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35 Knocklyon Drive

Drainage Report

ONCE Civil & Structural Ltd

Company Registration No. 464217

Contents

1.0INTRODUCTION 3
1.1Instruction 3
1.2 Existing Site 3
1.3 Proposals 3
2.0 SURFACE WATER DRAINAGE 3
2.1 Existing Surface Water 3
2.2 Surface Water Policy 3
2.3 Surface water 3
2.4 Attenuation Tank: 3
3.0 Design 4
3.1 Protection of the property 4
3.2 Drainage 4
Proposed Layout 5
4.0 Flood Studies Report 6
Appendix 8
Appendix 9

1.0INTRODUCTION

1.1Instruction

ONCE Civil & Structural Ltd Consulting Engineers have been appointed to provide civil engineering design services for a proposed new two story extension to the side of 35 Knocklyon Drive Knocklyon along with a single story extension to the rear.

The following report will address the civil engineering elements, including;

- Surface Water Strategy design, provision of SUDS.

1.2 Existing Site

The existing site is a semidetached dwelling located along Knocklyon Drive.

1.3 Proposals

The proposed development consists of the construction of a new two story extension to the side the existing dwelling with a single story extension to the rear of 35 Knocklyon Drive Knocklyon. This development will create an additional 67.5m^2 of hard landscape

The new roof is located to the side of the existing pitch (Front and Back) , while the location of the SuDS is located to the rear. It is proposed to drain the New two Story Roof and 100% of the new rear extension to the proposed Attenuation Tank.

2.0 SURFACE WATER DRAINAGE

2.1 Existing Surface Water

The existing surface water drains the current pipe network located on Knocklyon Drive.

2.2 Surface Water Policy

The proposed development will include a new surface water drain to collect the surface water runoff from the new roof area and discharge to a Attenuation Tank within the rear of the site.

The drainage is designed to comply with policies and guidelines, outlined in the Greater Dublin Strategic Drainage Study (GDSDS), the requirements of Dublin City Council and the SUDs Manuals C697 and C609.

2.3 Surface water

The roof area of the dwelling will be approx. 67.5sqm with 100% discharge to a uPVC collector drain in the rear garden which flows to a Wavin Aqua Cell. (Figure 1)

2.4 Attenuation Tank:

The Attenuation system chosen for this project is an Aqua Cell Attenuation Tank.
The nominal Dimension of an Aqua Cell Attenuation Tank is 1.25mx0.5mx0.4m (0.25M3). Each unit has a volume capacity of 90% of the overall volume (0.225m3).
It has been proposed to use 12 units (2.7m3>1.88m3).
Attenuation system will be sealed, square cover and frame, suitable for foot traffic with a 350mm

opening. Given the current conditions of the site the attenuation tank is to be located in the Rear garden of the proposed site.

The attenuation tank was chosen based on the characteristics of the site and the data extracted from the Flood studies Reports.
The contribution factors were;
Contribution Area – 67.5m2
Total Site Area -- 326.035 m2
Obar – 0.350/sec
With these factors and the data from the rainfall Return Table (Appendix) we determined the required storage needed for the site (Figure 8) .
A 30min storm will require storage of 1.88m3.

With these factors and the data from the rainfall Return Table (Appendix) we determined the required storage needed for the site (Figure 9) .
A 240min storm will require storage of 2.3m^3.

It has been proposed to use a 1No. Aqua Cell Attenuation tank, each sized 1.25x0.5x0.4m. This will have a combined Capacity of 2.7 m^3> 1.88 m^3 . This complies with the flood studies report & our calculations.
(Full dimensions of retention tank are shown in appendix)

2.5 Garastor System

The Garastor unit is a polypropylene chamber. When the Garastor is used in conjunction with an aqua cell tank, the 6SC501 version must be used. Due to the site condition it has been proposed to stack the Aqua cell tanks in a 3x2 formation. Stacking the Aqua cell tanks will require the 50mm Extension Kit (6SC205)

3.0 Design

3.1 Protection of the property

The design of the surface water runoff is such that it will cater for a storm event of 100-year critical event without causing any significant unplanned flooding. The design allows for a 20% for climate change in the capacity of the storage.

3.2 Drainage

The proposed pipe will be a 150mm Diameter pipe with a gradient of 1:60. The Storm water will discharge with a new saddle connection to the existing Combined Pipe Network in the rear of the property.

3.3 Design Calculations

Storm & Foul Drainage have been designed in accordance with the Building Regulations Part H and specifically in accordance with the principles and methods set out in the DOE "Recommendations for Site Development Works for Housing Areas", BS8301: 1985, IS EN752 (2008), IS EN12056: Part 2 (2000) and the recommendations of the 'Greater Dublin Strategic Drainage Study', (GDSDS), and Irish Water Code of Practice.

The following criteria have been applied:

- Pipe Friction (Ks) 1.5mm
- Minimum Velocity 0.75 mls (self-cleansing velocity)
- Maximum Velocity 3.0 mls
- Frequency Factor 0.5 for domestic use

The standard drainage details are outlined on drawings 5064 D01 and are in accordance with the Greater Dublin Regional Code of Practice for Drainage Works.

All private drainage runs will be uPVC at a fall of 1:60 or 1:80 for 100mm pipework. All access junctions, inspection chambers and gulley traps are uPVC.
All ground floor sink / shower will be piped separately to ground floor w.c pipes and routed through back inlet gulley traps (BIGT) prior to the external foul collection system.

Proposed Layout

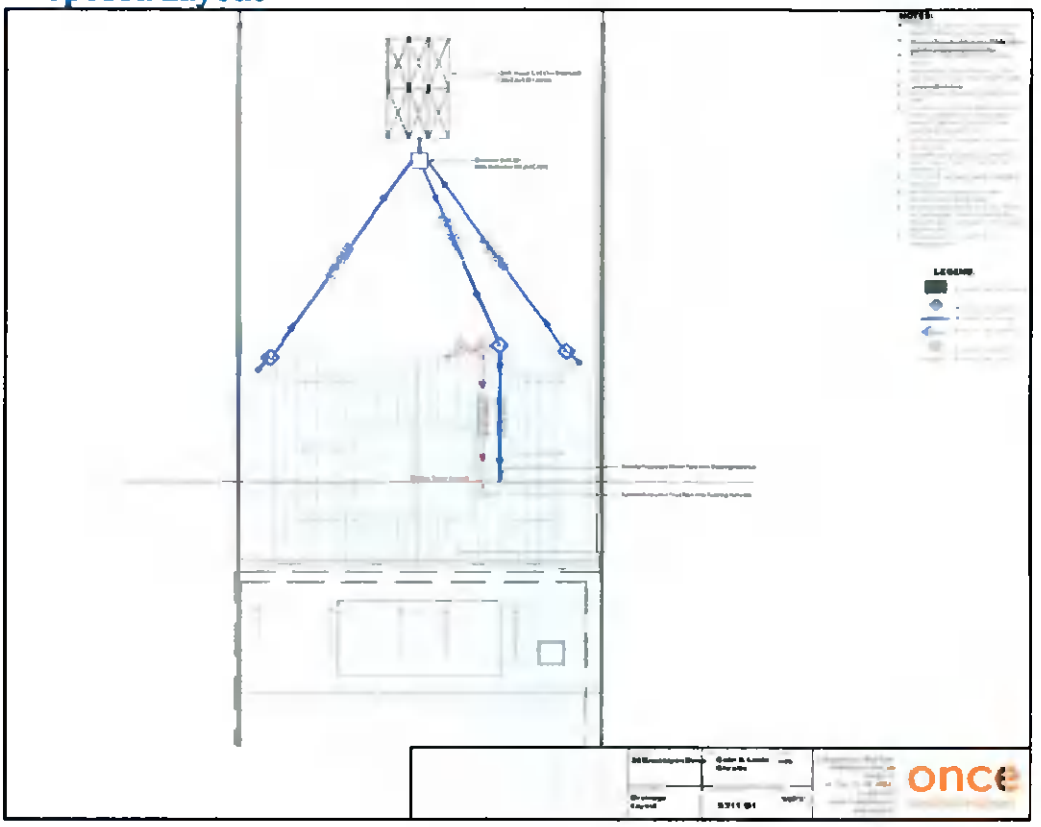

Figure 1

4.0 Flood Studies Report

Date	Delevopment Address	Calculations By Mc
23/09/2021		ONCE Civil & Structural Ltd
Ref. No		4 Bridgecourt Office Park
5311	35 Knocklyon Drive	01 426 4883

	Sq.m =	Sq.km	
Area of hard land scaping	67 500		
To change from sq.m to sq.km enter	326 035	0 000	
Total Area of the Site (sq. km)	Area	0 000	SQ KM
Standard Average Annual Rainfall (mm)	SAAR	900	MM
Soil Type	G1	0	%
	G2	100	%
	G3	0	%
	G4	0	%
	G5	0	%
Soil Index SOIL= 15G1+ 3G2+ 4G3+ 45G4+ 5G5 / (g1+g2+g3+g4+g5)	SOIL	0.30	
Mean Annual Flow (l/sec)	MAF	0.179	l/sec

Maximum Allowable Discharge

Return Period	2	5	10	25	50	100
FSR Ireland Multiplier	0 95	1 2	1.37	1.6	1.77	1.96
Max Allowable Discharge (l/sec)	0 170	0.214	0.245	0 286	0.316	0.35

Institute of Hydrology Rpt 124 Flood Estimation for Small Catchments 1997

Flood Studies Report, NERC (1975) Vol 1 Table 2.2 p 173

Figure 2

Rainfall Figures for Co Dublin from Met Eireann

Return Period 100
Gross Area 67.5 Sq m
SAAR 900 **35 Knocklyon Drive**
Soil Index 0.30

Duration (mins)	Rainfall (mm)	Intensity (mm/hr)	Runoff (l/sec)	Outflow (l/sec)	Storage (cu m)
1	3.3	198.00	3.71	0.350	0.201739
2	6.6	198.00	3.71	0.350	0.403477
5	18.3	219.60	4.12	0.350	1.130193
10	25.5	153.00	2.87	0.350	1.511137
15	30	120.00	2.25	0.350	1.70983
30	37	74.00	1.39	0.350	1.867161
60	46.6	46.60	0.87	0.350	1.884822
120	58.2	29.10	0.55	0.350	1.407143
240	72.6	18.15	0.34	0.350	-0.14221
360	82.6	13.77	0.26	0.350	-1.98857
720	103.1	8.59	0.16	0.350	-8.16889
1440	128.7	5.36	0.10	0.350	-21.569

Qbar = 0.350 l/sec Required Storage (cu.m) 1.88

100 year return table

Pipe Diameter (meters)	Required Length	Tank Size (meters)	SQUARE	(meters)		DEPTH
0.6	4.1	1.37	X	1.37	X	1.0
0.9	1.8	1.12	X	1.12	X	1.5
1.05	1.3	0.97	X	0.97	X	2.0
1.2	1.0	0.87	X	0.87	X	2.5
1.5	0.7	0.79	X	0.79	X	3.0

Figure 3

Allowing for an outflow of 0.245L/sec the worst case storm event is a 60 min rainfall over a 100 year event will require an attenuation of 2.0cu.m (See Figures 7&8)

M.Caffrey

Mark Caffrey for ONCE Civil & Structural Ltd.

Appendix

Date	Delevopment Address	Calculations By Mc
23/09/2021		ONCE Civil & Structural Ltd
Ref. No.		4 Bridgecourt Office Park
5311	35 Knocklyon Drive	01 426 4883

	Sq.m =	Sq.km	
Area of hard land scaping	67.500		
To change from sq.m to sq.km enter	326.035	0.000	
Total Area of the Site (sq. km)	Area	0.000	SQ.KM
Standard Average Annual Rainfall (mm)	SAAR	900	MM
Soil Type	G1	0	%
	G2	100	%
	G3	0	%
	G4	0	%
	G5	0	%
Soil Index SOIL= .15G1+.3G2+.4G3+.45G4+.5G5 / (g1+g2+g3+g4+g5)	SOIL	0.30	
Mean Annual Flow (l/sec)	MAF	0.179	l/sec

Maximum Allowable Discharge

Return Period	2	5	10	25	50	100
FSR Ireland Multiplier	0.95	1.2	1.37	1.6	1.77	1.96
Max Allowable Discharge (l/sec)	0.170	0.214	0.245	0.286	0.316	0.350

Institute of Hydrology No.124 Flood Estimation for Small Catchments 1997

Flood Studies Report NERC (1975). Vol. 1 Table 2.39 p.473

Rainfall Figures for Co.Dublin from Met Eireann

Return Period 100
Gross Area 67.5 Sq.m
SAAR 900 **35 Knocklyon Drive**
Soil Index 0.30

Duration (mins)	Rainfall (mm)	Intensity (mm/hr)	Runoff (l/sec)	Outflow (l/sec)	Storage (cu.m)
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720	103.1	8.59	0.16	0.350	-8.16889
1440	128.7	5.36	0.10	0.350	-21.569

Required Storage (cu.m)

Qbar = 0.350 l/sec 1.88

100 year return table

Pipe Diameter (meters)	Required Length	Tank Size (meters)	SQUARE	(meters)		DEPTH
0.6	4.1	1.37	X	1.37	X	1.0
0.9	1.8	1.12	X	1.12	X	1.5
1.05	1.3	0.97	X	0.97	X	2.0
1.2	1.0	0.87	X	0.87	X	2.5
1.5	0.7	0.79	X	0.79	X	3.0

Introduction to Garastor

Development of sites results in a large proportion of area being covered by impermeable surfaces such as roofs, car parks and roads. Surface water run-off therefore increases up to 80%. Building Regulations and guidance now requires a sustainable approach to development, which minimises the effects of run-off to that of a greenfield site (20%).

Developed in collaboration with Bryant Homes, Garastor (polypropylene control chamber) represents a house by house, rather than a development wide approach, to stormwater management. Garastor controls the flow of water at source by temporarily storing water under a soft landscaped area using the AquaCell system or in the void space under the floor slab of a residential garage. It eliminates the need for costly, space-hungry, on-site communal water-storage structures or ponds which enables better use of developable land.

During high intensity rainfall, water from the roof or hardstanding areas is diverted via the Garastor control unit into the storage void. As the storm subsides the rainwater can be slowly released back into the main drainage system.

Note
Garastor can be used as a flow control device for any AquaCell storage system, no greater than one unit deep with a discharge of up to 1.4 l/s via the 30mm release flow orifice.

Garastor - polypropylene control chamber

Internal view of Garastor

Garastor System Overview

Garastor System

The Garastor unit is a polypropylene chamber that connects to a water storage reservoir. There are two versions of the Garastor available both of which are 500mm in diameter, the 6SC500 version is 1m deep for garage installations (with a 300mm storage depth capacity) and the 6SC501 is 1.25m deep for use with AquaCell (with a 400mm storage depth capacity). When Garastor is used in conjunction with an AquaCell tank the configuration of units must be no deeper than 1 AquaCell unit. If site conditions are such that a deeper Garastor unit is required then the 500mm Extension Kit (6SC205 - consisting of a coupler and two ring seals) can be used in conjunction with a shaft of 500mm Twinwall cut to suit, to extend the Garastor unit.

HOW IT WORKS

Storm or surface water flows through two 110mm diameter incoming pipes. If the flow is light to moderate, the water is simply stored in the chamber before being slowly released through a 30mm orifice. However, if the inflow is heavy, excess water in the chamber discharges through a 150mm diameter pipe into the water storage area (either the undercroft of a garage or an AquaCell tank). The water is temporarily stored until the water level inside the chamber has dropped sufficiently, and the water can flow out to the drainage system via the 110mm outflow pipe. Inside the Garastor chamber there are specially designed weir walls that ensure that the hydraulics of the unit work to the optimum levels.

KEY BENEFITS

- No use of valuable, developable land.
- Safer than open/above ground storage structures.
- Caters for 1 in 150 year storm.
- Spreads cost of water storage over the development period.
- Maintenance free, with no moving parts or filters.
- Run-off reverts to that of a greenfield site.

Garastor Principal Components

6D935 < 1.2m deep
6D939 > 1.2m deep
Covers and Frames

6SC205
Extension Kit
(a shaft of 500mm TwinWall pipe or an Inspection Chamber Shaft (6D938 - 3.0m length / 6D934 - 1.5m length) cut to suit will also be required)

150mm TwinWall Socket
(for connection to other pipe materials, a small section of 150mm TwinWall is required, alternatively use the 150mm Garastor Connection Kit (6SC200 - consisting of a short section of 150mm TwinWall pipe and two ring seals)

500mm diameter

1m (6SC500)
1.25m (6SC501)

Garastor
6SC500 (for use with garage undercroft)
6SC501 (for use with AquaCell)

6TW141
TwinWall S/S
Adaptor
(150mm TwinWall socket x 160mm OsmaDrain spigot for connection of 150mm TwinWall pipe directly into the AquaCell pre-formed socket)

6TW142
TwinWall D/S
Adaptor
(150mm TwinWall socket x 160mm OsmaDrain socket for connection of 150mm TwinWall pipe to 160mm OsmaDrain pipe)

6TW145
TwinWall S/S
Adaptor
(150mm TwinWall socket x 150mm UltraRib spigot for connection of 150mm TwinWall pipe directly to 150mm UltraRib socket)

6TW148
TwinWall D/S
Adaptor
(150mm TwinWall socket x 150mm UltraRib socket for connection of 150mm TwinWall pipe to 150mm UltraRib pipe)

Typical Garastor Installation Methods

1. Place the Garastor Unit (6SC500 or 6SC501) on a minimum of 100mm "as-dug" or granular material. Ensure that the unit is as close to the garage undercroft or AquaCell structure as possible and in a suitable position to allow pipework connection.

Note:
It is important to ensure that the chamber is placed in a level position and that the invert of the 150mm pipe connection is level with the base of the concrete undercroft or the base of the AquaCell units.

2. Connect pipework in accordance with standard pipe installation guidelines.

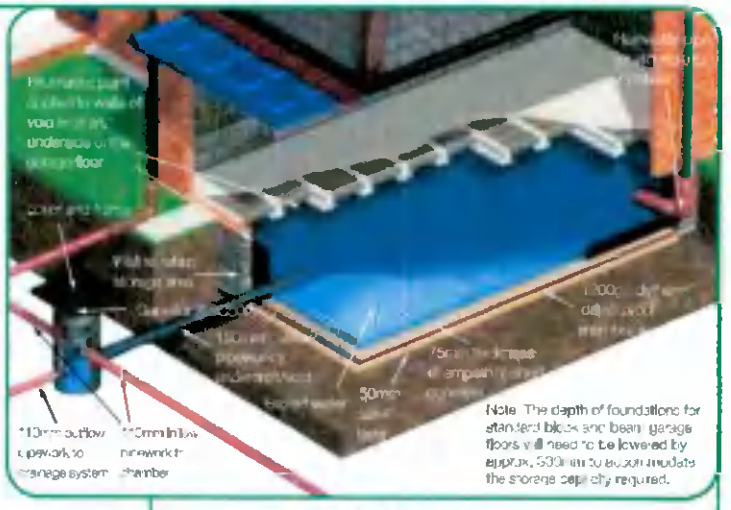
3. Surround the Garastor unit with 150mm of similar material to that used for the bedding.

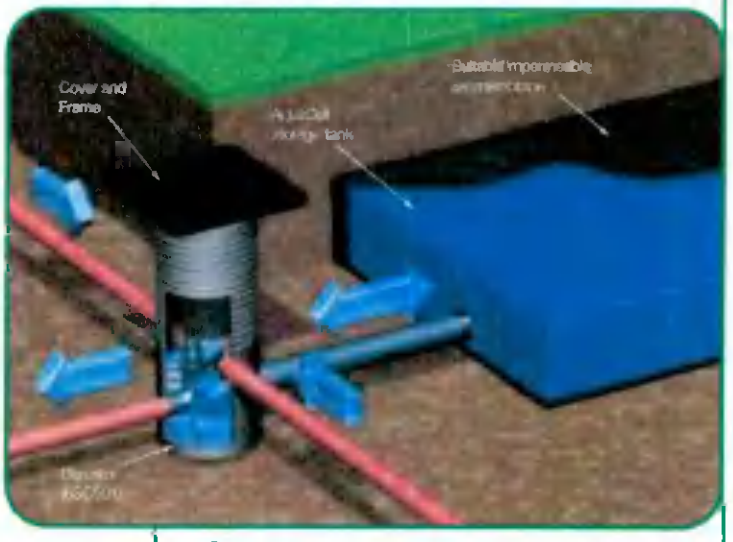
4. Fit relevant cover and frame according to depth of unit:

Up to and including 1.2m deep	6D935
Deeper than 1.2m	6D939

Note:
When surrounded by a concrete plinth (150mm x 150mm) the cover can be used in situations with a loading of upto 30Kn (3 tonnes) i.e. domestic driveways.

5. Adequate ventilation must be provided:
   - to the garage undercroft using either air bricks or rainwater downpipes connected directly into the storage area.
   - to the AquaCell structure using an air vent (NB. One air vent is required per 7,500 square metres of impermeable area to be drained).





Garastor installation using AquaCell

Notes:
When using Garastor with the undercroft/void of a garage, it is the responsibility of the designer to ensure that the enhancement to the garage undercroft/void and drainage works comply with current prevailing Building Regulations.
Also to prevent softening of the soils below the foundations or loss of fines leading to settlement, the void beneath the garage should be lined as follows:

- Underneath the concrete base of the void area there should be a 1200g polythene damp proof membrane
- Bitumastic paint should be applied to the walls of the void area and to the underside of the reinforced garage floor beams.

Specification

5C Element: Garastor Domestic Attenuation System Control Chamber

Installation of Domestic Attenuation System Control Chamber

The control chamber shall be installed strictly in accordance with the manufacturer's recommendations and in a manner that will not cause damage.

1m deep domestic attenuation system control chamber would use a sealed, square cover and frame, suitable for use with foot traffic only with a 450mm opening size for use to depths up to 1.2m (e.g. 6D935 Polypropylene cover and frame). When surrounded by a concrete plinth can be used in situations with loading up to 35kN (3.5 Tonnes), i.e. domestic driveways.

1.25m deep domestic attenuation system control chamber would use a sealed, square cover and frame, suitable for use with foot traffic only with a 350mm opening size for use at depths greater than 1.2m. (e.g. 6D939 Polypropylene cover and frame). When surrounded by a concrete plinth can be used in situations with loading up to 35kN (3.5 Tonnes), i.e. domestic driveways.

Note: If the 1.25m deep chamber is cut to size to accomodate 0.5m or 0.6m depth of cover AquaCell situations, a 450mm opening size cover and frame should be used (6D935).

Typical Physical Properties of the domestic attenuation system control chamber shall be:

Element	Value	Unit
Nominal Unit Size for garage void storage	1000 x 500	mm deep x mm diameter
Nominal Unit Size for AquaCell storage	1250 x 500	mm deep x mm diameter
2 Incoming Connections	100	mm diameter
1 Outgoing Connection	100	mm diameter
1 Connection to Storage Facility	150	mm diameter
Discharge Rate at 150mm head	0.8	litres/sec
Discharge Rate at 225mm head	1	litres/sec
Discharge Rate at 300mm head	1.16	litres/sec
Discharge Rate at 400mm head	1.4	litres/sec
Storage Depth created for garage void type	300	mm
Storage Depth created for AquaCell type	400	mm

Design procedures: Hydraulic

Garden void application

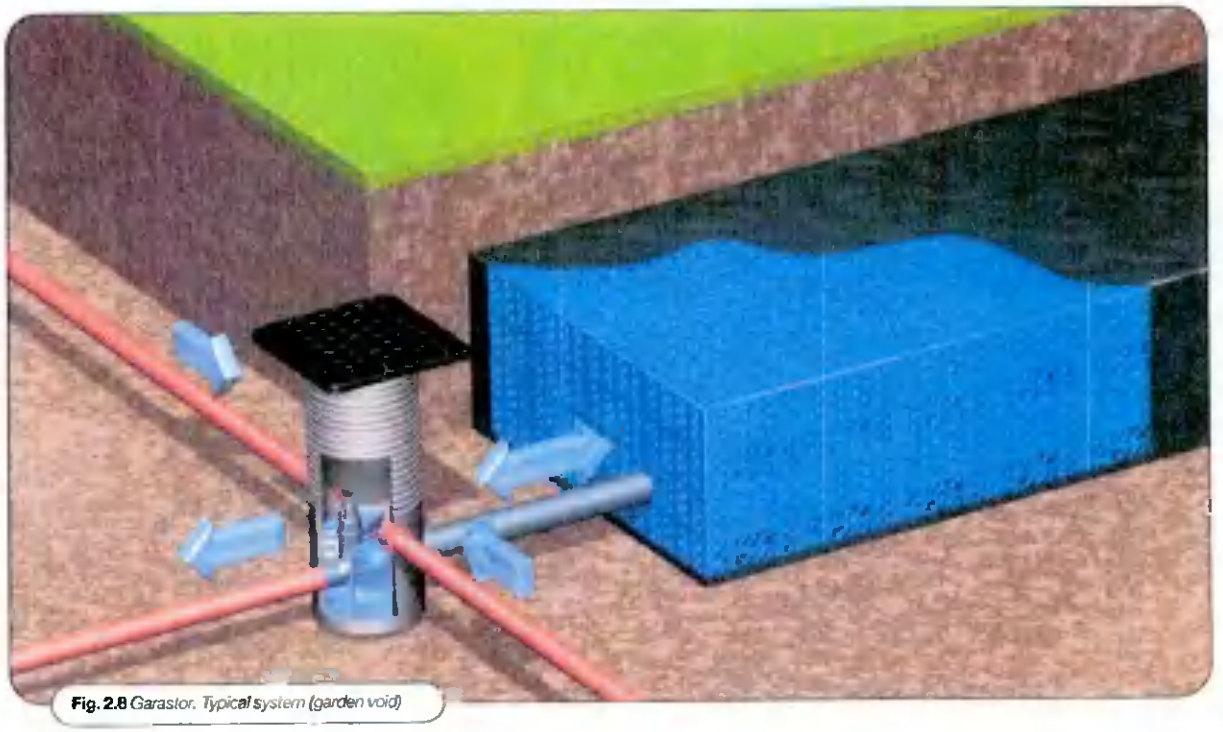


Fig. 2.8 *Garastor. Typical system (garden void)*

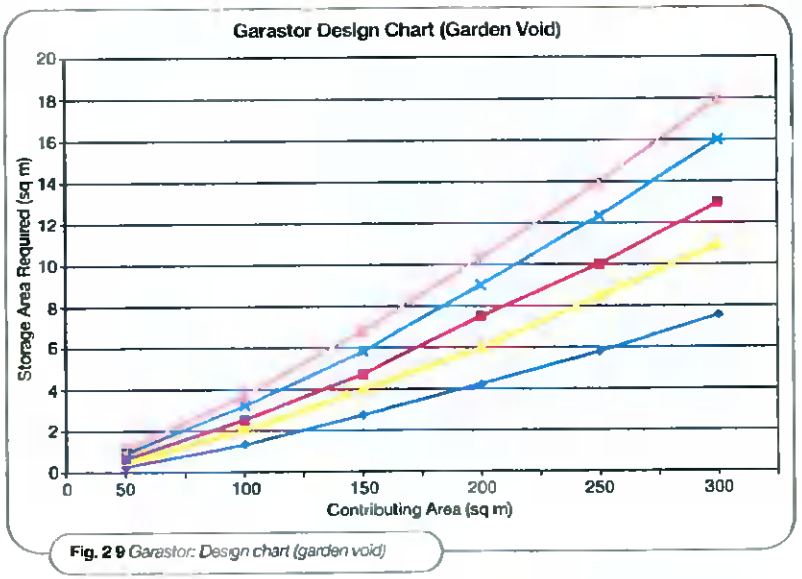


Fig. 2.9 *Garastor: Design chart (garden void)*

2.3.4 Siltation management

Transportation of silt and debris

When stormwater passes over paved or natural surfaces, it will pick up particles of sand, silt and grit. These particles are transported by the shear forces generated by the velocity of the moving water. They may be carried in suspension, or moved by rolling and saltation along the surface over which the water is flowing.

The water will also move other debris. This may include leaves or rubbish which can be transported by floating. The washing of debris from a surface normally happens at the start of a storm and is often known as 'the first flush'.

Design procedures: Hydraulic

Garage void application

Fig. 2.6 *Garastor. Typical system (garage void)*

2.3.3.2 *Garastor system*

Application options

The Garastor control chamber application may be designed to control attenuation in conjunction with:

- A storage void created beneath the floor of a garage (**Fig. 2.6**)
- A storage void (made up of AquaCell units) under garden and driveway areas (**Fig. 2.8**)

Required storage volumes

The volume of the required storage facility may be influenced by consideration of:

- Area contributing to run-off
- Design basis in terms of length of storm return.

For each of the applications, an indicative chart is provided as a guide to required volumes, correlating these factors at a number of design levels (**Figs. 2.7** *and* **2.9**).

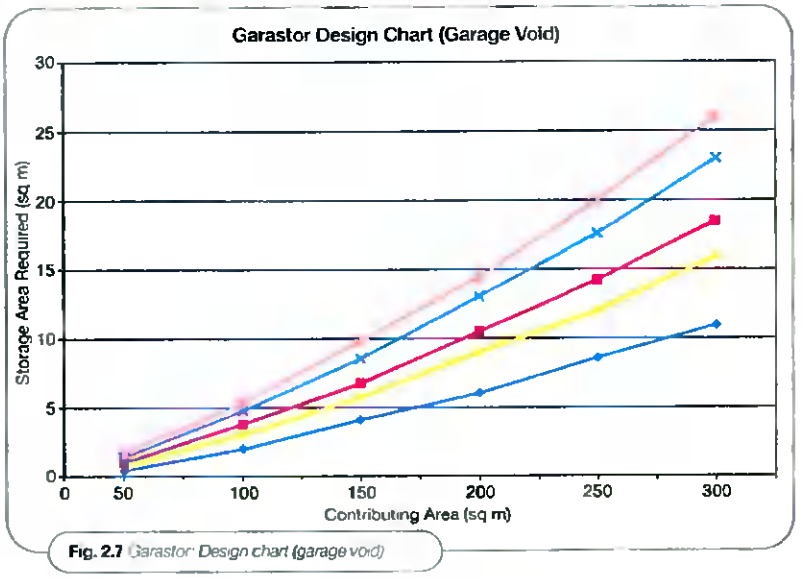
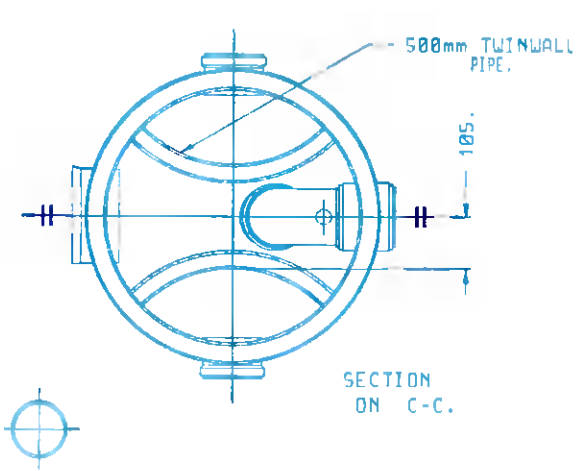
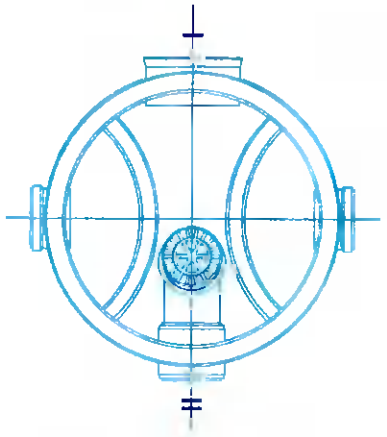


Fig. 2.7 *Garastor Design chart (garage void)*

500mm x 1.25m
GARASTORE
UNIT.

6SC501





ITEM 5. 110mm P/E