NSAI Agrément

IRISH AGRÉMENT BOARD
CERTIFICATE NO. 18/0406

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Cultec Attenuation and Infiltration Systems
Stürmen Sie Wasser Leitung System

NSAI Agrément (Irish Agrément Board) is designated by Government to carry out European Technical Assessments.

NSAI Agrément Certificates establish proof that the certified products are **'proper materials'** suitable for their intended use under Irish site conditions, and in accordance with the **Building Regulations 1997 to 2017**.

PRODUCT DESCRIPTION:
This Certificate relates to the Cultec Recharger® Subsurface Stormwater Management System which comprise of interlocking modular units which, in conjunction with a satisfactory civil engineering design, will act as either an attenuation or infiltration vessel as part of a sustainable drainage system.

USE:
The product is used as a subsurface stormwater management system, used for sub-surface water storage/attenuation or as a soakaway/infiltration tank to manage rain water run-off from impermeable surfaces. Subject to site conditions, the Cultec Recharger® system is designed as interlocking modules and can be built up to create the volumetric capacity required for:

- Attenuation system,
- Infiltration system,
- Or a combined attenuation/infiltration system.

MARKETING, DESIGN AND MANUFACTURE:
The product is owned and designed by:

CULTEC, Inc.
878 Federal Rd,
P.O. Box 280,
Brookfield,
Connecticut 06804
United States of America

The product is manufactured by:

Allied Plastics, Inc.
150 Holy Hill Road,
Twin Lakes,
WI 53181,
USA

and

Horizon Plastics International
Building 3, PO Box 474, Northam Industrial Park
Cobourg, ON K9A 4L1
Canada

The product is marketed by:

SEWES Ltd.
53 Iona Crescent,
Drumcondra,
Dublin 9
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Part One / Certification 1

1.1 ASSESSMENT
In the opinion of the NSAI (National Standards Authority of Ireland) Agrément Board, the Cultec Recharger® system if used in accordance with this Certificate can meet the requirements of the Building Regulations 1997 to 2017, as indicated in Section 1.2 of this Agrément Certificate.

1.2 BUILDING REGULATIONS 1997 to 2017

REQUIREMENT:

Part A – Structure
A1 - The Cultec Recharger® system, as certified in this Certificate, can be designed to ensure that the combined dead and imposed loads are sustained and transmitted to the ground.

Part D - Materials & Workmanship
D3 – The Cultec Recharger® system, as certified in this Certificate, is comprised of proper materials fit for their intended use (See Part 4 of this Certificate).

D1 – The Cultec Recharger® system, as certified in this Certificate, meets the requirements of the building regulations for workmanship.

Part H – Drainage and waste water disposal.
H1 - The Cultec Recharger® system, as certified in this Certificate, meets the requirements of the building regulations for the adequate disposal of surface water from the building.

2.1 PRODUCT DESCRIPTION

The Cultec Recharger® system consists of interlocking chambers and end caps. Chambers are laid on a bed of suitable granular material in rows with a minimum spacing as described in Table 1 between each row.

The Cultec Recharger® range is available in three sizes, the 150XL, the 330XL and the Recharger 902. The Cultec Recharger® 150XL and 330XL are manufactured from high density polyethylene by thermoform moulding. The larger Cultec Recharger® 902 range is injection moulded with impact-modified polypropylene. The 150XL and 330XL range can be supplied with integrated end caps. The Recharger® 902 end cap is a separate polyethylene twin-sheet thermoformed moulding.

The units when assembled on suitable granular material are wrapped in membrane and buried below ground. The assemblies can be used for attenuation applications (temporary storage of storm water) or for infiltration/soakaway tanks to store storm water which in turn will seep back into the ground over time.

When the modules are used for infiltration they are wrapped in a permeable geotextile membrane. When used for attenuation purposes an additional impermeable geomembrane is required. Flange adaptors are used for connecting the modules to PVC pipe work. The Cultec Recharger® system can be designed for use in green field, light and heavy trafficked areas.

A minimum depth of suitable granular material is backfilled over the crown of the units based on the applied design dead and live loads.

The storage capacity of the installation includes the voids within the crushed stone infill surrounding the chambers.

The systems are installed by Cultec trained installers in accordance with the Cultec installation manual.

2.2 ANCILLARY ITEMS

Other items used with the Cultec Recharger® system, but outside the scope of this Certificate, include the following ancillary items,

- CULTEC Separator Row
- Petrol/oil interceptor
- Pipe distribution network
- HVLV Feed connector
- Impermeable geomembrane
- Permeable geotextile membrane
- CULTEC Warning Tape
- Inlet manhole
- Outlet Manhole
- Hydro brake
- Vent pipes
- Fittings/adaptors

Element (unit)	Recharger			
	150XL	***330XL***	***902***	***902 End Cap***
Overall length (m)	3.35	2.59	1.30	0.25
Installed length (m)	3.12	2.13	1.12	0.16
Nominal width (mm)	838	1321	1981	1982
Nominal height (mm)	470	775	1219	1231
Span (mm)	736	1143	1690	N/A
Rise (mm)	419	724	1123	N/A
Foot width (mm)	50	89	147	N/A
Minimum wall thickness (mm)	2.5	2.5	7.6	2.5
Nominal mass (kg)	25	36	39	24
Maximum cut-out diameter in end wall (mm)	300	600	N/A	600
Nominal storage volume (m^3)	0.77	1.48	1.84	0.08
Nominal installed storage volume (m^3)(1)(2)	1.42	2.24	2.83	0.29
Row spacing (mm)	155	155	230	N/A

(1) For 150XL and 330XL models: Based on a minimum thickness of 150 mm of crushed stone above, below and between chambers assuming a porosity of 40% for the stone.

(2) For 902 model: Based on a minimum thickness of 300 mm of crushed stone above, 230 mm between, and 230 mm below the chambers.

Table 1 - Characteristics of Cultec Recharger range

2.3 PRODUCT RANGE

The dimensional and volumetric characteristics of the Recharger 150XL, 330XL and the Recharger 902 are described in Table 1.

2.3.1 Recharger 150XL and 330XL

The Recharger 150XL and 330XL are vacuum formed from sheets of black, high density polyethylene with a blue top layer, by thermoform moulding. The blue top layer provides UV protection. Both units are manufactured with integrated end caps. The end caps are trimmed out from one side of the chamber in the manufacturing facility to produce end of line units, or from both sides to create an intermediate or mid line unit.

Removed polyethylene end caps and trimmings generated in the final stages of the manufacture of the chambers are shredded and reprocessed into the manufacture of new polyethylene sheets. Only clean uncontaminated polyethylene material is reprocessed.

The material properties for the polyethylene Recharger 150XL and 330 XL are given in Table 2.

2.3.2 Recharger 902

he Recharger 902 is injection moulded from blue, impact modified polypropylene. All units are intermediate or mid line units with polyethylene end caps provided as separate units.

Removed polypropylene trimmings generated in the final stages of the manufacture of the chambers are shredded and reprocessed into the manufacture of polypropylene chambers. Only clean uncontaminated polypropylene material is reprocessed.

The material properties for the polypropylene Recharger 902 are given in Table 2.

2.3.3 Recharger 902 End Cap

The Recharger 902 end cap is manufactured from polyethylene sheets using a twin-sheet thermoformed moulding process. Two polyethylene sheets are fused together during the thermoform moulding.

Excess trimming are reprocessed in the same manner as the Recharger 150XL and 330XL. The material properties for the polyethylene Recharger 902 End Cap are given in Table 2.

2.4 DELIVERY, STORAGE AND MARKING

The Cultec Recharger® chambers units are supplied to site in stacks on pallets. Chambers are stacked, and as a result they occupy a significantly smaller volume for ease of transport. Each pack of units carries a label bearing the product name and quantity.

While the Recharger 150XL, 330XL and the Recharger 902 (and end cap) have UV stabilizers added during the manufacturing stage, prolonged exposure to UV radiation in the form of sunlight should be avoided.

2.5 GRANULAR INFILL MATERIAL

Granular fill material must be 25 - 50 mm washed, crushed stone which meets the requirements of Clause 805 material as described in Transport Infrastructure Ireland (TII) *Specification for Road Works Series 800 - Road Pavements - Unbound and Cement Bound Mixtures*. The volume of voids is taken as 40% when calculating the storage capacity of the granular fill.

Granular fill materials must comply with and be CE marked against the requirements of I.S. EN 13242:2001 + A1:2007. To CE mark granular fill material to I.S. EN 13242:2001 + A1:2007 it is inferred that the requirements of S.R. 21:2014+A1:2016 *Guidance on the use of I.S. EN 13242:2002* have been satisfied.

Property	Test Method		Required Specification in accordance with ISO or ASTM test methods unless otherwise noted.	
	ASTM	ISO	Recharger 150XL, 330XL, 902 End Cap	Recharger 902
Tensile Strength	ASTM D638	ISO 527-2	20 MPa	16 MPa(2)
Flexural Modulus @ 2% Secant	ASTM D790 - Procedure A	ISO 178	760 MPa	N/A
Flexural Modulus @ 1% Secant	ASTM D790 - Procedure A	ISO 178	N/A	850 MPa(2)
Melt Flow Rate	ASTM D1238	ISO 1133	10 g/ 10 min	10 g/ 10 min
Izod Impact Resistance	ASTM D256	N/A	N/A	1.5 ft-lb/in(2)
50-year Creep Modulus at 3.5 MPa and 23 degrees C	ASTM D6992 or ASTM D2990	ISO 899-1(1)	92 MPa	165 MPa

(1) Generally, in accordance with ISO 899-1: 2003.
(2) Data obtained from specimens taken from actual formed cellular plastic chamber wall.

Table 2 - Material Properties Cultec Recharger range

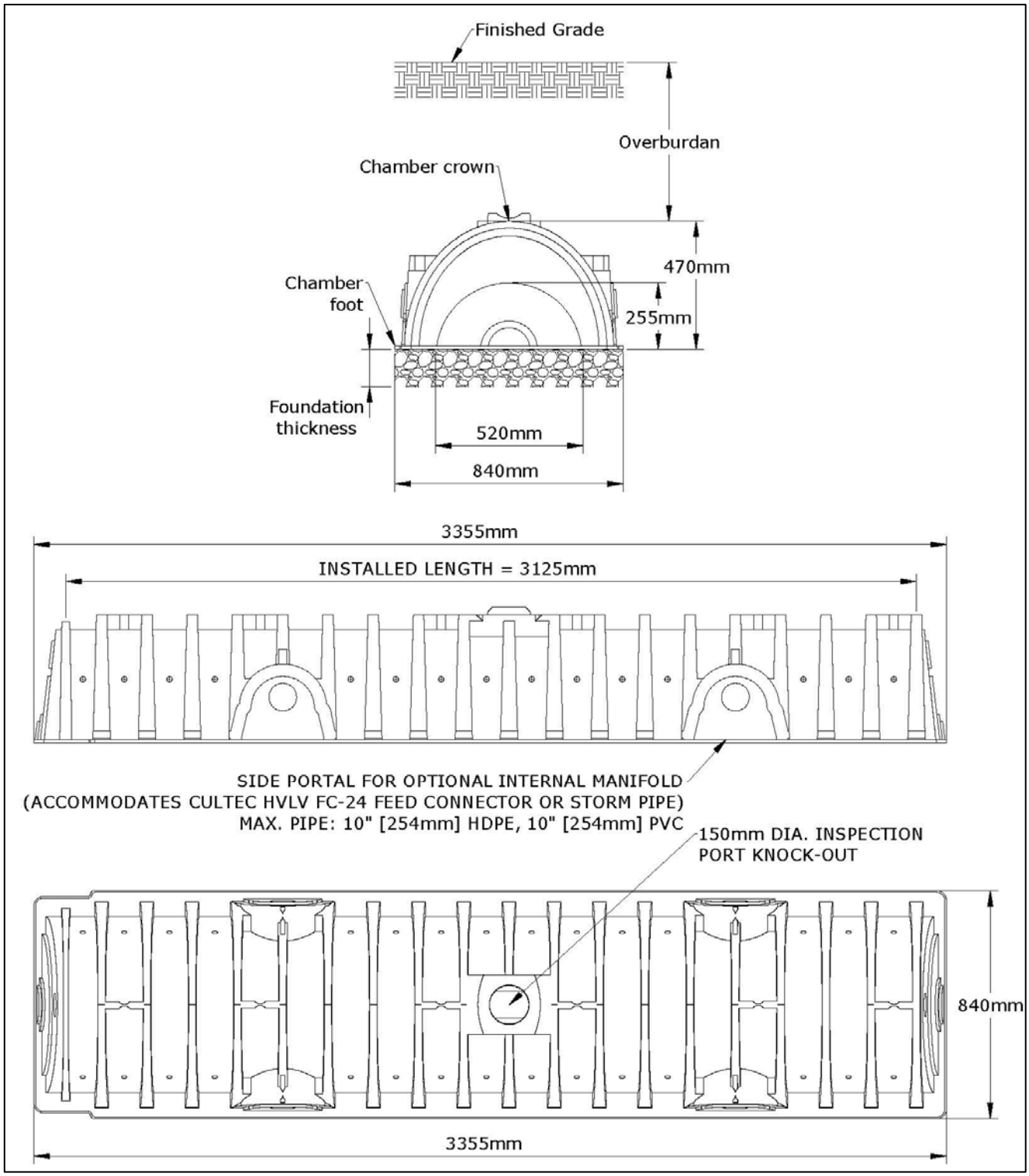

Figure 1 - CULTEC Recharger® 150XLHD

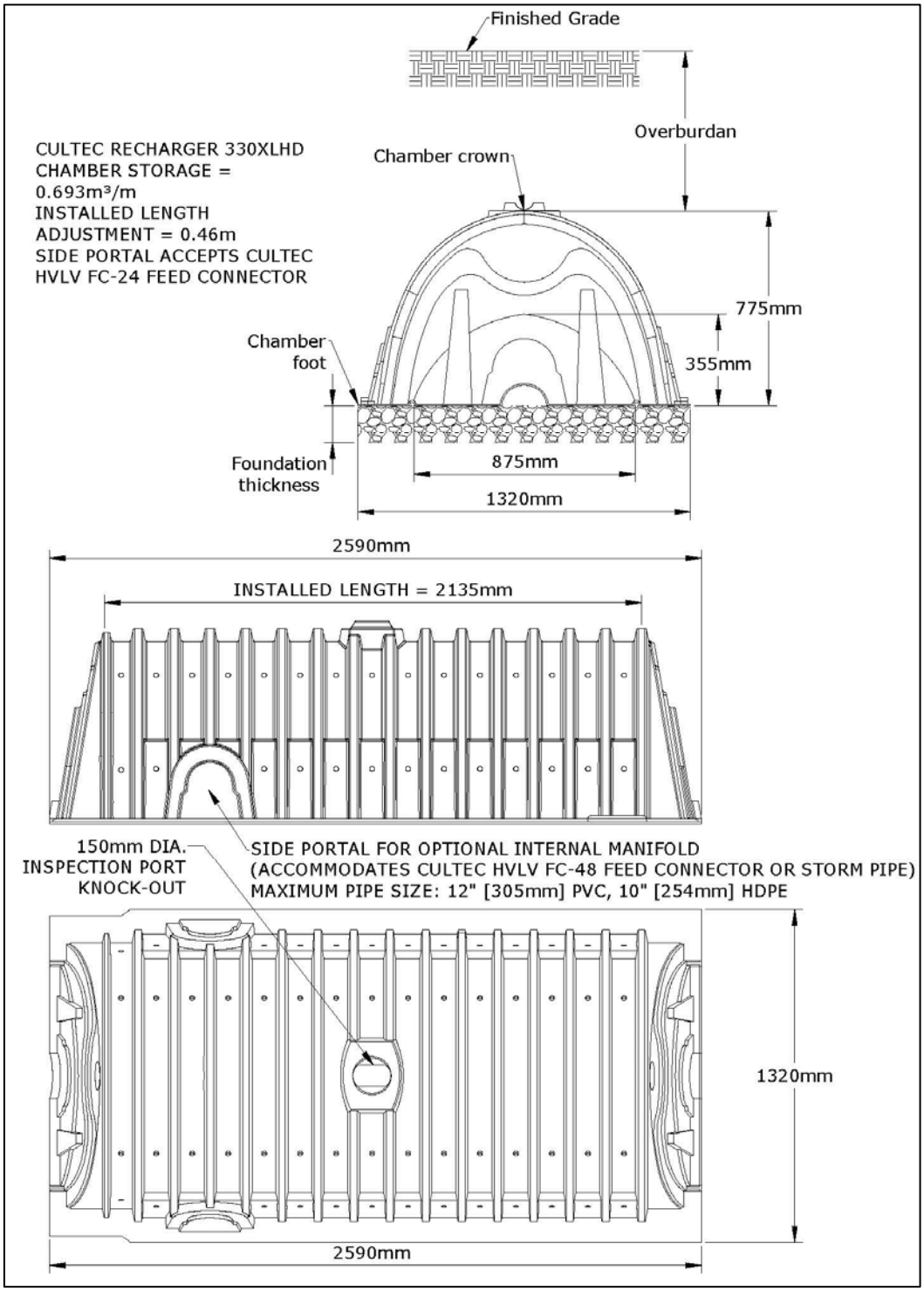

Figure 2 - CULTEC Recharger® 330XLHD

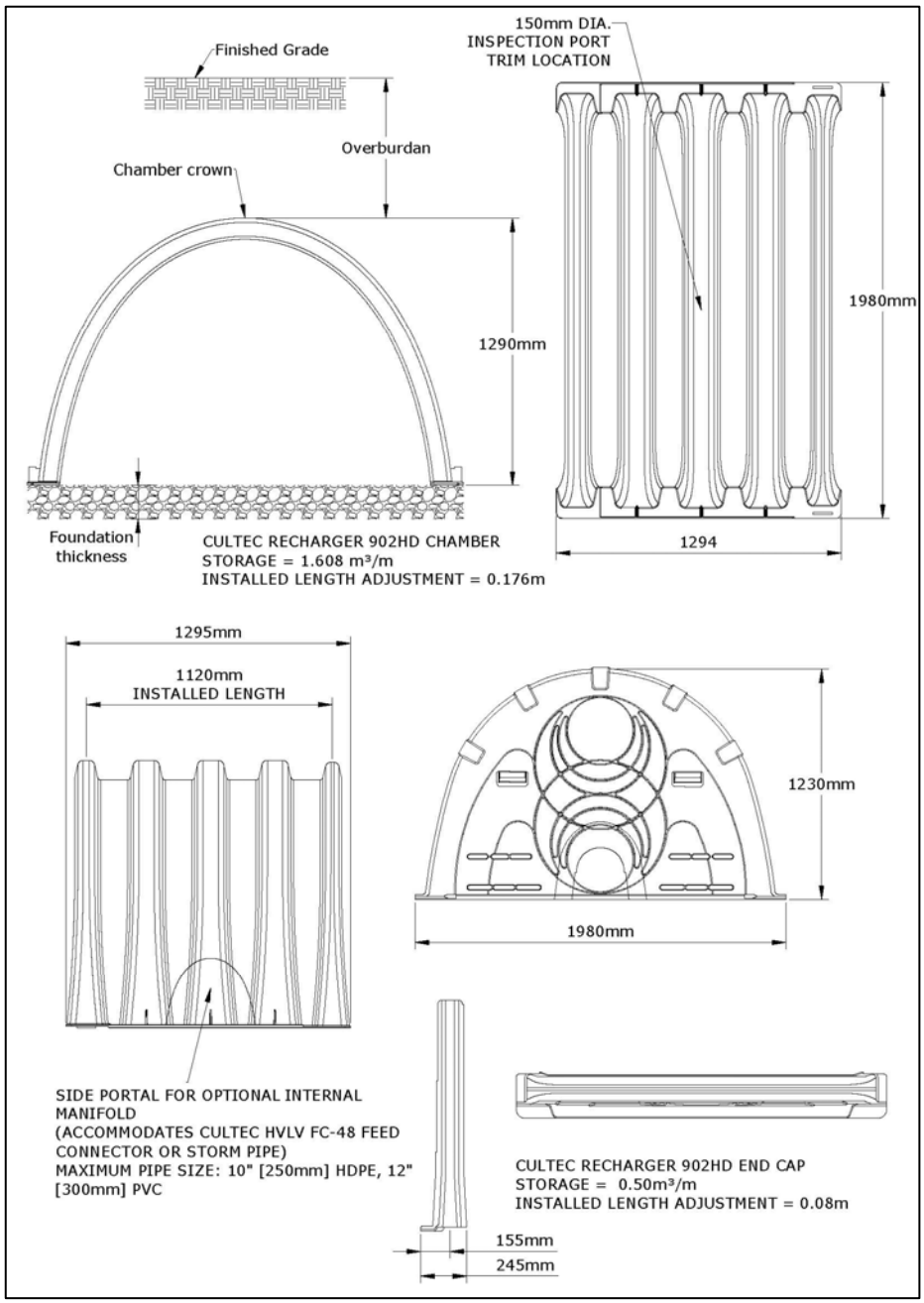

Figure 3 - CULTEC Recharger® 902 HD

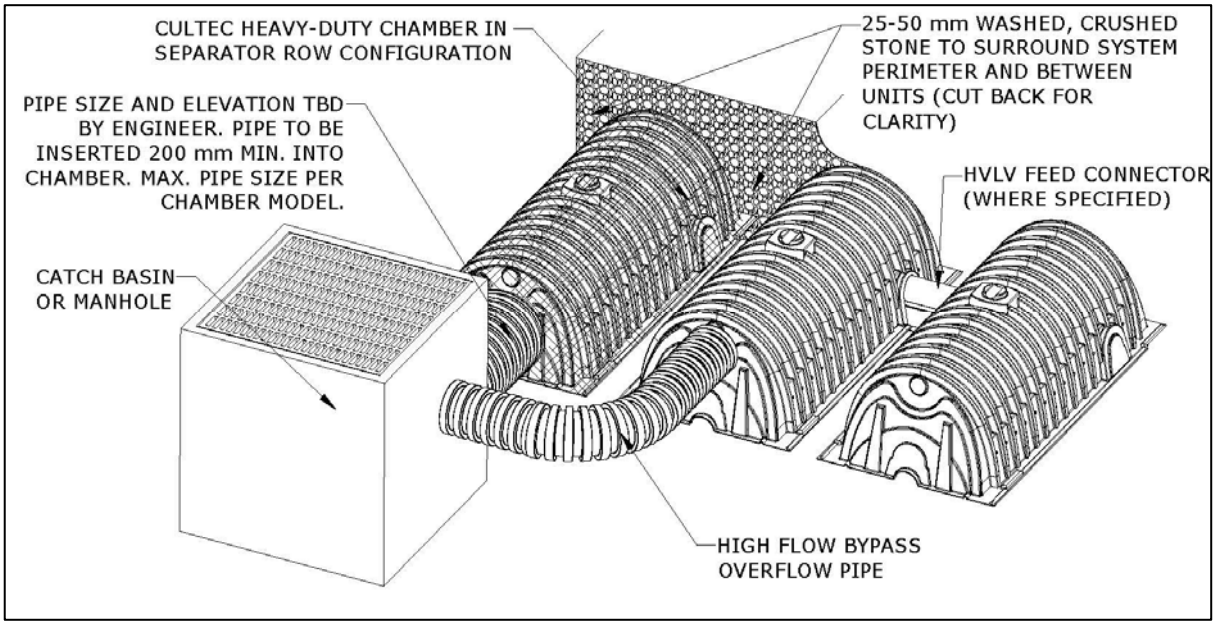

Figure 4 - Typical separator row configuration

2.6 INSTALLATION

2.6.1 General

Prior to commencing site installation, a full site investigation and design as outlined in section 3.0 of this certificate must be completed by a suitable qualified person such as a Chartered Engineer.

Once a location has been specified and invert levels checked, the entire area should be checked for buried cables and utilities. Designers and or project managers' design stage (PMDS), as part of their assessment of Health and Safety, must consider all aspects of the site installation.

Designers should consider the following non-exhaustive Health and Safety issues

- access for plant such as excavators
- embankment of excavations
- installation of temporary works if necessary for deep excavations.
- reducing local water table levels if necessary
- floatation both during and post installation

2.6.2 Installation Procedure

The location for the Cultec Recharger® Subsurface Stormwater Management Chambers is excavated to formation level. The load bearing capacity at formation level is checked to ensure adequate bearing at formation.

As specified in the design, either a non-woven geotextile or combination of a non-woven geotextile and an impermeable liner is placed over the entire site with sufficient material to allow the membrane return up and over the side of the system.

A continuous granular stone base layer is installed to a depth as specified in the site-specific design. Selected chambers are then installed as per the design configuration.

The minimum spacing between successive rows of chambers will be specified on the design and spacers may be provided between chambers to ensure that this minimum spacing is maintained during the back-filling process.

All interconnecting pipe work, inspections chambers and vents are installed prior to backfilling with granular stone to the required depth. The geotextile membrane is then returned over the top of the installation.

Granular well-graded soil/aggregate mixture (<35% fines) can now be placed over the installation to the design depth and compacted in 150mm layers using a roller with a gross vehicle weight not exceeding 50Kn. The dynamic force of the roller must not exceed 89Kn.

The depth of the fill material over the installation will be site specific and will depend on the intended final use of the ground above the installation i.e. green field, trafficked, etc.

2.6.3 Pipe Connections

Pipe connections are made to the system using a pre-formed socket and adaptor or a flange adaptor. These items are outside the scope of this Certificate. Information can be found in the Certificate holder's Product and Installation Guide. When connecting pipes to the system, when used for storage applications (in which the system is wrapped with a geomembrane), care must be taken to ensure a robust, watertight seal is achieved.

3.1 Design General

The Cultec Recharger® system design must be in accordance with the Certificate holder's instructions. Guidance on the application of sustainable drainage systems (SuDS) for new developments, such as the Cultec Recharger stormwater management system, can also be found in the Planning Policy Statement PPS25 *Development and Flood Risk*.

3.2 Design options

The system can be used for the management of stormwater run-off from impermeable surfaces and can be utilized in three ways:

- Infiltration (recharge/soakaway) - stormwater is collected in the system during rainfall and allowed to drain away by soaking into the surrounding ground over a substantial period of time after the rain has stopped.

- Attenuation (detention) - Stormwater is stored within the system during rainfall and released at a reduced flow rate through a flow control device into an appropriate outfall. This reduces peak flows in the watercourse, thereby minimizing the risk of flooding.

- Combined - a combination of infiltration and attenuation.

3.3 Site Investigation

Design of the appropriate system for a specific project must always be preceded by a detailed audit of the proposed site to establish:

- existing factors and considerations applicable to the site;

- predicted factors relating to the site's use following the planned development, and the parameters within which the installation is required to function;

- the type of function of application suggested by this audit.

3.4 Drainage system design.

Once the project criteria have been established from the site survey, there are two main parts to the design procedure: Hydraulic design and structural design.

3.5 Hydraulic Design

3.5.1 Infiltration

There are two design approaches which may be adopted:

- the Construction Industry Research and Information Association (CIRIA) Report 156 *Infiltration Drainage — Manual of Good Practice;*
- or BRE Digest 365 Soakaway Design.

Further information on the design of sustainable drainage systems may be obtained from CIRIA Report C753 which is the SuDS Manual 2015.

3.5.2 Simplified infiltration Design

3.6 A simplified approximate approach can be used on a very small site (i.e. a single-house development) where detailed site infiltration rate information may not be required nor available (see Table **3**). For areas up to 25 m^2, a storage volume equal to the area to be drained multiplied by 10 mm may be used. Beyond this size, design should be carried out in accordance with I.S. EN 752:2008 or BRE Digest 365. It is suggested in I.S. EN 752:2008 that a storage volume equal to 20 mm multiplied by the area to be drained may be used.

3.6.1.1 When the BRE or CIRIA approach is used, the design volumes for the chambers are given in Table 4.

3.6.2 Attenuation Calculation Principles

The anticipated total run-off volume from the site is estimated. The most commonly-used method for evaluating storm rainfall events in Ireland is the Wallingford Procedure, by which the total rainfall level of storms over defined time periods ranging from five minutes up to 48 hours is assessed.

The allowable discharge rate from the site to an appropriate outfall is established but will normally be set by the Department of the Environment or Planning Authorities.

The volume of water to be stored underground in the system is then determined and the number of Cultec Recharger units needed to contain this volume is calculated.

3.7 Outlet connections

Connection is made from the chamber rows to inlet and outlet pipework through the end panels. The inlet pipework must be sized to ensure unimpeded flow for a design storm event. The inlet should be free of obstructions and, in some applications, it may be necessary to use multiple inlet pipes in a manifold configuration.

No. of units	Storage volume[2] (m^3)			Max Area to be Drained (m^2)		
	150XL	330XL	902HD	150XL	330XL	902HD
1	1.42	2.24	3.41	25(3)	112(3)	170(3)
2	2.84	4.48	6.82	142(3)	224(3)	341(3)
3	4.26	6.72	10.23	213(3)	336(3)	511(3)
4	5.68	8.96	13.64	284(3)	448(3)	682(3)

(1) If there is doubt over suitability of ground for infiltration, permeability figure should be derived by test (see BRE Digest 365).

(2) In accordance with Approved Document H. Based on minimum foundation depth of 155mm crushed stone, 155mm crushed stone above and typical centre-to-centre spacing. For the Recharger 902, use 230mm stone base & 305mm stone above.

(3) In accordance with I.S. EN 752:2008 Clause NA 4.4.8.

Table 3 - Simplified Soakaway Design for Single House Development(1)

No of rows	150XLHD				330XLHD				902HD			
	Volume (1)	Side area	Base area	End of chamber area	Volume (1)	Side area	Base area	End of chamber area	Volume (2)	Side area	Base area	End of chamber area
	m^3/m	m^2/m	m^2/m	m^2	m^3/m	m^2/m	m^2/m	m^2	m^3/m	m^2/m	m^2/m	m^2
1	0.59	0.77	1.45	1.12	1.24	1.08	1.93	2.08	2.78	1.75	2.59	4.53
2	1.05	0.77	2.44	1.88	2.29	1.08	3.40	3.67	5.30	1.75	4.80	8.40
3	1.50	0.77	3.43	2.64	3.34	1.08	4.88	5.27	7.82	1.75	7.01	12.27
4	1.96	0.77	4.42	3.40	4.38	1.08	6.35	6.86	10.33	1.75	9.22	16.14
5	2.41	0.77	5.41	4.17	5.43	1.08	7.82	8.45	12.85	1.75	11.43	20.00

(1) Based on a minimum foundation depth of 155 mm of crushed stone and 155 mm above and typical centre-to-centre spacing between chambers & assuming a porosity of 40% for the stone.

(2) Based on a minimum foundation depth of 230 mm of crushed stone and 305 mm above and typical centre-to-centre spacing between chambers assuming a porosity of 40% for the stone.

Table 4 - Volumetric Data for Infiltration Applications

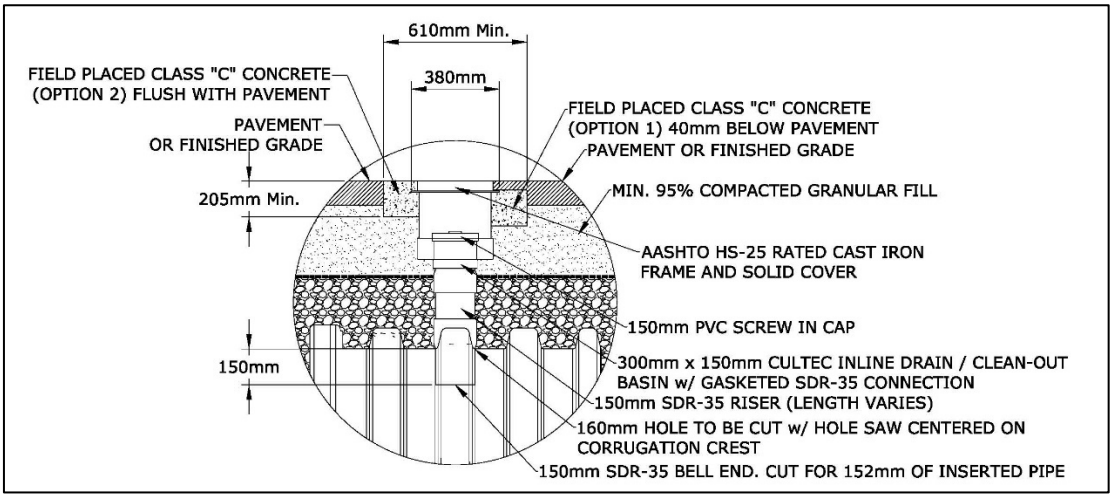

Figure 5 - Recommended Inspection/Vent Configuration

3.7.1.1 The inlet pipework should normally connect to a Cultec Separator Row for capture of sediment and debris (see Clause 3.7.2). Oil separators may also need to be incorporated where there is a likelihood of contamination or the discharge site is particularly sensitive.

3.7.2 Cultec Separator Row

To control the build-up of sediment, chamber systems are normally configured with a separator row. CULTEC's Separator™ Row is used as an inexpensive means of removing Total Suspended Solids from the chamber system, as well as providing easier access for inspection and

maintenance. The Separator™ Row is a row of CULTEC chambers that are to be surrounded in filter fabric for containment of these solids and to provide a filter media for flows passing through the perforations in the sidewalls of the chamber.

Sediment is captured in the separator row and water passes through the fabric. This row is normally located at the inlet locations that receive sediments in storm water and are configured with an upstream manhole and large diameter pipe access for inspection and removal of sediments. A high flow bypass is incorporated to enable flows that exceed the capacity of the separator row to bypass the separator row and feed the chamber bed directly. Once wrapped, it is then placed over a woven geotextile fabric. This geotextile provides a durable surface within the row for maintenance procedures as well as to prevent any scouring of the stone underneath during high pressure jetting.

In the 'Separator Row Maintenance Procedures' CULTEC recommends inspections of the Separator Row to be performed every six months for the first year. The inspection time can then be adjusted based upon previous observation of sediment deposition. Access will be provided via a manhole(s) located at the end(s) of the row for clean out. Maintenance is achieved by pressure washing any sediment out of the Separator™ Row. The pressure washer is to be sent down the entire length of the Separator™ Row. As the high-pressure water nozzle is retrieved, the captured sediments are pushed back into the manhole for vacuuming.

3.7.3 Ventilation

It is recommended that inspection ports (Figure 5) are utilized within the system. These also act as ventilation portals, and at a minimum, there should be not less than one per 350m^3 of storage provided.

3.8 Structural Design

3.8.1 General

The Cultec Recharger Chambers attenuation system consists of a buried attenuation drainage system with two composite components forming the structure of the drainage system, the components area as follows:

1. An arched corrugated chamber with a capping to the ends formed from a high molecular weight polyethylene or from an impact-modified polypropylene.
2. A granular bed and surround consisting of a 25-50mm crushed broken stone.

The corrugated chambers consist of a corrugated open based arch with the arches designed to provide a structural support for the attenuation system, the ached chambers cannot be tested independently to assess the structural integrity of the arches, as the units act compositely with the granular fill.

The arches when laid in the attenuation bed are positioned so there is sufficient space between the rows of chambers to allow the stone filling to be sufficiently bound together when backfilled around the arch.

The granular material consists of a clean crushed broken stone which is sized to create a free volume space for water storage and to create an interlock between the stone to enable an interlocked arch to be formed in the stone around the chambers.

The chambers are laid in longitudinal rows on a granular base and with a full granular surround creating arches between the chambers across the attenuation system. The chambers are only laid on a single horizontal plain which ensure that the arches are always formed and supported off the granular bed and that no geometrical deformities can occur due to vertical or horizontal slippage between units.

The arched shape of the unit and the stone arches created provide a resistance to loads in both the vertical and horizontal planes.

3.8.2 Design Loads

The corrugated chambers act compositely with the granular fill material between the arches and as a result their safe allowable design loads as described in Table 5 of this certificate have been established through a combination of finite element analysis (FEA) and physical in-site load testing.

Minimum subgrade recommendations for the Cultec Recharger® 150 XLHD, Cultec Recharger® 330 XLHD and Cultec Recharger® 902HD are outlined in Table 6, Table 7 and Table 8.

The structural integrity of the Cultec system requires that the subgrade is suitable for the intended loads and application. The foundation stone depth of the chamber system may be modified to produce an acceptable site condition. The design engineer or consultant is responsible for ensuring that the bearing capacity of the subgrade soils meets the requirements of the design.

3.8.3 Site specific Structural design

The appointed Chartered Engineer will provide a structural design of the Cultec Recharger® systems on a project by project basis.

	Short-term Vehicle Loading [2]			Long-term Loading		
	Recharger					
	150XL [4]	*330XL* [4]	*902HD*	*150XL* [4]	*330XL* [4]	*902HD*
Minimum cover depth (mm)	356	406	600	356	406	600
Maximum cover depth (m)	3.66	3.66	2.53	3.66	3.66	2.53
Expected service life (years)	50+	50+	50+	50+	50+	50+
Safety Factor	1.75	1.75	1.75	1.95	1.95	1.95
Design Load Basis	348 kN	348 kN	Case 1[5]: Design truck: Single axle 142 kN. Wheels at 1830 mm centres. Case 2[5]: Design tandem: Two axles 111 kN each Axles at 1220 mm centres Wheels at 1830 mm centres	N/A	N/A	18.9 kN/m^3
Modulus for design condition	N/A	N/A	N/A	138 MPa	138 MPa	165 MPa
Strain Limits [3]	N/A	N/A	4%	N/A	N/A	4%

(1) Design vehicles, loads and load multipliers are based on AASHTO LRFD Bridge Design Specifications, Section 3. AASHTO is the American Association of State Highway Transportation Officials, who set design standards for all aspects of highway construction in the United States.
(2) Parked and moving vehicles and construction equipment may impose load durations from instantaneous to several days. The live load design is based on the most severe combination of live load duration, load factors and modulus that is likely to occur.
(3) Design methods are based on AASHTO LRFD Bridge Design Specifications, Section 12.12. The product strain limit is based on compression testing of the product. Actual strains have been determined by finite element analysis and verified by test.
(4) Structural validation via large scale in situ tests applying the AASHTO design truck live loads.
(5) In each case tire contact area= 508 x 254 mm

Table 5 - Design values

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Cultec Recharger 150 XLHD Subgrade Bearing Stress (kPa)			
Foundation Thickness (mm)			Depth (m) of overburden
155	305	460	
141	90	69	0.41
105	68	53	0.61
101	66	52	0.76
101	66	52	0.91
103	67	53	1.07
106	69	54	1.22
110	71	56	1.37
114	74	58	1.52
118	76	59	1.68
122	78	61	1.83
127	82	63	1.98
132	85	66	2.13
138	88	68	2.29
144	92	71	2.44
149	95	73	2.59
155	99	76	2.74
161	103	78	2.90
167	106	81	3.05
173	110	84	3.20
180	114	87	3.35
186	118	89	3.51
192	122	92	3.66

Table 6 - Subgrade Bearing Stress 150 XLHD

Cultec Recharger 330 XLHD Subgrade Bearing Stress (kPa)			
Foundation Thickness (mm)			Depth (m) of overburden
155	305	460	
208	131	99	0.46
174	111	84	0.61
170	108	82	0.76
170	108	82	0.91
172	109	83	1.07
177	112	85	1.22
183	116	88	1.37
189	120	91	1.52
194	123	93	1.68
200	126	95	1.83
207	131	99	1.98
215	136	102	2.13
223	141	106	2.29
232	146	109	2.44
241	151	113	2.59
250	157	117	2.74
258	162	121	2.90
268	168	125	3.05
277	173	129	3.20
286	179	133	3.35
296	185	138	3.51
305	191	142	3.66

Table 7 - Subgrade Bearing Stress 330 XLHD

Cultec Recharger 902HD Subgrade Bearing Stress (kPa)			
Foundation Thickness (mm)			Depth (m) of overburden
155	305	460	
159	107	84	0.61
152	103	81	0.76
152	103	81	0.91
156	105	82	1.07
162	109	85	1.22
169	114	89	1.37
178	119	93	1.52
184	124	96	1.68
192	129	100	1.83
201	135	104	1.98
211	141	109	2.13
222	148	114	2.29
236	157	121	2.44
248	165	127	2.59

Table 8 - Subgrade Bearing Stress 902 HD

4 DESIGN CONSIDERATIONS

4.1 General

The Cultec Recharger® Subsurface Stormwater Management System must be designed in accordance with the certificate holder's instructions. The design guidance outlined in section 3 of this certificate should be considered.

The system is suitable for the control of storm water run-off from impermeable surfaces. The Cultec Recharger® Subsurface Stormwater Management System can be utilised in three ways as described in Clause 3.2 of this certificate namely an infiltration soakaway, an impermeable attenuation system or a permeable attenuation system which combines infiltration and attenuation.

4.2 Site specific design considerations

The design of the Cultec Recharger® Subsurface Stormwater Management System shall be site specific and shall depend on a number of site-specific factors such as topography, winter water table level, soil type, infiltration rates and tie into levels to water courses or existing surface water drainage systems.

The load bearing capacity of the existing ground must be determined to establish that the formation level has sufficient capacity for the anticipated maximum applied loads. This will include the intended use of the area above the installation weather landscaped or trafficked. This will normally require a geotechnical report.

Once the project specific design factors are established then the two parts of the design process can proceed namely the system drainage design and the structural design.

4.3 Resistance to Chemicals

An assessment indicates that the components of the system are suitable for use in contact with the chemicals likely to be found in rainwater.

An assessment of the suitability for use of the Cultec Recharger® Subsurface Stormwater Management System units on brownfield sites should be made only after a suitable site investigation to determine the possibility for chemical attack. Care must be taken where acids and organic solvents are present at high concentrations. Further information can be obtained from the Certificate holder.

4.4 Bibliography

- C737 *Structural and geotechnical design of modular geocellular drainage systems*
- CIRIA Report C753 The SuDS Manual 2015
- ASTM F2418 *'Standard Specification for Polypropylene Corrugated Wall Stormwater Collection chambers'*
- I.S. EN 1991-2:2003, *Eurocode 1: Actions on structures - Part 2: Traffic loads on bridges*
- I.S. EN 13242:2001 + A1:2007, *Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction*
- S.R. 21:2014+A1:2016, *Guidance on the use of I.S. EN 13242:2002 - Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction*
- BRE Digest 365 Soakaway Design.
- BS 6031: 2009, *Code of practice for earthworks*
- I.S. EN 752:2017, *Drain and sewer systems outside buildings - Sewer system management*
- I.S. EN 1401-1: 2009 Plastics piping systems for non-pressure underground drainage and sewerage. Unplasticized poly(vinylchloride) (PVC-U) — Specifications for pipes, fittings and the system
- I.S. EN ISO 9001: 2000 *Quality management systems — Requirements*
- CIRIA Report 156, *Infiltration drainage — Manual of good practice*
- BRE Digest 365, *Soakaway design*
- CIRIA Report SP124: 1996 Barriers, liners and cover systems for containment and control of land contamination
- Manual of Contract Documents for Highway Works, Volume 1 Specification for Highway Works
- Manual of Contract Documents for Highway Works, Volume 2 Notes for Guidance on the Specification for Highway Works
- PPS25, Development and Flood Risk.
- TII publication DN-DNG03072 Design of Soakaways

5.1 National Standards Authority of Ireland ("NSAI") following consultation with NSAI Agrément has assessed the performance and method of installation of the product/process and the quality of the materials used in its manufacture and certifies the product/process to be fit for the use for which it is certified provided that it is manufactured, installed, used and maintained in accordance with the descriptions and specifications set out in this Certificate and in accordance with the manufacturer's instructions and usual trade practice. This Certificate shall remain valid for five years from date of issue or revision date so long as:

(a) the specification of the product is unchanged.

(b) the Building Regulations 1997 to 2017 and any other regulation or standard applicable to the product/process, its use or installation remains unchanged.

(c) the product continues to be assessed for the quality of its manufacture and marking by NSAI.

(d) no new information becomes available which in the opinion of the NSAI, would preclude the granting of the Certificate.

(e) the product or process continues to be manufactured, installed, used and maintained in accordance with the description, specifications and safety recommendations set out in this certificate.

(f) the registration and/or surveillance fees due to NSAI Agrément are paid.

5.2 The NSAI Agrément mark and certification number may only be used on or in relation to product/processes in respect of which a valid Certificate exists. If the Certificate becomes invalid the Certificate holder must not use the NSAI Agrément mark and certification number and must remove them from the products already marked.

5.3 In granting Certification, the NSAI makes no representation as to;

(a) the absence or presence of patent rights subsisting in the product/process; or

(b) the legal right of the Certificate holder to market, install or maintain the product/process; or

(c) whether individual products have been manufactured or installed by the Certificate holder in accordance with the descriptions and specifications set out in this Certificate.

5.4 This Certificate does not comprise installation instructions and does not replace the manufacturer's directions or any professional or trade advice relating to use and installation which may be appropriate.

5.5 Any recommendations contained in this Certificate relating to the safe use of the certified product/process are preconditions to the validity of the Certificate. However, the NSAI does not certify that the manufacture or installation of the certified product or process in accordance with the descriptions and specifications set out in this Certificate will satisfy the requirements of the Safety, Health and Welfare at Work Act 2005, or of any other current or future common law duty of care owed by the manufacturer or by the Certificate holder.

5.6 The NSAI is not responsible to any person or body for loss or damage including personal injury arising as a direct or indirect result of the use of this product or process.

5.7 Where reference is made in this Certificate to any Act of the Oireachtas, Regulation made thereunder, Statutory Instrument, Code of Practice, National Standards, manufacturer's instructions, or similar publication, it shall be construed as reference to such publication in the form in which it is in force at the date of this Certification.

NSAI Agrément

This Certificate No. **18/0406** is accordingly granted by the NSAI to **Cultec Inc.** on behalf of NSAI Agrément.

Date of Issue: **7th June 2019**

Signed

Seán Balfe
Director of NSAI Agrément

Readers may check that the status of this Certificate has not changed by contacting NSAI Agrément, NSAI, 1 Swift Square, Northwood, Santry, Dublin 9, Ireland. Telephone: (01) 807 3800. Fax: (01) 807 3842. www.nsai.ie