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Elevator

In-situ concrete stormwater storage systems

stormwater MANAGEMENT

Elevator
In-situ concrete stormwater storage systems

With increasingly intense, frequent, and extreme weather events, there is a need to mitigate the flooding and pollution risks caused by uncontrolled surface water run-off, especially in urban and developed zones.

Elevator is an innovative permanent plastic former system used to create an 'adoptable' in-situ concrete attenuation and storage tank for stormwater management.

Its patented design offers engineers and contractors an alternative and cost effective way of achieving a strong concrete water storage void with a very high load bearing capacity and therefore suitability for heavily trafficked areas.

- Provides storage volumes for attenuation of surface water runoff
- Flexible modular system – allows any custom shape and size to be configured to suit site constraints
- Cost effective alternative to conventional pre-cast concrete systems
- Quickly helps to create a high strength reinforced concrete void
- Open structure allows for easy access and maintenance
- Suitable for use with minimal / no cover, beneath car parks and under minor roads, and for use by HGV's
- Lightweight structure – removes the need for costly lifting equipment
- PVC columns can be supplied to required depth

The challenge of surface water management

The problem

Flooding is an issue that needs no introduction in the UK.

Pluvial flooding has become a regular occurrence as our drainage networks become incapable of coping with increased urbanisation combined with climate change.

Since the turn of the millennium, the construction industry has sought to tackle the problems associated with more intensive rainfall, and in particular the volumes of water generated.

This culminated in the Flood and Water Management Act 2010, which sets out the responsibilities for the design, construction, and maintenance of sustainable drainage systems.

Much of the onus to comply with the FWM Act falls on Local Authorities whose role it is to mitigate and minimise both flood and pollution risk by ensuring that hard-landscaping design and installation 'design-out' and 'build-out' both flood risk and pollution risk, usually by employing SuDs techniques.

Key to the successful implementation of any below ground storage structure is that it should have a long design life and be capable of being inspected and maintained. Failure to remove accumulated sediment is one of the largest reasons for failure of any drainage system.

The solution

Stormwater Management Limited specialise in highly innovative water management solutions for source control, water quantity and quality. Stormwater Management are able to offer design, supply and install options to give added assurance.

Elevator, in particular, offers engineers an alternative storage option that meets the requirements the Technical Standards for Sustainable Drainage Systems. Elevator can be used independently or as an integral part of a sustainable drainage system (SUDS) in applications where other storage options would not be viable.

Elevator
The solution

Elevator is an innovative permanent plastic former system used to create an 'adoptable' and high load bearing, in-situ concrete attenuation and storage tank for stormwater management.

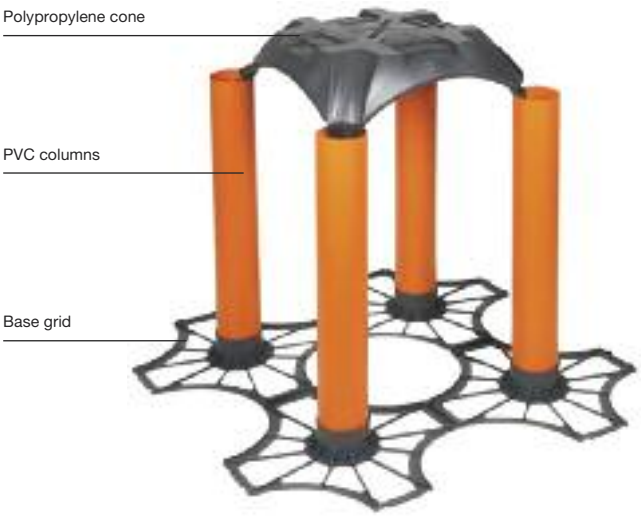
Elevator is manufactured from a lightweight recyclable plastic making it easy to handle and quick to install, and the modular system can be adapted to suit site requirements allowing any custom configuration to be easily and quickly formed.

Elevator creates a high load bearing capacity structure which is suitable for use in many landscaped and vehicular trafficked areas.

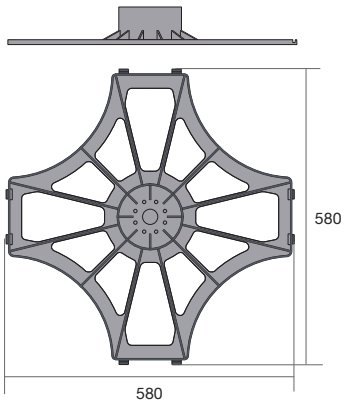
The open internal structure of Elevator offers completely free and easy access for the inspection and maintenance of the system. The design of the system also removes the potential for silt build up or blockage which could affect the long-term functionality of such a stormwater storage system.

Components and accessories

Elevator is comprised of three simple, easy to handle and install polypropylene components.

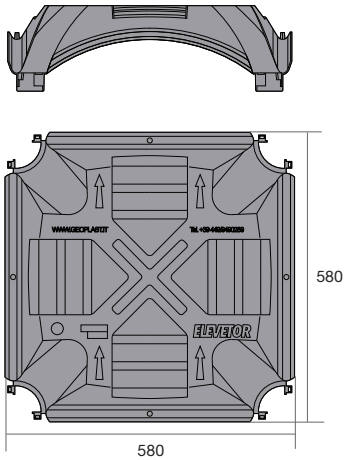


A
Base grid
- Part No. EELBASE5858
- Concrete consumption: n/a



B
Columns
- Part No. EELTUB500-2500
- Concrete consumption: 0.030 m³/m³

C
Polypropylene cone
- Part No. EELEVEN5858
- Concrete consumption: 0.0037 m³/m³



Performance and design

Concrete requirements

The following concrete consumption does not include the base slab, the top slab and the perimeter walls that may vary depending on the project specification.

Concrete consumption of elevator formwork [m^3/m^2] = [0.037 X (net height of internal tank – 0.15)] + 0.030 (see example below).

Example of a tank height 1.5m:

Elevator base + PVC pipes Ø125mm and 1.35m deep and Elevator formwork.

Concrete consumption = (0.037 x 1.35) + 0.030 = 0.080 m^3/m^2.

Elevator Tank Technical Characteristics

The Elevator system makes it possible to create reinforced concrete tanks of custom depth by using the PVC columns supplied to the required length. The maximum depth achievable is 2500mm.

Load (t)	Slab thickness (mm)	Base slab thickness (mm)	Gravel thickness (mm)	Distributed load on ground (KN/m^2)	Welded mesh (mm)
60	150	200	350	8.5	200 x 200 x Ø8mm
45	100	150	300	9.1	200 x 200 x Ø8mm

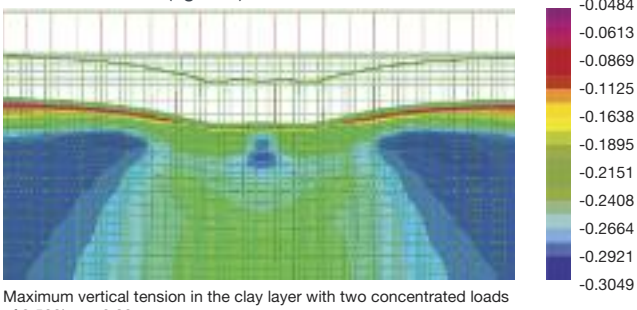
Finite Element Analysis

Finite Element Analysis techniques have been used in accurate modelling of the Elevator System, and has been an integral part of its design development. A site specific example of such a model is shown below.

Finite Element Modelling for a plot of land 16.82 metres long and 7 metres wide, of which 6.30 metres are soft clay and 0.70 metres of compacted DOT type 2.

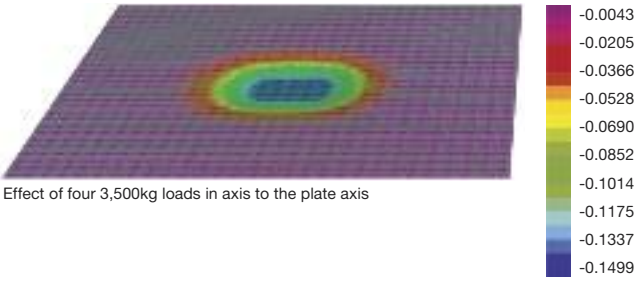
The simulated structure was assumed to have a base of 12cm thick layer of lean mix concrete and a 95cm high Polyline Elevator system with a 5cm top cover slab.

Plate stress: MC (kg/cm^2)



Maximum vertical tension in the clay layer with two concentrated loads of 3,500kg at 2.32m centres.

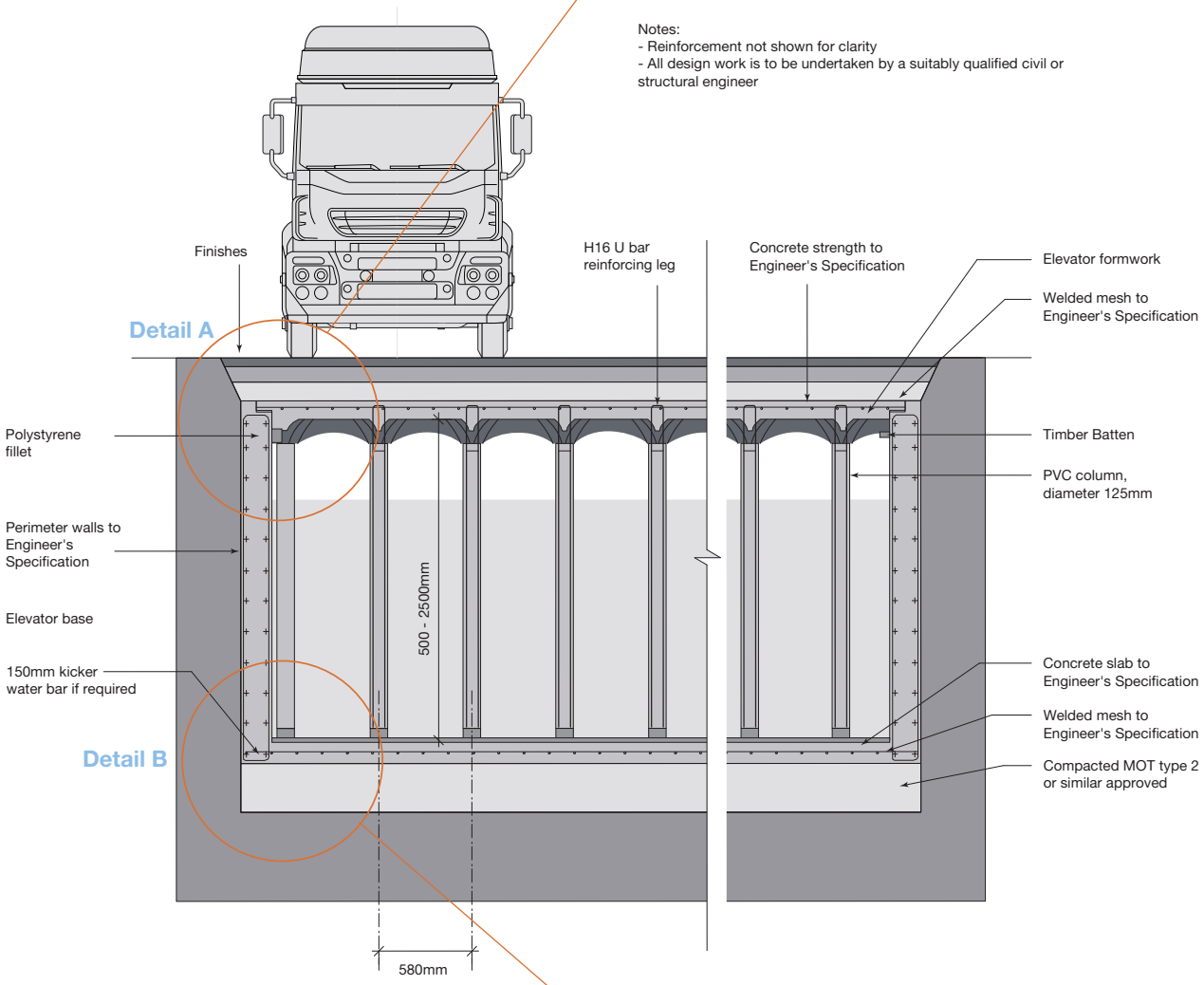
Plate Disp: DZ (cm)

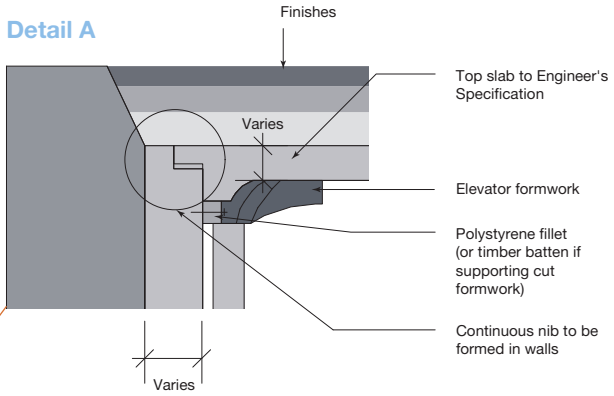


Effect of four 3,500kg loads in axis to the plate axis

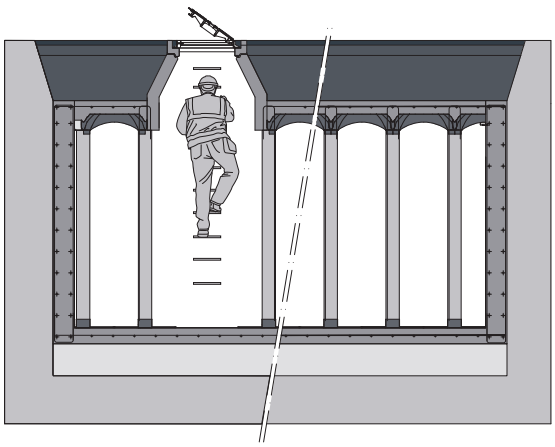
General design information

The Elevator system can be readily be installed in deep, buried applications or close to the surface with a nominal road construction laid over (as in the typical section below), alternatively it can be directly trafficked on the top of the concrete tank roof slab.



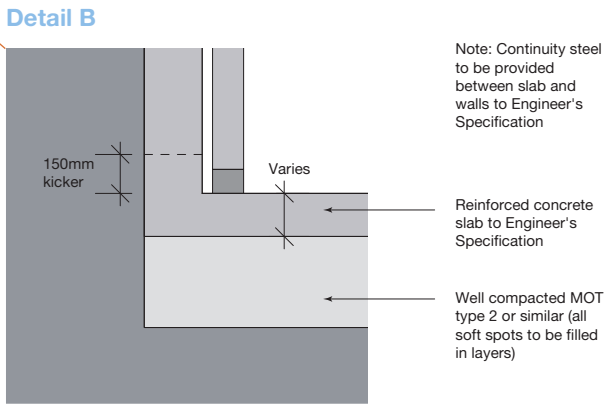


Notes:
- Reinforcement not shown for clarity
- All design work is to be undertaken by a suitably qualified civil or structural engineer



Inspection detail

Position inspection chambers at corners of installation



Notes:
- Reinforcement not shown for clarity
- All design work is to be undertaken by a suitably qualified civil or structural engineer

Installation details

Installation recommendations
The structure is suitable to carry dead, live and dynamic loads. Variations in load capacity can be achieved by changes to the structural specification which makes this system extremely versatile.

The Elevator tank system comprises a reinforced concrete base slab, perimeter walls and a top slab formed by the Elevator form, columns, and grid. The structure has high load bearing capacity once poured and is suitable for overload with both static and dynamic loads.

The top slab of the Elevator system may be surcharged with earth for landscape areas or, alternatively, it can be surfaced with asphalt and directly accessed by vehicular traffic.

Prior to any construction, the prevailing ground condition needs to be established, the advice of a suitably qualified engineer should be sought.

The Elevator base plate grid - laid on the floor – and the Elevator Forms - laid over the columns – are the same for all installations. The columns are all 125mm diameter, and are available in a variety of standard lengths up to 2500mm.

The reinforced concrete base and the concrete side walls are cast in situ, or can be precast to a detailed design by the client's Engineer or his specialist Contractor. The concrete fill to the columns, the concrete cover to the roof of the tank, and the reinforcement of these elements are site specific and designed by the Client's Engineers. Stormwater Management can offer consultancy services and advice on demand.

In order to create an Elevator system the following steps need to be carried out:

1. Excavate the ground to the required depth including any battering of sides to ensure stability (see fig A).

2. Place and compact a gravel subgrade to the engineer's specification to provide a sound base suitable to receive the design loadings.

3. Provide all necessary formwork. Construct concrete slab and walls, all to Engineer's specification, ensuring that pipe inlet/outlet vent connections are provided (see fig B).

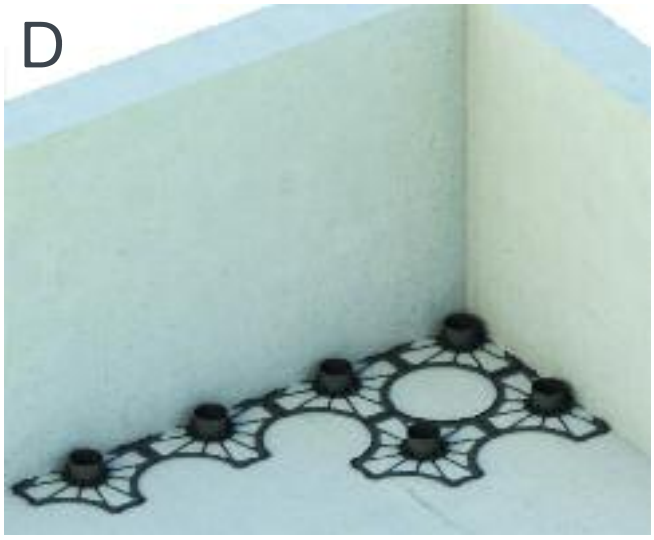
4. Fix timber battens to external walls as Engineer's specification. (Note: timber battens are not provided by Stormwater Management) (see fig C).

5. The grid is assembled on the floor. The columns are placed into the grid. The forms are fitted between the tops of the columns (see figs D-H).

Fig A. The ground should be excavated to the required depth including the battering of sides to ensure stability, then the area should be filled with compacted gravel.

Fig B. The concrete slab and walls should be constructed to Engineer's specification, and the formwork installed.

Fig C. Ensure the outside edge of the first row of forms rests securely on the pre-fixed batten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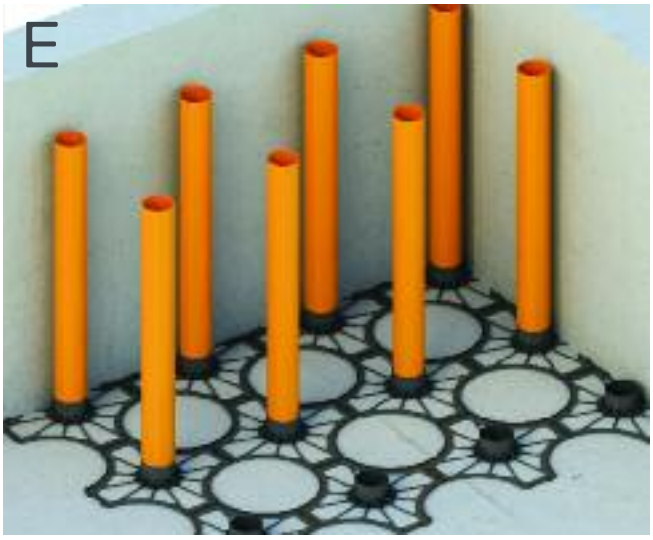
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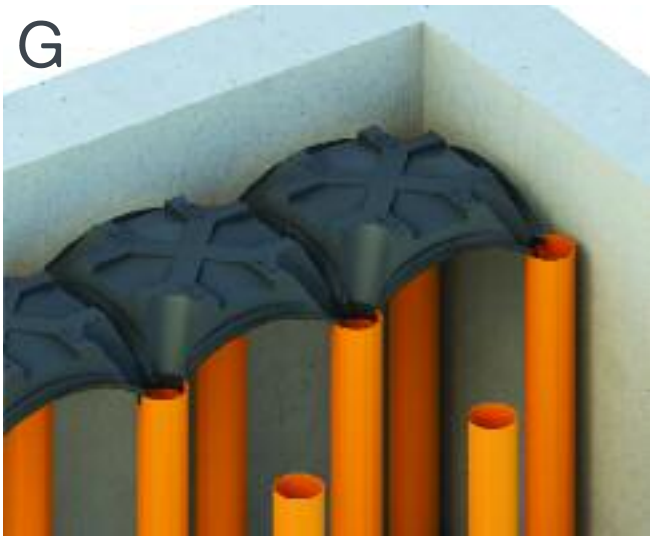
F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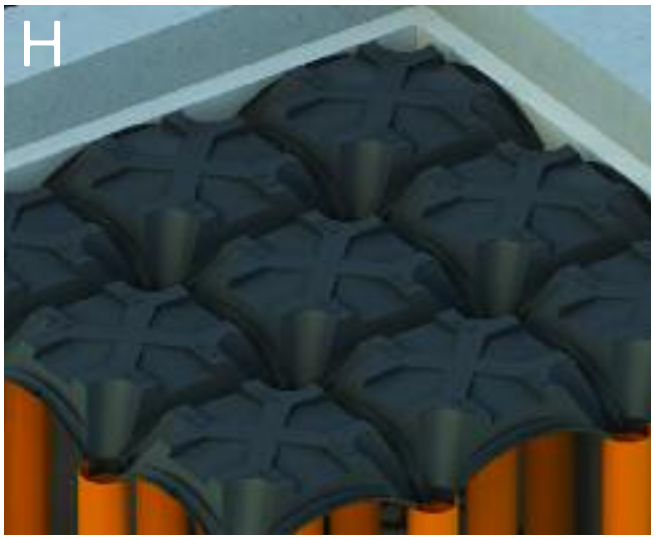
H

Installation details

6. If formwork is cut to suit site constraints, any gaps should be filled using a polystyrene fillet (can be supplied by Stormwater Management).

7. If columns are positioned adjacent to the external walls, a 160mm polystyrene fillet should be used (see fig I).

8. Lay 200mm x 200mm x 8mm welded mesh fabric with suitable laps on top of the polypropylene forms (see fig J).

9. Provide H16 U bar reinforcement leg, (length to suit height of columns), at every column position. Note the 'U' bar is positioned over the 200mm x 200mm x 8mm welded mesh fabric to provide continuity between top slab and columns (see fig K).

10. Provide site specific access holes (see page 7) by cutting mesh reinforcement and top former.

11. Pour concrete slab and columns and vibrate the concrete pour. Concrete strength and thickness of slab to Engineer's Specification (see fig L).

12. Allow concrete to attain 28 day cube strength. Concrete cube testing to Engineer's Specification.

13. Connect all pipework.

14. Backfill to Engineer's specification.

Fig I. A polystyrene fillet piece placed between the tank wall and the first row of forms, to fill the gap when the first row of columns is close to the wall.

Fig J. 200mm x 200mm x 8mm of welded mesh fabric with suitable laps on top should be laid over the polypropylene forms.

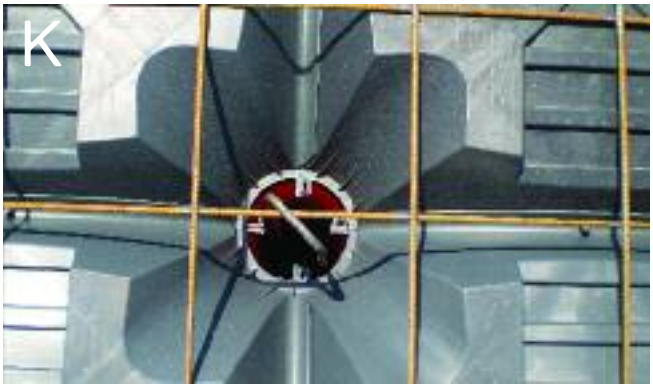

Fig K. U-bar reinforcement is placed inside every column, hung over the bars of the welded wire mesh. Ensure that the bars are long enough to reach the bottom of the columns.

Fig L. Concrete is poured into the slab and columns to Engineer's Specification.

Elevator Specification Clause

The stormwater storage system shall be Elevator by Stormwater Management Ltd. The system shall comprise an in-situ cast concrete structure x.xm high using Elevator formwork to create an accessible and maintainable void. The structure shall be designed by a suitably qualified engineer and installed by a competent contractor.

NBS Specification

Elevator stormwater storage tanks should be specified in NBS section R17:315 Assistance in completing this clause can be found in the Stormwater Management entry in NBS Plus or a model specification can be downloaded from www.storm-water.co.uk. For further assistance, please contact the Stormwater Engineering Team.

Stormwater Management Ltd

Stormwater Management Ltd are specialists in the design, supply and install of surface water and sustainable drainage systems, whether the requirement is for landscaped, hybrid or more engineered drainage systems Stormwater Management Ltd are able to offer a solution.

Based in Hinckley, Leicestershire with a team of design and site engineers, Stormwater Management Ltd provide a wide range of drainage solutions for volume control and surface water treatment.

Maintenance

It is important to note that failure to control and remove sediment build-up in SUDS is the single largest cause of system failure. The incorporation of man accessible inspection wells at inlet and outlet positions (see page 7), can ensure that any accumulated sediment can be removed from potential pinch points in the tank.

The open design of Elevator allows the system to be visually inspected or alternatively, remote CCTV can be deployed from access chambers, inspection points or pipes at the perimeter of the Elevator system.

Other products and applications

Re-Medi8

This unique and versatile filter media can be used for other sustainable drainage treatment train components.

Innolet

Innolet is a range of point drain cartridges that treat Stormwater run-off from roads and comprise aerobic and anaerobic filter to remove priority pollutants.

D-Rainclean

Robust channel systems using bio-remediation media for stormwater run off and excellent pollution control.

Technical Support

Stormwater Management design service

Stormwater Management provide full technical support from design right through to installation and commissioning – from product and system selection, design calculations and CAD drawings, we aim to provide clients with all the relevant technical information.

Whether your scheme uses soft, engineered or hybrid drainage systems Stormwater Management have a range of product and system solutions to allow you to meet your objectives.

On site support

Stormwater Management Ltd. now boasts the largest product range of its kind in the UK. Fully conversant in all Elevator solutions as well as other associated products, our well-trained staff are always available to discuss the technical merits of Elevator and to advise which solution would be most suited to a particular application.

Tel 01455 502222
Email sales@storm-water.co.uk

Stormwater Management Limited
Fleming Road, Harrowbrook Industrial Estate, Hinckley, Leicestershire LE10 3DU

Tel 01455 502222 **Fax** 01455 502223 **Email** sales@storm-water.co.uk **www.storm-water.co.uk**

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