Polystorm Uplift / Buoyancy Check - Based on Eurocode 7

Winscott Farm - Tank 1 Buoyancy Check - Min depth of 2m GWL at GL

Design factor of safety (FoS)

Ultimate Limit State			Uplift (UPL)				
$\begin{array}{llllllllllllllllllllllllllllllllllll$		G,stb 0.9 , γ _{G,dst} 1.1		[Table A.NA.15, NA to BS EN 1997-1:2004] [Table A.NA.15, NA to BS EN 1997-1:2004]			
Variable actions (Q) - Stabilising, - Destabilising		/ _{Q,stb} 0 g, γ _{Q,dst} 1.5		[Table A.NA.15, NA to BS EN 1997-1:2004] [Table A.NA.15, NA to BS EN 1997-1:2004]			
Assumed installation	on parameters						
$\begin{array}{ll} \textit{Material density} & \mbox{- granular backfill, } \gamma_{Bk} \\ \mbox{- water, } \gamma_{Wk} \end{array}$		/Bk	20.0 kN/m ³ 9.81 kN/m ³	[Assumed] [Assumed]			
	- saturated backfill, (= γ _{Bk} - γ _{Wk})	YВk	10.2 KIN/III*				
Depths	- GL to structure IL, - GL to GWL, h _w	, H	2.000 m 0.000 m				
Proposed Polystor	m structure						
Unit description Product code	Deep PSM5			hw Wgk2			
Structure depth, h ₁	0.800 m						
Cover depth, h _c	1.200 m						
Actions							
Displaced water volume, Vol _{cell} 0.80 m³/r		0.80 m³/m	1 ²				
Characteristic destabil	ising						
Water uplift , U _{Gk} (= γ _{wk} x \	/ol _{cell})	7.85 kN/n	n²	U _{Gk} Fig 1) Definitions illustration			
Characteristic stabilisii Self weight of	ng - Polystorm structur - Backfill, W _{Gk2} (If h _w <h<sub>c = γ_{Bk} x</h<sub>	re, W _{Gk1} h _w ; else = γ _{Βk}	0.43 kN/m ² 0.00 kN/m ² x h _c)	[Polypipe technical data]			
	- Saturated fill, W' _G (= γ' _{Bk} x [h _c - h _w]	k2)	12.23 kN/m²				
Effects of Actions							
Destabilising design vertical actions , $V_{d,dst}$ (= $\gamma_{G,dst} \times U_{Gk})$		8.63 kN/m²					
Stabilising design vertical actions , $V_{d,stb}$ (= $\gamma_{G,stb} \times W_{Gk})$		11.39 kN/m²					
Degree of utilization, Λ_{UPL} (= V _{d,dst} / V _{d,stb})		76 %	< 100%; Passes Check				
Traditional Verifica	tion of Stability	Against U	plift				
Traditional lumped (= W _{GK} /	FoS, F _{U_{GK})}		1.6				

Notes

1 Groundwater assumed to act as a permanent destabilising action

- 2 If uncertainty in the level of ground or free water exists, consideration should be given to the application of a safety margin to the assumed characteristic water level
- **3** The above assessment assumes that the Polystorm structure is completely flexible and that there is negligible fricitional resistance between the geocellular structure and the native soil. The uplift stability verification has therefore been simplified, based on a m² (plan area) basis.

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Polystorm Uplift / Buoyancy Check - Based on Eurocode 7

Winscott Farm - Tank 1 Buoyancy Check - Max depth of 2.7m GWL at GL

Design factor of safety (FoS)

Ultimate Limit State			Uplift (UPL)	
$\begin{array}{llllllllllllllllllllllllllllllllllll$		/G,stb], γ _{G,dst}	0.9 1.1	[Table A.NA.15, NA to BS EN 1997-1:2004] [Table A.NA.15, NA to BS EN 1997-1:2004]
Variable actions (Q) - Stabilising, γ - Destabilising		/ _{Q,stb}], γ _{Q,dst}	0 1.5	[Table A.NA.15, NA to BS EN 1997-1:2004] [Table A.NA.15, NA to BS EN 1997-1:2004]
Assumed installati	on parameters			
Material density	- granular backfill, γ - water, γ _{Wk}	ular backfill, γ _{Bk} er, γ _{Wk}		[Assumed] [Assumed]
	- saturated backfill, (= γ_{Bk} - γ_{Wk})	Ү' Вк	10.2 kN/m ³	
Depths	- GL to structure IL, - GL to GWL, h _w	Н	2.700 m 0.000 m	
Proposed Polystor	m structure			
Unit description Product code	Deep PSM5			hw Wgk2
Structure depth, h	1 0.800 m			
Cover depth, h_c	1.900 m			
Actions		0 80 m³/m	2	
			<u>1</u>	
Characteristic destabilising Water uplift , U _{Gk} 7.85 kN/m (= Ywk × Vol _{cel}) 7.85 kN/m		7 ²	Fig 1) Definitions illustration	
Characteristic stabilising Self weight of - Polystorm structure, W _{Gk1} - Backfill, W _{Gk2} (If h _w <h<sub>c = y_{Bk} x h_w; else = y_{Bk}</h<sub>		0.43 kN/m² 0.00 kN/m² x h _c)	[Polypipe technical data]	
	- Saturated fill, W' _G , (= $\gamma'_{Bk} \times [h_c - h_w]$	<2)	19.36 kN/m²	
Effects of Actions				
Destabilising design vertical actions , $V_{d,dst}$ (= $\gamma_{G,dst} \times U_{Gk})$		8.63 kN/m²		
Stabilising design vertical actions , $V_{d,stb}$ (= $\gamma_{G,stb}$ x W_{Gk}		17.81 kN/m²		
Degree of utilization, Λ_{UPL} (= V _{d,dst} / V _{d,sib})		48 %	< 100%; Passes Check	
Traditional Verifica	tion of Stability A	Against U	plift	
Traditional lumped (= W _{GK} /	FoS, F U _{GK})		2.5	

Notes

1 Groundwater assumed to act as a permanent destabilising action

- 2 If uncertainty in the level of ground or free water exists, consideration should be given to the application of a safety margin to the assumed characteristic water level
- **3** The above assessment assumes that the Polystorm structure is completely flexible and that there is negligible fricitional resistance between the geocellular structure and the native soil. The uplift stability verification has therefore been simplified, based on a m² (plan area) basis.

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Polystorm Uplift / Buoyancy Check - Based on Eurocode 7

M43012 - Winscott Farm - Floation Check - at 1.8m dp

Design	factor	of	safety	(FoS)
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Design factor of st	aloty (i	00)						
Ultimate Limit State				Uplift (UP	'L)			
Permanent actions (G)		- Stabilising, γ _{G,stb} - Destabilising, γ _{G,dst}		0.9 1.1		[Table A.NA.15, NA to BS EN 1997-1:2004] [Table A.NA.15, NA to BS EN 1997-1:2004]		
Variable actions (Q)		- Stabilising, γ _{Q,stb} - Destabilising, γ _{Q,dst}		0 1.5		[Table A.NA.15, NA to BS EN 1997-1:2004] [Table A.NA.15, NA to BS EN 1997-1:2004]		
Assumed installat	ion par	ameters						
Material density - Gran - Wate		ular backfill, γ _{Bk} εr, γ _{Wk}		20.0 kN/m³ 9.8 kN/m³		[Assumed] [Assumed]		
	- Saturated backfill, γ' _{Bk} (= γ _{Bk} - γ _{Wk})		10.2 kN/m³					
Depths	- GL to - GL to	structure IL, H GWL, h _w		1.800 m 0.400 m				
Proposed Polysto	rm stru	cture						
Layer 1 unit typeXtra(PSMLayer 2 unit typePolystorm-R(PSM		(PSM3) (PSM1 <i>A</i>	N)	¥ - • •	⊢−1.0m ──	F.G.L.		
Layer 1 depth, h ₁ Layer 2 depth, h ₂		0.210 m 0.800 m			hw h₀	WGk3	GWL	
Total structure dep	oth	1.010 m					Top of units	
Cover depth, h _c		0.790 m			₽ ₽ ►			
Actions					h ₂	VVGk2 1	Unit 2	
Displaced water volume, Vol _{cell} 1.01 n			1.01 m ²	³/m²	h1	WGk1 / IL	Unit 1	
<u>Characteristic destabi</u> Water uplift , U _{Gk} (= _{Ywk} x	ilising Vol _{cell})		9.91 kN	√/m²	Fig 1) D	efinitions illustra	tion	
Characteristic stabilis	ing							
$ \begin{array}{llllllllllllllllllllllllllllllllllll$		Gk1 Gk1 h _w ; else =	0.12 kN/m ² 0.38 kN/m ² 8.00 kN/m ² = γ _{Bk} x h _c)			[Polypipe technical data] [Polypipe technical data]		
	- Satura	ated fill, W' _{Gk2} (= $\gamma'_{Bk} \times [h_c - h_w]$)	3.97 kN/n	1 ²			
Effects of Actions								
Destabilising design vertical actions , $V_{d,dst}$ (= $\gamma_{G,dst} x U_{Gk})$			10.90 kN/	/ m ²				
Stabilising design vertical actions , $V_{d,stb}$ (= $\gamma_{G,stb} \times W_{Gk})$				11.22 kN/	/ m ²			
Degree of utilization, Λ_{UPL} (= V _{d,dst} / V _{d,stb})				97 %	< 100	%; Passes Che	ck	
Traditional Verifica	ation of	Stability Ag	ainst U	plift				
Traditional lumped	l FoS. F			1.3				

(= W_{GK} / U_{GK})

Notes

- 1 Groundwater assumed to act as a permanent destabilising action
- 2 If uncertainty in the level of ground or free water exists, consideration should be given to the application of a safety margin to the assumed characteristic water level
- **3** The above assessment assumes that the Polystorm structure is completely flexible and that there is negligible fricitional resistance between the geocellular structure and the native soil. The uplift stability verification has therefore been simplified, based on a m² (plan area) basis.

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Polystorm Uplift / Buoyancy Check - Based on Eurocode 7

M43012 - Winscott Farm - Floation Check - at 3m dp

Design factor of s	afety (F	oS)							
Ultimate Limit State				Uplift (UF	PL)				
Permanent actions (G)		- Stabilising, γ _{G,stb} - Destabilising, γ _{G,dst}		0.9 1.1		[[[Table A.NA.15, NA to BS EN 1997-1:2004] [Table A.NA.15, NA to BS EN 1997-1:2004]		
Variable actions (Q)	- Stabilising, γ - Destabilising	sing, γ _{Q,stb} pilising, γ _{Q,dst}		0 1.5		[Table A.NA.15, NA to BS EN 1997-1:2004] [Table A.NA.15, NA to BS EN 1997-1:2004]		
Assumed installat	ion par	ameters							
Material density	- Granu - Water	- Granular backfill, γ _{Bk} - Water, γ _{Wk}		20.0 kN/m³ 9.8 kN/m³			[Assumed [Assumed		
	- Saturated backfill, γ'_{Bk} (= γ_{Bk} - γ_{Wk})		lk	10.2 kN/m³					
Depths	- GL to - GL to	structure IL, H GWL, h _w		3.000 m 0.000 m					
Proposed Polysto	rm stru	cture							
Layer 1 unit type Layer 2 unit type		Xtra Polystorm-R	(PSM3) (PSM1A	A)		 	▪1.0m		F.G.L.
Layer 1 depth, h ₁ Layer 2 depth, h ₂		0.210 m 0.800 m			h	h _w	WGk3		GWL
Total structure de	oth	1.010 m							Top of units
Cover depth, h_c 1.		1.990 m	n			┡	Work		
Actions					h				Unit 2
Displaced water volume, Vol cell 1.01			1.01 m	³/m²	h1		WGk1	IL	Unit 1
Characteristic destab	ilising		/ / .				1 1 1		
Water uplift , U_{Gk} 9.: (= $\gamma_{wk} \times Vol_{cell}$)		9.91 KI	∿/m²	Fig	1) Def	U initions illu	l _{Gk} stratior	ı	
Characteristic stabilis	ing								
$ \begin{array}{ll} \textit{Self weight of} & - \textit{Polystorm layer 1, W}_{Gk1} \\ - \textit{Polystorm layer 2, W}_{Gk1} \\ - \textit{Backfill, W}_{Gk2} \\ & (\textit{If }h_w < h_c = \gamma_{Bk} \textit{x } h_w; e \end{array} $		Gk1 Gk1 n _w ; else =	_{Sk1} 0.12 kN/m ² _{Sk1} 0.38 kN/m ² 0.00 kN/m ² _{w;} else = γ _{Bk} x h _c)				[Po [Po	olypipe technical data] olypipe technical data]	
	- Satura	ated fill, W' _{Gk2} (= γ' _{Βk} x [h _c - h _w])		20.28 kN	l/m²				
Effects of Actions									
Destabilising design vertical actions , $V_{d,dst}$ (= $\gamma_{G,dst} x U_{Gk})$			10.90 kN	l/ m ²					
Stabilising design vertical actions , $V_{d,stb}$ (= $\gamma_{G,stb} x W_{Gk})$				18.70 kN	l/m²				
Degree of utilization, Λ_{UPL} (= V _{d,dst} / V _{d,stb})				58 %		< 100%	; Passes (Check	
Traditional Verifica	ation of	f Stability Aga	ainst U	lplift					
Traditional lumped	d FoS, F			2.1					

 $(= W_{GK} / U_{GK})$

2.1

Notes

- 1 Groundwater assumed to act as a permanent destabilising action
- 2 If uncertainty in the level of ground or free water exists, consideration should be given to the application of a safety margin to the assumed characteristic water level
- 3 The above assessment assumes that the Polystorm structure is completely flexible and that there is negligible fricitional resistance between the geocellular structure and the native soil. The uplift stability verification has therefore been simplified, based on a m² (plan area) basis.

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