site and acquire WWII-era aerial imagery in order to assess the wartime footprint of the site.

#### Recommendations

In accordance with CIRIA guidelines, it is recommended that **further research** should be undertaken in the form of a **Detailed UXO Risk Assessment.** 

Further research would enable the exact wartime condition of the site area to be determined, and subsequently the risk that signs of UXO could have gone unrecorded within the area of works. Further investigation would entail archive / record office visits to consult additional records of relevance, including any available high resolution WWII-era aerial imagery, relevant written records, historical maps and Goad fire insurance plans.

Prior to or in lieu of a Detailed Assessment, it is recommended that appropriate UXO Risk Mitigation Measures are provided for intrusive works proposed.

If the client has any anecdotal or empirical evidence of UXO risk on site, please contact 1<sup>st</sup> Line Defence.



# **APPENDIX – PART 2**

# **Ground Movement Assessment**

### SOIL DISPLACEMENT MODEL RESULTS

### **P-DISP ANALYSIS**

Short Term Movement (Contour Plots and Tabular Output)

Total Movement (Contour Plot and Tabular Output)

## **BUILDING DAMAGE ASSESSMENT (X-DISP)**

Tabular Output of Results







$\boldsymbol{\wedge}$	Job No.	Sheet No.	Rev.
Oasys	J19228		
12 Keats Grove, London, NW3 2RN	Drg. Ref.		
Underpin Installation	Made by MC	Date	Checked
Specific Building Damage Results - Detail			

Stage:	Stage: Name	Specific	Specific	Sub-building	Vertical Offset	Segment	Start	Length	Curvature 1	Deflection	Average	Max	Max Gradient	Max Gradient	Min	Damage
Ref.	ΣY	Building: Ref.	Building: Name	Name	from Line for Vertical Movement Calculations					Ratio	Horizontal Strain	Tensile Strain	of Horizontal Displacement Curve	of Vertical Displacement Curve	Radius of Curvature	
					[m]		[m]	[m]		[%]	[%]	[%]			[m]	
0	Base Model	1	12B Keats Grove	Wall A	0.0	1	0.0	4.9000	None	0.0	0.0	35.763E-9	0.0	0.0	-	) (Negligible)
						2	4.9000	2.9400	Sagging	786.13E-6	-0.0043464	977.72E-6	130.41E-6	83.375E-6	33008.	) (Negligible)
		2	12B Keats Grove	Wall B	0.0 A	ll vertical	displacen	ents are	less than	the limit	sensitivity	·.				
		3	12B Keats Grove	Wall C	0.0 A	ll vertical	displacen	ments are	less than	the limit	sensitivity	·.				
		4	12B Keats Grove	Wall D	0.0 A	ll vertical	displacen	ents are	less than	the limit	sensitivity	·.				
		5	12B Keats Grove	Wall E	0.0 A	ll vertical	displacen	ents are	less than	the limit	sensitivity	·.				
		6	12B Keats Grove	Wall F	0.0 A	ll vertical	displacen	ents are	less than	the limit	sensitivity	·.				
		7	12B Keats Grove	Wall G	0.0 A	ll vertical	displacen	ments are	less than	the limit	sensitivity	·.				
		8	12B Keats Grove	Wall H	0.0 A	ll vertical	displacen	ents are	less than	the limit	sensitivity	·.				
		9	12B Keats Grove	Wall I	0.0 A	ll vertical	displacen	ments are	less than	the limit	sensitivity	·.				
		10	12B Keats Grove	Wall J	0.0 A	ll vertical	displacen	ents are	less than	the limit	sensitivity	·.				
		11	12B Keats Grove	Wall K	0.0 A	ll vertical	displacen	ents are	less than	the limit	sensitivity	·.				
		12	12B Keats Grove	Wall L	0.0	1	1.2990	0.0	None	0.0	0.0	35.763E-9	-333.22E-6	-190.08E-6	6411.8	) (Negligible)
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12 Keats Gro	ove, Lor nd Exca	ndon, NW3 avation	2RN					F	Drg. Ref.						
Short Term M	loveme	nts followin	g Excava	tion					Made by MC		D 24	ate 4-Oct-2019		Check	ed
Specific Building Da Stage: Stage: Name Category Ref.	Building: Ref.	<b>Its – Detail</b> Specific Building: Name	Sub-building Name	Vertical Offset from Line for Vertical Movement Calculations [m]	Segment	Start [m]	Length [m]	Curvature	e 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
Specific Building Da Stage: Stage: Name Category Ref.	<pre>specific Building: Ref. 1</pre>	<pre>Its - Detail Specific Building: Name 12B Keats Grove</pre>	Sub-building Name Wall A	Vertical Offset from Line for Vertical Movement Calculations [m] 0.0	Segment	Start [m] 0.0	[m] 5.9606 3.8394	Curvature	<pre>Peflection Ratio [%] 0.0012289 0.0078086</pre>	Average Horizontal Strain [%] 0.0 -0.0033908	Max : Tensile Strain : [%] 0.0011866 0.0062924	Max Gradient of Horizontal Displacement Curve 0.0 130.41E-6	Max Gradient of Vertical Displacement Curve -50.033E-6 401.83E-6	Min Radius of Curvature [m] 59658.0	Damage (Negligible) (Negligible)
Specific Building Da Stage: Stage: Name Category Ref. 0 Base Model	<pre>specific Building: Ref. 1 2</pre>	Its - Detail Specific Building: Name 12B Keats Grove 12B Keats Grove	Sub-building Name Wall A Wall B	Vertical Offset from Line for Vertical Movement Calculations [m] 0.0	Segment	Start [m] 0.0 5.9606 0.0	[m] 5.9606 3.8394 5.2990	Curvature Hogging Sagging	<pre>&gt; Deflection Ratio [%] 0.0012289 0.0078086 0.0062652</pre>	Average Horizontal Strain [%] 0.0 0.0033908 0.0021956	Max : Tensile Strain [%] 0.0011866 0.0062924 0.0079345	Max Gradient of Horizontal Displacement Curve 0.0 130.41E-6 -111.32E-6	Max Gradient of Vertical Displacement Curve -50.033E-6 401.83E-6 -423.55E-6	Min Radius of Curvature [m] 59658. 0 2181.2 0 1770.4 0	(Negligible) (Negligible) (Negligible)
Specific Building Da Stage: Stage: Name Category Ref.	<pre>specific Building: Ref. 1 2 3</pre>	tts - Detail Specific Building: Name 12B Keats Grove 12B Keats Grove	Sub-building Name Wall A Wall B Wall C	Vertical Offset from Line for Vertical Movement Calculations [m] 0.0 0.0	Segment	Start [m] 0.0 5.9606 0.0 0.0	[m] 5.9606 3.8394 5.2990 3.3000	Curvature Hogging Sagging Sagging	<pre>Deflection Ratio [%] 0.0012289 0.0078086 0.0062652 0.0076014</pre>	Average Horizontal Strain [%] -0.0033908 0.0021956 0.0	Max : Tensile Strain : [%] 0.0011866 0.0062924 0.0079345 0.0079345	Max Gradient of Horizontal Displacement Curve 0.0 130.41E-6 -111.32E-6 0.0	Max Gradient of Vertical Displacement Curve -50.033E-6 401.83E-6 -423.56E-6 246.77E-6	Min Radius of Curvature [m] 59658.0 2181.2 0 1770.4 0 4505.4 0	(Negligible) (Negligible) (Negligible) (Negligible)
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Specific Building Da Stage: Stage: Name Category Ref. 0 Base Model	<pre>mage Resul   Specific   Building:     Ref.  1 2 3 4 5</pre>	Its - Detail Specific Building: Name 128 Keats Grove 128 Keats Grove 128 Keats Grove 128 Keats Grove	Sub-building Name Wall A Wall B Wall C Wall D Wall E	Vertical Offset from Line for Vertical Movement Calculations [m] 0.0 0.0 0.0 0.0 0.0	Segment 1 2 1 1 1 1	<pre>start [m]     0.0     5.9606     0.0     0.0     0.0     0.0     0.0 </pre>	[m] 5.9606 3.8394 5.2990 3.3000 0.60000	Curvature Hogging Sagging Sagging None Sagging	Deflection Ratio [%] 0.0012289 0.0078086 0.0062652 0.0076014 0.00	Average Horizontal Strain [%] 0.0033908 0.0021956 0.00 0.0 0.0 0.0	Max Tensile Strain [%] 0.0011866 0.0062924 0.0079345 0.0072836 35.763E-9 0.0072807	Max Gradient of Horizontal Displacement Curve 0.0 130.41E-6 -111.32E-6 0.0 0.0 0.0	Max Gradient of Vertical Displacement Curve -50.033E-6 401.83E-6 -423.55E-6 246.77E-6 -49.776E-6 279.94E-6	Min Radius of Curvature [m] 59658. 0 2181.2 0 1770.4 0 4505.4 0 - 0 3501.2 0	Damage (Negligible) (Negligible) (Negligible) (Negligible) (Negligible)
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Specific Building Da Stage: Stage: Name Category Ref. 0 Base Model	<pre>specific specific Building: Ref.  1 2 3 4 5 6 7 8</pre>	Its - Detail Specific Building: Name 128 Keats Grove 128 Keats Grove	Sub-building Name Wall A Wall B Wall C Wall E Wall E Wall F Wall G Wall H	Vertical Offset from Line for Vertical Movement Calculations [m] 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Segment 1 2 1 1 1 1 1 2 1 1 1 1 1 1	<pre>Start [m] 0.0 5.9606 0.0 0.0 0.0 0.0 1.9614 0.0 0.0 0.0</pre>	[m] 5.9606 3.8394 5.2990 3.3000 0.60000 1.9614 0.83862 0.83862 0.83690 1.30690	Curvature Bogging Sagging Sagging None Sagging Hogging None Sagging	<pre>B Deflection Ratio  [%] 0.0012289 0.0078086 0.0062652 0.0076014 0.0 0.0072759 0.00 0.0072759 0.021992</pre>	Average Horizontal Strain [%] 0.0033908 0.0021956 0.0021956 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	Max : Tensile Strain : [%] 0.0011866 0.0062924 0.0079245 0.0070807 35.763E-9 0.0070807 35.763E-9 0.0068977	Max Gradient of Horizontal Displacement Curve 0.0 130.41E-6 -111.32E-6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	Max Gradient of Vertical Displacement Curve -50.033E-6 401.032E-6 -426.77E-6 246.77E-6 249.94E-6 279.94E-6 55.879E-6 -55.879E-6 -55.879E-6 503.01E-5	Min Radius of Curvature [m] 59658. 0 2181.2 0 1770.4 0 4505.4 0 - 0 3501.2 0 1652.6 0 - 0 0 543.2 0 0 7.4 7 4 0	(Negligible) (Negligible) (Negligible) (Negligible) (Negligible) (Negligible) (Negligible) (Negligible) (Negligible) (Negligible)
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Specific Building Da Stage: Stage: Name Category Ref. 0 Base Model	<pre>mage Resul specific Building: Ref. 1 2 3 4 5 6 7 7 8 9 9 10</pre>	Its - Detail Specific Building: Name 128 Keats Grove 128 Keats Grove	Sub-building Name Wall A Wall B Wall C Wall D Wall C Wall F Wall G Wall F Wall H H Mail I	Vertical Offset from Line for Vertical Movement Calculations [m] 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	<b>Segment</b> 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	<pre>Start [m] 0.0 5.9606 0.0 0.0 0.0 0.0 1.9614 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.</pre>	[m] 5.9606 3.8394 5.2990 3.3000 0.60000 1.9614 0.60000 3.6990 1.3000 0.30000 0.30000	Curvature Hogging Sagging Sagging None Sagging None Sagging None Sagging None	Peflection Ratio           [%]           0.0012289           0.0078086           0.0076016           0.0076014           0.0071899           0.00           0.0072899           0.021893           0.021893           0.0121893	Average Horizontal Strain [%] 0.0033908 0.0021956 0.0021956 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	Max Tensile Strain [%] 0.0011866 0.0062924 0.0079345 0.0070807 35.763E-9 0.0068977 0.021746 35.763E-9 0.0021746 0.021746	Max Gradient of Horizontal Displacement Curve 0.0 130.412-6 -111.322-6 -111.322-6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Max Gradient of Vertical Displacement Curve -50.033E-6 401.83E-6 -423.566.77E-6 -43.7765-6 279.94E-6 529.94E-6 55.8785-6 -222.945-6 -53.01E-6 -13.012E-6	Min Radius of Curvature [m] 59658.0 1770.4 4505.4 4505.4 0 3501.2 0 1652.6 5543.2 0 734.74 0 5543.2 0 734.74	(Negligible) (Negligible) (Negligible) (Negligible) (Negligible) (Negligible) (Negligible) (Negligible) (Negligible) (Negligible)
Specific Building Da Stage: Stage: Name Category Ref. 0 Base Model	<pre>mage Result specific Building: Ref.  1 2 3 4 5 6 7 8 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</pre>	Its - Detail specific Building: Name L2B Keats Grove L2B Keats Grove	Sub-building Name Wall A Wall B Wall C Wall C Wall G Wall G Wall F Wall G Wall H Wall J	Vertical Offset from Line for Vertical Kovement Calculations [m] 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Segment 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	[m] 0.0 5.9606 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	[m] 5.9606 3.8394 5.2900 0.60000 1.9614 0.83862 0.60000 3.6900 1.3000 0.30000 0.30000 2.7000	Curvature Bogging Sagging Sagging None Sagging None Sagging Sagging None Sagging	<pre>Peflection Ratio [%] 0.0012289 0.0078086 0.0078086 0.0078059 0.00 0.0072759 0.00 0.0072759 0.021893 0.0 0.013208</pre>	Average Horizontal strain [%] 0.0033908 0.0021956 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	Max Tensile Strain [%] 0.0011866 0.0062924 0.0079245 0.0079245 0.0079245 0.0070807 0.021746 0.002176 0.002176 0.002176 0.002176 0.002176 0	Max Gradient of Horizontal Displacement Curve 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Max Gradient of Vertical Displacement Curve 401.832-6 -433.562-6 -279.942-6 279.942-6 55.8792-6 -53.192-6 503.012-6 -348.022-6	Min Radius of Curvature [m] 59658.0 1770.4 0 4505.4 0 4505.4 0 0 5543.2 0 734.74 0 734.74 0 2529.8 0	(Negligible) (Negligible) (Negligible) (Negligible) (Negligible) (Negligible) (Negligible) (Negligible) (Negligible) (Negligible)
Specific Building Da Stage: Stage: Name Category Ref. 0 Base Model	mage Resul pecific Building: Ref. 1 2 3 4 5 6 7 8 9 10 11 12 2 3 4 5 5 6 7 8 9 10 10 10 10 10 10 10 10 10 10	Its - Detail Specific Building: Name 128 Keats Grove 128 Keats Grove	Sub-building Name Wall A Wall B Wall C Wall C Wall C Wall F Wall G Wall F Wall G Wall I Wall I Wall I Wall I Wall I Wall I K	Vertical Offset from Line for Vertical Movement Calculations [m] 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Segment	[m] 0.0 5.9606 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	[m] 5.9606 3.8394 5.2990 3.3000 0.60000 1.9614 0.83862 0.60000 1.3000 0.30000 2.7000 0.30000 0.30000	Curvature Bogging Sagging Sagging None Sagging Sagging Sagging Sagging None Sagging Sa	<pre>&gt; Deflection     Ratio     [%]     0.0012289     0.0078086     0.0062552     0.0076014     0.00     0.00721899     0.021893     0.021893     0.0012209     0.012200     0.01200     0.012</pre>	Average Horizontal strain [%] -0.0033908 0.0031956 0.0031956 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	Max Tensile Strain [%] 0.0011866 0.0062924 0.0072836 0.0072836 0.0072836 0.0072837 0.007887 0.002176 0.021746 0.001877 0.001787 0.0	Max Gradient of Horizontal Displacement Curve 0.0 130.412-6 -111.322-6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Max Gradient of Vertical Displacement Curve -50.0335-6 401.835-6 -422.3555-6 -424.5755-6 -49.7765-6 279.945-6 5.79.945-6 -5.8795-6 -223.295-6 -5.3.012-6 -5.5.002-6 -	Min Radius of Curvature [m] 59658.0 1770.4 4505.4 0 3501.2 0 1652.5 0 734.74 0 734.74 0 2529.0 0 2529.0 0 2529.0	(Negligible (Negligible (Negligible (Negligible (Negligible (Negligible (Negligible (Negligible (Negligible (Negligible (Negligible (Negligible

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Oas	s"Y.	S	ENVIR	ONMEN <sup>-</sup>	TALA	SSO	CIA	TE\$	5 <b>L</b> J192	228					
12 Keats Gro	ve, Lor	ndon, NW3	2RN Iding					ŀ	Drg. Ref.						
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Specific Building Dan	nage Result	s - Detail													
Stage: Stage: Name Category	Specific	Specific	Sub-building	Vertical Offset	Segment	Start	Length	Curvatur	e Deflection	Average	Max	Max Gradient	Max Gradient	Min	Damage
Ref.	Building: Ref.	Building: Name	Name	from Line for Vertical Movement Calculations					Ratio	Horizontal Strain	Tensile Strain	of Horizontal Displacement Curve	of Vertical Displacement Curve	Radius of Curvature	
				[m]		[m]	[m]		[%]	[%]	[%]			[m]	
0 Dece Medel	1	12B Keats Grove	Wall A	0.0	1	0.0	2.7955	Sagging	0.014231	0.0	0.013799	0.0	-597.66E-6	1217.2	0 (Negligible)

[m]         [m] <th></th> <th></th> <th></th> <th></th> <th></th> <th>Calculations</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>Curve</th> <th></th>						Calculations								Curve	
D         Base Model         1         128 Keats Grove         Wall A         0.0         1         0.0         2.7555         Sagging         0.014231         0.0         0.13799         0.0         -597.66           2         128 Keats Grove         Wall A         0.0         1         0.0         2.7555         3.3202         Expression         0.957.78-5         0.943.226-5         0.0         -597.66           3         1228 Keats Grove         Wall B         0.0         1         0.0         5.290         Sagging         0.005794         0.005794         0.0212565         0.0084223         -111.328-6         -452.02           3         1228 Keats Grove         Wall D         0.0         1         0.0         3.3000         Sagging         0.007545         0.0         0.072483         0.0         -583.322           4         128 Keats Grove         Wall E         0.0         1         0.0         1.007464         Sagging         0.0072661         0.0         0.0         283.45           5         128 Keats Grove         Wall F         0.0         1         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         28						[m]		[m]	[m]		[%]	[%]	[%]		
2         2.7955         3.202 Hogging         955.77E-6         0.0         949.32E-6         0.0         -72.583           3         6.1157         3.6434 Sagging         0.0084307         -0.033336         0.0065578         1.01.41E-6         402.02           3         12B Keats Grove Wall B         0.0         1         0.0         5.2990 Sagging         0.0065794         0.0021956         0.0021956         0.002223         -111.32E-6         -451.72           4         12B Keats Grove Wall D         0.0         1         0.0         5.3000 Sagging         0.007545         0.0         0.072483         0.0         25.328           5         12B Keats Grove Wall E         0.0         1         0.0         1.9694 Sagging         0.0         0.0         0.0         35.763E-9         0.0         -58.322           6         12B Keats Grove Wall F         0.0         1         0.0         1.9694 0.83068 Bogging         0.0         0.0         0.0         35.763E-9         0.0         -27.458           6         12B Keats Grove Wall F         0.0         1         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0	0	Base Model	1	12B Keats Grove	Wall A	0.0	1	0.0	2.7955	Sagging	0.014231	0.0	0.013799	0.0	-597.66F
3         6.1157         3.6843         Sagging         0.0084307         -0.033336         0.0065888         130.412-6         402.02           3         128         Keats Grove         Wall C         0.0         1         0.0         5.2990         Sagging         0.0055794         0.0021956         0.002223         -111.32e-6         -451.72           4         128         Keats Grove         Wall D         0.0         1         0.0         3.000         Sagging         0.0055794         0.007548.3         0.0         -256.322           5         128         Keats Grove         Wall E         0.0         1         0.0         0.0         0.0072661         0.0         0.07365745         0.0         0.085745         0.00         0.0         256.322           6         128         Keats Grove         Wall E         0.0         1         0.0         0.0072661         0.0         0.035.7638-9         0.0         281.45           7         128         Keats Grove         Wall F         0.0         1         0.0         1.0073169         0.0         0.0         0.0035674         0.0         0.0035674         0.020545         0.0         272.49           9         128							2	2.7955	3.3202	Hogging	959.77E-6	0.0	949.32E-6	0.0	-72.583E
2         128         Keats Grove Wall B         0.0         1         0.0         5.2990         Sagging         0.0065794         0.0021956         0.0021956         0.0021956         0.0021956         0.0021956         0.00         0.0         3.3000         Sagging         0.0075445         0.0         0.0075445         0.0         0.0         0.0         3.3000         Sagging         0.0075445         0.0         0.0         0.0         3.3000         Sagging         0.0075445         0.0							3	6.1157	3.6843	Sagging	0.0084307	-0.0035336	0.0068588	130.41E-6	402.02E
3       128 Keats Grove Wall C       0.0       1       0.0       3.000 Sagging       0.0075645       0.0       0.0       0.0       25.322         4       128 Keats Grove Wall D       0.0       1       0.0       6.6000 None       0.0       0.0       0.5632-9       0.0       -55.322         5       128 Keats Grove Wall E       0.0       1       0.0       0.60000 None       0.0       0.0       0.35,7632-9       0.0       281.45         6       128 Keats Grove Wall F       0.0       1       0.0       0.60000 None       0.0       0.0       0.035,7632-9       0.0       67.000         7       128 Keats Grove Wall F       0.0       1       0.0       3.6990 Sagging       0.0073169       0.0       0.0       70.00       0.0       0.0       35,7632-9       0.0       67.000         8       128 Keats Grove Wall H       0.0       1       0.0       1.3000 Sagging       0.0035763-9       0.0       727.403         10       128 Keats Grove Wall H       0.0       1       0.0       1.3000 Sagging       0.022164       0.0       0.022015       0.0       727.403         10       128 Keats Grove Wall J       0.0       1       0.0       0.3000 None			2	12B Keats Grove	Wall B	0.0	1	0.0	5.2990	Sagging	0.0065794	0.0021956	0.0082223	-111.32E-6	-451.72E
4         128 Keats Grove Wall D         0.0         1         0.0         0.60000 None         0.0         0.0         35,763E-9         0.0         -58,322           5         128 Keats Grove Wall E         0.0         1         0.0         1.9694 Sagging         0.0072061         0.0         0.000958         0.0         28.424           6         128 Keats Grove Wall F         0.0         1         0.0         0.6000 None         0.0         0.0         35,763E-9         0.0         281.455           7         128 Keats Grove Wall G         0.0         1         0.0         0.6900 Sagging         0.0013169         0.0         0.0059367         0.0         -227.495           8         128 Keats Grove Wall H         0.0         1         0.0         1.3000 Sagging         0.02164         0.0         0.0         2527.495           9         128 Keats Grove Wall H         0.0         1         0.0         1.3000 Sagging         0.02164         0.0         0.0         2527.495           10         128 Keats Grove Wall J         0.0         1         0.0         2.0000 Sagging         0.014268         0.0035185         0.0         77.803           11         128 Keats Grove Wall J         0.0			3	12B Keats Grove	Wall C	0.0	1	0.0	3.3000	Sagging	0.0075645	0.0	0.0072483	0.0	250.35E
5         128 Keats Grove Wall E         0.0         1         0.0         1.9694 Sagging         0.072061         0.0         0.0         0.070958         0.0         281.45           6         128 Keats Grove Wall F         0.0         1         0.0         0.6994 Sagging         0.0073169         0.0         0.0         281.45           6         128 Keats Grove Wall G         0.0         1         0.0         0.60000 None         0.0         0.0         0.35,7638-9         0.0         281.45           7         128 Keats Grove Wall G         0.0         1         0.0         0.60000 None         0.0         0.0         0.0035,7638-9         0.0         67.000           8         128 Keats Grove Wall H         0.0         1         0.0         1.3000 Sagging         0.022164         0.0         0.0         520.76           9         128 Keats Grove Wall J         0.0         1         0.0         2.0000 Sagging         0.041465         0.0085165         0.018182         -170.348-6         396.5           10         128 Keats Grove Wall K         0.0         1         0.0         1.2990 Sagging         0.041455         0.033333         0.05919         -333.228-6         949.21           11			4	12B Keats Grove	Wall D	0.0	1	0.0	0.60000	None	0.0	0.0	35.763E-9	0.0	-58.322E
2         1.9694 0.83060 Hogging         0.0         0.0         35,763E-9         0.0         281.48           6         12B Keats Grove Wall F         0.0         1         0.0         0.6000 None         0.0         0.35,763E-9         0.0         281.48           7         12B Keats Grove Wall G         0.0         1         0.0         0.6000 None         0.0         0.035,763E-9         0.0         67.000           8         12B Keats Grove Wall H         0.0         1         0.0         1.3000 Sagging         0.02164         0.0         0.02015         0.0         -227.49           9         12B Keats Grove Wall I         0.0         1         0.0         0.30000 None         0.0         0.035.763E-9         0.0         -27.803           10         12B Keats Grove Wall J         0.0         1         0.0         2.7000 Sagging         0.042548         0.0035185         0.013182         -170.34E-6         396,503           11         12B Keats Grove Wall K         0.0         1         0.0         0.30000 None         0.0         0.033333         0.059119         -333.22E-6         949.21           11         12B Keats Grove Wall L         0.0         1         0.0         1.2990 Sagging <t< td=""><td></td><td></td><td>5</td><td>12B Keats Grove</td><td>Wall E</td><td>0.0</td><td>1</td><td>0.0</td><td>1.9694</td><td>Sagging</td><td>0.0072061</td><td>0.0</td><td>0.0070958</td><td>0.0</td><td>281.45E</td></t<>			5	12B Keats Grove	Wall E	0.0	1	0.0	1.9694	Sagging	0.0072061	0.0	0.0070958	0.0	281.45E
6         128 Keats Grove Wall F         0.0         1         0.0         0.60000 None         0.0         0.0         35.763x-9         0.0         67.000           7         128 Keats Grove Wall G         0.0         1         0.0         3.6990 Sagging         0.073169         0.0         0.0         0.227.49           8         128 Keats Grove Wall H         0.0         1         0.0         1.3000 Sagging         0.022164         0.0         0.022015         0.0         520.76           9         128 Keats Grove Wall I         0.0         1         0.0         3.0000 None         0.0         0.0         0.522.76         0.0         -72.803           10         128 Keats Grove Wall J         0.0         1         0.0         2.7000 Sagging         0.041465         0.035165         0.0         -77.803           11         128 Keats Grove Wall K         0.0         1         0.0         3.0000 None         0.0         0.0         0.357.653-9         0.0         7.631           12         128 Keats Grove Wall L         0.0         1         0.0         1.2990 Sagging         0.041465         0.033333         0.05919         -333.22E-6         949.21           11jdpt)         128         50.							2	1.9694	0.83060	Hogging	0.0	0.0	35.763E-9	0.0	281.45E
7         128 Keats Grove Wall G         0.0         1         0.0         3.699 Saging         0.0073169         0.0         0.0069367         0.0         -227.49           8         128 Keats Grove Wall H         0.0         1         0.0         1.300 Sagging         0.022164         0.0         0.02015         0.0         520.76           9         128 Keats Grove Wall I         0.0         1         0.0         0.30000 None         0.0         0.0         35.7638-9         0.0         -27.493           10         128 Keats Grove Wall J         0.0         1         0.0         2.7000 Sagging         0.04268         0.0085185         0.018182         -170.34E-6         396.503           11         128 Keats Grove Wall K         0.0         1         0.0         0.0353658-9         0.0         -77.803           12         128 Keats Grove Wall K         0.0         1         0.0         3.0000 None         0.0         0.0         0.03537658-9         0.0         77.503           12         128 Keats Grove Wall L         0.0         1         0.0         1.2909 Sagging         0.041465         0.033333         0.05919         -333.22E-6         949.21           311ght)          0.0			6	12B Keats Grove	Wall F	0.0	1	0.0	0.60000	None	0.0	0.0	35.763E-9	0.0	67.000E
8         128 Keats Grove Wall H         0.0         1         0.0         1.3000 Sagging         0.022164         0.0         0.022015         0.0         520.76           9         128 Keats Grove Wall I         0.0         1         0.0         0.0000 None         0.0         0.035763F-9         0.0         -27.803           10         128 Keats Grove Wall J         0.0         1         0.0         2.0000 Sagging         0.041465         0.0085185         0.018182         -170.34E-6         396.501           11         128 Keats Grove Wall K         0.0         1         0.0         0.0000 None         0.0         0.03533         0.059119         -333.22E-6         949.21           11         128 Keats Grove Wall L         0.0         1         0.0         1.2990 Sagging         0.041465         0.033333         0.059119         -333.22E-6         949.21           11         128 Keats Grove Wall L         0.0         1         0.0         1.2990 Sagging         0.041465         0.033333         0.059119         -333.22E-6         949.21			7	12B Keats Grove	Wall G	0.0	1	0.0	3.6990	Sagging	0.0073169	0.0	0.0069367	0.0	-227.49E
9         128 Keats Grove Wall I         0.0         1         0.0         0.00000 None         0.0         0.0         35.7638-9         0.0         -27.803           10         128 Keats Grove Wall J         0.0         1         0.0         2.7005 Sagging         0.014268         0.0085185         0.018122         -17.845-0         31.45-6         31.65           11         128 Keats Grove Wall K         0.0         1         0.0         0.0030000 None         0.0         0.0         35.7638-9         0.0         77.631           12         128 Keats Grove Wall K         0.0         1         0.0         0.0000 None         0.0         0.033333         0.059119         -333.22E-6         949.21           3light)         1         0.0         1         0.0         1.290 Sagging         0.041455         0.033333         0.059119         -333.22E-6         949.21			8	12B Keats Grove	Wall H	0.0	1	0.0	1.3000	Sagging	0.022164	0.0	0.022015	0.0	520.76E
10         128 Keats Grove Wall J         0.0         1         0.0 & 2.7000 Sagging         0.014268         0.0085185         0.1018182         -170.34E-6         396.50           11         128 Keats Grove Wall K         0.0         1         0.0 0.3000         None         0.0         0.35763E-9         0.0         77.631-9           12         128 Keats Grove Wall L         0.0         1         0.0         1.2990 Sagging         0.041465         0.033333         0.059119         -333.22E-6         949.21           3light)         1         0.0         1         0.0         1.2990 Sagging         0.041465         0.033333         0.059119         -333.22E-6         949.21			9	12B Keats Grove	Wall I	0.0	1	0.0	0.30000	None	0.0	0.0	35.763E-9	0.0	-27.803E
11         12B Keats Grove Wall K         0.0         1         0.0         0.30000 None         0.0         0.0         35.7638-9         0.0         77.631           12         12B Keats Grove Wall L         0.0         1         0.0         1.2990 Sagging         0.041465         0.033333         0.059119         -333.22E-6         949.21           3light)         1         0.0         1         0.0         1.2990         Sagging         0.041465         0.033333         0.059119         -333.22E-6         949.21			10	12B Keats Grove	Wall J	0.0	1	0.0	2.7000	Sagging	0.014268	0.0085185	0.018182	-170.34E-6	396.50E
12 12B Keats Grove Wall L 0.0 1 0.0 1.2990 Sagging 0.041465 0.033333 0.059119 -333.22E-6 949.21 Slight)			11	12B Keats Grove	Wall K	0.0	1	0.0	0.30000	None	0.0	0.0	35.763E-9	0.0	77.631E
Slight)			12	12B Keats Grove	Wall L	0.0	1	0.0	1.2990	Sagging	0.041465	0.033333	0.059119	-333.22E-6	949.21E
	Slight	t)													

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

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[m]
1217.2 0 (Negligible)
40058.0 (Negligible)
2054.0 0 (Negligible)
1679.3 0 (Negligible)
4453.4 0 (Negligible)
5516.0 0 (Negligible)
5451.8 0 (Negligible)
725.76 0 (Negligible)
725.76 0 (Negligible)
2422.0 0 (Negligible)
2422.0 0 (Negligible)
388.06 1 (Very

#### Geotechnical & Environmental Associates

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