

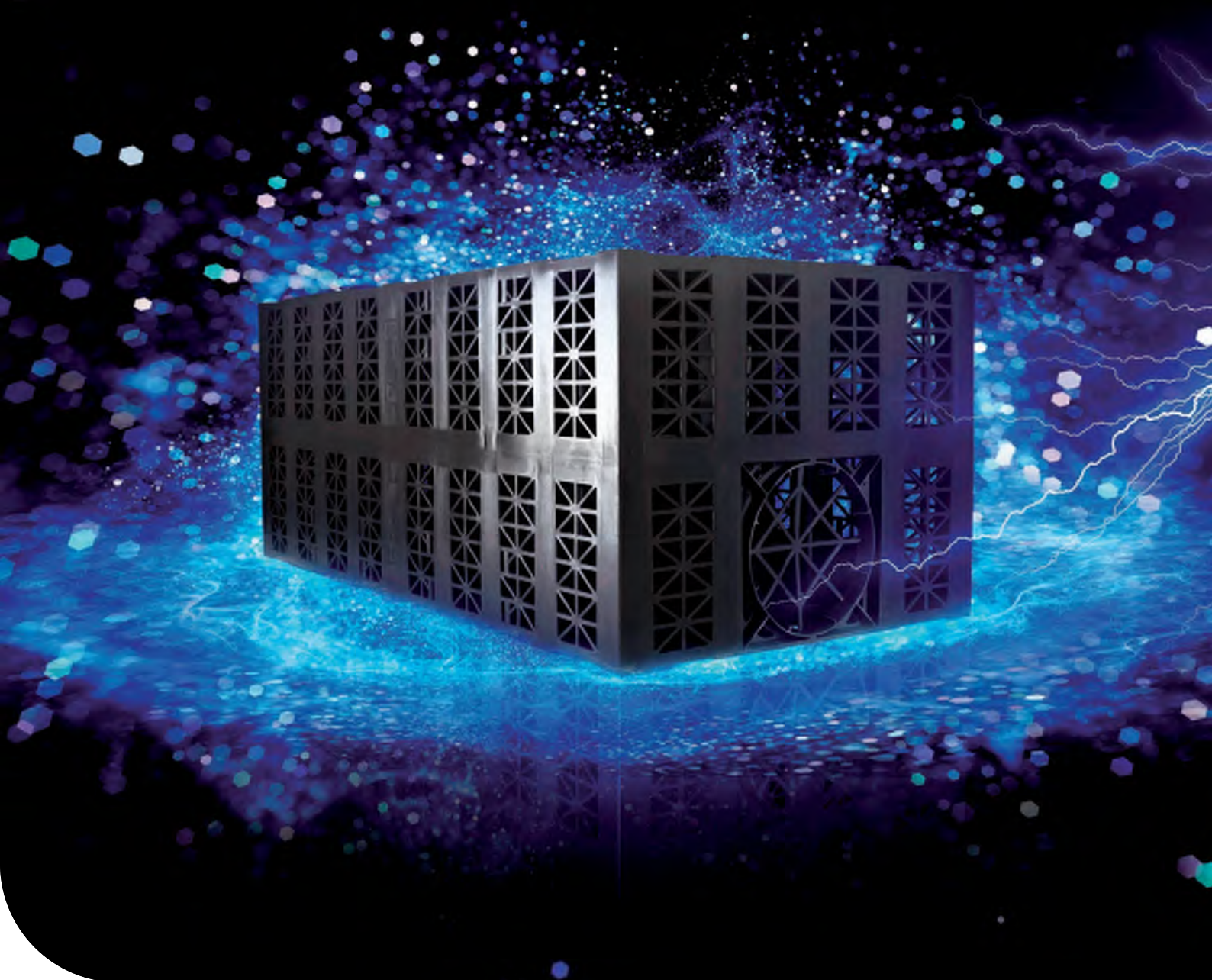
Appendix E

Manufacturer Specific Information

WATER MANAGEMENT

AquaCell systems

Product and installation manual



AquaCell Eco

Application

AquaCell Eco is manufactured from specially reformulated, recycled material and has been specifically designed for shallow, non-trafficked, landscaped applications. AquaCell Eco is **NOT** suitable for locations subject to high water tables.

AquaCell Eco is typically suitable for installations to a maximum depth of 2.68 metres, to the base of the units from ground level, with a minimum cover depth of 0.3 metres, (CIRIA's recommendation, is to allow a cover depth of 0.5 metres in applications where a ride on mower may be used).

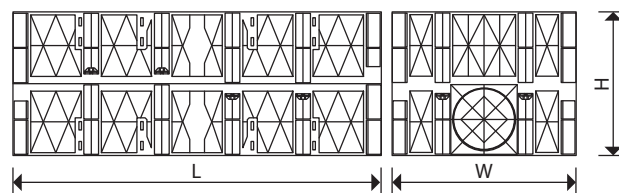
Any installation using AquaCell Eco must **NOT** be subjected to additional loading at any time. Trafficking by construction plant on site, including mechanical equipment, must be avoided.

If trafficking of the buried tank by construction plant or, other vehicles is unavoidable, the installation should be constructed using AquaCell Core-R units (see page 9).

The width of an AquaCell Eco installation should not exceed 12 metres to allow for mechanical backfilling without loading. There is no limit to the length of the installation.

Features and benefits

- ⌚ Manufactured from specially reformulated, recycled material
- ⌚ Suitable for both soakaway and attenuation applications
- ⌚ Proven vertical loading capacity of: 21.3 tonnes/m² (213kN/m²)
- ⌚ Proven lateral loading capacity of: 5.2 tonnes/m² (52kN/m²)
- ⌚ Integral "hand holds" for ease of carrying/handling
- ⌚ BBA approved – Certificate No 03/4018



Material: Reformulated polypropylene

Nominal size (mm)	Part number	Dimensions (mm)		
		W	H	L
160	6LB025	500	400	1000



Maximum installation depths – to base of units (m)¹

Typical soil type	Soil weight kN/m ³	Angle of internal friction ϕ (degrees) ^{2, 3}	Landscaped areas
Over-consolidated stiff clay	20	24	1.53
Silty sandy clay	19	26	1.68
Loose sand and gravel	18	30	2.08
Medium dense sand and gravel	19	34	2.35
Dense sand and gravel	20	38	2.68

(1) These values relate to installations where the groundwater is a minimum of one metre below the base of the excavation.

(2) AquaCell Eco units should not be used where groundwater is present.

(3) 0.5m cover is required where a ride-on mower may be used.

Assumptions made: ⌚ Ground surface is horizontal

⌚ Shear planes or other weaknesses are not present within the structure of the soil.

Source: BBA

AquaCell Core-R

Application

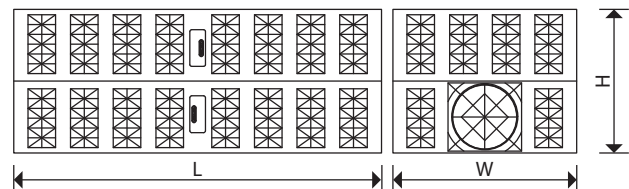
AquaCell Core-R has been designed for use in deep applications, subject to regular and heavy traffic loadings, e.g. cars and HGV's. AquaCell Core-R can also be used for deep soakaways and landscaped applications.

Typically for use down to depths of 6.68m in landscaped areas (6.43m trafficked by cars) to the base of the units from ground level, in best soil conditions.

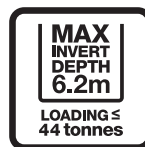
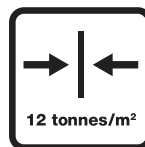
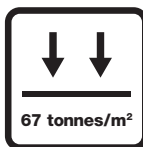
Trafficking by heavy construction plant on site, including mechanical equipment, must be avoided until the minimum cover depth of 1.11 metres is in place.

Features and benefits

- ⌚ Suitable for regular and heavy traffic loadings
- ⌚ Proven vertical loading capacity of: 66.9 tonnes/m² (669 kN/m²)
- ⌚ Proven lateral loading capacity of: 12.3 tonnes/m² (123kN/m²)
- ⌚ BBA approved – Certificate No 03/4018
- ⌚ Ideal for all types of shallow and deep projects including major attenuation and infiltration schemes



Nominal size (mm)	Part number	Dimensions (mm)		
		W	H	L
160	6LB150	500	400	1000



Maximum installation depths – to base of units (m)¹

Typical soil type	Soil weight kN/m ³	Angle of internal friction ϕ (degrees) ^{2,3}	Landscaped areas	Vehicle mass <9 tonnes ^{4,5}	Vehicle mass <44 tonnes
Over-consolidated stiff clay	20	24	3.85	3.61	3.36
Silty sandy clay	19	26	4.35	4.09	3.83
Loose sand and gravel	18	30	5.34	5.06	4.78
Medium dense sand and gravel	19	34	5.94	5.68	5.41
Dense sand and gravel	20	38	6.68	6.43	6.18

- (1) Without groundwater present below base of units – AquaCell Core-R may be used where groundwater is present, contact Wavin for technical advice.
- (2) Loosening of dense sand or softening of clay by water can occur during installation. The designer should allow for any such likely effects when choosing an appropriate value of ϕ .
- (3) The design is very sensitive to small changes in the assumed value of ϕ , therefore, it should be confirmed by a chartered geotechnical engineer. In clay soils, it may be possible to utilise cohesion in some cases.
- (4) Applicable for car parks or other areas trafficked only by cars or occasional refuse collection trucks or similar vehicles (typically one per week).
- (5) This category should be used when considering landscaped areas that may be trafficked by ride on mowers.

Assumptions made: ⌚ Ground surface is horizontal
 ⌚ Shear planes or other weaknesses are not present within the structure of the soil.

Source: BBA

AquaCell Plus-R

Application

AquaCell Plus-R has been designed primarily for use in applications where inspection is required. It is suitable for use in all applications from landscaped areas to heavily trafficked areas (for vehicles up to 44 tonnes). The units can be used in combination with AquaCell Core-R (and Eco if there is at least one layer of Core-R in between the Plus-R and Eco layer).

Extra lateral loading capacity allows installation at greater depths. Integral inspection channels in each unit combine to create viewing channels for the full length of the installed structure.

Typically for use down to depths of 7.82m in landscaped areas (7.57m trafficked by cars and 7.3m trafficked by HGV's) to the base of the units from ground level, in best soil conditions. Trafficking by heavy construction plant on site, including mechanical equipment, must be avoided until the minimum cover depth of 1.30 metres is in place.

Features and benefits

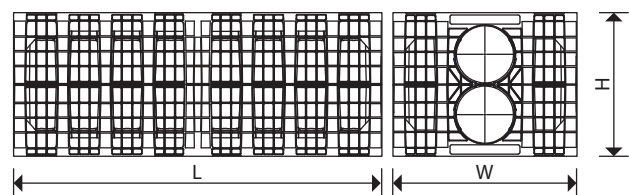
- ⌚ Suitable for extra deep installations
- ⌚ Inspectable (supplied with end cap for use when an inspection channel is not required)
- ⌚ Proven vertical loading capacity of: 70.2 tonnes/m² (702 kN/m²)
- ⌚ Proven lateral loading capacity of: 15.1 tonnes/m² (151 kN/m²)

Maximum installation depths – to base of units (m)¹

Typical soil type	Soil weight kN/m ³	Angle of internal friction ϕ (degrees) ^{2,3}	Landscaped areas	Vehicle mass <9 tonnes ^{4,5}	Vehicle mass <44 tonnes
Over-consolidated stiff clay	20	24	4.67	4.42	4.17
Silty sandy clay	19	26	5.03	4.78	4.53
Loose sand and gravel	18	30	5.86	5.61	5.36
Medium dense sand and gravel	19	34	6.87	6.62	6.37
Dense sand and gravel	20	38	7.82	7.57	7.30

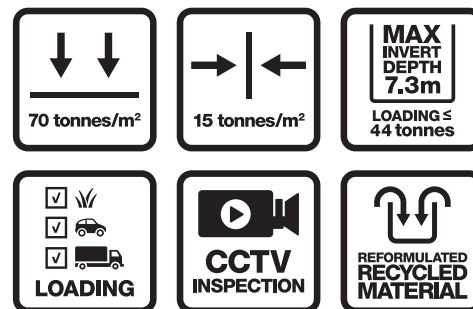
- (1) Without groundwater present below base of units – AquaCell Plus-R may be used where groundwater is present, contact Wavin for technical advice.
- (2) Loosening of dense sand or softening of clay by water can occur during installation. The designer should allow for any such likely effects when choosing an appropriate value of ϕ .
- (3) The design is very sensitive to small changes in the assumed value of ϕ , therefore, it should be confirmed by a chartered geotechnical engineer. In clay soils, it may be possible to utilise cohesion in some cases.
- (4) Applicable for car parks or other areas trafficked only by cars or occasional refuse collection trucks or similar vehicles (typically one per week).
- (5) This category should be used when considering landscaped areas that may be trafficked by ride on mowers.

Assumptions made: ⌚ Ground surface is horizontal
 ⌚ Shear planes or other weaknesses are not present within the structure of the soil.



Material: Polypropylene

Nominal size (mm)	Part number	Dimensions (mm)		
		W	H	L
160	6LB200	500	400	1000



AquaCell Plus-R: for inspectability

By aligning AquaCell Plus-R units end-to-end, full length viewing channels can be created – allowing for CCTV inspection if required. These are created in the bottom layer of an AquaCell tank installation.

The units can be used in combination with AquaCell Core-R (and with Eco if there is at least one layer of AquaCell Core-R in between the Plus-R and Eco layer).

NOTE: For any AquaCell Plus-R units on the perimeter of a structure that are NOT required for inspection access, the open ends of the integral inspection tunnels should be fitted with the end caps provided.

Inspection chambers

An inspection chamber should precede the inlet pipework for the AquaCell structure.

A silt trap or hydro-dynamic separator prior to the inspection chamber is also recommended.

For on-line installations the following Chambers are recommended:

- Down to 3m Wavin Non-Entry Inspection Chambers
- Down to 5m Wavin Range 600 Inspection Chambers, or a traditional manhole*

**where inlet pipework is replaced by AquaCell units acting as flow conduit.*

For off-line installations:

- Manhole with in-built flow control

Recommendation: If installing any Wavin Non-Entry Inspection Chamber, deeper than 1.2 metres, ensure that the cover and frame includes a 350mm restrictor to prevent man entry.

Inspection and maintenance

CCTV inspection at every inspection point is recommended:

- after every major storm
- at regular intervals according to the specific maintenance plan for the site

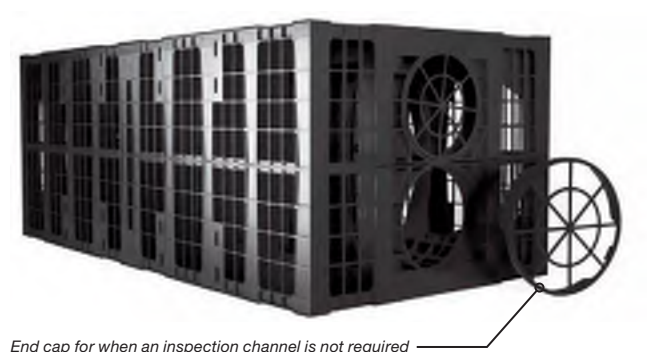
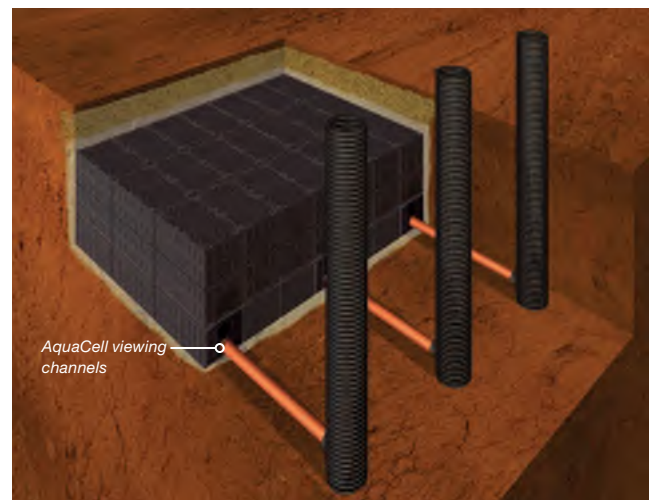
Silt traps prior to inlet pipework should be routinely inspected and cleaned out to minimise debris reaching the tank. It is important to prevent construction silt from entering the AquaCell structure.

Inspectability scenarios

AquaCell Plus-R viewing channel



Trafficked tank installation with inspection chambers



Discover our broad portfolio at
www.wavin.co.uk



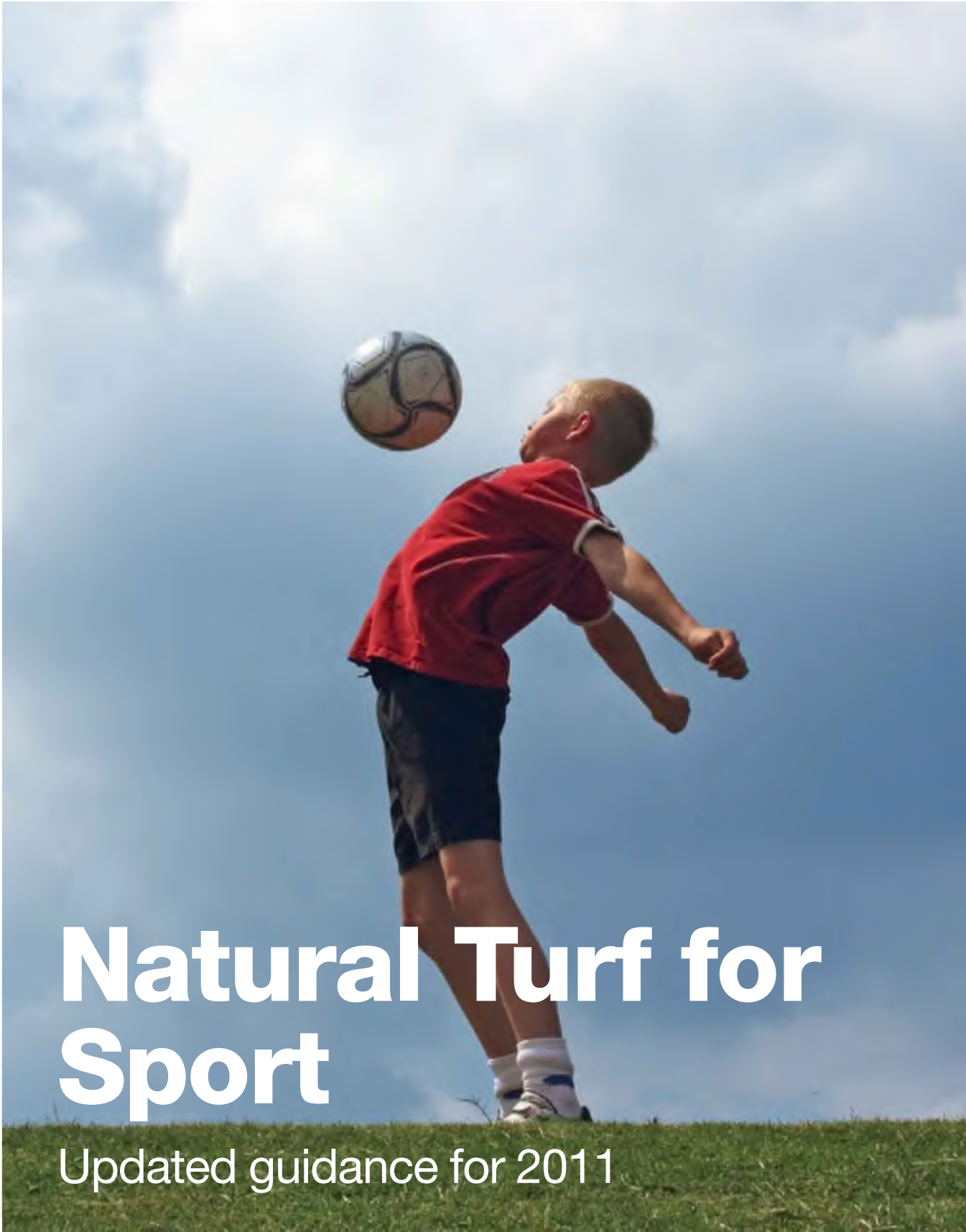
Water management | Plumbing and heating | Waste water drainage
Water and gas distribution | Datacom



Wavin is part of Orbia, a community of companies working together to tackle some of the world's most complex challenges. We are bound by a common purpose: To Advance Life Around the World.



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Natural Turf for Sport

Updated guidance for 2011

General maintenance

Performance Quality Standards (PQS) provide a benchmark for assessing the efficacy of maintenance operations in terms of achieving and maintaining the quality and performance of natural turf sports surfaces.

Refer to Appendix 4 for selected key PQS.

If weeds, pests or diseases are evident, herbicides and pesticides should only be applied according to manufacturer's recommendations, and by qualified personnel holding the relevant certificate issued by the National Proficiency Test Council (NPTC). www.nptc.org.uk

As soon as the grass has started to establish, a rigorous programme of aftercare must commence with a sequence of operations to encourage the development of a strong dense sward.

This must continue until the surface is ready for play. The turf will continue to mature and the ongoing maintenance must take this into account.

A fully specified maintenance schedule must be produced by a competent Consultant and acted upon. Consider the frequency of mowing, aeration, irrigation, seeding, use of fertilizer, and weed/pest control.



During periods of dry weather, it may be necessary to irrigate newly seeded areas

The management regime for a new facility is different to that required for old, well established turf:

- Regular mowing is fundamental to the maintenance of surface quality. Frequency of mowing will depend on the time of year and will vary according to the location of the site.
- To aid growth and recovery, as well as to maintain good presentation, fertilizer must be applied at the optimum rate and at appropriate times. The exact requirements must be determined by soil analysis.
- Aeration, the process of increasing the availability of air to soil and roots, is essential to relieve compaction and maintain surface drainage. Additionally, it promotes strong root growth and sward resilience.
- Irrigation may be required to aid grass growth during dry periods.
- Regular seeding is necessary to repair damaged and weakened areas of turf. Full grass cover is essential to maintain consistency and to prevent weed invasion.
- Ongoing preventive measures are required to protect the playing surface from pest damage.

Specific maintenance requirements for each type of playing surface are detailed in the appropriate sections that follow.

Maintenance equipment

There are two main approaches to the provision of maintenance resources; to either employ staff and purchase own equipment or to engage a turf maintenance contractor.

It is possible to hire specialist machinery used occasionally to supplement the basic equipment. Hiring equipment and engaging contractors will save on the initial capital cost. It will also reduce problems associated with maintaining the machinery in a safe and efficient condition. The appropriateness of this method will depend on the size of the facility and the availability of skilled local contractors with the appropriate equipment. Factors to be considered are presented in Appendix 5 - *Maintenance resource check list*. It may be possible to purchase some maintenance materials and achieve savings but this will depend on the purchasing power of the contractors.

Appropriate timing of maintenance operations in relation to the weather and ground conditions is important for the effective maintenance of the turf. Where contractors are appointed for maintenance, it is essential they are contracted to achieve the performance standards with all operations carried out at the appropriate times and under the right conditions. It is paramount this is taken into account by grounds staff and contractors.

In practice, a combination of these approaches may prove to be the most economical and effective. The cost of maintenance will vary considerably according to the method of procurement and the availability of contractors and materials.

Good maintenance practice is regarded as the most important factor influencing the success of a new pitch development⁹.

Designers should consider maintenance and capital cost together.

A budget should be prepared to provide for new equipment, annual servicing and the replacement of worn out implements to ensure the quality of the playing surface is maintained.

Create adequate, secure storage provision for maintenance and sports equipment.

Facilities must be provided for the secure storage of equipment on site with space for materials that are used for maintenance such as top dressing sand or cricket loam.

Provision must be made for the safe storage of pesticides, all other chemicals and fuels conforming to current legislation. Additional information on pesticide storage is available in the Agriculture Information Sheet No. 16 available from the Health and Safety Executive¹⁰.

Protective measures must be adopted to prevent the discharge of any contaminated drainage water to public sewers or watercourses. To this end, care must be taken to ensure that waste materials (e.g. grass clippings, engine oil etc.) are stored appropriately prior to disposal.

⁹ SAPCA Code of Practice for Design, Construction and Maintenance of Natural Turf Pitches.

¹⁰ www.hse.gov.uk.

4.0 Football and Rugby Pitches

This section discusses in more detail the use, design, configuration, construction, establishment and ongoing maintenance of football and rugby pitches. The summary table on page 27 shows estimated costs, maintenance and the advantages and disadvantages of various construction techniques.

Traditionally, football and rugby union are played on a seasonal basis when grass growth is minimal and soil very wet. Frequently grass cover is worn at the beginning of winter and quagmire conditions can develop in high wear areas of the pitch such as goalmouths and centre circles. As a result players are unable to experience a satisfactory quality of game.

The pressure to get matches played means they often take place at inappropriate times, for example, during heavy rain. Frequently, maintenance routines during and after the season are unable to restore the pitch to an adequate state for quality play to take place. A vicious circle of deterioration sets in as a direct result of poor drainage and compaction of the playing surface.

Designing for likely use

Performance Quality Standards (PQS) provide a benchmark for the quality and performance of natural turf sports surfaces, as well as to assist with their management. These constitute the minimum acceptable performance criteria (e.g. drainage capacity, hardness etc.) for different levels of the game (e.g. local, regional or national) and are an essential mechanism for the effective design, construction, maintenance and long-term sustainability of the surface. Refer to Appendix 4 *Performance Quality Standards* for PQS relating to football and rugby.

The majority of playing surfaces require a designed drainage system to provide satisfactory playing conditions throughout the playing season.

Consider the frequency and intensity of use. A hard wearing seed mixture would be suitable for pitches with winter use.



Good surfaces maintain safety levels and maximize quality of play

Poor construction, lack of effective maintenance and overuse of the pitch will, eventually, lead to poor drainage and unacceptable playing conditions. It is essential that pitches are designed taking into account the estimated intensity of use.

Players under the age of 15 are judged to inflict about half the damage to a pitch than their more senior counterparts. Therefore, a pitch used predominantly by juniors can accommodate approximately twice the capacity of one used solely by more senior players.

The pattern of use must be taken into account when designing a pitch. Where use primarily takes the form of a large number of games played during weekends with little play during the rest of the week, demand cannot be staggered to make best use of a single 'high specification' pitch. In these circumstances, general upgrading of pitches using sand grooving or slit draining and sand amelioration (i.e. the incorporation of sand into the surface to improve playability - see Section 4 *Pitch Construction* pages 21-27) would be more appropriate than the creation of a single 'premier' pitch.

Pitch configuration

The layout of the pitches should be considered carefully to maximise the use of the available space and the future flexibility. Pitch marking with safe clearances and ball stop fencing where appropriate should meet the current recommendations of the relevant sports NGB.

The location of spectators needs to be considered to avoid interference or damage to adjacent playing surfaces. This can be a particular problem if football /rugby pitches are located too close to a cricket square.



Laser-guided grading of a pitch

The minimum requirement for all pitches is for conveniently located hydrant points where a hose or mobile sprinkler can be connected. For free-draining rooting mediums over drainage rafts, an automatic pop-up irrigation system is essential.

The irrigation system must comply with local water company regulations and this will involve the installation of a system incorporating facilities to prevent reverse siphoning into the water main.

Irrigation may also be required to offset potential problems with soil shrinkage on drain lines where the indigenous soil has a high clay content.

Maintenance

The design of an irrigation system will normally require advice from a specialist Irrigation Consultant on issues such as:

- Irrigation demand
- Capacity and location of water storage
- The potential for use of grey water
- The source and cost of water
- Potential for abstracting groundwater (up to 20 cubic metres per day may be abstracted without a licence)
- Potential for abstracting surface water (up to 20 cubic metres per day may be abstracted without a licence)
- Pumps, power supplies, pipe work, hydrants and sprinklers
- Irrigation scheduling.



Specialist equipment such as a verti-drainer can be hired to maintain pitch quality



Alleviation of soil compaction can greatly improve the condition of natural turf facilities

Maintenance is key to the success of all pitches and is an essential requirement to provide pitches that meet relevant PQS over a long period. There are too many examples of well constructed pitches that fail after a short period of time due to inadequate maintenance, and then require further significant investment to make them effective again.

Typically, post-match work will involve replacing divots and may require the application of top dressing material to the most badly damaged areas of turf. Ensure provision of a reasonable quantity of top dressing sand and that adequate storage facilities are available to keep it dry and clean.

To restore the pitch for the following season a number of operations may need to be performed at the end of the playing year. Provision should be made for aeration, cultivation, sanding, seeding and/or re-turfing.

The following equipment is fundamental to successful maintenance:

- Mower: various models fulfill different requirements. Cylinder mowers produce a better quality finish.
- Aerator: tractor-mounted or pedestrian. This can be hired when appropriate.
- Sprayer: for application of liquid fertilizer and pesticides.
- Chain harrow/roller: to break up clumps and re-level the surface. Heavy rolling should be avoided due to adverse effects on the soil or rootzone.

- Hand tools should include spade, fork, halfmoon turf edger, dragbrush, edging shears, wheelbarrow, measuring and line marking equipment.
- Health and Safety: appropriate Personal Protective Equipment (PPE) should be used.

There is a wide range of equipment available that can be used for aeration or for renovating the pitch surface when a more thorough operation is necessary to restore good surface drainage or to remove excessive fibre or thatch.

This expensive equipment can be hired in as and when required but care is needed to ensure that the work is carried out in suitable conditions.

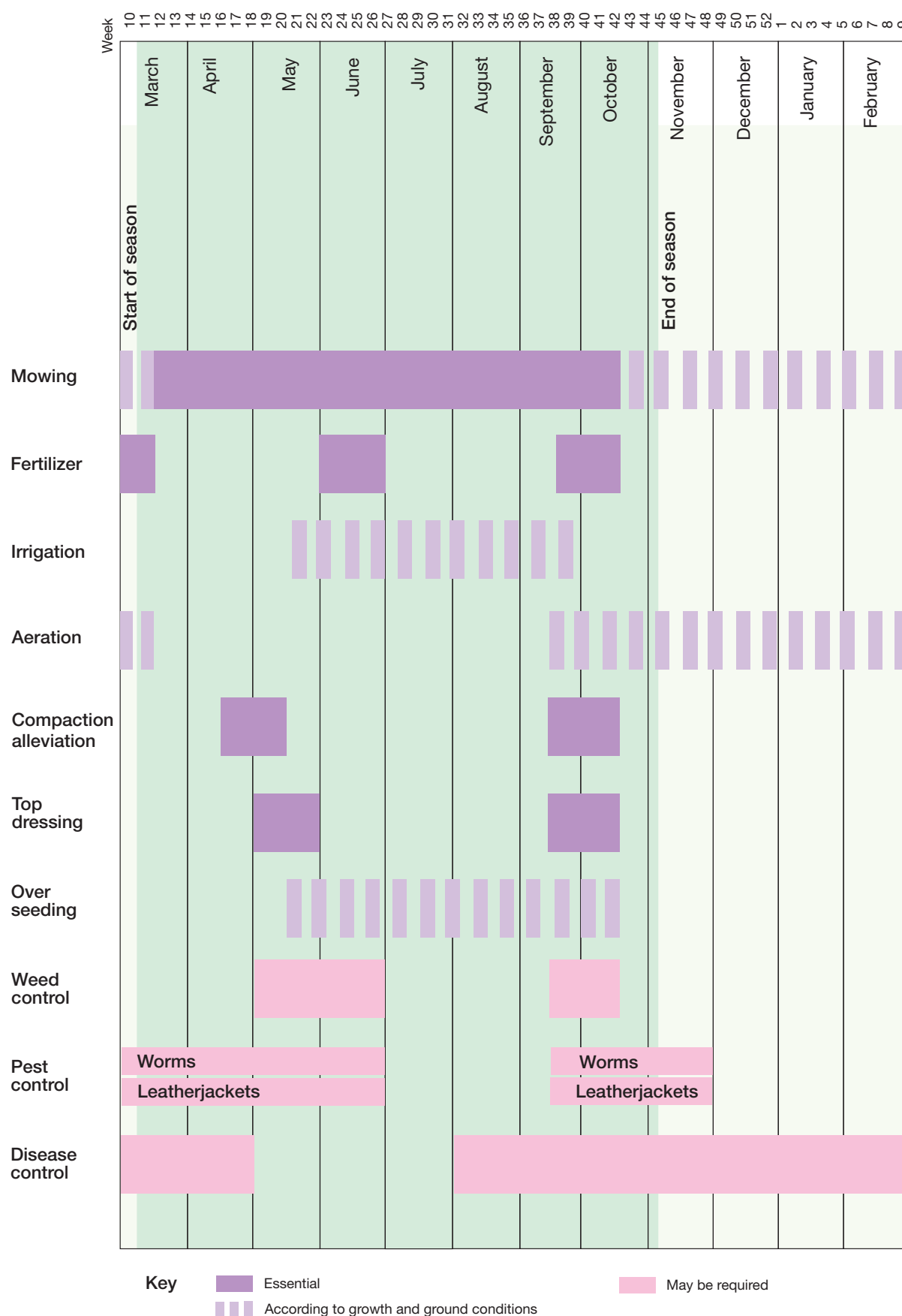
It is essential to bear in mind that the maintenance requirements for a newly established facility may be considerably higher than for mature playing surfaces.

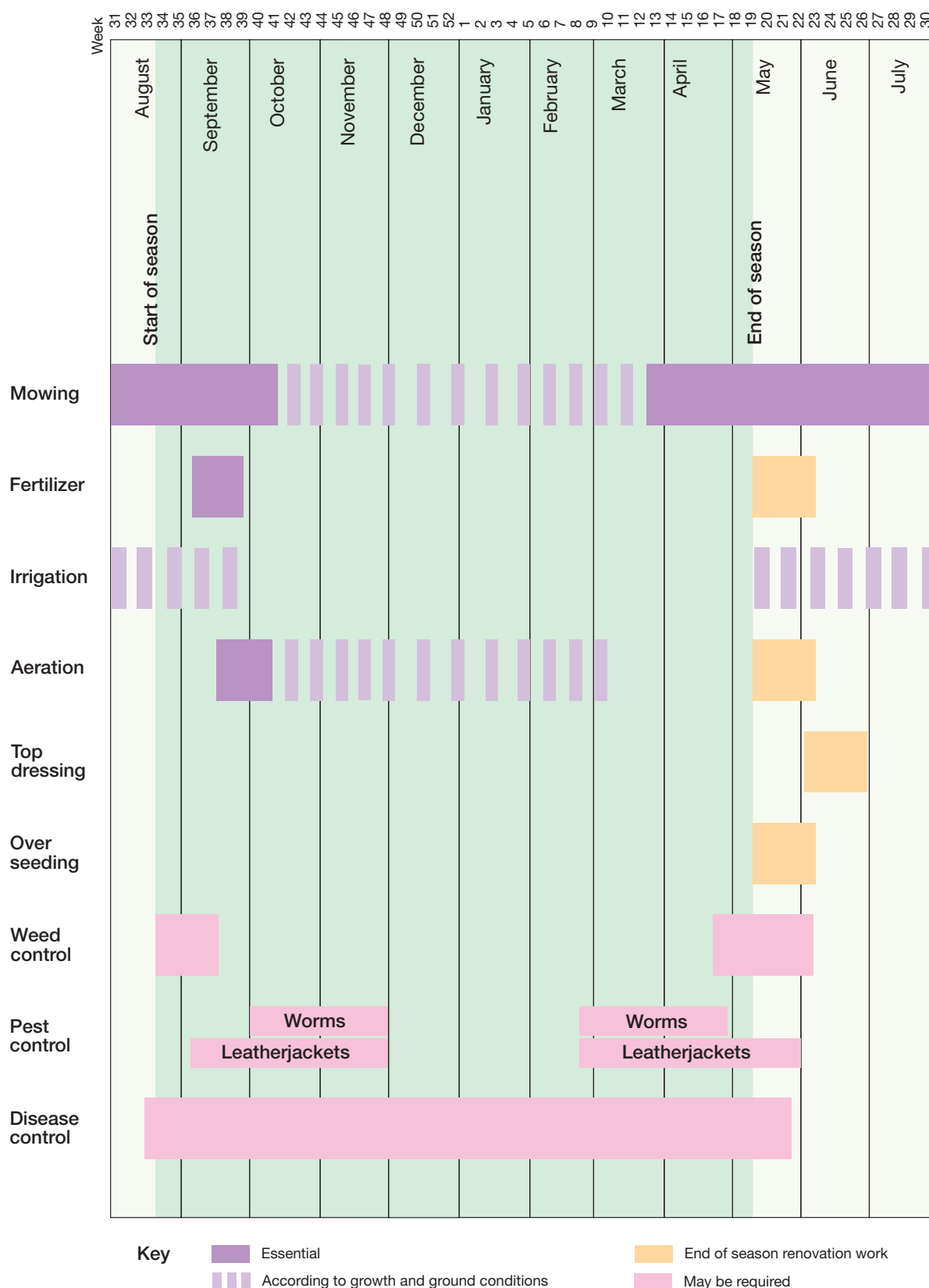


At the end of the season, over seeding reinstates worn turf

Natural Turf for Sport

Design Guidance Note





Winter Football and Rugby League: Summary pitch maintenance programme

APPENDIX 5

Maintenance resource check list

When considering the viability of developing a new natural turf sports facility, or improving existing facilities, the provision of sufficient maintenance resource is crucial to the success of the project.

The maintenance operations required, and the timings of these activities, will vary depending on the range of sports supported and site specific

factors (e.g. construction type, usage, level of play and weather conditions). See the 'Summary Pitch Maintenance Programmes' in Sections 4.0, 5.0 and 6.0 for specific sports contained within this guidance note.

The following check list is not exhaustive, but is intended to provide stakeholders of a potential natural turf sports development with a list of resources that may be required in order to optimise the quality of the facility and the longevity of the capital investment.

People and skills	When recruiting grounds staff (either voluntary or paid) responsible for the agronomic maintenance of the facility, consider if applicants: • Are practical and fit • Have suitable experience, or whether there is a need to attend appropriate Institute of Groundsmanship courses • Have at least 3-4 years experience at 2 or more grounds (for a Head Groundsman) • Lack experience or knowledge, and will require provision for commissioning the services of a Sports Turf Agronomist to carry out routine visits and produce agronomic recommendations.
Premises	Facilities required and available should include: • Secure machinery maintenance and storage area • Appropriate storage for consumables (e.g. sand, fertilizer and agro-chemicals) • Fuel storage • Machinery wash down area • Storage area for disposal of grass clippings and composting (away from water courses) • Welfare facilities for staff.
Machinery and tools	Basic maintenance equipment should include: • Mower • Fertiliser distributor • Line marking equipment • Selection of hand tools such as strimmer, spade, shovel, devotting fork, brushes, switches, rakes and a wheel barrow • Measuring tapes, ropes, strings, measuring jugs / cylinders, buckets and pegs. Access to the more specialised maintenance equipment, or provision to use specialist contractors, particularly for end of season renovations should include: • Scarifier • Topdressing distributor • Overseeding drill • Sprayer • Vertidrainer • Hollow and solid tining equipment • Linear decompactor • Chain harrows • Drag mats • Irrigator.

**MAINTENANCE REGIME FOR
WASP FLOW CONTROL CHAMBERS**

**SEL Environmental Limited
Canal House
Bonsall Street
Blackburn
Lancashire
BB2 4DD
T 01254 589987**

FLOW CONTROL CHAMBERS AND DEVICES

DESCRIPTION

WASP Flow Control Chambers are prefabricated hdpe chambers that are pre-fitted with orifice or vortex devices. They are designed to hold back surface water and discharge at a low pre-specified rate. They are usually associated with up-stream temporary attenuation, accommodates the peak flow volume until drain down at the attenuated discharge rate controlled by the WASP flow control chamber.

OPERATION AND MAINTENANCE REQUIREMENTS

Regular inspection and maintenance is required to ensure the effective long-term operation of the WASP flow control chamber. Maintenance responsibility for systems should be placed with the site owner or maintenance representative. Maintenance requirements are described in the table below. Maintenance plans and schedules should be developed during the design phase. Specific maintenance needs of the system should be monitored, and maintenance schedules adjusted to suit requirements.

Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly
	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Inspection of flow control chamber to assess if system is draining down correctly and that the orifice or flow control device is not blocked. Assess if there are any silt accumulations in the chamber sump.	Monthly (and after large storms)
	Removal of accumulated silt from silt trap and catchpit sumps.	Annually, or as required
Remedial actions	Repair/rehabilitation of inlets, outlet, overflows and vents.	As required
Monitoring	Inspect/check all inlets, outlets, and overflows to ensure that they are in good condition and operating as designed.	Annually and after large storms

Permavoid System Technical Manual



Planning, design, specification and installation guide

Maintenance

Like any conventional drainage system, sustainable drainage systems (SuDS) should be inspected regularly and correctly maintained to ensure optimum performance.

Maintenance plan

This should be initiated by the drafting of routine maintenance plans to suit the site installation. A pre-handover inspection should be carried out and the Permavoid system cleaned prior to final handover.

Routine inspection and maintenance should include:

- Inspection of systems
- Removal of silts
- Decanting of oils and hydrocarbons
- Channel jetting
- Water sampling and testing at point of discharge (if required)

Excess silt/debris held within Permachannel and gullies should be cleared manually or with a vacuum tank. We do not recommend pressure led cleaning.



Routine maintenance

Permachannel

For Permachannel the following routine maintenance procedures are required:

- 3 monthly inspections of channels for signs of blockage and oil spillage
- Remove litter and blockages as required
- Every 12 months inspect all chambers for silt and oil build up
- Every 12 months sweep external surfaces
- Remove silt as required but at least every year
- Records of inspections and maintenance undertaken should be kept by the client

Permaceptor

For Permaceptors the following routine maintenance procedures are required:

- 3 monthly inspections of road/yard gullies for signs of blockage and oil spillage
- Remove litter and blockages as required
- Every 6 months inspect all Permaceptors for silt and oil build up
- Every 12 months sweep external surfaces
- Records of inspections and maintenance undertaken should be kept by the client

Accidental spillages

If accidental spillages occur of oil or other substances that can cause water pollution, they must be dealt with immediately. An example of this is if a car sump fails and there is large spillage of oil on the car park or road surfaces. A spillage kit appropriate to the size of the car park should be kept by the site caretaker. This should include absorbent pads, socks and rain seals.

As soon as a spillage is identified, the drain inlets in that area should be covered to prevent pollution entering the system. The pollution should then be cleared from the road or car park surface. The local channel system and/or Permaceptor receiving the spillage should be emptied of all pollution that has entered.

The Permachannels and Permaceptors should prevent any significant pollution entering the rest of the drainage system. The Environment Agency should be informed of the spillage and the appropriate actions should be taken.

General design details

The Permavoid range of products can be used individually or linked together to provide unique and flexible water management solutions.

The following typical design details highlight a range of solutions available. These drawings are available on the Polypipe website at www.polypipe.com/toolbox. Individual projects may require tailored solutions that are not detailed. For more information please contact our Technical Team on +44 (0) 1509 615100.

Typical permeable pavements

Figure 8.1.1: Sub-base infiltration detail (drawing no. PV_SD_IN_PP_001)

(For illustration purposes, we have shown a permeable block paving system. For Permeable asphalt a 40mm surface course and 80mm binder course are recommended)

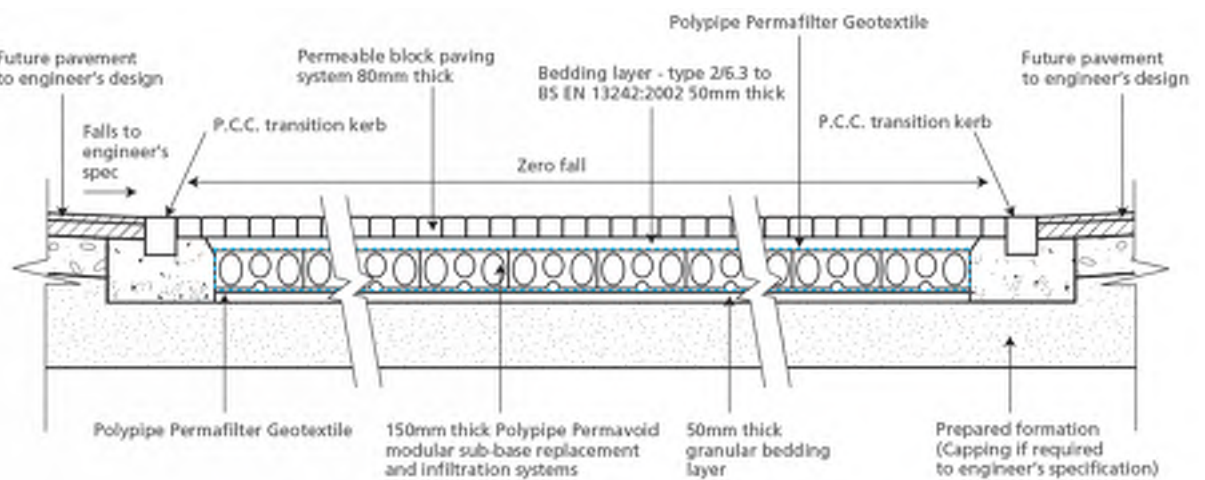
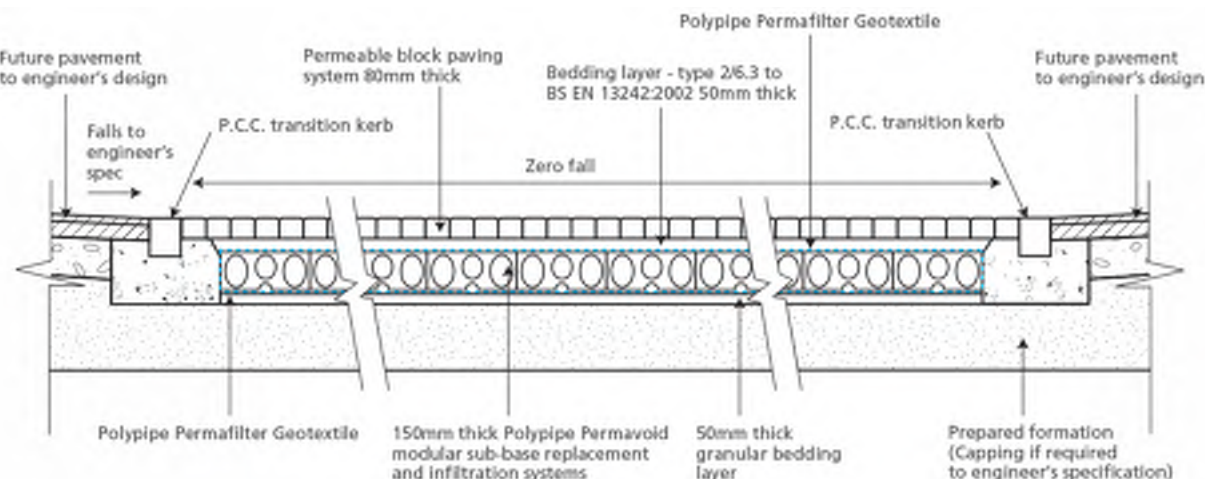
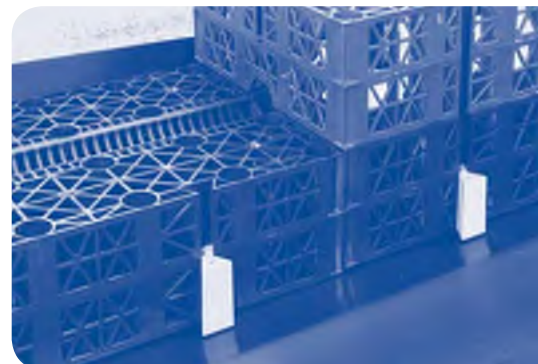


Figure 8.1.2: Permavoid permeable pavement sub-base attenuation detail (drawing no. PV_SD_AT_PP_001)

(For illustration purposes, we have shown a permeable block paving system. For Permeable asphalt a 40mm surface course and 80mm binder course are recommended)



Permavoid System Technical Manual



Civils & Infrastructure

Polypipe Civils

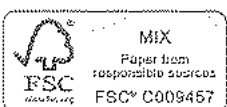
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CI/SfB (52.5)	

ACO Maintenance Guide



ACO Maintenance Guide

Channel drainage, ACO KerbDrain® and ACO Qmax®



Maintenance of grates

ACO grates are available in a variety of materials; ductile iron, composite, galvanised and stainless steel. Each has their own characteristic oxidisation cycle. The following information documents the expected performance of ACO grates, focusing on the four main grates, which depending on customer aesthetic standards, may require maintenance during the life of the grate types. One piece polymer channels like MonoDrain/RoadDrain/H Range do not have separate grates as the inlets are integral to the channel. This reduces the risk of stolen or incorrectly installed grate types.

	Grate Material Type			
	ACO Ductile Iron	ATec Ductile Iron	Composite	
				
Coating at delivery	Black paint	Electrochemical coating, black	No coating present, no possibility of oxidisation	
Protection achieved	Minimal protection, may require painting to retain black appearance if not frequently trafficked	High protection, may require occasional touch-ups	No possibility of oxidisation	
Possible treatments	Acrylic black paint /rust inhibitor	Acrylic black paint /rust inhibitor	N/A	
Low traffic areas	✔ Ideal*	✔ Ideal*	✔ Ideal	
High traffic areas	✔ Ideal	✔ Ideal	✔ Ideal	

*Application of paint may be preferred over time



ACO Ductile Iron

Ductile iron has long been used in outdoor drainage situations, as over time oxidation forms an insoluble graphitic layer which protects the iron from further attack. This is a natural process called patination. The structural integrity of a grating made of ductile iron will not be negatively affected by surface oxidation and the formation of a protective surface film. Areas with moderate traffic will help to buff the grates into the characteristic aged cast iron usually seen and do not require painting.

The water based paint with which ACO coat our gratings, is intended to protect the grating for a short period of time after manufacture. It is not intended to be either a long term or architectural finish. In areas of low traffic it may be preferred to apply a proprietary rust inhibitor.



Images showing stages in the process of patination. The period of oxidation depends on the environmental conditions. Photo on the right shows a stable buffed grate

	Polymer*	Galvanised Steel	Stainless Steel
			
	No coating present, no possibility of oxidation	Zinc oxide coating	Inherent protection due to high grade SS
	No possibility of oxidation	High protection from oxidation. Any materials damaged or cut to fit on site will require recoating on their cut or damaged surface	High protection from oxidation
	N/A	Galvanised metal paint	N/A
	✓ Ideal	✓ Ideal	✓ Ideal
	✓ Ideal	✓ Ideal	✓ Ideal

ACO ATec Ductile Iron

ACO ATec coating is a high performance finish offering superior resistance to corrosion and enhanced long term durability in demanding environments. ATec uses an electrophoretic process, which uses current to deposit organic coatings on electrically conductive parts, this is then cured at high temperatures forming a strong and durable coating. The benefit of ATec or KTL coatings is that any scratches or damage will not result in the oxidation undercutting or spreading under the painted surface, and this results in overall lower levels of visible oxidation.

ATec is particularly suited to low trafficked areas, or areas where high aesthetic appearance is required, as it provides an easily maintained system compared to water based surface coatings. ATec provides a chemically stable platform for the application of secondary paint finishes if preferred. In moderate traffic areas the coating will eventually wear away and form the polished ductile iron surface common to architectural ductile iron as discussed above.

ACO Stainless Steel

Stainless steel gives very high protection from oxidation due to the high grade steel used, and the use of pickle passivation process during production. Along with polymer and composite, stainless steel grates are a good choice for coastal applications where environmental salt levels are high. Stainless steel products in coastal applications will require regular cleaning to remove salt build up, and a proprietary protective coating may be advisable depending on the aesthetic required.

In most standard drainage situations stainless steel will not require any maintenance, and will retain a high standard of appearance over the life of the grate.

Maintenance of grates

ACO Galvanised Steel

Galvanised grates are hot dipped in zinc, which gives long lasting protection from environmental effects. During the coating process the zinc reacts with the steel, giving a demarcation free transition of alloy layers.

The quality of zinc coating applied by hot dip galvanization is specified in the technical standard EN ISO 1461. For mild steel sheet material thickness >1.5mm and <3mm minimum local coating thickness is required to be 45 microns (to average coating thickness 55 microns). ACO's galvanised steel zinc coating can measure between 60 to 80 microns, giving extra protection to the underlying steel.

The zinc corrodes in preference to the steel in a process called sacrificial protection.

Zinc will react with the environment, creating a thin white protective layer. Damage to the coating will result in the zinc deposits resealing it from the atmosphere and therefore protecting from corrosion.

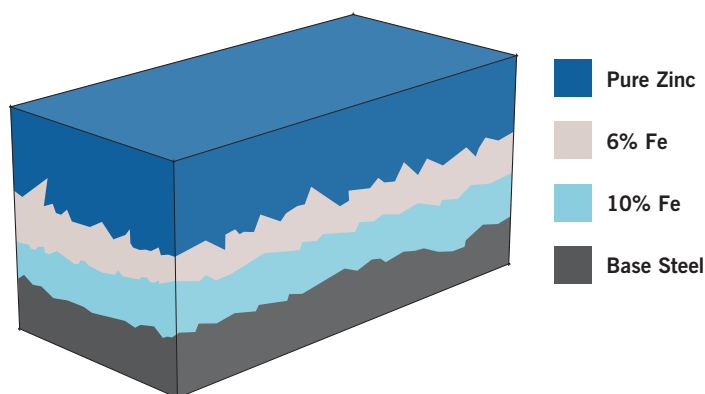
The distance of the installation from the coast will effect the level of protection achieved as the salt accelerates the oxidation process. For more information please refer to the Galvanizers Association website: www.galvanizing.org.uk/corrosion-map/ Divide 60 microns by the microns/ year figure to get a rough estimate on the level of protection. This figure gives a guide to the maximum time before the zinc coating is oxidised due to varying levels of wear. The base metal will still be functional and may require an application of zinc based protection to retain the aesthetic.



Newly galvanised



Protective oxidised layer



ACO Channel Edge Rails

Channel edge rails improve the strength and durability of grated channels, and their dimensions and performance must conform to EN1433:2002. There are three types of edge rail available, ductile iron, galvanised and stainless steel depending on the channel system chosen.



Users who wish to have the highest resistance to oxidation should select stainless steel edged channels. These are made from 304 Stainless steel. The percentage of nickel and chromium that is present in 304 stainless steel equips this metal with good corrosion resistance, in particular from moderately caustic and acidic solutions.

Due to the wet nature of their environment and their exposure to chemicals, metal components will naturally oxidise at varying rates depending on wear. Metal edges have been selected for their long term performance, but for customers who demand specific aesthetics, maintenance may be required in the form of painting the edge rails as required. In most cases rails and grates are left untouched for the life of the product, with ACO drainage channels being renowned for their high performance.

Access through grates



Locking systems

BS EN 1433 recommends that all gratings and covers, at or above Load Class C 250, should be locked in position. ACO gratings can be secured by a variety of locking arrangements. These will vary according to the channel system, grating type and Load Class. With the exception of the heavy-duty S system, which is provided with eight bolts per metre length, gratings will generally be locked every 500mm. Part of your maintenance procedure should be to check that all grates are secure and that no bolts or locking mechanisms are missing/broken.

Current locking systems:

1. Drainlock™ bar-less locking; used in the MultiDrain range of grates
2. Bolt direct into integrally-cast frame; used in S Range channels
3. Powerlock® boltless locking system; used on some access covers

Older locking systems:

1. Quicklock® bayonet and bar boltless locking system
2. Bolt and locking bar

Grated and non-grated channel systems will have access to the channels through the sump or access unit. If access is through a grate, ensure that any security locks (where fitted) or bolts are removed prior to lifting the grate.

Bolted grates

Bolts can be removed using a spanner or socket set. Greasing or oiling bolts before refitting is suggested.

Security locks and Drainlock™

Round M6 security screws, mean that the grate has been installed with ACO's security locking system. Both of these screws need loosening before the grate can be removed

Drainlock™ systems are the standard locking mechanisms identified by black squares.

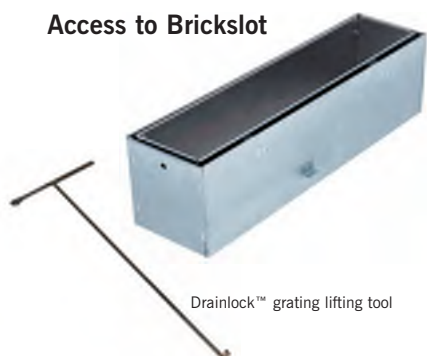
LIFTING GRATES

When lifting gratings, use the Drainlock™ grating lifting tool (part number 1367). Insert the tool in from the end of the grate as shown, and gently lift the grate until the Drainlock™ clips release taking care not to bend or damage the grate.

Lifting with/without the lifting tool at the end of a grate, may result in damage/bending of the grate (particularly the composite and steel grates). Always lift closer to the Drainlock™ clips as shown.



Access to Brickslot



To remove the ACO Brickslot access unit tray, insert two lifting tools as shown.



Then lift the tray vertically from the frame.

Be aware that this unit complete with surfacing material, may be very heavy and safety precautions should be taken.

Access units

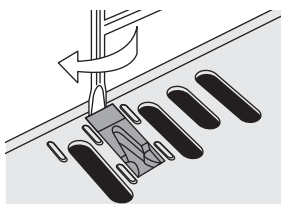
Other than grates on sumps, there are two types of solid access covers, Ductile iron and Composite. Composite access units are present in all new production of MonoDrain, KerbDrain and RoadDrain.

Ductile iron access unit Powerlock® system

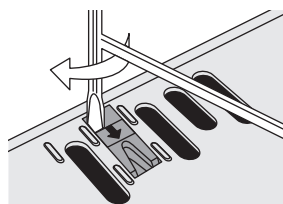


POWERLOCK

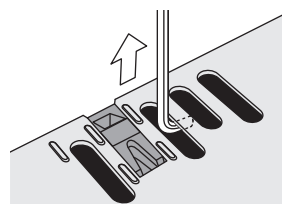
Used on the older systems, Powerlock® provides secure locking without bolts or screws and simple, rapid installation, using the ACO locking tool.



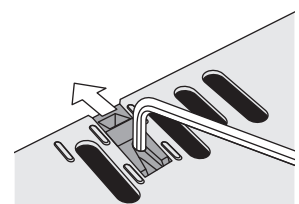
1. **To open:** slip chamfered end of locking tool into the slot behind the back of the Powerlock mechanism as shown.



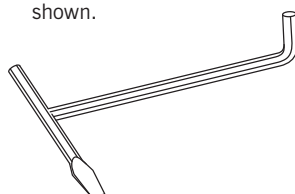
2. Rotate the tool through 90° until the lock mechanism slides across and clicks. Repeat for each lock.



3. Lift grating with the hook at the end of tool.



4. **To close:** fit one side of grating under lugs in channel rail and lower grating into position. Use the hook on the locking tool in the recess of the lock mechanism to push clip back towards the closed position, until a click is heard. Repeat for all locks.



ACO Locking Tool

Composite access units



MonoDrain access unit



KerbDrain access unit

COMPOSITE ACCESS UNIT - TO OPEN



1. Using a standard, medium duty drain lifting key, insert the key head through the keyway slot and press down.



2. Rotate the drain lifting key 90° - ensuring the key remains vertical.



3. Lift the key and cover as a complete unit and remove from the frame. (If you wish to remove the key, hold the cover and twist the key 90°.)

COMPOSITE ACCESS UNIT - TO CLOSE



1. If the key is still in the cover, closing is the reverse of opening. If the key is not used see above.



2. To fit the cover in the frame, simply push the cover down onto the frame - The locking pins will retract and snap into place to lock the cover.

The steel crossbar will rise to the top to identify the cover is secure.



Always ensure that access units are securely closed and locked after use.

Access through universal gullies and access chambers

UNIVERSAL GULLYS



- ▶ Universal gullies may be installed with MultiDrain, MonoDrain, RoadDrain and S Range channels.



- ▶ There are two types of ductile iron cover, the D400 version will be bolted (remove bolts before lifting), whilst the F 900 version is hinged (open as shown). Care should be taken when lifting the cover.



ACO QMAX® ACCESS CHAMBERS

- ▶ Access chambers are installed with ACO Qmax® channels. There are three types of access lid depending on the channel system installed. The covers may/may not be bolted in the corners, and these require removing prior to lifting. The cover may be hinged, and opened as shown above.

- ▶ The top of the screw should not project above the top of the tray, maximum tightening torque 18Nm.
- ▶ Removal and lifting of access covers will require on-site assessment of H&S manual handling procedures.

- ▶ Access chambers installed with ACO Qmax® Q-Slot grates will have a recessed steel cover and frame. Remove the M8 screws with an allen key, and lift out the tray using appropriate lifting method. When replacing ensure the screws are fully tightened through the tray and into the frame.



Maintenance of domestic channel systems

Channel systems which have silt buckets can use method 1 or 2, including channels with grates or Brickslot.

Alternatively method 2 can be used for grated systems with or without silt buckets. For instructions on lifting grates please refer to page 7.

Equipment needed: ACO recommend using a domestic pressure jetting machine with jetting hose attachment for method 1, or small trowel for method 2.



ACO RainDrain



ACO HexDrain Brickslot



ACO HexDrain

METHOD 1



1. Remove the grate located over the outlet or sump using an ACO Drainlock™ lifting tool (refer to page 7).
2. Remove the silt bucket, disposing of any contents and clean.
3. Return the silt bucket to the sump, this will catch any flushed out debris.
4. Insert the jetting hose, and push until it reaches the end of the channel system. Cover the channel system to prevent spray or debris damaging nearby vehicles/buildings.
5. Turn on the pressure jet machine and slowly pull out of the channel system. The jetting machine will flush debris into the silt bucket.
6. If cleaning brickslot, pressure jet down through the slot with a standard hand held attachment, and repeat the flushing of the channel.
7. Remove the silt bucket and clean.
8. Replace the silt bucket and grate.

METHOD 2



1. Remove the grates along the entire channel system using an ACO Drainlock™ lifting tool (refer to page 7).
2. Using a trowel remove any debris.
3. Empty the silt bucket if applicable.
4. Replace silt bucket and all grates.



Using boiling water or cleaning agents is not recommended. If you want to use cleaning agents, please consult the cleaning product's manufacturer for information on compatibility with the material properties.

Maintenance of commercial channel systems

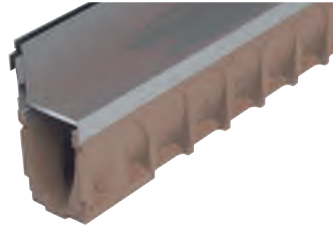
Independent of whether the channel system has grates, Brickslot or is monocast (ie one piece channel with built-in inlets) the maintenance method is the same. Access is gained through

an access unit, sump or universal gully. For instructions on lifting and locking/unlocking grates and access units please refer to page 7.

Equipment needed: ACO recommend using a recycler combination jetting unit with hydraulic winch, capable of producing pressure from 80 bar (1160 psi) to 150 bar (2176 psi).



ACO MultiDrain®



ACO MultiDrain® Brickslot



ACO MonoDrain

METHOD



1. Remove the bolts or use a lifting tool to gain access to the sump or access unit (refer page 7-8).
2. Remove the silt bucket, disposing responsibly of any contents and clean the bucket.
3. Position the jetting unit near the access unit. Introduce a 3 inch (75mm) suction hose into the sump area. This suction hose will remove the silt/detritus that the jetting hose flushes out.
4. Attach a suitable jetting head. In this example a 1 inch (25mm) diameter tandem jetting head with forward and backward facing jets was used.
5. Introduce the jet into the sump/access unit, facing the direction of channel section which is to be cleaned.
6. Activate the suction hose and jetting hose. A suitable initial jetting pressure is 80 bar or 1160 psi.
7. As the jetting head travels up the length of the channel, place boards or other suitable material over the channel grates to prevent the escape of water (spray back) and protect any vehicles or nearby property.
8. The jetting head will be propelled to the end of the channel. When it reaches the end, increase the pressure to 150 bar (2176 psi).
9. Use a hydraulic winch to pull the jetting head backwards toward the sump. The suction hose previously inserted in the sump will remove the flushed out water and detritus.
10. If a reduction of 'spray back' is required reduce the pressure to 80 bar (1160 psi). This pressure will still be sufficient to clean the channel.
11. If cleaning brickslot, pressure jet down through the slot with a standard hand held attachment, and repeat the flushing of the channel.
12. Replace the silt bucket and grate/access lid, and secure (refer pg 7-8).



ACO MultiDrain® channels incorporate Drainlock™ gratings. This is a bar-less locking device which improves hydraulic capacity and provide easier access for maintenance. Older grated channels may have a bar system for holding the gratings in place. The occurrence of these bars may restrict access to the channel. In this case reduce the size of the jetting head to gain access.

Maintenance of ACO Qmax® channels

ACO Qmax® high capacity slot drainage is accessed through the large combined access and silt chambers and jets in a similar way to standard channel systems.

Equipment needed: ACO recommend using a recycler combination jetting unit with hydraulic winch, capable of producing pressure from 80 bar to 150 bar (2176 psi).



ACO Qmax® channels

METHOD



ACO Qmax® maintenance demonstration images taken from ACO lifecycle testing event

1. Access to ACO Qmax® channels is gained through the access and silt chambers (picture shows chamber without metal cover or frame). See page 10 for more information on ACO Qmax® access units.
2. Position the jetting unit near this access chamber to allow a 3-6 inch (75-150mm) suction hose to be introduced. This suction hose will remove the silt/detritus that the jetting hose flushes out.
3. Attach a suitable jetting head. In this example a round headed 'bullet' jet (15cm length 8cm diameter) was used for ACO Qmax® 225 with rear facing jets. The larger ACO Qmax® 500 was jetted with a 'bomb' jet (40cm length 12cm diameter) with rear facing jets.
4. Introduce the jet into the channel, facing the direction of travel.
5. Activate the suction hose and jetting hose. A suitable initial jetting pressure is 80 bar or 1160 psi.
6. As the jetting head travels up the length of the channel, place boards over the channel inlets to prevent the escape of water (spray back) and protect any vehicles or nearby property.
7. The jetting head will be propelled to the end of the channel. When it reaches the end, increase the pressure to 150 bar (2176 psi).
8. Use a hydraulic winch to pull the jetting head backwards toward the access chamber. The suction hose previously inserted in the access unit will remove the water and detritus.
9. If a reduction of 'spray back' is required reduce the pressure to 80 bar (1160 psi). This pressure will still be sufficient to clean the channel.
10. After cleaning is complete, replace cover and secure in place.

ACO Qmax® life cycle testing & other maintenance information

ACO Qmax® life cycle testing



Extensive testing was overseen and reported by Vine Technical Services Ltd, who documented the results of pressure jetting ACO Qmax® channels.

ACO Qmax® channels are extremely strong and robust, able to withstand maximum pressure 150 bar (2176 psi) [maximum pressure UK industrial pressure jetting machine]. This pressure was applied to the surface of the channel for two minutes at a distance of 5mm, resulting in no damage to the channel [Test method according to Water Industry Standard 4-35-01]. The only visible sign of this rigorous testing was in some cases a faint superficial scuff



mark, some tests resulted in no visible signs at all. Vine Technical Services Ltd concluded "The results showed that a maximum pressure of 150 bar or 2176 psi caused no damage (as defined in Water Industry Standard 4-35-01) to the ACO Qmax® 225 or 550 channel bodies during the maximum pressure testing".

ACO Qmax® channels have also been subjected to life cycle maintenance tests, to replicate twenty years of annual cleaning. Abrasive material was introduced along the length of ACO Qmax® channels (ACO Qmax® 225 and 550) and pressure jetted along its length. At the end of



this 20 test cycle the internal surfaces of the channels were inspected by Vine Technical Services Ltd who reported "The introduction of sand to replicate sediment build up within channel bodies did not cause any visible signs of damage to the inside of the channel bodies' surface".

ACO Qmax® channels robust material and innovative design will provide long term solutions for surface water drainage, and regular pressure jetting will not affect the structural integrity of the product, when our maintenance guidelines are followed.

Other important information

Using boiling water or cleaning agents is not recommended. If you want to use cleaning agents, please consult the cleaning product's manufacturer for information on compatibility with the material properties.

When conducting maintenance, channels and grates should be inspected for damage. Grating slots and exposed edges of channels should be examined, and ensure that locking mechanisms and bolts are tight.

Sumps and sump bucket

Each site has different levels of debris and leaf matter which will be collected by the sump bucket during rain events. The frequency for inspecting your sumps or gullies will depend on these factors. Inspection of sumps/gullies should be carried out in conjunction with an inspection of the underground drainage connection out of the channel system. Occasionally, water should be poured into the sump (or gully) to check that it disperses freely.

Maintenance of connecting drains

ACO's sumps may be connected to a roddable foul air trap or directly to a straight connector pipe, either option will provide an access point to the connecting drains.



View of foul air trap before installation



The use of an ACO roddable foul air trap with an ACO sump allows the pipe system to be accessed and maintained. Simply remove the top bung to gain access. When you have completed your maintenance, replace the bung.

Maintenance of sealed joints

In installations such as petrol stations channel sealing joints should be inspected routinely, to check they are functional and that the sealing material has not become dislodged.

Where necessary the joint sealant should be removed and replaced in accordance with the relevant manufacturer's instructions.

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ACO. creating the future of drainage

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