

Natural Turf for Sport



Introduction

This Guidance Note concentrates on the broad requirements for the successful design, development and aftercare of playing surfaces for the major natural turf sports with the exception of golf. If these sports are to be played and developed successfully it is essential they take place on good quality surfaces that are available most of the year.

Timely consideration of the issues will result in a good quality playing surface that is:

- appropriate for the planned level, type and quantity of use
- physically and financially sustainable in the long term.

It is essential to consider in detail all the implications of the proposal before deciding how to proceed. Failure to consider all aspects of the project early in the development process will result in lost opportunities. Still worse, it may not be possible to correct resultant problems without making radical alterations to established plans thus causing delay and, possibly, additional costs.

Lack of appropriate planning in the early stages of the design of natural turf playing surfaces will be costly and severely affect the long-term viability of the project. A poorly considered proposal resulting in a mediocre facility will discourage users and/or increase maintenance costs to unsustainable levels.



A well-designed surface, properly constructed and maintained, is enjoyable to play on.



A poor quality pitch – appropriate planning, design, management and long-term maintenance are as critical to the success of a natural turf playing surface as they are to any other sports facility.

This guidance does not attempt to give detailed advice on the design, construction and maintenance of playing surfaces. This must, except for the smallest projects, be sought from qualified, experienced and independent professionals.

As well as giving appropriate technical advice, an experienced professional should be able to give specific guidance on the financial and contractual implications of the proposed work.

This guidance discusses the key issues and should be used as a reference point in the quest to ensure the achievement of a suitable and sustainable playing surface.

Appropriate planning, design, management and maintenance are critical to the success of a natural turf playing surface. Further information is available from the Sports Turf Research Institute, telephone 01274 565131.

Strategic planning

User profile

The following basic information regarding types of use and user needs should be compiled before appointing consultants or initiating any development of a natural turf playing surface:

- Identify the sports to be played month by month.
- Expected level of user performance, for example local league, regional.
- Likelihood that the facility will be used for training.
- Number of times per week for each activity, duration and whether for junior or senior use.
- Will floodlighting of the playing or training surface be required?
- Is there a requirement for phased development?
- Will there be any non-sport use during the year, for example as temporary car parking or a venue for a local gala?
- Realistically, what long-term resources will be available to maintain the playing surface?
- How much money is available to carry out the necessary work?

Additionally it is important to take account of the likely long-term developments in sport that might affect facility use, for example the introduction of mini-games or the move from the winter to the summer season. Consider also the need to introduce facilities for additional sports, for example a cricket square located between winter sports pitches.

Location

Obviously, the shape and contours of the available site will influence the location of the facility. This is particularly true for natural turf



Lack of proper maintenance will exacerbate minor problems and eventually affect surface performance.

playing surfaces where the need for level and well-drained areas is paramount.

Careful consideration must be given to the specific requirements of the playing surfaces and supporting ancillary facilities. It should not be assumed that because an existing facility, a pavilion or pitch, for example, is located in a certain position that it should stay there. Careful replanning will be rewarded by efficient layouts that are often easier and more economic to construct and maintain.

When analysing the suitability of a site ensure that:

- There is sufficient space for the proposed facility and space for future expansion.
- There will be adequate space for car parking based on local authority requirements and for any potential overflow.
- Access is available for service and emergency vehicles.

Further information on locating and planning sports facilities is given in separate guidance notes.

Feasibility study

The site must be analysed in the light of expected usage and potential restrictions. For all but the smallest projects a feasibility study must be commissioned from an experienced independent professional.

For most projects a detailed survey, with levels, will be required to establish the key features of the site. The areas for consideration are detailed below:

- The topography of the site will determine the need for any level adjustment. Sites with significant slopes will need to be regraded in order to produce playing surfaces with acceptable gradients.
- Watercourses: where drainage improvements are required a positive outfall should be identified into which water from the site can be discharged. Consent must be obtained from bodies such as the Environment Agency and/or the local authority if utilising existing watercourses or surface water drainage systems.
- Physical structures, such as retaining walls and fences.
- Planting, including the location and condition of trees and whether they are covered by tree preservation orders (TPO).
- The site's ecology.
- Site boundaries/perimeters: condition and ownership.
- The location of main services.



Badly constructed and maintained surfaces are dangerous and detract from quality of play.

Ground conditions

Areas for consideration include:

- The general underlying geology of the site including the type of soil and drift. This information can often be obtained from geological maps.
- Soil resources: quality and depth of the topsoil and the nature of the underlying subsoil.
- The site's natural drainage capacity including the permeability of the soil and subsoil. Reliable information can be obtained from on-site sampling and expert laboratory analysis.
- The history of the site: it is important to establish whether the site has been used as a formal tip or if any 'fly tipping' has taken place.
- All reclaimed sites should be treated with caution. Former household refuse tips are vulnerable to localised settlement and the production of hazardous gases. Glass and other debris in surface soils are hazardous to players, while the presence of asbestos, heavy metals or toxic chemicals can give rise to further complications.
- Rainfall levels will affect the performance of all surfaces. Areas of high prevalent rainfall will need higher standards of construction and drainage.

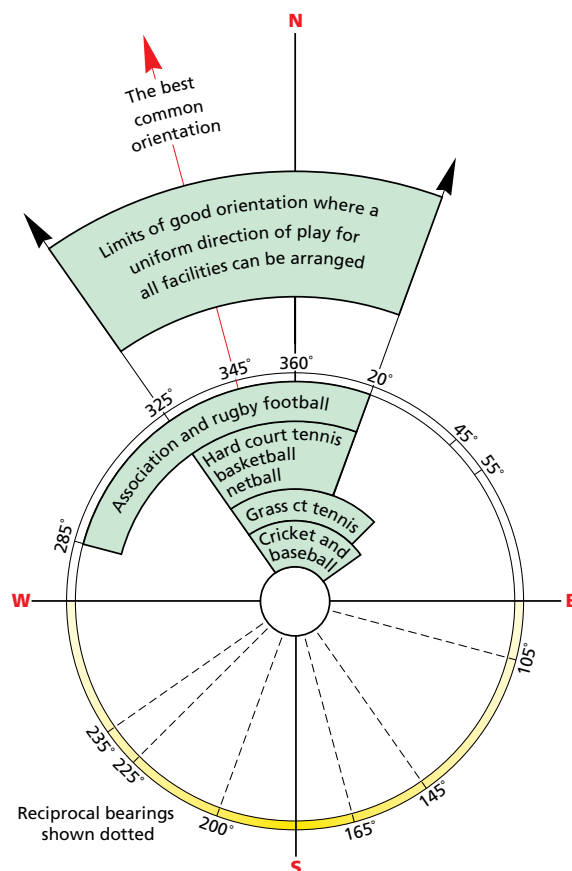
Requirements for planned activities

Each sports surface will have specific dimensions defined by the relevant national governing body or league. These requirements will not only define the size of the playing surface but will include 'safety margins' around it. Additionally, they may define relationships to other facilities such as a changing room or pavilion.

- Facilities and viewing positions should be oriented to avoid low sun angles.
- Ensure that there are no conflicting relationships between uses. For example, adjacent to a cricket pitch do not locate an activity immediately behind the bowler's arm.

- Consider issues relating to access and security: visibility, lighting, roads and footpaths.
- Ensure adequate car parking provision.
- New development will require planning permission involving the submission of detailed drawings. Car parking, access and potential effects on neighbours will be considered as part of the application.
- Protection of users from the elements: sun rain and wind.
- Temporary roads affording access for heavy machinery during construction and, later, access for maintenance equipment.

Detailed guidance on the design of landscaping and car parking can be found in a separate guidance note.



Goal to goal, wicket to wicket, or baseline to baseline orientation diagram. From the National Playing Fields Association's original.

Site conditions

Clearance

The site must be cleared of rubbish, rough grass and all unwanted hedges, trees and scrub before works start.

Tree felling must only be done where absolutely necessary and after ascertaining that no TPOs exist.

Drainage

Good drainage is a key requirement and a naturally well-drained site will form a sound basis for a playing surface.

On land where the soil tends to be impervious, adequate provision for supplementary drainage must be provided to meet the needs of the intended use.

At the feasibility stage it is essential to consider the effects of 'run-off' from adjacent areas of land or hard surface on to the playing surface so that appropriate provision can be made.

Level adjustment

On sites where extensive adjustment is necessary major regrading will involve altering the levels in the subsoil.



Many sites require major regrading of levels. Existing topsoil is removed and set aside for later use; level adjustments are made in the subsoil.



Embankments should be no steeper than 1:3. On larger bankings plan a catchment drain to collect any run-off affecting adjacent playing/spectator surfaces.

The first stage is to scrape off the existing topsoil cover and retain for eventual respreading.

Levels are adjusted in the subsoil, using the surplus 'cut' from high parts to fill lower areas. In some situations imported fill material may be required to build up low areas.

Filling must be done in consecutive layers not exceeding 250mm. Each layer must be adequately consolidated to avoid subsequent settlement.

The final formation must be trimmed smooth to the required level before replacing the topsoil.

Any embankments formed must be gently graded, no steeper than 1:3, in order to facilitate subsequent safe and effective maintenance.

On completion of the grading operations the topsoil is replaced to a uniform depth to produce a finished surface that marries in with the surrounding ground levels.

Where there are only shallow depressions these can be infilled with imported topsoil of a similar nature to the existing material.

Surface grading involves smoothing out the surface by moving soil from slightly higher parts to lower areas by means of a blade grader.

There must be a minimum 'firmed' depth of 150mm of topsoil to give adequate cover on completion of the project.

General maintenance

When planning a natural turf surface it is essential to understand the requirements for future maintenance in order to achieve a successful and sustainable project.

The designer must prepare a fully specified maintenance schedule that will ensure the surface is maintained in accordance with design requirements. The report must include recommendations for appropriate maintenance equipment and any special training that may be required to adequately maintain the pitch.

The report must indicate likely maintenance costs and the capital cost of purchasing the equipment necessary to cover this essential work. The following points must be borne in mind:

- Regular mowing maintains surface quality. Frequency of mowing is linked closely to the growing season which will vary depending upon the location of the site.
- To aid growth and recovery, as well as to maintain good presentation, fertiliser must be applied at appropriate times. The exact requirements must be determined by soil analysis.
- Aeration is essential to relieve compaction and maintain surface drainage. Additionally, it promotes strong root growth and sward resilience.
- Adequate irrigation is essential 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.
- Suitable pesticide storage facilities to conform with the Control of Pesticides Regulations 1986 must be planned. All health and safety requirements must be fulfilled.

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

Equipment

Maintenance tools can be purchased or, where appropriate, hired. Investment in good quality, up-to-date equipment will increase efficiency and make maintenance work less time-consuming.

Budget for new equipment, annual servicing and replacement of worn out implements to ensure the quality of the playing surface is maintained.

Note that machinery can be hired and the work contracted out. This saves on initial capital cost and also reduces problems associated with maintaining machinery in a safe and efficient condition.



Turf must be mowed regularly. It is essential to select the correct mower to maintain the quality of the playing surface.

Soccer, rugby and hockey pitches

Traditionally these sports are played 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 directly related to poor drainage and compaction of the playing surface.

Design issues

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

Upgrading a poorly drained pitch or constructing a new one does not necessarily solve the drainage and usage problem. 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 account of 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



Good surfaces maintain safety levels and maximise quality of play – this is particularly important for hockey.

general upgrading of pitches using slit-drainage and sand amelioration (see later sections) would be more appropriate than the creation of a single 'premier' pitch.

Pitch layout

Consider carefully the layout of pitches to maximise the potential of the site. In particular the space and pitch marking requirements for mini-games need to be taken into account.

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

Pitch construction

Generally, depending on the standard of facility required, the playing surface should be no steeper than 1:80–100 along the line of play and 1:40–50 across the line of play.

Pitch construction falls into four main categories according to the system of drainage used.

Undrained pitches

There are few situations when pitches of this type will provide a sustainable, quality playing surface. They are likely to be of use only on naturally well-drained soils such as sand, shallow soils over gravel, limestone or chalk.

Pipe-drained pitches

Currently this is the most frequently used pitch drainage system. However, unless the site has reasonably free-draining sandy soil or sufficient gradients to remove large quantities of water by surface shedding, pipe-drainage alone is often inadequate and the pitch can be susceptible to wet weather cancellations.

- Dependent on drainage design plastic pipe-drains are commonly installed with laterals at spacing between 5 and 10m centres at a depth between 450 and 600mm below ground level.
- All drains must be laid with a steady fall, no less than 1:200.
- A positive outfall must be provided in the form of an existing watercourse or surface water system.

When the drains have been laid trenches must be backfilled with porous material to ensure the high percolation rates necessary for effective drainage.



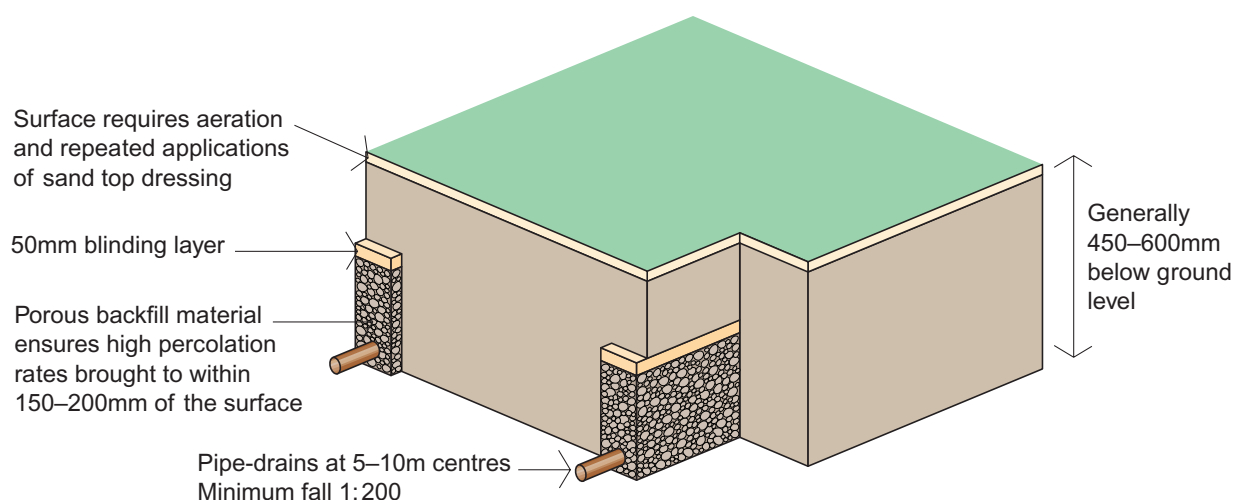
Installing pipe-drainage in a new pitch.

Predominantly single-sized, hard, angular gravel or broken stone within the range 6–10mm must be used as backfill. This should be brought to within 150–200mm of the surface.

The trench backfill is then 'capped' with a 50mm 'blinding layer' in the form of coarse sand or fine grit to prevent infiltration of the topsoil.

The trench is backfilled to ground level with preserved or imported topsoil.

Given reasonably permeable soils and good management, fairly good playing surfaces can result. However, in many areas of the UK this method is not suitable in very wet weather and will require aeration and dressing with appropriate sand to ensure maximum use of the pitch.



Pipe-drainage construction.

Pipe- and slit-drained pitches

Supplementary slit-drains will significantly improve the removal of water into pipe-drains. Basically the construction mirrors that of a pipe-drained system with the addition of:

- a series of narrow, commonly 50mm, trenches cut across and into the porous backfill of the drains
- slit-drain trenches, with spacing of 600–1000mm partially backfilled with small (6–8mm) hard aggregate and topped off to the surface with a coarse sand.

Heavy top dressings of suitable sand are essential for the successful construction and management of slit-drained pitches:

- The dressing should be applied immediately after installation of the slits and subsequently reapplied as part of routine maintenance works in the close season. This process will be necessary for at least three to five years.
- Each application of dressing should be in the region of 60–100 tonnes, depending on the size of the pitch.

A drawback of slit-drains is that they can become capped and sealed over with topsoil which can render them useless. Sand dressings must be designed to ensure that capping does not occur.

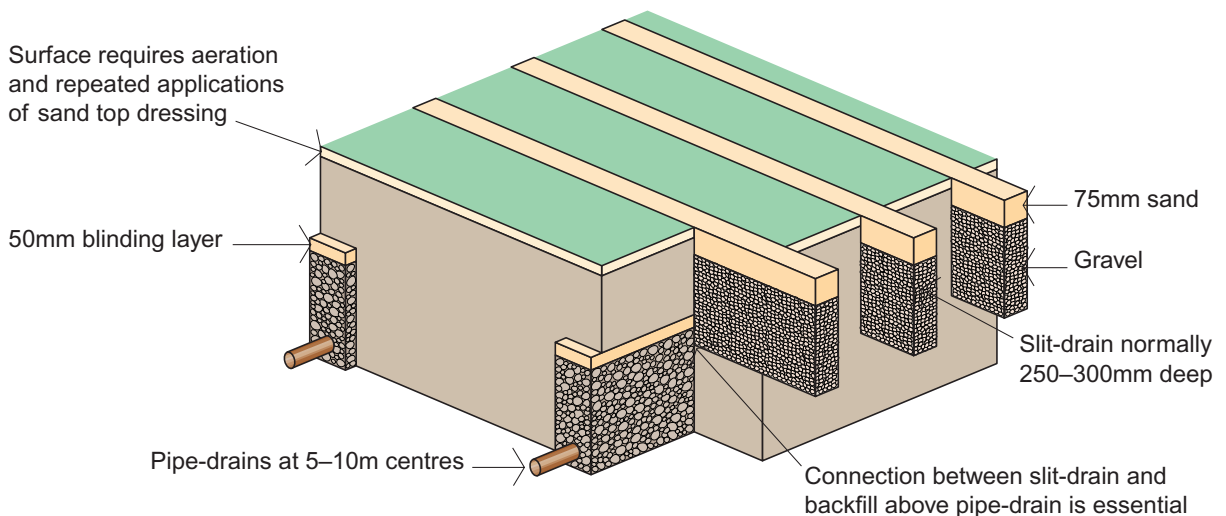


Combined pipe- and slit-drainage will significantly improve the drainage of most pitches.

It is essential that maintenance results in a vigorous and dense sward and that the appearance of bare soil is prevented.

It should be noted that pipe- and slit-drained surfaces may:

- be uneven during the first season
- shrink in clay soils in the summer months causing slits to open up. These must be



Pipe- and slit-drainage construction.

monitored and filled with sand to maintain the safety and quality of the surface and the effectiveness of the drainage system

- be less suited to finer turf areas, such as hockey pitches, where any settlement within the trenches will have a particularly adverse effect on surface levels and playing characteristics.

Suspended water table

The term 'suspended water table' refers to water held in the lower part of the rootzone and above the blinding or drainage layer. This moisture reserve helps sustain the grass sward during dry weather. This solution is the preferred option where:

- The subsoil is unsuitable because it is impermeable or contaminated.
- A very high standard of pitch performance is required.
- The pitch is required to accommodate high levels of play during the season.
- The required drainage rate is high, for example at professional football clubs.
- A high level of reliable maintenance is available.

- A fully automatic irrigation system is available. This is essential as the grass sward is likely to dry out due to the high sand content of the construction.

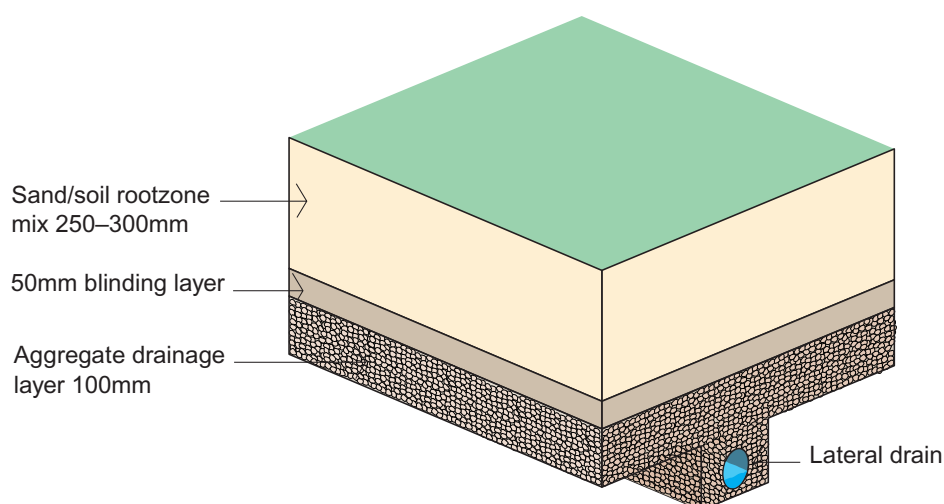
This type of construction comprises:

- A graded base drained by a series of drains, normally spaced between 5–10m.
- Suitable gravel laid to a minimum depth of 100mm with a 50mm blinding layer of suitable coarse sand or fine grit.
- 250–300mm depth of specially prepared sand/soil rootzone mix.

If properly maintained this construction provides a very high standard of playing surface.

These very sandy constructions often benefit from some form of reinforcement to help stabilise the upper part of the profile. Various materials have been developed in recent years for stabilising sandy rootzones and these include polypropylene fibres, shredded mesh elements and artificial grass fibres.

This type of pitch construction is more demanding in terms of management, particularly with regard to fertiliser and irrigation requirements. The more efficient the drainage system the greater the need for effective irrigation.

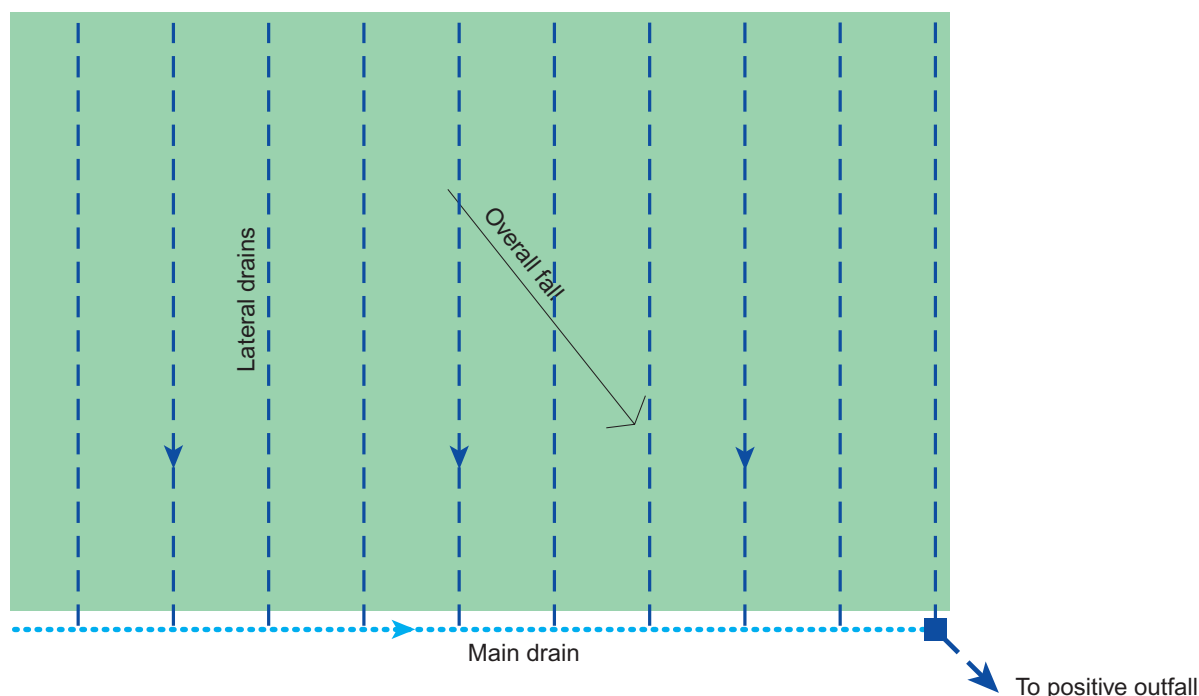


Suspended water table construction. High standards of pitch performance require high levels of reliable maintenance.

Pitch type	Adult weekly use* (hours)	Construction costs per pitch (1999 approx figures, £)	Annual maintenance costs (approx figures, £)	Maintenance	Advantages	Disadvantages
Undrained	Under 2	Under 5,000	5,000 – 7,000	Aeration and sand dressing, when conditions allow, to maximise use of pitch.		Likely to be suitable only in naturally well-drained soils.
Pipe-drained	2 – 3	5,000 – 10,000	5,000 – 7,000	Aeration and sand dressing, when conditions allow, to maximise use of pitch.	Low capital cost.	Susceptible to cancellations in wet weather. In most areas of the UK, only suitable as a 'dry weather pitch'.
Pipe- and slit-drained	3 – 6	20,000 – 30,000	7,000 – 10,000	Regular aeration. Top dressing with suitable sand (approx 60–80 tonnes per annum). High drainage rates mean that some irrigation may be necessary during periods of low rainfall.	Cost-effective way of improving drainage thereby allowing increased use without damage to the playing surface.	Can become capped and sealed over with topsoil rendering them virtually redundant. May be uneven during the first season. The slits may open up during the summer due to shrinkage. Not suitable for hockey pitches where any settlement will adversely affect play.
Suspended water table	4 – 6	200,000 – 250,000	10,000 – 15,000	Artificial reinforcement of the upper rootzone. Appropriate levels of fertiliser and irrigation to maintain hard-wearing turf. Top dressings with rootzone-compliant material. Surface aeration work.	Increases wear tolerance and the performance of play. Greater drainage rates than pipe- and slit-drained systems. If properly maintained a very high standard of playing surface can result.	Regular high level maintenance required. Pop-up irrigation system must be available.

* These figures are only a guide. The playability of pitches depends upon a combination of prevailing weather conditions, physical characteristics of the soil profile and the standard of management provided. The usage levels shown will increase by approximately 50% for players 15 years of age and under.

Principal types of pitch construction.



Typical pipe-drain layout for soccer/rugby/hockey pitches and training areas.

Cultivation

General cultivation is an essential part of seedbed preparation. Cultivation at a deeper level (with a 'subsoiler') may be necessary on sites levelled by major grading.

It is important that the works are correctly timed and that soils are only worked in appropriate conditions. To achieve the desired tilth it is essential that the appropriate equipment is used.

With stony topsoil allowance must be made for the removal of stones or other debris using appropriate stone picking/rotary equipment.

The final seedbed must produce a smooth surface that is uniformly firm but not over-compacted.

An appropriate fertiliser dressing should be applied prior to the establishment of the grass.

Grass cover

The cheapest means of establishing grass cover is by seeding. It is essential that seeding is uniform over the working area.

For rugby and soccer pitches the seed mixture must be composed predominantly, if not entirely, of hard-wearing and fine-leaved cultivars of perennial ryegrass.

On hockey pitches slightly finer textured seed mixtures can be employed, particularly if the pitch doubles as cricket outfield in the summer.



Cultivation of the subsoil is particularly important after major regrading.



Seeding a well-prepared, smooth and level tilth from a tractor-mounted seedbox.

Pitches can be established using purpose-grown imported turf, although this is a more expensive option.

The turf must contain hard-wearing grass cultivars suitable for winter games and be predominantly weed-free.

The turf must be grown on light sandy topsoil and should not be excessively fibrous.

On specialist constructions a washed turf may be considered. This is where the entire topsoil base has been washed away before laying.

Turfed pitches often require intensive hollow tine aeration in order to assist surface drainage in the early years of establishment.

Upgrading pipe-drained pitches

Properly constructed pipe-drained pitches can be upgraded by adding further pipe-drains to achieve a more intensive system. They can be supplemented with additional slit-drains to improve the overall rate of drainage from the playing surface.

Sand amelioration

The drainage characteristics of existing topsoil can be improved by adding suitable sand.

The quantity of sand required should be determined by laboratory analysis. In some cases the sand will be mixed with the topsoil off-site, with the final rootzone spread over the prepared base.

Irrigation

Watering facilities are required for winter games pitches not only for initial grass establishment but to assist with renovation of the playing surface.

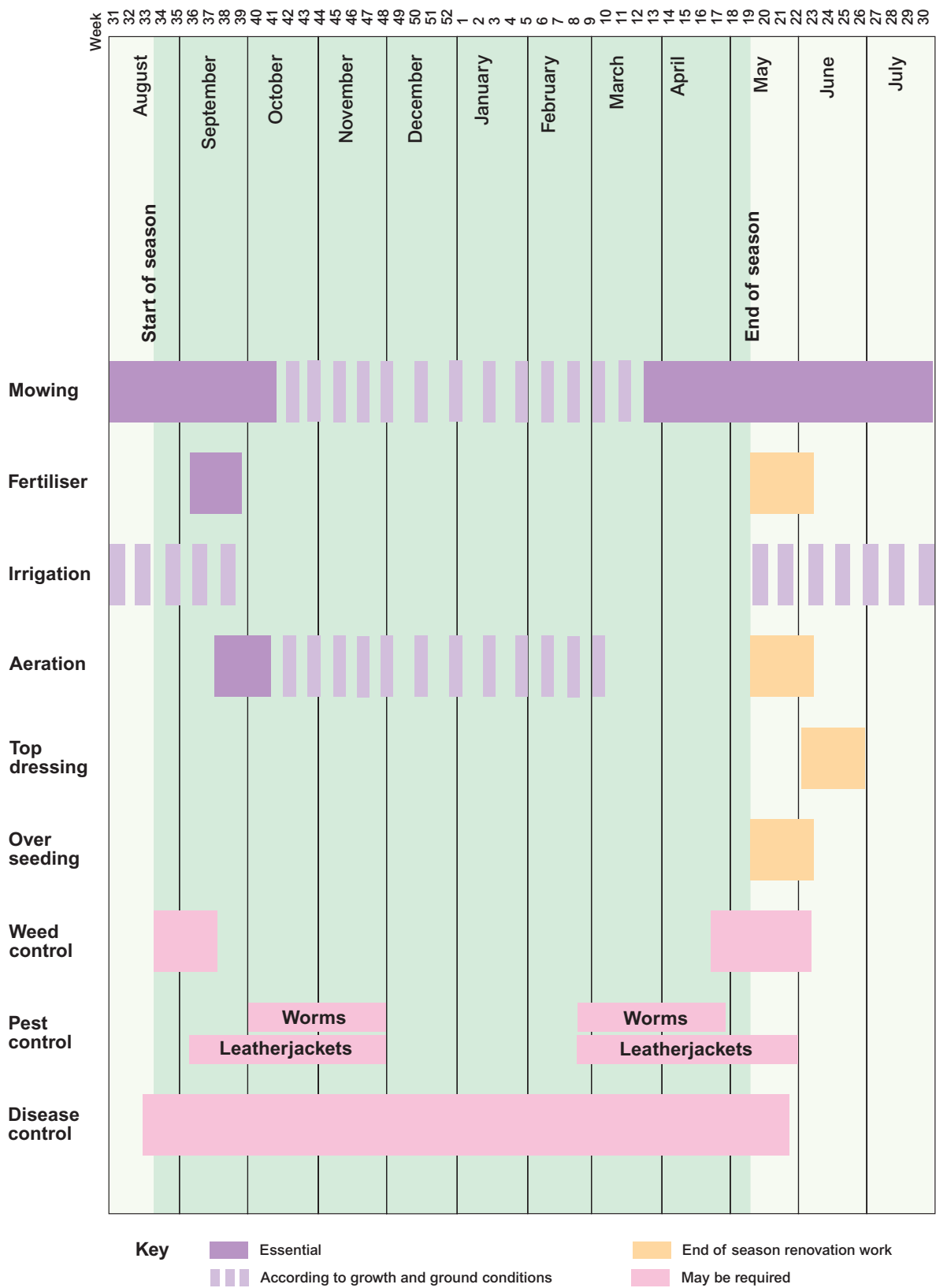
Due to high percolation rates well-drained pitches will require intensive irrigation to combat problems caused by drying out during periods of low rainfall.

The minimum requirement for all pitches is conveniently located hydrant points where a hose or mobile sprinkler can be connected.

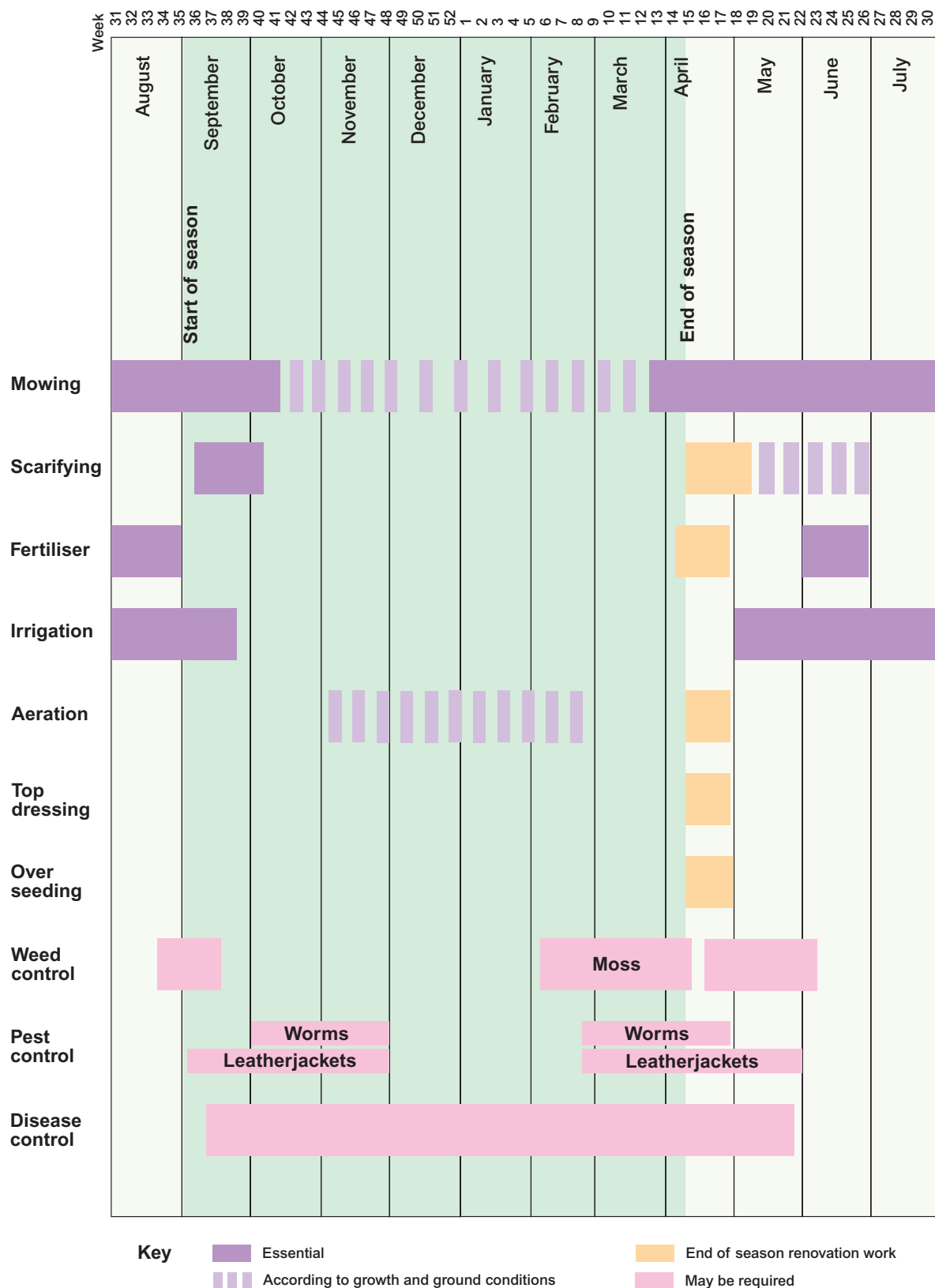
For free-draining rooting mediums over drainage carpets an automatic pop-up irrigation system is essential.



Regular maintenance of the playing surface is essential to prevent expansion of wet areas.



A summary maintenance programme for soccer and rugby pitches.



A summary maintenance programme for hockey pitches.

Maintenance

Typically, post-match work will involve divoting and this 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 and that adequate storage facilities are available to keep it dry.



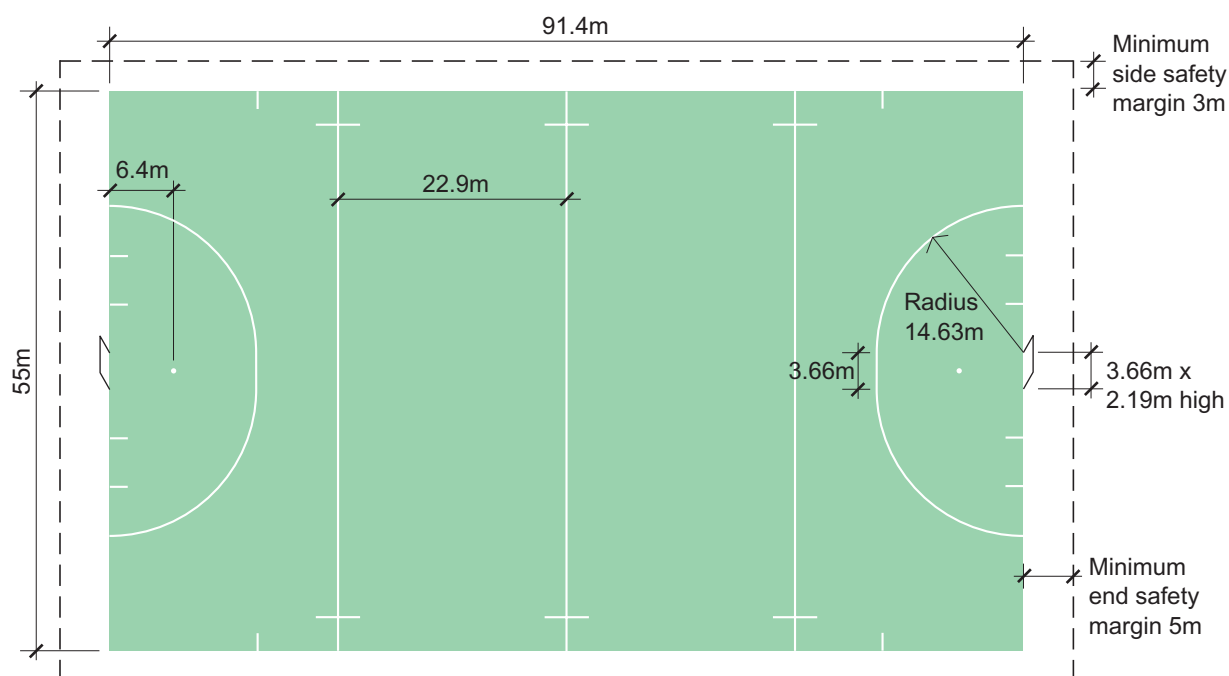
Specialist equipment can be hired to maintain pitch quality.

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 returfing.

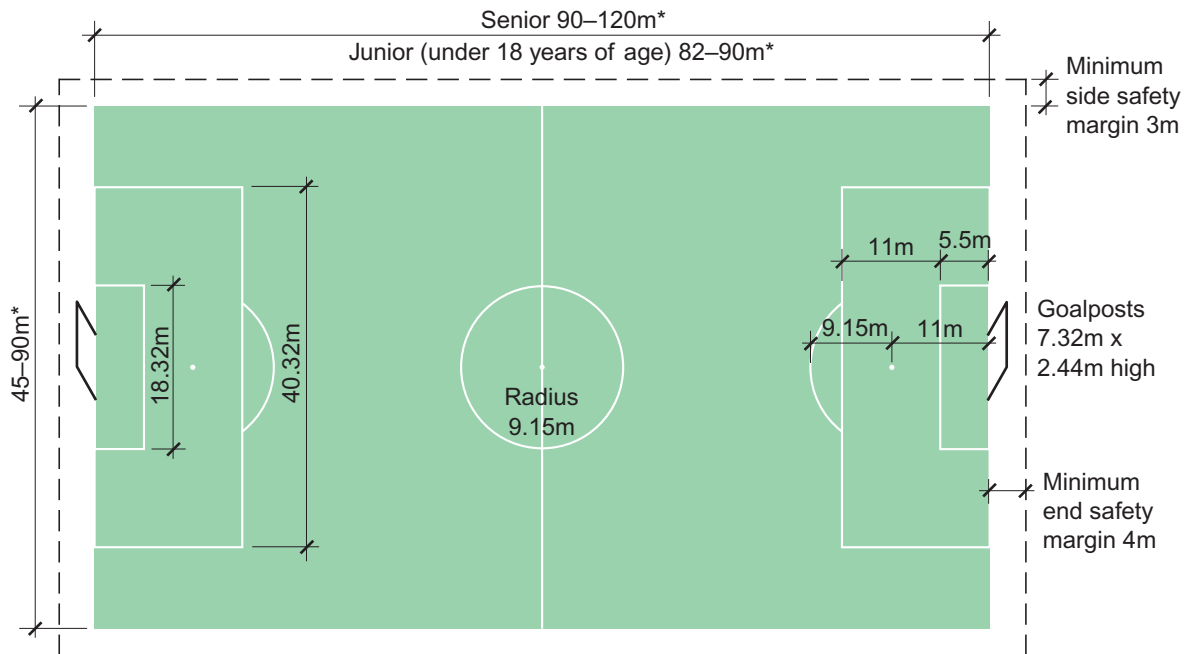
The following equipment is fundamental to successful maintenance:

- mower: various models fulfil different requirements. Cylinder mowers produce a better quality finish
- aerator: tractor-mounted or pedestrian
- sprayer: for application of liquid fertiliser and pesticides
- chain harrow/roller: to break up clumps and relevel the surface. Heavy rolling is no longer considered suitable due to adverse effects on the rootzone
- hand tools: spade, fork, halfmoon brush, dragbrush, edging shears, wheelbarrow, measuring equipment.

Hire expensive equipment as and when required.

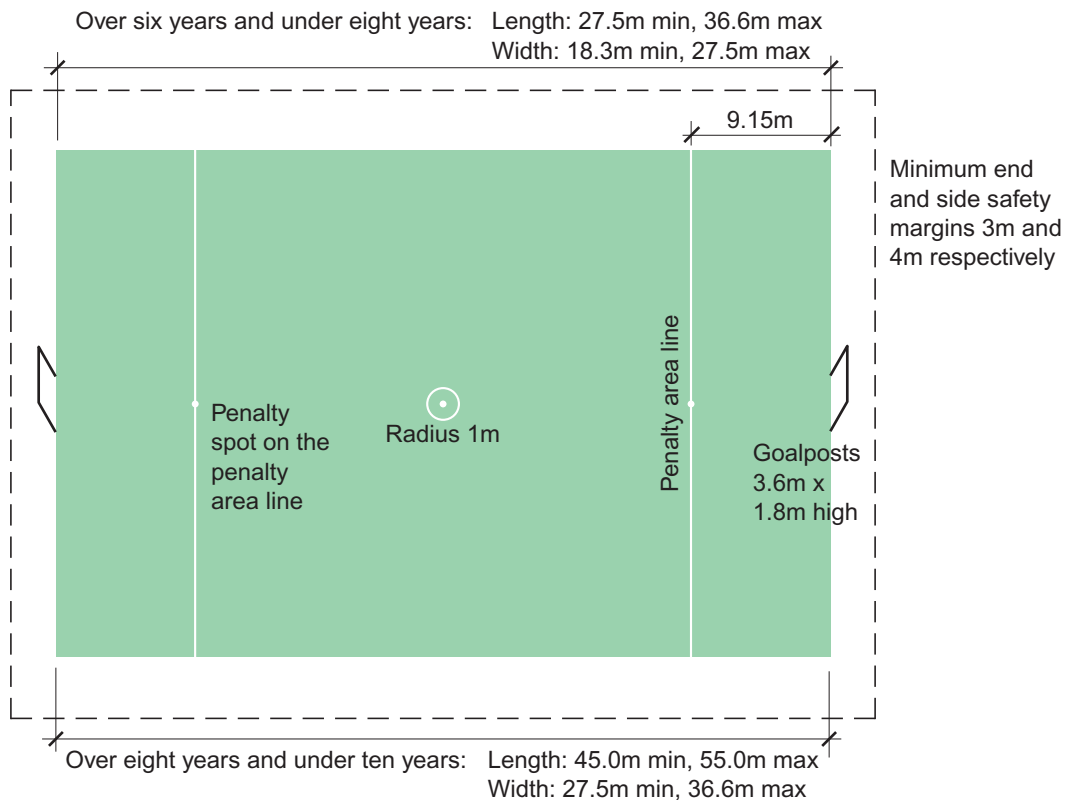


Playing area for hockey.

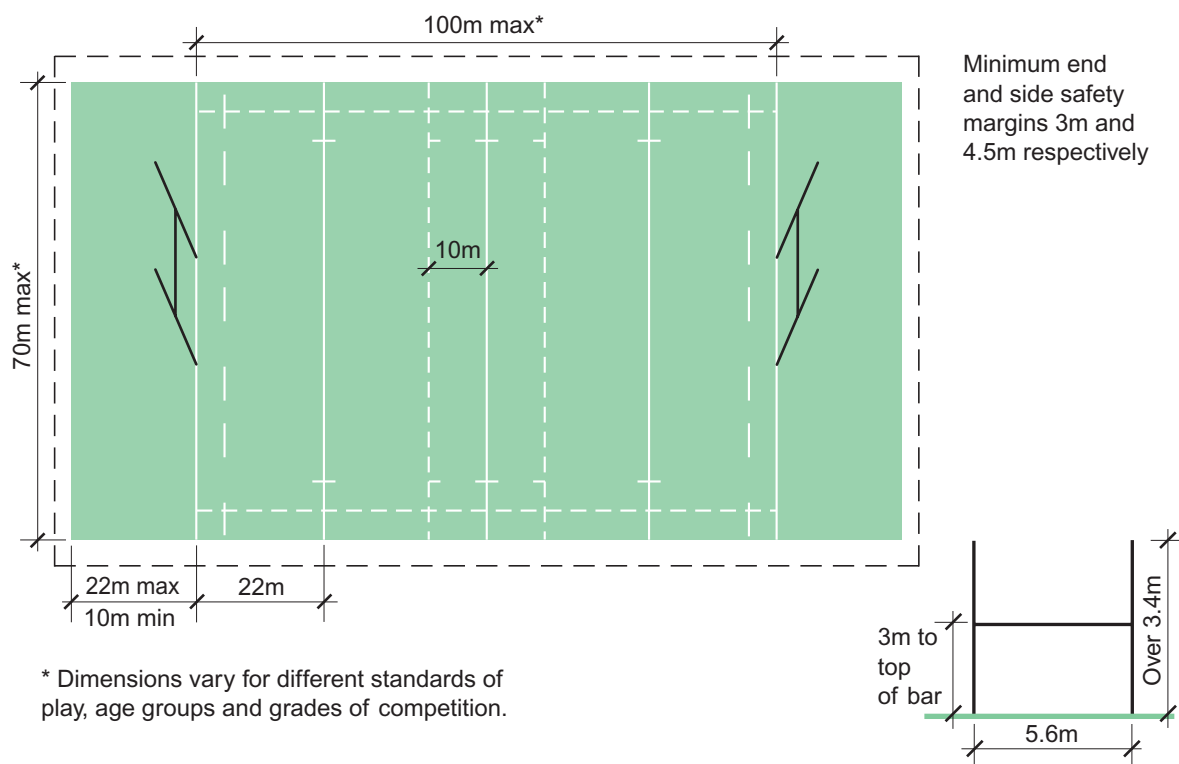


* Dimensions vary for different standards of play and grades of competition.

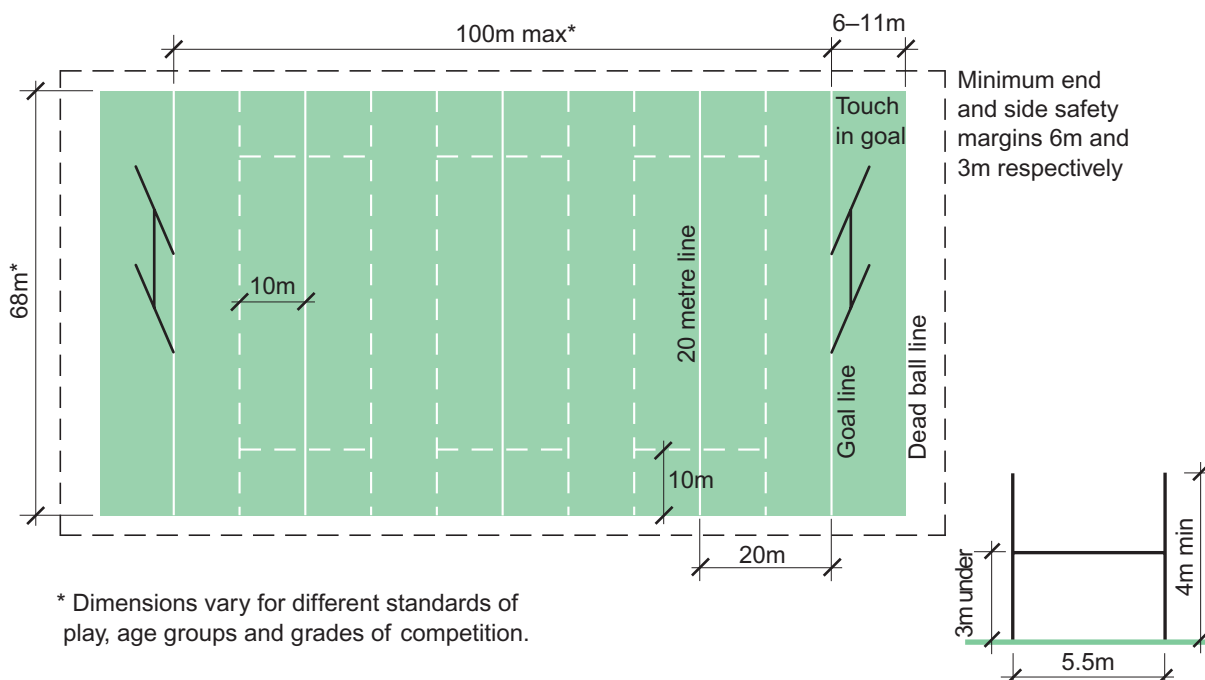
Playing area for soccer.



Playing area for mini-soccer.



Playing area for rugby union.



Playing area for rugby league.

Flat and crown bowling greens

Site considerations

Consider the following points when selecting the location for a new bowling green:

- There must be sufficient land available to accommodate the required dimensions of the green and its immediate surrounds.
- Allowance should be made for a surround path, usually 1.5–2.0m wide, and outer planting borders/grass verges as required.
- A detailed survey drawing of the site will be required to establish finished levels relating to the surrounds and to establish the relationship of the pipe-drainage system to finished levels.
- Ideally, to avoid subsequent settlement problems, bowling greens should not be built on 'filled' areas.
- The green must be located away from tall buildings and trees that may cast shadows over the bowling surface thereby affecting turf performance.
- Avoid tall plantings around the bowling green.
- There must be good access to the site to facilitate construction work and subsequent maintenance operations. Narrow gateways may prove inconvenient for delivery of machines, materials and so on.



The green must be located away from tall buildings and trees that may cast shadows over the bowling surface.



Plan a perimeter hedge and seating around the green.

The basic construction of flat and crown greens is similar – both require the formation of a smooth and uniform bowling surface.

The following sections cover the main stages of construction and the requirements for both types of green.

Grading

Flat greens

A completely level and smooth subsoil formation surface must be prepared with a tolerance of $\pm 15\text{mm}$. Allowance must be made for the various layers of materials used in construction and for making the surface of the green a minimum of 230mm lower than the surrounds.

Crown greens

Adjustment to subsoil levels must allow for a crown formation between 254mm and 380mm above the corner levels. A 380mm crown is the Crown Green Bowling Association's recommended height for a 37m x 37m green; pro rata for other sizes.

Drainage

Greens constructed over porous subsoils such as gravel or sand may not need any special drainage measures but this is exceptional. Most sites will require a drainage carpet and an underlying system of pipe-drains.

Flat and crown greens require a perimeter drain laid beneath the outer ditch channel.

Flat greens

'Emptying drains' should be installed through the graded subsoil formation surface usually at 5–8m centres.

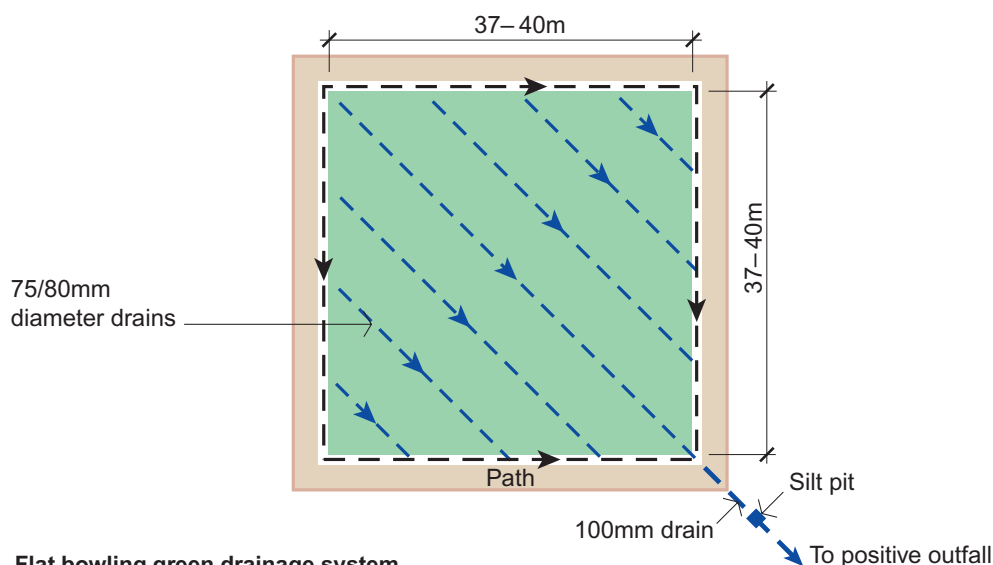
Crown greens

'Emptying drains' are normally omitted from the body of the green as the contouring of the formation allows speedy surface and sub-surface water run-off.

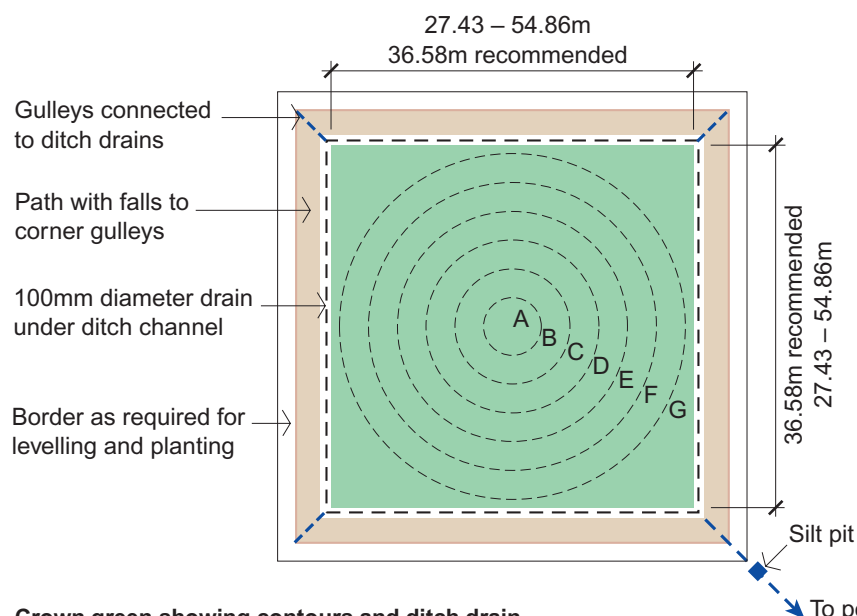
All drains must be laid to an appropriate fall with pipework conforming to the relevant British Standard. All junctions, end stops and so on must be provided as required.

All drain trenches must be backfilled to the formation surface with a 6–10mm layer of hard gravel.

A suitable silt chamber should be provided at the lowest point of the drainage system on the



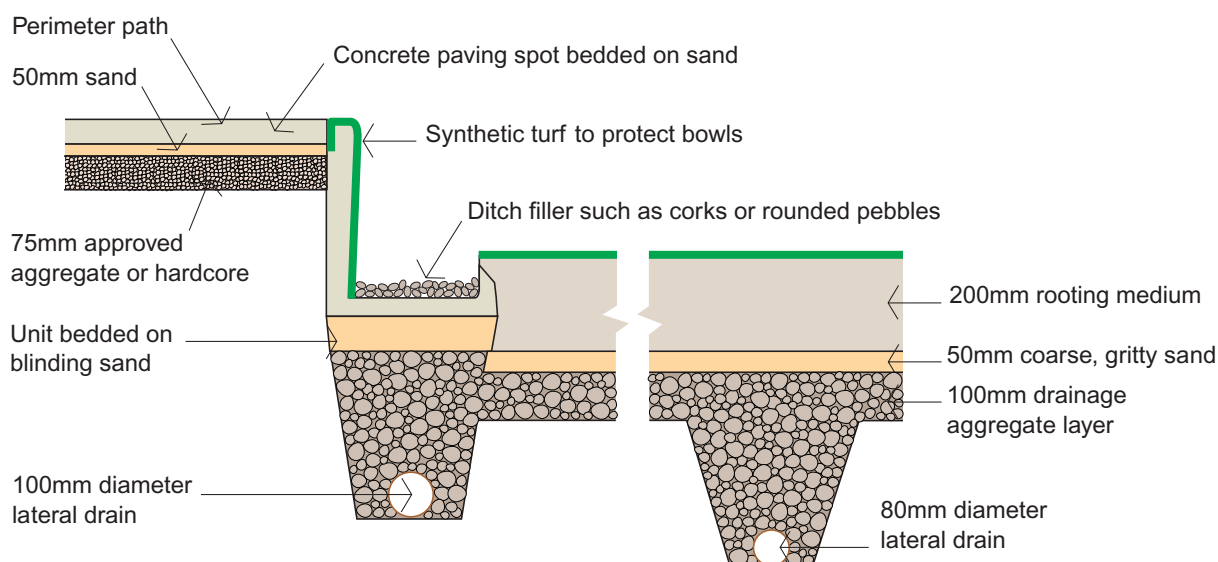
Flat bowling green drainage system.



Crown green showing contours and ditch drain.

	Circle radii (m)	Circle heights (mm)
A	–	254
B	3.05	248
C	6.10	235
D	9.14	216
E	12.19	190
F	15.24	165
G	18.29	127

Details of camber formation



Cross-section through flat bowling green.

green surround. A sealed outlet pipe will be required from the silt pit to a positive outfall such as a watercourse or surface water drain.

Once the pipe-drains have been installed a 100–150mm deep drainage layer of 6–10mm hard gravel is spread over the graded formation surface. The layer is then blinded with a coarse, gritty sand to a firmed depth of 50mm.

Ditch channels

Flat greens

An outer ditch channel the dimensions of which must conform to the statutory criteria laid down by the English Bowling Association (EBA). The height of the outer path surround above the bowling surface is critical.

Traditionally, treated timber boards and/or pre-cast concrete kerb edgings haunched on concrete were used to form the ditch channels. More up-to-date forms of ditch channel are now available in the form of pre-cast concrete, glass reinforced cement and moulded polyethylene plastic. These are manufactured to conform with EBA criteria.

In most cases some form of protection is required to protect the bowls when striking the outer ditch face. This can be in the form of treated wooden battens, artificial turf or rubber 'bumper' bars.

Some form of ditch filler will also be required such as corks, rounded pebbles or other suitable inert durable material that will not harm the bowls.

Crown greens

For crown greens where ditch requirements are rather less rigid, traditional timber edging or pre-cast concrete kerbs are usually used.

Additionally, crown greens require treated timber striking boards along the outer ditch kerb. Alternatively, synthetic turf may be used.



Pre-formed ditch channel simplifies construction.

Rootzone

A free-draining rootzone is required for both crown and flat greens, particularly where local rainfall levels are high.

Sufficient rootzone material should be prepared to provide a minimum of 200mm firmed depth over the blinded drainage layer on completion.

Depending on the location of the green it may be possible to utilise indigenous topsoil if it is light sandy loam in nature. Some preliminary screening of the topsoil to remove larger stones and other debris may be required prior to spreading.

In some situations the drainage qualities of the topsoil might be improved by adding approved sand. Quantities are determined by laboratory analysis and mixing should be done off-site in dry conditions, using appropriate shredders/screeners to ensure the production of uniformly blended topsoil.

If local topsoil is unsuitable provision must be made to import suitable commercially prepared sand/soil rootzone material. The approved rootzone must be spread using appropriate equipment taking care not to disturb the underlying blinded drainage layer.

Seed/turfbed preparation will comprise alternative hand-raking and heeling in order to produce a fine, smooth and evenly consolidated tilth.

Preparation

Note that for all greens it is imperative that a level survey be carried out to ensure that accurate levels aid the setting out.



Laying wide roll turf.

Flat greens

Levelling pegs must be set up on a 3m grid or alternatively 'screeding battens' can be used to accurately set out the levels. Final levels must be to a tolerance of $\pm 6\text{mm}$.

Crown greens

It is important to maintain correct contours and levels by setting up level pegs at 3m centres on each contour line.

Seed/turfbed preparation

In the final stages of seed/turfbed preparation a suitable fertiliser dressing should be well raked into the surface.

Grass cover

Grass cover can be established by seeding or turfing, the choice of which depends upon budget and the time available before the facility is required for use.

Seeding is the cheaper option but a longer establishment period is required, usually 18–24 months. The seed mixture should contain approved cultivars of fescue and bents. A sowing rate of 35g/m^2 is normally used.

Turfing is more expensive, but requires a shorter period to become established (usually between six to nine months). Turf must be purpose-grown on a light sandy topsoil containing fescue and bent grasses and free of broad-leaved weeds and weed grasses.

Traditionally turf is supplied in narrow rolls (approximately 300mm wide) and laid by hand working from boards. Wider rolls, up to 1m across, are now available. These can be laid directly from specially made tracked machines or trolleys.

Irrigation

During construction works a suitable irrigation system must be installed. This is necessary to assist establishment of the grass sward and to aid future maintenance of the green.

A basic system would comprise one or two water hydrants located around the outer edge of the green. These can be used for supplying

portable sprinklers, spray lines or self-travelling sprinklers, given adequate pressure.

A more expensive option would be to install an automatic pop-up irrigation system. This would comprise between four and eight sprinkler heads located outside the bowling green perimeter.

This system would also include a storage tank, pumps and control. All will require safe and secure housing near the bowling green.

Green surrounds

Some form of path will be required on the outside of the green for pedestrian access and/or spectator viewing. The following must be considered:

- The perimeter path must be formed from a durable, level material such as brick/slab paving or, when the budget is a consideration, from tarmacadam.
- Provide safe, easy access to the green for wheelchair players.
- Outer borders may be required for the planting of ornamentals, shrubs and/or perimeter hedging.
- Tree planting demands a cautious approach owing to the potential for harmful shading of the green, as well as penetrating root systems.
- A well-detailed type of outer perimeter boarded fence must be provided for shelter and security.
- Make allowance for sufficiently wide access gates through the fence for maintenance machinery and so on.
- Facilities such as seat recesses, litter bins, path drainage gulleys and access ramps to the green must also be provided.

Maintenance

Maintenance requirements will depend upon site conditions and prevailing growth. Proper management will be vital to the achievement of the best possible playing surface and top dressing the green will be crucial in achieving this.



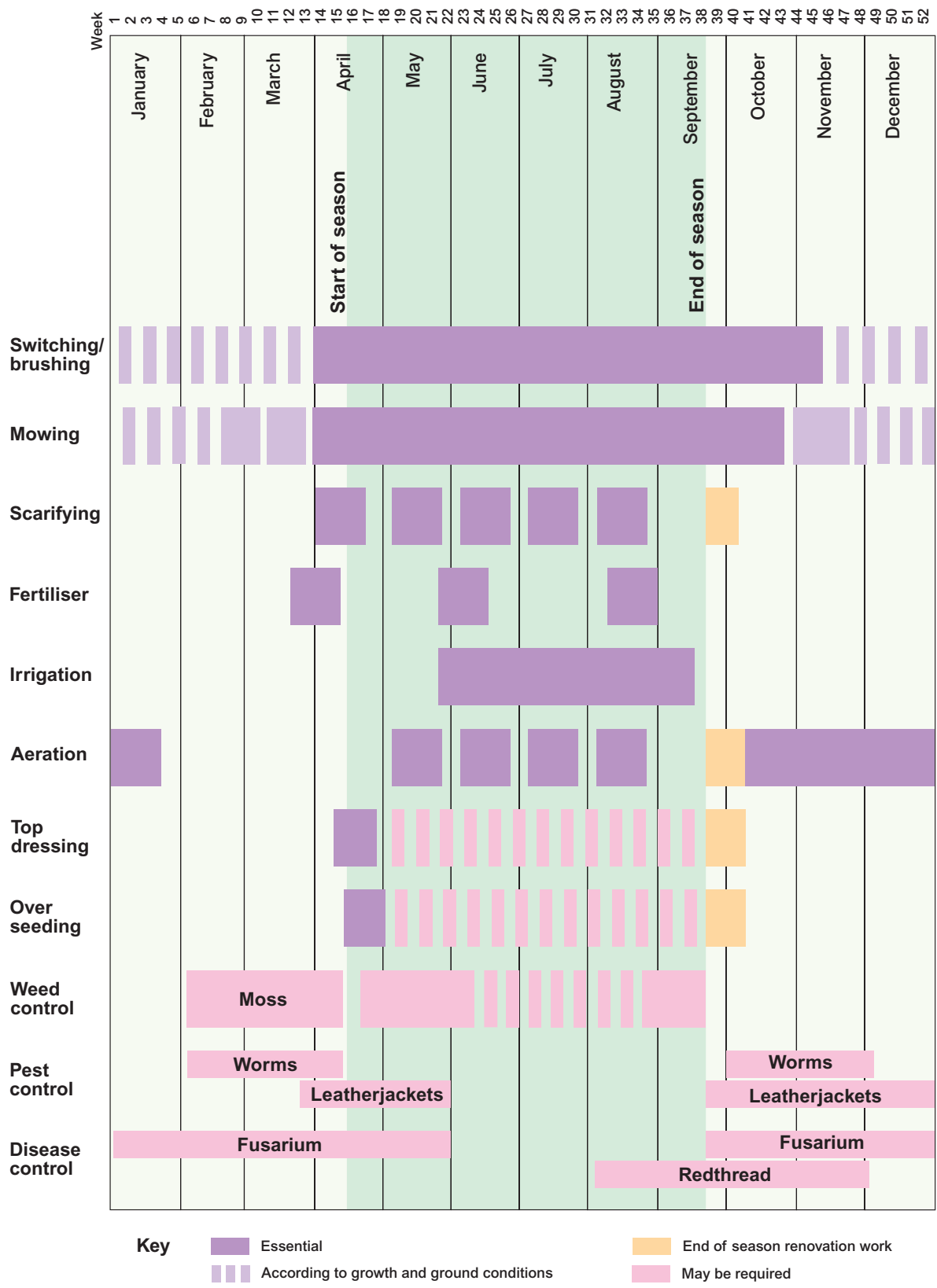
Regular maintenance is essential to ensure a quality playing surface.

Other maintenance requirements should be discussed and agreed with the green design specialist who should provide a detailed maintenance schedule with the original design. Consideration of these requirements must not be left until the works are completed.

The following equipment is fundamental to successful maintenance:

- mower: a high quality professional cylinder mower, the most expensive and important piece of maintenance machinery
- aeration machine: ideally a powered, pedestrian version
- scarifier: the most efficient are powered, pedestrian models
- sprayer: for pest and disease control
- spinner-type pedestrian distributor: to achieve even application of granular materials, especially fertilisers
- water square or spray line: to water the green in the absence of an automatic pop-up system
- hand tools: including a switch, dragmat or dragbrush, edging shears, fork, spade and springbok rake. A large lute will be required for flat greens.

Expensive equipment that will rarely be used such as a punch-action hollow tine machine or top dresser, should be hired as and when required.



A summary maintenance programme for bowling greens.

Cricket grounds

The following guidance will assist clubs and schools during the early stages of planning a new cricket square or pitch. The guidance does not, however, go into great detail in terms of design, construction and maintenance issues and these must be considered in relation to the guidelines available from the England and Wales Cricket Board (ECB). Additionally, for all but the smallest projects, expert independent advice must be sought.

Initial planning

First, identify the level of cricket to be played and thereby the standard of pitch required.

Plan the square to have a lifespan of 25 years and factor in realistic maintenance costs to achieve this.

The boundary should be a minimum of 45.72m from the centre of the pitch in current use.

Pitches must run approximately north/south to minimise the risk of batsmen or bowlers facing a low sun. The pitch axis must point in a direction between 325 degrees and 55 degrees on the compass.

One pitch area is 22.86m long x 3.05m wide. The size of the cricket square is determined by the number of pitch areas required in a season. To calculate this:

- Assess the total number of matches to be played during the season.
- Assess the number of times each strip can be used during the playing season. This is variable but could be between two and five times dependent on the type of cricket, the standard of maintenance and the time available to the groundsman to maintain and prepare the pitches.
- Calculate the number of pitches required and hence the total width of the square: the number of matches to be played divided by the assessed number of games per pitch gives the total number of pitches required.

Site investigation

Before making decisions about the construction of the cricket ground it is important to identify the characteristics of the indigenous soil. This is achieved by analysis of the topsoil and the subsoil from a minimum of six locations on the site. The soil analysis should be presented in the form of a professional report.

The initial investigation should identify the site's natural run-off and the location of existing drainage. Where available, obtain copies of drainage plans.

Ensure there will be reasonable access for construction vehicles and take steps to protect the outfield from damage by heavily laden traffic.

Following initial planning and site investigation and before proceeding further, the following information must be available:

- required size of square
- depth of dig for construction of the square
- drainage requirements for the proposed square and for any future expansion.

Falls

The final surface level of the square must blend with the fall of the surrounding outfield and must be of a consistent and uniform grade.

Ideally, the square must be completely level along the line of play. A slight fall of up to 1:100 might be acceptable.

A slight cross-fall of between 1:80 and 1:100 is acceptable as this will encourage surface run-off.

Materials

Cricket demands a firm, level surface that provides consistent bounce and pace. The selected soil will have a major influence on the physical characteristics of the playing surface and will also affect the selection of grass cover. The nature of the existing topsoil will determine the extent of the construction works required to develop the square. For different standards of pitch the minimum clay content should be:

Note that marl should not be used.

To accommodate the imported topsoil an equivalent depth of existing material must be removed. The imported topsoil must be compatible with the indigenous topsoil.

The drainage system must be designed by a specialist to meet the demands of the location and planned pitch use.

Except when designed with a drainage raft, never install a pipe-drainage system under the square as this will result in differential drying out at the surface. Drains should not be laid with falls less than 1:200.

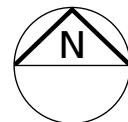
'Drainage rafts' are required only in exceptional circumstances, such as on very wet sites or where the highest standards of construction are required, for example at county level.

Excavate topsoil to required depth, invariably 100–150mm. Install the drainage system.

If excavation exceeds 100mm introduce appropriate loam in layers no deeper than 50mm.

Soil should be consolidated every 50mm by heeling. While time-consuming, consolidation is the most important element of the construction process and must be carefully supervised.

Alternative methods of consolidation are available, for example with 'whacker plates' but



27

particular care must be taken if this method is used. All levels must be keyed in and air pockets removed. Failure to carry out this process diligently will curtail the expected lifespan of the pitch or square and lead to disruption and additional costs.

Levelling and construction can be achieved with levelling pegs or laser levelling equipment and, if correctly carried out, there should be no need for overlapping. The success of this procedure relies on exact marrying up with the outfield.

A roller must not be used for the final levelling as this may leave isolated pockets that can only be eradicated by 'walking and heeling'.

Seeding

Note that turfing a pitch or square is strongly discouraged. Grass cover will normally be established by seeding using appropriate cultivars of suitable grass species sown at a rate of 35g/m². The selection of a suitable seed mixture will depend on:

- proposed intensity of use
- available levels of management and maintenance.

The seed mixture should be selected in consultation with a specialist and taking account of advice available from the ECB. Successful seedbed preparation relies on the following steps:

- Ensure all stones are removed.
- Rake the surface and, where necessary, apply a pre-seeding fertiliser.
- Spread the seed uniformly then lightly rake into the surface and roll with a hand-roller.
- Water the seedbed.
- Provide protective fencing around the perimeter to prevent encroachment onto the new surface.

The square will be ready for use between 18 months and two years after seeding.

Irrigation

Provide at least one hydrant point at a location convenient to the square. A hose or sprinkler



The best quality playing surfaces are mown regularly at an appropriate height for the sport taking place.

can be attached for general watering of the square and/or preparation of pitches.

Automatic pop-up irrigation systems are not usually installed on cricket grounds.

Outfield

The outfield must comprise smooth and even levels that permit balls to roll freely across the surface. If the outfield is to be cut from grassland the site must be checked for:

- uneven surfaces
- inadequate drainage
- inappropriate grasses.

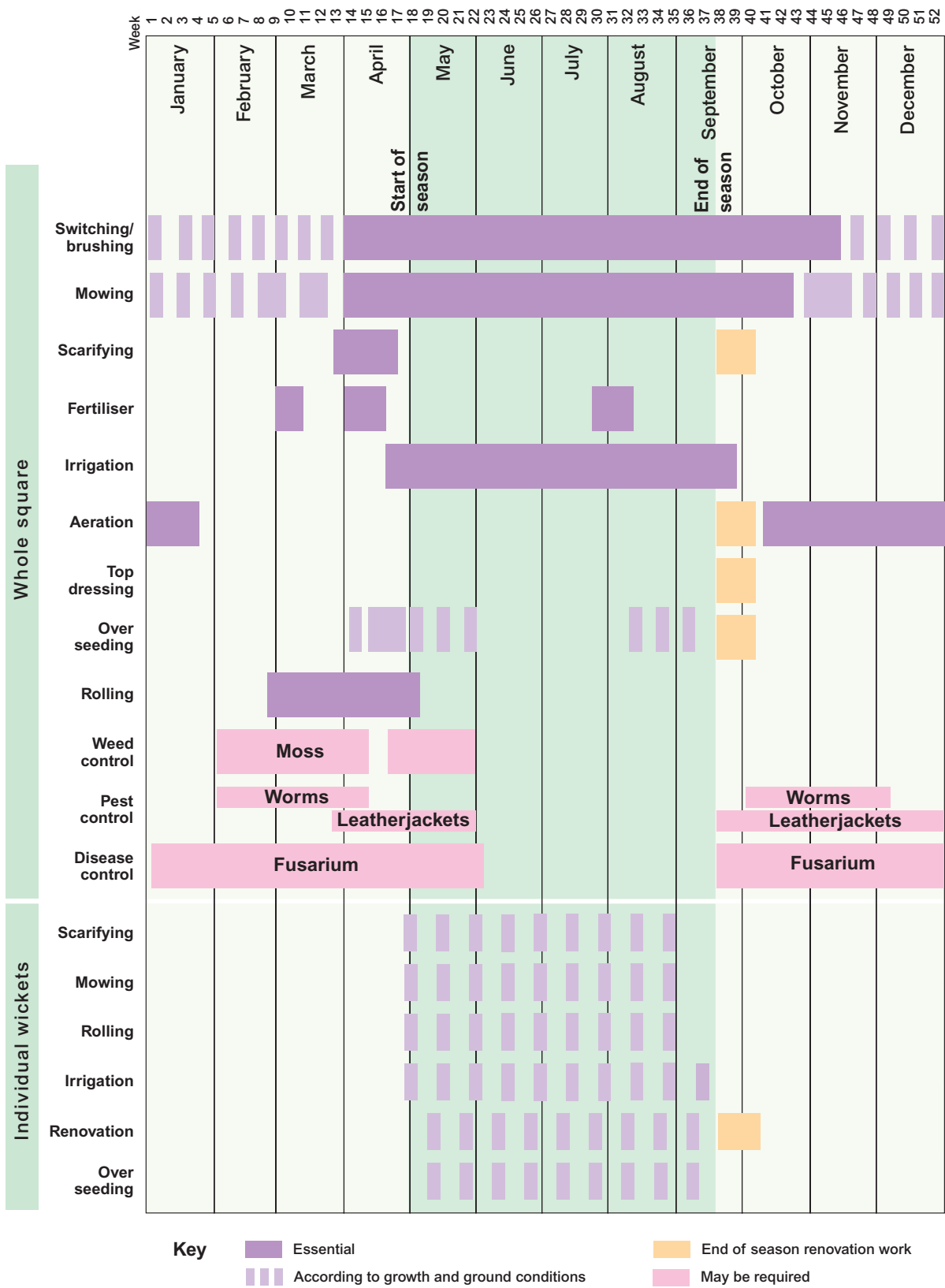
Where the quality of turf is satisfactory and site undulations are isolated it should be sufficient to strip away portions of turf and, where necessary, adjust the underlying ground level.

The turf is then replaced to form a level and firm surface.

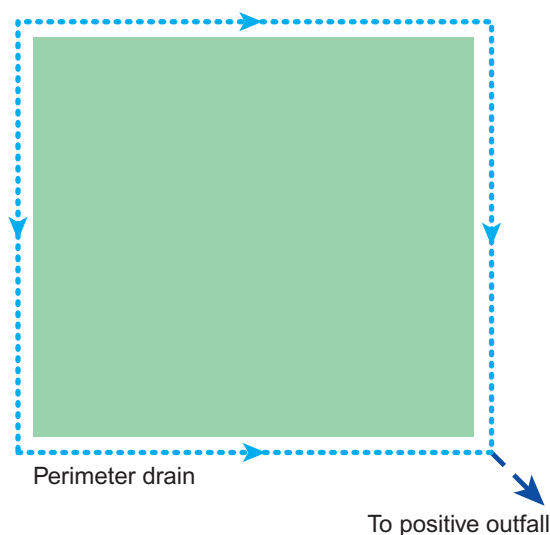
Where site undulations are more severe but there is a good depth of topsoil, it may be enough simply to regrade the site to a uniform surface.

Where existing gradients are too steep, more drastic level adjustment may be necessary involving the removal of topsoil and grading of exposed subsoil, followed by topsoil replacement.

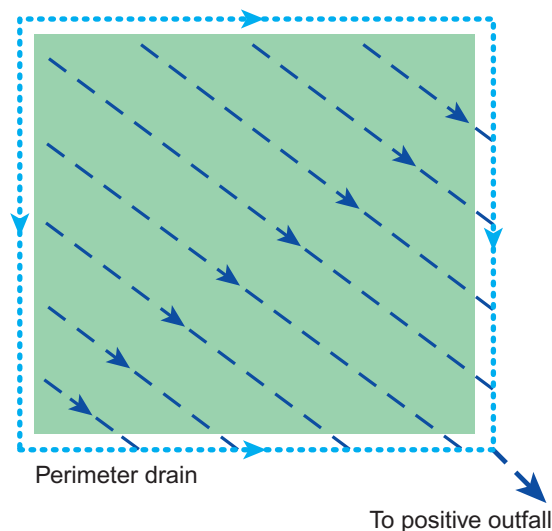
The outfield need not be completely level and a slight gradient of up to 1:50 may assist shedding of surface water.



A summary maintenance programme for cricket squares.



Cricket square without drainage raft.



Cricket square with drainage raft.

Outfield drainage

Where rainfall levels are low and topsoil is naturally free-draining there should be no need for artificial drainage, particularly if the outfield is to be used for summer cricket only.

If the ground is relatively impervious some form of pipe-drain system may be required.

Where the outfield will be used as a playing surface for soccer, rugby or hockey construction should follow recommendations for those sports.

While supplementary slit-drains may be used on cricket outfields caution is advised owing to the possibility of settlement of backfilling material within the slits during dry weather. This will result in an uneven playing surface which is potentially dangerous for fielders. Make allowance for topping up the slits with suitable sand when settlement occurs.

Grass cover

For the finest quality outfields mixtures containing appropriate species of fescue and bent are most appropriate.

Where winter games are to be played on the outfield the inclusion of a proportion of perennial ryegrass is essential to maintain the hard wearing quality of the surface in anticipated wet

winter playing conditions. The cultivars chosen should have a high tolerance of close mowing. A seed mixture containing between 40–60% by weight perennial ryegrass would be suitable for most winter games situations.

Maintenance

Detailed guidance on the maintenance of cricket squares and outfields is available from the ECB. Requirements will depend on:

- site conditions
- prevailing growth
- intensity of use.

Equipment

The ECB provides detailed guidance on the equipment necessary to maintain the quality of the playing surface throughout its life. It is vital that this guidance is considered in detail during consultation with your appointed specialist at the outset of the project.

Non-turf pitches

Non-turf pitches are popular for practice and occasionally for matches. The ECB has set performance standards for these pitches which are implemented through suppliers approved and regulated by the Board.

Grass tennis courts

Playing surface

Uniformity and consistency are the key requirements. There must be no variation in ball bounce or speed of the playing surface.

To achieve these standards a number of criteria need to be satisfied including sound basic construction, correct maintenance of the turf, and regulation of court usage.

Site considerations

Before work begins a full and detailed investigation of the site is required. For championship standard and good quality club courts the requirement is:

- good stone-free topsoil of medium to heavy loam type
- true, firm, fast playing surface that does not readily break up.

In the majority of cases indigenous topsoil may well be acceptable for 'domestic' courts. For this

standard of surface the requirements are less exacting and the level and intensity of usage would not necessitate or justify the importation of selected loams.

Topography

Grass growth may be adversely affected on very exposed sites. On the other hand, excessively shaded courts can pose their own problems.

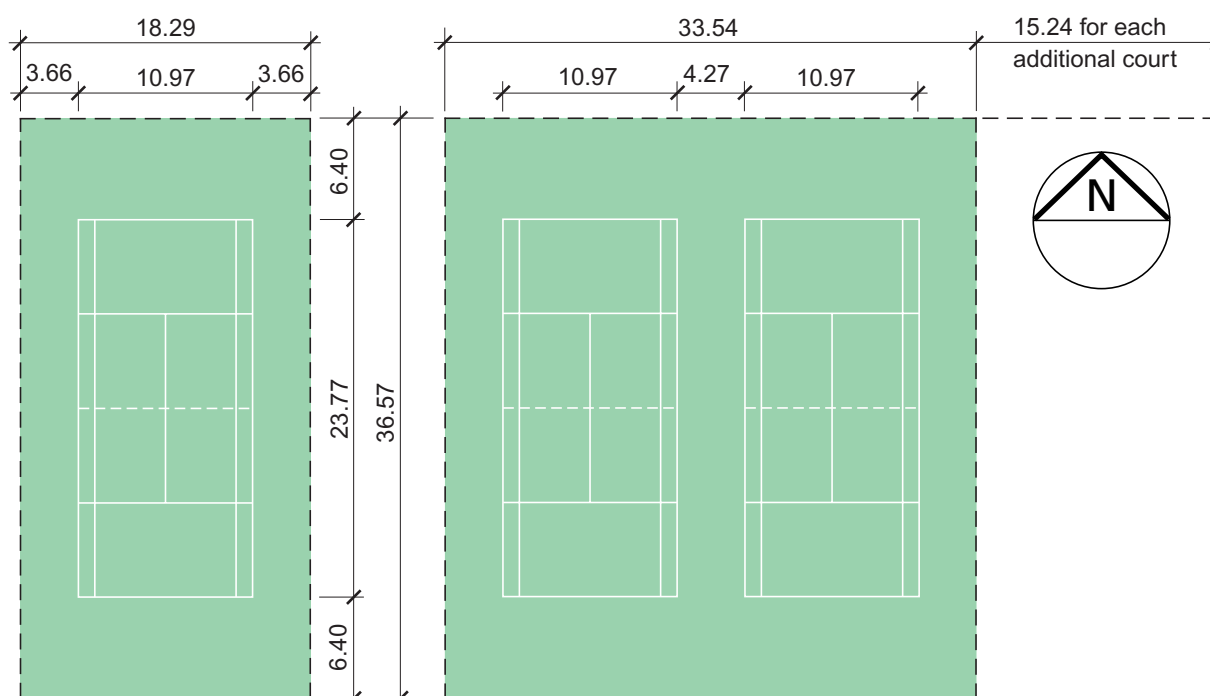
Orientation

Courts must be oriented with play along an approximate north/south axis.

Levels

- Gradients must not exceed 1:120 on championship standard courts.
- For general club use 1:100 is acceptable.
- Where possible the gradient must be across the line of play.

In all cases gradients must be uniform throughout.



Dimensions for enclosed tennis courts.

Earthworks

Most sites will require regrading to the desired levels. This usually involves stripping off the existing topsoil and grading out the subsoil on a 'cut and fill' basis before replacement of the topsoil. The end result must be a stable, level and smooth plateau on which to spread preserved or imported topsoil.

Drainage

Although tennis on natural turf is a summer sport grass courts must be reasonably well drained to:

- facilitate routine maintenance
- avoid waterlogging during the winter months.

On naturally well-drained soils courts may not require supplementary drainage.

Where level adjustment is necessary as an element of court preparation, basic pipe-drainage will normally be required. This should involve the introduction of a perimeter drain.

If the subsoil is unsuitable due to impermeability and a high standard of court performance is required, it may be necessary to provide a layer of free-draining aggregate over the entire court sub-base. This would normally require:

- a graded gravel or stone spread to a thickness of 100–150mm and drained by a series of pipe-drains, normally at a spacing of 5–10m
- finishing with a blinding layer of coarse sand or fine grit, approximately 50mm deep.

Topsoil profile

If the topsoil is unsuitable for tennis spread a 75–100mm layer of selected clay loam over the existing topsoil following preliminary cultivation and grading.

Where a drainage layer has been provided it is usual to spread over this 200–250mm of imported selected topsoil (with a clay content of 16–21%). More detailed advice is available from the Lawn Tennis Association (LTA).



High levels of maintenance are required to minimise the effects of wear and tear.

Cultivation

Initially cultivation equipment may be required to break down the soil and create a rough working tilth.

The final seedbed should be produced to form a fine, smooth and evenly consolidated but not over-compacted surface.

The seedbed should be graded using laser-guided equipment or by working to levelling pegs at 3m centres.

During seedbed preparation all small stones and debris should be removed and a pre-seeding or pre-turfing fertiliser applied.

Grass cover

On courts that will attract only occasional use the grass cover could contain a mixture of fine-leaved fescue and bent grasses. However, regularly used courts where a high standard of performance is required will need grass cover comprising predominantly perennial ryegrass with fescue. The cultivars chosen should be highly rated for shoot density and tolerance of close mowing.

Seeding

Where grass cover is to be established by seeding it is essential that this is done uniformly. Seeding is cheaper than turfing but takes longer to become established, usually 18–24 months.

Turfing

Courts can be established using purpose-grown imported turf. The turf used should:

- contain appropriate grass species
- be free of broad-leaved weeds and excessive amounts of fibre.

The soil on which the turf is grown should match the soil on the court as closely as possible.

Once laid, the court will require regular dressings of screened topsoil, compatible with the underlying soil, in order to perfect surface levels.

Turfing is more expensive but play will be possible sooner, usually within about six months, given adequate aftercare.

Irrigation

A suitable water supply must be planned when developing a grass tennis court. This is required to help sustain normal grass growth in dry spells, as well as to assist the renovation of worn sections.

A single hydrant point to which appropriate sprinklers can be attached is a basic requirement.

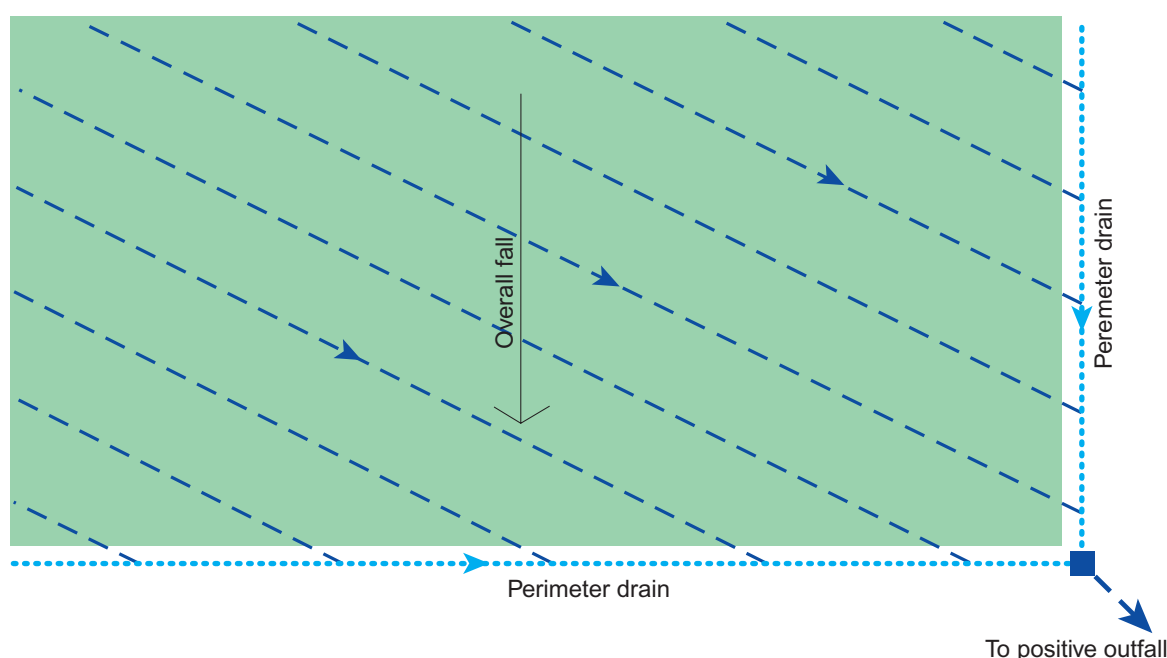
For higher standard facilities an automatic pop-up irrigation system could be installed.

Maintenance

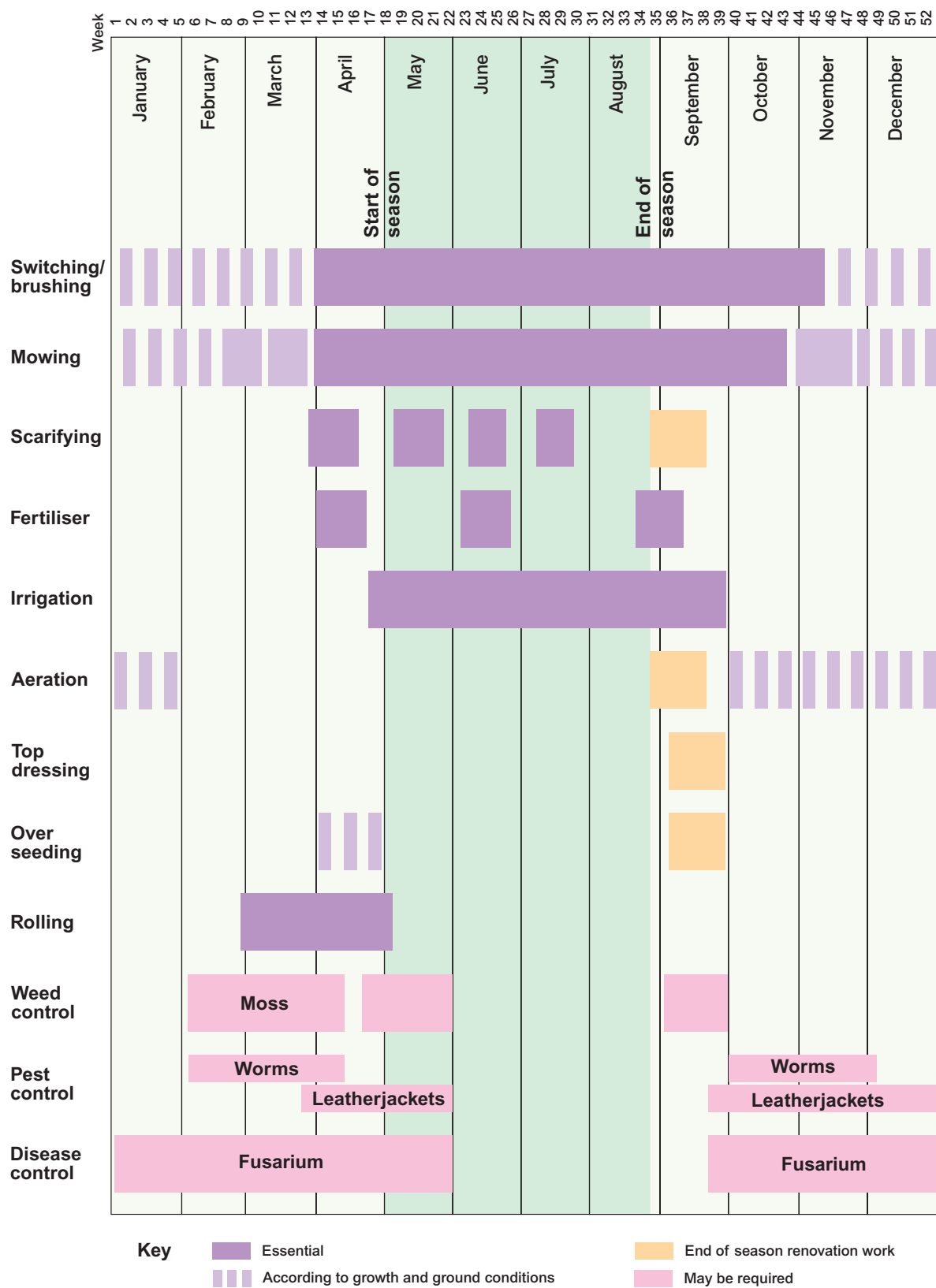
Maintenance requirements depend on site conditions and prevailing growth. The following machinery is the basic requirement:

- high quality, professional standard cylinder mower
- line-marking equipment
- powered aeration machine
- powered rotary scarifier
- sprayer for the application of pesticide
- spinner-type pedestrian distributor for applied fertiliser treatments
- suitable roller
- wide lute (approximately 3m)
- watering equipment
- hand tools including a switch, fork and mower gauge.

Rarely used expensive equipment such as a punch-action aerator or top dresser should be hired as and when required. Detailed guidance on court maintenance is available from the LTA.



Typical pipe-drainage layout for tennis courts where gravel drainage layer provided.



A summary maintenance programme for tennis courts.



All sports require a quality playing surface. Detailed consideration of design, construction and maintenance is essential.

Sport England aims to lead the development of sport in England by influencing and serving the public, private and voluntary sectors. Our aim is:

more people involved in sport

more places to play sport

more medals through higher standards of performance in sport

Sport England Disclaimer

Every effort has been made to ensure the accuracy of the information contained in this publication. Sport England, its servants or agents shall not at any time, in any circumstances, be held responsible or liable to any party in respect of any loss, damage or costs of any nature arising directly or indirectly from reliance placed on the material in this publication, or any other guidelines or policies issued by Sport England. This information has been prepared as a basic guide only and should not be viewed as a substitute for obtaining comprehensive expert or professional advice.

This guidance and Sport England policies on Lottery funding applications are subject to change from time to time, including variations required to comply with governmental directions on the application of Lottery funds. Sport England reserves the right to amend, supplement and/or discontinue, at its absolute discretion for whatever reason, any or all of the guidelines set out in this publication.

Copyright statement

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the permission of Sport England.

There are a number of Guidance Notes on related matters. A current list is available from:

Sport England Publications
PO Box 255, Wetherby LS23 7LZ
Tel: 0870 5210255. Fax: 0870 5210266
Minicom: 0870 1207405. E-mail (order enquiries only): sportebooks@twoten.press.net

© Sport England, March 2000
SE/920/5M/3/00
16 Upper Woburn Place, London WC1H 0QP
Tel: 020 7273 1581. Fax: 020 7273 1710
www.english.sports.gov.uk



Sport England is the brand name of the English Sports Council which is the distributor of Lottery funds to sport.

Design concept by GDA Creative Solutions
Produced by NBA Tectonics
Printed in England by Belmont Press



Ref: 920
£10
ISBN 1 86078 103 9