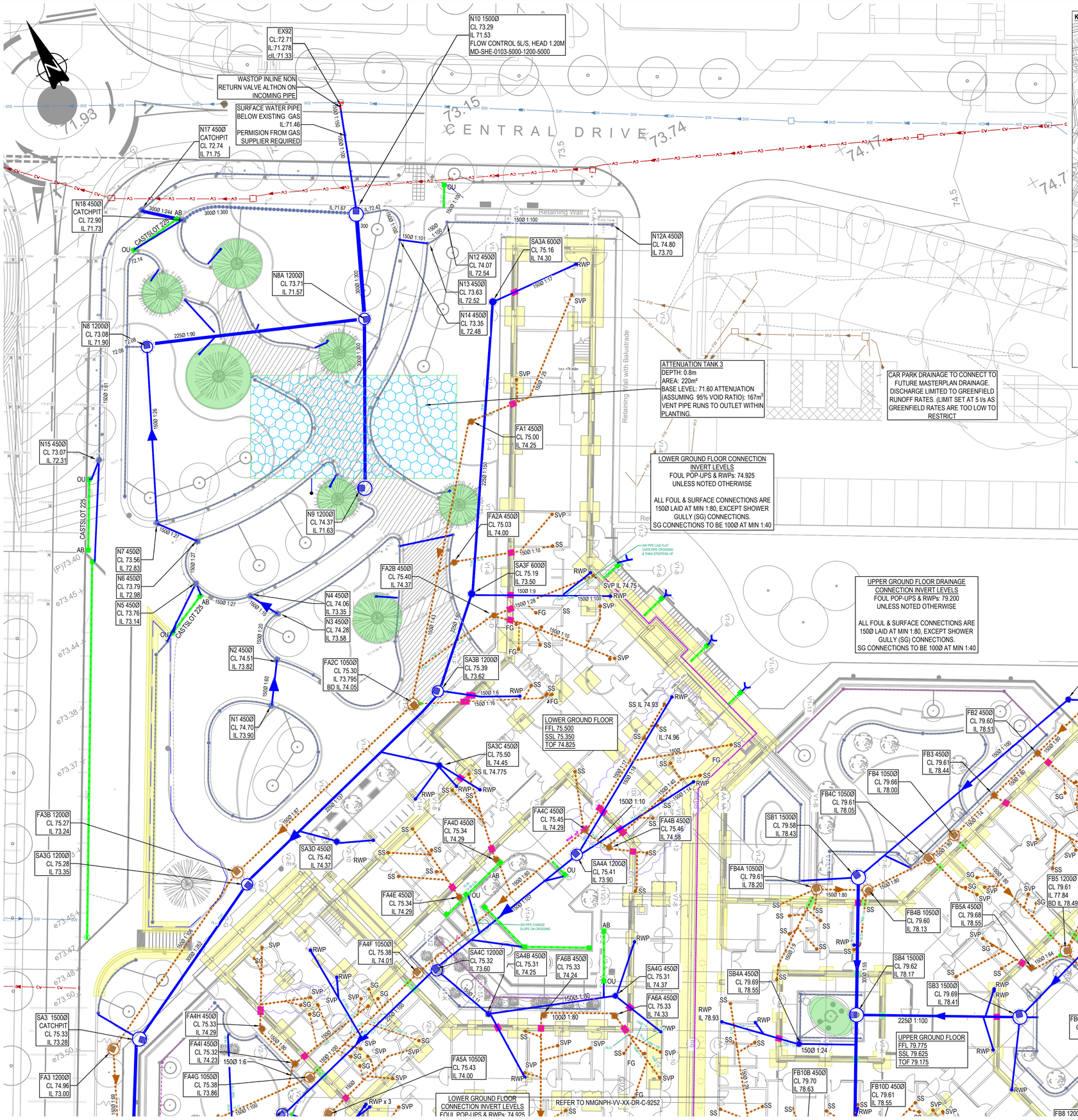


GENERAL PIPE SIZES, DEPTHS AND GRADIENTS

SOME PIPE DIAMETERS HAVE NOT BEEN SHOWN FOR CLARITY: ALL FOUL & SURFACE WATER DRAINAGE IS 150Ø UNLESS NOTED OTHERWISE

SOME PIPE GRADIENTS ARE NOT SHOWN FOR CLARITY. ALL PIPES TO BE SET OUT USING UPSTREAM & DOWNSTREAM INVERT LEVELS.

PIPE CROSSING CLASH CHECK NOTES (REV C10)

INVERT LEVELS & PIPE GRADIENTS INDICATED IN SMALLER TEXT FOR CLARITY. REFER TO AUTOCAD DRAWING TO CONFIRM TEXT.
PLEASE NOTE THAT ILs/ GRADIENTS ETC. HAVE BEEN CALCULATED MANUALLY & ARE THEREFORE INDICATIVE, TO ASSIST CONSTRUCTION.

CONSTRUCTION RECORD - FINAL CONSTRUCTION

THE INFORMATION IS BASED ON CONFIRMATION FROM THE CONTRACTOR OF THE INSTALLED WORKS. THERE MAY BE VARIATIONS ON SITE WHICH ARE NOT REFLECTED ON THIS DRAWING AND HAS NOT BEEN VERIFIED BY CURTINS.

DRAWING BASED ON

AS-BUILT INFORMATION -

- CONTRACTOR DRAINAGE ASBUILT DRAWINGS RECEIVED 13.06.24

GENERAL NOTES:

FOR DRAWING REFERENCES REFER TO DRAWING NMGNPH-CUR-VV-XX-DR-C-9250
FOR FULL DRAINAGE NOTES REFER TO DRAWING NMGNPH-CUR-VV-XX-DR-C-9260

KEY:

- SITE BOUNDARY BASED ON LANDSCAPE ARCHITECT'S LAYOUT
- EXISTING PUBLIC COMBINED SEWER
- EXISTING PRIVATE COMBINED DRAINAGE
- EXISTING PRIVATE SURFACE WATER DRAINAGE
- EXISTING PRIVATE FOUL DRAINAGE
- PROPOSED COMBINED MANHOLE
- PROPOSED FOUL DRAINAGE
- PROPOSED FOUL DRAINAGE MANHOLE/ INSPECTION CHAMBER
- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED SURFACE WATER ROUTED THROUGH PETROL INTERCEPTOR
- PROPOSED SURFACE WATER MANHOLE/ INSPECTION CHAMBER
- PROPOSED FLOW CONTROL MANHOLE
- PROPOSED CELLULAR ATTENUATION TANK
- PROPOSED ARBORCELL
- PROPOSED BACKDROP
- PROPOSED ROAD GULLY
- PROPOSED GULLY TO SEATING AREA
- PROPOSED FOUL CONNECTION
  SVP - SOIL VENT PIPE
  SS - STUB STACK
  SG - SHOWER GULLY
  FG - FOUL GULLY
  KG - MAIN KITCHEN COMPACT DRAIN
- PROPOSED RAINWATER PIPE
- DRAINAGE CAST PASSES THROUGH STRIP FOOTING*
- DRAINAGE PASSES UNDER STRIP FOOTING**
- LINEAR DRAINAGE CHANNEL GATIC CASTSLOT TREADSAFE (150 UNLESS NOTED OTHERWISE)
- AB LINEAR DRAINAGE ACCESS BOX
- OU LINEAR DRAINAGE OUTLET UNIT
- PERFORATED PIPE IN FILTER DRAIN 150Ø UNLESS NOTED OTHERWISE.
- RODDING EYE FOR LAND DRAIN
- 300Ø INSPECTION CHAMBER ON LAND DRAIN
- 150Ø RETAINING WALL DRAIN
- TREE PIT DRAINAGE - 150Ø PERFORATED PIPE AND INFILTRATION TANK
- PERMEABLE PAVING

* ALL DRAINAGE PASSES ABOVE FOUNDATION UNLESS NOTED OTHERWISE

DRAINAGE TO BE ABANDONED NOT SHOWN FOR CLARITY. REFER TO DRAINAGE REMOVAL DRAWING NMGNPH-VV-XX-DR-C-9254

COVER LEVELS SHOWN ARE TO BE FIXED

Rev:	Description:	Date:	By:	Chkd:
CR01	FINAL CONSTRUCTION	26.07.24	KS	ATL

curtins
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
0161 236 2394
manchester@curtins.com
www.curtins.com
Civils & Structures • Transport Planning • Environmental • Infrastructure • Geotechnical • Conservation & Heritage • Principal Designer
Birmingham • Bristol • Cambridge • Cardiff • Douglas • Dublin • Edinburgh • Glasgow • Kendal • Leeds • Liverpool • London • Manchester • Nottingham

Status: CONSTRUCTION RECORD

Project: NORTH VIEW

Drg Title: PROPOSED 1:200 DRAINAGE LAYOUT SHEET 1

Size:	Date:	Drawn By:	Designed By:	Checked By:
A1	15/04/21	ATL	ATL	MW

Scale: 1:500

Project No:	Originator:	Volume:	Level:	Type:	Role:	Category / Number:	Rev:
NMGNPH	CUR	VV	XX	DR	C	9251	CR01

\\ma-fs-1\Projects\070501 - 070600\070565 - New Park House\04-Production\4A-Models-Drawings\CAD\25

Appendix B

United Utilities Approval – Reference EC5673

Copyright © 2023 Curtins Consulting Ltd

S106 Part 1 'Application to connect to a public sewer' Approval Notice

United Utilities Reference Number:	**03202214**
Applicant details	
Applicant name	**Andy Losty**
Applicant address *(including postcode)*	**Curtins** **Merchant Exchange** **17-19 Whitworth Street West** **Manchester M1 5WG**
Applicant email	**andy.losty@curtins.com**
Site details: The site / property which is proposed for connection to the public sewer	
Site address *(including postcode)*	**Delaunays Rd,** **Crumpsall,** **Manchester M8 5RB**

APPROVED

Your application for connection to the public sewer has been approved, to be made via a new connection:

To a private drain	☒	You may appoint your contractor and advise your appointed building control body (who should inspect the work). United Utilities should be advised when this work is complete.
Direct to the public sewer	☐	**Further action required** You may now appoint an appropriately qualified contractor. Your appointed contractor is responsible for obtaining authorisation to work on a public sewer. (The S106 Part 2 application form **'Request for permission to work on a public sewer'** is available on our website; unitedutilities.com).

Mode of connection approved	**Other - please see comments box**					
Sewer connection type	Foul	☐	Surface water	☒	Combined	☐

This approval is valid for 12 months from the date below.
This approval does not grant access to third party land, permission should be sought if required between applicant and land owner
If the new connection renders access unsafe or is otherwise detrimental to the manhole or sewer, a new/upgraded manhole will be requested.

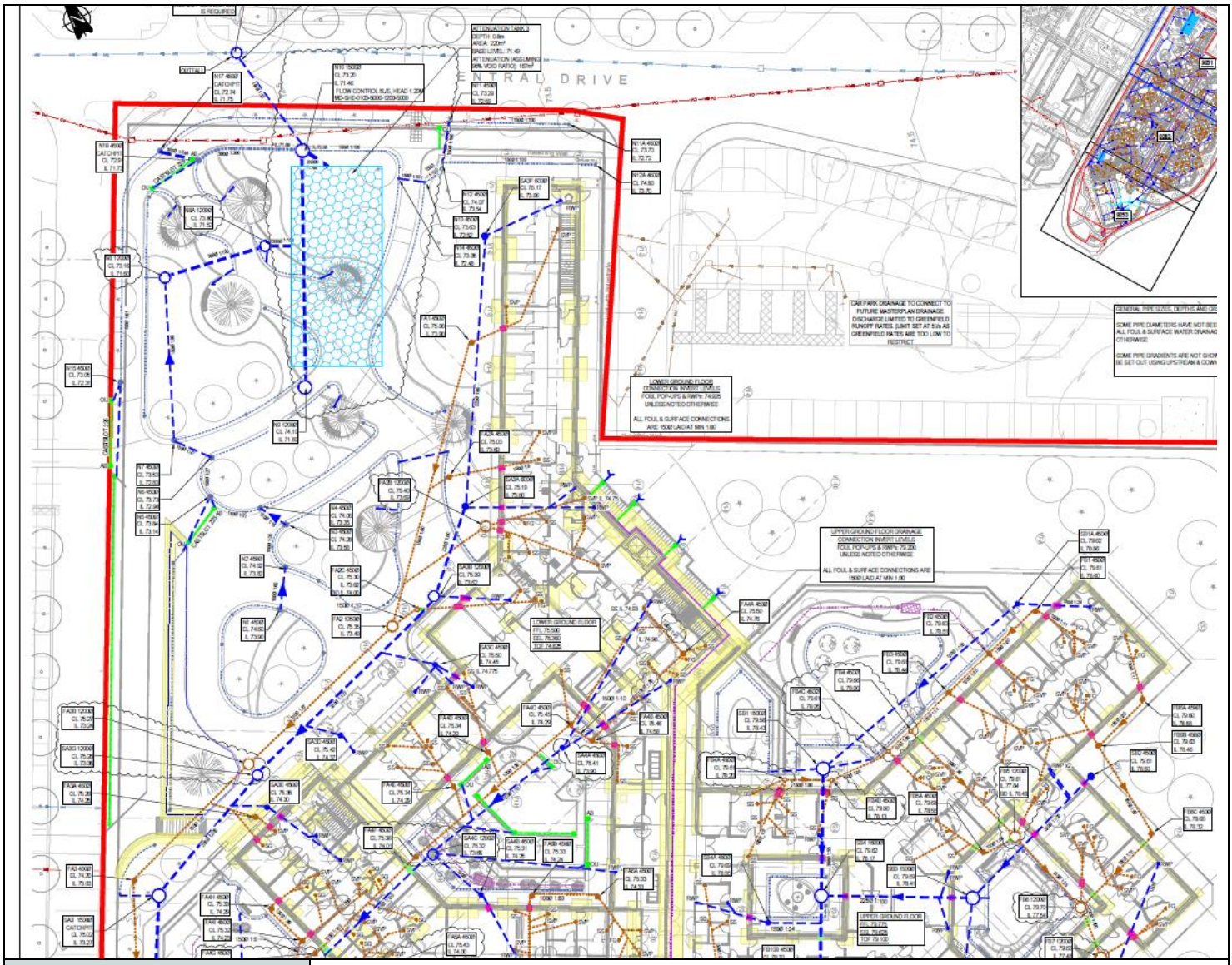
Comments

Approval granted for the 150mm surface water connection via existing on site private drainage in Central Drive attenuation indicated with a fow control restricted to 5l/s as indicated on the drainage plan below

Please note, if you are proposing to connect to an existing, unchartered drain or sewer then it is the developer's responsibility to confirm that it communicates with the Public Sewer.

For low-lying sites, (where the ground level of the site or the level of a basement is below the ground level at the point where the drainage connects to the public sewer), care should be taken to ensure that the property is not at increased risk of flooding. If these circumstances exist it could affect the detailed design of your site and result in the need to incorporate appropriate mitigating measures in your drainage scheme.

Please note, if you are proposing to connect to an existing, unchartered drain or sewer then it is the developer's responsibility to confirm that it communicates with the Public Sewer.
Connections may be made to private lateral drains or to existing neighbouring drain. A part 1 approval does not give permission to access third party land. The applicant must seek permission from the relevant land owner.



Developer Services Inspector	**Lynne Berry**
Contact number	**07881 034558**
Date	**22/12/2022**

S106 Part 1 'Application to connect to a public sewer' Approval Notice

	EC5673/02649241
Applicant details	
Applicant name	Andy Losty
Applicant address *(including postcode)*	Curtins Merchant Exchange 17-19 Whitworth Street West Manchester M1 5WG
Applicant email	andy.losty@curtins.com
Site details: The site / property which is proposed for connection to the public sewer	
	Delaunays Rd, Crumpsall, Manchester M8 5RB

APPROVED

Your application for connection to the public sewer has been approved, to be made via a new connection:

To a private drain	☒	You may appoint your contractor and advise your appointed building control body (who should inspect the work). United Utilities should be advised when this work is complete.
Direct to the public sewer	☐	**Further action required** You may now appoint an appropriately qualified contractor. Your appointed contractor is responsible for obtaining authorisation to work on a public sewer. (The S106 Part 2 application form **'Request for permission to work on a public sewer'** is available on our website; unitedutilities.com).

Mode of connection approved	**Other - please see comments box**					
Sewer connection type	Foul	☐	Surface water	☐	Combined	☒

This approval is valid for 12 months from the date below.
This approval does not grant access to third party land, permission should be sought if required between applicant and land owner
If the new connection renders access unsafe or is otherwise detrimental to the manhole or sewer, a new/upgraded manhole will be requested.

Comments

As per Email received from Andy Losty and conversation with Andy today 06/10/22 there has been some conflicting information available on their survey and the existing private drain within the site is a 750mm sewer and not a 375mm

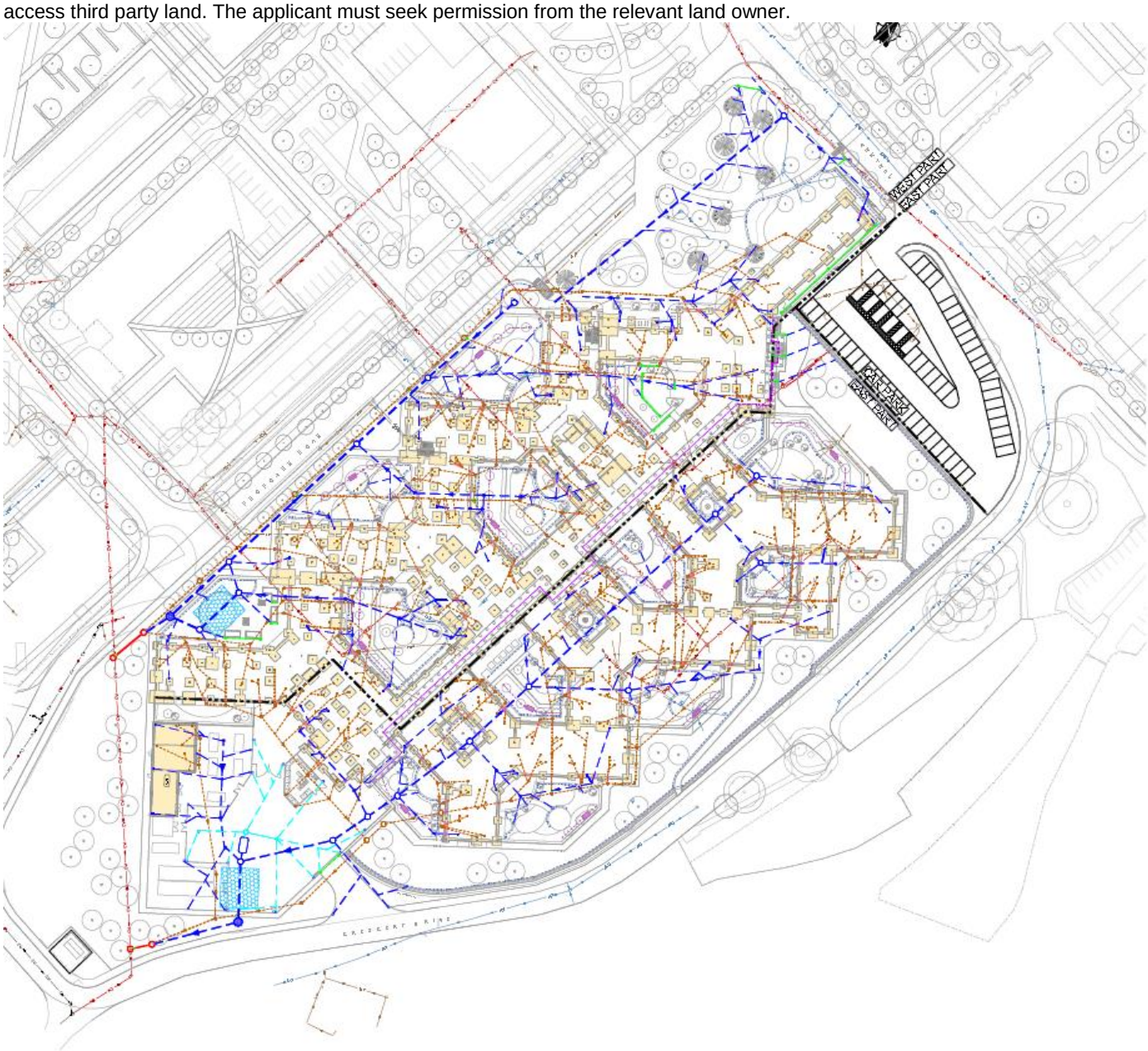
amended part 1

Approval for the 2x private combined connections (indicated as MHC2 and MHC1 on your drainage plan) via the utilisation of an existing 750mm combined private drain within the site which connects to an existing 375mm existing private drain that outfalls to the 375mm public combined sewer in Crescent Drive

(flow rates have been agreed with Gary Jaundrell under reference number 02457752
As mentioned in my previous email, we hold no objection to your proposed variable rates of discharge rates at 112l/s, 212l/s and 225l/s for the 1, 30 and 100 year events respectively,)

For low-lying sites, (where the ground level of the site or the level of a basement is below the ground level at the point where the drainage connects to the public sewer), care should be taken to ensure that the property is not at increased risk of flooding. If these circumstances exist it could affect the detailed design of your site and result in the need to incorporate appropriate mitigating measures in your drainage scheme.

Please note, if you are proposing to connect to an existing, unchartered drain or sewer then it is the developers responsibility to confirm that it communicates with the Public Sewer
Connections may be made to private lateral drains or to existing neighbouring drain. A part 1 approval does not give permission to access third party land. The applicant must seek permission from the relevant land owner.



Development Support Technician	**Lynne Berry**
Contact number	**07881 034558**
Date	**06/10/2022**

Appendix C

Alderburgh Attenuation Tank Manufacturers Information

Klargester Petrol Interceptor Manufacturers Information

Alderburgh Aquabrake Manufacturers Information

Copyright © 2023 Curtins Consulting Ltd

Preliminary Performance Assessment

Project	NORTH VIEW, NORTH MANCHESTER GENERAL HOSPITAL

Revision	R(0)	**Date:**	03/05/2022	**By:**	AY
Description	ATTENUATION TANK 1			Pluvial Cube HD	
Draiange Layout No.	NMGNPH-CUR-VV-XX-DR-C-9253/C07 AND SI REPORT				
Contractor	*0*				
Tank Information (m)	**Tank Depth**	**BOT**	**TOT**	**CL**	**COVER**
	2.15	72.580	74.730	75.280	0.550
		72.580	74.730	75.190	0.460
GroundWater level (m)	66.290			*TBC*	*Min.*
Vehicle Location:	Landscape maintenance			**N/A**	**N/A**

1.0 Proposal Brief

The following section details the assumed parameters on which our proposed product offering has been based. Please refer to CIRIA Report C680 (2008; RP782) for further details on typical product testing procedures and the calculation methodology proposed.

1.1 Proposed: Pluvial Cube HD

The unit(s) proposed, along with the relevant unit characteristic parameters which may be used for design purposes, are given below:

Product:			**Pluvial Cube HD**
Ultimate compressive strength [kN/m²]	- Vertical, $X_{k;VC}$	=	**317**
	- Lateral, $X_{k;LC}$	=	**201**

1.2 Recommended Material and Partial Factor of Safety

Factor of safety	**ULS**	**SLS**
Material, $f_{m;*}$	2.75	1.50

(Alderburgh recommended factor; based on the minimum values proposed in CIRIA C680; Clause 4.6)

Partial factor of safety	**ULS**	**SLS**
Variable loads, γ_Q	1.6	1.0
Permanent loads, γ_G	1.4	1.0
Lateral earth pressure, γ_e	1.35	1.0
Hydrostatic, γ_u	1.35	1.0

(Based on CIRIA C680, Clause 4.6)

Strength of the modules

Allowable load on the modules **115.27 kN/m²**

Weight of cover fill and surcharge load over the module

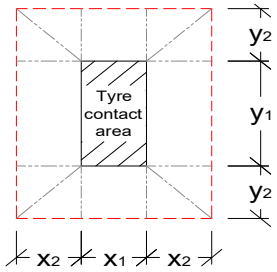
Unit weight Backfill (γ_a)	=	18.000 kN/m³		
Depth of Backfill (z1)	=	0.150 m		
Depth of Backfill (z2)		0.060 m		
Unit weight stone (γ_b)	=	20.000 kN/m³		
Depth of stone (z3)	=	0.250 m	***(Assumed)***	
Unit weight Asphalt(γ_c)	=	23.000 kN/m³		
Depth of Asphalt (z4)	=	0.150 m	***(Assumed)***	
Load from each wheel	=	0.140 tons	*Vehicles up to GVW DIN 1072*	N/A
(Qw)	=	1.400 kN	*Classification*	N/A

Note:-The above calculations only apply when the relevant system is installed and signed off by an accredited contractor using Alderburgh membrane and connections.

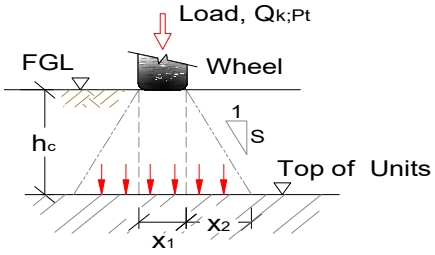
Please note that the information in this document is of an illustrative nature and is supplied by Alderburgh Ltd without charge. It does not form part of any contract or intended contract with the user. Final determination of the suitability of any information or material for the use contemplated and the manner of use is the sole responsibility of the user and the user must assume all risk and liability in connection therewith. Refer to www.alderburgh.com.

Project	NORTH VIEW, NORTH MANCHESTER GENERAL HOSPITAL

Area of applied load on the modules



PLAN



TYPICAL SECTION

Considering the soil is well compacted, the load distribution is to be (degrees): 26.5° *(Tarmac)*

Depth of cover on the modules (D_1) = 0.55 m Max.
(D_2) 0.46 m Min.

Considering the area of contact of the wheel and the road is 150 x 150 mm
(Loading Model - GVW DIN 1072 Classification NONE)

L (m) = 0.15
B (m) = 0.15

The total area of load applied on the modules = 0.27 + 0.15 + 0.27 m
0.27 + 0.15 + 0.27 m

B` = 0.7 m
L` = 0.7 m

Contact area **A'** = **0.7 x 0.7 m**

The total area of load applied on the modules = 0.23 + 0.15 + 0.23 m
0.23 + 0.15 + 0.23 m

B` = 0.61 m
L` = 0.61 m

Contact area **A'** = **0.61 x 0.61 m**

Evaluation of Load Model GVW DIN 1072 Classification: N/A

Qw= 1.4 kN

Equivalent pressure per wheel at a depth of (D_1)

$Q`_w = \frac{Q_w}{B` \times L`}$

Q'w= 2.9 kN/m^2 ***Max. Cover***
Q'w= 3.8 kN/m^2 ***Min. Cover***

Additional UDL = 0 kN/m^2

$$Q_{max,k} = Q_{OL} + Additiional\ UDL$$

Qmax,k= 2.9 kN/m^2 ***Max. Cover***
Qmax,k= 3.8 kN/m^2 ***Min. Cover***

Note:-The above calculations only apply when the relevant system is installed and signed off by an accredited contractor using Alderburgh membrane and connections.

Please note that the information in this document is of an illustrative nature and is supplied by Alderburgh Ltd without charge. It does not form part of any contract or intended contract with the user. Final determination of the suitability of any information or material for the use contemplated and the manner of use is the sole responsibility of the user and the user must assume all risk and liability in connection therewith. Refer to www.alderburgh.com.

Project	NORTH VIEW, NORTH MANCHESTER GENERAL HOSPITAL

1.4 Calculation of design Factors of safety

Permanent Action unfavourable loading	γ_G=	1.4
Variable Action unfavourable loading	γ_Q=	1.6
Dynamic Factor for z1	=	1.0
Dynamic Factor for z2	=	1.0

(Dynamic Factor for z1 & z2 Speed < 15mph)

1.5 Design vertical traffic loading:

Q_b=(Ya × $z2$ × γ_G)+(Yb × z3 × γ_G)+(Yc × $z3$ × γ_G) + ($Q_{max,k}$× γ_Q)

Q_b=(Ya × $z1$ × γ_G)+(Yb × z3 × γ_G)+(Yc × $z4$ × γ_G) + ($Q_{max,k}$× γ_Q)

Max. Cover =	**20.18**	**kN/m²**	**<**	**115.27** **kN/m²**
Min. Cover =	**19.36**	**kN/m²**	**<**	**115.27** **kN/m²**

Loading design is safe ***Allowable load with F.O.S***

2.0 CALCULATION OF HORIZONTAL EARTH PRESSURE LOADING (ULS)

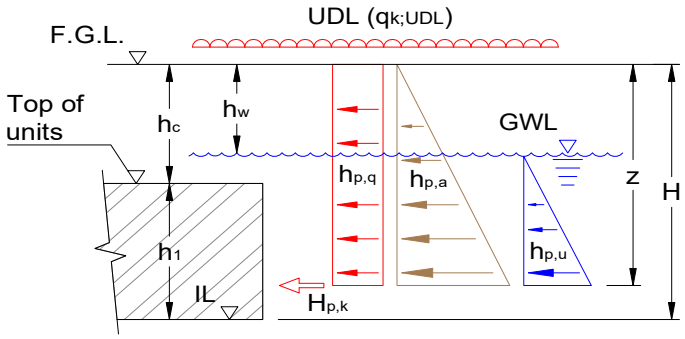


Figure 3) Idealised illustration of lateral pressure(s)

Compressive strength of the modules

Compressive Strength	P_{ck}	=	201 kN/m²
Partial factor of safety for materials (F_m)		=	2.75
Allowable load on the modules		=	**73.09 kN/m²**

Horizontal earth pressure on the modules

Total horizontal pressure:

Where,

Ka - is the co-efficient of active earth pressure = (1 - sinΦ) / (1 + sinΦ)

Φ - angle of shearing resistance of soil

d - is the height of fill material till the base of the tank, m

y - is the unit weight of fill material, kN/m³

w - water pressure

$\sigma_{surcharge\ load}$ - is the surcharge load, kN/m²

Note:-The above calculations only apply when the relevant system is installed and signed off by an accredited contractor using Alderburgh membrane and connections.

Please note that the information in this document is of an illustrative nature and is supplied by Alderburgh Ltd without charge. It does not form part of any contract or intended contract with the user. Final determination of the suitability of any information or material for the use contemplated and the manner of use is the sole responsibility of the user and the user must assume all risk and liability in connection therewith. Refer to www.alderburgh.com.

Preliminary Performance Assessment

Project	NORTH VIEW, NORTH MANCHESTER GENERAL HOSPITAL

Soil type:	Medium-dense sand and gravel	
Considering the soil is well compacted, the load distribution to be:		35°

(Soil type Assumed - TBC confirmed by engineer)

Co-efficient of active earth pressure (Ka) = (1 - sinΦ) / (1 + sinΦ)

= 0.27

Unit weight fill material (y) = 19 kN/m^3 **Ave.**

Depth of fill till the bottom of the tank (d) = 2.700 m Max. / 2.610 m Min.

Water pressure (W) = 0.00 kN/m^2

NOTE:- Groundwater level below tank base - TBC: 66.290

Surcharge load ($\sigma_{surcharge\ load}$) = 10 kN/m^2

Partial factors applied to loading:

Permanent unfavourable loading (Y_G)	1.35
Variable unfavourable loading, (Y_Q)	1.50
Dynamic factor for speed < 15mph (Y_{DF})	1.00
Site importance factor for Class 1 site for ULS calculation (Y_{SF})	1.00

Total horizontal pressure(σ_h) on module =

Including partial factors γ_{DF} , γ_{SF}, γ_G and γ_Q

$$\sigma'h,a = Ka\ x\ \gamma_{DF}\ x\ \gamma_{SF}\ x\ [(\gamma\ x\ d\ x\ \gamma_G) + (\sigma surcharge\ x\ \gamma_Q]$$

Design load on the module =

Max. =	**22.83** kN/m^2	**<**	**73.09**	**kN/m^2**
Min. =	**22.21** kN/m^2	**<**	**73.09**	**kN/m^2**

Loading design is safe ***Allowable load with F.O.S***

Note:-The above calculations only apply when the relevant system is installed and signed off by an accredited contractor using Alderburgh membrane and connections.

Please note that the information in this document is of an illustrative nature and is supplied by Alderburgh Ltd without charge. It does not form part of any contract or intended contract with the user. Final determination of the suitability of any information or material for the use contemplated and the manner of use is the sole responsibility of the user and the user must assume all risk and liability in connection therewith. Refer to www.alderburgh.com.

Preliminary Performance Assessment

Project	NORTH VIEW, NORTH MANCHESTER GENERAL HOSPITAL

Revision	R(0)	**Date:**	01/02/2023	**By:**	AY
Description	ATTENUATION TANK 2			Pluvial Cube HD	
Draiange Layout No.	LEVELS AND GWL BY CURTINS / 01/02/23				
Contractor					
Tank Information (m)	**Tank Depth**	**BOT**	**TOT**	**CL**	**COVER**
	1.60	71.280	72.880	74.700	1.820
		71.280	72.880	74.260	1.380
GroundWater level (m)	72.050			*TBC*	*Min.*
Vehicle Location:	Low speed road			**60/30**	**< 60,000 Kg**

1.0 Proposal Brief

The following section details the assumed parameters on which our proposed product offering has been based. Please refer to CIRIA Report C680 (2008; RP782) for further details on typical product testing procedures and the calculation methodology proposed.

1.1 Proposed: Pluvial Cube HD

The unit(s) proposed, along with the relevant unit characteristic parameters which may be used for design purposes, are given below:

Product:			**Pluvial Cube HD**
Ultimate compressive strength [kN/m²]	- Vertical, $X_{k;VC}$	=	**317**
	- Lateral, $X_{k;LC}$	=	**201**

1.2 Recommended Material and Partial Factor of Safety

Factor of safety	**ULS**	**SLS**
Material, $f_{m;*}$	2.75	1.50

(Alderburgh recommended factor; based on the minimum values proposed in CIRIA C680; Clause 4.6)

Partial factor of safety	**ULS**	**SLS**
Variable loads, γ_Q	1.6	1.0
Permanent loads, γ_G	1.4	1.0
Lateral earth pressure, γ_e	1.35	1.0
Hydrostatic, γ_u	1.35	1.0

(Based on CIRIA C680, Clause 4.6)

Strength of the modules

Allowable load on the modules **115.27 kN/m²**

Weight of cover fill and surcharge load over the module

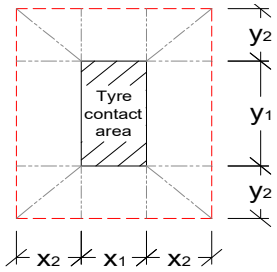
Unit weight Backfill (γ_a)	=	18.000	kN/m³	
Depth of Backfill (z1)	=	1.420	m	
Depth of Backfill (z2)		0.980	m	
Unit weight stone (γ_b)	=	20.000	kN/m³	
Depth of stone (z3)	=	0.250	m	***(Assumed)***
Unit weight Asphalt(γ_c)	=	23.000	kN/m³	
Depth of Asphalt (z4)	=	0.150	m	***(Assumed)***
Load from each wheel	=	10.000	tons	*Vehicles up to GVW DIN 1072* < 60,000 Kg
(Qw)	=	100.000	kN	*Classification* 60/30

Note:-The above calculations only apply when the relevant system is installed and signed off by an accredited contractor using Alderburgh membrane and connections.

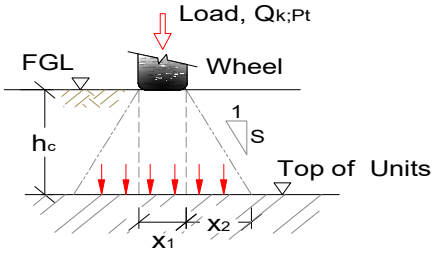
Please note that the information in this document is of an illustrative nature and is supplied by Alderburgh Ltd without charge. It does not form part of any contract or intended contract with the user. Final determination of the suitability of any information or material for the use contemplated and the manner of use is the sole responsibility of the user and the user must assume all risk and liability in connection therewith. Refer to www.alderburgh.com.

Project	NORTH VIEW, NORTH MANCHESTER GENERAL HOSPITAL

Area of applied load on the modules



PLAN



TYPICAL SECTION

Considering the soil is well compacted, the load distribution is to be (degrees): 26.5° *(Tarmac)*

Depth of cover on the modules (D_1) = 1.82 m Max.
(D_2) = 1.38 m Min.

Considering the area of contact of the wheel and the road is 200 x 600 mm
(Loading Model - GVW DIN 1072 Classification 60/30)

L (m) = 0.20
B (m) = 0.60

The total area of load applied on the modules = 0.91 + 0.2 + 0.91 m
0.91 + 0.6 + 0.91 m

B` = 2.02 m
L` = 2.42 m

Contact area **A'** = **2.02 x 2.42 m**

The total area of load applied on the modules = 0.69 + 0.2 + 0.69 m
0.69 + 0.6 + 0.69 m

B` = 1.58 m
L` = 1.98 m

Contact area **A'** = **1.58 x 1.98 m**

Evaluation of Load Model GVW DIN 1072 Classification: 60/30

Qw= 100 kN

Equivalent pressure per wheel at a depth of (D_1)

$Q`_w = \frac{Q_w}{B` \times L`}$

Q'w= 20.5 kN/m² ***Max. Cover***
Q'w= 32.0 kN/m² ***Min. Cover***

Additional UDL = 0 kN/m²

$$Q_{max,k} = Q_{OL} + Additiional\ UDL$$

Qmax,k= 20.5 kN/m² ***Max. Cover***
Qmax,k= 32.0 kN/m² ***Min. Cover***

Note:-The above calculations only apply when the relevant system is installed and signed off by an accredited contractor using Alderburgh membrane and connections.

Please note that the information in this document is of an illustrative nature and is supplied by Alderburgh Ltd without charge. It does not form part of any contract or intended contract with the user. Final determination of the suitability of any information or material for the use contemplated and the manner of use is the sole responsibility of the user and the user must assume all risk and liability in connection therewith. Refer to www.alderburgh.com.

Project	NORTH VIEW, NORTH MANCHESTER GENERAL HOSPITAL

1.4 Calculation of design Factors of safety

Permanent Action unfavourable loading	Y_G=	1.4
Variable Action unfavourable loading	Y_Q=	1.6
Dynamic Factor for z1	=	1.0
Dynamic Factor for z2	=	1.0

(Dynamic Factor for z1 & z2 Speed < 15mph)

1.5 Design vertical traffic loading:

Q_b=(Ya × $z2$ × γ_G)+(Yb × z3 × γ_G)+(Yc × $z3$ × γ_G) + ($Q_{max,k}$× γ_Q)

Q_b=(Ya × $z1$ × γ_G)+(Yb × z3 × γ_G)+(Yc × $z4$ × γ_G) + ($Q_{max,k}$× γ_Q)

Max. Cover =	**80.34**	**kN/m²**	<	**115.27** **kN/m²**
Min. Cover =	**87.67**	**kN/m²**	<	**115.27** **kN/m²**

Loading design is safe ***Allowable load with F.O.S***

2.0 CALCULATION OF HORIZONTAL EARTH PRESSURE LOADING (ULS)

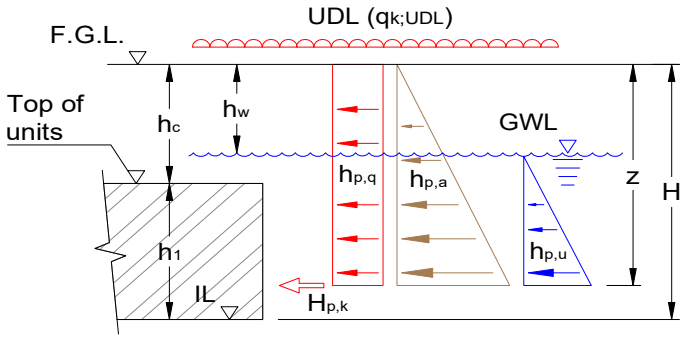


Figure 3) Idealised illustration of lateral pressure(s)

Compressive strength of the modules

Compressive Strength	P_{ck}	=	201 kN/m²
Partial factor of safety for materials (F_m)		=	2.75
Allowable load on the modules		=	**73.09 kN/m²**

Horizontal earth pressure on the modules

Total horizontal pressure:

Where,
Ka - is the co-efficient of active earth pressure = (1 - sinΦ) / (1 + sinΦ)
Φ - angle of shearing resistance of soil
d - is the height of fill material till the base of the tank, m
y - is the unit weight of fill material, kN/m³
w - water pressure
$\sigma_{surcharge\ load}$ - is the surcharge load, kN/m²

Note:-The above calculations only apply when the relevant system is installed and signed off by an accredited contractor using Alderburgh membrane and connections.

Please note that the information in this document is of an illustrative nature and is supplied by Alderburgh Ltd without charge. It does not form part of any contract or intended contract with the user. Final determination of the suitability of any information or material for the use contemplated and the manner of use is the sole responsibility of the user and the user must assume all risk and liability in connection therewith. Refer to www.alderburgh.com.

Preliminary Performance Assessment

Project	NORTH VIEW, NORTH MANCHESTER GENERAL HOSPITAL

Soil type:	Medium-dense sand and gravel	
Considering the soil is well compacted, the load distribution to be:		35°

(Soil type Assumed - TBC confirmed by engineer)

Co-efficient of active earth pressure (Ka) = (1 - sinΦ) / (1 + sinΦ)

= 0.27

Unit weight fill material (y) = 19 kN/m^3 **Ave.**

Depth of fill till the bottom of the tank (d) = 3.420 m Max. / 2.980 m Min.

Water pressure (W) = 7.55 kN/m^2

NOTE:-Groundwater level by Curtins : 72.050 — 0.77m above the bottom of the tank

Surcharge load ($\sigma_{surcharge\ load}$) = 10 kN/m^2

Partial factors applied to loading:

Permanent unfavourable loading (Y_G)	1.35
Variable unfavourable loading, (Y_Q)	1.50
Dynamic factor for speed < 15mph (Y_{DF})	1.00
Site importance factor for Class 1 site for ULS calculation (Y_{SF})	1.00

Total horizontal pressure(σ_h) on module =

Including partial factors γ_{DF} , γ_{SF}, γ_G and γ_Q

$$\sigma'h,a = Ka\ x\ \gamma_{DF}\ x\ \gamma_{SF}\ x\ [(\gamma\ x\ d\ x\ \gamma_G) + (\sigma surcharge\ x\ \gamma_Q]$$

Design load on the module =

Max. =	**35.39** kN/m^2	<	**73.09** kN/m^2	
Min. =	**32.33** kN/m^2	<	**73.09** kN/m^2	

Loading design is safe ***Allowable load with F.O.S***

Note:-The above calculations only apply when the relevant system is installed and signed off by an accredited contractor using Alderburgh membrane and connections.

Please note that the information in this document is of an illustrative nature and is supplied by Alderburgh Ltd without charge. It does not form part of any contract or intended contract with the user. Final determination of the suitability of any information or material for the use contemplated and the manner of use is the sole responsibility of the user and the user must assume all risk and liability in connection therewith. Refer to www.alderburgh.com.

Preliminary Polystorm Performance Assessment

Project Title - NORTH VIEW, NORTH MANCHESTER HOSPITAL - MAX. COVER

1.0 Proposal Brief

The following section details the assumed parameters on which our proposed product offering has been based. Please refer to CIRIA Report C680 (2008; RP782) & BBA Certificate No 06/4297 for further details on typical product testing procedures and the calculation methodology proposed.

1.1 Proposed Polystorm Geocellular Unit

The Polystorm unit(s) proposed, along with the relevant unit characteristic parameters which may be used for design purposes, are given below:

Polystorm unit	- Description	Polystorm-R
	- Product Code	PSM1A
Ultimate compressive strength [kN/m²]	- Vertical, $X_{k;VC}$	610
	- Lateral, $X_{k;LC}$	63.0
Short term deflection [kN/m² per mm]	- Vertical, $X_{k;VD}$	60
	- Lateral, $X_{k;LD}$	4.4
Creep equation co-efficient, x [mm]	- Vertical, $X_{k;VCr}$	0.2798
[x ln (design life; hrs)]	- Lateral, $X_{k;LCr}$	1.0192
Allowable deflection [mm]	- Vertical, $\delta_{k;V}$	9.0
	- Lateral, $\delta_{k;L}$	14.0
Allowable creep deformation [mm]	- Vertical, $\varepsilon_{k;V}$	9.0
	- Lateral, $\varepsilon_{k;L}$	18.0

1.2 Recommended Material and Partial Factor of Safety

Factor of safety	ULS	SLS
Material, $f_{m;*}$	2.75	1.5

(Polypipe recommended factor; based on the minimum values proposed in CIRIA C680; Clause 4.6)

Partial factor of safety	ULS	SLS
Variable loads, γ_Q	1.6	1.0
Permanent loads, γ_G	1.4	1.0
Lateral earth pressure, γ_e	1.35	1.0
Hydrostatic, γ_u	1.35	1.0

(Based on CIRIA C680, Clause 4.6)

1.3 Proposed Installation

Idealised details of the proposed Polystorm installation are summarised below (refer to figure 1).

Depths

Depth to structure invert, H	2.610 m
Polystorm structure depth, h_1	0.800 m
Design depth, z *(= H - 0.2m)*	2.410 m
Cover depth, h_c *(= H - h_1)*	1.810 m

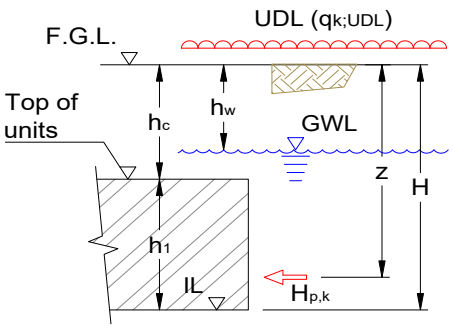


Figure 1) Idealised illustration of installation

Please note that the information in this document is of an illustrative nature and is supplied by Polypipe Civils without charge. It does not form part of any contract or intended contract with the user. Final determination of the suitability of any information or material for the use contemplated and the manner of use is the sole responsibility of the user and the user must assume all risk and liability in connection therewith. Refer to www.polypipe.com/disclaimer for further information.

Preliminary Polystorm Performance Assessment

Project Title - NORTH VIEW, NORTH MANCHESTER HOSPITAL - MAX. COVER

Assumed ground conditions

Information was not available on the proposed site ground conditions. A minimum required soil shearing resistance has been assumed for illustration purposes. To be confirmed, prior to commencement of final design or construction activities.

Native soil

Shearing resistance, Ø	33°	
Density, γ_k	20.0 kN/m³	*[Assumed]*

Active earth pressure co-efficient, Ka 0.295
(= [1 - Sin Ø] / [1 + Sin Ø])

Ground water

Depth below FGL, h_w	N/A
Density, γ_w	N/A

1.4 Assumed Transient (Live) Loads

No information was provided on expected vehicle loading. For illustration purposes, vehicle loading assumed.

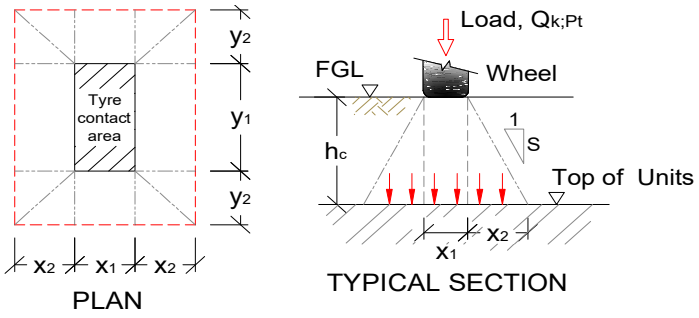


Figure 2) Concentrated load parameters

Loading classification	Landscape maintenance	*[CIRIA C680; Table 4.2]*
DIN 1072 classification	N/A	*[CIRIA C680; Table 4.2]*
Max Gross vehicle weight	N/A	*[CIRIA C680; Table 4.2]*
Uniformly distributed load, $q_{k;UDL}$	5.0 kN/m²	*[CIRIA C680; Table 4.2]*
Concentrated wheel load, $Q_{k;Pt}$	1.4 kN	*[CIRIA C680; Table 4.2]*
Dynamic load factor, Φ	1.0	*[Assumed]*
Contact area - Length, y_1	0.150 m	*[CIRIA C680; Table 4.2]*
- Width, x_1	0.150 m	*[CIRIA C680; Table 4.2]*
Load distribution, S	1 in 2.0	*[Assumed]*
Additional load spread, x_2 & y_2	0.905 m	

(= h_c / S)

Unfactored

Imposed load, $q_{k;Pt}$ **0.4 kN/m²** [< Uniformly distributed load]

(= [$Q_{k;pt}$. Φ] / [(x_1 + 2x_2) x (y_1 + 2y_2)])

Please note that the information in this document is of an illustrative nature and is supplied by Polypipe Civils without charge. It does not form part of any contract or intended contract with the user. Final determination of the suitability of any information or material for the use contemplated and the manner of use is the sole responsibility of the user and the user must assume all risk and liability in connection therewith. Refer to www.polypipe.com/disclaimer for further information.

Preliminary Polystorm Performance Assessment

Project Title - NORTH VIEW, NORTH MANCHESTER HOSPITAL - MAX. COVER

2.0 Assumed Imposed Loading

The following section illustrates how Polypipe would typically expect imposed loads on a proposed Polystorm structure to be derived; in accordance with the guidance given in CIRIA C680 (2008; RP782)

2.1 Vertical Loads Imposed on Upper Structure Face

The following section estimates the vertical imposed load at the Polystorm structure soffit.

Unfactored

Distributed load gave worst case transient parameter; refer to Section 1.4

Live load, $q_{k;*}$ **5.0 kN/m²** *[* - UDL; refer to Section 1.4]*

Dead load, G_k **36.2 kN/m²**

(= [h_c x γ_k])

Factored

ULS, $V_{d;ULS}$ **58.7 kN/m²** [< 221.8 kN/m² Therefore OK]

(= [$q_{k;*}$]$\gamma_{Q;\,ULS}$ + [G_k]$\gamma_{G;\,ULS}$) *(= $X_{k;VC}$ / $f_{m;ULS}$; Refer to Section 1.0)*

Degree of utilization, Λ_{STR} **26%**

SLS, $V_{d;SLS,\,\delta}$ **0.4 kN/m²**

(= [$q_{k;Pt}$]$\gamma_{Q;\,SLS}$)

SLS, $V_{d;SLS,\,\varepsilon}$ **36.2 kN/m²**

(= [G_k]$\gamma_{G;\,SLS}$)

2.2 Lateral Load Imposed at Depth z

The following section estimates the lateral pressure imposed on the proposed Polystorm structure, at design depth z (worst case imposed load assumed to occur at the centre of the unit, due to additional support provided by the unit's external faces)

Unfactored

Live load, $q_{k;UDL}$ **5.0 kN/m²**

Dead load, W_{Gk} **48.2 kN/m²**

Hydrostatic load, U_k **N/A**

Where h_w < z

(W_{Gk} = [h_w x γ_k] + [(z - h_w) . (γ_k - γ_w)])

(U_k = [z - h_w] x γ_w)

Where h_w > z

(W_{Gk} = z x γ_k)

Lateral pressure, $H_{p;k}$ **15.7 kN/m²**

(= Ka [q_k + W_{Gk}] + U_k)

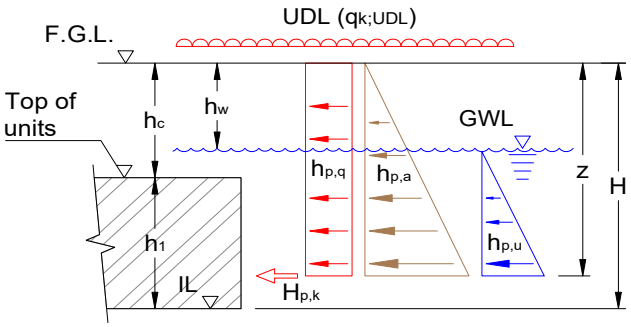


Figure 3) Idealised illustration of lateral pressure(s)

Factored

ULS, $H_{d;ULS}$ **21.2 kN/m²** [< 22.9 kN/m² Therefore OK]

(= Ka [q_k + W_{Gk}]$\gamma_{e;\,ULS}$ + [U_k]$\gamma_{U;\,ULS}$) *(= $X_{k;LC}$ / $f_{m;ULS}$; Refer to Section 1.0)*

SLS, $H_{d;SLS}$ **15.7 kN/m²**

(= Ka [q_k + W_{Gk}]$\gamma_{e;\,SLS}$ + [U_k]$\gamma_{U;\,SLS}$)

Please note that the information in this document is of an illustrative nature and is supplied by Polypipe Civils without charge. It does not form part of any contract or intended contract with the user. Final determination of the suitability of any information or material for the use contemplated and the manner of use is the sole responsibility of the user and the user must assume all risk and liability in connection therewith. Refer to www.polypipe.com/disclaimer for further information.

Preliminary Polystorm Performance Assessment

Project Title - NORTH VIEW, NORTH MANCHESTER HOSPITAL - MAX. COVER

3.0 Serviceability Limit State Checks (Deflection & Creep)

The serviceability of the proposed Polystorm structure (Section 1.3) may be assessed by predicting possible unit deflection (short term) and creep (long term)

3.1 Vertical Deflection Due to Expected Traffic Loading

The overseeing engineer should be consulted to ensure that the deformation predicted below, would not compromise the structural integrity of any proposed surface pavement. Where excessive deflections are predicted, protective measures may be introduced.

Design strength; $X_{d;VD}$	**40.0 kN/m² per mm**	
(= $X_{k;VD}$ / $f_{m;SLS}$; refer to Section 1.0)		
SLS, $V_{d;SLS,\delta}$	**0.4 kN/m²**	
Deflection, δ_V	**0.01 mm**	[< 1.0 mm Typically OK]
(= $V_{d;SLS}$ / $X_{d;VD}$)		

3.2 Vertical Creep

Derived creep equation is only valid if expected imposed load(s) do not exceed the creep test load

Creep test load, $X_{d;v,cr}$	**162.0 kN/m²**	
SLS, $V_{d;SLS,\varepsilon}$	**36.2 kN/m²**	[< 162.0 kN/m² Therefore OK]
Degree of utilization, Λ_{STR}	**22%**	
Creep data limit, t	**60 years**	*[Unit has a durability life in excess of 60yrs]*
Estimated unit creep, $\varepsilon_{h,c}$	**3.7 mm**	[< 9.0 mm Therefore OK]
(= 0.2798 ln [design life, t]); t in hours		*[Refer to Section 1.1; based on test load]*
Degree of utilization, Λ_{STR}	**41%**	

3.3 Lateral Deflection

Design strength; $X_{d;LD}$	**2.9 kN/m² per mm**	
(= $X_{k;LD}$ / $f_{m;SLS}$; refer to Section 1.0)		
SLS, $H_{d;SLS}$	**15.7 kN/m²**	
Deflection, δ_L	**5.35 mm**	[< 14.0 mm Therefore OK]
(= $H_{d;SLS}$ / $X_{d;LD}$)		*[Refer to Section 1.1; based on test load]*
Degree of utilization, Λ_{STR}	**38%**	

3.4 Lateral Creep

Derived creep equation is only valid if expected imposed load(s) do not exceed the creep test load

Test load, $X_{d;v,cr}$	**30.9 kN/m²**	
SLS, $H_{d;SLS}$	**15.7 kN/m²**	[< 30.9 kN/m² Therefore OK]
Degree of utilization, Λ_{STR}	**51%**	
Creep data limit, t	**60 years**	*[Unit has a durability life in excess of 60yrs]*
Estimated unit creep, $\varepsilon_{h,c}$	**13.4 mm**	[< 18.0 mm Therefore OK]
(= 1.0192 ln [design life, t]); t in hours		*[Refer to Section 1.1; based on test load]*
Degree of utilization, Λ_{STR}	**75%**	

Please note that the information in this document is of an illustrative nature and is supplied by Polypipe Civils without charge. It does not form part of any contract or intended contract with the user. Final determination of the suitability of any information or material for the use contemplated and the manner of use is the sole responsibility of the user and the user must assume all risk and liability in connection therewith. Refer to www.polypipe.com/disclaimer for further information.

Preliminary Polystorm Performance Assessment

Project Title - NORTH VIEW, NORTH MANCHESTER HOSPITAL - MIN. COVER

1.0 Proposal Brief

The following section details the assumed parameters on which our proposed product offering has been based. Please refer to CIRIA Report C680 (2008; RP782) & BBA Certificate No 06/4297 for further details on typical product testing procedures and the calculation methodology proposed.

1.1 Proposed Polystorm Geocellular Unit

The Polystorm unit(s) proposed, along with the relevant unit characteristic parameters which may be used for design purposes, are given below:

Polystorm unit	- Description	Polystorm-R
	- Product Code	PSM1A
Ultimate compressive strength [kN/m²]	- Vertical, $X_{k;VC}$	610
	- Lateral, $X_{k;LC}$	63.0
Short term deflection [kN/m² per mm]	- Vertical, $X_{k;VD}$	60
	- Lateral, $X_{k;LD}$	4.4
Creep equation co-efficient, x [mm]	- Vertical, $X_{k;VCr}$	0.2798
[x ln (design life; hrs)]	- Lateral, $X_{k;LCr}$	1.0192
Allowable deflection [mm]	- Vertical, $\delta_{k;V}$	9.0
	- Lateral, $\delta_{k;L}$	14.0
Allowable creep deformation [mm]	- Vertical, $\varepsilon_{k;V}$	9.0
	- Lateral, $\varepsilon_{k;L}$	18.0

1.2 Recommended Material and Partial Factor of Safety

Factor of safety	ULS	SLS
Material, $f_{m;*}$	2.75	1.5

(Polypipe recommended factor; based on the minimum values proposed in CIRIA C680; Clause 4.6)

Partial factor of safety	ULS	SLS
Variable loads, γ_Q	1.6	1.0
Permanent loads, γ_G	1.4	1.0
Lateral earth pressure, γ_e	1.35	1.0
Hydrostatic, γ_u	1.35	1.0

(Based on CIRIA C680, Clause 4.6)

1.3 Proposed Installation

Idealised details of the proposed Polystorm installation are summarised below (refer to figure 1).

Depths

Depth to structure invert, H	1.710 m
Polystorm structure depth, h_1	0.800 m
Design depth, z *(= H - 0.2m)*	1.510 m
Cover depth, h_c *(= H - h_1)*	0.910 m

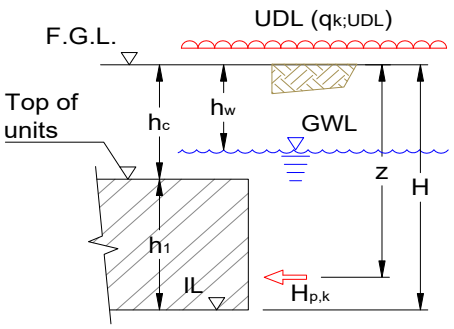


Figure 1) Idealised illustration of installation

Please note that the information in this document is of an illustrative nature and is supplied by Polypipe Civils without charge. It does not form part of any contract or intended contract with the user. Final determination of the suitability of any information or material for the use contemplated and the manner of use is the sole responsibility of the user and the user must assume all risk and liability in connection therewith. Refer to www.polypipe.com/disclaimer for further information.

Preliminary Polystorm Performance Assessment

Project Title - NORTH VIEW, NORTH MANCHESTER HOSPITAL - MIN. COVER

Assumed ground conditions

Information was not available on the proposed site ground conditions. A minimum required soil shearing resistance has been assumed for illustration purposes. To be confirmed, prior to commencement of final design or construction activities.

Native soil

Shearing resistance, Ø	33°	
Density, γ_k	20.0 kN/m³	*[Assumed]*

Active earth pressure co-efficient, Ka 0.295
(= [1 - Sin Ø] / [1 + Sin Ø])

Ground water

Depth below FGL, h_w	N/A
Density, γ_w	N/A

1.4 Assumed Transient (Live) Loads

No information was provided on expected vehicle loading. For illustration purposes, vehicle loading assumed.

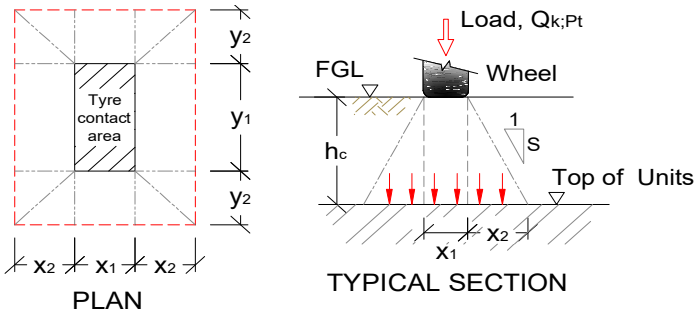


Figure 2) Concentrated load parameters

Loading classification	Landscape maintenance	*[CIRIA C680; Table 4.2]*
DIN 1072 classification	N/A	*[CIRIA C680; Table 4.2]*
Max Gross vehicle weight	N/A	*[CIRIA C680; Table 4.2]*
Uniformly distributed load, $q_{k;UDL}$	5.0 kN/m²	*[CIRIA C680; Table 4.2]*
Concentrated wheel load, $Q_{k;Pt}$	1.4 kN	*[CIRIA C680; Table 4.2]*
Dynamic load factor, Φ	1.0	*[Assumed]*
Contact area - Length, y_1	0.150 m	*[CIRIA C680; Table 4.2]*
- Width, x_1	0.150 m	*[CIRIA C680; Table 4.2]*
Load distribution, S	1 in 2.0	*[Assumed]*
Additional load spread, x_2 & y_2	0.455 m	

(= h_c / S)

Unfactored

Imposed load, $q_{k;Pt}$ **1.2 kN/m²** [< Uniformly distributed load]

(= [$Q_{k;pt}$. Φ] / [(x_1 + 2x_2) x (y_1 + 2y_2)])

Please note that the information in this document is of an illustrative nature and is supplied by Polypipe Civils without charge. It does not form part of any contract or intended contract with the user. Final determination of the suitability of any information or material for the use contemplated and the manner of use is the sole responsibility of the user and the user must assume all risk and liability in connection therewith. Refer to www.polypipe.com/disclaimer for further information.

Preliminary Polystorm Performance Assessment

Project Title - NORTH VIEW, NORTH MANCHESTER HOSPITAL - MIN. COVER

2.0 Assumed Imposed Loading

The following section illustrates how Polypipe would typically expect imposed loads on a proposed Polystorm structure to be derived; in accordance with the guidance given in CIRIA C680 (2008; RP782)

2.1 Vertical Loads Imposed on Upper Structure Face

The following section estimates the vertical imposed load at the Polystorm structure soffit.

Unfactored

Distributed load gave worst case transient parameter; refer to Section 1.4

Live load, $q_{k;*}$ **5.0 kN/m²** *[* - UDL; refer to Section 1.4]*

Dead load, G_k **18.2 kN/m²**

(= [h_c x γ_k])

Factored

ULS, $V_{d;ULS}$ **33.5 kN/m²** [< 221.8 kN/m² Therefore OK]

(= [$q_{k;*}$]$\gamma_{Q;\,ULS}$ + [G_k]$\gamma_{G;\,ULS}$) *(= $X_{k;VC}$ / $f_{m;ULS}$; Refer to Section 1.0)*

Degree of utilization, Λ_{STR} **15%**

SLS, $V_{d;SLS,\,\delta}$ **1.2 kN/m²**

(= [$q_{k;Pt}$]$\gamma_{Q;\,SLS}$)

SLS, $V_{d;SLS,\,\varepsilon}$ **18.2 kN/m²**

(= [G_k]$\gamma_{G;\,SLS}$)

2.2 Lateral Load Imposed at Depth z

The following section estimates the lateral pressure imposed on the proposed Polystorm structure, at design depth z (worst case imposed load assumed to occur at the centre of the unit, due to additional support provided by the unit's external faces)

Unfactored

Live load, $q_{k;UDL}$ **5.0 kN/m²**

Dead load, W_{Gk} **30.2 kN/m²**

Hydrostatic load, U_k **N/A**

Where h_w < z

(W_{Gk} = [h_w x γ_k] + [(z - h_w) . (γ_k - γ_w)])

(U_k = [z - h_w] x γ_w)

Where h_w > z

(W_{Gk} = z x γ_k)

Lateral pressure, $H_{p;k}$ **10.4 kN/m²**

(= Ka [q_k + W_{Gk}] + U_k)

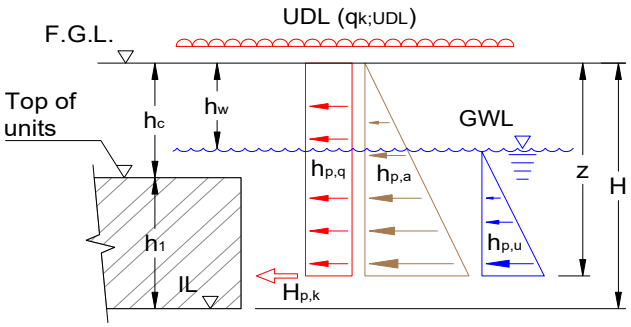


Figure 3) Idealised illustration of lateral pressure(s)

Factored

ULS, $H_{d;ULS}$ **14.0 kN/m²** [< 22.9 kN/m² Therefore OK]

(= Ka [q_k + W_{Gk}]$\gamma_{e;\,ULS}$ + [U_k]$\gamma_{U;\,ULS}$) *(= $X_{k;LC}$ / $f_{m;ULS}$; Refer to Section 1.0)*

SLS, $H_{d;SLS}$ **10.4 kN/m²**

(= Ka [q_k + W_{Gk}]$\gamma_{e;\,SLS}$ + [U_k]$\gamma_{U;\,SLS}$)

Please note that the information in this document is of an illustrative nature and is supplied by Polypipe Civils without charge. It does not form part of any contract or intended contract with the user. Final determination of the suitability of any information or material for the use contemplated and the manner of use is the sole responsibility of the user and the user must assume all risk and liability in connection therewith. Refer to www.polypipe.com/disclaimer for further information.

Preliminary Polystorm Performance Assessment

Project Title - NORTH VIEW, NORTH MANCHESTER HOSPITAL - MIN. COVER

3.0 Serviceability Limit State Checks (Deflection & Creep)

The serviceability of the proposed Polystorm structure (Section 1.3) may be assessed by predicting possible unit deflection (short term) and creep (long term)

3.1 Vertical Deflection Due to Expected Traffic Loading

The overseeing engineer should be consulted to ensure that the deformation predicted below, would not compromise the structural integrity of any proposed surface pavement. Where excessive deflections are predicted, protective measures may be introduced.

Design strength; $X_{d;VD}$	**40.0 kN/m² per mm**	
(= $X_{k;VD}$ / $f_{m;SLS}$; refer to Section 1.0)		
SLS, $V_{d;SLS,\delta}$	**1.2 kN/m²**	
Deflection, δ_V	**0.03 mm**	[< 1.0 mm Typically OK]
(= $V_{d;SLS}$ / $X_{d;VD}$)		

3.2 Vertical Creep

Derived creep equation is only valid if expected imposed load(s) do not exceed the creep test load

Creep test load, $X_{d;v,cr}$	**162.0 kN/m²**	
SLS, $V_{d;SLS,\varepsilon}$	**18.2 kN/m²**	[< 162.0 kN/m² Therefore OK]
Degree of utilization, Λ_{STR}	**11%**	
Creep data limit, t	**60 years**	*[Unit has a durability life in excess of 60yrs]*
Estimated unit creep, $\varepsilon_{h,c}$	**3.7 mm**	[< 9.0 mm Therefore OK]
(= 0.2798 ln [design life, t]); t in hours		*[Refer to Section 1.1; based on test load]*
Degree of utilization, Λ_{STR}	**41%**	

3.3 Lateral Deflection

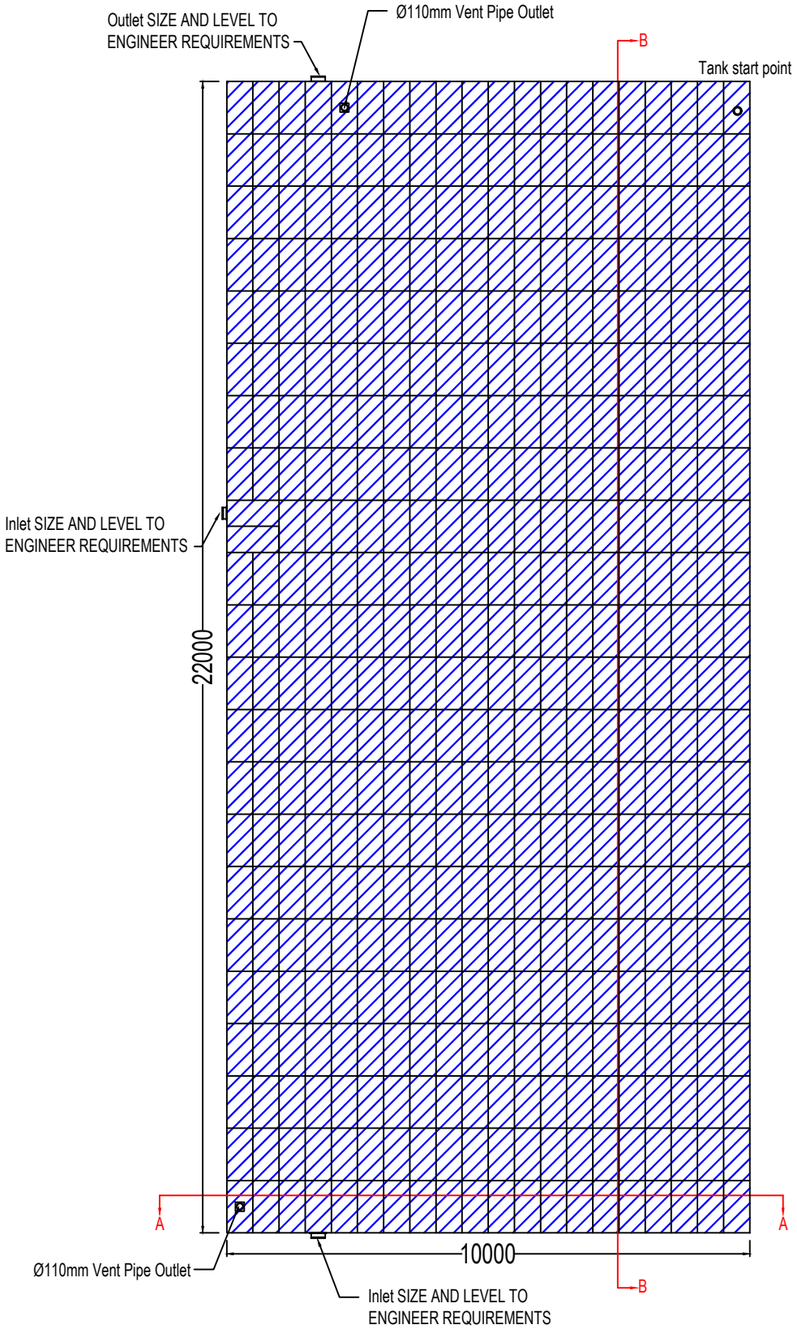
Design strength; $X_{d;LD}$	**2.9 kN/m² per mm**	
(= $X_{k;LD}$ / $f_{m;SLS}$; refer to Section 1.0)		
SLS, $H_{d;SLS}$	**10.4 kN/m²**	
Deflection, δ_L	**3.54 mm**	[< 14.0 mm Therefore OK]
(= $H_{d;SLS}$ / $X_{d;LD}$)		*[Refer to Section 1.1; based on test load]*
Degree of utilization, Λ_{STR}	**25%**	

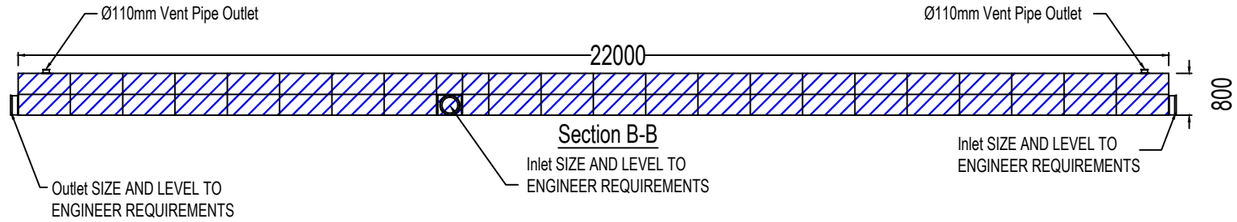
3.4 Lateral Creep

Derived creep equation is only valid if expected imposed load(s) do not exceed the creep test load

Test load, $X_{d;v,cr}$	**30.9 kN/m²**	
SLS, $H_{d;SLS}$	**10.4 kN/m²**	[< 30.9 kN/m² Therefore OK]
Degree of utilization, Λ_{STR}	**34%**	
Creep data limit, t	**60 years**	*[Unit has a durability life in excess of 60yrs]*
Estimated unit creep, $\varepsilon_{h,c}$	**13.4 mm**	[< 18.0 mm Therefore OK]
(= 1.0192 ln [design life, t]); t in hours		*[Refer to Section 1.1; based on test load]*
Degree of utilization, Λ_{STR}	**75%**	

Please note that the information in this document is of an illustrative nature and is supplied by Polypipe Civils without charge. It does not form part of any contract or intended contract with the user. Final determination of the suitability of any information or material for the use contemplated and the manner of use is the sole responsibility of the user and the user must assume all risk and liability in connection therewith. Refer to www.polypipe.com/disclaimer for further information.

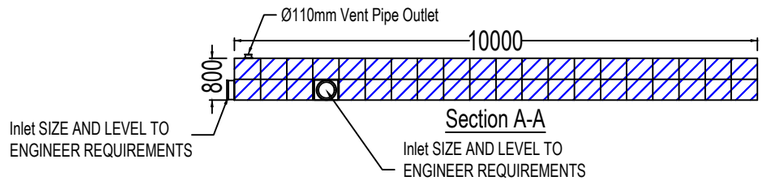


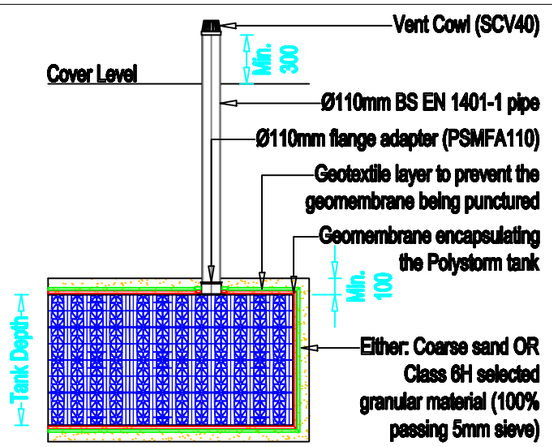


LEGEND:

Polystorm-R Units
(PSM1A)

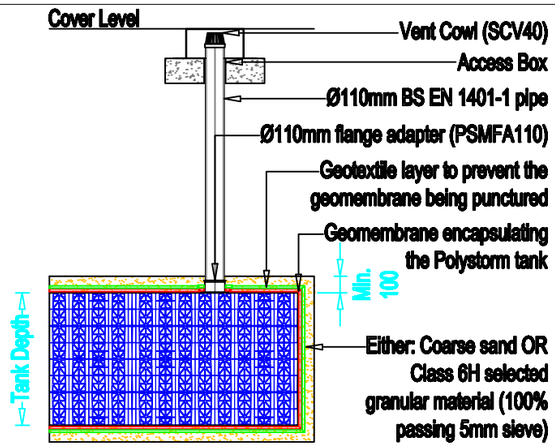
PROPOSED POLYSTORM STRUCTURE	
Plan Area	220m²
Tank Volume	176m³
Storage	167.2m³
Polystorm-R Units	880 (PSM1A)





ATTENUATION TANK VENTILATION SYSTEM - OPTION 1)

Scale (N.T.S)



ATTENUATION TANK VENTILATION SYSTEM - OPTION 2)

Scale (N.T.S)

© Copyright

NOTES:-

1. THIS DRAWING DETAILS A PROPOSED POLYPIPE CIVILS & GREEN URBANISATION PRODUCT GENERAL ARRANGEMENT, REFLECTING OUR INTERPRETATION OF THE INFORMATION PROVIDED.
2. POLYPIPE CIVILS & GREEN URBANISATION (PCGU) PRODUCTS SHALL BE INSTALLED IN ACCORDANCE WITH PCGU RECOMMENDATIONS (REFER TO PCGU TECHNICAL GUIDANCE FOR FURTHER INFORMATION); GIVING DUE CONSIDERATION TO THE SITE SPECIFIC CONDITIONS AND REQUIREMENTS, IN ADDITION TO ANY REQUIREMENTS MANDATED BY THE RELEVANT APPROVING AND ULTIMATE OWNER ORGANISATION(S).
3. DO NOT SCALE, REFER TO FIGURED DIMENSIONS ONLY.
4. ALL DIMENSIONS IN MILLIMETRES, UNLESS OTHERWISE STATED.
5. ALL DIMENSIONS ARE NOMINAL AND MAY VARY WITHIN MANUFACTURING OR CONSTRUCTION TOLERANCES.
6. ALL SITE TEMPORARY AND ENABLING WORKS BY OTHERS.
7. THIS DRAWING IS INTENDED FOR GUIDANCE ONLY. CONFIRMATION OF THE INFORMATION CONTAINED WITHIN THIS DOCUMENT SHOULD BE SOUGHT FROM THE OVERSEEING ENGINEER(S) PRIOR TO THE COMMENCEMENT OF FINAL DESIGN OR CONSTRUCTION ACTIVITIES.
8. PLEASE REFER TO POLYSTORM & POLYSTORM LITE TECHNICAL GUIDE.
9. THE PROPOSED POLYSTORM STRUCTURE GENERAL ARRANGEMENT HAS BEEN BASED ON PROVIDING THE MINIMUM STRUCTURE VOLUME STATED ONLY. NO STRUCTURAL OR HYDRAULIC ASSESSMENT HAS BEEN MADE OF THE SUITABILITY OF THE PROPOSED POLYSTORM STRUCTURE FOR THE PROPOSED APPLICATION, NOR HOW IT WILL INTEGRATES INTO THE PROPOSED DRAINAGE SYSTEM.

Notes :- All the Dimensions by Millimeters

ALDERBURGH
KEYTEC Geomembranes
LINING SOLUTIONS
ALDERBURGH LTD
SOLUTIONS HOUSE
DANE STREET
ROCHDALE
OL11 4EZ
TEL: 01706 374416
EMAIL: TECHNICAL@ALDERBURGH.COM

PROJECT

NORTH VIEW, NORTH MANCHESTER HOSPITAL

ATTENUATION TANK

TITLE

DETAILS OF STORAGE/ATTENUATION TANK DETAILS USING POLYSTORM PSM1A MODULES

Scale	Drawn	Checked
N.T.S.	MI	AY

Date	Drawing No.	Revision
17/05/2023	PSM - 2	R0



WMS

Polystorm Lite and Polystorm

Installation Guide

Water Management Solutions

Installation Guidlines

Polypipe

Installation

The following section outlines **site best practise** for the installation of **Polystorm Lite** and **Polystorm**.







5. Installation

5.1 Installation details

5.1.1 Health and Safety

Under the Construction (Design and Management) Regulations 2007, unless they are a domestic client, all parties involved in construction or building work have legal duties. These include:

Clients

- Check competence and resources of all appointees
- Ensure there are suitable management arrangements for the project welfare facilities
- Allow sufficient time and resources for all stages
- Provide pre-construction information to designers and contractors

Designers

- Eliminate hazards and reduce risks during design
- Provide information about remaining risks

Contractors

- Plan, manage and monitor own work and that of workers
- Check competence of all their appointees and workers
- Train own employees
- Provide information to their workers
- Comply with the specific requirements in Part 4 of the Regulations
- Ensure there are adequate welfare facilities for workers

It should be noted that additional legal duties are imposed where construction work is notifiable.

All installation activities should be carried out observing the requirements of The Health and Safety at Work Etc. Act 1974; and
The Management of Health and Safety at Work Regulations 1999.

Polystorm Benefits for CDM Compliance

Storage applications using Polystorm Water Management Systems are actually beneficial to CDM compliance. This is because the system avoids or reduces several risks associated with the construction of traditional storage tanks which can involve deep excavations and construction of large engineered structures. Specific advantages of Polystorm in this respect are:

- Individual Polystorm components are lightweight – making it easier for individual lifting of Polystorm cells.
- Installation of Polystorm is quick – so open excavation time is minimised and high numbers of manpower and machinery is reduced.

5.1.2 Risk Assessment

Contractors are required to submit a method statement which includes a methodology for installation and risk assessment for the work to be carried out.

5.1.3 Site Guidance

Good Practice Guide

The following are good practice principles for the handling and storage of all Polystorm cells on site:

- Store units away from direct sources of heat including sunlight for excessive periods
- Place packs of cells on level ground:
  DO NOT stack filled pallets on site
- Store loose individual cells
  NO MORE THAN 5 cells high
- Ensure a well positioned and secure stand for platform issued to remove the top layer of Polystorm cells from the pallet
- Although Polystorm cells contain an inhibitor giving ultra violet resistance for up to 6 months, avoid prolonged storage in direct sunlight
- DO NOT store cells near fuel bowsers, fuel tanks or any other solvents
- Although Polystorm cells are very robust and resistant to damage when handled normally, store in locations where impacts from vehicles and site plant will be avoided
- Ensure Polystorm cells are kept clean at all times

- Broken/cracked cells should not be installed. Broken/cracked cells should be recycled wherever possible
- Individual Polystorm Lite cells weigh 7kg and Polystorm 9kg so they can normally be safely lifted on site in accordance with current manual handling regulations.
- Avoid walking on the geosynthetic membrane to reduce risk of puncturing or tearing the textile
- Care must be taken when placing the cells into the excavation
- Install 1st layer of cells to minimise walking on the geomembrane textile

5.1.4 Floatation

When placed below the ground water table as an attenuation system (i.e. wrapped in a geomembrane) there is a risk that the buoyancy of a tank may cause it to float. This can be prevented by placing a sufficient weight of soil on top of the tank to counteract the upward forces. Our Technical Team can assist with groundwater calculations. Please contact Polypipe WMS technical support team.
Also see section 4.

5.1.5 Excavation and Preparation

Excavate to the required plan dimensions and level, ensuring that the excavation orientation will allow easy installation of connecting pipework. Consideration should be given to maintaining construction plant access for reinstating around the installed Polystorm cells.

Ensure that the ground bearing capacity at the formation level is sufficient for the proposed operational loads. The base of the excavation should be smooth and level, free of large or sharp stones and soft spots to avoid punctures or tears of the geomembrane. Any soft spots should be excavated and replaced with suitable compacted granular material.

Place and compact a minimum 100mm thick layer of bedding material (typically coarse sand). If required, line the base and sides of the excavation with a protective geotextile before placement of the impermeable geomembrane. Excavation should be carried out in accordance with BS6031, paying particular attention to safety procedures.

5.1.6 Handling and Installation

All materials used should be checked before and after installation for any damage such as punctures or tears to the membrane.

The type of geosynthetic material used to encapsulate the Polystorm cells will determine the installation requirements. Please note the following information is generic and advice from the geosynthetic manufacturer should be sought to ensure that the appropriate protective measures are taken to comply with any proprietary requirements.

Physical Properties		
Thickness	Min 0.75 to 1.0mm	ASTM D5199
Density	900 kg/m³	ASTM D1505
Mechanical Properties		
Tensile strength, at yield	Min 1600kN/m³	ASTM D4885
Elongation at break	>500%	ASTM D4885
Puncture resistance	Min 170N	ASTM D4833
Tear resistance	Min 67N	ASTM D1004 Die C
Impact resistance	Min 15 Joules	ASTM 3998 mod
Stress crack resistance	Min 200 hrs	ASTM D5391 (SP-NCTL)
Permeability coefficient	Max 2.0 x 10-12	ASTM D
pH	Resistant to all naturally occurring soil acids and alkalis	
Chemical/biological resistance	Resistance to all substances found to naturally occur in soils and rainwater. Detailed information would need to be provided to geomembrane manufacturer in instances of contaminated land.	

Table 5-1 Impermeable Geomembrane

Before cells are installed a geomembrane should be laid over the subgrade level. Positioning of sheeting is undertaken by machinery or hand. After unrolling the sheeting, its position is adjusted so that a suitable overlap is achieved for the welding process. Before welding, the sheet must be checked for any damage including punctures or tears. If damage has occurred re-patch the damaged area with additional geomembrane material and weld over damaged area. Ensure the damaged area is overlapped by a minimum of 400mm.

Joint each sheet of geomembrane together according to the suppliers' recommendations.

Polystorm Cell Installation

Before proceeding with the installation please ensure you carefully read and understand the Good Practise Guidelines stated earlier in the document.

Ensure cells are arranged so that they are in the correct alignment with the adjoining pipework. Wherever possible, minimise the amount of walking on the geomembrane to reduce the chances of punctures or tears to the material by laying the first layer of cells.

5.1.7 Connecting Polystorm Cells

Place the Polystorm cells on the geomembrane in accordance with the construction drawings. Ensure the Polystorm cells are abut and the corners align with each other. During installation, Polystorm cells should be securely connected using clips and shear connectors. Clips and shear connectors are supplied in sealed polythene bags of 60 and 30.

Clip Connectors

Polypipe clips connect horizontally adjacent units.

Shear Connector

Vertical connections are formed with the Polypipe shear connector.

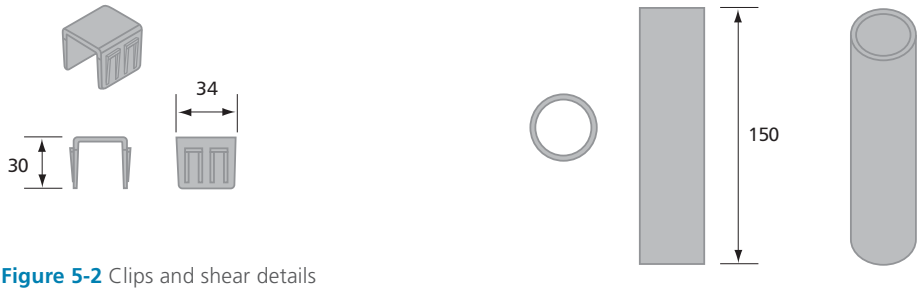


Figure 5-2 Clips and shear details

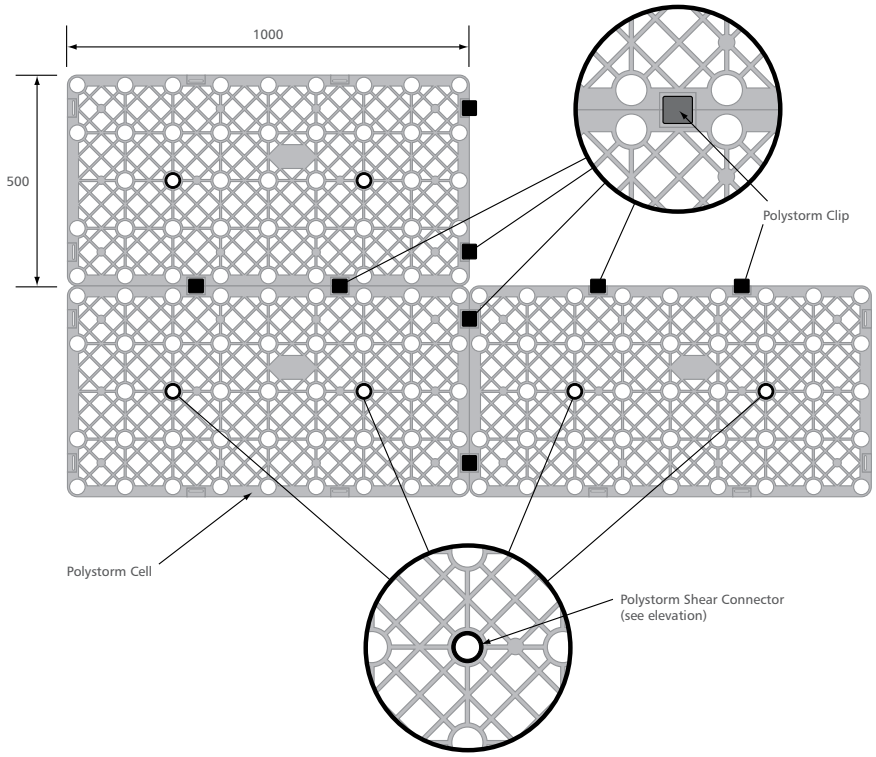


Figure 5-3 Location points for clips and shears

Shear Connector Installation

Insert shear connectors into Polystorm cell as shown. Ensure the shear connector is fully inserted before mounting the Polystorm cell.

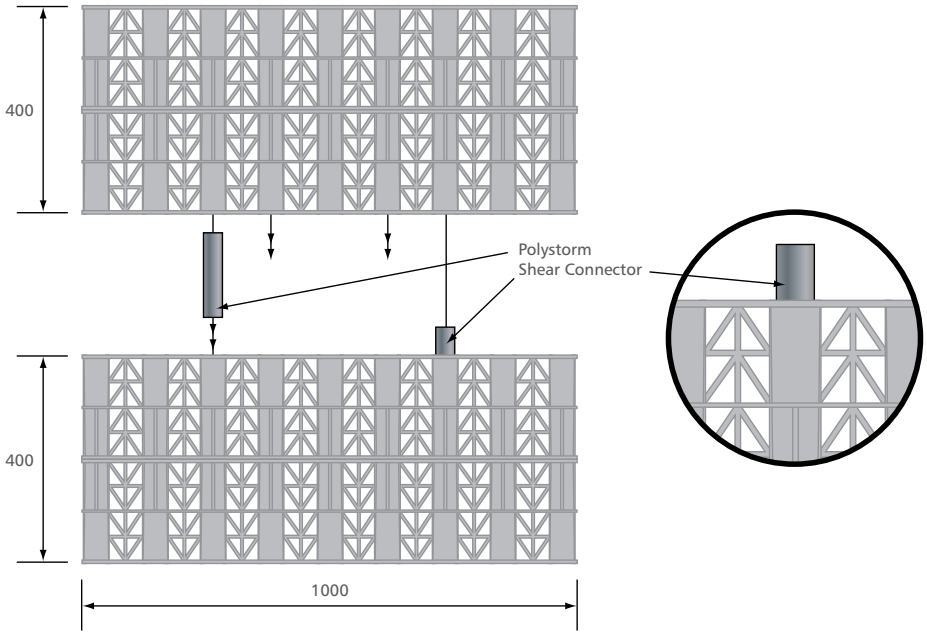


Figure 5-4 Shear connector installation

Clip connector installation

Polystorm cells are adjacently connected by clipping the two units together.

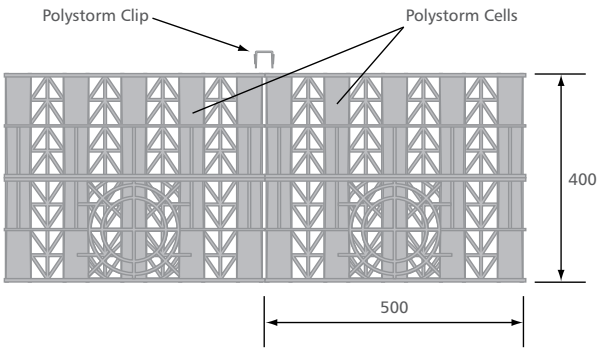


Figure 5-5 Clip connector installation