

APPENDIX 4 – QUALITATIVE RISK ASSESSMENT METHODOLOGY

QUALITATIVE RISK ASSESSMENT METHODOLOGY

The following Contaminated Land Risk Assessment methodology is based on CIRIA C552 (2001) *Contaminated Land Risk Assessment – A Guide to Good Practice*, in order to quantify potential risk via **risk estimation** and **risk evaluation**, which can be adopted at the Phase I stage. This will then determine an overall risk category which can be used to identify likely actions. This methodology uses qualitative descriptors and therefore is a qualitative approach.

The methodology requires the classification of:

- the magnitude of the consequence (severity) of a risk occurring, and
- the magnitude of the **probability** (likelihood) of a risk occurring.

The potential consequences of contamination risks occurring at this site are classified in accordance with Table A4.1 below, which is adapted from the CIRIA guidance.

Classification	Definition of Consequence
Severe	 Short-term (acute) risks to human health. Short-term risk of pollution of sensitive water resource or ecosystem. Catastrophic damage to crops/buildings/property/infrastructure, including off-site soils.
Medium	 Medium/long-term (chronic) risks to human health. Medium/long-term risk of pollution of sensitive water resource or ecosystem. Significant damage to crops/buildings/property/infrastructure (on or off-site). Contamination of off-site soils.
Mild	 Easily preventable, permanent health effects on humans. Pollution of non-sensitive water resources. Localised damage to crops/buildings/property/infrastructure (on or off-site).
Minor	 Easily preventable, non-permanent health effects on humans, or no effects. Minor, low-level and localised contamination of on-site soils. Easily repairable damage to crops/buildings/property/infrastructure.

Table A4.1: Classification of Consequence

The probability of contamination risks occurring at this site will be classified in accordance with Table A4.2 below which is also adapted from the CIRIA guidance. Note that for each category, it is assumed that a pollution linkage exists. Where a pollution linkage does not exist, the likelihood is zero, as is the risk.

Classification	Definition of Probability
High Likelihood	Circumstances are such that an event appears very likely in the short-term or almost inevitable in the long-term; or there is already evidence that such an event has occurred.
Likely	Circumstances are such that such an event is not inevitable, but is possible in the short-term and is likely over the long-term.
Low Likelihood	Circumstances are such that it is by no means certain that an event would occur even over a longer period, and it is less likely in the short-term.
Unlikely	Circumstances are such that it is improbable that an event would occur even in the very long-term.

Table A4.2: Classification of Probability

For each possible pollution linkage (source-pathway-receptor) identified, the potential risk can be evaluated, as presented in Table A3.3. Based upon this, CIRIA C552 presents definitions of the risk categories, together with the investigatory and remedial actions that are likely to be necessary in each case, as in Table A3.4. These risk categories apply to each possible pollutant linkage, and not simply to each hazard/source of contamination or sensitive receptor.

			Conse	quence	
		Severe	Medium	Mild	Minor
	High likelihood	Very high risk	High risk	Moderate risk	Low risk
bility	Likely	High risk	Moderate risk	Moderate risk	Low risk
Proba	Low likelihood	Moderate risk	Moderate risk	Low risk	Very low risk
	Unlikely	Low risk	Low risk	Very low risk	Very low risk

Table A4.3: Overall Contamination Risk Matrix

Table A4.4: Definition of Risk Categories and Likely Actions Required

Risk Category	Definition and likely actions required
Very high	 Severe harm to a defined receptor is very likely, or has already occurred. The risk is likely to result in a substantial liability. Urgent investigation (if not already undertaken) is likely to be required. Urgent remediation is likely to be required.
High	 Harm to a defined receptor is likely. The risk, if realised, may result in a substantial liability. Urgent investigation (if not already undertaken) is likely to be required. Remediation is likely to be required in the long term, possibly sooner.
Moderate	 Harm to a defined receptor is possible, but severe harm is unlikely. Investigation is likely to be required to clarify the level of potential liability and risk. Some remediation may be required in the longer term
Low	 Harm to a defined receptor is possible, but is likely to be mild at worst. Liabilities could theoretically arise, but are unlikely. Further investigation is not required at this stage Remediation is unlikely to be required.
Very low	 Harm to a defined receptor is unlikely, and would be minor at worst. No liabilities are likely to arise. Further investigation is not required at this stage Remediation is very unlikely to be required.



APPENDIX 5 – BGS BOREHOLE RECORDS

GEOLO	GICAL SURVEY OF GREAT BRITAIN	(ro			
tish Geological Survey	British Geological Survey	6-inch Map	Registere	ed No.	
KECORD OF	SHAFT OR DORE FOR MINERALS	_			
Name of Shaft or Bore	given by Geological Survey:	TG	2281	NE/3	, <u>></u>
Name and Number giv	en by owner:	Nat. Grid I	Reference		
	anian Geological Sulvay	27	22.	- 852	ev (
For whom made	Hampstead, county	1" N.S.Map	1" O.S.M	inp Confid	ler
Exact site Junc and Have	him I Belaze AU. Attach a tracing from a map, or a aketch- map, if possible.	256	NO.	orn	DT.
Ground Level at shaft bore	relative to O.D. 234' If not ground level give	O.D. of begin	nning of sl gical Survey b	haft xore)
Made by	hcc	Date of	sinking	/100	
Information from			CCIVCU		,
	SPECIMEN NUMBERS AND ADDITIONAL	NOTES			
British Geological Sun	rey British Geological Survey		British	n Geological Surv	√ey
tish Geological Survey	British Geological Survey	British Geolo	gical Survey		
(For Survey use only)		Тніс		Depth	
(For Survey use only) GROLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	Thici Fr.	IN IN.	Depth Ft.	
(For Survey we only) GEOLOGICAL CLASSIFICATION British Geක්රිනිසින් Sun	DESCRIPTION OF STRATA Made Grown deal Survey	Thick Fr.	IN. Bijish	DEPTH Ft.	ЭУ
(<i>For Survey use only</i>) GBOLOGICAL CLASSIFICATION British රටෝහිසින් Sun LC	DESCRIPTION OF STRATA Made Grounder Survey Clay	Тнісі Fr. 4- /6	IN.	DEPTH Fr. Geological Sur 20	Έy
(For Survey use only) GBOLOGICAL CLASSIFICATION British Geটাস্টিলি Sun LC	DESCRIPTION OF STRATA Made Grounder Survey Clay	Тнісі Fr. 4 /6	IN.	DEPTH Ft. Ceological Sur 20	Эy
(<i>For Survey use only</i>) GEOLOGICAL CLASSIFICATION British 6ංක්ශිලීබ Sur L C	DESCRIPTION OF STRATA Made Grounders Survey Clay For Hampstead Tube RCy.	Тнісі Fr. 4 / 6	IN.	DEPTH Fr. 20	Зy
(For Survey use only) CEOLOGICAL CLASSIFICATION British Geර්ගිනිසින් Surv	DESCRIPTION OF STRATA Made Groundersurv Clay For Hampstead Tube RG,	Тнісі Fr. 4- /6	IN.	DEPTH Fr. 20	'ey
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(For Survey we only) GEOLOGICAL CLASSIFICATION British Geological Survey British Geological Survey Steelogical Survey	DESCRIPTION OF STRATA Made Grocunschild Survey Clay For Hampstead Tube RG, British Geological Survey British Geological Survey British Geological Survey	Тпісі Fr. / 4 / 6		DEPTH Fr. n Geological Sur 20	



APPENDIX 6 – EXPLORATORY HOLE RECORDS

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					J	0)						Explora	tory Hole No:		WS2		
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Logged By:			MJ,	LP								Date Co	ommenced:		14/11/2017		-
Checked By:			PSv	v								Date Co	mpleted:		14/11/2017		
Type and diame	ter of equip	ment:	Win	ndowles	ss Sam	pler						Sheet N	lo:		1 Of 2		
Water levels re	ecorded du	ring bo	oring,	m													
Date:																	
Hole depth:																	
Casing depth:																	
Level water on s	strike:																
Water Level after	r 20mins:																
Remarks																	
1: No water rec	orded.																
2:																	
3:																	
4:			-								<u>.</u>						
		Sampl	e or I	ests					-		Strata	10/	-				
T	Depth				Resul	t				I a second	Depth	Water	Strata	a Description		Instal	latior
Type	(mbgl)	75	75	75	75	75	75		-	Legend	(mbgl)	(mbgl)					
		/5	/5	/5	/5	/5	/5	N	0.00 -								
									0.00		0.03		Paving slab. (MADE G	ROUND).		<u> </u>	1333
									_		0.20		Reinforced concrete. ((MADE GROUND).		노크크	1
P + J	0.25								_				Light brown low streng	gth gravelly clay.	Gravel	는크	1222
									_				sub-angular flint, brick	k and concrete fra	gments.	는크	1222
P + J	0.50								0.50 —				(MADE GROUND).			123	12-23
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			(J	0)						Explora	tory Hole No:			WS2	
Site Address:			38 (Glenoc	h Road	, Camo	den, N	N3 4D	N			Project	No:			P1207J1245	
Client:			McK	kay Est	ates Lt	d						Ground	Level:				
Logged By:			MJ,	LP								Date Co	mmenced:			14/11/2017	
Checked By:			PSw	v								Date Co	mpleted:			14/11/2017	
Type and diame	ter of equip	ment:	Win	dowles	ss Sam	pler						Sheet N	lo:			2 Of 2	
Water levels r	ecorded du	ring bo	oring,	m													
Date:																	
Hole depth:																	
Casing depth:																	
Level water on s	strike:																
Water Level afte	er 20mins:																
Remarks																	
1: No water rec	corded.																
2:																	
3:																	
4:																	
		Sample	e or Te	ests					-		Strata		4				
	Depth				Result	t					Depth	Water		Strata D	escription		Installation
Туре	(mbgl)				1	-			-	Legend	(mbgl)	(mbal)					
CDT	F 00	75	75	75	75	75	75	N	5.00			(
311	5.00	2	3		2	3	4	12	5.00 -				Light brown w	ith blue vei	ns medium stre	ength CLAY	
										F <u></u> -			(LONDON CLA	Y_			
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Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample Jomas Associates Ltd - Lakeside House, 1 Furzeground Way, Stockley Park, UB11 1BD T: 0843 289 2187 E: info@jomasassociates.com W: www.jomasassociates.com

9.50 -

10.00-

				-						TRI AL F	PIT RECORD
			(IOM	A5				Exploratory Ho	le No:	TP1
Site Address:			38 Glenoch I	Road, Camden,	NW3 4DN				Project No:		P1207J1245
Client:			McKay Estat	es Ltd					Ground Level:		
Logged By:			MJ, LP						Date Commen	ced:	14/11/2017
Checked By:			PSw						Date Complete	ed:	14/11/2017
Type and diame	eter of equipm	ent:	Hand Dug	0.50		Mid	the	0.50	Sheet No:	Dopth	1 Of 1
Remarks			Length.	0.50		vviu	ui.	0.50		Deptil.	0.85
1: No water red	corded.										
2: *field descri	ption of the cla	ays "cor	nsistency" and	d not a strength	assessment.						
3:											
4:											
		Samp	ole or Tests					Strata		-	
Туре	Depth (mbgl)			Result			Legend	Depth (mbgl)	(mbgl)		Strata Description
						0.00 —		0.02		Kitchen tile. (MADE	GROUND).
								0.15		Concrete. (MADE G	ROUND).
						_				Soft to firm consist Gravel consists of a	ency* dark brown sandy gravelly clay.
P + J	0.40					-				sub-angular flint, b	rick and concrete fragments. (MADE
						0.50 —				GROUND).	
								0.70			
								0.72		Soft to firm consist	ency* light brown CLAY (LONDON
								0.85		CLAY)	
						1.00 —					
						_					
						-					
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						1.50 —					
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			(10112)	-				TRIAL F	PIT RECORD
			JOMAS	5			Exploratory Ho	le No:	TP2
Site Address:			38 Glenoch Road, Camden, NW3 4E	DN			Project No:		P1207J1245
Client:			McKay Estates Ltd				Ground Level:		
Logged By:			MJ, LP				Date Commen	ced:	14/11/2017
Checked By:			PSw				Date Complete	:d:	14/11/2017
Type and diame	eter of equipm	nent:	Hand Dug				Sheet No:		1 Of 1
Pit Dimension:			Length: 0.60	Wid	lth:	0.60		Depth:	1.40
Remarks									
1: No water red	corded.								
2: Investigation	n terminated	due to s	pace limitations.						
3: *field descri	ption of the c	lays "co	nsistency" and not a strength assess	ment.					
4:									
		Sam	ple or Tests			Strata		-	
Туре	Depth (mbgl)		Result		Legend	Depth (mbgl)	Water Strikes (mbgl)		Strata Description
				0.00 —				Laminate flooring a	nd wooden boards. (MADE GROUND).
				-		0.05		, , , , , , , , , , , , , , , , , , ,	· · ·
				-	*****			Suspended flooring	. (VOID).
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				-	×				
				0.50 —	XXXXX				
					×××××				
				-	*****				
				-	XXXXX				
				1.00 —					
						1 00			
				-	××××××	1.20		Soft to firm consist	ency* light brown gravelly clay. Gravel
				-				consists of abundar	t fine to coarse angular to sub-angular
P + J	1.40							flint, brick and cond	crete fragments. (MADE GROUND).
				1.50 -					
				-		1.65			
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				5.00 -					
		Sa	ampling Code: U- Undisturbed B - La	arge Disturbed	D - Small Disti	irbed W	- Water (U*)	Non recovery of San	nple
		50	Jomas Associates Ltd	- Lakeside House,	1 Furzegroun	d Way, St	ockley Park, UB	11 1BD	
			T: 0843 289 2187	E: info@jomasas	sociates.com \	V: www.jo	omasassociates.	com	

			(1011-1					TRI AL F	PIT RECORD
			(JOMAS	5			Exploratory Ho	ble No:	TP3
Site Address:			38 Glenoch Road, Camden, NW3 4DI	N			Project No:		P1207J1245
Client:			McKay Estates Ltd				Ground Level:		
Logged By:			MJ, LP				Date Commen	ced:	14/11/2017
Checked By:			PSw				Date Complete	ed:	14/11/2017
Type and diame	ter of equipme	ent:	Hand Dug				Sheet No:		1 Of 1
Pit Dimension:			Length: 0.30	Wi	dth:	0.50		Depth:	0.95
Remarks									
1: No water rec	orded.								
2: *field descrip	otion of the cla	iys "cor	nsistency" and not a strength assessm	ient.					
3:									
4:		6				Churche			
		Samp	Die of Tests			Strata	Mator	-	
Туре	Depth (mbgl)		Result		Legend	Depth (mbgl)	(mbgl)		Strata Description
				0.00 -		0.02		Concrete paving sla Concrete. (MADE G	ab. (MADE GROUND). ROUND).
				-		0.30		Soft to firm consist	ency* light brown gravelly clay. Gravel
P + J	0.45			0.50 -		0.95		consists of abundar flint, brick and cond	r fine to coarse angular to sub-agular crete fragments. (MADE GROUND).
						0.95			
				3.50 -					
				4.50 -					
		Sa	mpling Code: U- Undisturbed B - Lar Jomas Associates Ltd - T: 0843 289 2187	ge Disturbed Lakeside House E: info@jomasa:	D - Small Distu e, 1 Furzegroun ssociates.com	urbed W d Way, St N: www.jo	/ - Water (U*) tockley Park, UB omasassociates.	Non recovery of San 11 1BD com	nple

			1 101111						TRIAL	PIT RECORD
			JOMAS					Exploratory Ho	ble No:	TP4
Site Address:			38 Glenoch Road, Camden, NW3 4DN	l				Project No:		P1207J1245
Client:			McKay Estates Ltd					Ground Level:		
Logged By:			MJ, LP					Date Commen	ced:	14/11/2017
Checked By:			PSw					Date Complete	ed:	14/11/2017
Type and diame	eter of equipm	ent:	Hand Dug					Sheet No:		1 Of 1
Pit Dimension:			Length: 1.33	V	Nid	th:			Depth:	1.30
Remarks										
1: No water red	corded.									
2: *field descri	ption of the cla	ays "co	nsistency" and not a strength assessme	ent.						
3:										
4:		Som	plo or Tosts				Strata			
		Sam					Slidid	Water	-	
Туре	Depth (mbgl)		Result			Legend	Depth (mbgl)	Strikes (mbgl)		Strata Description
				0.00	-		> 0.04		Concrete paving sla	ab. (MADE GROUND).
					-		0.06		Concrete. (MADE G	ROUND).
					_				Soft to firm consist	ency* light brown gravelly clay. Gravel
P + J	0.30				_				consists of frequen	t fine to coarse angular to sub-angular
				0.50						crete magments. (MADE GROUND).
				0.50			0.60			
									Firm to stiff consist	ency* light brown with blue veins clay
					_				containing rare roo	tiets. (MADE GROUND)
					_					
P + J	1.00			1.00						
					_					
					_		1.25			
					_		\		Pink to brown claye	ey SAND. Sand is coarse containing fine
					_		1 30		to medium angular	clinker fragments. (MADE GROUND)
				1.50	_		1.50			
					-					
					-					
					-					
					-					
				2.00	_					
					-					
					-					
					_					
				2.50						
				2.50						
					_					
					_					
				3.00	_					
					_					
					_					
					-					
					-					
				3.50	-					
					-					
						1				
]				
				4.00	_					
				4.00						
					_					
					_					
					_					
				4.50	_					
					-					
					-					
					-					
					-	1				
				5.00		1				
	<u> </u>	Sa	ampling Code: U- Undisturbed B - Lar Jomas Associates Ltd - T- 0843 280 2927 E	ge Disturbed Lakeside Hou	E se,) - Small Distr 1 Furzegrour	urbed W d Way, St	- Water (U*) ockley Park, UB	Non recovery of Sar 11 1BD	nple
			1. 0040 207 2107 L							



Job No.:	P1207J1245	Issue Date:	November 2017
Project:	Spectrum House	Reference:	P1207J1245/AM
Subject:	Foundation Inspection Pit Sketches	Prepared by:	AM

<u>TP1</u>



L: 0.5m, W: 0.5m, D: 0.85m

Depth proven



Job No.:	P1207J1245	Issue Date:	November 2017
Project:	Spectrum House	Reference:	P1207J1245/AM
Subject:	Foundation Inspection Pit Sketches	Prepared by:	AM

<u>TP2</u> <u>L: 0.5m, W: 0.5m, D: 1.65m</u>



Depth not proven



Job No.:	P1207J1245	Issue Date:	November 2017
Project:	Spectrum House	Reference:	P1207J1245/AM
Subject:	Foundation Inspection Pit Sketches	Prepared by:	AM

<u>TP3</u> <u>L: 0.5m, W: 0.5m, D: 1.65m</u>



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Job No.:	P1207J1245	Issue Date:	November 2017
Project:	Spectrum House	Reference:	P1207J1245/AM
Subject:	Foundation Inspection Pit Sketches	Prepared by:	AM

TP4a (Garden Wall) L: 0.35m, W: 0.5m, D: 0.74m



Depth not proven

TP4b (Wall of House)

L: 1.33m, W: 0.5m, D: 1.30m



Depth and breadth of footing not proven

GL GL - 0.04m Laminate floor boards. (MADE GROUND).

0.04m - 0.06m Concrete. (MADE GROUND).

0.6m – 0.60m Soft to firm consistency light brown gravelly clay. Gravel consists of frequent fine to coarse angular t sub-angular flint, brick and concrete fragments. (MADE GROUND).

0.60m – 1.25m Firm to stiff consistency light brown CLAY containing blue veins and rare rootlets.

0.60m - 1.25m Pink to brown clayey SAND. Sand is coarse containing fine to medium angular clinker fragments.

	GL
-	GL – 0.04m Laminate floor boards. (MADE GROUND)
	0.04m – 0.06m Concrete. (MADE GROUND).
	0.6m – 0.60m Soft to firm consistency light brown gravelly clay. Gravel consists of frequent fine to coarse angular t sub-angular flint, brick and concrete fragments. (MADE GROUND).

0.60m – 1.25m Firm to stiff consistency light brown CLAY containing blue veins and rare rootlets.

0.60m - 1.25m Pink to brown clayey SAND. Sand is coarse containing fine to medium angular clinker fragments.

Providing a reliable a

vice, with no compromise on quality Jomas Associates Lu - Negisce cu in Engianu and Wales No. 7095350. Page 4 of 4



APPENDIX 7 – CHEMICAL LABORATORY TEST RESULTS



Emma Hucker Jomas Associates Ltd Lakeside House 1 Furzeground Way Stockley Park UB11 1BD



i2 Analytical Ltd. 7 Woodshots Meadow, Croxley Green Business Park, Watford, Herts, WD18 8YS

t: 01923 225404 f: 01923 237404 e: reception@i2analytical.com

e: Jomas Group

Analytical Report Number : 17-67859

Project / Site name:	38 Glenoch Road, Camden, NW3 4DN	Samples received on:	15/11/2017
Your job number:	JJ1245	Samples instructed on:	16/11/2017
Your order number:	P1207JJ1245.3	Analysis completed by:	23/11/2017
Report Issue Number:	1	Report issued on:	23/11/2017
Samples Analysed:	2 10:1 WAC samples		

Signed:

Rexona Rahman Customer Services Manager For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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i2 Analytical

7 Woodshots Meadow Croxley Green Business Park Watford, WD18 8YS

Telephone: 01923 225404 Fax: 01923 237404 email:reception@i2analytical.com

Waste Acceptance Criteria Analytical	Results							
Report No:		17-6	7859					
					Client:	JOMASASSO	С	
Location	3	8 Glenoch Road,	Camden, NW3 4	DN				
Lab Reference (Sample Number)					Landfill Waste Acceptance Criteria			
		859439	/ 859440			Limits	-	
Sampling Date		14/11	1/2017			Stable Non-		
Sample ID		TP2	P+J		Inert Waste	reactive HAZARDOUS	Hazardous	
Depth (m)	1.40		Landfill	waste in non- hazardous Landfill	Waste Landfill			
Solid Waste Analysis								
TOC (%)**	1.0				3%	5%	6%	
Loss on Ignition (%) **	3.9						10%	
BTEX (µg/kg) **	< 10				6000			
Sum of PCBs (mg/kg) **	< 0.007				1			
Mineral Oil (mg/kg)	< 10				500			
Total PAH (WAC-17) (mg/kg)	180				100			
pH (units)**	7.4					>6		
Acid Neutralisation Capacity (mol / kg)	2.4					To be evaluated	To be evaluated	
Eluate Analysis	10:1			10:01	Limit value	es for compliance le	eaching test	
(BS EN 12457 - 2 preparation utilising end over end leaching					using BS EN 12457-2 at L/S 10 l/kg (mg/kg)			
procedure)	mg/l			mg/kg				
Arsenic *	< 0.0011			< 0.0110	0.5	2	25	
Barium *	0.0289			0.205	20	100	300	
Cadmium *	< 0.0001			< 0.0008	0.04	1	5	
Chromium *	0.0011			0.0076	0.5	10	70	
Copper *	0.010			0.074	2	50	100	
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2	
Molybdenum *	0.0494			0.350	0.5	10	30	
Nickel *	0.0009			0.0066	0.4	10	40	
Lead *	0.0052			0.037	0.5	10	50	
Antimony *	< 0.0017			< 0.017	0.06	0.7	5	
Selenium *	0.011			0.080	0.1	0.5	7	
Zinc *	0.0044			0.031	4	50	200	
Chloride *	2.5			17	800	4000	25000	
Fluoride	1.1			8.1	10	150	500	
Sulphate *	1700			12000	1000	20000	50000	
TDS	1200			8700	4000	60000	100000	
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-	
DOC	7.10			50.4	500	800	1000	
Looch Tost Information								
Stone Content (%)	< 0.1		ļ	ļ				
Sample Mass (kg)	1.4							
Dry Matter (%)	80		ļ					
Moisture (%)	20							
			ļ					
		ļ	L	ļ		L	ļ	
Results are expressed on a dry weight basis, after correction for m	oisture content whe	ere applicable.			*= UKAS accredit	ed (liquid eluate an	alysis only)	
Stated limits are for guidance only and i2 cannot be held responsib	le for any discrepa	ncies with current le	gislation		** = MCERTS acc	redited		

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3. This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Iss No 17-67859-1 38 Glenoch Road, Camden, NW3 4DN JJ1245

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i2 Analytical

7 Woodshots Meadow Croxley Green Business Park Watford, WD18 8YS

Telephone: 01923 225404 Fax: 01923 237404 email:reception@i2analytical.com

Waste Acceptance Criteria Analytical	Results						
Report No:		17-6	57859				
					Client:	JOMASASSO	С
Location	3	8 Glenoch Road,	Camden, NW3 4	DN			
Lab Poferonce (Sample Number)					Landfill	Naste Acceptanc	e Criteria
		859441	/ 859442			Limits	-
Sampling Date		14/1	1/2017			Stable Non-	
Sample ID		TP4	1 P+J		Inert Waste	HAZARDOUS	Hazardous
Depth (m)	0.30			Landfill	waste in non- hazardous Landfill	Waste Landfill	
Solid Waste Analysis							
TOC (%)**	0.6				3%	5%	6%
Loss on Ignition (%) **	3.2						10%
BTEX (µg/kg) **	< 10				6000		
Sum of PCBs (mg/kg) **	< 0.007		1		1		
Mineral Oil (mg/kg)	< 10		1		500		
Total PAH (WAC-17) (mg/kg)	1.6				100		
pH (units)**	7.8					>6	
Acid Neutralisation Capacity (mol / kg)	3.7					To be evaluated	To be evaluated
	5.7					To be evaluated	To be evaluated
Eluate Analysis	10:1			10:01	Limit value	es for compliance le	eaching test
(BS EN 12457 - 2 preparation utilising end over end leaching					using BS EN	12457-2 at L/S 10) l/kg (mg/kg)
procedure)	mg/l			mg/kg			
Arsenic *	0.0019			0.0117	0.5	2	25
Barium *	0.0382			0.238	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0021			0.013	0.5	10	70
Copper *	0.014			0.085	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0106			0.0661	0.5	10	30
Nickel *	0.0064			0.040	0.4	10	40
Lead *	0.0035			0.022	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.012			0.073	4	50	200
Chloride *	1.2			7.7	800	4000	25000
Fluoride	2.1			13	10	150	500
Sulphate *	21			130	1000	20000	50000
TDS	93			580	4000	60000	100000
Phenol Index (Monhydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	6.39			39.8	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1		1				
Sample Mass (kg)	1.2						
Dry Matter (%)	77	1	1				
Moisture (%)	23						
	l		İ				
Results are expressed on a dry weight basis, after correction for me	oisture content wh	ere applicable.	•	•	*= UKAS accredit	ed (liquid eluate and	alysis only)
Stated limits are for guidance only and i2 cannot be held responsib	le for any discrepe	ncies with current le	gislation		** = MCERTS acci	ediited	

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as ameded) and EA Guidance WM3. This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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Project / Site name: 38 Glenoch Road, Camden, NW3 4DN

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
859439	TP2	P+J	1.40	Brown clay and sand with gravel and brick.
859441	TP4	P+]	0.30	Brown clay and sand with gravel.





Project / Site name: 38 Glenoch Road, Camden, NW3 4DN

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.	In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance""	L046-UK	W	NONE
BS EN 12457-2 (10:1) Leachate Prep	10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-2.	L043-PL	W	NONE
BTEX in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	w	NONE
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
Loss on ignition of soil @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L047-PL	D	MCERTS
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Mineral Oil (Soil) C10 - C40	Determination of mineral oil fraction extractable hydrocarbons in soil by GC-MS/GC-FID.	in-house method	L076-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	w	ISO 17025
PCB's By GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
pH in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	MCERTS
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate 10:1 WAC	Determination of sulphate in leachate by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by electrometric measurement.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L004-PL	W	NONE
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L009-PL	D	MCERTS

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Project / Site name: 38 Glenoch Road, Camden, NW3 4DN

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.



Sample ID	Other_ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
TP2	P+J	S	17-67859	859439	b	BTEX in soil (Monoaromatics)	L073B-PL	b
TP2	P+J	S	17-67859	859439	b	Total BTEX in soil (Poland)	L073-PL	b
TP4	P+J	S	17-67859	859441	b	BTEX in soil (Monoaromatics)	L073B-PL	b
TP4	P+J	S	17-67859	859441	b	Total BTEX in soil (Poland)	L073-PL	b



Emma Hucker Jomas Associates Ltd Lakeside House 1 Furzeground Way Stockley Park UB11 1BD



i2 Analytical Ltd. 7 Woodshots Meadow, Croxley Green Business Park, Watford, Herts, WD18 8YS

t: 01923 225404 f: 01923 237404 e: reception@i2analytical.com

e: Jomas Group

Analytical Report Number : 17-67858

Project / Site name:	38 Glenoch Road, Camden, NW3 4DN	Samples received on:	15/11/2017
Your job number:	JJ1245	Samples instructed on:	16/11/2017
Your order number:	P1207JJ1245.3	Analysis completed by:	23/11/2017
Report Issue Number:	1	Report issued on:	23/11/2017
Samples Analysed:	6 soil samples		

Signed:

Rexona Rahman Customer Services Manager For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Project / Site name: 38 Glenoch Road, Camden, NW3 4DN Your Order No: P1207111245 3

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TPH (C10 - C12)

TPH (C12 - C16)

TPH (C16 - C21)

TPH (C21 - C40)

Sample Reference WS2 WS2 WS3 TP1 TP12 TP13	Lab Sample Number				859433	859434	859435	859436	859437
Sample Number Pr-1 D D D D D Date Simpled 1.007 1.007 1.007 1.0017 1.0112007 1.011	Sample Reference				WS2	WS2	WS2	TP1	TP3
Depth (m)	Sample Number				P+J	D	D	P+J	D
Date Sampled Jun 2017 19/11/2017 10/11/2017 10/11/2017 10/11/2	Depth (m)				0.50	1.00	3.00	0.40	0.95
Time Taken Two Sugulat None Sugulat None Sugulat None Sugulat None Sugulat None Sugulat None Sugulat Analytical Parameter gr	Date Sampled				14/11/2017	14/11/2017	14/11/2017	14/11/2017	14/11/2017
Analytical Parameter (Soil Analysis) gr br gr	Time Taken				None Supplied				
Stone Content 9. 0.1 NOME 2.0.1 < 0.0.1 < 0.0.2 < 0.0.1 < 0.0.2 2.1 2.0.1 2.0.1 7.2 2.3 Total mass of sample received 1.9 0.001 NORE 1.3 1.4 0.34 1.4 0.34 Aebetos in Soi Type N/A NORE 1.3 1.4 0.34 1.4 0.34 Consent Lorrances Pri-Antomand attains NA MCR3TS 2.1 - NA 2.1 - NA 2.1 - NA 1.4 - 1.4 - 1.4 - 1.4 - 1.4 - 1.4 - 1.4 - 1.4 - 1.4 - 1.4 - 1.4 - 1.4	Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Model Location % N/A Nova 2.0 2.1 2.3 1.7 2.3 Addector, in: Sol Tarle 0,001 Nova 1.3 1.4 0.34 1.4 0.34 Addector, in: Sol Tarle Nova 1.3 1.4 0.34 1.4 0.34 Addector, in: Sol Tarle Nova 1.3 1.4 0.34 1.4 0.34 Addector, in: Sol Pathuki N/A MEBTS 8.2 - 8.3 9.8 8.4 Total Subhle SOL In: Mathue N/A MEBTS 8.2 - 0.32 1.6 0.90 Water Soluble SOL for retriction (2:1 Leachine g1 0.022 MCERTS 6.6 - - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6	Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total mass of sample received tog 0.001 NNE 1.3 1.4 0.34 1.4 0.34 Assession Soll Type NA 350 17028 Net/detected - Net/detected - General Inorganics make 1 MCRITS 8.2 - 8.3 9.8 8.4 Total Construct make 1 MCRITS <.1	Moisture Content	%	N/A	NONE	20	21	23	17	23
Addestors in Soll Type N/A ISO 17025 Not-detected . Not-detected . General Longanics #1 - Automated pt lunks N/A MCRETS 0.2 - 0.3.3 9.8 8.4 Todal Quarke mayle 50 MCRETS 0.2 - 0.3.2 1.6 0.909 Water Soluble SOL 16F restraction (2:1 Leachate opt 1.0 MCRETS 0.6.6 - 0.0.2 1.6.5 0.909 Water Soluble SOL 16F restraction (2:1 Leachate opt 1.1.5 MCRETS <.	Total mass of sample received	kg	0.001	NONE	1.3	1.4	0.34	1.4	0.34
Adapted in Sold Type N/A IS 017028 Nord-detected - Nord-detected - General Loroganics - - 8.3 9.8 8.4 If - Automated math 1 MCRTS 6.2 - 6.3 9.8 8.4 Total Capatio math 10 MCRTS <.1									
General Inorganics pt - Automated pt initials N/A MCRRTS 8.2 - 8.3 9.8 8.4 Total Sounde mg/h 10 MCRRTS 6.2 - 0.6 - - 0.6 - - 0.6 - - 0.6 - - 0.6 - - 0.6 - - 0.6 - - 0.6 - - 0.6 - - 0.6 - - 0.6 - - 0.6 - - 0.6 - - 0.6 - - 0.6 - <	Asbestos in Soil	Туре	N/A	ISO 17025	Not-detected	-	-	Not-detected	-
General Inorganics MA MCRRTS 8.2 - 8.3 9.8 8.4 Total Cynnice mg/a 1 MCRTS <.1									
ph - Automated ph - Units N/A MCRTS 8.2 - 8.3 9.8 8.4 Total Signified mg/s 1 MCRTS 4.1 - 0.6 - - 0.6 - - 0.6 - - 0.6 - - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - 0.6 - - 0.6 - <td>General Inorganics</td> <td></td> <td>-</td> <td></td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td></td>	General Inorganics		-		-	-	-	-	
Total Cycle as SO. maging SO. MCRRS 470 - - C 1 - Water Soluble SO 16br extraction (2:1 Leachate gl 0.00125 MCRRS 0.064 - 0.32 1.6 0.90 Water Soluble SO 16br extraction (2:1 Leachate gl 0.00125 MCRRS 0.66 - - 0.66 Total Organic Carbon (TOC) % 0.1 MCRRS 63.6 - - 0.66 Total Phenois (monohydric) mg/hg 1 MCRRS <1.0	pH - Automated	pH Units	N/A	MCERTS	8.2	-	8.3	9.8	8.4
Total Suphate as SO, magka 50 PMCRIS 470 - 12000 - Equivalent) all 0.00125 PMCRIS 0.064 - 0.32 1.6 0.90 Marker Solute SOV 16hr extraction (2:1 Leachate all 0.00125 PMCRIS 63.6 - - 1590 - Total Grant Carbon (TOC) % 0.1 PMCRIS 63.6 - - 0.6 - 0.6 Total Grant Carbon (TOC) % 0.1 PMCRIS <	Total Cyanide	mg/kg	1	MCERTS	< 1	-	-	< 1	-
Water Soluble S04 16tr extraction (2:1 Leachate grit 0.00125 MCBRIS 0.064 . 0.32 1.6 0.90 Water Soluble S04 16tr extraction (2:1 Leachate mgl) mgl) 1.25 MCBRIS 0.064 . 0.32 1.6 0.90 Total Opanic Carbon (TOC) % 0.1 MCBRIS - 0.6 . . 0.6 Total Opanic Carbon (TOC) % 0.1 MCBRIS - 0.6 . . 0.6 Speciated PAHs . . 0.05 . . 0.48 . Bighthalene mgl/g 0.05 MCBRIS - 0.05 . . 0.48 . Aconsphthyline mgl/g 0.05 MCBRIS - 0.05 . . 0.48 . Hornere mgl/g 0.05 MCBRIS - 0.05 . . 0.48 . Mithistere mgl/g 0.05 MCBRIS - . 0.53 . . 0.53 . . 0.53 . . .	Total Sulphate as SO ₄	mg/kg	50	MCERTS	470	-	-	12000	-
Caluvalent) or 0.0025 MCERTS 0.004 - 0.02 1.5 0.90 Galvalent) mgl 1.25 MCERTS 63.6 - - 1590 - Galvalent) mgl 1.25 MCERTS 63.6 - - 0.6 Total Phenols Total Phenols (monohydric) mg/rg 0.05 MCERTS < 0.05	Water Soluble SO4 16hr extraction (2:1 Leachate								
Tradit Journel Del 2008 Del 2008 DEL 21 DEDURCE mg/t 1.25 MCERTS 6.3.6 - - 1.590 - Total Organic Carbon (TOC) % 0.1 MCERTS - 0.6 - - 0.6 Total Phenols (mail Phenols (monolydric) mg/kg 1 MCERTS <	Equivalent) Water Soluble SO4 16br extraction (2:1 Leachate	g/l	0.00125	MCERTS	0.064	-	0.32	1.6	0.90
Calculation Total Participant Color	Fauivalent)	ma/l	1 25	MCEDTS	63.6	_	_	1500	
Total Phenols Total Phenols Total Phenols Total Phenols (monhydric) mg/kg 1 MCERTS < 1.0	Total Organic Carbon (TOC)	0%	0.1	MCERTS	-	0.6		-	0.6
Total Phenols mg/kg 1 MCERTS < 1.0 - < 1.0 - Speciated PAHs		70	0.1	PICERT3	_	0.0	_		0.0
Total Phenols (monohydric) mg/hg 1 MCERTS < 1.0 - < 1.0 - Speciated PAHs Naphthalene mg/hg 0.05 MCERTS < 0.05 - - 0.48 - Acenapith/Weite mg/hg 0.05 MCERTS < 0.05 - - 0.48 - Acenapith/Weite mg/hg 0.05 MCERTS < 0.05 - - 0.48 - Acenapith/Weite mg/hg 0.05 MCERTS < 0.05 - - 0.63 - Acenapith/Weite mg/hg 0.05 MCERTS < 0.05 - 1.1 - Adthracene mg/hg 0.05 MCERTS 0.65 - - 9.7 - Pyrene mg/hg 0.05 MCERTS 0.33 - - 4.6 - Eluorenthere mg/hg 0.05 MCERTS 0.24 - - 4.8 - Benzo(hjluoranthe	Total Phenois								
Characterization Construction Construction Construction Construction Speciated PAHs	Total Phenols (monohydric)	ma/ka	1	MCERTS	< 1.0	_	-	< 1.0	-
Speciated PAHS Naphthalene mg/kg 0.05 MCERTS < 0.05		iiig/kg	1	PICERT3	< 1.0	_	_	< 1.0	_
Operation mg/kg 0.05 MCERTS < 0.05 - - 0.48 - Acenaphthylene mg/kg 0.05 MCERTS < 0.05	Speciated PAHs								
Implicit Implicit Could Implicit Could Implicit Could Implicit Could Implicit Implici	Nanhthalene	ma/ka	0.05	MCEDTS	< 0.05	_	_	0.48	_
Categorithytene Indukty Codd Fick Sty <		mg/kg	0.05	MCEDITC	< 0.05			< 0.05	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		mg/kg	0.05	MCEDIC	< 0.05	-	-	0.03	
Indexity Indexity Outs Incents Outs Outs <thouts< th=""> Outs Outs</thouts<>	Fluorene	mg/kg	0.05	MCEDTS	< 0.05		_	0.52	-
Internationalize Implify 0.000 Incents 0.015 - 1.1 Fluoranthene mg/kg 0.05 MCERTS 0.05 9,7 Prene mg/kg 0.05 MCERTS 0.53 9,7 Benzolophilowanthene mg/kg 0.05 MCERTS 0.30 4.6 Benzolophilowanthene mg/kg 0.05 MCERTS 0.28 4.6 Benzolophilowanthene mg/kg 0.05 MCERTS 0.20 4.6 Benzolophilowanthene mg/kg 0.05 MCERTS 0.20 4.8 Benzolophilowanthene mg/kg 0.05 MCERTS 0.24 3.8 Dibenzolaphiperviene mg/kg 0.05 MCERTS 0.18 1.9 Dibenzolaphiperviene mg/kg 0.05 MCERTS 0.20 2.2	Dhenanthrene	mg/kg	0.05	MCEDTS	0.05			77	
Bundentic Imgring Dood MCRTS Cools Imgring Dood	Anthracene	mg/kg	0.05	MCERTS	< 0.45			1.1	
Inductories Img/kg Outs MCRTS Outs Img/kg	Fluoranthene	mg/kg	0.05	MCERTS	0.65	_	_	9.7	-
Indust Implug Outs Indust Indust <thindust< th=""> Indust<td>Pyrene</td><td>mg/kg</td><td>0.05</td><td>MCERTS</td><td>0.05</td><td>_</td><td>_</td><td>7.6</td><td>_</td></thindust<>	Pyrene	mg/kg	0.05	MCERTS	0.05	_	_	7.6	_
Chrysene mg/kg O.05 MCERTS O.28 - - 4.0 - Benzo(b)fluoranthene mg/kg 0.05 MCERTS 0.28 - - 4.8 - Benzo(k)fluoranthene mg/kg 0.05 MCERTS 0.21 - - 2.2 - Benzo(k)fluoranthene mg/kg 0.05 MCERTS 0.24 - - 3.8 - Indenci,2,3-cd)pyrene mg/kg 0.05 MCERTS 0.18 - - 0.41 - Benzo(a)pyrene mg/kg 0.05 MCERTS 0.20 - - 0.41 - Benzo(ghi)perylene mg/kg 0.05 MCERTS 0.20 - 2.2 - Total PAH Speciated Total EPA-16 PAHs mg/kg 0.2 MCERTS 3.40 - - 2.2 - Boron (water soluble) mg/kg 0.2 MCERTS 0.2 - <	Benzo(a)anthracene	ma/ka	0.05	MCERTS	0.36	-	-	4.6	-
Benzo(b)fluoranthene mg/kg 0.05 MCRTS 0.30 - - 4.8 - Benzo(k)fluoranthene mg/kg 0.05 MCRTS 0.21 - - 2.2 - Benzo(k)fluoranthene mg/kg 0.05 MCRTS 0.24 - - 3.8 - Indenc(1,2,3-cd)pyrene mg/kg 0.05 MCRTS 0.18 - - 1.9 - Dibenz(a,h)anthracene mg/kg 0.05 MCRTS <.0.05	Chrysene	ma/ka	0.05	MCERTS	0.28	-	-	4.0	-
Benzo(k)fluoranthene mg/kg 0.05 MCERTS 0.21 - 2.2 - Benzo(k)fluoranthene mg/kg 0.05 MCERTS 0.21 - 3.8 - Dibenz(a,h)anthracene mg/kg 0.05 MCERTS 0.18 - - 0.41 - Dibenz(a,h)anthracene mg/kg 0.05 MCERTS 0.20 - - 0.41 - Benzo(k)fluoranthene mg/kg 0.05 MCERTS 0.20 - 0.41 - Dibenz(a,h)anthracene mg/kg 0.05 MCERTS 0.20 - - 2.2 - Total PAH	Benzo(b)fluoranthene	ma/ka	0.05	MCERTS	0.30	-	-	4.8	-
Benzo(a) pyrene ma/kg 0.05 MCERTS 0.24 - - 3.8 - Indenci (1,2,3-cd) pyrene mg/kg 0.05 MCERTS 0.18 - - 1.9 - Dibenz(a,h) anthracene mg/kg 0.05 MCERTS <	Benzo(k)fluoranthene	ma/ka	0.05	MCERTS	0.21	-	-	2.2	-
Indeno(1,2,3-cd)pyrene mg/kg 0.05 MCERTS 0.18 - - 1.9 - Dibenz(a,h)anthracene mg/kg 0.05 MCERTS <.0.05	Benzo(a)pyrene	ma/ka	0.05	MCERTS	0.24	-	-	3.8	-
Dibenz(a,h)anthracene mg/kg 0.05 MCERTS < 0.05 - - 0.41 - Benzo(ghi)perylene mg/kg 0.05 MCERTS 0.20 - - 2.2 - Total PAH Speciated Total EPA-16 PAHs mg/kg 0.8 MCERTS 3.40 - - 52.0 - Heavy Metals / Metalloids Arsenic (aqua regia extractable) mg/kg 1 MCERTS 0.7 - 2.7 - Gadmium (aqua regia extractable) mg/kg 0.2 MCERTS 0.7 - 2.7 - Cadmium (aqua regia extractable) mg/kg 0.2 MCERTS <0.2	Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.18	-	-	1.9	-
Benzo(ghi)perylene mg/kg 0.05 MCERTS 0.20 - - 2.2 - Total PAH Speciated Total EPA-16 PAHs mg/kg 0.8 MCERTS 3.40 - - 52.0 - Heavy Metals / Metalloids Arsenic (aqua regia extractable) mg/kg 1 MCERTS 16 - - 16 - Born (water soluble) mg/kg 0.2 MCERTS 0.7 - 2.7 - Cadmium (aqua regia extractable) mg/kg 0.2 MCERTS 0.7 - 2.7 - Chromium (hexavalent) mg/kg 4 MCERTS <0.2 - < <0.2 - Chromium (aqua regia extractable) mg/kg 1 MCERTS 38 - - < <0.2 - Chromium (aqua regia extractable) mg/kg 1 MCERTS 38 - - 78 - Chromium (aqua regia extractable) mg/kg 1 MCERTS 38	Dibenz(a,h)anthracene	ma/ka	0.05	MCERTS	< 0.05	-	-	0.41	-
Total PAH Speciated Total EPA-16 PAHs mg/kg 0.8 MCERTS 3.40 - - 52.0 - Heavy Metals / Metalloids Arsenic (aqua regia extractable) mg/kg 1 MCERTS 0.7 - 2.7 - Boron (water soluble) mg/kg 0.2 MCERTS 0.7 - 2.7 - Cadmium (aqua regia extractable) mg/kg 0.2 MCERTS <0.2	Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.20	-	-	2.2	-
Total PAH Speciated Total EPA-16 PAHs mg/kg 0.8 MCERTS 3.40 - - 52.0 - Heavy Metals / Metalloids Arsenic (aqua regia extractable) mg/kg 1 MCERTS 16 - - 16 - Boron (water soluble) mg/kg 0.2 MCERTS 0.7 - 2.7 - Cadmium (aqua regia extractable) mg/kg 0.2 MCERTS <.0.2		0. 0							
Speciated Total EPA-16 PAHs mg/kg 0.8 MCERTS 3.40 - - 52.0 - Heavy Metals / Metalloids Arsenic (aqua regia extractable) mg/kg 1 MCERTS 16 - - 16 - Boron (water soluble) mg/kg 0.2 MCERTS 0.7 - - 2.7 - Cadmium (aqua regia extractable) mg/kg 0.2 MCERTS < 0.2 - - < - - - 16 - - - 0.2 - - 2.7 - - Cadmium (aqua regia extractable) mg/kg 0.2 MCERTS <<0.2 - - <<0.2 - - <<0.2 - - <<0.2 - - <<0.2 - - <<0.2 - - <0.2 - - <0.2 - <<0.2 - <<0.2 - <<0.2 - <0.2 - <0.2 - <0.2	Total PAH								
Heavy Metals /	Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	3.40	-	-	52.0	-
Heavy Metals / Metalloids Arsenic (aqua regia extractable) mg/kg 1 MCERTS 16 - 16 - Boron (water soluble) mg/kg 0.2 MCERTS 0.7 - - 2.7 - Cadmium (aqua regia extractable) mg/kg 0.2 MCERTS <0.2									
Arsenic (aqua regia extractable) mg/kg 1 MCERTS 16 - 16 - Boron (water soluble) mg/kg 0.2 MCERTS 0.7 - - 2.7 - Cadmium (aqua regia extractable) mg/kg 0.2 MCERTS < 0.2	Heavy Metals / Metalloids								
Boron (water soluble) mg/kg 0.2 MCERTS 0.7 - - 2.7 - Cadmium (aqua regia extractable) mg/kg 0.2 MCERTS < 0.2	Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	16	-	-	16	-
Cadmium (aqua regia extractable) mg/kg 0.2 MCERTS < 0.2 - - < 0.2 - Chromium (hexavalent) mg/kg 4 MCERTS < 4.0	Boron (water soluble)	mg/kg	0.2	MCERTS	0.7	-	-	2.7	-
Chromium (hexavalent) mg/kg 4 MCERTS < 4.0 - < < 4.0 - Chromium (aqua regia extractable) mg/kg 1 MCERTS 44 - - 31 - Copper (aqua regia extractable) mg/kg 1 MCERTS 38 - - 31 - Lead (aqua regia extractable) mg/kg 1 MCERTS 140 - - 420 - Mercury (aqua regia extractable) mg/kg 0.3 MCERTS <0.3	Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	-
Chromium (aqua regia extractable) mg/kg 1 MCERTS 44 - - 31 - Copper (aqua regia extractable) mg/kg 1 MCERTS 38 - - 78 - Lead (aqua regia extractable) mg/kg 1 MCERTS 140 - - 420 - Mercury (aqua regia extractable) mg/kg 0.3 MCERTS <0.3	Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	-	-	< 4.0	-
Copper (aqua regia extractable) mg/kg 1 MCERTS 38 - - 78 - Lead (aqua regia extractable) mg/kg 1 MCERTS 140 - - 420 - Mercury (aqua regia extractable) mg/kg 0.3 MCERTS <0.3	Chromium (aqua regia extractable)	mg/kg	1	MCERTS	44	-	-	31	-
Lead (aqua regia extractable) mg/kg 1 MCERTS 140 - - 420 - Mercury (aqua regia extractable) mg/kg 0.3 MCERTS < 0.3	Copper (aqua regia extractable)	mg/kg	1	MCERTS	38	-	-	78	-
Mercury (aqua regia extractable) mg/kg 0.3 MCERTS < 0.3 - - < 0.3 - Nickel (aqua regia extractable) mg/kg 1 MCERTS 38 - - 23 - Selenium (aqua regia extractable) mg/kg 1 MCERTS <1.0	Lead (aqua regia extractable)	mg/kg	1	MCERTS	140	-	-	420	-
Nickel (aqua regia extractable) mg/kg 1 MCERTS 38 - - 23 - Selenium (aqua regia extractable) mg/kg 1 MCERTS <1.0	Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	-
Selenium (aqua regia extractable) mg/kg 1 MCERTS < 1.0 - - < 1.0 - Zinc (aqua regia extractable) mg/kg 1 MCERTS 110 - - 84 - Petroleum Hydrocarbons Petroleum Range Organics (C6 - C10) mg/kg 0.1 MCERTS < 0.1 - - < 0.1 -	Nickel (aqua regia extractable)	mg/kg	1	MCERTS	38	-	-	23	-
Zinc (aqua regia extractable) mg/kg 1 MCERTS 110 - 84 - Petroleum Hydrocarbons Petroleum Range Organics (C6 - C10) mg/kg 0.1 MCERTS < 0.1	Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Petroleum Hydrocarbons Petroleum Range Organics (C6 - C10) mg/kg 0.1 MCERTS < 0.1	Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	-	-	84	-
Petroleum Hydrocarbons Petroleum Range Organics (C6 - C10) mg/kg 0.1 MCERTS < 0.1									
Petroleum Hydrocarbons Petroleum Range Organics (C6 - C10) mg/kg 0.1 MCERTS < 0.1									
Petroleum кange Organics (Со - С10) mg/kg U.1 MCERTS < 0.1 < 0.1 -	Petroleum Hydrocarbons		0.1						
	reu vieum kange organics (Cb - C10)	mg/kg	0.1	MCERTS	< 0.1	-	-	< 0.1	-

mg/kg 10 MCERTS < 10 - - 100 -

< 2.0

< 4.0

< 1.0

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2

4

1

mg/kg

mg/kg

mg/kg

MCERTS

MCERTS

MCERTS

3.6

11

45





Project / Site name: 38 Glenoch Road, Camden, NW3 4DN Your Order No: P1207JJ1245.3

Lab Sample Number				859433	859434	859435	859436	859437
Sample Reference				WS2	WS2	WS2	TP1	TP3
Sample Number				P+J	D	D	P+J	D
Depth (m)				0.50	1.00	3.00	0.40	0.95
Date Sampled		14/11/2017	14/11/2017	14/11/2017	14/11/2017 14/11/2017			
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied None Supplied	
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Iss No 17-67858-1 38 Glenoch Road, Camden, NW3 4DN JJ1245





Project / Site name: 38 Glenoch Road, Camden, NW3 4DN Your Order No: P1207JJ1245.3

Lab Sample Number				859438			
Sample Reference				TP4			
Sample Number				D			
Depth (m)				1.00			
Date Sampled				14/11/2017			
Time Taken			-	None Supplied			
			A				
Analytical Parameter	c	det	St SL				
(Soil Analysis)	nit	nit	atu				
	v	ion f	is atio				
			ă				
Stone Content	%	0.1	NONE	< 0.1			
Moisture Content	%	N/A	NONE	22			
Total mass of sample received	kg	0.001	NONE	1.3			
Asbestos in Soil	Туре	N/A	ISO 17025	-			
General Inorganics		NI / A	MOTOTO	7.0			
pri - Automated	pH Units	IN/A	MCERTS	7.8		 	
Total Sulphate as SO.	mg/kg	1	MCEDIC	-			
Water Soluble SO4 16hr extraction (2:1 Leachate	mg/Kg	50	MCERT3	-			
Equivalent)	g/l	0.00125	MCERTS	0.40			
Water Soluble SO4 16hr extraction (2:1 Leachate							
Equivalent)	mg/l	1.25	MCERTS	-			
Total Organic Carbon (TOC)	%	0.1	MCERTS	-			
Total Phenois							
Total Phenols (monohydric)	mg/kg	1	MCERTS	-			
a							
Speciated PAHs							
Naphthalene	mg/kg	0.05	MCERTS	-			
Acenaphthylene	mg/kg	0.05	MCERTS	-			
Acenaphthene	mg/kg	0.05	MCERTS	-			
Fluorene	mg/kg	0.05	MCERTS	-			
Anthrasana	mg/kg	0.05	MCERTS	-			
Fluoranthono	mg/kg	0.05	MCEDTC				
Dyrene	ma/ka	0.05	MCERTS				
Benzo(a)anthracene	ma/ka	0.05	MCERTS	-			
Chrysene	ma/ka	0.05	MCERTS	-			
Benzo(b)fluoranthene	ma/ka	0.05	MCERTS	-			
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-			
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-			
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-			
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-			
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-			
Total PAH							
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-			
Heavy Metals / Metalloids	-						
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-			
Boron (water soluble)	mg/kg	0.2	MCERTS	-			
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-			
Chromium (nexavalent)	mg/kg	4	MCERTS	-			
Corpor (agua regia extractable)	mg/kg	1	MCERTS	-			
Lood (aqua regia extractable)	mg/kg	1	MCEDIC	-			
Leau (ayud Teyid exildudule) Morcum (agua rogia ovtractable)	mg/kg	1	MCEDIC	-	L		
Nickel (aqua regia extractable)	mg/kg	1		-			
Selenium (aqua regia extractable)	ma/ka	1	MCERTS	-			
Zinc (aqua regia extractable)	mg/kg	1	MCEDIS			 	
	iiig/Ng	1	PICENTS	-			
Petroleum Hydrocarbons							

Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	-		
TPH (C10 - C12)	mg/kg	2	MCERTS	-		
TPH (C12 - C16)	mg/kg	4	MCERTS	-		
TPH (C16 - C21)	mg/kg	1	MCERTS	-		
TPH (C21 - C40)	mg/kg	10	MCERTS	-		

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Project / Site name: 38 Glenoch Road, Camden, NW3 4DN Your Order No: P1207JJ1245.3

Sample Reference					
Sample Number			TP4		
Sample Number			D		
Depth (m)			1.00		
Date Sampled			14/11/2017		
Time Taken			None Supplied		
Analytical Parameter (Soil Analysis)	Limit of detection	Accreditation Status			

Iss No 17-67858-1 38 Glenoch Road, Camden, NW3 4DN JJ1245





Project / Site name: 38 Glenoch Road, Camden, NW3 4DN

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
859433	WS2	P+J	0.50	Brown clay with gravel.
859434	WS2	D	1.00	Brown clay with gravel.
859435	WS2	D	3.00	Brown clay with gravel.
859436	TP1	P+J	0.40	Brown clay and sand with gravel and brick.
859437	TP3	D	0.95	Brown clay and sand with gravel.
859438	TP4	D	1.00	Brown clay.





Project / Site name: 38 Glenoch Road, Camden, NW3 4DN

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	w	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
PRO (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP- OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP- OES.	L038-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L009-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding.	L076-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland. Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.



Sample ID	Other_ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
TP1	P+J	S	17-67858	859436	b	PRO (Soil)	L088-PL	b
WS2	P+J	S	17-67858	859433	b	PRO (Soil)	L088-PL	b



APPENDIX 8 – GEOTECHNICAL LABORATORY TEST RESULTS

			TES	T CI	ERTI	FICA	TE			i2 A 7 W	nalytica oodsho	ll Ltd ots Mea	dow		iyiteal
	Deter	mina	tion	of Li	quid	and	Plas	tic Li	imits	Cro: Wat	xley Gre tford He	een Bus erts WD	siness F 18 8YS	Park S	Environmental Scien
4041	Tested in A	ccordan	ce with B	S1377	-2: 1990	: Clause	4.3 & 5	5: Definiti	ive Metho	bd					
Client:	Joma	as Asso	ciates L	td						Clie	ent Refe	erence:	JJ124	5	
Client Address	: Lake 1 Fui	rzegrou	nd Way							[Job N Date Sa	mpled:	Not Gi	ven	
	Stoc	kley Pai 1 1 BD	rk							C	ate Re	ceived:	15/11/2	2017	
Contact:	Emm	na Huck	er								Date 1	Fested:	27/11/2	2017	
Site Name: Site Address:	38 G 38 G	lenoch lenoch	Road, C Road, C	Camde Camde	n NW3 n NW3	4DN 4DN					Samp	led By:	Not Gi	ven	
TEST RESUL	TS		Labo	oratory	Refere	ence:	860)851							
			S	ample	Refere	ence:	Not	Given				_		_	
Description:	Yello WS2	wish br	own CL	AY								San Dept	nple Ty h Top (i	pe:B m1·20	0
Sample Prepar	ation:	Teste	ed in na	tural co	onditior	1						Depth	Base [m]: No	t Given
As Rece Moisture Co	ived		Liquid	Limi	t	PI	astic	Limit		Plastic	city Inc	lex	% Pa	assin	g 425µm t Sieve
36			8	8			29)	╈		59			10	0
100 ·	1 1		1			1					1		1		
90 -														\ line	
80 -															l
70 -												\checkmark			
60										GE					
E CO								cv	• 86	J851					
										ME					
						CH	\nearrow	MV							
190 · 30 ·				С											
<u> </u>			CL		\frown	мн									
10 ·			MI	M	ı										
0 -	 0 10	20	30	40	50	60	70	80	90	100	110	120	130	140	 150
							LIQUI	DLIMI	r 						
		Legend	, based or	n BS 593	0:2015 C	ode of pra Plasticity	actice for	site inves	tigations	Liquid l	imit				
		C M	Clay Silt			L Lov I Me	w edium			below 3 35 to 50	85 D				
						H Hig V Ve	gh rv hiah			50 to 70))				
						E Ex	tremely	high		exceed	ing 90				
			Organic			O ap	pend to	classificati	ion for org	anic matei	ial (eg Cl	HO)			
Remarks															

Approved:

Dariusz Piotrowski PL Laboratory Manager Geotechnical Section

Date Reported:

Piotuli

30/11/2017

Signed:

Darren Berrill Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

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Tested in Accordance with BS1377-2: 1990: Clause 4.3 & 5. Definitive Method Client Address: Lakeside House	UKAS TISTING Tested in Accordance with BS1377-2: 1990: Clause 4.3 & 5: Definitive Method	i2 Analytical Ltd 7 Woodshots Meadow Croxley Green Business Park Watford Herts WD18 8YS												
Client Address: Jones Associates Ltd Client Reference: JJ1245 Client Address: Lakeside House TFUTE: Lakeside House Stockley Park Jones Associates Ltd Client Reference: J1245 List Name: Jones Associates Ltd Client Reference: Jones Testes: 27/11/2017 Stite Name: J38 Glenoch Road, Canden NW3 4DN TEST RESULTS: Lakoratory Reference: Mot Given Bescription: Vellowish forwn CLAY Sampled By: Not Given Bescription: Tested in natural condition Tested in natural condition As Received Liquid Limit Plastic Limit Plasticity Index % Passing 425µm Moisture Content [%] I% I 1%														
Site Vadrese: 33 Gleinoch Road, Camben NW3 4DN TEST RESULTS Laboratory Reference: 860852 Sample Reference: Not Given Description: VS2 Sample Preparation: Tested in natural condition Moisture Content [9] 10 10 10 10 10 10 10 10 10 10	Hutting Jomas Associates Ltd Client Reference: JJ1245 Client Address: Lakeside House Job Number: 17-68135 1 Furzeground Way Date Sampled: Not Given Stockley Park Date Received: 15/11/2017 Contact: Emma Hucker Date Tested: 27/11/2017 Site Name: 38 Glenoch Read Camdon NW/2 4DN Sampled By: Not Given	lient:Jomas Associates LtdClient Reference: JJ1245lient Address:Lakeside HouseJob Number: 17-681351 Furzeground WayDate Sampled: Not GivenStockley ParkDate Received: 15/11/2017UB11 1BDDate Tested: 27/11/2017contact:Emma HuckerDate Tested: 27/11/2017ite Name:38 Glenoch Road, Camden NW3 4DNSampled By: Not Givenite Address:38 Glenoch Road, Camden NW3 4DN												
TEST RESULTS Laboratory Reference: Not Given Description: Yellowish brown CLAY Sample Reference: Not Given Description: Yellowish brown CLAY Sample Type: B Depth Top (m): 3.00 Sample Preparation: Tested in natural condition Depth Base [m]: Not Given As Received Liquid Limit Plastic Limit Plasticity Index % Passing 42Sµm 33 84 31 53 100 Of the set	e Address: 38 Glenoch Road, Camden NW3 4DN													
As Received Moisture Content [%] Liquid Limit [%] [%] [%] [%] [%] [%] BS Test Sieve 33 84 31 53 100 100 100 100 100 100 100 100	TEST RESULTS Laboratory Reference: 860852 Sample Reference: Not Given Description: Yellowish brown CLAY Sample Type: B Location: WS2 Depth Top [m]: 3.00 Sample Preparation: Tested in natural condition Depth Base [m]: Not Given	'en												
33 84 31 53 100 100 100 100 100 100 100 100	As Received Liquid Limit Plastic Limit Plasticity Index % Passing 42 Moisture Content [%] [%] [%] BS Test Sig	5µm ve												
100 100 100 100 100 100 100 100	33 84 31 53 100													
	As Received Moisture Content [%] Liquid Limit [%] Plastic Limit [%] Plasticity Index [%] % Passing 425µm BS Test Sieve 33 84 31 53 100 Image: Signed													

Remarks

Approved:

Dariusz Piotrowski PL Laboratory Manager Geotechnical Section

Date Reported:

Piotuli

30/11/2017

Signed:

Darren Berrill Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

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		TE	ST CE		i2 Analytic 7 Woodsh	al Ltd ots Mead	dow		alytical			
	Deterr	ninatio	n of Lie	quid a	nd Pla	astic Lin	<u>nits</u>	Watford H	een Bus erts WD	iness Pa 18 8YS	ark Enviror	mental Science
testing 4041 Te	ested in Ac	cordance wit	h BS1377-2	2: 1990: C	lause 4.3	& 5: Definitive	e Method					
Client:	Jomas Lakes	s Associate	s Ltd					Client Ref	erence:	JJ1245 17-6813	35	
	1 Furz	eground W	ay					Date Sa	ampled:	Not Giv	en	
	UB11	1BD						Date Re	ceived:	15/11/2	017	
Contact: Site Name:	Emma 38 Gle	a Hucker enoch Road	l, Camden	NW3 4E	ON			Date Sam	Tested: oled By:	27/11/2 Not Giv	017 en	
Site Address:	38 Gle	enoch Road	l, Camden	NW3 4E	ON				,			
TEST RESULT	rs	L	aboratory	Referenc	e: 8	360853						
Description:	Yellow	ish brown	Sample CLAY	Referenc	e: I	Not Given			Sam	ple Typ	e: B	
Location:	WS2								Depth	n Top [m	n]: 4.00	
Sample Prepara	ition:	Tested in	natural co	ndition					Depth	Base [n	ij: Not G	iven
As Receiv	/ed topt [%]	Liqu	id Limit		Plast	tic Limit	P	Plasticity In	dex	% Pa	ssing 4	25µm
32	tent [/0]		81			28		53			100	
100 T				- T			-					
90 -					_						line	
80 -				_			_			\nearrow		
70 -					-		_	CE	\checkmark	_		
× ⁶⁰				_								
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≧ 40 -					сн							
TAST 30 -			CI				-			_		
a 20 -		CL		\checkmark	мн							
10 -	•••••		м									
0 0	10	20 3) 40	50	60 7	70 80	90	100 110	120	130 2	40 15	0
		Legend been	d an DC 5000	2015 Code	LIC		otione					
		Legend, base	1 ON BS 2930	Pla	e of practice	for site investig	ations	Liquid Limit				
		M Silt		L 	Medium	ı		35 to 50				
				V E	Very high	gh		70 to 90				
		Orgai	nic	E O	append	to classification	i for organ	ic material (eg C	HO)			
Remarks												

Approved:

Dariusz Piotrowski PL Laboratory Manager Geotechnical Section

Date Reported:

Piotuli

30/11/2017

Signed:

Darren Berrill Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

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Page 1 of 1

		<u></u>	EST	i: 7 0	2 Analytic 7 Woodsh 2 roxley G	cal Ltd nots Mea	dow	Park	nahytical					
	Deterr	ninatio	on of	Liqu	uid a	nd Pl	astic	Limit	<u>s</u>	Vatford F	lerts WD	511855 018 8YS	S	Environmental Science
4041	sted in Acc	cordance w	ith BS1	377-2: 1	1990: C	lause 4.3	3 & 5: Def	finitive Me	ethod					
Client: Client Address:	Jomas Lakes	s Associat ide House	es Ltd							Client Re	ference:	JJ124	5 135	
	1 Furz	eground \	Vay							Date S	ampled:	Not G	iven	
	UB11	1BD								Date R	eceived:	15/11/	2017	
Contact: Site Name:	Emma 38 Gle	i Hucker enoch Roa	id, Can	nden N	Date Tested: 27/11/2017 Sampled By: Not Given									
Site Address:	38 Gle	enoch Roa	id, Can	nden N	IW3 40	DN					, ,			
TEST RESULT	S	I	abora	tory Re	eferenc	e:	860854							
Description:	Yellow	vish browr	Sam CLAY	iple Re	eterenc	e:	Not Give	en			Sar	nple Ty	pe: B	
Location:	WS2										Dept	th Top	[m]: 5.0	00
Sample Preparat	ion:	Tested ir	natura	al cond	lition						Depth	Base	mj: No	ot Given
As Receiv	ed	Lic	uid Li	mit		Plas	tic Lim	it	Pla	sticity Ir	ndex	% P	assin	g 425µm
32	ent [/o]		82				27			55			<u>3 res</u> 1()0
100 -				1	_		-					•		
90 —						_							A line	
80 —														
70 -									CE		\checkmark			
y 60 -						_				\triangleleft				
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0	10					LI		МІТ	, 10	5 110	120	150	140	150
		Legend, bas	ed on BS	5930:20	15 Code Pla	e of practic sticity	e for site ir	nvestigatio	ns Liqi	uid Limit				
		C Cla M Sil	y t		L	Low Mediu	m		bel 35 t	ow 35 to 50				
					H V	High Very h –	ligh		50 70	to 70 to 90				
		Ora	anic		E O	Extren appen	nely high d to classif	fication for	exc organic m	eeding 90 aterial (eo (CHO)			
Remarks		0							-		,			

Approved:

Dariusz Piotrowski PL Laboratory Manager Geotechnical Section

Piotuli

Signed:

Darren Berrill Geotechnical General Manager

Date Reported:

: 30/11/2017

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	TEST CERTIFICATE Determination of Liquid and Plastic Limits											dow siness Park	Analytical		
	Detern	matio		Liqu						Watford	I Herts WD	18 8YS	Environmental Science		
4041 Tes	sted in Acc	ordance wit	h BS13	77-2: 1	990: Cl	ause 4.3	& 5: Defi	nitive N	lethod						
Client: Client Address:	Jomas Lakesi	Associate	s Ltd							Client F Jo	Reference: b Number:	JJ1245 17-68135			
	1 Furz Stockl	eground W	/ay							Date Sampled: Not Given					
	UB11	1BD							Date Received: 15/11/2017						
Contact: Site Name:	Emma	Hucker	l Cam	dan Ni			Da	te Tested:	27/11/201 Not Given	7					
Site Address:	38 Gle	noch Road	l, Cam l, Cam	den N	W3 4D)N				30	пріец Бу.	NUL GIVEN			
TEST RESULT	s	La	aborato	ory Re	ferenc	e:	860855								
Decemintica	Brown	alightly are	Samp		ferenc	e:	Not Give	n			0		D		
Description: Location:	TP1	siightiy gra	aveny C	JLAY							San Dept	h Top [m]:	в 0.85		
Sample Preparati	on:	Tested af	er >42	5um re	emove	d by ha	nd				Depth	Base [m]:	Not Given		
As Receive	ed	Liqu	uid Lir	nit		Plas	tic Limi	t	PI	asticity	Index	% Pass	sing 425µm		
31	ent [%]		62				22			40		B9 I	93		
100															
90															
20															
70															
70 60															
							С	v							
										ИE					
						CH 86	0855 M	v							
19 June 19 Jun				CI											
2 0 -		CL			1	мн									
10				МІ											
0 +	10	20 3	0 4	0	50	60	70 80) (- 	00 11	0 120	130 14	 0 150		
· ·	10					LI		NIT				200 2.0			
		Legend, base	d on BS {	5930:20	15 Code Pla	of practic sticity	e for site in	vestigati	ons L	iquid Limit					
		C Clay M Silt			L	Low Mediur	n		t 3	elow 35 35 to 50					
					H V	High Verv h	iah		5	50 to 70 70 to 90					
					Ē	Extrem	iely high		e	exceeding 90	0				
		Orgai	nic		0	appene	d to classifie	cation fo	or organic	material (e	eg CHO)				
Remarks															

Remains

Approved:

Dariusz Piotrowski PL Laboratory Manager Geotechnical Section

Date Reported:

Piotuli

30/11/2017

Signed:

Darren Berrill Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

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Determ	TEST CER	TIFICATE iid and Plastic Limi	i2 Analytical Ltd 7 Woodshots Mea Croxley Green Bu Watford Herts WI	adow Isiness Park D18 8YS									
U K A S TETING 4041 Tested in Acc	ordance with BS1377-2: 1	990: Clause 4.3 & 5: Definitive N	Nethod										
Client: Jomas Client Address: Lakesi 1 Furz Stockle UB11	Associates Ltd de House eground Way ey Park 1BD		Client Reference Job Number Date Sampled Date Received	: JJ1245 : 17-68135 : Not Given : 15/11/2017									
Contact: Emma Site Name: 38 Gle Site Address: 38 Gle	Intact: Emma Hucker Date Tested: 27/11/2017 Name: 38 Glenoch Road, Camden NW3 4DN Sampled By: Not Given Address: 38 Glenoch Road, Camden NW3 4DN Sampled By: Not Given												
TEST RESULTS	Laboratory Re Sample Re	ference: 860856 ference: Not Given											
Description: Yellow Location: TP3 Sample Preparation:	ish brown gravelly CLA Tested after washing t	Y o remove >425um	Sa Dep Depti	mple Type: B th Top [m]: 0.95 n Base [m]: Not Given									
As Received Moisture Content [%]	Liquid Limit	Plastic Limit	Plasticity Index	% Passing 425µm BS Test Sieve									
34	84	31	53	64									
100 90 80 70 60 50 40 30 20 10 0 10	CL CL CL MI 20 30 40 CCI CL CL MI 20 30 40 CCI CCI CL MI CI CI CI CI CI CI CI CI CI CI CI CI CI	CH CH MH CH MH 50 60 70 80 5 LIQUID LIMIT 15 Code of practice for site investigati Plasticity L Low I Medium H Hinb	CE 60856 ME 00 100 110 120 00 100 110 120 00 100 10 120	A line A line 130 140 150									

Approved:

Dariusz Piotrowski PL Laboratory Manager Geotechnical Section

Date Reported:

Piotuli

30/11/2017

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Darren Berrill Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Summary of Classification Test Results

Client:	Jomas Associates Ltd
Client Address:	Lakeside House
	1 Furzeground Way
	Stockley Park
	UB11 1BD
Contact:	Emma Hucker
Site Name:	38 Glenoch Road, Camden NW3 4DN
Site Address:	38 Glenoch Road, Camden NW3 4DN

Test results

7 Woodshots Meadow Croxley Green Business Park Watford Herts WD18 8YS

i2 Analytical Ltd



Client Reference: JJ1245 Job Number: 17-68135 Date Sampled: Not Given Date Received: 15/11/2017 Date Tested: 27/11/2017 Sampled By: Not Given

		I	Sa	mole			Density					-		
Laboratory Reference	Hole No.	Reference	Top depth [m]	Base depth [m]	Туре	Soil Description	bulk	dry	M/C	% Passing 425um	LL	PL	PI	PD
860855	TP1	Not Given	0.85	Not Given	В	Brown slightly gravelly CLAY	Mg/m3	Mg/m3	31	% 93	% 62	22	40	Mg/m3
860856	TP3	Not Given	0.95	Not Given	В	Yellowish brown gravelly CLAY			34	64	84	31	53	
860851	WS2	Not Given	2.00	Not Given	В	Yellowish brown CLAY			36	100	88	29	59	
860852	WS2	Not Given	3.00	Not Given	В	Yellowish brown CLAY			33	100	84	31	53	
860853	WS2	Not Given	4.00	Not Given	В	Yellowish brown CLAY			32	100	81	28	53	
860854	WS2	Not Given	5.00	Not Given	В	Yellowish brown CLAY			32	100	82	27	55	

Comments:

Approved:

Dariusz Piotrowski PL Laboratory Manager Geotechnical Section Piotuli

Date Reported: 30/11/2017

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Darren Berrill



Geotechnical General Manager

for and on behalf of i2 Analytical Ltd



Approved:

Dariusz Piotrowski PL Laboratory Manager Geotechnical Section

Protuli

Date Reported:

30/11/2017

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Darren Berrill

Manager

Geotechnical General

for and on behalf of i2 Analytical Ltd



APPENDIX 9 – SOIL GAS MONITORING TEST RESULTS

	GAS AND (IG BOREHOLE R	RECORD	SHEET				
Site: Glenoch Road	Operative(s): AM	Date: 21/11/2017	Time: 10:30		Round: 1		Page: 1		
			ITORING EQUIPMENT						
Instrument Type	Instrument Make		Serial No.		Date Last Calibra	ated			
Analox	GA5000				19/06/2017				
PID	Phocheck tiger				20/05/2016				
Dip Meter	GeoTech								
			NDITIONS						
Weather Conditions: Overcast	t Gr	round Conditions: Dry		Temperature: 10°C					
Barometric Pressure (mbar):	1002 Ba	arometric Pressure Trend (24hr):	Falling	Ambien	t Concentration:	0.0% CH ₄ ,	0.1%CO ₂ ,	21.1%O ₂	

						MONIT	ORING RES	ULTS						
Monitoring	F	low	Atmospheri					voc	; (ppm)			Depth to	Depth to	Depth to
Point Location	Peak	Steady	c Pressure (mbar)	CH₄ %	LEL	CO₂ %	O2 %	Peak	Steady	H2S (ppm)	CO (ppm)	(mbgl)	water (mbgl)	Base of well (mbgl)
WS2	+0.6	+0.6	1002	0.1	/	0.8	20.6	2	1	0	0	/	4.16	4.70

	GAS AND GROUNDWATER MONITORING BOREHOLE RECORD SHEET												
Site: Glenoch Road	Operative(s): AM	Date: 30/11/17	Time: 10:05		Round: 2	F	Page: 1						
Instrument Type	Instrument Make		Serial No.		Date Last Calibrate	d							
Analox	GA5000				19/06/2017								
PID	Phocheck tiger				20/05/2016								
Dip Meter	GeoTech												
			NDITIONS										
Weather Conditions: Clear sky	y / Sunny	Ground Conditions: Dry		Temper	ature: 1°C	·							
Barometric Pressure (mbar):	1000	Barometric Pressure Trend (24hr):	nd (24hr): Steady Ambient Concer			0 %CH ₄ ,	0.3%CO ₂ ,	21.0%O ₂					

	MONITORING RESULTS													
Monitoring	F	low	Atmospheri					voc	(ppm)			Depth to	Depth to	Depth to
Point Location	Peak	Steady	c Pressure (mbar)	CH₄ %	LEL	CO₂ %	O2 %	Peak	Steady	H2S (ppm)	CO (ppm)	product (mbgl)	water (mbgl)	Base of well (mbgl)
WS2	+0.4	+0.4	1000	0.0	/	1.9	20.6	-	-	0	0	/	3.16	4.70

	GAS AND GROUNDWATER MONITORING BOREHOLE RECORD SHEET												
Site: Glenoch Road	Operative(s): AM	Date: 07/12/2017	Time: 10:05		Round: 3	[Page: 1						
Instrument Type	Instrument Make		Serial No.		Date Last Calibrat	ed							
Analox	GA5000				19/06/2017								
PID	Phocheck tiger				20/05/2016								
Dip Meter	GeoTech												
			NDITIONS										
Weather Conditions: Light Rai	in Gr	round Conditions: Damp		Temper	ature: 5°C								
Barometric Pressure (mbar):	998 B a	arometric Pressure Trend (24hr):	Falling	Ambien	t Concentration: 0).0 %CH ₄ ,	0.1%CO ₂ ,	21.1%O ₂					

	MONITORING RESULTS													
Monitoring	Flow		Atmospheri					voc	; (ppm)			Depth to	Depth to	Depth to
Point Location	Peak	Steady	c Pressure (mbar)	CH₄ %	LEL	CO ₂ %	O2 %	Peak	Steady	H2S (ppm)	CO (ppm)	product (mbgl)	water (mbgl)	Base of well (mbgl)
WS2	+0.3	+0.3	998	0.0	/	1.0	20.4	2	1	0	0	/	Dry	4.70

	GAS AND	GROUNDWATER MONITORIN	IG BOREHOLE R	ECORD	SHEET			
Site: Glenoch Road	Operative(s): AM	Date: 12/12/2017	Time: 11:45		Round: 3		Page: 1	
Instrument Type	ument Type Instrument Make Serial No. Date Last Calibrated							
Analox	GA5000			19/06/2017				
PID	Phocheck tiger				20/05/2016			
Dip Meter	GeoTech							
			NDITIONS					
Weather Conditions: Clear sky	y - Sunny C	Ground Conditions: Damp - Dry	ditions: Damp - Dry Temperature: 0°C					
Barometric Pressure (mbar):	999 E	Barometric Pressure Trend (24hr):	Rising	Ambient Concentration: 0.0%CH ₄ , 0.1%CO ₂ , 21				21.1%O ₂

	MONITORING RESULTS													
Monitoring	Flow		Atmospheri			0/		VOC (ppm)				Depth to	Depth to	Depth to
Point Location	Peak	Steady	c Pressure (mbar)	CH₄ %	LEL	CO ₂ %	O ₂ %	Peak	Steady	H2S (ppm)	CO (ppm)	product (mbgl)	water (mbgl)	Base of well (mbgl)
WS2	+0.4	+0.4	999	0.0	/	2.5	20.4	1	1	0	0	/	2.42	4.70

Appendix D

Building Damage Classification Table

Classification of visible damage to walls (after Burland et al, 1977, Boscardin and Cording, 1989; and Burland, 2001)

C: da	ategory of image	Description of typical damage (ease of repair is underlined)	Approximate crack width (mm)	Limiting tensile strain ɛ _{lim} (per cent)
0	Negligible	Hairline cracks of less than about 0.1 mm are classed as negligible.	< 0.1	0.0–0.05
1	Very slight	Fine cracks that can easily be treated during normal decoration. Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection.	<1	0.05-0.075
2	Slight	<u>Cracks easily filled. Redecoration probably</u> <u>required.</u> Several slight fractures showing inside of building. Cracks are visible externally and <u>some repointing may be required externally</u> to ensure weathertightness. Doors and windows may stick slightly.	< 5	0.075–0.15
3	Moderate	The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable linings. Repointing of external brickwork and possibly a small amount of brickwork to be replaced. Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired.	5–15 or a number of cracks > 3	0.15–0.3
4	Severe	Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Service pipes disrupted.	15–25 but also depends on number of cracks	> 0.3
5	Very severe	This requires a major repair involving partial or complete rebuilding. Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion. Danger of instability.	usually > 25 but depends on number of cracks.	

Notes

- 1. In assessing the degree of damage, account must be taken of its location in the building or structure.
- 2. Crack width is only one aspect of damage and should not be used on its own as a direct measure of it.



Appendix E

Design Philosophy and Preliminary Calculations



CALCULATION SHEET

		JOB NORBER / FIL	E:	CAECODATION NOTIBER		Folli	
38 G.R.		1720	104				
ATION:		CALCULATION B	Y:	DATE:	CHECKED BY:		
FOUN	IDATIONS AT GREDLENE 4D			- C., mi			
CULATI	ONS:			•	OUTPUT		
	7 88+2.8						
	FRAME						
	GROUND						
		-					
	BASE BEAM						
	L FOUNDATEONS					-	
	2.5m						
	7556						
	LATERAL				DL	IL	
	LOADENG						
	MASONRY: 19/20/m3 × 0.35m	× 11.5m :			76.5 km/~		
4	MASONRY: 19/23× 0.25m	×(7m×1.8m×0	67)-2	÷	·21/en		
	ROOF: 09kul/m2 x 5m + 2 x	2-+2 -			2.25km	-	
	26 0.6 pro/2 × 5m-77	· 6 - 2 +	2 7			1.5k	
	3" AND 2" FLOORS 1. KN/2"	K 4 - C × 2	12.7		4t. TRN	Inh	
	Elect Finne 11h.1 2 VE	-7-7-7	+ C × C		7 Skal	1010	
	IL 2.562/22	5-2×2m	-2			6.3	
5	GROUND LEVEL : 6kn/m2 x 2	5m - 2 x 2m -	-2 =		15km	-	
	IL 2.5km/m2;	x 5m - 2x2	Z :			6.3k	
	TOTAL REAR FACADE IDADTA	> DESTRIBUT	ED DUE	R 7×21m=4.	2m		
	- 121+225+44+2.8+1	5]-4.2m =	11pm/	~			
	[1.5+10+6.3+6.3]	:4.2m = 5	.8 km				
	- TOTAL LOADING = 76.5+	11=88kn/~ D	4				
-		5.8 km/m I	- can'da	ALCINAN			
	LATERAL COADENCS SOF	C REFERTO	DEECD +	OTENS'S CALLULAN	045		
	WAT	ARGE GOLULS.	x11 1	10ku/2 = 37kn.	12		
	REFER TO TEDD'S CALCULA	ATEONS	(IIII)T	101-112 = 50.5-7	m		
	SPECEFY 350mm LINER	AND 450mm	BASE				
	BEARENG = 176.7kN/~2	< 150km/~2					
	- BEARING < BEARING (APACETY					
				1 1 1 1			

Tekla	Project	Job no.				
Tedds		172904				
Form Structural Design	Calcs for	Start page no./Revision				
77 St John Street		Foundations a	at gridlines 4D			1
EC1M 4NN	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date



γ_m = 18.0 kN/m³

Moist density of retained material

	Project	Gle	enloch		Job no. 172	904
Form Structural Design	Calcs for	Foundations	at gridlings AD		Start page no./Re	evision 2
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
EC1M 4NN						
Saturated density of retained ma	aterial	γs = 21.0 k	۸/m³			
Design shear strength		φ' = 24.2 c	leg			
Angle of wall friction		δ = 0.0 de	g			
Base material details						
Moist density		γmb = 18.0	kN/m³			
Design shear strength		φ'ь = 24.2	deg			
Design base friction		δь = 18.6 d	deg			
Allowable bearing pressure		P _{bearing} = 1	50 kN/m ²			
Using Coulomb theory						
Active pressure coefficient for re	etained material	$\sin(\alpha S) = 1$	1 al(ain(11 + S)	$\sin(41, 0)/(\sin(41))$	S) oin/a. L ((1)(12) = 0.440
$Ka = SIR(\alpha)$	+ $\varphi')^2 / (SIN(\alpha)^2 >$	$\langle \sin(\alpha - \delta) \times [1] \rangle$	+ $\gamma(\sin(\phi^2 + \delta) \times \theta)$	$\sin(\phi - \beta) / (\sin(\alpha$	$-\delta$ × sin(α + μ	3)))] ²) = 0.419
	$K_p = sin(9)$	90 - φ' _b)² / (sin(9	l0 - δ₀) × [1 - √(si	$n(\phi'_{b} + \delta_{b}) \times sin(\phi')$	_b) / (sin(90 + δ	b)))] ²) = 4.187
At-rest pressure	· · · ·		, L ((1) / (1)		///] /
At-rest pressure for retained ma	terial	K0 = 1 – s	in(φ') = 0.590			
Loading details						
Surcharge load on plan		Surcharge	e = 32.0 kN/m ²			
Applied vertical dead load on wa	all	W _{dead} = 88	3.0 kN/m			
Applied vertical live load on wall		Wlive = 5.8	kN/m			
Position of applied vertical load	on wall	l _{load} = 135 0	0 mm			
Applied horizontal dead load on	wall	F _{dead} = 0.0	kN/m			
Applied horizontal live load on w	vall	F _{live} = 0.0	kN/m			
Height of applied horizontal load	l on wall	h _{load} = 0 m	im			
			32			
P 32.1	op ->-		48.2	0107 24.5		
Vertical forces on wall					,,	
Wall stem		$w_{wall} = h_{ster}$	$_{m} \times t_{wall} \times \gamma_{wall} = 1$	6.9 kN/m		

	Project	Gle	nloch		Job no. 172904				
Form Structural Design 77 St John Street	Calcs for	Foundations	at gridlines 4D		Start page no./	Revision 3			
London EC1M 4NN	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date			
Wall base	·	Wbase = Ibase	$e \times t_{base} \times \gamma_{base} =$	15.9 kN/m	·				
Applied vertical load		$W_v = W_{dead}$	d + Wlive = 93.8	κN/m					
Total vertical load		$W_{total} = W_{wa}$	$_{\rm all}$ + $W_{\rm base}$ + $W_{\rm v}$ =	126.7 kN/m					
Horizontal forces on wall									
Surcharge	$F_{sur} = K_a \times Surcharge \times h_{eff} = 33.5 \text{ kN/m}$								
Saturated backfill	Saturated backfill $F_s = 0.5 \times K_a \times (\gamma_{s} - \gamma_{water}) \times h_{water}^2 = 14.6 \text{ kN/m}$								
Water	$F_{water} = 0.5 \times h_{water}^2 \times \gamma_{water} = 30.7 \text{ kN/m}$								
Total horizontal load $F_{total} = F_{sur} + F_s + F_{water} = 78.8 \text{ kN/m}$									
Calculate propping force									
Passive resistance of soil in fro	ont of wall	F_p = 0.5 \times	$K_{p} imes cos(\delta_{b}) imes (cos)$	l _{cover} + t _{base} + d _{ds}	- $d_{exc})^2 \times \gamma_{mb}$ =	7.2 kN/m			
Propping force		F _{prop} = max	$F_{prop} = max(F_{total} - F_{p} - (W_{total} - W_{live}) \times tan(\delta_{b}), \ 0 \ kN/m)$						
	F _{prop} = 30.9 kN/m								
Overturning moments									
Surcharge		Msur = Fsur	× (heff - $2 \times d_{ds}$)	/ 2 = 41.9 kNm/n	n				
Saturated backfill		$M_s = F_s \times ($	hwater - $3 \times d_{ds}$) /	3 = 12.2 kNm/m					
Water		M _{water} = F _{wa}	ater $ imes$ (hwater - 3 $ imes$	dds) / 3 = 25.5 kM	Nm/m				
Total overturning moment		$M_{ot} = M_{sur}$ -	+ M _s + M _{water} = 7	9.6 kNm/m					
Restoring moments									
Wall stem		$M_{wall} = W_{wal}$	$I \times (I_{\text{toe}} + t_{\text{wall}} / 2)$	= 22.4 kNm/m					
Wall base		M _{base} = w _{ba}	_{ase} × I _{base} / 2 = 1 1	.9 kNm/m					
Design vertical dead load		$M_{dead} = W_{d}$	$lead \times l_{load} = 118.3$	3 kNm/m					
Total restoring moment		M _{rest} = M _{wa}	II + Mbase + Mdead	= 153.2 kNm/m					
Check bearing pressure									
Design vertical live load		Mlive = Wlive	$a \times I_{load} = 7.8 \text{ kN}$	m/m					
Total moment for bearing		M _{total} = M _{res}	st - Mot + Mlive = 8	8 1.4 kNm/m					
Total vertical reaction		R = W _{total} =	= 126.7 kN/m						
Distance to reaction		$x_{bar} = M_{total}$	/ R = 643 mm						
Eccentricity of reaction		e = abs((lba	ase / 2) - Xbar) = 1	07 mm					
		· · ·		Reaction acts	within middle	e third of base			
Bearing pressure at toe		$p_{toe} = (R / I)$	$_{base}$) + (6 × R × 6	e / Ibase ²) = 120.6	KN/m²				
Bearing pressure at heel		p _{heel} = (R /	I_{base}) - (6 × R × 6	e / I _{base} [∠]) = 48.2 k	:N/m²				
		PASS - Maximum l	bearing pressu	re is less than a	llowable bea	arıng pressure			

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Tedds		Gler	IIOCN		1/2				
Form Structural Design 77 St John Street	Calcs for	Foundations :	at gridlines 4D		Start page no./Re	evision 4			
London	Calcs by	Calcs date		Checked date	Approved by	Approved date			
EC1M 4NN	Calos by		oncolled by		, pproved by	Approved date			
RETAINING WALL DESIGN (B	S 8002:1994)								
<u></u>	<u> </u>			т	EDDS calculation	version 1.2.01.06			
Ultimate limit state load factor	rs								
Dead load factor		γ _{f_d} = 1.4							
Live load factor		γf_l = 1.6							
Earth and water pressure factor		γ _{f_e} = 1.4							
Factored vertical forces on wa	all								
Wall stem		$w_{wall_f} = \gamma_{f_d}$	\times h _{stem} \times t _{wall} \times γ_w	all = 23.7 kN/m					
Wall base		$W_{base_f} = \gamma_{f_d}$	$\times \ I_{\text{base}} \times t_{\text{base}} \times \gamma_{\text{I}}$	_{base} = 22.3 kN/m	ı				
Applied vertical load		$W_{v_f} = \gamma_{f_d} \times$	$W_{\text{dead}} \textbf{+} \gamma_{f_l} \times W$	_{live} = 132.5 kN/m	l				
Total vertical load		W _{total_f} = www	$_{all_f} + W_{base_f} + W_{v}$	_{v_f} = 178.5 kN/m					
Factored horizontal active for	ces on wall								
Surcharge		$F_{sur_f} = \gamma_{f_l} \times$	$K_a \times Surcharge$	× h _{eff} = 53.6 kN/	/m				
Saturated backfill		$F_{s_f} = \gamma_{f_e} \times$	$0.5 imes K_a imes (\gamma_s\text{-}\gamma_w)$	ater) × h _{water} ² = 20).5 kN/m				
Water	Water $F_{water_f} = \gamma_{f_e} \times 0.5 \times h_{water}^2 \times \gamma_{water} = 42.9 \text{ kN/m}$								
Total horizontal load		F _{total_f} = F _{sur}	$F_{total_f} = F_{sur_f} + F_{s_f} + F_{water_f} = 117 \text{ kN/m}$						
Calculate propping force									
Passive resistance of soil in from	nt of wall	$F_{p_f} = \gamma_{f_e} \times$	$0.5 imes K_p imes cos(\delta_p)$	$(d_{cover} + t_{base})$	+ d _{ds} - d _{exc}) ² ×	γ _{mb} = 10.1			
kN/m									
Propping force		F _{prop_f} = ma	x(F total_f - Fp_f - (V	Vtotal_f - $\gamma f_I \times W$ live	e) × tan(δ⊳), 0 ł	۸/m)			
		F _{prop_f} = 49.	9 kN/m						
Factored overturning moment	ts								
Surcharge		$M_{sur_f} = F_{sur_f}$	$f \times (h_{eff} - 2 \times d_{ds})$) / 2 = 67 kNm/n	n				
Saturated backfill		$M_{s_f} = F_{s_f} \times$	$(h_{water} - 3 \times d_{ds})$	/ 3 = 17.1 kNm/r	m				
Water		$M_{water_f} = F_{water_f} \times (h_{water} - 3 \times d_{ds}) / 3 = 35.8 \text{ kNm/m}$							
i otal overturning moment		Mot_f = Msur_	f + Ms_f + Mwater_f	= 119.8 kNm/m					
Restoring moments									
Wall stem		M _{wall_f} = W _{wa}	$I_f \times (I_{toe} + I_{wall} / 2)$	2) = 31.4 kNm/m					
Wall base		$M_{base_f} = W_{base_f}$	$ase_f \times base / 2 = 1$	6.7 kNm/m					
Design vertical load		$M_{v_f} = VV_{v_f}$	< Iload = 1/8.8 KN	Im/m					
		IVIrest_f - IVIwa	$\ _f + W_base_f + W_v$	$_f - 227 \text{ KINIII/III}$					
Factored bearing pressure		N4 N4	M 407 (D 1.5 1					
Total moment for bearing		$ V $ total_f = $ V $ re	$st_f - IVIot_f = IU/.4$	2 KINM/M					
Distance to reaction		Xbar f = Mtotal	f / Rf = 601 mm						
Eccentricity of reaction		$e_f = abs((I_{ba})$	se / 2) - Xbar f) = 1	1 49 mm					
-			,	Reaction acts v	vithin middle	third of base			
Bearing pressure at toe		$p_{toe_f} = (R_f / $	I _{base}) + (6 \times Rf \times	ef / Ibase ²) = 190.	1 kN/m ²				
Bearing pressure at heel		$p_{heel_f} = (R_f)$	lbase) - (6 $ imes$ Rf $ imes$	ef / Ibase ²) = 47.8	kN/m ²				
Rate of change of base reaction	n	rate = (p _{toe_}	- p _{heel_f}) / I _{base} =	94.87 kN/m²/m					
Bearing pressure at stem / toe		$p_{stem_toe_f} = 1$	max(p _{toe_f} - (rate	\times I _{toe}), 0 kN/m ²)	= 81 kN/m²				
Bearing pressure at mid stem		p _{stem_mid_f} =	max(p _{toe_f} - (rate	\times (I _{toe} + t _{wall} / 2))	, 0 kN/m²) = 6	4.4 kN/m²			
Bearing pressure at stem / heel		$p_{stem_heel_f} =$	max(p _{toe_f} - (rate	$e \times (I_{toe} + t_{wall})), 0$	kN/m ²) = 47.8	kN/m ²			

🖉 Teka	Project	Job no.				
Tedds		172904				
Form Structural Design	Calcs for		Start page no./Revision			
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Material properties	
Characteristic strength of concrete	f _{cu} = 40 N/mm ²
Characteristic strength of reinforcement	f _y = 500 N/mm ²
Base details	
Minimum area of reinforcement	k = 0.13 %
Cover to reinforcement in toe	c _{toe} = 40 mm
Calculate shear for toe design	
Shear from bearing pressure	$V_{toe_bear} = (p_{toe_f} + p_{stem_toe_f}) \times I_{toe} / 2 = 155.9 \text{ kN/m}$
Shear from weight of base	$V_{toe_wt_base} = \gamma_{f_d} \times \gamma_{base} \times I_{toe} \times t_{base} = 17.1 \text{ kN/m}$
Total shear for toe design	V _{toe} = V _{toe_bear} - V _{toe_wt_base} = 138.8 kN/m
Calculate moment for toe design	
Moment from bearing pressure	Mtoe_bear = (2 × ptoe_f + pstem_mid_f) × (Itoe + twall / 2) ² / 6 = 130.1 kNm/m
Moment from weight of base	Mtoe wt base = ($\gamma f d \times \gamma base \times t base \times (I toe + t wall / 2)^2 / 2$) = 13.1 kNm/m
Total moment for toe design	M _{toe} = M _{toe_bear} - M _{toe_wt_base} = 117.1 kNm/m
↓ ↓ • • • • • • • • • • • • • • • • • •	
↓ ↓ ● • • • • • • • • • • • • • • • • •	
↓ ↓ • • • • • • • • • • • • • • • • • •	• • • • •
↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	b = 1000 mm/m d _{toe} = t _{base} - c _{toe} - (φ _{toe} / 2) = 402.0 mm
↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	b = 1000 mm/m $d_{toe} = t_{base} - c_{toe} - (\phi_{toe} / 2) = 402.0 \text{ mm}$ $K_{toe} = M_{toe} / (b \times d_{toe}^2 \times f_{cu}) = 0.018$
↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	b = 1000 mm/m $d_{toe} = t_{base} - c_{toe} - (\phi_{toe} / 2) = 402.0 \text{ mm}$ $K_{toe} = M_{toe} / (b \times d_{toe}^2 \times f_{cu}) = 0.018$ <i>Compression reinforcement is not require</i>
↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	b = 1000 mm/m $d_{toe} = t_{base} - c_{toe} - (\phi_{toe} / 2) = 402.0 mm$ $K_{toe} = M_{toe} / (b \times d_{toe}^2 \times f_{cu}) = 0.018$ <i>Compression reinforcement is not require</i> $z_{toe} = min(0.5 + \sqrt{(0.25 - (min(K_{toe}, 0.225) / 0.9)), 0.95) \times d_{toe}}$ $z_{toe} = 382 mm$
↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	b = 1000 mm/m $d_{toe} = t_{base} - c_{toe} - (\phi_{toe} / 2) = 402.0 \text{ mm}$ $K_{toe} = M_{toe} / (b \times d_{toe}^2 \times f_{cu}) = 0.018$ $Compression reinforcement is not required z_{toe} = \min(0.5 + \sqrt{(0.25 - (\min(K_{toe}, 0.225) / 0.9)), 0.95) \times d_{toe}}z_{toe} = 382 \text{ mm}A_{s_toe_des} = M_{toe} / (0.87 \times f_y \times z_{toe}) = 705 \text{ mm}^2/\text{m}$
	b = 1000 mm/m $d_{toe} = t_{base} - c_{toe} - (\phi_{toe} / 2) = 402.0 \text{ mm}$ $K_{toe} = M_{toe} / (b \times d_{toe}^2 \times f_{cu}) = 0.018$ Compression reinforcement is not require $z_{toe} = \min(0.5 + \sqrt{(0.25 - (\min(K_{toe}, 0.225) / 0.9)), 0.95) \times d_{toe}}$ $z_{toe} = 382 \text{ mm}$ $A_{s_toe_des} = M_{toe} / (0.87 \times f_y \times z_{toe}) = 705 \text{ mm}^2/\text{m}$ $A_{s_toe_min} = k \times b \times t_{base} = 585 \text{ mm}^2/\text{m}$
Lever arm Area of tension reinforcement required Minimum area of tension reinforcement required Area of tension reinforcement required	b = 1000 mm/m $d_{toe} = t_{base} - C_{toe} - (\phi_{toe} / 2) = 402.0 \text{ mm}$ $K_{toe} = M_{toe} / (b \times d_{toe}^2 \times f_{cu}) = 0.018$ $Compression reinforcement is not required z_{toe} = \min(0.5 + \sqrt{(0.25 - (\min(K_{toe}, 0.225) / 0.9)), 0.95) \times d_{toe}}z_{toe} = 382 \text{ mm}A_{s_toe_des} = M_{toe} / (0.87 \times f_y \times z_{toe}) = 705 \text{ mm}^2/\text{m}A_{s_toe_min} = k \times b \times t_{base} = 585 \text{ mm}^2/\text{m}A_{s_toe_req} = Max(A_{s_toe_des}, A_{s_toe_min}) = 705 \text{ mm}^2/\text{m}$
	b = 1000 mm/m dtoe = tbase - Ctoe - (ϕ toe / 2) = 402.0 mm Ktoe = Mtoe / (b × dtoe ² × fcu) = 0.018 Compression reinforcement is not required ztoe = min(0.5 + $\sqrt{(0.25 - (min(Ktoe, 0.225) / 0.9)), 0.95) \times dtoe}$ ztoe = 382 mm As_toe_des = Mtoe / (0.87 × fy × ztoe) = 705 mm ² /m As_toe_min = k × b × tbase = 585 mm ² /m As_toe_req = Max(As_toe_des, As_toe_min) = 705 mm ² /m 16 mm dia.bars @ 150 mm centres
Check toe in bending Width of toe Depth of reinforcement Constant Lever arm Area of tension reinforcement required Minimum area of tension reinforcement Area of tension reinforcement required Reinforcement provided Area of reinforcement provided	b = 1000 mm/m $d_{toe} = t_{base} - c_{toe} - (\phi_{toe} / 2) = 402.0 \text{ mm}$ $K_{toe} = M_{toe} / (b \times d_{toe}^2 \times f_{cu}) = 0.018$ Compression reinforcement is not requires $z_{toe} = \min(0.5 + \sqrt{(0.25 - (\min(K_{toe}, 0.225) / 0.9)), 0.95) \times d_{toe}}$ $z_{toe} = 382 \text{ mm}$ $A_{s_toe_des} = M_{toe} / (0.87 \times f_y \times z_{toe}) = 705 \text{ mm}^2/\text{m}$ $A_{s_toe_min} = k \times b \times t_{base} = 585 \text{ mm}^2/\text{m}$ $A_{s_toe_req} = Max(A_{s_toe_des}, A_{s_toe_min}) = 705 \text{ mm}^2/\text{m}$ $16 \text{ mm dia.bars @ 150 \text{ mm centres}}$ $A_{s_toe_prov} = 1340 \text{ mm}^2/\text{m}$
Check toe in bending Width of toe Depth of reinforcement Constant Lever arm Area of tension reinforcement required Minimum area of tension reinforcement Area of tension reinforcement required Reinforcement provided Area of reinforcement provided	b = 1000 mm/m dtoe = tbase - Ctoe - (ϕ toe / 2) = 402.0 mm Ktoe = Mtoe / (b × dtoe ² × fcu) = 0.018 Compression reinforcement is not required Ztoe = min(0.5 + $\sqrt{(0.25 - (min(Ktoe, 0.225) / 0.9)), 0.95) × dtoe}$ Ztoe = 382 mm As_toe_des = Mtoe / (0.87 × fy × Ztoe) = 705 mm ² /m As_toe_req = Max(As_toe_des, As_toe_min) = 705 mm ² /m As_toe_req = Max(As_toe_des, As_toe_min) = 705 mm ² /m 16 mm dia.bars @ 150 mm centres As_toe_prov = 1340 mm ² /m PASS - Reinforcement provided at the retaining wall toe is adequated
Check toe in bending Width of toe Depth of reinforcement Constant Lever arm Area of tension reinforcement required Minimum area of tension reinforcement Area of tension reinforcement required Reinforcement provided Area of reinforcement provided Check shear resistance at toe	b = 1000 mm/m $d_{toe} = t_{base} - c_{toe} - (\phi_{toe}/2) = 402.0 mm$ $K_{toe} = M_{toe} / (b \times d_{toe}^2 \times f_{cu}) = 0.018$ Compression reinforcement is not required $z_{toe} = min(0.5 + \sqrt{(0.25 - (min(K_{toe}, 0.225) / 0.9)), 0.95) \times d_{toe}}$ $z_{toe} = 382 mm$ $A_{s_toe_des} = M_{toe} / (0.87 \times f_y \times z_{toe}) = 705 mm^2/m$ $A_{s_toe_min} = k \times b \times t_{base} = 585 mm^2/m$ $A_{s_toe_min} = k \times b \times t_{base} = 585 mm^2/m$ $A_{s_toe_req} = Max(A_{s_toe_des}, A_{s_toe_min}) = 705 mm^2/m$ 16 mm dia.bars @ 150 mm centres $A_{s_toe_prov} = 1340 mm^2/m$ PASS - Reinforcement provided at the retaining wall toe is adequated
	$b = 1000 \text{ mm/m}$ $d_{toe} = t_{base} - c_{toe} - (\phi_{toe} / 2) = 402.0 \text{ mm}$ $K_{toe} = M_{toe} / (b \times d_{toe}^2 \times f_{cu}) = 0.018$ $Compression reinforcement is not requires$ $z_{toe} = min(0.5 + \sqrt{(0.25 - (min(K_{toe}, 0.225) / 0.9)), 0.95) \times d_{toe}}$ $z_{toe} = 382 \text{ mm}$ $A_{s_toe_des} = M_{toe} / (0.87 \times f_y \times z_{toe}) = 705 \text{ mm}^2/\text{m}$ $A_{s_toe_min} = k \times b \times t_{base} = 585 \text{ mm}^2/\text{m}$ $A_{s_toe_min} = k \times b \times t_{base} = 585 \text{ mm}^2/\text{m}$ $A_{s_toe_req} = Max(A_{s_toe_des}, A_{s_toe_min}) = 705 \text{ mm}^2/\text{m}$ $A_{s_toe_prov} = 1340 \text{ mm}^2/\text{m}$ $PASS - Reinforcement provided at the retaining wall toe is adequated to the example of the top of top of the top of top of the top of t$
Check toe in bending Width of toe Depth of reinforcement Constant Lever arm Area of tension reinforcement required Minimum area of tension reinforcement Area of tension reinforcement required Reinforcement provided Area of reinforcement provided Check shear resistance at toe Design shear stress Allowable shear stress	b = 1000 mm/m $d_{toe} = t_{base} - c_{toe} - (\phi_{toe} / 2) = 402.0 \text{ mm}$ $K_{toe} = M_{toe} / (b \times d_{toe}^2 \times f_{cu}) = 0.018$ Compression reinforcement is not require $z_{toe} = \min(0.5 + \sqrt{(0.25 - (\min(K_{toe}, 0.225) / 0.9)), 0.95) \times d_{toe}}$ $z_{toe} = 382 \text{ mm}$ $A_{s_toe_des} = M_{toe} / (0.87 \times f_y \times z_{toe}) = 705 \text{ mm}^2/\text{m}$ $A_{s_toe_min} = k \times b \times t_{base} = 585 \text{ mm}^2/\text{m}$ $A_{s_toe_min} = k \times b \times t_{base} = 585 \text{ mm}^2/\text{m}$ $A_{s_toe_min} = \max(A_{s_toe_des}, A_{s_toe_min}) = 705 \text{ mm}^2/\text{m}$ $16 \text{ mm dia.bars @ 150 \text{ mm centres}}$ $A_{s_toe_prov} = 1340 \text{ mm}^2/\text{m}$ PASS - Reinforcement provided at the retaining wall toe is adequa $v_{toe} = V_{toe} / (b \times d_{toe}) = 0.345 \text{ N/mm}^2$ $v_{adm} = \min(0.8 \times \sqrt{(f_{cu} / 1 \text{ N/mm}^2)}, 5) \times 1 \text{ N/mm}^2 = 5.000 \text{ N/mm}^2$

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77 St John Street		Foundations	at gridlines 4D			6
London EC1M 4NN	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
From BS8110:Part 1:1997 – Ta Design concrete shear stress	ible 3.8	v _{c_toe} = 0.5	513 N/mm² Vto	e < Vc_toe - No she	ear reinforcen	nent required
Design of reinforced concrete	retaining wal	l stem (BS 800	2:1994 <u>)</u>			
Material properties Characteristic strength of concre Characteristic strength of reinfor	ete rcement	f _{cu} = 40 N/ f _y = 500 N	′mm² /mm²			
Wall details						
Minimum area of reinforcement		k = 0.13 %	6			
Cover to reinforcement in stem		c _{stem} = 40	mm			
Cover to reinforcement in wall		c _{wall} = 40 r	nm			
Factored horizontal active for	ces on stem					
Surcharge		$F_{s_sur_f} = \gamma_{f}$	$_{-1} \times K_a \times Surcha$	$rge imes (h_{eff} - t_{base} - o)$	d _{ds}) = 43.9 kN/	m
Saturated backfill		$F_{s_s_f} = 0.5$	$5 imes \gamma_{f_e} imes K_a imes (\gamma_s)$	- γ_{water}) × h_{sat}^2 = 13	3.8 kN/m	
Water		Fs_water_f =	$0.5\times\gamma_{f_e}\times\gamma_{water}$	\times h _{sat} ² = 28.9 kN/	m	
Calculate shear for stem desig Shear at base of stem	gn	V _{stem} = F _s _	_sur_f + Fs_s_f + Fs_	_water_f - Fprop_f = 36	5.7 kN/m	
Calculate moment for stem de	sign					
Surcharge		Ms_sur = ⊢s	$s_sur_f \times (h_{stem} + t_b)$	_{ase}) / 2 = 54.9 kNr	n/m	
Saturated backfill		$M_{s_s} = F_{s_s}$	s_f × hsat / 3 = 9.4	kNm/m		
Water		Ms_water = I	-s_water_f × hsat / 3	= 19.7 kNm/m		
	► ● ● ●	·	•	• •	•	
Check wall stem in bending		h - 4000	mm/m			
Depth of reinforcement		b = 10001	nm/m _ C	2) - 302 0 mm		
Constant		$G_{stem} = W_{el}$	$v_{stem} - (\psi_{stem})$	f_{cu} = 0.023		
oonstant		ristern - IVIs		Compression reir	nforcement is	not reauired
Lever arm		Zstem = mir Zstem = 28 7	n(0.5 + √(0.25 - (7 mm	(min(K _{stem} , 0.225)	/ 0.9)),0.95) ×	dstem
Area of tension reinforcement re	equired	$A_{s_stem_des}$	= M _{stem} / (0.87 \times	$f_y \times z_{stem}$) = 673 n	nm²/m	
Minimum area of tension reinfor	cement	$A_{s_stem_min}$	= $\mathbf{k} \times \mathbf{b} \times \mathbf{t}_{wall}$ = 4	155 mm²/m		
Area of tension reinforcement re	equired	As_stem_req	= Max(As_stem_des	s, As_stem_min) = 673	mm²/m	
Reinforcement provided Area of reinforcement provided		16 mm di As_stem_prov	a.bars @ 150 m = 1340 mm²/m	nm centres		

🖉 Tekla	Project					
Tedds		G	Blenloch		172904	
Form Structural Design	Calcs for		Start page no./Revision			
77 St John Street		Foundations at gridlines 4D				7
London EC1M 4NN	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
		PASS - Reir	nforcement pro	vided at the reta	ining wall ste	m is adequate
Check shear resistance at v	wall stem					
Design shear stress	$v_{stem} = V_{stem} / (b \times d_{stem}) = 0.121 \text{ N/mm}^2$			• 0.121 N/mm ²		
Allowable shear stress		v _{adm} = m	in(0.8 × $\sqrt{f_{cu}}$ / 1	N/mm²), 5) × 1 N/	/mm ² = 5.000 N/mm ²	
		PAS	S - Design shea	r stress is less t	han maximum shear stress	
From BS8110:Part 1:1997 -	Table 3.8					
Design concrete shear stress	5	v _{c_stem} =	0.605 N/mm ²			
			Vsten	n < Vc_stem - No sł	hear reinforce	ment required
Check retaining wall deflec	tion					
Basic span/effective depth ra	tio	ratio _{bas} =	7			
Design service stress	$f_s = 2 \times f_y \times A_{s_stem_req} / (3 \times A_{s_stem_prov}) = 167$				7.5 N/mm ²	
Modification factor	factor _{tens} = I	min(0.55 + (477 N	I/mm ² - fs)/(120 >	< (0.9 N/mm ² + (N	$I_{\rm stem}/(b \times d_{\rm stem}^2)$))),2) = 1.97
Maximum span/effective dept	th ratio	ratio _{max} =	= ratio _{bas} × factor	_{tens} = 13.76		
Actual span/effective depth ra	atio	ratio _{act} =	h _{stem} / d _{stem} = 6.7	79		
				PASS - Span	to depth ratio	is acceptable

	Project	Gler	lloch		Job no. 172	904
Form Structural Design 77 St John Street	Calcs for	Foundations a	at gridlines 4D		Start page no./Re	evision 8
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Toe bars - 16 mm dia.@ 150 mm centres - (1340 mm²/m) Stem bars - 16 mm dia.@ 150 mm centres - (1340 mm²/m)

CALCULATION SHEET

JOB TITLE:	JOB NUMBER / FILE:	CALCULATION NUM	1BER:	Eorm
38 G.R.	172904			
CALCULATION:	CALCULATION BY:	DATE:	CHECKED BY:	
RC LINERS ADJACENT 40 G.R.	-		-	

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	I THE PREMATOR AT ROTH COROLUD AND RAC	ELENE	(
	LINER RESTRAINED AT BOTH GROUND AND BAS	E LEVEL	٢		
-	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: 20km/m ³ x 0.4 × 3.15m = 25.2km/m ²	E LEVEL	(
	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: $20kn/m^3 \times 0.4 \times 315m = 25.2kn/m^2$ WATER: $10kn/m^3 \times 2.5m = 25.5kn/m^2$	E LEVEL	(
	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: $20 \text{ km}/\text{m}^3 \times 0.4 \times 3.15 \text{m} = 25.2 \text{ km}/\text{m}^2$ WATER: $10 \text{ km}/\text{m}^3 \times 2.5 \text{m} = 25.5 \text{ km}/\text{m}^2$ SURCHARGE: $10 \text{ km}/\text{m}^2 \times 0.4 = 4 \text{ km}/\text{m}^2$ REFERENCE CONTROLOGY	E LEVEL	(
	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: 20kn/m3x 0.4 × 3.15m = 25.2km/m2 WATER: 10kn/m3 × 2.5m = 25.5kn/m2 SURCHARDE: 10kn/m2 × 0.4 = 4kn/m2 REFER TO TEDD'S CALCULATIONS	E LEVEL	· · ·		
	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: 20kn/m ³ × 0.4 × 3.15m = 25.2km/m ² WATER: 10kn/m ³ × 2.5m = 25.5kn/m ² SURCHARGE: 10kn/m ³ × 0.4 = 4 kn/m ² REFER TO TEDD'S CALCULATIONS SPECIFY 200mm RC LINERS	E LEVEL	ζ 		
	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: 20kn/m ³ × 0.4 × 3.15m = 25.2km/m ² WATER: 10kn/m ³ × 2.5m = 25.5kn/m ² SURCHARDE: 10kn/m ² × 0.4 = 4 kn/m ² REFER TO TEDD'S CALCULATIONS SPECIFY 200mm RC LINERS	E LEVEL	<		
	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: 20kn/m ³ × 0.4 × 3.15m = 25.2km/m ² WATER: 10kn/m ³ × 2.5m = 25.5kn/m ² SURCHARDE: 10kn/m ² × 0.4 = 4kn/m ² REFER TO TEDD'S CALCULATIONS SPECIFY 200mm RC LINERS	E LEVEL			
	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: 20kn/m ³ × 0.4 × 3.15m = 25.2km/m ² WATER: 10kn/m ³ × 2.5m = 25.5kn/m ² SURCHARGE: 10kn/m ² × 0.4 = 4kn/m ² REFER TO TEDD'S CALCULATIONS SPECIFY 200mm RC LINERS	E LEVEL	<		
	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: 20kn/m ³ × 0.4 × 3.15m = 25.2km/m ² WATER: 10kn/m ³ × 2.5m = 25.5kn/m ² SURCHARGE: 10kn/m ² × 0.4 = 4 kn/m ² REFER TO TEDD'S CALCULATIONS SPECIFY 200mm RC LINERS	E LEVEL			
	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: 20kn/m ³ × 0.4 × 3.15m = 25.2km/m ² WATER: 10kn/m ³ × 2.5m = 25.5kn/m ² SURCHARDE: 10kn/m ² × 0.4 = 4kn/m ² REFER TO TEDD'S CALCULATIONS SPECIFY 200mm RC LINERS	ELEVEL			
	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: 20kn/m ³ × 0.4 × 3.15m = 25.2ku/m ² WATER: 10kn/m ³ × 2.5m = 25.5kn/m ² SURCHARDE: 10kn/m ² × 0.4 = 4kn/m ² REFER TO TEDD'S CALCULATIONS SPECIFY 200mm RC LINERS	ELEVEL			
	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: 20kn/m ³ × 0.4 × 3.15m = 25.2km/m ² WATER: 10kn/m ³ × 2.5m = 25.5kn/m ² SURCHARGE: 10kn/m ² × 0.4 = 4 kn/m ² REFER TO TEDD'S CALCULATIONS SPECIFY 200mm RC LINERS	E LEVEL	• • • • • • • • • • • • • • • • • • •		
	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: 20kn/m ³ × 0.4 × 3.15m = 25.2km/m ² WATER: 10kn/m ³ × 2.5m = 25.5kn/m ² SURCHARGE: 10kn/m ² × 0.4 = 4kn/m ² REFER TO TEDD'S CALCULATIONS SPECIFY 200mm RC LINERS	E LEVEL	C		
	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: 20kn/m ³ × 0.4 × 3.15m = 25.2km/m ² WATER: 10kn/m ³ × 25m = 25.5kn/m ² SURCHARDE: 10kn/m ² × 0.4 = 4kn/m ² REFER TO TEDD'S CALCULATIONS SPECIFY 200mm RC LINERS	ELEVEL			
	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: 20kn/m ³ × 0.4 × 3.15m = 25.2ku/m ² WATER: 10kn/m ³ × 2.5m = 25.5kn/m ² SURCHARDE: 10kn/m ² × 0.4 = 4 kn/m ² REFER TO TEDD'S CALCULATIONS SPECIFY 200mm RC LINERS	ELEVEL			
	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: 20kn/m ³ × 0.4 × 3.15m = 25.2km/m ² WATER: 10kn/m ³ × 2.5m = 25.5kn/m ² SURCHARGE: 10kn/m ² × 0.4 = 4kn/m ² REFER TO TEDD'S CALCULATIONS SPECIFY 200mm RC LINERS	E LEVEL			
	LINER REGTRAINED AT ROTH GROUND AND BAS SOIL: 20kn/m ³ x 0.4 × 3/5m = 25.2km/m ² WATER: 10kn/m ³ × 2.5m = 25.5kn/m ² SURCHARCOE: 10kn/m ² × 0.4 = 4kn/m ² REFER TO TEDD'S CALCULATIONS SPECIFY 200mm RC LINERS	E LEVEL			
	LINER RESTRAINED AT ROTH GROUND AND BAS SOIL: 20kno/m ³ × 0.4 × 3/5m = 25.2ku/m ² WATER: 10kn/m ³ × 2.5m = 25.5kn/m ² SURCHAROSE: 10kn/m ² × 0.4 = 4 kn/m ² REFER TO TEDD'S CALCULATIONS SPECIFY 200mm RC LINERS	E LEVEL			
	LINER RESTRAINED AT ROTH GROUND AND BAS SOIL: 20kno/m3x 0.4 x 215m = 25.260/m2 WATER: 10kn/m3 x 2.5m = 255kn/m2 SURCHARDE: 10kn/m2 x 0.4 = 4kn/m2 REFER TO TEDD'S CALCULATIONS SPECIF 7 200mm RC LINERS	ELEVEL			
	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: 20kn/m ³ × 0.4 × 3.15m = 25.7km/m ² WATER: 10kn/m ³ × 2.5m = 255kn/m ² SURCHARCE: 10kn/m ³ × 0.4 = 4 kn/m ² REFER TO TEDD'S CALCULATIONS SPECIFY 200mm RC LINERS	ELEVEL			
	LINER RESTRAINED AT BOTH GROUND AND BAS SOIL: 20kn/m ³ × 0.4 × 3.15m = 25.2km/m ² WATER: 10km/m ³ × 2.5m = 25.5kn/m ² SURCHARCOE: 10km/m ² × 0.4 = 4km/m ² REFER TO TEDD'S CALCULATIONS SPECIFY 200mm RC LINERS	ELEVEL			





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	Calcs for				Start page no./F	Revision
		RCI	Liners			2
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
Maximum moment span 1 at 1	415 mm	Ms1_max = 2	2 kNm	Ms1_red =	= 22 kNm	
Maximum moment support B		M _{B_max} = -5	0 kNm	$M_{B_{red}} =$	-50 kNm	
Maximum shear support A		VA_max = 25	kN	VA_red =	25 kN	
Maximum shear support A spa	in 1	$V_{A_s1_max} =$	25 kN	VA_s1_red	i = 25 kN	
Maximum shear support B		V _{B_max} = -9	6 kN	$V_{B_{red}} =$	-96 kN	
Maximum shear support B spa	in 1	$V_{B_s1_max} =$	-96 kN	$V_{B_s1_red}$	i = -96 kN	
Maximum reaction at support A	4	Ra = 25 kN				
Unfactored dead load reaction	at support A	R _{A_Dead} = 12	2 kN			
Unfactored imposed load react	tion at support A	$R_{A_{lmposed}} =$	5 kN			
Maximum reaction at support E	3	R _B = 96 kN				
Unfactored dead load reaction	at support B	RB_Dead = 6	0 kN			
Unfactored imposed load react	tion at support B	$R_{B_{Imposed}} =$	8 kN			
Rectangular section details						
Section width		b = 1000 m	ım			
Section depth		h = 200 mr	n			
500						
		1	000			
Concrete details		1	000			
Concrete details Concrete strength class		1 1 1	000			
Concrete details Concrete strength class Characteristic compressive cul	be strength	1 C32/40 f _{cu} = 40 N/r	000		►	
Concrete details Concrete strength class Characteristic compressive cul Modulus of elasticity of concrete	be strength te	C32/40 f _{cu} = 40 N/r E _c = 20kN/	000	u = 28000 N/mm ²	>	
Concrete details Concrete strength class Characteristic compressive cul Modulus of elasticity of concrete Maximum aggregate size	be strength te	C32/40 f _{cu} = 40 N/r E _c = 20kN/r h _{agg} = 20 m	000 nm ² mm ² + 200 × fc im	u = 28000 N/mm ²	>	
Concrete details Concrete strength class Characteristic compressive cul Modulus of elasticity of concrete Maximum aggregate size Reinforcement details	be strength te	C32/40 f _{cu} = 40 N/r E _c = 20kN/r h _{agg} = 20 m	000 nm^2 $mm^2 + 200 \times f_c$ im	u = 28000 N/mm ²	>	
Concrete details Concrete strength class Characteristic compressive cul Modulus of elasticity of concret Maximum aggregate size Reinforcement details Characteristic yield strength of	be strength te		000	u = 28000 N/mm ²		
Concrete details Concrete strength class Characteristic compressive cul Modulus of elasticity of concret Maximum aggregate size Reinforcement details Characteristic yield strength of Characteristic yield strength of	be strength te		$\frac{1}{1000}$ $\frac{1}{1000}$ $\frac{1}{1000} \times \frac{1}{1000}$ $\frac{1}{1000} \times \frac{1}{1000} \times \frac{1}{1000}$ $\frac{1}{1000} \times \frac{1}{1000} \times \frac{1}{1000} \times \frac{1}{1000}$ $\frac{1}{1000} \times \frac{1}{1000} \times 1$	u = 28000 N/mm ²	>	
Concrete details Concrete details Concrete strength class Characteristic compressive cul Modulus of elasticity of concret Maximum aggregate size Reinforcement details Characteristic yield strength of Characteristic yield strength of Nominal cover to reinforcem	be strength te ^f reinforcement ^f shear reinforcem		$\frac{1}{1000}$ mm^{2} $mm^{2} + 200 \times f_{c}$ mm^{2} mm^{2} $/mm^{2}$	u = 28000 N/mm ²	>	
Concrete details Concrete details Concrete strength class Characteristic compressive cul Modulus of elasticity of concret Maximum aggregate size Reinforcement details Characteristic yield strength of Characteristic yield strength of Characteristic yield strength of Nominal cover to reinforcem Nominal cover to top reinforcem	be strength te ¹ reinforcement ² shear reinforcem ent ment	1 C32/40 $f_{cu} = 40 \text{ N/r}$ $E_c = 20 \text{ kN/r}$ $h_{agg} = 20 \text{ m}$ $f_y = 500 \text{ N/r}$ $h_{rent} f_{yv} = 500 \text{ N/r}$ $C_{nom_t} = 40$	000	u = 28000 N/mm ²		
Concrete details Concrete details Concrete strength class Characteristic compressive cul Modulus of elasticity of concret Maximum aggregate size Reinforcement details Characteristic yield strength of Characteristic yield strength of Nominal cover to reinforcem Nominal cover to top reinforcen Nominal cover to bottom reinforcen	be strength te ^f reinforcement ^f shear reinforcem ent ment prcement	C32/40 fcu = 40 N/r Ec = 20kN/r hagg = 20 m fy = 500 N/r hent fyv = 500 N/ Cnom_t = 40 Cnom_b = 40	000 nm^2 $mm^2 + 200 \times f_c$ mm^2 $/mm^2$ mm mm	u = 28000 N/mm ²	►	
Concrete details Concrete details Concrete strength class Characteristic compressive cul Modulus of elasticity of concret Maximum aggregate size Reinforcement details Characteristic yield strength of Characteristic yield strength of Characteristic yield strength of Nominal cover to reinforcem Nominal cover to top reinforce Nominal cover to bottom reinforce	be strength te ⁱ reinforcement ⁱ shear reinforcem ent ment orcement ement	1 C32/40 $f_{cu} = 40 \text{ N/r}$ $E_c = 20 \text{ kN/r}$ $h_{agg} = 20 \text{ m}$ $f_y = 500 \text{ N/r}$ $h_{rom_t} = 500 \text{ N/r}$ $C_{nom_t} = 40$ $C_{nom_b} = 40$ $C_{nom_s} = 40$	000 nm^2 $mm^2 + 200 \times fc$ mm^2 $/mm^2$ mm^2 mm mm mm mm	u = 28000 N/mm ²	>	
Concrete details Concrete details Concrete strength class Characteristic compressive cul Modulus of elasticity of concret Maximum aggregate size Reinforcement details Characteristic yield strength of Characteristic yield strength of Characteristic yield strength of Nominal cover to reinforcem Nominal cover to top reinforcer Nominal cover to bottom reinfo Nominal cover to side reinforces Support A	be strength te ^f reinforcement ^f shear reinforcem ent ment prcement ement ement	C32/40 f _{cu} = 40 N/r E _c = 20kN/r h _{agg} = 20 m f _y = 500 N/r hent f _{yv} = 500 N/r Cnom_t = 40 Cnom_b = 40 Cnom_s = 40	000 mm^2 $mm^2 + 200 \times f_c$ mm^2 mm^2 mm^2 mm mm mm	u = 28000 N/mm ²	>	
Concrete details Concrete details Concrete strength class Characteristic compressive cul Modulus of elasticity of concret Maximum aggregate size Reinforcement details Characteristic yield strength of Characteristic yield strength of Characteristic yield strength of Nominal cover to reinforcem Nominal cover to top reinforces Nominal cover to bottom reinfo Nominal cover to side reinforces Support A	be strength te ¹ reinforcement ² shear reinforcem ent ment prcement ement	1 C32/40 f _{cu} = 40 N/r E _c = 20kN/r hagg = 20 m f _y = 500 N/r hent f _{yv} = 500 N/r Cnom_t = 40 Cnom_b = 40 Cnom_s = 40	000 nm ² mm ² + 200 × fc mm ² /mm ² mm mm mm	u = 28000 N/mm ²	→	
Concrete details Concrete details Concrete strength class Characteristic compressive cul Modulus of elasticity of concret Maximum aggregate size Reinforcement details Characteristic yield strength of Characteristic yield strength of Nominal cover to reinforcem Nominal cover to top reinforces Nominal cover to bottom reinfo Nominal cover to side reinforces Support A	be strength te f reinforcement shear reinforcem ent ment procement ement	C32/40 fcu = 40 N/r Ec = 20kN/r hagg = 20 m fy = 500 N/r hent fyv = 500 N/r Cnom_t = 40 Cnom_s = 40	000 nm ² mm ² + 200 × fc im mm ² /mm ² mm mm mm	u = 28000 N/mm ²	egs at 75 c/c	
Concrete details Concrete strength class Characteristic compressive cul Modulus of elasticity of concret Maximum aggregate size Reinforcement details Characteristic yield strength of Characteristic yield strength of Nominal cover to reinforcem Nominal cover to top reinforcet Nominal cover to side reinforcet Nominal cover to side reinforcet	be strength te ⁷ reinforcement ⁶ shear reinforcem ent ment prcement ement		000 nm ² mm ² + 200 × fc mm mm ² /mm ² mm mm mm	u = 28000 N/mm ² 6 ※ Չֆ գ ՏԵՁՔՏ 6 x 16 _ф bars	egs at 75 c/c	
Concrete details Concrete strength class Characteristic compressive cul Modulus of elasticity of concret Maximum aggregate size Reinforcement details Characteristic yield strength of Characteristic yield strength of Characteristic yield strength of Nominal cover to reinforcem Nominal cover to top reinforces Nominal cover to bottom reinfo Nominal cover to side reinforces Support A	be strength te ^f reinforcement ^f shear reinforcem ent ment procement ement	1 C32/40 f _{cu} = 40 N/r E _c = 20kN/r hagg = 20 m f _y = 500 N/r nent f _{yv} = 500 N/r Cnom_t = 40 Cnom_b = 40 Cnom_s = 40	000 nm ² mm ² + 200 × fc im mm ² //mm ² mm mm mm	u = 28000 N/mm ² 6 x %φ/sbans h 6 x 16φ bars	egs at 75 c/c	
Concrete details Concrete strength class Characteristic compressive cul Modulus of elasticity of concret Maximum aggregate size Reinforcement details Characteristic yield strength of Characteristic yield strength of Nominal cover to reinforcem Nominal cover to top reinforcer Nominal cover to bottom reinfo Nominal cover to side reinforcer Support A	be strength te ^c reinforcement shear reinforcem ent ment prcement ement ement		000 nm ² mm ² + 200 × fc mm ² /mm ² mm mm mm	u = 28000 N/mm ² ề ¥ Φφsbans I 6 x 16φ bars	egs at 75 c/c	
Concrete details Concrete strength class Characteristic compressive cul Modulus of elasticity of concret Maximum aggregate size Reinforcement details Characteristic yield strength of Characteristic yield strength of Nominal cover to reinforcem Nominal cover to top reinforces Nominal cover to bottom reinfo Nominal cover to side reinforces Support A	be strength te f reinforcement f shear reinforcem ent ment procement ement ement 	C32/40 fcu = 40 N/r Ec = 20kN/r hagg = 20 m fy = 500 N/r hent fyv = 500 N/r Cnom_t = 40 Cnom_s = 40 Cnom_s = 40	000 nm ² mm ² + 200 × fc im mm ² /mm ² mm mm mm	u = 28000 N/mm ² ề ¥ ቅ¢ φs bare I 6 x 16φ bars	egs at 75 c/c	

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Са	lcs for				Start page no./R	Revision
		RC	Liners			3
Са	lcs by	Calcs date	Checked by	Checked date	Approved by	Approved
Design shear stress		v = V / (b :	× d) = 0.173 N/	mm ²		1
Design concrete shear stress		vc = 0.79 >	< min(3,[100 × /	$A_{s,prov} / (b \times d)]^{1/3}$	× max(1, (400	/d) ^{1/4}) ×
(min(f _{cu} , 40) / 25) ^{1/3} / γ _m						
		Vc = 0.900	N/mm ²	5 (4 b)(2)05 -	NU 2)	• • • • • • •
Allowable design shear stress		V _{max} = min	(0.8 N/mm² × (i	t _{cu} /1 N/mm ²) ^{0.5} , 5	N/mm ²) = 5.00	0 N/mm ²
Volue of v from Table 2.7			SS - Design sr	iear stress is les	ss than maxim	ium allov
Design shear resistance required		$v < 0.5v_c$	((2) - 0.400 N/mm	2	
Area of shear reinforcement require	ad		\sim b / (0.87 \times f.	$() = 920 \text{ mm}^2/\text{m}$	I	
Shoar reinforcement provided	5u	Asv, req - vs	\times D7 (0.07 \times ly	/) = 320 mm /m		
Area of about reinforcement provided	od		$340 \text{ mm}^2/\text{m}$			
Area of shear remorcement provid	eu PA	Asv,prov - I	s40 mm /m	ement provided	exceeds minir	num rea
Maximum longitudinal spacing	17	Sulmay = 0	75 × d = 108 m	m	exceeds minin	numreq
	ASS - Longit	udinal snacin	a of shear rei	nforcement prov	vidad is lass th	an mavi
	100 Longi	aamar spacm	g or shear ren	noreement prot		
	•10	•	••	6 x 1Ġ _∲ bars	;	
Design moment resistance of red Design bending moment Depth to tension reinforcement Redistribution ratio	• 10	00 ction (cl. 3.4.4 M = abs(M d = h - cnoι β _b = min(1	• • • • • • • • • • • • • • • • • • •	6 x 1Ġ∳ bars oment n = 144 mm		
Design moment resistance of red Design bending moment Depth to tension reinforcement Redistribution ratio	● 10	00 ction (cl. 3.4.4 M = abs(M d = h - cnoi β _b = min(1 K = M / (b	 Positive me As1_red) = 22 kNr m_b - φv - φbot / 2 mrs1, 1) = 1.0 × d² × f_{cu}) = 0.0 	6 x 16́∳ bars oment n = 144 mm 000 027		
Design moment resistance of red Design bending moment Depth to tension reinforcement Redistribution ratio	• 10	00 ction (cl. 3.4.4 M = abs(M d = h - cnoi β _b = min(1 K = M / (b K' = 0.156	 Positive model Positive model As1_red) = 22 kNr m_b - φv - φbot / 2 - mrs1, 1) = 1.0 × d² × fcu) = 0.0 	6 x 16́∳ bars oment n = 144 mm 000 027		
Design moment resistance of red Design bending moment Depth to tension reinforcement Redistribution ratio	● 10	00 ction (cl. 3.4.4 M = abs(M) $d = h - c_{noi}$ $β_b = min(1)$ K = M / (b) K' = 0.156 z = min(d)	$(0.5 \pm (0.25))$	6 x 16́∳ bars oment n = 144 mm 000 027 <i>No compressio</i>	n reinforceme	nt is req
Design moment resistance of real Design bending moment Depth to tension reinforcement Redistribution ratio	• 10	$M = abs(M)$ $d = h - cnoid{figure}$ $\beta_{b} = min(1)$ $K = M / (b)$ $K' = 0.156$ $z = min(d)$ $x = (d - z)$	$f_{s1_{red}} = 22 \text{ kNr}$ $m_b - \phi_v - \phi_{bot} / 2$ $- m_{rs1}, 1) = 1.0$ $\times d^2 \times f_{cu}) = 0.0$ $K' > K - $ $\times (0.5 + (0.25 - 16))$	6 x 16́ ₀ bars oment n = 144 mm 000 027 <i>No compressio</i> K / 0.9) ^{0.5}), 0.95	<i>n reinforceme</i> × d) = 137 mm	nt is req
Design moment resistance of red Design bending moment Depth to tension reinforcement Redistribution ratio	•10	$ction (cl. 3.4.4)$ $M = abs(M)$ $d = h - c_{noi}$ $\beta_b = min(1)$ $K = M / (b)$ $K' = 0.156$ $z = min(d)$ $x = (d - z)$ $A_{a} con = M d$	b) - Positive models As1_red) = 22 kNr m_b - φv - φbot / 2 - mrs1, 1) = 1.0 × d ² × fcu) = 0.0 K' > K - × (0.5 + (0.25 - / 0.45 = 16 mm (0.87 × fcv < 7)	6 x 16́∳ bars oment n = 144 mm 000 027 <i>No compressio</i> K / 0.9) ^{0.5}), 0.95 n = 375 mm ²	n <i>reinforceme</i> × d) = 137 mm	nt is req
Design moment resistance of red Design bending moment Depth to tension reinforcement Redistribution ratio	• 10 ctangular sec	oo ction (cl. 3.4.4 M = abs(M $d = h - c_{not}$ $\beta_b = min(1$ K = M / (b K' = 0.156 z = min(d x = (d - z) $A_{s,req} = M /$ 6×166 bs	$f_{s1_{red}} = 22 \text{ kNr}$ $m_{b} - \text{Positive mod}$ $m_{b} - \phi_{V} - \phi_{bot} / 2$ $- m_{rs1}, 1) = 1.0$ $\times d^{2} \times f_{cu}) = 0.0$ $K' > K - 4$ $\times (0.5 + (0.25 - 4))$ $/ 0.45 = 16 \text{ mm}$ $/ (0.87 \times f_{y} \times z))$ $Dres$	6 x 16́∳ bars oment n = 144 mm 000 027 <i>No compressio</i> K / 0.9) ^{0.5}), 0.95	<i>n reinforceme</i> × d) = 137 mm	nt is req
Design moment resistance of red Design bending moment Depth to tension reinforcement Redistribution ratio	• 	00 ction (cl. 3.4.4 M = abs(M) $d = h - c_{nor}$ $β_b = min(1)$ K = M / (b) K' = 0.156 z = min(d) x = (d - z) $A_{s,req} = M / 6$ $\delta \times 16\phi$ bas $A_{s,rey} = 12$	$f_{s1_red} = 22 \text{ kNr}$ $m_b - \phi_v - \phi_{bot} / 2$ $- m_{rs1}, 1) = 1.0$ $\times d^2 \times f_{cu}) = 0.0$ $K' > K - $ $\times (0.5 + (0.25 - $ $/ 0.45 = 16 \text{ mm}$ $/ (0.87 \times f_y \times z)$ ars	6 x 16́∳ bars oment n = 144 mm 000 027 <i>No compressio</i> K / 0.9) ^{0.5}), 0.95 1 = 375 mm ²	<i>n reinforceme</i> × d) = 137 mm	nt is req
Design moment resistance of red Design bending moment Depth to tension reinforcement Redistribution ratio Lever arm Depth of neutral axis Area of tension reinforcement requ Tension reinforcement provided Area of tension reinforcement prov	• 	ction (cl. 3.4.4 M = abs(M d = h - cnor β _b = min(1 K = M / (b K' = 0.156 z = min(d x = (d - z) A _{s,req} = M / 6 × 16φ ba A _{s,prov} = 12 A _{s,req} = 0 ($f_{s1_{red}} = 22 \text{ kNr}$ $m_{b} - \text{Positive mod}$ $m_{b} - \phi_{v} - \phi_{bot} / 2$ $- m_{rs1}, 1) = 1.0$ $\times d^{2} \times f_{cu}) = 0.0$ $K' > K - 4$ $\times (0.5 + (0.25 - 4))$ $/ 0.45 = 16 \text{ mm}^{2}$ $/ (0.87 \times f_{y} \times z))$ ars 206 mm^{2} $D013 \times b \times b = 4$	6 x 16́ ₀ bars oment n = 144 mm 000 027 <i>No compressio</i> K / 0.9) ^{0.5}), 0.95 n = 375 mm ²	<i>n reinforceme</i> × d) = 137 mm	nt is req
Design moment resistance of red Design bending moment Depth to tension reinforcement Redistribution ratio	• 10 ctangular sec	00 ction (cl. 3.4.4 M = abs(M d = h - cnoi β _b = min(1 K = M / (b K' = 0.156 z = min(d x = (d - z)) A _{s,req} = M / 6 × 16φ ba A _{s,prov} = 12 A _{s,min} = 0.0	$f_{s1_{red}} = 22 \text{ kNr}$ $m_b - \varphi - \varphi_{bot} / 2$ $- m_{rs1}, 1) = 1.0$ $\times d^2 \times f_{cu}) = 0.0$ $K' > K - $ $\times (0.5 + (0.25 - $ $/ 0.45 = 16 \text{ mm}$ $/ (0.87 \times f_y \times z)$ ars 206 mm^2 $2013 \times b \times h = 20$	$6 \times 16_{\phi}$ bars oment m = 144 mm 000 027 <i>No compressio</i> K / 0.9) ^{0.5}), 0.95 = 375 mm ² 260 mm ² 00 mm ²	<i>n reinforceme</i> × d) = 137 mm	nt is req
Design moment resistance of red Design bending moment Depth to tension reinforcement Redistribution ratio Lever arm Depth of neutral axis Area of tension reinforcement requ Tension reinforcement provided Area of tension reinforcement prov Minimum area of reinforcement Maximum area of reinforcement	• 	oo ction (cl. 3.4.4 M = abs(M d = h - cnot $\beta_b = min(1$ K = M / (b K' = 0.156 z = min(d x = (d - z) $A_{s,req} = M /$ $6 \times 16\phi$ bas $A_{s,prov} = 12$ $A_{s,min} = 0.0$ $A_{s,max} = 0.0$ <i>reinforcement</i>	$f_{s1_{red}} = 22 \text{ kNr}$ $m_b - \phi_v - \phi_{bot} / 2$ $- m_{rs1}, 1) = 1.0$ $\times d^2 \times f_{cu}) = 0.0$ $K' > K - 4$ $\times (0.5 + (0.25 - 4))$ $/ (0.45 = 16 \text{ mm}^2)$ $/ (0.87 \times f_y \times z)$ R^2 206 mm^2 $2013 \times b \times h = 20$ $0.04 \times b \times h = 80$ R^2 R^2	$6 \times 16_{\phi}$ bars oment m = 144 mm 000 027 <i>No compressio</i> K / 0.9) ^{0.5}), 0.95 = 375 mm ² 260 mm ² 00 mm ² greater than are	n reinforceme × d) = 137 mm	nt is req nent req
Design moment resistance of red Design bending moment Depth to tension reinforcement Redistribution ratio Lever arm Depth of neutral axis Area of tension reinforcement requires Tension reinforcement provided Area of tension reinforcement provided Area of tension reinforcement provided Area of tension reinforcement provided Area of tension reinforcement provided Minimum area of reinforcement Maximum area of reinforcement PA Rectangular section in shear	• 10 ctangular sed ired ided SS - Area of	oo ction (cl. 3.4.4 M = abs(M $d = h - c_{not}$ $\beta_b = min(1$ K = M / (b K' = 0.156 z = min(d x = (d - z) $A_{s,req} = M /$ $6 \times 16\phi$ ba $A_{s,prov} = 12$ $A_{s,min} = 0.0$ $A_{s,max} = 0.0$ <i>reinforcemen</i>		$6 \ge 16_{\phi}$ bars oment m = 144 mm 000 027 <i>No compressio</i> K / 0.9) ^{0.5}), 0.95 = 375 mm ² 260 mm ² greater than are	n reinforceme × d) = 137 mm	nt is req nent req
Design moment resistance of red Design bending moment Depth to tension reinforcement Redistribution ratio Lever arm Depth of neutral axis Area of tension reinforcement requ Tension reinforcement provided Area of tension reinforcement prov Minimum area of reinforcement Maximum area of reinforcement	• 10 ctangular sed ited ided SS - Area of	00 ction (cl. 3.4.4 M = abs(M d = h - cnoi β _b = min(1 K = M / (b K' = 0.156 z = min(d x = (d - z) A _{s,req} = M / 6 × 16φ ba A _{s,min} = 0.0 A _{s,max} = 0.1 <i>reinforcemen</i> 2 × 8φ legs	$f_{1} - Positive models for the second state of the second state$	$6 \times 16\phi$ bars m = 144 mm 100 127 No compressio K / 0.9) ^{0.5}), 0.95 = 375 mm ² 260 mm ² greater than are	n reinforceme × d) = 137 mm a of reinforcer	nt is req nent req
Design moment resistance of red Design bending moment Depth to tension reinforcement Redistribution ratio Lever arm Depth of neutral axis Area of tension reinforcement requision reinforcement provided Area of tension reinforcement provided Area of tension reinforcement provided Maximum area of reinforcement Maximum area of reinforcement PA Rectangular section in shear Shear reinforcement provided Area of shear reinforcement provided	• 10 ctangular sed ired ided SS - Area of ed	00 ction (cl. 3.4.4 M = abs(M d = h - cnot β _b = min(1 K = M / (b K' = 0.156 z = min(d x = (d - z) A _{s,req} = M / 6 × 16φ ba A _{s,prov} = 12 A _{s,max} = 0.0 reinforcement 2 × 8φ legs A _{sv,prov} = 1	• Positive models A_{s1_red} = 22 kNr $m_b - \phi_v - \phi_{bot} / 2$ $- m_{rs1}, 1) = 1.0$ $\times d^2 \times f_{cu}$ = 0.0 $K' > K - \frac{1}{2}$ $(0.87 \times f_y \times z)$ $(0.87 \times f_y \times z)$ $(0.87 \times f_y \times z)$ Mr = 10 Mr = 10 M	$6 \times 16_{\phi}$ bars oment m = 144 mm 000 027 <i>No compressio</i> K / 0.9) ^{0.5}), 0.95 = 375 mm ² 260 mm ² greater than are	n reinforceme × d) = 137 mm	nt is req nent req
Design moment resistance of red Design bending moment Depth to tension reinforcement Redistribution ratio Lever arm Depth of neutral axis Area of tension reinforcement requ Tension reinforcement provided Area of tension reinforcement prov Minimum area of reinforcement Maximum area of reinforcement PA Rectangular section in shear Shear reinforcement provided Area of shear reinforcement provided	• 10 ctangular sed ired ided SS - Area of ed ent (Table 3.7	00 ction (cl. 3.4.4 M = abs(M d = h - cnor β _b = min(1 K = M / (b K' = 0.156 z = min(d x = (d - z) As,req = M / 6 × 16φ ba As,prov = 12 As,min = 0.0 reinforcement 2 × 8φ legs Asv,prov = 1) Asv,min = 0.	e b) - Positive model M_{s1_red}) = 22 kNr $m_b - \phi_V - \phi_{bot} / 2$ $- m_{rs1}, 1$) = 1.0 $\times d^2 \times f_{cu}$) = 0.0 $K' > K - \frac{1}{2}$ $(0.5 + (0.25 - \frac{1}{2}) - \frac{1}{2})$ $(0.45 = 16 \text{ mm}^2)$ $(0.87 \times f_y \times z)$ ars 206 mm ² $(0.13 \times b \times h = 30)$ $(0.13 \times b $	$6 \ge 16_{\phi} \text{ bars}$ oment n = 144 mm 000 027 No compressio K / 0.9) ^{0.5}), 0.95 n = 375 mm ² 260 mm ² 260 mm ² greater than are 0.87 × f _{yv}) = 920 f	m reinforceme × d) = 137 mm a of reinforcer	nt is req ment req
Design moment resistance of real Design bending moment Depth to tension reinforcement Redistribution ratio Lever arm Depth of neutral axis Area of tension reinforcement requ Tension reinforcement provided Area of tension reinforcement prov Minimum area of reinforcement Maximum area of reinforcement PA Rectangular section in shear Shear reinforcement provided Area of shear reinforcement provide Area of she	• 	oo ction (cl. 3.4.4 M = abs(M $d = h - c_{noi}$ $\beta_b = min(1$ K = M / (b K' = 0.156 z = min(d x = (d - z) $A_{s,req} = M /$ $6 \times 16\phi ba$ $A_{s,prov} = 12$ $A_{s,min} = 0.0$ $A_{s,max} = 0.0$ reinforcement $2 \times 8\phi legs$ $A_{sv,prov} = 1$ $2 \times 8\phi legs$ $A_{sv,min} = 0.5$ SS - Area of s	$f_{s} = 22 \text{ kNr}$ $m_b - \phi_v - \phi_{bot} / 2$ $- m_{rs1}, 1) = 1.0$ $\times d^2 \times f_{cu}) = 0.0$ $K' > K -$ $\times (0.5 + (0.25 -$ $/ 0.45 = 16 \text{ mm}^2$ $/ 0.45 = 16 \text{ mm}^2$ 206 mm^2 206 mm^2 $2013 \times b \times h = 30$ $404 \times b \times h = 80$	$6 \times 16\phi$ bars oment m = 144 mm 000 027 <i>No compressio</i> K / 0.9) ^{0.5}), 0.95 = 375 mm ² 260 mm ² greater than are 0.87 × f _{yv}) = 920 m ement provided	m reinforceme × d) = 137 mm a of reinforcer mm²/m exceeds minir	nt is req ment req mum req
Design moment resistance of red Design bending moment Depth to tension reinforcement Redistribution ratio Lever arm Depth of neutral axis Area of tension reinforcement requ Tension reinforcement provided Area of tension reinforcement prov Minimum area of reinforcement Maximum area of reinforcement PA Rectangular section in shear Shear reinforcement provided Area of shear reinforcement provided	• 10 ctangular sed ired ided SS - Area of ed ent (Table 3.7 PA 3.4.5.5)	00 ction (cl. 3.4.4 M = abs(M d = h - cnor β _b = min(1 K = M / (b K' = 0.156 z = min(d x = (d - z) As,req = M / 6 × 16φ ba As,prov = 12 As,min = 0.0 As,max = 0.0 reinforcement 2 × 8φ lega Asv,prov = 1) Asv,min = 0. SS - Area of s svl,max = 0.7	• Positive models (a) - Positive models M_{s1_red}) = 22 kNr $m_b - \phi_V - \phi_{bot} / 2$ $- m_{rs1}, 1$) = 1.0 $\times d^2 \times f_{cu}$) = 0.0 (b) $K' > K - K - K - K - K - K - K - K - K - K$	$6 \ge 16\phi$ bars oment m = 144 mm 000 027 <i>No compressio</i> K / 0.9) ^{0.5}), 0.95 m = 375 mm ² 260 mm ² greater than are 0.87 × f _{yv}) = 920 m ement provided m	n reinforceme × d) = 137 mm a of reinforcer mm²/m exceeds minir	nt is req nent req num req

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	Calcs for	RC	Liners		Start page no./R	evision 4
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
Design concrete shear stres	ŝs	vc = 0.79N	//mm ² × min(3,[²	100 × A _{s,prov} / (b >	< d)] ^{1/3}) × max(1	l, (400mm
		/d) ^{1/4}) × (m	iin(fcu, 40N/mm ²	²) / 25N/mm ²) ^{1/3} /	γm = 0.900 N/n	nm²
Design shear resistance pro	ovided	v _{s,prov} = As	$_{\rm v,prov} imes 0.87 imes f_{\rm yv}$	/ b = 0.583 N/m	m²	
Design shear stress provide	ed	$V_{prov} = V_{s,pr}$	ov + vc = 1.483 N	N/mm ²		
Design shear resistance		$V_{prov} = V_{pro}$	v × (b × d) = 21 3	3.5 kN		
Shear	links provided va	alid between 0 n	nm and 3150 m	m with tension	reinforcement	t of 1206 mm ²
Spacing of roinforcomont	(cl 2 12 11)					
A stud distance between be	(CI 3.12.11)	a – (h. 0.		(D)) //NL (1)	L = 162 mm	
Actual distance between ba	rs in tension	s = (b - 2 :	< (Cnom_s + φν + φ	bot/2))/(Nbot - 1)	- φ _{bot} = 162 mm	
Minimum distance betwee	en bars in tensio	n (cl 3.12.11.1)				
Minimum distance between	bars in tension	$s_{min} = h_{agg}$	+ 5 mm = 25 m	m		
			PAS	SS - Satisfies th	e minimum sp	acing criteria
Maximum distance betwee	en bars in tensio	n (cl 3.12.11.2)				
Design service stress		$f_s = (2 \times f_y)$	\times As,reg) / (3 \times A	s,prov $\times \beta$ b) = 103 .	6 N/mm ²	
Maximum distance between	bars in tension	s _{max} = min	(47000 N/mm /	f _s , 300 mm) = 30)0 mm	
			PAS	S - Satisfies the	e maximum sp	acing criteria
Span to depth ratio (cl. 3)	1.6)				-	-
Basic span to depth ratio (Cl. 3) Jahla 3 9)	span to c	lenth = 20 0			
Dasic spar to deptit ratio (1	sion roinforcomor	$f = (2 \times f)$	$\frac{1}{2} \sum_{n=1}^{\infty} \frac{1}{2} \sum_{n=1}^{\infty} \frac{1}$	v B.) – 102 (N/mm ²	
Medification for tangion rain	forcoment	It $I_s = (Z \times I_y)$	\times As,req)/ (3 \times As	,prov × рь) – ТОЗ.С	D IN/IIIII	
modification for tension rein	forcement		(477) (/ (400 (0 0N)/-		-12)))))
Madification for compressio	Itens =	= min(2.0, 0.55 +	(4771N/mm ² - Is)	/ (120 × (0.9N/m	1m- + (IVI / (D ×	a-))))) = 2.000
modification for compressio			(100 0 1)		0 A //h	
	Tcor	mp = min(1.5, 1 + 1)	$(100 \times A_{s2,prov} / ($	(10 × a)) / (3 + (10	$\mathbf{U} \times \mathbf{A}_{s2,prov} / (\mathbf{D})$	× a)))) = 1.218
Modification for span length		Tlong = 1.00				_
Allowable span to depth rati	10	span_to_c	lepthallow = span	_to_depthbasic × 1	Itens × Icomp = 48	.7
Actual span to depth ratio		span_to_c	$lepth_{actual} = L_{s1} / $	d = 21.9		
		PAS	S - Actual spar	to depth ratio	is within the a	llowable limit
Support B						
A						
	• •	٠	• 1	6 x 16 _φ bars	logs at 75 c/c	
50	• •	•		$6 \times 16_{\phi}$ bars	legs at 75 0/0	
▼				,		
		-1000				
Poctangular soction in flo	$x_{\rm uro}$ (cl 3 4 4)					
Design bonding moment	xule (cl.3.4.4)	M = aba(N)	1			
Design bending moment	ant		$IB_red = 50 KINIII$	- 111 mm		
	ient	$a = n - c_{nor}$	m_t - Φv - Φtop / 2 =	= 144 mm		
Redistribution ratio		β₅ = min(1	- m _г в, 1) = 1.00	00		
		K = M / (b	$\times d^2 \times f_{cu}$ = 0.0	61		
		K' = 0.156				
			K' > K -	No compressio	n reinforceme	nt is required
Lever arm		z = min(d	× (0.5 + (0.25 -	K / 0.9) ^{0.5}), 0.95	× d) = 134 mm	
Depth of neutral axis		x = (d - z)	/ 0.45 = 23 mm			
Area of tension reinforceme	ent required	$A_{s,req} = M$	$(0.87 \times f_y \times z) =$	= 866 mm²		
Tension reinforcement prov	ided	$6 imes 16\phi$ ba	irs			
lension reinforcement prov	Ided	6 × 16φ ba	irs			

	Project	G	lenloch		Job no. 172	2904		
	Calcs for		21.		Start page no./R	evision		
		R	Liners			5		
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved d		
Area of tension reinforceme	ent provided	A _{s,prov} = 1	206 mm ²					
Minimum area of reinforcer	nent	$A_{s,min} = 0$	$.0013 \times b \times h = 2$	2 60 mm²				
Maximum area of reinforce	ment	$A_{s,max} = 0$.04 × b × h = 80	00 mm²				
	PASS - Area	of reinforceme	nt provided is g	greater than are	a of reinforcer	nent requi		
Rectangular section in sh	near							
Design shear force span 1		V = abs(nin(VB_s1_max, VB	_s1_red)) = 96 kN				
Design shear stress		v = V / (b	× d) = 0.669 N/	mm²				
Design concrete shear stre	ss	$v_{c} = 0.79$	× min(3,[100 × /	$A_{s,prov} / (b \times d)]^{1/3}$	× max(1, (400	/d) ^{1/4}) ×		
(min(f _{cu} , 40) / 25) ^{1/3} / γ _m								
		vc = 0.90	0 N/mm ²					
Allowable design shear stre	ess	v _{max} = min(0.8 N/mm ² × (f _{cu} /1 N/mm ²) ^{0.5} , 5 N/mm ²) = 5.000 N/mm ²						
		PA	SS - Design sh	lear stress is le	ss than maxim	um allowa		
Value of v from Table 3.7		0.5 × v _c <	: v < (v _c + 0.4 N/	mm²)				
Design shear resistance re	quired	vs = max	(v - vc, 0.4 N/mm	²) = 0.400 N/mm	2			
Area of shear reinforcemer	nt required	A _{sv,req} = v	$s_s imes b$ / (0.87 $ imes$ fyv	y) = 920 mm²/m				
Shear reinforcement provid	led	$2 \times 8\phi$ les	gs at 75 c/c					
Area of shear reinforcemer	nt provided	A _{sv,prov} =	1340 mm²/m					
		PASS - Area of	shear reinforce	ement provided	exceeds minin	num requ		
Maximum longitudinal space	sing	Svl,max = C	.75 × d = 108 m	m				
	PASS - Lon	gitudinal spaci	ng of shear reii	nforcement prov	vided is less th	an maxin		
Spacing of reinforcement	: (cl 3.12.11)							
Actual distance between ba	ars in tension	s = (b - 2	\times (C _{nom_s} + ϕ_v + ϕ_v	¢ _{top} /2)) /(N _{top} - 1)	- φ _{top} = 162 mm			
Minimum distance betwe	en bars in tensio	n (cl 3.12.11.1)						
Minimum distance betweer	bars in tension	s _{min} = h _{ag}	_g + 5 mm = 25 m	ım				
			PA	SS - Satisfies th	e minimum sp	acing crit		
Maximum distance betwe	en bars in tensio	n (cl 3.12.11.2)						
Design service stress		f _s = (2 × 1	$y \times A_{s,req}) / (3 \times A_{s,req})$	A _{s,prov} × β _b) = 239	.2 N/mm ²			
Maximum distance betwee	n bars in tension	s _{max} = mi	n(47000 N/mm /	fs, 300 mm) = 1 9	97 mm			
				Codiation th				