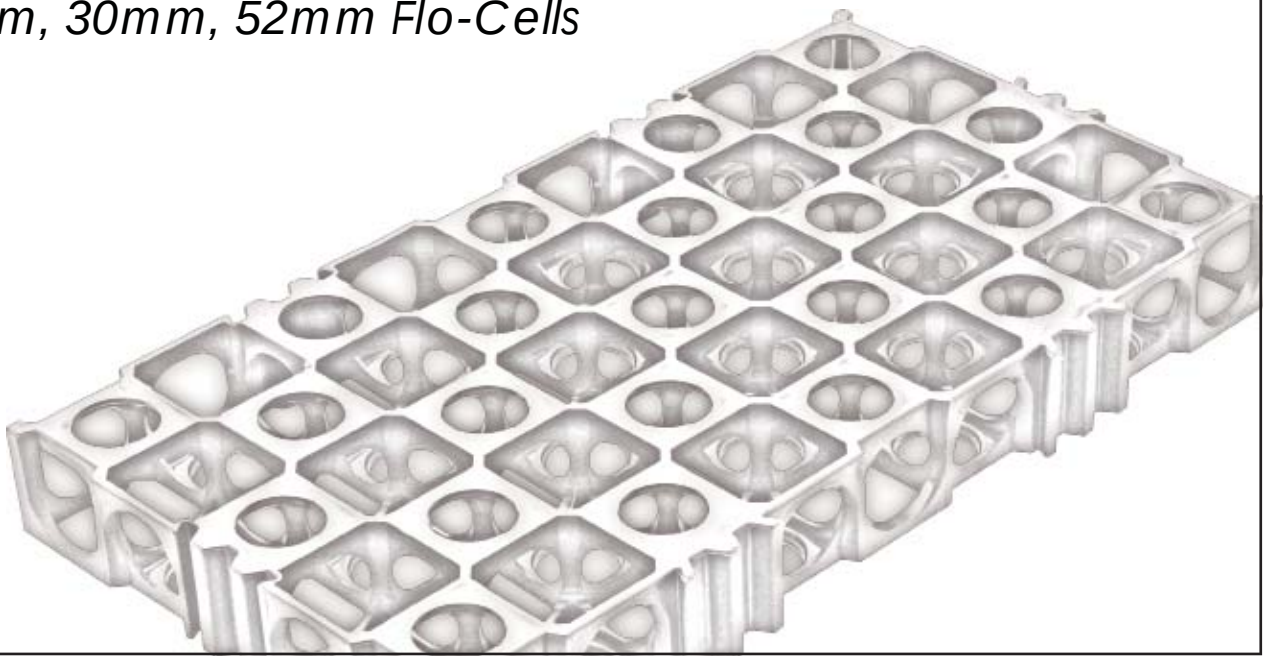
ATLANTIS DRAINAGE CELLS

20mm, 30mm, 52mm Flo-Cells



TECHNICAL SPECIFICATION - **2015**

Australia

Atlantis Corporation Australia Pty Ltd

3/19-21 Gibbes Street Chatswood,
NSW, 2067, Australia
Telephone: +61 2 9417 8344
Email: technical@atlantiscorp.com.au
Website: www.atlantiscorp.com.au

Updated: 11/11/2015

TABLE OF CONTENTS

1. GENERAL

1.1 Scope

This Section provides specifications for the structural design and installation of Atlantis Drainage Cells units for:

- Horizontal and vertical sub-surface drainage
- Porous paving systems and soil reinforcement applications - Turf Cell and Gravel Cell

The sub-surface drainage cell system replicates a permeable surface that conducts water efficiently, while infiltrating until the discharge point. It can be waterproofed to protect adjacent structures such as roofs and walls.

The porous paving system replicates a permeable surface providing durable grass and/or gravel reinforcement suitable for various applications such as parking, driveways, reinforced swales, slope stabilization and boat ramps.

Construction must be carried out in accordance with the requirements of the relevant Statutory Authority. The installation of the Atlantis system must be carefully planned and coordinated with concurrent work on the project such as; grading, excavation works, utilities installation, construction of access roads, site compaction and erosion management. The following documents must be submitted to the engineer: a geotechnical design report and all relevant design information; which includes plans, sections and elevations, site photos and hydrological/hydraulic studies.

1.2 References

This specification is defined in accordance with Australian Standards and Codes, and supplemented by various relevant international standards.

Australian Standards and Codes:

Code	Standards Name
AS 4678	Earth-Retaining Structures
AS/NZS 2566.1	Buried Flexible Pipeline – Structural Design
AS/NZS 1170	Structural Design Actions
AS/NZS 3500	Plumbing and Drainage
AS 5100	Bridge Design
AS 3704	Geosynthetics
AS 3705	Geotextiles – Identification, marking and general data
AS 1289	Methods of testing soils for engineering purposes
AS 1141	Methods for sampling and testing aggregates
AUSTROADS	Bridge Design Code (1992)
AUSTROADS	Guide to pavement technology (2010)
Safe Work Australia, NSW	Excavation Work Code of Practice (2014)
Road and Maritime Services, NSW	QA Specification 3051.

International Standards:

Code	Standard Name
BS EN 1997-1-2004	Eurocode 7: Geotechnical Design
BS 8002:1994	Code of practice for earth retaining structures
AASHTO	LRFD Bridge Design Specifications

International Guidelines:

Code	Standard Name
CIRIA C680	Structural Design of Modular Drainage Tanks
CIRIA C609	Sustainable Drainage Systems

1.3 Drainage Cells

Drainage cells are available in the following heights: 20mm, 30mm and 52mm with approximately 90% voids. They must meet characteristics and dimensions specified in the Atlantis Drainage Cell Technical Package. All three heights can be used for subsurface drainage applications. However, the 52mm and its Heavy Duty version can also be used for trafficable purposes; such as a porous paving system.

Materials shall be plastic with composition of 85% recycled polypropylene and 15% Atlantis proprietary selected plastic.

Drainage cells are lightweight, injection-moulded plastic units. The hollow rings and square pattern allows for maximum flow rate, infiltration and grass root penetration/development. The clipping system must be solid, so as to create a grid like uniform structure to ensure long-term structural performance. Peg like clipping is not acceptable for long-term structural integrity.

Due to the versatility of Atlantis Drainage Cells, Atlantis offers other related products:

- Wall Panel
- Drainage Log

Refer to the following Drawings in Atlantis Drainage Cells Technical Package for further details:

- Drawing 001: 52mm Drainage Cell
- Drawing 002: 30mm Drainage Cell
- Drawing 003: 20mm Drainage Cell
- Drawing 004: Drainage Log
- Drawing 005: Wall Panel

2. QUALITY ASSURANCE

2.1 Tests Performed

Requirement:

Atlantis carries out a batch-testing regime to ensure the products delivered to the marketplace meet our technical specifications.

Program:

A copy of the Atlantis quality assurance batch-test can be provided to the engineer as required.

Description:

Provide an Atlantis certificate to demonstrate that product complies with Atlantis quality management system, with specific reference to the following:

- Material properties of h products
- Measurement of dimensions
- Assembly calibration checks for components
- Measurement of mass of unit
- Visual inspection for defects
- Drop test
- Short-term compression tests
- Impact test/falling weight

2.2 Independent Test Certificates

Compression strength and flow capacity tests have been conducted at various independent universities and laboratories. Testing is done frequently and is continuously updated. Certificates can be sent upon request.

2.3 Delivery, Storage and Handling

Drainage cell units must be protected from damage during delivery and stored under a tarp to protect for sunlight protection if the time from delivery to installation exceeds one week.

3. STRUCTURAL DESIGN

3.1 Ultimate Limit State

Permanent (Dead) Loads

Permanent loads must be determined using AS 4678. The relevant sections are as follows:

- Section 4: Design Loads
  - *4.1: determines the vertical load as specified in AS1170.1*
- Section 5: Material Design Factors
  - *5.2: determine the partial design factors (Table 5.1(A) & Table 5.2(B))*

Imposed (Live) Loads

Traffic loads must be determined according to AS/NZS 2566.1, AS 5100, AUSTROADS Bridge Design Code and Guide to pavement technology. CIRIA C680 and AASHTO may also be used to obtain vehicle data.

According to AS1170.1 and CIRIA C680 the minimum recommended value for imposed loads is a surcharge of 5kPa (0.725 psi).

Load Combination for Permanent and Imposed Loads

Load Combinations must be determined according to AS 4678 and AS 1170.0, which classify different limit states based on stability and strength.

Lateral Loads

Lateral Loads will be determined according to AS 4678.

Lateral loads from nearby hills must be reviewed according to AS 4678 and CIRIA C680.

Uplift Loads

According to AS 4678, hydrostatic pressures causing uplift on the base of retaining structures should be included in design calculations, unless positive means are adopted to ensure that they do not develop. Uplift is determined in accordance to BS EN 1997-1:2004 and CIRIA C680. During the geotechnical checks, if the site is near a body of water or coastline, it must also be checked if there is a tidal water table and/or seasonal water table.

3.2 Serviceability Limit State

Refer to loads and steps stated in section 3.1. Partial safety factors used for the Serviceability Limit State are according to AS 4678, AS 1170, BS EN 1997-1:2004 and CIRIA C680.

3.3 Considering Creep Reduction

AS 4678 is used to determine the creep reduction factor.

4. MAINTENANCE

Under normal conditions and with the use of acceptable backfill materials, maintenance should not be required. See following sections to prevent possible clogging in sub-surface drainage systems.

4.1 Geotextile Protection

A suitable backfill layer must be placed between the geotextile and the in-situ material to clogging up of geoxtile materials with time.

The recommended layer is 100mm thickness; according to As 4678 it should be at least 50mm. Refer to section 5.3 for backfill materials.

4.2 Flushing Ports

Refer to Drawing 007 in Atlantis Drainage Cells Technical Package for further details.

Flushing should be performed, if sediment reaches a predetermined depth or volume of the drainage cell system, which reduces its performance to unacceptable levels.

In case of potential formation of iron oxide, special measures may also be incorporated in the design to allow for clearing of iron oxide blockage by flushing with suitable organic acids (As 4678).

The diameter of the port is determined by a number of factors including the rate at which water will be pumped into the system, the number of flushing ports incorporated, and the possible requirement of vacuuming through the port.

5. INSTALLATION

Installation must be performed only by skilled and competent contractors with satisfactory record of performance, and quality on underground installations. Contractors must adhere to the Atlantis installation guidelines and engineering specifications. If the plans or drawings conflict with our installation guide, please notify authorised engineer.

The geotechnical evaluation of the site to determine ground conditions must be accounted for; this would include seasonal, telluric conditions and soils that are prone to liquefaction. When considering the use of the Atlantis System in contaminated ground the specifying engineer must ensure substances that can cause deterioration of plastics are not present at excessive concentration levels.

Installation may only proceed after approval of existing ground conditions and assurance of satisfactory performance by the specifying engineer. If existing conditions are found unsatisfactory, the specifying engineer must be contacted for further advice.

51. Site Grading

To provide adequate infiltration, minimise erosion and/or maintain sediment control, ensure suitable grading and soil porosity of the base.

5.2 Foundation - Base Preparation

Materials used as founding material must comply with AS 1289, AS 1141 and RMS QA specification 3051.

Ensure that base materials (clean sand or gravel) are structurally adequate to support the applied design loads, particularly when there is presence of groundwater. The depth/width and compaction of the soils will be determined based on the bearing capacity and settlements, which must be calculated by either the specifying engineer, or a qualified geotechnical engineer.

5.3 Backfill

Backfilling must be placed in such a manner so as to avoid uneven loading or damage. A lightweight powered mechanical compactor or roller (Posi Track if a large scale project) should be used to spread materials. The compaction should be hydraulic (with water) to 95% Standard Proctor Density.

Backfill Material

Backfill material should be course washed sand with a mix of particles of 0.5-2mm and with less than 5% fines passing the 75 micron sieve. Alternative material could be aggregate material (10-15mm whased gravel).

Materials must comply with AS 1289, AS 1141 and RMS QA specification 3051.

5.4 Geotextile

Refer to AS 3704-2005 and AS 3705-2012.

For all applications the recommended geotextile shall be made of hydrophilic non-woven needle-punched material. The geotextile should be hydrophilic, so as to allow the infiltration of water. . It should be noted that geotextiles that are hydrophobic repel water due to the molecular structure and are not suitable for use with Atlantis products. Enough overlap must be available.

The authorised engineer must ensure the suitability for individual cases and determine if other geotextiles may be used.

5.5 Impermeable Liner

Liner is used to make faces of the either horizontal or vertical system impermeable and consequently protect adjacent structures.

The recommended geo-membrane is as follows:

- 0.75mm (0.03") HDPE (Suitable for welding)
- 1mm (0.04") HDPP (Suitable for welding)

The authorised engineer must ensure the suitability for individual cases and determine if other selec liners may be used.

5.6 Installation for Sub-surface Drainage Systems

The steps below can be followed for both horizontal and vertical applications. Refer to Drawings 005, 006 and 007 in Atlantis Drainage Cells Technical Package for typical sub-surface drainage installations.

1. (Only required for applications such as green roofs and wall panels) Waterproof the base and the sidewall surface as per engineering details.
2. Lay geotextile (recommended to protect waterproofing membrane).
3. Lay drainage cell units by placing in a way in which they clip up as a continuous blanket.
4. Place drainage cell units continuously over the top of drains inlets. Place some form of marker at finish grade to locate drain inlets.
5. Drainage cell units can be cut or bent to meet inside or outside corners and edges with an electric saw. Units placed on curves and slopes can be clipped thoroughly.
6. Unroll geotextile fabric over panels using widest roll possible to minimize joints. Fabric joints should be made with enough overlaps, 50-150 mm (2-4"), - secured with duct tape or similar as necessary to prevent soil intrusion. Allow for additional fabric to cushion the edges of the drainage cell around the perimeter against the waterproof membrane and walls.
7. Torn or punctured fabric must be covered with patches of new fabric, held in place by tape or continuous bead of adhesive.
8. If required for horizontal and vertical mixed applications such as planter boxes, install afterwards drainage cell units vertically to the walls of the planter boxes and cover with filter fabric. Allow sufficient overlap to the horizontal sections.
9. Cover the panels and geotextile as soon as possible, with a 100-150mm (4-6") layer of coarse washed river sand, taking care to not puncture or tear the fabric.
10. Backfill to required depth using soil least likely to clog the fabric - avoid fine silts, clays, and dusty organic materials. Perform clogging test beforehand if questions of backfill suitability exist.

The authorised engineer must check and review these considerations.

5.7 Installation for Porous Paving Systems

It should be noted that the 30mm Drainage Cell wrapped in geotextile could be used in less permeable soil conditions as a subsurface drainage layer to store or remove excess water.

After the authorised engineer has confirmed that all the site and ground conditions are suitable, the following installation recommended procedures specific to various applications should be followed.

Turf-Landscape Applications

1. (If necessary) Remove the turf and topsoil to the required specified depth and dispose all debris.
2. Install edge-retaining boards for support if required (i.e. if unstable soil).
3. Place coarse washed sand (0.5 to 2mm) over the prepared sub-base to grades highlighted on plans. Ensure that the material is compacted to 95% Standard Proctor in 150mm (6") lifts.
4. Place the pre-assembled 52mm Drainage Cell panels on the prepared sub-base; slip the individual panels to each other with the clips provided.
5. The panels can be cut using a hand or power saw to fit around bends and corners.
6. Fill the 52mm cells with the specified root zone grow mix (sand and potting mix). The content of organic mix depends on climatic conditions and rainfall: 80-90% sand and 10-20% organic compost. Ensure that the cell structure is over filled by at least 10mm to the finished level. A lightweight vibrating plate can be used to adequately compact the cell structure.
7. Use the normal seeding, watering and fertilizing process. A fine layer of top mulch is applied to cover the seeds and provide optimum germination conditions. A pre-grown turf can also be used – simply roll it on the surface.
8. The seeded areas must be protected from any traffic, other than emergency vehicles, for a period of 4-6 weeks.

Gravel Applications

1. Follow Steps 1-5 in the For Turf-Landscape Application section. Ensure that the grading and soil porosity of the sub-base will provide adequate subsurface drainage. The 30mm Drainage Cell wrapped in geotextile can be used as a water pressure relief system if the soil is in low permeability conditions.
2. Fill the 52mm cell surface with aggregate material, 10-15mm washed gravel is preferred.
3. The cell structure should be over filled by at least 10mm to the finished level. Compact the surface using a lightweight roller or plate compactor until an adequately firm surface is achieved (95% Standard Proctor).

The authorised engineer must check and review these considerations.

5.8 Cleaning

Cleaning must be performed during the installation of work and upon completion of the work. Remove all excess materials, debris, and equipment from site. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

5.9 Infiltration Systems Considerations

Infiltration systems receive stormwater and allow it to soak safely into the ground. Stormwater disposal systems are recommended to be at least 1m (3ft) above impervious layers or groundwater levels in order to prevent groundwater pollution.

5.10 Recommended Placement of Other Materials

Other materials placed directly upon the geo-membranes should be done with caution following next recommendations. The authorised Engineer must check and review these considerations.

Large Tree Balls

A slight cone of sand should be placed at the centre point of the tree location, with a 30mm (1.2") waterproof liner (min. thickness) 600-650mm (2-2.2ft) larger in diameter than the tree ball placed over the sand cone. This will encourage strong tree roots to grow horizontally. Drainage water will flow to the edge of the liner before passing into the drainage layer.

Paving Materials

Such as brick, concrete pavers and slabs, wood decking, stone slabs, etc., can be placed directly upon the fabric - provided the edges of the materials will not tear or puncture the fabric during handling. This will allow weight to be minimized. Otherwise, use traditional setting beds of sand and cement binder (allowing for drainage) between the drainage fabric and the paver. Aluminium or plastic "L" or "T" edging materials can be used to contain paving materials.

Planter Retaining Walls

Masonry or wood (railroad ties) planter walls can be placed directly upon the Drainage Cell and fabric covered structure, preferably with an additional layer of geotextile in between to act as a cushion. These planter walls should be designed to be self-supporting, with opposite walls tied together to maintain shape and resist "blow-out" pressure. Segments of upstanding pre-cast concrete pipe can be used successfully for planters also.

Irrigation systems

If possible, use of low - pressure spray, or drip, irrigation systems should be used (especially on roof decks) with all lines placed above the drainage fabric to minimize penetrations and chances for soil leakage. Valve boxes, supply mains and manifolds can be placed below and/or through the drainage layer and treated like any other vertical obstruction.

Electrical Wiring

All electrical wiring for current above 24v should be placed in conduit with watertight joints per electrical codes, and placed above the drainage fabric layer. If codes allow, low voltage wiring can be laid loose, secured to bottom side of protection board (1x2), or run in plastic pipe conduit (which allows easy replacement without disturbance of landscaping). Penetrations of drainage fabric layer should be avoided, or at least minimized.