FOOTBALL
QUEENSLAND

# FIELD CONSTRUCTION & MANAGEMENT

## NATURAL TURF PITCHES GUIDE

INFRASTRUCTURE

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# ACKNOWLEDGEMENTS

Football Queensland would like to acknowledge the work and commitment carried out by Football Victoria in the development of this guide.

This guide has been designed and produced for use by the Local Council Authorities to assist with grass football pitch design projects and maintenance programs. It also aims to assist sport and recreation consultants and architects when producing concept master-plans and final designs.

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# INTRODUCTION

**Football has steadily grown in popularity over the last 30 years and interest in this sport is arguably at an all-time high. This is the result of expansion with the national competition, its relevance in world sport and on the back of high junior as well as female participation. It is therefore important to ensure that the performance of the football pitch surface is able to meet these expectations.**

Football has specific requirements in terms of the surface that it should be played on. However, football is played on a vast range and quality of football pitch surfaces, some quite satisfactory while others are deficient in terms of both quality and safety, and which need improving.

The standard of each football pitch is now under more scrutiny than ever before because of public liability and risk management awareness as well as expectations of the high quality that the playing surface should deliver. Due diligence is needed at all times to minimise the risk of injury to players and users of football pitches as well as to spend money wisely. This is now providing increased pressure on the maintenance contractor to provide a top quality playing surface for all occasions.

The majority of football pitches in Metropolitan and Regional Queensland are owned and maintained by Local Councils. Many of these are not dedicated or exclusive football pitches and are used for multiple sporting activities during the year. It is therefore important that all people involved with the football pitch, including the users, maintenance contractors and Local Government Authorities, are working together to provide a safe work place and the best possible playing surface under the conditions and circumstances that may exist.

This manual covers the following:

- Requirements and Expectations of Football Pitches
- Factors Affecting Quality and Performance of Football Pitches

The objective of this manual is to provide guidelines for the management, upgrade and construction of football pitches, to be used by Local Government Authorities along with those involved with the management and the construction of football pitches.

# SECTION 2

## Requirements and Expectations of Football Pitches

The game of football relies heavily on the following three key elements:

- Interaction between the ball and the playing surface
- Interaction between the player and the playing surface
- Interaction between the player and the ball

It is essential that the playing surface is at the standard needed to satisfy these three key elements.

Details of field of play requirements for football pitches in Australia are presented in Table 1.

According to the regulators of football both nationally and in Queensland the football pitch should meet the following requirements:

The playing surface must be even with a thick, dense and uniform turf coverage.

- Either natural grass or FIFA approved artificial grass pitches may be used.
- The surface must be free of foreign objects and protrusions of any kind through the surface, or any deviations, depressions and undulations that could be hazardous to players or officials as they move across the surface.
- Safe to the user.
- Grass height that is regularly maintained to favour good ball roll and responsiveness of the surface
- Firm surface that will provide a responsive surface, including adequate ball bounce, ball roll and player traction
- Excellent condition for ball roll and responsiveness of the ball to the surface
- Excellent condition for traction.

Failure to provide all of these requirements will quickly result in an inferior quality and substandard and unsafe surface. It is therefore critical to correctly design and construct the football pitch and also to monitor the condition of the football pitch on a frequent basis to meet these requirements.

### 2.1 Pitch Size

Details of the field of play requirements for football pitches including pitch sizes required for various levels of football are summarised in Table 1.

There is flexibility in the pitch sizes accepted for football, especially for lower levels of football. This allows sporting venues other than those dedicated to football to be used to accommodate this sport, including AFL, rugby and cricket grounds.

The dimensions of the pitch required for premier grade football matches is 105 metres long by 68 metres wide. This is the maximum dimensions that should be considered for a football pitch and should be the size objective when designing and constructing new football pitches.

The minimum accepted dimensions for senior grade football matches is 96 metres long by 60 metres wide.

A schematic view of a premier football pitch surface is shown in Figure 1.

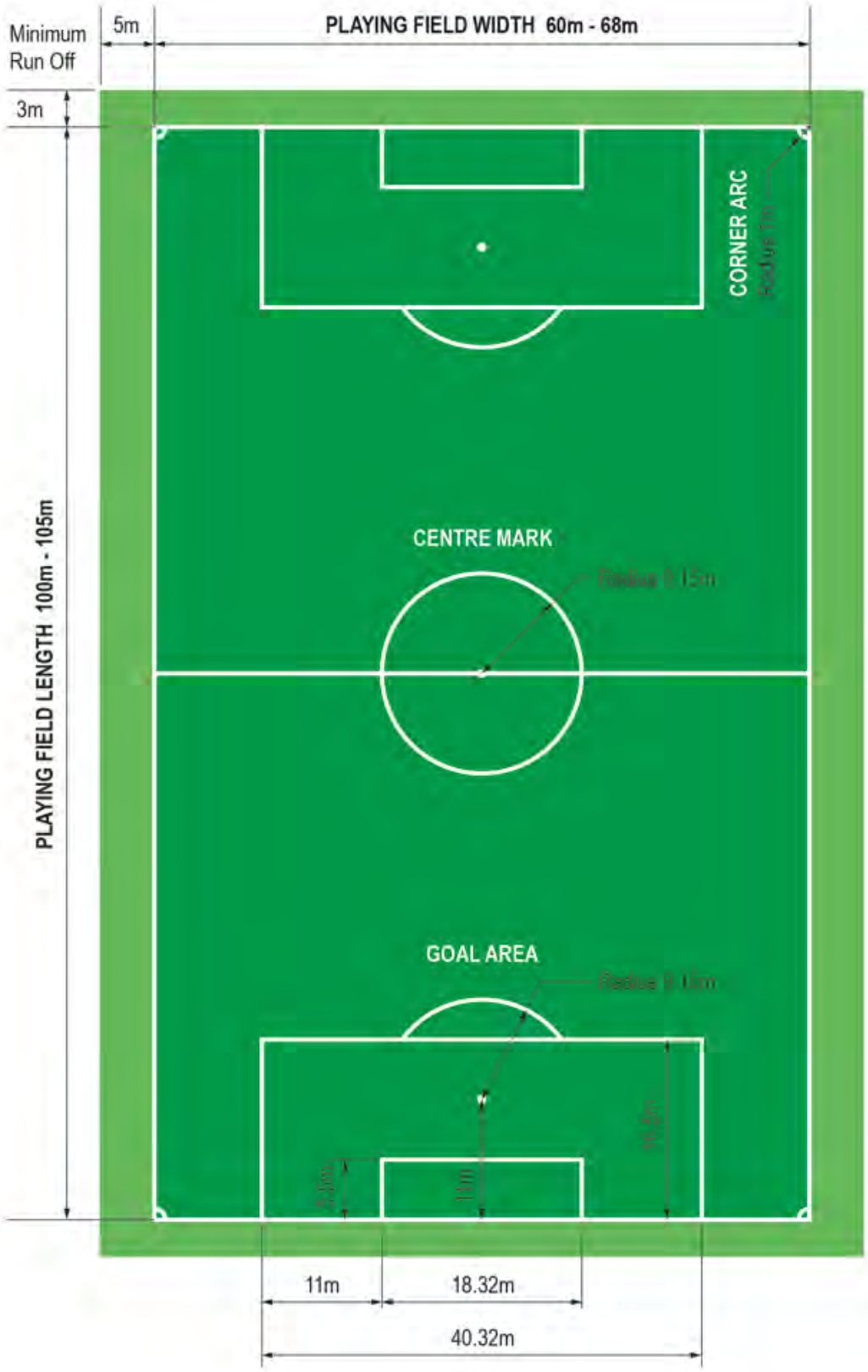



*Figure 1*

TABLE 1 Summary of Field of Play Requirements for Football Pitches

| HEADING | RULE | VENUE CLASS | REQUIRMENT |
|---|---|---|---|
| General | 1.1 | Senior and Junior | The Field of Play and related equipment including goals and corner flags must be compliant with the Laws of the Game. |
| Pitch Size | 1.2.1 | Senior | Length - Minimum 96 metres, maximum 105 metres.<br>Width - Minimum 60 metres, maximum 68 metres. |
| Pitch Size | 1.2.2 | Junior | Length - Minimum 90 metres, maximum 105 metres.<br>Width – Minimum 50 metres, maximum 68 metres. |
| Run o°s | 1.3 | Senior and Junior | A minimum runo° ar ea of 3 metres to any tripping hazard or solid obstruction, including fences and Team benches, must be provided. |
| Goals | 1.4.1 | Senior and Junior | Goalposts and nets must be in accordance with the Laws of the Game. The goalposts and crossbar must be made of metal or other approved materials. They may be square, rectangular, round or elliptical in shape and must not be dangerous to players. The distance between the posts is 7.32m and the distance from the lower edge of the crossbar to the ground is 2.44m. Both goalposts and the crossbar have the same width and depth, whiWch do not exceed 12cm. The goalposts and crossbars must be white. Goals must have nets which must be secured e° ectively to the posts ad ground to ensure the ball is trapped. The nets must be pulled back to allow suÿcient saf e space within the goal space. |
| Goals | 1.4.2 | Senior and Junior | Permanent and semi-permanent goals must conform to Australian Standard AS 4866.2-2007 – Playing field equipment – Football goals Part 1 : Safety aspects and be properly installed and secured. Movable goals must be compliant with the Australian Competition and Consumer Commission's Consumer Protection Notice No. 28 of 2010.<br>Goals must not have sharp edges protruding that may cause injury. |
| Corner posts and flags | 1.5 | Senior and Junior | Corner posts and flags must be in accordance with the Laws of the Game. Posts must not be metal or spring loaded. They be plastic or wood and stand a minimum of 1.5 metres above the ground with a non-pointed top. Corner flats must not feature nationalistic emblems or reference. |
| Pitch surface | 1.6.1 | Senior and Junior | The field of play must be safe and even without trip hazards. |
| Pitch surface | 1.6.2 | Senior and Junior | If a hard-based cricket wicket is present on the field of play it must be covered with soil or be of a material similar to grass. The edges of the wicket must not protrude from the ground or in any way cause a tripping hazard. The field of play must be configured so that the hard cricket wicket is not located within the penalty area. |
| Pitch surface - synthetic | 1.6.3 | Senior and Junior | Matches may be played on a pitch with a synthetic surface provided it has been constructed and maintained to at least FIFA 1 star standard or as otherwise approved by FQ. |
| Line markings | 1.7.1 | Senior and Junior | The playing pitch must be marked in accordance with Law 1. However, matches may be played on fields with extraneous markings provided approval has been sought from FQ with specific regard to the number of, and colour of, any marking not outlined in Law 1. |
| Line marking products | 1.7.2 | Senior and Junior | Only products such as agricultural limestone or water based spray paints or other similar material which will not endanger ground users or damage turf grasses may be used for line marking. Lime, herbicides and other products such as 'Round Up' that are harmful to a person's health can cause damage to the playing surface are not to be used under any circumstances. |
| Pitch fence | 1.9 | Men's and Women's State League Only | Where a pitch fence is not in place at least a rope or bunting around the pitch at a height of around 1 metre and a minimum 3 metres in distance from the side lines and goal lines must be in place to provide a clear indication of segregation of the playing area. |
| Technical Area | 1.10.1 | Senior and Junior | A technical area must be marked for each team on the same side of the field and on opposite sides of the half way line. It must be located no closer than 7 metres and no greater than 20 metres from the half way line. The technical area extends 1m on either side of designated seated area and extends forward up to a distance no closer than of 1m from the touch line. A technical area must be in accordance with the Laws of the Game. |
| Technical Area | 1.10.2 | Senior and Junior | The technical area must be marked in accordance with the line marking requirements in 1.7.2. |
| Technical Area | 1.10.3 | Senior and Junior | The technical area may be marked by crushable cones. If marked by lines they must be in accordance with the line marking requirements in 1.7.2. |
| Team benches | 1.12.1 | Senior and Junior | Two covered team benches or equivalent seating with adequate seating for nine (9) people must be provided. |

## 2.2 Turf Height

The turf height of a football pitch can greatly affect the responsiveness of the pitch surface to play as grass affects the spin of the ball, traction and ball roll.

For natural turf pitches, the height of the grass may not exceed 30mm for competition play and the playing surface must be cut at the same height to accommodate good football playing characteristics of the surface, including ball roll and bounce.

## 2.3 Surface Shape and Levels

The football pitch surface should be smooth, level and that is free of any undulations, depressions, foot holes and divot damage. These surface characteristics will ensure that the ball does not deviate and has the same ball roll in all directions on the surface.

Most football pitches have a slight surface slope, whether a single, diagonal, two way (ridge), or four way (pyramid) slope. The purpose of the slight surface fall is to quickly direct any excess water from the surface before it can impact on the surface and soil conditions on the football pitch.

Generally, the surface shape for a well-constructed football pitch should range from level to a slope of no more than 1 in 200 along the line of play and no more than 1 in 100 across the line of play. A surface slope of 1 in 100 is not as obvious to the naked eye nor greatly impact the ball roll but is sufficient to generate surface runoff, especially during periods of wet weather. Therefore a desired maximum surface grade of 1 in 100 (1%) is preferred. However greater latitude to surface levels is given for community standard football pitches and a gradient of up to 1 in 50 has been accepted.

## 2.4 Surface Traction

Surface traction is a vital component of a football pitch surface. It is interaction between the player's feet and the playing surface that enables movement without the player slipping and falling.

If the traction is too low, slipping and falling by the player will occur, and if it is too high, there is a danger of the player's feet jarring or locking to the surface and causing injury. Traction is principally influenced by the density, quality and wetness of the turf grass ground cover.

Soil factors influencing traction include soil texture and water content through their combined influences on soil shear strength. Consequently, cohesive soils having shear strengths dependent on soil moisture yield a degree of traction when dry but very little fraction when wet. High sand content root zones have shear strengths less influenced by moisture, unless quite dry. In this case, shear strengths become negligible and traction is extremely poor.

The turf surface plays a key role in surface traction. A well grassed surface consisting of a sand root zone, is likely to increase the shear strength by a factor of 2 to 3 and improve the performance responsiveness of the surface to play when compared to a surface with a poor turf cover.

## 2.5 Surface Hardness

The ability of the surface to absorb impact energy that is created by a player is related to its hardness. Surface hardness can affect both player performance and player safety. It is therefore important to avoid situations that favour either of these extreme situations.

A soft pitch surface may create early fatigue in the players leg movements due to the lack of traction generated by the football surface, while a hard surface can be detrimental to surface impact situations including player injury.

Regular testing to monitor surface hardness should be conducted. A device that measures impact absorption (surface hardness) is the Clegg Impact Hammer. This has become a useful tool for evaluating and monitoring the surface hardness of football pitch surfaces. Field Managers, technical representatives and consultants all employ this device to monitor and address surface hardness.

Details of a typical surface hardness guideline based on the 1st drop using the Clegg Hammer are as follows:

| Performance Indicator | Unacceptably Low | Low Normal | Preferred Range | High Normal | Unacceptably high |
|---|---|---|---|---|---|
| Surface Hardness (CIV) | <31 | 31-54 | 55-75 | 76-120 | >120 |

**Unacceptably low (<31 CIV)** indicates players will have footing problems and the ground will cut up under play and is relevant for all sporting activities and users.

**Unacceptably high (>120 CIV)** indicates the ground has high injury potential and is of relevance for sports such as football, AFL, rugby, athletics etc. These grounds should be amended and or closed until the surface hardness is acceptable (31 to 120 CIV). However, excessive hardness is of less importance for cricket, baseball and softball.

**Hard (>120 CIV) or soft (<31 CIV)** patch (es) indicates acceptable average hardness but at least one area on the ground that is hard or soft. Remedial work may be required before these grounds are used to address any variation in surface hardness.

The main soil factors influencing hardness are texture and moisture. In cohesive soils, moisture plays a dominant role in controlling hardness due to the relation between soil moisture and strength. In high sand content root zones, soil moisture has less e° ect on surface hardness unless the root zone becomes extremely dry, resulting in lower unconfined strength and decreased hardness. Thus, proper moisture management is critical prior to sporting events demanding firm and stable surfaces.

*Clegg Impact Hammer*

Turf cover and the degree of thatch also influence surface hardness, with a thicker and denser turf and thatch yielding reduced hardness levels. Loss of turf cover from excessive wear of a marginal soil environment for roots may result in a comparatively hard surface.

There is often a positive correlation between measurements of ball bounce and hardness of the playing surface. Consequently, factors that influence hardness also generally influence the extent of ball bounce.

## 2.6 Wickets

Ideally football pitches should not contain a cricket pitch, and where possible be strategically positioned so that the wicket is not on the pitch surface. This will avoid the potential injury risk associated with the wicket on the surface, and also eliminate the need to cover a concrete pitch to make it safe to play on.

Cricket wickets, whether concrete or turf wickets, can be a hazard on the surface of the football pitch and are not always tolerated on football pitch surfaces. However, it is sometimes accepted given the limited sporting surfaces that are sometimes available in Councils. This is especially the case for community pitches, where football may be played on a multipurpose sporting venue.

In the situation where a concrete wicket exists on the football pitch then it is important that the wicket is covered in some manner to provide a safe playing surface. The various methods of covering the wicket include:

- Using a thick layer of sand. This will bury the wicket to a sufficient depth below the playing surface
- Sodding the surface using turf and a thin layer of topsoil
- Using suitable synthetic grass covers that have been secured to the surface.

In the case of a turf wicket, the wicket surface should be slightly moist to improve the plasticity, and therefore the footing and traction on the surface. This should help to reduce the differences associated with the wicket and the rest of the playing surface, especially the jarring effect that hard surface can have on play.

*Covered cricket pitch on surface of soccer pitch*

*Cricket pitch on soccer pitches*

## 2.7 Line Marking

Line marking is sometimes taken for granted. The final presentation of the playing surface is of great importance and can be improved or alternatively marred by the standard of marking out procedures.

There are clearly defined requirements for line marking.

*Poor line marking*

*Faded lines*

The field of play must be rectangular and marked with lines. Essentially the marked lines must be visually bright, clean and of an approved width for clear viewing by umpires, referees, players, spectators and if necessary television coverage.

Line markings must be in accordance with the Field of Play Dimensions, and not exceed 12 cm in width as per FIFA Laws of the Game and be clear and accurate.

The line marking material ideally should be waterproof, quick-drying, not easily rubbed off or liable to flake or powder.

The line marking material used must be extremely safe to field operators, on-field personnel, players and the treated turf/ soil environment. It must be easy to apply. Furthermore, the product must be non-hazardous or deleterious to the coverage dimensions it transits on the pitch.

Most importantly, the line marking material must not inhibit or unnaturally deter or affect the actual growth process of the turfgrass or the below surface root zone and surrounding micro-environment it grows in.

Products such as Glyphosate and other herbicides should not be used because these can kill the grass and scar the surface and also result in a much wider line than is desired.

Once the turf surface is damaged or lost along the marked line, it is extremely difficult to provide a satisfactory or properly presented pitch or playing surface.

It also becomes inappropriate and difficult for field officials to view, interpret and adjudicate on when play occurs near the damaged and scarred boundaries. It is unattractive for all to observe and very expensive to re-establish, returf and sustain at a later date.

Costly repair of the damaged surface may be required to restore the turf surface in these areas.

Limil should no longer be used under any circumstances because it is now considered harmful to the user.

# SECTION 3

## Factors Affecting Quality and Performance of Football Pitches

The five (5) key factors affecting the quality and performance of a football pitch are:

- Weather conditions
- Turfgrass Selection
- Pitch Usage
- Pitch Construction
- Pitch Maintenance

### 3.1 Weather Conditions

Football is mostly played on outdoor sporting venues. Therefore, the weather conditions at the time of training and play can have a major bearing on the condition of the football pitches and the extent of damage that occurs from these activities, especially if there are deficiencies with the design, construction and maintenance of the football pitch.

Elite pitches are often irrigated before games begin to improve the performance of the playing surface. However, a saturated playing surface could expose the surface to greater damage than would otherwise occur during fine weather conditions. Alternatively, a dry surface could place the grass under extreme moisture stress and expose the surface to greater damage under these conditions.

All pitches, regardless of their type of construction or the inherent problems that may exist, are not going to cope with excessive usage during wet weather, and once damage occurs it will be extremely difficult to rectify and provide satisfactory playing conditions, especially during winter when grass growth and recovery is much slower.

It is difficult to manage weather that occurs during games and some damage is expected and often accepted if these conditions coincide with matches. However other practices such as training should be avoided if excessive damage to the surface occurs.

Although actual designated games of football may proceed regardless of the weather, the stringent Risk Management Practices that exist in all sporting codes may in the future increase the number of cancellations of play that occur through bad weather or potentially unsafe playing conditions. This decision alone, although considered to be extremely disruptive, could greatly reduce the overall damage and hence repair needed on a playing surface.

### 3.2 Turfgrass Selection

The grass species and turf composition are both important and will have a major bearing on the quality and performance of the football pitch surface.

Each grass species has specific management requirements. The type of grass species affects the level of usage, the type of management practices, timing of cultural and other practices, growing locality and aspect, as well as the chemical practices possible to control and prevent weed problems.

Most grass species can be used on a football pitch. However, the most appropriate grass species are those that can be mown low enough (30mm or lower) to provide a good grass cover and good ball roll and cope with wear. The growth characteristics of Tall Fescue and Buffalo grass are not considered ideal for producing a top quality football pitch

surface and are normally not considered when selecting suitable turf grasses. The main species considered to be suitable on natural turf football pitches include couch, ryegrass and kikuyugrass (suitable for cooler areas in SEQ).

A combination of couch/rye or even kikuyugrass/rye will perform well in cooler climates of QLD. These will provide a durable grass cover and playing surface that can resist wear and still have good recuperative powers. A monostand of rye will also perform well providing good management practices are maintained.

Regardless of the turf species involved, there is a need to fully understand the growth characteristics and properties of each turf species to maximise their performance if used exclusively or in combination with other turf species in the football pitch.

The choice of turf composition is important for a natural turf surface, especially when the main playing season is during the cooler months, including winter. The turf should provide a durable surface with a good dense and uniform turf cover capable of providing the features and characteristics necessary for football and any other sporting requirements.

There had been a shift to warm season grasses over the last 20 years initially because of imposed water restrictions during that period, but also for their ability to cope over summer and provide a tight knitted turf surface that is suitable for football. The warm season grasses involved are primarily couch and kikuyu.

The warm season grasses should generally handle the wear of a season well, if the field is maintained to a suitable level. Tis includes reducing the repetitive drills and staying out of the goal mouth as much as possible.

The inclusion of cool season grasses as part of the turf cover in combination with the understorey of kikuyu or couch can assist in providing additional durability and resistance to wear of the turf surface.

Ryegrass has the capacity of protecting the kikuyu and/or couch from excessive wear and damage. Without the ryegrass, the surface is likely to deteriorate more rapidly. This is especially the case where a thin cover of couch or kikuyu already exists before these grasses go dormant in winter.

A factor that should be considered when selecting suitable turf grass species is the wear tolerance of individual species and cultivars within species.

Another important factor related to grass selection is the effects on the playing conditions, i.e. traction and ball bounce. Even though Poa annua has high wear tolerance, it has a very low shear strength and ball bounce, resulting in poor playing conditions. The result is often observed on turf swards dominated by Poa annua in football pitches as well as other sporting activities.

Turf subjected to heavy wear is often invaded by inferior grass species such as Poa annua and summergrass (Digitaria sanguinalis) which are very invasive and are well adapted to compacted soils.

Turf grass selection has often been seen as the solution to the problems caused by poor drainage and excessive wear. However, grasses can only tolerate so much wear regardless of the turf grass species, even under the best growing conditions, before they deteriorate and lose density.

When turfgrasses are growing under ideal conditions, particularly climatic, they have excellent recuperative potential and will generally tolerate high levels of wear. However, when the conditions are less favourable, e.g. cool weather, low light intensities and high moisture conditions, the turfgrasses are less able to recover before being subjected to more traffic. As a consequence, the effects of the wear are cumulative and rapid turf deterioration can occur.


In cool, temperate climates, where cool season (C3) grasses are grown, perennial ryegrass has proven to be the best grass for year round growth and recovery. Bluegrass and tall fescue are particularly good during the summer, however, under cold conditions there is very little growth and very poor recovery potential. Given that many of the high wear sports of rugby, Australian Rules football and football are winter sports, then a turf with a high proportion (>50%) of ryegrass is desirable.

Couchgrass is the dominant species in warm humid, warm sub-humid and warm semi-arid climates and are utilised to varying degrees in the transitional zones. Their preferred optimum temperature range is 27 - 32°C and under these conditions they provide a hard wearing, vigorous high quality turf.

Couchgrass is tolerant of low mowing and provides a fast, firm surface that gives excellent traction. However, couchgrass and other warm season grasses are generally unsuitable in transitional climates for heavy winter traffic unless they are overseeded. At temperatures less than 15°C most warm season grasses become dormant or dramatically slow down in their growth and consequently they have no recovery under moderate to heavy traffic.

In transitional climates where warm-season grasses, such as couchgrass and kikuyu (Pennisetum clandestinum) are dominant during the summer but are dormant in the winter, a base of these grasses overseeded with ryegrass will provide the hardest wearing surface for winter sports. The couch or kikuyugrass understorey provides much added stability and durability of the playing surface, especially on sand profiles.

In mixed swards that have a high proportion of ryegrass it is difficult to transition out or weaken the ryegrass sufficiently to allow the warm season grass to dominate during summer. If there is sufficient time between the different sporting seasons, e.g. football and cricket, the ryegrass can be chemically removed in the spring, the couchgrass allowed to grow in over summer and then overseeded with ryegrass in the autumn. The reality is that the ryegrass is often allowed to persist and this is eventually to the detriment of the couchgrass. In time, high wear areas such as the goal to goal line and goal squares are best returfed with couchgrass and then overseeded.

## 3.3 Pitch Usage

Usage is without doubt the main factor affecting the condition of the football pitch surface, and the extent of work needed on the pitch to maintain a good playing surface for all sporting activities.

A pitch that is hardly used will need less work to maintain a good playing surface than a pitch that is continually used. Similarly, pitches that have deficiencies with their construction could be used for a minimum number of occasions without excessive damage particularly if favourable weather conditions prevail at the time of use.

### 3.3.1 Usage Levels

There is a limit to the level of usage that a football pitch can cope with before damage to the playing surface occurs that cannot be repaired during the playing season. This includes the number of fixtured games held per day of competition, practice matches, break between games and playing seasons, training, and other activities on the pitch surface.

Excessive usage does not allow the grass to recover from the wear and the damage that it has previously received before more damage occurs.

It is therefore important that strategies are in place that can minimise the impact of usage levels and usage patterns on the playing surface before excessive wear and damage occurs which could require additional work to repair and restore the playing surface to a safe condition.

Damage from overuse of natural turf fields is a common challenge. Programs to control traffic (permitting of field use and rotating and closing of fields) are needed to prevent severe loss of natural turf from year long, unregulated play.

### 3.3.2 Usage Pattern

Usage/traffic is not normally spread uniformly across a playing surface. Certain parts of the football pitch will receive more wear and damage than other areas of the pitch surface, i.e. the goal to goal line, especially the centre area and both goal mouths.

The condition of these areas on the pitch surface at any given time will generally govern the level of usage and hence number of games that the football pitch can handle.

Changes to the level of usage and also to the usage patterns may be needed to minimise the damage to parts of the pitch surface in order to maintain a good football pitch.

### 3.3.3 Training Practices

Training is a major issue on football pitches because it is generally concentrated on a small part of the pitch and normally results in excessive damage to the surface.

The main areas where training occurs are in the goal mouths, the area closest to the clubrooms, or where lighting exists. Excessive damage can quickly occur to these areas especially where a large number of players train on the pitch and where training remains in these same locations on the pitch surface for subsequent training sessions.

The damage caused by training practices can often compromise the standard and quality of the football pitch for the more important fixtured games.

Training practices are often governed by the infrastructure of the facilities, and whether dedicated training facilities exist or where training lights exist on the football pitch. These factors will sometimes limit the options that any club may have with training practices.

Therefore, changes to training practices and sometimes the attitudes of personnel involved with the venue are needed to reduce the damage to the playing surface.

## 3.3.4 Role of Pitch Re-orientation to Spread Wear

The preferred orientation for football pitches is North-South within the range of 20o W of N and 35o E of N. It is often difficult to shift the position of a football pitch due to restraints with the available size of the surface to begin with. Where a large open space area is being used, it may be practical to alter the direction and orientation of play.

A case study existed where a number of football pitches were orientated in a north-south direction on a huge open space area. Damage associated with matches as well as training quickly developed on the surface.

*Picture 1 - Current N-S orientation of Football pitches*

*Picture 2 - Extent of wear on Football pitches in September 2017*

The Council involved with these grounds had recognised the need to reduce the extent of wear and damage to the football pitch surfaces and had instigated to re-orientate and re-align the football pitches in an east west direction on the sportsfield.

*Picture 3 - Proposed E-W orientation of Football pitches*

*Picture 4 - Overlay of N-S & E-w layout of Football pitches*

The key benefits of re-orientating the football pitches East-West is that the traffic is shifted away from the main wear areas through the corridor between each goal and in fact the goal to goal corridor is generally on a completely different part of the sportsfield surface.

## 3.3.5 Carrying Capacity

The carrying capacity is the amount of usage a sports field can sustain before damage to the turf occurs.

The carrying capacity of a football pitch varies considerably and is influenced by a range of factors, including the following:

- Climate; the frequency and intensity of heavy rainfall events, and conversely, extended periods of dry weather.
- Soil type; how well the soil drains and how soon are you able to use a field after heavy rain.
- Maintenance; adequate application of fertilisers to maintain a healthy, actively growing sward, pest and disease control to prevent damage to the sward and repairs of any damaged areas.
- Effective renovation programmes during spring and autumn.
- User demand; for many councils player demand requires that sports fields are used beyond what could be considered optimal with a subsequent loss in field quality as a playing season progresses.

There has been considerable work conducted to predict carrying capacity of football pitches. There is a general consensus that the highest carrying capacity will be achieved on grounds constructed with a well draining sand rootzone layer, a network of subsurface drains, an automatic irrigation system a good surface shape (preferably ridge) and grassed

with a combination of warm and cool season grasses. The carrying capacity achieved by this type of construction is in the vicinity of 25-30 hours per week (by 25-30 adults over one hectare).

Techniques and formulas used to predict usage levels and carrying capacity tend to fall down and become inconsistent where there are high training pressures, concentrating in the same areas and with no thought r management to spread the wear over the surface. The combination of wet weather and play will also quickly impact on the condition of the playing surface and result in the rapid deterioration of the surface. Sensible management practices, such as god fertilising, aeration etc. will assist with offsetting the impact of usage on the playing surface.

## 3.3.6 Limitations to Optimal Use

The loss of ground cover, invasion of weeds and creation of an uneven surface are indicators that a pitch is not coping with the amount of use.

It is important to appreciate that a deteriorating surface could be attributed to several factors (often compounding) and it is important to thoroughly and professionally evaluate the full system. Factors contributing to deterioration include:

- Over use, beyond the carrying capacity of even the best managed system.
- Problems with management systems, such as unrestricted use under wet conditions, or poor control over location of practices (e.g. no restriction to practice in goal boxes).
- Inadequate renovation program and routine maintenance during a playing season, such that the optimum performance of the turf is not realised.
- Inherent problems with the soil profile, in particular poor drainage.
- Unusual weather patterns, such as a dry summer (resulting in poor cover) followed by a wet spell.

For a council to ensure it is achieving optimal use it will need to give due regard to each of these factors.

### 3.3.6.1 Assessing Limitations to Optimal Use

The following is a step by step process that could be considered to assess the main limitation(s) to optimal sports field use.

#### Step 1

- Gather Accurate Data on Field Usage and Benchmark Usage Against the Recommended Hours of Use for the National Best Use Modelling Project.
- Ensure data for field usage is accurate and allowance is made for age and levels of participants.
- Ensure any benchmarking is "apples for apples". Narrow down the range so that the benchmarked region and soil type are similar.

#### Step 2

- Assess the quality of the playing surface to determine if it meets recommended and desirable standards throughout the year.
- Identify the period of great concern (most likely mid-winter) and focus on evaluation during this period.
- Use the best use modelling tools to measure surface performance.
- Compare measured performance with recommended values.

#### Step 3

- Evaluate Information in Steps 1 and 2 to determine if optimal use is being achieved.
- If use matches or exceeds recommended benchmark, and if surface quality meets desirable standards, then you are achieving optimal use.

- If use is below recommended benchmark, and/or surface quality has fallen below the desirable standards then proceed to Step 4.

### Step 4

- Determine if the football pitch is being effectively managed.
- Determine where the field is failing and where the high wear areas are; are they localised and can be pinpointed to training activity (e.g. under lights, in goal boxes, by club house).
- Identify if there are any practical solutions to minimise high wear (e.g. relocation of lights, moveable goals, club member education, use of adjacent un-used strips in wet weather).

### Step 5

- Evaluate the Turf Management (and Renovation) Program.
- Identify the skill level of the staff looking after the surface.
- Determine if staff are adequately skilled and sufficient resources are allotted to the field (fertiliser etc).
- Identify if there is adequate attention given/window of opportunity for renovation between seasons in order to enable effective repair and recovery of damaged areas.

### Step 6

- Evaluate the Properties of the Root Zone and Base.
- Use specialist expertise to identify if there are any inherent root zone properties, such as a compaction layer.
- Identify the impact of the root zone limitation on surface performance and ascertain if the impact is significant.
- Identify potential corrective options for any significant limitation.

### Step 7

- Determine if any Issue with Surface Quality is On-Going or a One-Off (Due to Climatic Extremes).
- Refer to past records and feedback on performance of the surface. Relate past performance to past usage.
- Consider the impact of adverse climatic conditions on the performance of the ground – in particular refer to any drought conditions that might have restricted turf recovery (mainly in un-irrigated fields), and the amount and time of winter season rainfall.

## 3.3.7 Usage Strategies to Minimise the Damage to Football Pitches

Strategies should be implemented that involve all groups associated with the football pitch, including the users, maintenance contractors and Local Government Authorities.

A combination of some or all of the following usage strategies should be considered to minimise the damage to the playing surface:-

**Strategy 1:** Where possible elite and high profile football pitches should not be used for training. Removal of training altogether from the playing surface will ensure that the surface does not receive any wear or damage other than what occurs from general matches held on these grounds. This will ensure that they do not receive any damage other than from fixtured games.

**Strategy 2:** Where more than two football pitches exist in a reserve, the main pitch should be identified and all training removed from this pitch and transferred to the remaining pitch(es) or alternative training facilities.

**Strategy 3:** Where substandard training facilities exist, capital improvements should be undertaken to upgrade these training

facilities and alleviate deficiencies that may be associated with the existing playing conditions. Sufficient training lights should also be installed as part of the upgrade to spread the traffic and help to minimise further damage to the surface.

**Strategy 4:** Changing attitude by user groups who should appreciate that the Local Government Authorities and the maintenance contractors are all working in their best interest to provide a playing surface of good quality for their use. Educate the users to ensure they understand the importance of controlling the level of usage and training. It is recommended to conduct education seminars on this subject.

**Strategy 5:** The level of activity on each football pitch should be regularly reviewed by all concerned to determine the infrastructure needed to maintain or improve their condition. Usage patterns and levels should be monitored and changed where needed to reduce the damage to the pitches and avoid overloading the pitches with matches or with training. Regular policing and inspections by all stakeholders are required to monitor the damage to the surface and to make correct decisions on the level of usage and training patterns.

**Strategy 6:** Where pitches are to be used for training, clubs should ensure that damage due to training is kept to a minimum. Some of the practices which should be considered to reduce the damage to the playing surface include:

- Use temporary goals rather than the goals used for matches to avoid further wear and damage in the high use areas on the playing surface, and also to spread the wear and minimise the damage to the surface.
- Do not train on the surface during rain of any degree.
- Do not train if water is laying on the surface or if the surface is saturated.
- Where possible, avoid training in the same location that was last used for training.
- Reduce training in the goal square that has been damaged, and use movable and portable training goals.
- Train on the highest part of the pitch.
- Do not train on any turf wicket, and on any previously damaged areas.

**Strategy 7:** Implement good management practices to allow the turf surface to recover from wear. This will help to increase the level of usage that the pitch can cope with. More importantly it will help to hasten the recovery of the surface from any damage that it receives.

**Strategy 8:** Where large open space areas are being used, monitor and change the orientation of the football pitches during the football season to spread the wear before excessive damage to the playing surface occurs.

**Strategy 9:** Monitor the level of usage on each turf playing surface and change where needed to reduce the wear and damage to the surface and avoid overloading the surfaces with matches or with training. This will involve rotating usage on the football pitches.

## 3.4 Pitch Construction

The type of construction of the football pitch will have a major bearing on the quality of the playing surface, its resilience to inclement weather conditions, the carrying capacity that the pitch surface can tolerate, the standards of sports played and the level of maintenance required to provide a satisfactory playing surface.

As a general rule a poorly constructed sportsfield or one that has deficiencies with its initial construction would not be expected to cope with the same levels or quality of play as for well-constructed sportsfields. The effort needed to produce a satisfactory playing surface on a poorly or deficient construction would be expected to be far greater than a properly constructed pitch.

The construction and design of football pitches like other natural turf sporting surfaces have evolved from the use of existing native soil conditions and site conditions for the proposed pitch, and in most cases the failure of these to produce a satisfactory sustainable playing surface that will cope with repetitive use. Further many football pitches were not dedicated pitches for football and were dual or multipurpose sporting facilities where football happened to be adapted to the existing sporting surface.

It is important to construct the football pitch correctly from the outset. Otherwise the condition of the playing surface could be easily damaged when used and would quickly deteriorate as a result. The extent of the work needed to maintain this football pitch in a good condition and the cost of management may become prohibitive. Furthermore, the level of usage, the standard of football that can be played and the quality of the playing surface may be severely limited.

The main objectives of any new construction are as follows:

- provide a good quality playing surface that is durable and will resist wear.
- optimise/maximise the level of usage.
- tolerate a greater range of weather conditions during play.
- minimise the costs to maintain the football pitch.
- provide a surface that is able to recover satisfactorily and rapidly.

Ideally a ground should be constructed that is totally dedicated to football. However, this may be impractical, especially for football pitches where they are not dedicated to football and are used for a diverse range of sporting activities, and also in the economic climate that confronts many of the Clubs and Local Government Authorities.

Research into the construction of turf surfaces in other turf areas led to the development conducted by the United States Golf Association (USGA) to the following recognised construction:

- Rootzone layer consisting of sand or amended sand that was tested in the laboratory to satisfy specific physical requirements.
- Suitable constant depth of rootzone material that would allow rapid infiltration of water from the surface and upper levels of the rootzone layer whilst retaining sufficient moisture to support the survival and management of the natural turf surface.
- Existence of a subsurface drainage system below the sand rootzone layer that would allow the rapid removal of excess water from the rootzone profile while retaining sufficient moisture in the profile to support the natural turf surface. The typical subsurface drainage system consists of a combination of a 100mm blanket layer of blue metal, scoria or quartz aggregate screenings situated above a network of subsurface drains that can quickly remove water collected from the drainage system away from the site. The screening layer must also meet specific testing parameters, particular size grade distribution that will prevent the migration of the sand rootzone layer into this layer while at the same time allowing water to move and create a perched water table within the sand rootzone layer to support the survival of the natural turf.

The USGA football pitch construction as it is often referred to is extremely specialised, requiring considerable testing and strict testing guidelines, not only initially, but throughout its construction to ensure that the materials being used are consistent from the first to the last load and the profile is constructed properly. There is an expense involved, not only in terms of testing and monitoring the materials being used during construction, but the import of these materials

and the precise construction required of the subgrade, drainage layers, and sand root zone layer.

The recipe for the construction of the preferred football pitch can sometimes deviate from this design and philosophy due to a range of reasons, primarily budgetary restraints. Any compromise to this design is unlikely to improve the performance or extent of use that the sporting surface can cope with and it is important to recognise this when making decisions that might compromise the depth of the rootzone layer, the exclusion of the blanket drainage layer, the spacing of the subsurface drainage system etc. These changes might still result in an acceptable playing surface under most environmental conditions that are experienced on the site. However, it will be difficult to achieve the ultimate maximum level of use that could be achieved under all climatic conditions if there is too much deviation from the recipe.

Councils and user bodies have recognised the importance of correct construction and there are far more grounds being constructed these days using the USGA construction than ever before. Just remember that any reduction in any component of the above, could result in the surface that never achieves the expected results or expected levels of usage. Given the premium on available football pitches for matches and training, this is a risk that Councils and clubs are less likely to take in the current political environment.

Other types of construction include the following:

- Sand based profile with subsurface drains, often termed the California method. The main difference between this construction design and the USGA construction is the exclusion of the screening drainage layer from the profile which reduces the ability to retain moisture in the soil profile.
- Soil based with subsurface drains, where the root zone layer comprises of considerably poorer soil types than achieved using the sand rootzone material, which relies on the number of drains been installed for excess water to be removed.
- Soil based with no subsurface drainage.

The latter two types of construction are not expected to deliver a turf playing surface that is capable of accommodating the same level of repeated use and quality of playing surface as for the USGA and California methods.

### 3.4.1 Site Assessment

A site assessment is essential before proceeding with any new construction or upgrade to assess the proposed site and to determine the following:

- Current features and conditions of the site.
- Site constraints.
- Detailed feature survey of the surface shape.
- Surface and subsurface drainage requirements (including drainage outfall).
- Any services running near or through the site that could affect construction.
- Availability of a water supply to the site and the irrigation requirements for the football pitch.
- Establish any restrictions to usage or access to the site.
- Soil survey to determine the suitability, depths and types of topsoil that exist, including soil analytical tests.
- Geotechnical survey of the site to ensure the base material is stable and will be a suitable foundation for a football pitch.

A thorough site assessment is needed to avoid costly mistakes with any new construction or upgrade and to efficiently utilise all inputs and resources needed. The outcomes from the site assessment will include:

- Identifying the potential for the site.
- Producing a design which will satisfy the

needs of the proposed sporting activities and levels.

- Overcoming and or minimising any limitations of the site or within defined financial restraints.
- Identifying the costs involved to construct a new pitch or upgrade an existing pitch.

### 3.4.2 Subgrade Conditions

The stability of the subgrade of the site is critical. Sports field subgrades often has a chequered history and is often not a premium site. It could be on an old tip site, swamp site, retarding basin or land not considered suitable for any other purposes. It is therefore important to determine the suitability and stability of the site and quality of the foundations or subgrade for a football pitch before proceeding. Just because a sports field already exists on the site does not mean that problems do not exist.

Regardless of the sporting surface constructed on this site, the subgrade should be stable and well compacted, free of localised depressions with no chance of settling or subsiding and free of organic material.

Subgrade works must meet the stringent requirements of the Australian Standards as detailed in AS 3798-1996 - Guidelines on earthworks for commercial and residential developments.

*Subgrade work on a sportsfield*

### 3.4.2.1 Role of Geotechnical Site Investigation

A geotechnical site investigation should be conducted to determine the physical properties of this site and whether deficiencies exist in terms of stability that need addressing.

A geotechnical site investigation will help to determine the following:

- Types and consistency of material present on site.
- Extent of fill material on site.
- Soil properties.
- Predisposed issues and weaknesses that may exist with the site.

Once a geotechnical site investigation is completed there should be enough information about the problems and issues that exist that must be considered and addressed when commencing any subgrade works.

## 3.4.3 Drainage Aspects to Consider in Turf Surfaces

Drainage is one of the major factors affecting the quality and performance of any turf surface.

The lack of attention to drainage is where problems normally originate and can result in a substandard saturated surface that could be come easily saturated or a soil profile that could accumulate excess water. Under these conditions the surface would quickly deteriorate especially through wet weather and heavy use and pose a hazard and increased injury risk to users.

The main components of drainage to consider are:

- Surface drainage.
- Hydraulic conductivity of the soil/sand rootzone layer.
- Subsurface drainage.

Each component of drainage is important and needs consideration to quickly remove the excess surface and subsurface water before it can impact on the quality and performance of the sporting surface.

### 3.4.3.1 Surface Drainage

Surface drainage relies on the shape of the surface to direct and remove water before it accumulates and saturates the surface. This often becomes the primary means of removing water from the surface, particularly as the turf surface develops barriers to the movement of water through the soil profile, such as thatch or surface sealing.

Surface shape needs considerable thought. The steeper the surface the quicker the water will move from the surface. This can be achieved in some turf surfaces; however, the requirements of most sporting activities where a flat surface is desired generally limit the slope of the playing surface. In some instances, such as bowling greens, and croquet courts, the surface must be level otherwise the requirements of the sport cannot be achieved. In these cases, the soil hydraulic conductivity and subsurface drainage become more important to remove the excess water than surface shape. In the case of a football pitch, a surface slope of more than 1 in 80 may start to affect the quality of the playing surface.

Care is needed to avoid potential problem issues and failures such as poor surface shape or low lying areas that will more than likely hold water. If the surface shape is poor then it is important and more logical to rectify this deficiency in construction that exists before concentrating on any other aspect of construction. A smooth surface free of undulations and depressions and having some slope will at least provide some means of removing excess water from the surface.

### 3.4.3.2 Soil Draining Properties

The soil hydraulic conductivity is the rate that the soil moves through the soil profile.

The preferred situation is a well draining profile, often consisting of a suitable sand or loamy sand that drains sufficiently while still holding sufficient moisture to support good grass growth. Poor draining soil types tend to be more susceptible to compaction, surface sealing. These conditions reduce the health and survival of the grass growing in this soil type. As a consequence, the surface deteriorates.

If the existing soil material is unsuitable and cannot provide the desired drainage properties then a more suitable material should be used and imported to the site.

Infiltration rate will be greatest where sand is used as the turf rootzone material that been chosen for high permeability. But even sand experiences reduced infiltration rate through compaction caused by intense use and through the clogging caused by grass roots and the accumulation of thatch and organic material.

### 3.4.3.3 Subsurface Drainage

Subsurface drainage is essential to remove the excess water that exists in the soil profile before it can accumulate.

A range of subsurface drainage systems exist dependent on price and the requirements of the playing surface.

Where a uniform behaving grass sporting surface is required, then the ultimate system is one consisting of a drainage layer, whether gravel or coarse sand, above a network of subsurface drains. Both the drainage layer and subsurface drains are situated in the subgrade and below the rootzone layer.

*Trench dug prior to installing drain*

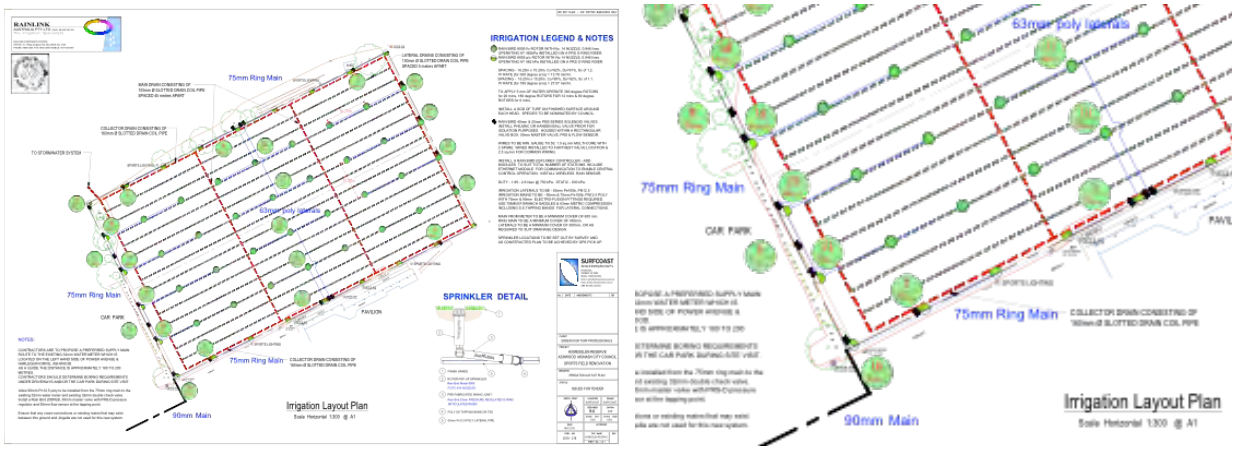
*Subsurface drainage being installed in oval*

In this situation the rootzone layer should be a consistent depth. This will generally enable uniform wetting and drying of the profile and help to provide a uniformly behaving surface.

## 3.4.4 Performance of Irrigation System

An irrigation system must be installed that can deliver sufficient water to the turf, uniformly across the surface to avoid wet and dry areas from developing when required. The preferred irrigation system is an automatic pop-up irrigation system.

Considerable thought and correct design is needed to ensure sufficient water can be delivered to the site where needed to support turf growth.




The irrigation system will be one of the major factors affecting the success of any construction.

An appropriate irrigation system should be designed that considers the existing water supply, operating pressure required for the system, rectifies any deficiencies with water supply and pressure that may exist on the site and ensures complete sprinkler head to head coverage on the surface. It is also recommended to install an irrigation controller that connects via WIFI which can assist in tracking water patterns and when issues occur. Additionally, the controller should have hi and low flow measures in place.

*Installation of irrigation pipework*

*Installed solenoid box*

### 3.4.5 Gravel Drainage Layer

The drainage layer serves to perch water at the interface of the top of the gravel layer and the sand which provides a moisture reserve in the bottom of the sand layer. This allows uniform draw down and drainage of water from the sand layer. Further, it helps to achieve uniform behaviour and performance of the football pitch surface.

The material used to construct the gravel drainage layer must pass a series of stringent tests to determine its suitability and compatibility with the selected sand rootzone material that will also be used on the site. These tests include particle size distribution and bridging properties with the sand rootzone material.

The depth of the drainage layer is typically 100mm beneath the sand root zone layer.

The contractor must use the appropriate equipment that will not mark or damage the base during the laying and spread of this drainage layer. Typically, screenings must be applied to the edge of the site of the pitch and spread over the rest of the pitch using appropriate equipment. Machinery should work on the top of the screening layer rather than the base to avoid damage to the levels of the base. The drainage layer must be levelled using suitable laser equipment.

The shape of the drainage layer must mirror that of the final level of the surface to ensure constant depth of the sand rootzone layer which will be applied to the gravel layer and therefore uniform wetting and drying of the pitch surface.

### 3.4.6 Root Zone Layer

The root zone layer used to construct a football pitch needs to be able to support a living turf surface that is capable of coping with regular levels of use.

Most native soil types drain poorly, are susceptible to compaction and are not suitable for a football pitch.

Considerable research has been conducted to determine the properties needed for the root zone layer to support turf while at the same time cope with regular use. This has led to industry standard specifications used to produce material that meets or best meets these requirements when selecting and producing suitable root zone material.

*Installation of sand root zone layer*

Some of the specific requirements for the root zone material include:

- Good draining properties of 150mm/hr or more to quickly remove water from the surface before it can impact on play.
- Capacity to retain suÿcient moistur e in the profile to support good turf growth.
- Good deep profile in the vicinity of 300mm to enable the root zone layer to function properly for turf growth.

Considerable thought is therefore needed when selecting the root zone material based on sound research.

The choice of sand is critical and forms the basis of the success of any football pitch construction. The use of a less than suitable soil will a° ect the success of any construction. This will ultimately reduce the e° ectiveness of the removal of water from the surface, through the soil profile and through to the subsurface drainage system. Greater attention to shape and renovation will be required if poor sand/ soil selection occurs.

The rootzone sand ideally should be a fine to medium sand meeting the criteria specified in Tables 2 and 3:

TABLE 2 Sand Particle Size Distribution

| Fraction Size Name | Unacceptabla USGA Sportsground & Amenity Guidelines | | |
|---|---|---|---|
| | Sieve (mm) | Allowable Range % Retained on Sieve | |
| Gravel | 2.00 | < 3% | No more than 10% including 3% fine gravel |
| Very Coarse | 1.00 | < 7% to 10%* | |
| Coarse | 0.50 | At least 60% particles in this range | A minimum of 80% in these combined sand fractions |
| Medium | 0.25 | | |
| Fine | 0.15 | 20% Maximum | |
| Very Fine | 0.05 | 5% Maximum | Combined Fractions no more than 10% |
| Silt | 0.002 | 5% Maximum Allowable | |
| Clay | < 0.002 | 3% Maximum Allowable | |

TABLE 3 Physical Characteristics of Sand Material

| Physical Characteristic | Specification |
|---|---|
| Hydraulic conductivity (32 drops compaction @ 150mm) | 200 – 350mm/hr |
| Bulk density (32 drops compaction @ 150mm) | 1.3 – 1.7g/cm³ |
| Total Porosity @ 30cm tension (32 drops compaction) | 35 – 55% v/v |
| Volumetric water @ 30cm tension (32 drops compaction) | 15 -25% v/v |
| Aeration porosity @ 30cm tension (32 drops compaction) | 15 – 30% v/v |

The success and performance of the football pitch could hinge on the attention detail and the care taken when delivering and constructing the sand root zone layer.

The sand must be carefully applied to the edges of the pitch and the drainage layer to minimise any damage to the drainage layer surface. Once applied, the sand can be spread across the drainage layer by traversing the top of the sand layer with the appropriate machinery with minimum damage to the surface of the drainage layer. At no time should machinery travel onto the surface of the screenings.

The final finished level of the sand rootzone layer shall be as per design levels within tight tolerances. The finished levels of this layer must be conducted with laser controlled equipment to achieve the required surface level tolerances.

In the situation where a heavier soil type is used, a complete rethink to the approach of installing subsurface drains is required, keeping in mind that covering the subsurface drainage system with heavy soil types will severely reduce the performance of the subsurface drainage system. The effectiveness of the subsurface drainage system can be retained if the drainage system is installed after the root zone layer, and providing suitable sand is used to back fill the trenches to the surface.

## 3.4.7 Improving Root Zone Stability

The sand rootzone layer must be reasonably firm and stable to support maintenance machinery including mowers, topdressing and renovation equipment. This is vital to reduce potential problems developing with surface levels, compaction, root growth, drainage and the survival of the grass surface.

Some of the stability required of the surface can be achieved through the choice of grass species, and also the correct selection of the sand rootzone material. However, soil amendments, such as organic matter, and re-inforced materials, may be required where added stability is needed to rectify any deficiencies that exist. This is especially the case where the football pitch is part of a multipurpose venue which could host non-turf related events, such as concerts, wrestling or other profit ventures for the clubs and organisations involved.

Several reinforcement materials have been used and there are a number of mechanisms by which these materials may improve the wear tolerance and quality of turf:

- By load-spreading, therefore reducing the rate of soil compaction.
- By reducing the effects of shearing forces which helps to preserve the continuity of large pores at the soil surface.
- By protection of the crown tissue of the grass plant.
- By increasing traction through the interaction between the fibres in the reinforcement material and the studs on the players' footwear.

## 3.4.8 Grassing the Turf Surface

A number of grassing techniques can be used to establish a natural turf surface. These include seeding, sprigging and turfing (sodding).

A number of factors will determine the choice of grassing technique. These include:

- Time restraints.
- Cost restraints.
- Appropriate technique for the selected turf species.

### 3.4.8.1 Seeding

Seeding was considered the traditional method of establishing a new turf surface. It is the cheapest option but requires considerable time (up to 12 months) to establish and be ready for use.

Seeding is not a viable option where the desired turf species can only be propagated vegetatively as for many of the selected couch and kikuyu grass varieties.

The following points should be considered for successful establishment from seeding:

- Apply the seed evenly for best results.
- Use the correct seed rate. A high seeding rate does not always result in a better turf surface and may lead to the development of spindly, immature plants less able to cope with wear or environmental stress, whereas low seeding rates will provide greater opportunity for weeds to invade any thin or bare areas.
- Seed at the correct depth. While seed must be placed deep enough in the soil to protect it from disease, pests, weather etc, they must be shallow enough to be able to reach the surface on the seed reserves. It is also important to maintain good soil/seed contact to help to conserve moisture and prevent seed desiccation.

### 3.4.8.2 Sprigging

Sprigging is where plant material is used to vegetatively propagate and establish a new turf surface. This is commonly used for establishing warm season grass species such as couchgrass (Cynodon sp.) buffalo grass (Stenotaphum sp.), and other grass species that cannot be successfully established from seed. The cost of vegetative material is generally greater than for seed but considerably less than for turf sod. However, it generally takes longer to establish and to provide a satisfactory playing surface than for the other grassing alternatives and the pitch might not be fully grassed in excess of 12 months.

The following points should be considered when establishing a turf surface from sprigging:

- The success of sprigging can be extremely variable and it is generally unlikely that all sprigs will establish uniformly across the surface, requiring follow up planting of some areas.
- Vegetative material must be viable and recently harvested and not allowed to dry out or not before planting.
- Sprigs must be planted in the soil profile then kept moist. Spreading the sprigs on the surface is less likely to be successful.

### 3.4.8.3 Sodding

Sodding or turfing is the laying of mature turf that is taken from a turf sod nursery.

There is a cost outlay for using turf. However, it is the only technique that results in an instant turf cover and hence reduces the time taken before the turf surface can be used. Many councils have decided to turf rather than sprig or seed turf surfaces due to the pressure to resume play and have available the playing surface as quickly as possible.

Sod can be used either washed or with a thin layer of the soil where the turf was grown. Washed turf is preferred because it eliminates any issues associated with compatibility of the introduced soil layer with the sand rootzone material. This is especially a concern where the turf has been grown on a heavy soil type. In this situation it is strongly advised to wash the turf beforehand to avoid any possible issues going forward.

*Recently installed turf*

*Turf installation*

The following is the general procedure when using turf sod:

- Check that the turf is healthy when delivered and before it is used.
- Water the underlying soil prior to laying to ensure rapid transplant rooting.
- Avoid damaging the surface or surface levels when laying the turf.
- Lay the sod in a brickwork pattern initially along a straight edge and ensure it is butted tightly into the adjoining sods for a good stable and firm finish.
- Lightly consolidate by rolling.
- Topdress with a light application of sand root zone material.
- Water immediately after laying.

Instant turf should show new root growth within days of laying and be well established within weeks depending on the grass species and the time of year. The sod establishment can be checked by lifting and inspecting a corner of the grass section.

Before the turfed area is used the sods must be stable under the intended use and not shift or lift up. Football pitches that have been turfed should be ready for use within 8 weeks of laying, however this should only be used as a guide.

Time is still needed with traditional turf sod for the roots of the turf to establish before it is used for play.

Where the surface is to be used immediately after sodding, a deeper sod containing a compatible sand rootzone material must be used. This will minimise any transplant shock and ensure a stable surface that can be played on immediately.

## 3.4.9 Retrofitting

It is not always possible to construct the football pitch according to the ideal option as discussed in this manual, due to either financial restraints or time restraints. Therefore, consideration must be made as to the possible work that can be conducted to upgrade and improve the condition of the pitch, and to address some of the issues that exist.

In some cases, infrastructure such as subsurface drains are retrofitted. This is recognising the importance that things must change in order to cope with the current conditions, sporting activities and usage levels and practices.

In some cases, the installation of sand slitting, sand grooving, sand banding offer techniques to improve the drainage and soil and surface conditions on the sportsfield surface without major expense and/or major disruption.

In recent years there have been number of clubs and communities that have not had the budget to completely reconstruct the sporting surface and replace with the USGA or California types of construction and have resorted to retrofitting the existing surface with drainage. This could be considered providing other aspects of the playing surface are sound, in particular that the surface shape is smooth and level. Without a smooth and level surface it will be difficult to achieve a satisfactory playing surface irrespective of the type of construction or extent retrofitting that takes place.

*Installing sand slit drains into existing sportsfield*

A number of grounds have been retrofitted with a range of different types of subsurface drainage systems, including a combination of one or more of the following or variations of the following:

- Sand piped drains consisting of a trench with a drainage pipe in the bottom, screenings surrounding and above the drainage pipe to approximately 300mm from the finished surface level and filled to the surface with suitable sand similar to that used in USGA and California type rootzone constructions.
- Sand gravel slit drains approximately 75-100mm wide and 250mm deep consisting of a trench backfilled with gravel to approximately 200mm from the finished surface levels and the rest of the trench backfilled with suitable sand. The spacing of these trenches is as close as 1 metre apart.
- Sand slit drains approximately 75-100mm wide and 250mm deep consisting of the entire trench backfilled with suitable sand. The spacing of these trenches is as close as 1 metre apart.

- Sand grooving, where small trenches are created using a machine with openings created of no more than 25mm wide and 100mm deep and spaced generally 200-250mm apart.

The retrofitting of these drains can substantially improve the draining properties of the playing surface, by compensating for the deficiencies that occur with the existing soil type. The more drains that are installed, the more surface area is being treated that will be improved. However, there is a tipping point where the cost of retrofitting is not much behind the preferred construction types of the USGA and California methods.

Retrofitting has a place where there is insufficient budget for the complete reconstruction as well as unavailable time to reconstruct, given that a complete reconstruction could mean the ground is not available to use for at least 12 months.

### 3.4.10 Resurfacing

Resurfacing is also considered a means of upgrading and improving the condition of the football pitch surface. This has particular relevance where:

- The turf surface is to be converted to a warm season grass or different turf species
- There are deficiencies with the surface shape and levels that need to be addressed
- Excessive thatch build-up has occurred.

Resurfacing can involve any of the discussed grassing techniques depending on the costs and time restraints that exist.

### 3.4.11 Further Considerations

In the situation of a new construction, both surface drainage and subsurface drainage will be important. Subsurface drainage and the quality of the sand rootzone layer will be more critical where deficiencies exist in the surface shape. For example, a flat surface will rely more on the soil profile and the subsurface drainage system than a dome or ridge shape surface.

Where poor site conditions, such as shape and soil type exist, the ideal scenario will be to completely reconstruct.

In situations where shape is okay and a reasonable soil/sand type and profile exists, then it may be as simple as installing a network of subsurface drains through the surface.

Where poor surface shape exits, although the installing of drains will be of assistance, it may be better to reconstruct and reshape. Otherwise long term management issues and practices will be required to offset these deficiencies.

## 3.5 Turf Management

All natural turfgrass pitches are living, breathing organisms that require mowing, watering, fertilising, time off from play and depending upon disease and pests, the application of plant protectants. It is therefore important to implement a sports field management program.

The primary focus of a sportsfield management program is to provide a suitable playing surface capable of coping with the current sporting activities and level of usage, as well as able to recover quickly from the wear and damage it receives.

A properly managed natural turf surface can withstand a significant amount of play without wearing out and losing its turf cover. Abuse, however can cause permanent damage that cannot be overcome by even the best maintenance program.

The primary goal of a maintenance program is to produce conditions favourable for the growth and development of a vigorous healthy turf. All natural turf fields do not require the exact same maintenance practices; however, any maintenance program should include attention to the following cultural practices; mowing, fertilisation, irrigation,

oversowing, turf replacement and renovation.

Maintaining turf is not easy and consequently proper care and attention to management is required to maintain good grass growing conditions and a good quality playing surface.

The main objectives of any management program are to:

- Efficiently utilise all available resources.
- Produce and maintain a good quality and safe playing surface at all times.
- Provide a well presented surface.
- Resist wear and damage to the pitch surface.
- Allow the pitch to recover satisfactorily from use.

A maintenance program should be developed bearing in mind the characteristics of the football pitch, irrigation, use, drainage and grass cover.

Maintenance and cultural practices will vary based on the following factors:

- Amount of use and level of play.
- Multi-sport use.
- Weather and climate.
- Soil and terrain.
- Water availability and irrigation system.
- Budget including personnel availability.
- Type and quality of field construction.
- Field security.

Management practices must address the following issues:

- Fertilising and nutrition
- Watering
- Salinity
- Weed
- Grass cover and species
- Pests
- Diseases
- Chemical damage
- Thatch
- Drainage
- Surface levels
- Mowing
- Goal squares
- Shade
- Soil Compaction
- Renovation practices

### 3.5.1 Fertilising and Nutrition

A good healthy and vigorous growing turf surface is essential to be able to cope with the level of use that the football pitch receives. The nutrient status of the soil and ultimately the turf surface is often neglected. The normal indication of nutrient deficiencies is the yellowing of the turf and under extremely severe conditions, the thinning of the turf and a loss of grass cover. Poor growing grass is also more susceptible to wear, disease (e.g. rust and Red Thread Disease), other turf problems and damage because of the inability to recover from any problems and issues that occur. It is therefore important to maintain good nutrient levels and minimise the likelihood of these problems from occurring.

The aim of any fertilising program is to provide a sufficient, regular and consistent supply of nutrients to the plant to avoid a weakening of the turf, and hence damage from wear, pests and other problems.

It is important to monitor the nutrient status of the sportsfield to optimise growth. Regular soil nutrient tests and leaf tissue tests must be conducted concurrently at least once per year on the football pitch and especially during the initial construction and establishment stages of the football pitch to determine any imbalances and deficiencies in the level of fertility that may exist. The combination of leaf and soil test results will help to accurately formulate a suitable fertiliser program and avoid unwanted problems or poor turf

wearability and recovery, which often occurs where regular and correct fertilising does not occur. Tests must also include pH and total soluble salt content as well as the nutrient status.

*Red Thread Disease*

*Low soil fertility*

The rate and uniformity of fertiliser application are issues that may affect turf growth and cover and need to be closely monitored. Uneven fertilising may result in certain areas of the pitch surface receiving more nutrients and growing better and recovering better than those areas that miss out or that are under-fertilised. Similarly, low fertilising rates could cause a motley appearance because of insufficient nutrients being applied for even growth. Alternatively, over-fertilising could cause fertiliser burn.

## 3.5.2 Watering

Water is essential for growth and for conditioning the turf to handle and recover from stress caused by heavy use and harsh environmental conditions. A well maintained natural turf surface is not achievable without an effective watering system.

Irrigation can have a major bearing on the condition and quality of the playing surface, especially if deficiencies in the water system exist or if watering is not conducted when it is required. The performance of a turf surface can easily be set back by a lack of watering.

Some of the problems encountered with an irrigation system and lack of evenness include:

- Sprinklers and sprays spaced too far apart
- Poor sprinkler precipitation distribution profile
- Unfavourable environmental operating conditions
- Incorrect operating pressure
- Incorrect nozzle size
- Poor pipe and valve sizing
- Sprinkler heads or equipment not functioning properly.

A qualified irrigation designer should be engaged to design an irrigation system that will achieve a high uniformity and

*Uneven watering*

*Uneven watering*

performance. There is a considerable amount of skill and expertise needed to evaluate the requirements of a site and develop an irrigation design that will meet the needs of the site and deliver water uniformly and efficiently.

The selection of sprinkler heads, operating pressure, nozzles combinations, and spacing are critical to the achievement of uniform application. Information is required on the available water sources, the existing flow and pressure for the water source, whether it is satisfactory to water or whether additional infrastructure in the form of a tank and pump is required to ensure good irrigation coverage and delivery.

A sand-based construction cannot be treated the same as for other grounds constructed from native or heavier soil types. Moisture stress can have a profound effect on turf growth and vigour. Turf species such as couch and kikuyu often go dormant if under any type of moisture stress. This cannot be afforded on a turf surface that is heavily trafficked and must be able to cope and recover from the wear it receives.

It is important to closely monitor the moisture status of the sports field and scientific assistance in the form of moisture sensors should be considered.

Daily inspection is also recommended not only to check how frequent watering should be conducted but to check and make sure that the irrigation system is operating properly. Tanks should have a float valve to prevent run dry and pumps should have their own run dry protection in case of failures.

Some of the problems that might be encountered include:

- Malfunctioning valves.
- Sunken sprinkler heads.
- Tilted heads.
- Incorrect or non-rotation of sprinkler heads.
- Plugged nozzles.
- Broken casings and missing parts.
- Distorted spray distribution.
- Incorrect nozzles installed.
- Leaking pipes, valves, fittings, equipment, broken seals.
- Incorrect operating pressure.

Remember that a substandard performing irrigation system could result in a substandard performing turf surface.

*Uneven watering*

*Water pressure gauge*

*Low sprinkler head*

*Correct sprinkler height*

The frequency and duration of any irrigation depends on environmental factors and limitations with the irrigation system. It is important not to over-water. It should be good deep watering. Frequent light watering should be avoided because it promotes weak turf, undesirable grass species such as wintergrass (Poa annua), thatch accumulation and shallow and weak root system.

The ideal situation is to irrigate during the night rather than during the day, and to irrigate 1-2 days before major field usage. However, common sense must prevail and watering must take place whenever it is needed to avoid moisture stress.

The soil profile must be regularly inspected to determine the moisture status of the soil profile.

Uneven watering often occurs where problems with water pressure or spacing of sprinkler heads exist. This can result in donut rings where lush green patches exist inside a much weaker stressed area of turf.

The initiative is to ensure that the irrigation system is operating efficiently and any deficiencies in the system are rectified.

The water quality must be closely monitored to avoid potential salt and other associated problems. Regular water tests should be conducted where effluent or bore water is used.

### 3.5.3 Salinity

Salinity can be detrimental to turf performance and survival. Salinity is caused by an accumulation of soluble salts in the soil. The typical soluble salts involved with salinity include carbonates, bicarbonates, sulphates, chlorides and nitrates.

High salinity reduces water intake by plant roots. The plant is subjected to drought conditions even when soil moisture is adequate. The plant is unable to take up sufficient water and reduced growth and even death may occur.

A number of factors contribute to high salinity, including:

- Use of bore or recycled water containing high salts.
- Application of fertilisers or chemicals containing salt.

*Effects of salinity*

- Thick thatch layer which can accumulate salt.
- Poor soil drainage conditions that favour salt accumulation.
- Inadequate leaching.

It is therefore important to monitor the salinity level of the football pitch and address salinity problems before they develop further and result in weakening the turf and serious loss of grass cover.

It will be necessary to address the salinity problem once it exists.

Practices to consider include:

- Irrigate using potable water that is low in salts.
- Avoid irrigating with water containing high salt levels.
- Surface and deep subsurface aeration followed by heavy watering using potable water that is low in salts to leach the salts through the profile.
- Use low salt index fertilisers.
- Avoid using lime, gypsum and sulphur.

## 3.5.4 Pests

Football pitches can be damaged by the same pests as other turf surfaces. These include root feeding insects, eg red and yellow headed cockchafer grubs, black headed cockchafer grubs, billbugs, Argentine Stem Weevil, cutworms, blade sucking insects, couch mite, ground pearls, ants, earthworms.

The main pest problems in football pitches are the scarab beetle larvae and cockchafer grubs. These can cause serious loss of cover if left unchecked and will warrant chemical control once they reach sufficient levels to cause turf damage.

It is often difficult to detect the pest visually. Symptoms are not always evident until excessive damage occurs. This is especially the case with underground grubs, billbugs and stem weevils.

Many pests cause similar types of injury and it is often impossible to identify the pest on the basis of damage alone.

*Pest damage to turf*

*Red headed cockchafer grubs*

It is important to correctly identify pest problems and if necessary seek assistance. Knowing which insect pest is causing the problem is crucial to knowing what to do about it.  This will help to determine the:

- Timing of chemical treatment.
- Method of treatment.
- Practicality of treatment.

The key is to routinely inspect the turf

Indicators of surface insect activity include:

- Skeletonised or chewed off leaf blades.
- Birds feeding on turf or bird holes apparent in the turf surface.
- Moths and other insects flying across the turf, particularly at dusk.
- Residue similar to coarse sawdust found on the turf.

Indicators of subsurface insect activity include:

- General thinning of the turf surface.
- Individual plants can be pulled away from the surface.
- Turf can be rolled up like carpet.
- Birds, rodents destroy turf in search for underground grubs.

Some insects are often associated with a pest problem, in particular the presence of flea beetles and lady beetles when an argentine stem weevil problem exists.

*Pest damage*

Pest control should be an integrated approach involving a combination of chemical, cultural and biological practices.

Cultural control methods include:

- Thatch management; pests thrive on thatch so reducing thatch development will reduce the habitat for insects and improve the effectiveness of chemicals.

- Mowing; raising mowing height can reduce the incidence of sun living insects while regular mowing will assist with turf vigour and health.
- Species and cultivar selection; high endophyte varieties are less desirable to some pests eg Argentine Stem Weevil.
- Maintain good fertility.
- Maintain adequate watering.

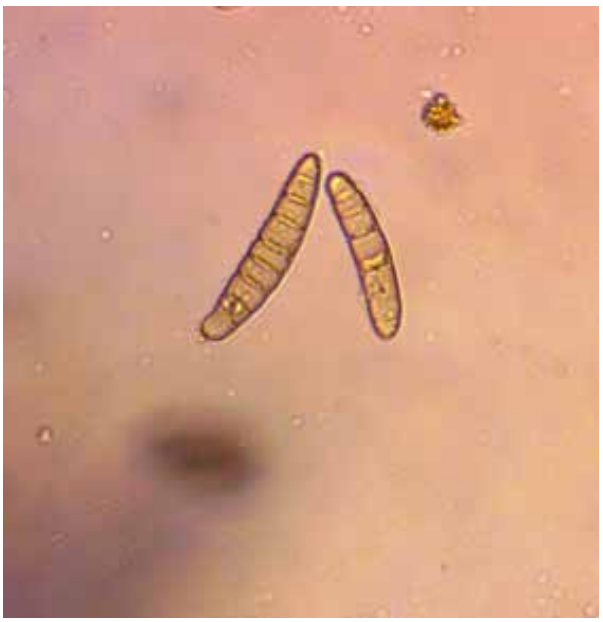
Although a well managed and vigorous turf may attract pests, it can tolerate a higher pest population without serious harm than can a turf in poor condition. Healthy turf is less likely to be affected by pests; however, the incidence of pests may sometimes be unavoidable due to climatic stresses. It is therefore important to monitor the turf for pest types and numbers and to implement appropriate control programs once the pest reaches unacceptable levels.

## 3.5.5 Diseases

Turfgrass diseases is one of the major problems confronting turf managers in their quest to produce and maintain a good quality and well presented playing surface. Although diseases are only one aspect of turf management, they can quickly damage the quality of the turf surface, resulting in costly and time consuming repair measures, especially where a high quality turf surface is needed.

A disease occurs when a pathogen meets the right turf grass host under environmental conditions that encourage disease development.

The main organism that causes disease in turf is fungi. There are more than 50 fungal diseases that can occur in turf. Fungi are microscopic organisms that are difficult to detect without using a microscope. The microscope enables the turf manager to detect whether specific parts of the life cycle of the disease organism are present, including fungal spores, mycelium, fruiting bodies etc. These can occur at differing times of years under different environmental conditions and attack specific turfgrass species.



*Leaf Disease*

There are a wide range of diseases that can affect turf. These include diseases that attack mainly roots; such as *Pythium sp* (Damping-off), *Rhizoctonia sp*, Take-all patch, Spring Dead Spot, Necrotic Ring Spot, Fairy Ring Disease. Leaf diseases include Anthracnose disease, Dollar Spot, Fusarium, Winter Fusarium, *Curvularia, Drechslera, Leptosphaerulina* leaf blight, Red Thread Disease and rust.

*Fairy Ring Disease*

Football pitches are susceptible to all disease problems that occur in turf. The major disease problems occurring in football pitches are Rust, Red Thread Disease, leaf blights and Fairy Ring Disease. The incidence of these problems obviously depends on the grass species present, the stress on the playing surface and climatic conditions.

## 3.5.5.1 Environmental Factors Affecting Turfgrass Disease Development

A favorable environment is one of the critical pre-requisites for disease development. It is important to understand the environmental conditions necessary for disease development so that appropriate measures can be taken to maintain conditions that are generally unfavorable for turfgrass diseases but still favorable for grass growth.

The following environmental factors affect disease development:-

- Temperature.
- Water.
- Humidity.
- Light.
- Wind.
- Soil texture.
- Soil reaction.
- Soil organic matter.

### (i) Temperature

Temperature influences the following:

- The growth rate and relative susceptibility of the host.
- Multiplication and growth of the pathogen.

- Interaction of the host and pathogen.

Each fungal species has a minimum, an optimum and a maximum temperature for germination, growth, infection and survival.

Temperature is an important factor influencing the growth rate of the plant and fungal disease. The optimal temperature for disease development may be distinctly different from the optimum temperature for fungal growth. Optimal grass growing conditions tends to result in a more vigorous plant that is better able to resist disease attack and recover from the effects. Extreme temperatures may injure the plant, causing a weakened plant that is more susceptible to infection.

The most rapid disease development occurs at optimum temperatures for the development of the fungal disease, which are above or below the optimum for the growth of the host plant. The frequency and severity of a disease is usually associated with a particular season of the year.

### (ii) Water

Most fungal diseases require free water or very high atmospheric humidity for infection to proceed rapidly. Therefore, a sensible approach to water management is required to minimise problems from disease. The "free" water can originate from rain, irrigation, fog, dew or leaf exudates.

Water stress or waterlogging will weaken the host plant and increase disease development. High soil water levels tend to increase the succulence of the plant, which increases its susceptibility to fungal infections. It also causes root malfunction, and greatly favors encroachment of parasites that tolerate low oxygen concentrations such as Pythium, Fusarium. It is important to have good drainage, and also regular irrigations.

Whenever practical, turf should be watered during the morning or midday period so that the leaf surfaces will dry rapidly and the water will infiltrate down from the surface before nightfall. Cooling temperatures at night are often conducive to the formation of dew on the leaf surfaces. This should be minimised to retard fungal growth.

The amount of water that should be applied varies according to the soil characteristics, the topography and the geographic region (temperature and rainfall patterns). Water should be applied to prevent wilting, and the actual amount may vary from area to area within a given turf.

### (iii) Humidity

The atmospheric water vapor (humidity) in the grass canopy is very important in disease development because free water and high humidity are required for the germination of most fungal spores and for mycelial growth.

The humidity inside the turf grass canopy can be very high, especially when the tiller density is high, the leaves are long, soil water content is high, and air movement is restricted. When the humidity is high the evaporation of water from leaf surfaces in the morning is slowed and the favorable period for disease growth is extended. Rapid drying aids disease control by dehydrating and killing active fungal structures that have not yet penetrated the plant.

Generally more than 12 hours of leaf wetness are needed for most pathogens to penetrate plants.

High humidity, coupled with shaded areas will result in areas remaining wet longer following irrigation, rainfall or dew formation. The occurrence and severity of diseases can be significantly influenced by the frequency and duration of dews.

The period of leaf wetness can be reduced mechanically by moving a long, flexible bamboo pole, rope or water hose across the grass to remove the dew from the leaf blades. Humidity can be controlled to some extent by mowing at the correct height, planting seed at the suggested rate, watering early

in the morning or at midday rather than in the afternoon or evening and by removing obstructions that reduce the movement of air across the turf grass canopy. This includes pruning or tree removal.

### (iv) Light

Diseases are influenced much more by humidity and temperature than light intensity and quality. However, high light intensities can help to dry moisture films on the leaves and reduce germination and mycelial growth of most fungi. Whereas, plants grown at low light intensities are frequently more susceptible to fungal diseases.

Diseases such as powdery mildew and rust occur more frequently in shaded areas.

### (v) Wind

Wind can be an important factor in the occurrence of diseases. Wind can spread fungal spores. It can also influence the rate of evaporation of free water from the leaf surface. The longer free water remains on the leaf and more likely that fungal infection will occur.

### (vi) Soil Texture

Few soil-borne diseases appear to be directly favored by soils of heavy texture, however heavy soils may favor some diseases because of the slow drainage rate and the wet soil conditions that develop. Most fungi, whether soil borne or otherwise, are strong aerobes and most pathogenic soil fungi are favored by soils of light texture which allow the natural diffusion of soil gases.

(vii) Soil Reaction

There appears to be some evidence that the soil pH affects the development of certain fungal pathogens, whether by the direct effect of the pH or the indirect effect on nutrient availability and turf health.

Bentgrass did not appear to be affected by Rhizoctonia in the pH range from 4.0 to 10.0 under low nitrogen levels. However, when the nitrogen level increased, the plants were less susceptible at high pH.

Take-all patch (Gaeumannomyces gram in is) was found to be more prevalent in alkaline than acidic soils. Increased incidence of this disease has been found as the pH increases from liming etc. and decreased by the application of sulphur. Similarly, Winter Fusarium is also favored by liming.

### (viii) Soil Organic Matter

There is little information on the direct effects of soil organic matter on turf grass diseases; however it is important in maintaining plant vigor and hence minimising disease damage. Soil organic matter will affect soil structure, water relationships in the soil, nutrition retention and release, aeration, root respiration, survival of pathogens and their antagonists.

If organic matter is lacking, then associated reductions in plant vigor will lead to increased disease and pathogen problems. This has been observed with Dollar Spot, Red Thread Disease and the rust diseases.

The addition of organic matter to the soil sometimes reduces the parasitic effects of some fungal organisms, in particular Gaeumannomyces graminis and Rhizoctonia sp. Excessive amounts of organic matter in the soil can increase water retention, impede drainage and favor root diseases such as Fairy Ring Disease.

## 3.5.5.2 Cultural Factors Affecting Turfgrass Disease Development

A number of cultural conditions can affect disease development, including:

- Watering practices.
- Fertility.
- Soil reaction.
- Mowing.
- Clipping removal.

- Thatch.
- Drainage and soil modification.
- Seedling establishment.
- Topdressing.
- Pesticides.
- Aeration.
- Dew rolling.
- Temporary turf covers.

### (i) Watering Practices

The amount of water and the timing of its application can prevent or contribute to disease development. The presence of dew on the leaf surface and extending the natural period of leaf wetness can increase fungal growth and increase foliar diseases.

Leaf wetness influences the initiation and development of all plant diseases and determines the production of spores and their survival. Most fungal disease pathogens require specific conditions for their spores to germinate; favorable temperature and a film of water on the plant surface. These conditions must last sufficiently long enough for the pathogen to penetrate the plant, otherwise, the germinating spore dries out and dies. The longer the leaf surface is wet, the greater the risk of infection and the number of infections per leaf.

Patch diseases are more severe with prolonged periods of leaf wetness. The take-all patch organism (Gaeumannomyces graminis) is particularly sensitive to moisture fluctuations and high moisture levels in the surface layer of soil must be maintained for the infection of the grass plant to occur. Necrotic ring spot has also been shown to increase in severity with excessive moisture and frequent irrigations. The powdery mildew fungi are an exception as they require high humidity without the film of moisture on the leaf surface for germination of spores and infection to occur.

Control measures against some disease organisms, such as Ascochyta leaf blight includes irrigating grass early in the morning hours when dew is already present. Dollar spot is visible when due is present due to the growth of the fungal mycelium over the surface of the leaf. This mycelium requires a period of leaf wetness for the cobwebby structure to develop. Watering early in the morning as previously mentioned would dilute the nutritional benefits of the dew thereby reducing dollar spot problems.

Control for the Helminthosporium-type diseases (melting-out and leaf spot) includes avoiding frequent short irrigations, especially in the evening.

Watering practices should be followed that keep the leaf wetness less than 12 hours. Twelve or more hours of moist foliage can trigger a major disease outbreak. The shorter the time the grass is wet, the less the disease problem.

The infection of a plant by a fungal pathogen requires spore germination and development before tissue penetration can occur .The requirement of leaf wetness for these processes to occur in part explains the reason why leaf-spot is more serious in lawns on the north side of a building or in low areas where the turf remains moist for extended periods of time (does not dry out). The spores of some fungal organisms germinate producing a motile spore that must swim in a film of water before infection can occur.

The proper frequency and intensity of irrigation should provide a controlled growth rate that enables the turf to resist as well as rapidly recover from disease. If possible, grass should be irrigated when the evaporation of water droplets from the leaves is at its greatest. Early morning irrigation is also beneficial because it disperses the dew droplets so that the surface dries more rapidly. Syringing can also be used to minimise the

conditions that favor spore germination and mycelial growth.

### (ii) Fertility

A balanced level of nutrition is needed for good grass growth to enable it to resist and recover rapidly from disease and is the best defense against turf grass diseases. A balanced level of nutrition should provide a controlled shoot growth rate, a deep extensive root system and good recuperative potential. Nutrient imbalances can often cause stresses in plants and increase their susceptibility to disease.

The amounts and timing of fertiliser applications can have major effects on disease.

Excessively high nitrogen fertilising may increase the risk of severe outbreaks of diseases caused by Fusarium, Helminthosporium, Ophiobolus, and Rhizoctonia. Both Fusarium and Brown Patch are extremely destructive at high Nitrogen levels because the cell walls of the turfgrass host are thinner and more easily penetrated by fungal hyphae. In contract, other diseases caused by Laetisaria (Red Thread disease), Puccinia (rust) and Sclerotinia (Dollar Spot), are particularly severe at low levels of nitrogen nutrition. Some nitrogen is needed to provide turf grass plants with the vigor to resist or recover from disease injury. Regardless of the detrimental or beneficial effects of high nitrogen; the recovery rate from disease injury is more rapid at higher levels of nitrogen nutrition.

The soil potassium, phosphorus, calcium and iron levels can also affect disease incidence. Adequate potassium level is important in reducing the likelihood of disease. High levels of potassium will reduce the incidence of Brown Patch, Dollar Spot, Fusarium species, Ophiobolus Patch, and Red Thread.

Optimum phosphorus levels stimulate root development and reduce the susceptibility of grass to seedling damping-off diseases. High calcium levels tend to reduce the susceptibility of grass to Pythium blight and Red thread. Applications of iron are also reported to reduce Fusarium patch.

Soil tests should be conducted regularly to ensure a good balance of nutrients exist and to determine the changes necessary.

### (iii) Soil Reaction

The soil reaction determines the ability of plants to remove nutrients from the soil and the activity of and population of micro-organisms including fungal pathogens.

Most parasitic soil fungi are favored by an acidic soil pH of less than 6.0. Neutral and alkaline soil pH's can increase the incidence of a few diseases, such as Ophiobolus patch and Fusarium patch.

The soil reaction also indirectly affects the susceptibility of some grasses to disease. The root system is restricted under extremely alkaline or acidic soil conditions and the availability of essential nutrients is reduced to the extent that the plant is weakened and is susceptible to disease infections. The soil reaction also influences the activity of saprophytic soil organisms that directly or indirectly affect the pathogen population.

### (iv) Mowing

Most diseases are favored by mowing practices. Mowers damage the leaves, move infected clippings and spores, and remove photosynthetic tissue that produces the carbohydrates required for shoot and root growth. It can also reduce the plants defense system. Disease development increases with increased mowing frequency.

Fungi that infect leaves may be transported by mowers. These fungi may exist as spores dislodged from leaves or as mycelium in the infected tissue. Spread of disease by mowers is particularly severe if grass is cut when it is wet. Spread of disease can be reduced

by mowing after the leaves have dried. Dry clippings are less likely to stick to a mower as much as wet leaves.

Mowing height can also affect disease development. Close cutting increases the susceptibility to disease injury from Helminthosporium, Puccinia, Rhizoctonia and Sclerotinia species. As the mowing height is reduced, the plant partially compensates for its reduced carbohydrate-producing area by producing more tillers. The result is an increased leaf density, which contributes to higher humidity in the leaf canopy. The vigor of each plant is also reduced because plants are small and have a restricted rooting depth.

The effects of low mowing lead to increases in the susceptibility to many diseases and brings cut leaf tips more closely together. When leaves are allowed to become long, they tend to mat down. The matted leaves provide highly efficient food and moisture conditions that favor disease outbreaks.

Regular mowing can be beneficial to turf that is actively growing. Some fungal diseases that invade leaf tips have a slow rate of downward infection. This includes Fusarium, Lanzia homoeocarpa (Dollar Spot). Therefore, the infected leaf tips may be removed by mowing while the lover, disease-free continue to grow.

(v) Clipping Removal

Removal of disease clippings from a turf can reduce the disease severity, especially for fungi that are unable to grow in the thatch but can survive on the clippings.

(vi) Thatch

A thick thatch layer provides an ideal micro-environment for the survival and development of diseases, especially if it is in a moist condition through irrigation or poor drainage.

Thatch development is preferred by one or more of the following:-

- Keeping the turf very wet or very dry.
- Allowing the soil pH to become too acidic or too alkaline.
- Remove clippings and allowing the nitrogen concentration in the thatch to become depleted.
- Making repeated applications of fungicides or certain insecticides before or during summer season when most decomposition usually occurs.

Regular topdressing will help to reduce the formation of excessive thatch layers. It can also provide beneficial bacterial and fungi that;

- Stimulate thatch decomposition.
- Are antagonistic to parasitic fungi.

### (vii) Drainage and Soil Modification

Good drainage is particularly effective in reducing disease development. This can be achieved through proper soil modification, surface contouring, and the use of a subsurface drainage system. These practices also encourage the development of a deep root system, and healthy vigorous turf.

### (viii) Seedling Establishment

Any process which encourages rapid germination and establishment of turf grass will directly or indirectly reduce the severity of fungal disease problems. However, conditions which delay germination, such as low temperature, excessive soil moisture or extremely dry soil conditions should be avoided because they will reduce turf vigor.

Sowing rates are critical. High seed rates will result in over-crowding, the development of soft and spindly turf grass plants, and favor seed-rotting and damping-off diseases.

### (ix) Topdressing

The choice of topdressing material and technique is critical. Generally, the topdressing material should be similar to the soil on which the turf was produced. Otherwise, soil layering may develop if the topdressing material is too dissimilar, which may reduce water movement, root development, turf vigor, and increase the

susceptibility of the turf to disease damage. Heavy textured topdressing material should be avoided because it will seal the surface, leading to problems of air movement, water penetration, root growth and survival, and increasing the potential disease problems.

Frequent light topdressing with straight sand may generate problems when improperly used on old established turf which has developed considerable thatch and rootmat. This may favor disease problems such as Pythium sp. The incorporation of organic material with the topdressing sand may increase the level of biological control agents that can naturally reduce fungal disease problems and needs to be considered.

Care is needed when topdressing to avoid smothering. Light topdressings must be considered. otherwise, loss of both the turf cover and vigor may result. Both conditions will favor the incidence of disease.

### (x) Pesticides

Very few pesticides are selective and will tend to control both target and non-target organisms. As a result, the incidence of disease may in fact increase where the naturally occurring biological agents are removed. This had been observed in trials using Benlate in the control of Spring Dead Spot Disease. It was found that the incidence of Spring Dead Spot disease increased when compared to the nil fungicide treatment. Therefore, a sensible approach to chemical usage is needed.

### (xi) Aeration

Cultural practices such as coring, scarifying, subsurface aeration, spiking etc, will help to improve water penetration and air movement in soils which have become compacted or where a thick thatch and rootmat layer has developed. There is a possibility that some fungal disease pathogens will be spread by machinery during these practices. However, the benefits of improved aeration and turf vigor generally outweigh any increased incidence of disease.

### (xii) Temporary Turf Covers

Temporary covers may protect the turf area from excessive rain and associated problems of water logging and compaction before being used. However, they tend to increase the incidence of disease by increasing the humidity beneath the covers and may reduce light intensity and result in softer and elongated plants if left for long periods. Sensible use of covers is therefore needed.

## 3.5.5.3 Disease Diagnosis

The disease must be recognized and the causal organism identified before the appropriate disease control practice(s) can be initiated. Accurate and early diagnosis is needed to successfully control turf grass diseases and to minimise the costs involved to repair and maintain the turf area. Every effort should be made to determine the cause(s) of the problem in order that appropriate remedial measures may be implemented.

It must be emphasized that combinations of fungal pathogens generally occur rather than individual disease pathogens, and that disease symptoms can vary greatly on different grass species and under different environmental conditions.

Correct diagnosis and determination of the major cause(s) of the problem can only be determined by a combination of field and clinical diagnosis.

### (i) Field Diagnosis

The steps to follow when diagnosing the problem in the field are:-

- Identify the affected grass species.
- Observe the symptoms.
- Observe the cultural and environmental conditions.
- Identify any visible signs of the pathogen.

### (ii) Clinical Diagnosis

When no evidence of fungal organisms is visible, clinical diagnosis is essential in conjunction with the field diagnosis to confirm the types of fungal organisms that may be present as well as the stages of the fungal life cycle that exist and part of the turf grass plant that is being affected. This involves microscopic analysis of samples taken from the affected area and may involve the sending away of samples to a diagnostic laboratory. Microscopic examination must be taken to confirm as well as to identify the causes of the problem.

It is sometimes difficult to justify treating disease affected football pitches with fungicides unless it is a high priority football pitch because of the large area and the cost involved. However, all information on the problem that exists is needed to make a well informed decision.

Red Thread, Rust and some of the leaf blight diseases can generally be controlled through good application of nitrogenous or balanced fertilisers as well as other management practices without incurring a huge expense.

*Microscope*

*Microscopic organisms*

## 3.5.6 Weeds

A weed is defined as a plant growing in a situation where it is not wanted. Any plant can be a weed in a certain situation, e.g. Kikuyu in a couch turf surface.

The main issues with weeds are as follows:

- Interfere with turf quality and the quality of the playing surface; the surface can become slippery and uneven, which can affect traction, ball roll.
- Compete for light, nutrients, water with the turfgrass plants.
- Affect appearance of the turf.
- Differ in appearance from the turf.

Weeds are likely to invade a weakly grassed or poor growing turf surface and less likely to invade a dense vigorous sward. It is therefore important to rectify the cause of poor turf growth.

*Weed infestation*

Weeds are often difficult to eradicate.  Once the weed seed gets into the soil it can act as a seed bank where it can survive harsh conditions for extended periods before it germinates.

The main weeds that can be an issue in football pitches include wintergrass, clover, summergrass, capeweed, onion grass, chickweed, couch, bent, kikuyu, flatweeds, paspalum, wireweed, crowsfoot grass.

*Patches of clover in turf surface*

The best way to prevent a weed problem is to start without a problem. This is achieved by eliminating the weed bank in the soil involving:

- Proper seed bed preparation before grassing.
- Use clean soil.
- Sterilise soil.
- Use certified seed and turf seed and vegetative planting material that is weed free.

Once a weed problem exists it is important to identify the weed species so that the correct herbicide can be used to eradicate the problem without affecting the turf species involved.

Poa annua (wintergrass) is a major problem in football pitches, and in some cases becomes the major grass species that must be managed accordingly.

## 3.5.7 Nematodes

Nematodes can also cause problems in turf surfaces. Nematodes are small worm like organisms approximately 0.1 mm long as adults. Large numbers of harmless (saprophytic) species occur in soil and are beneficial. However, some species can cause harmful effects and damage to the turf.

Nematodes must produce high population levels before they have produced a high incidence of feeding sites before they adversely affect turf quality. The actual number of root feeding nematodes needed to affect quality varies for each species.

Certain nematodes are more pathogenic and will cause damage at lower population levels than other nematodes.

As plant vigour decreases due to such factors as lowered cutting heights or high air temperatures, the number of nematodes needed to bring about major damage also decreases.

The main damage caused by nematodes is an improperly functioning root system. Affected plants may show various shades of light green to yellow. Nematodes have a non-uniform of clustered distribution in the soil, therefore, the areas showing damage vary in shape also in contrast with diseases, and the boundaries between good turf and poor turf are not always sharply defined.

Since the affected plants lack vigour, they have reduced ability to withstand stresses such as dry soil conditions, low fertility, extremely high air temperatures, and other adverse growing conditions.

Some degree of reduction to nematode activity can be achieved by giving close attention to management practices that promote root growth and development.

Beside chemical control measures in severe cases, the following cultural practices should be considered:

- Irrigation should be sufficient duration to favour deep penetration of the soil/root medium.
- Regular aeration to maintain adequate oxygen levels in the root zone and ensure proper water infiltration.
- The source of nitrogen in the fertiliser program may affect the population levels of some nematodes, and may be lower from an organic source than with ammonium nitrate.

## 3.5.8 Algae

Algae are simple forms of plant life that are always present in soil and water. They occur more generally on turf areas where greater quantities of water are used, and the soil stays wet for longer periods.

Algae are not normally a problem in a dense stand of turf but may occur in thin weak areas. Control must be based on detection and remedying of the cause of the thin weak turf and bare soil patches. Such factors as failure to control disease, composition and over-watering are often primary causes of weak turf.

Permanent control of algae can only be achieved when a dense turf cover has been established in the patches. Control includes adequate aeration and drainage of the soil and satisfactory applications.

### 3.5.9 Moss

Moss also consists of dense growth of simple plants that develop rapidly in shaded areas on soils which are saturated with moisture, or on bare moist soil in unshaded areas. They can be particularly troublesome on acid soils of low nutrient status such as those used in new sportsfield constructions.

Factors that favour their development include wet and humid conditions and compacted soils with thin turf. Moss is more common in shady areas with infertile, acid soils and excessive thatch.

Under ideal conditions the mosses may increase to the extent that they choke out the turf forming grasses and cause large bare areas during the dry summer period.

Control can be obtained by providing adequate drainage and aeration of the soil, the diversion of surface water from the rain, adjusting soil pH, supplying adequate fertiliser, reducing the amount of shading and increasing the exposure to the area to drying winds, and by treating with iron sulphate.

After death of the moss the area should be raked clean, scarified, lightly top-dressed and reseeded.

*Moss in turf surface*

## 3.5.10 Chemical Damage

Maintenance contractors should be aware that chemical damage can sometimes occur. This is more likely where overlapping of herbicides, wetting agents and other chemicals occurs, or where the rates and types of chemicals applied are incorrect.

It is also possible that adverse chemical reactions can occur where more than one chemical is applied to the football pitch.

*Chemical damage*

It is important to keep detailed records of all chemicals maintenance practices conducted to the football pitch, together with the weather conditions, rates and types of chemicals applied and reasons for their application. This will help to determine the cause(s) of chemical damage and therefore a solution to any chemical damage.

*Chemical damage*

It is also important that operators check the rates of all chemicals and ensure that they are applied at the correct rate, time and for the correct purpose before proceeding with their use.

## 3.5.11 Thatch

Thatch is the layer of decomposed or partially decomposed plant material found between the soil surface and green vegetation. When organic matter accumulates faster than it is decomposed, thatch results.

Thatch is a natural and vital component of a turf surface because it protects the growing points of turf and improves the wearability and resilience of the turf. A small amount of thatch will provide some cushioning and minimise to some degree the potential for player injury.

It also minimises surface and soil erosion and insulates the soil against temperature extremes. However, too much thatch could be detrimental to the quality of the playing surface because it can result in the following:

- Makes management unpredictable.
- Affect quality of the surface.
- Localised dry patches.
- Scalping.
- Poor response to fertilisers and chemicals.
- Restricts root growth.
- Impairs the trueness of the turf surface.
- Salt accumulation.
- Increased pest and disease problems.

*Chemical damage*

Many management practices can cause rapid thatch development. These include:

- Low or high soil pH.
- Compacted soils.
- Poor drainage.
- Use of pesticides.
- Climate conditions.
- Cultural factors.
- Mowing height.
- Plant density.
- Grass species.
- Irrigation.

A sensible approach to management is required to minimise the development of thatch. Once thatch reaches excessive levels, it will be necessary to implement cultural practices that will reduce the thatch layer as well as the impact of thatch on the turf surface. These management and cultural practices include coring, scarifying, topdressing.

Where excessive thatch develops and management and cultural practices are unlikely to reduce or contain the thatch development, it will be beneficial to strip the surface to remove the thatch and to make management more predictable.

## 3.5.12 Soil Conditions

During the winter playing season, one of the main limitations to optimal use on any type of sportsfield is the rate that water infiltrates into the surface and drains through the soil profile. The rate of surface infiltration and drainage will affect a field's ability to be used soon after heavy rainfall, without any significant risk of damage to the playing surface quality.

The ability of a field to return to a playable condition after heavy rainfall is site specific and depends on:

- Field construction.
- Texture, structure and stability of the soil structure for a given soil.
- Topsoil depth.
- Presence of any impediments to surface and subsurface drainage.
- Physical treatment of the soil.
- Whether an effective drainage system has been installed.

Sportsfield managers need to be aware of the drainage characteristics of their football pitch if optimal use is to be achieve; usage demand may need to be limited if inclement weather is encountered. Sand-based pitches generally have a greater tolerance of weather conditions.

During summer (or dry seasons) water deficit can limit turf growth and reduces recovery from wear. This damage is often carried through to next season's use.

Irrigation or adaption to warm season grass species offers solutions to water deficits.

## 3.5.13 Drainage

Drainage is a major issue especially where deficiencies in the surface shape and the soil conditions exist.

*Muddy conditions*

*Poor soil conditions*

Drainage is closely linked with the soil physical properties.

Good surface and subsurface drainage are essential to remove excess water away from the surface before it can impact on the quality of the playing surface.

An inferior playing surface will quickly develop during wet weather where poor drainage exists.

Damage to the football pitch will occur more rapidly where poor soil types and poor surface shape exists.

This is often the case for community football pitches where existing native soil types may have been used to construct the playing surface.

The solutions to poor drainage include:

- Reconstruct the pitch and use better soil types and improved surface shape.
- Install subsurface drains.
- Surface and subsurface aeration.
- Amend the soil.
- Minimise use of the football pitch during wet weather or wet soil conditions.

### 3.5.13.1 Installation of Subsurface Drains

Subsurface drains are often installed into football pitches after they have been constructed and been used for a number of years to rectify existing drainage problems. This was discussed in the construction section when dealing with retrofitting the football pitch with drainage. This practice will help to reduce the problems associated with poor drainage and poor surface shape that may exist. However, it can also create other problems such as the deterioration of the surface where the drains have been installed and a potential injury risk to users.

The problem normally develops because well-draining sand is used in the drainage trenches which can become unstable where the grass cover is lost and when the sand dries out.

The lack of grass cover along the trench lines could lead to the deterioration of the surface and the development of foot holes. This problem can be minimised by grassing the trenches with instant turf, preferably washed or soilless couch turf. The success of this practice was seen on football pitches that were suffering from moisture stress.

The other issue is subsidence of the trench lines. Some subsidence is expected after construction. However, excessive subsidence can result in depressions along the trench lines and major injury risks to all users on the football pitch surface. It will therefore be necessary to diligently address these issues through regular monitoring, and topdressing using sufficient sand to avoid smothering the grass and repeated until the surface levels are restored.

### 3.5.14 Mowing

Mowing involves the periodic removal of turfgrass leaves and is the most basic and time intensive of all routine turfgrass management practices.

Both reel mowers and rotary mowers are used on natural turf football pitches. Reel mowers are used on high quality fields where a lower more precision cut is desired. Reel mowers are more expensive than rotary mowers and require extra maintenance. It also generally takes longer to mow a turf surface with a reel mower than with a rotary mower. Rotary mowers are very common, affordable and reliable. A clean cut can be achieved with sharp blades and a high blade speed. They can cut taller grass but sharp blades are essential.

Mowing has a huge impact on the quality and durability of the turf surface. Mowing practices affect the durability, appearance, health and composition of the turf.

Mowing plays a key role in improving the stem density and quality of the turf surface,

resulting in better ball bounce and roll, better traction, less surface hardness and uniform appearance.

Proper mowing promotes good deep root development, good shoot density and uniform growth.

*Effects of Scalping*

## 3.5.14.1 Mowing Height

Mowing height is important. Effective mowing height is determined by the grass species and variety, site use, level of management, desired field conditions, traffic level and other management practices.

Turf mown below or above the recommended cutting height for an extended period of time may not be able to perform as expected or desired. Low or infrequent mowing places more demand on management, makes grass less tolerant to wear, can affect turf composition and can cause scalping and death of grass.

Turf mown too low or scalped will have a reduced root system, shallow roots and lower stored food reserves resulting in a weakened turf which is more susceptible to pest or disease pressure and requiring frequent irrigation and fertilising.

Mowing at 75mm or higher does not increase traffic tolerance of turf. However, the turf will have a deeper root system and greater access to water and nutrients. The lower shoot density of higher cut turf can result in a more open and shaggy appearance of the turf surface.

For increased density, the mower height must be selected and maintained. Any adjustment to the mowing height should be conducted gradually to allow the turf to adapt to the different eight. This will reduce scalping and damage to the turf.

The mowing height for different sporting activities often differ and needs to be considered as much as possible, especially when the sporting surface is used for different sporting activities. For example, the preferred mowing height for a football pitch ranges from 25 to 40 mm, while the preferred height for a cricket field is 20 mm or less.

It is important to conduct good mowing practices, including regular mowing at the appropriate height for the grass species involved, as well as properly maintaining equipment. This will help to maintain a dense, healthy and vigorous turf and avoid weakening the sward.

The frequency of cut will depend on the grass species involved, the growth rate of the plant and the time of year but is generally at least once per week during the cool seasons and at least twice per week during warm seasons.

The ideal situation is to remove grass clippings from the surface. These can remain without harming the turf if mowing is frequent. Otherwise excessive grass clippings can result in clumping, smothering and hence death of grass.

Mow sportsfields as often as needed so that no more than one-third of the height of the turf is cut off in a single mowing. This will allow the return of leaf clippings without interfering with play.

Regular sharpening and adjustment of mower blades, reels and bed knives ensures that mowers will cut cleanly rather than tear and bruise leaf blades. Mowers that are operated daily will probably need weekly sharpening of the cutting edges.

Similarly, mowers cutting turf grown or sandy soil will need more routine sharpening of dulled blades, reels and bed knives than turf grown on loamy soil. The mowing height has a huge impact on the quality and durability of the turf surface.

The cutting height depends on the intended use of the turf area, time of year and the turf composition. In particular it is important to avoid low mowing. Mowing heights less than the optimum for the grass species being maintained requires greater inputs to maintain a good playing surface. Increased watering and fertilising are just some of the maintenance practices that must be increased to compensate for low mowing or high levels of usage.

The typical final cutting height for football pitches is 20-40mm, but ultimately depends on the grass species involved. Premier and senior football require the turf to be mown at a constant height of 30mm.

### 3.5.14.2 Mowing Pattern

Sportsfield managers use skill and creativity to design field striping patterns that are visually appealing to spectators. This is an important tool in terms of presenting an appealing playing surface. The patterns give a professional look to the field and do not affect playability. By mowing in different directions, the leaves reflect light resulting in the appearance of dark and light stripes.

Mowing direction should be changed every mowing. Grass will lean or grow in the same direction it is mown so changing the mowing direction each time the turf is mown will avoid the undesirable streaking appearance. Varying the mowing pattern also helps to prevent scalping high spots that develop as well as wear in the wheel tracks.

### 3.5.14.3 Clipping Removal

Clippings should be removed from the turf surface on each mowing occasion. Leaving excessive clippings on the turf surface could smother the grass, causing heat stress as well as loss of turf cover in the affected areas.

## 3.5.15 Turf Replacement

It is critical to ensure that the surface remains safe and is not deteriorating to the extent that an unsafe turf cover or foot holes develop. Turf replacement has become extremely important not only to repair worn, potentially risk injury areas to restore the surface but also a means of quickly returning the surface to a complete turf cover. Turf replacement should be factored in as an integral component of turn surface management.

Turf replacement is a highly skilled process requiring precision with the removal and replacement with the new turf to ensure the surface is stable, smooth, level and does

not pose any issue in terms of injury risk or management going forward. It is often left to skilled operators with the correct equipment. Turf replacement should be conducted in the situation where the surface is worn or unsafe, to restore the integrity and safety of the surface as quickly as possible.

Major turf replacement of worn goals, centre areas and other areas showing significant wear is normally conducted at the end of the playing season. In the case of football, it is critical that turf replacement should be conducted immediately at the end of the season. This ensures the surface is repaired and turf cover resolved as quickly as possible.

Where turf replacement is conducted during the season, thick sods should be used that are installed correctly and become stable immediately.

## 3.5.16 Management of Goal Squares

The condition of the goal mouth is important to provide a true and level surface. The ideal situation is to maintain a good grass cover and level surface. This is sometimes difficult to achieve, especially where the goals are receiving considerable traffic and are also being used for training drills.

Damage to the goals either needs to be minimised or repaired.

The following strategies should be considered:

- Where possible, shift the location of the goals, by either moving the position of the pitch forwards, backwards or sideways. This will take the worn area out of play as well as spread the wear and give the surface a chance to recover.
- Replace or regrass the goals either by seeding or sodding.
- Use moveable/portable goals for all training.

## 3.5.17 Shade

The effect of shade on turf growth and survival is a complex one. Shade directly affects light intensity and hence turf quality and vigour. The morphological and physiological characteristics of turfgrass plants alter as the light intensity decreases and they become weak and spindly plants with thin leaves and also long and thin stems.

*Shade from trees*

*Shady aspect on oval*

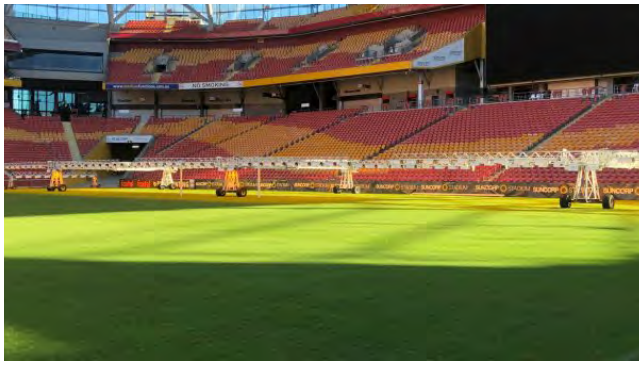
is more susceptible to damage from wear and other stresses than plants grown in full sun and high light intensity.

Shade can also affect air circulation, and hence the time it takes for the turf surface to dry out. As a result, the pitch surface will be more susceptible to damage while it remains wet.

A number of cultural practices will help to improve the survival of turfgrass plants in shade. These include:

- Judicious pruning of the tree canopy or removal of some of the trees, to increase both light intensity and air circulation.
- Increasing mowing height to avoid cutting below the growing point of the elongated turfgrass plants.
- Remove clippings.
- Irrigate properly with deep infrequent watering to minimise the time the leaves remain wet.
- Control the level of usage and traffic in the shaded areas.
- Maintain good preventative pest and disease control.

*Impact of roof at Dolphin Stadium*



*Growth lights at Suncorp Stadium*

## 3.5.18 Restoring Surface Levels

The pitch surface should be smooth at all times to provide a suitable playing surface and to minimise the risk of injury to all users of the pitch. This is sometimes difficult to achieve, given the damage that can occur to the surface from excessive usage levels.

The surface can also be damaged from tractor driven equipment, especially during wet weather, and wheel ruts are not uncommon on sportsfields.

It is imperative that any wheel ruts or localised depressions are quickly removed to maintain a safe and good quality playing surface. This can be achieved through topdressing, although this undoubtedly will result in some loss of grass cover.

The other alternative is to subsurface aerate the affected areas using a vertidrain or similar implement then roll the surface. This will help to restore the surface levels.

Similarly, damage can often occur from rabbits and other rodents. These can create foot holes in the surface that could be an injury risk to users.

The surface should be regularly inspected, and any foot holes or depressions be quickly repaired.

## 3.5.19 Topdressing

Topdressing of football pitches will be conducted for a number of reasons including:-

- Maintaining a level surface.
- Diluting the thatch.
- Maintaining a firm surface.
- Improving the soil conditions.

Whether topdressing is necessary will depend on the situation but should be considered where surface levels are critical or the integrity of sand slit drainage is to be maintained.

Topdressing can be conducted at any time during the year providing the turf is actively growing and it is not applied heavily.

Another thought to consider with topdressing is the material used. Fine sand is likely to blow around and may become a hazard to the eyes of the players. Therefore, an appropriate sand or otherwise an appropriate time of topdressing must be considered.

## 3.5.20 Managing Surface Hardness

Managing surface hardness on natural turf pitch surfaces requires both routine testing and proper field maintenance.

Surface hardness is best managed in the off season but must be addressed if it poses an issue during the season to ensure a safer playing surface without sacrificing playability if properly performed.

The following maintenance practices should be considered when addressing surface hardness:

### During the season

- Subsurface aeration using small diameter solid tynes.
- Maintain adequate moisture if and when required.

### During off -season

- Subsurface aeration using large solid tynes.
- Coring at close spacings.
- Heavy topdressing as part of aeration.
- Re-turfing any areas that have become poorly grassed and that have become hard.

## 3.5.21 Role of Renovation Practices

Renovation includes any practice that is used to improve the conditions of the playing surface and to restore the environment in which the football pitch surface is growing.

Renovation practices will depend primarily on the inherent problems of the turf area and the types of problems which develop.

The common problems that occur include:-

- Change in surface levels.
- Loss of grass cover (whether uniform or patchy), density, texture, grass species, turf composition.
- Weeds.
- Disease.
- Pests.
- Excessive build-up of thatch.
- Inadequate soil depth.
- Soil depth.
- Degree of soil compaction.
- Root growth.
- Poor growth.


*Vertidrain*

- Poor drainage.
- Root development.

The role of renovation is to assist in resolving the problems that have developed on the pitch. Some of the renovation practices employed may be similar to the maintenance practices for the football pitch in question. However, they are normally regarded as operations over and above general maintenance practices.

Renovation practices conducted on a football pitch to remedy these problems include;

- Scarifying - to remove thatch, improve water penetration, improve surface levels, provide a good seed bed for oversowing and establishment.
- Surface aeration; includes spiking, hollow tyning, coring, slicing, tracaire - to improve surface aeration and water penetration and remove thatch.
- Subsurface aeration; includes verti-drain, mini-mole plough, vibra-mole - to alleviate compaction and improve soil drainage and aeration.
- Topdressing - to restore surface levels.
- Overseeding - to maintain/improve turf density and/or improve/change turf composition.

The lack of an appropriate and timely renovation and maintenance program can be a major limitation to achieving optimal use from sportsfields. Regardless of the construction method, a site specific,

appropriately resourced renovation and maintenance program is essential for ensuring that the playing performance of a sportsfield is optimised.

The renovation and maintenance program needs to reflect:

- Type (junior vs senior play) and intensity of use.
- Climate and its impact on the grass types used and their recovery from wear (temperature and rainfall).
- Expectations and programs of user groups.
- Available budget.

The main objectives of a sportsfield renovation and maintenance program are:

- To ensure the surface is restored (or maintained) to a standard that meets the specific requirements of user groups, in particular ensuring the surface is safe to play on.
- To provide a complete cover of the desirable turf species.
- To maintain sufficient surface infiltration and drainage through the root zone.

It is essential that adequate time is allowed for renovation to be undertaken and for the recovery and for growing of any new turf to occur. However, the demands of modern sport have resulted in the period between playing seasons becoming shorter, making it more difficult for Councils to maintain quality playing surfaces through a season.

When Councils cannot guarantee enough time to undertake a renovation program, they should consider adopting a preventative management policy towards damage and amend their maintenance program accordingly.

# SECTION 4

## Guidelines to Management of Natural Turf Football Pitches

It is important to monitor the maintenance activities, frequency of maintenance operations and the intended quality of the turf surface. Scenarios are provided both high standard football pitches (National Premier League) and community level football pitches. Regardless of the standard of football pitches, the expectations of a sound and safe playing surface are the same. This information will provide a framework in which to maintain the football pitch surface.

### 4.1 Premier Standard Pitches

The premier standard football pitches are generally purpose built grounds that are fully enclosed and used for soccer and sometimes other rectangular sports such as Rugby League and Rugby Union. There is a high level of expectation on the presentation as well as safety of these sporting surfaces.

Details of specific maintenance activities, workload indicators and performance criterial for Premier Standard Pitches is presented in Table 4.

TABLE 4 Details of Specific Maintenance Activities, Workload Indicators and Performance Criteria for Premier Standard Football Pitches

| ACTIVITY | WORKLOAD INDICATOR | PERFORMANCE CRITERIA |
|---|---|---|
| **1. MOWING**<br>• The football pitch should be cut with either a walk-behind quality or ride on quality cylinder type mower and adjusted to the manufacturer's specifications. | • The football pitch should be mown at least 3 times per week (depending on the weather, growth rate of the grass, and time of year). | • Provide a good healthy and vigorous turf cover<br>• Avoid thinning out the turf |
| • The mower should be checked prior to use for any fuel or oil leaks and the cutting height checked by setting the bed knife above a hard surface.<br>• The bed knives should be checked prior to use for wear and damage. | • Each time the football pitch is mown | • Mowers are maintained in good working order and produce an even quality of cut with no scalping |
| • The football pitch should be maintained at a year round cutting height of 25 mm. | • Each time the football pitch is mown | • Provide a true playing surface with good smooth playing surface |
| • The football pitch may be cut at a lower mowing height (at 5mm less than the regular height) prior to major events including a double cut the day before the event and a single cut on the day of the event. | • Prior to any tournament or major event | • Provide a faster playing surface |
| • Collect grass clippings. | • Each time the football pitch is mown | • Playing surface is free of grass clippings |

| ACTIVITY | WORKLOAD INDICATOR | PERFORMANCE CRITERIA |
|---|---|---|
| • The mowing pattern should be varied so that the mowing pattern is multi-directional. | • Each time the football pitch is mown | • absence of grain, wear patterns and possible scalping |
| • Wash down mower after cutting football pitch to remove all grass clippings and soil. | • Each time the football pitch is mown | • Mowers are clean |
| **2. FERTILISING**<br>• Fertilise football pitch with appropriate nutrients | • Quantities and ratio of each nutrient required is based on results of soil and leaf tissue tests | • Provide a vigorous and healthy growing turf with good shoot density so that no soil can be seen between the blades of grass, good recuperative potential, and a moderate and uniform green colour |
| • Apply either chelated iron or iron sulphate at 0.1 – 0.25 kg/100m2. | • Based on soil and leaf tissue tests<br>• Prior to any tournament or major event | • Provide improved darker green colour and hence overall appearance as well as a tougher wearing turf cover |
| • Apply either chelated magnesium or magnesium sulphate | • Based on soil and leaf tissue tests<br>• Prior to any tournament or major event | • Provide improved darker green colour and hence overall appearance as well as a tougher wearing turf cover |
| • Apply phosphorus either as superphosphate or as part of the fertiliser mix | • Based on soil and leaf tissue test results<br>• As required | • Provide good healthy root growth, development and turf vigour |
| • Apply calcium in the form of gypsum or calcium ammonium nitrate | • Based on soil and leaf tissue test results<br>• As required | • Maintain calcium at the ideal amount in the soil |
| • Apply trace elements either as a trace element mix or as part of the fertiliser mix | • Based on soil and leaf tissue test results<br>• As required | • Maintain optimal levels of trace elements and avoid issues with turf growth |
| • take one (1) representative soil and one (1) representative leaf tissue sample from the football pitch and have them analysed for pH, salt, and nutrient content | • every 6 months | • To maintain the soil nutrient levels at the following levels;<br>PH (water) 6.5 – 7.0<br>Electrical conductivity (dS/m) <0.34<br>Total soluble salts (ppm) <1000<br>Phosphorus (P) – Olsen (ppm) >150<br>Extractable cations<br>Calcium/Magnesium ratio 2-5<br>Calcium (%) 65-70<br>Magnesium (%) 15-20<br>Sodium (%) <6<br>Potassium (%) 5-10<br>• To maintain the leaf tissue levels at the following levels;<br>Total Nitrogen (%) 3 – 6<br>Total Phosphorus (%) 0.2 – 0.4<br>Total Potassium (%) 2 – 5<br>Total Calcium (%) 0.2 – 0.5<br>Total Magnesium (%) 0.1 – 0.25<br>Total Sulphur (%) 0.2 – 0.4<br>Total Manganese (mg/kg) 25 – 30<br>Total Iron (mg/kg) 50 – 60<br>Total Copper (mg/kg) 6 – 7<br>Total Zinc (mg/kg) 14 – 20<br>Total Sodium (mg/kg) 0.1 – 0.2<br>Total Chloride (mg/kg) 1 - 2<br>• To eÿciently utilise all nutrients<br>• Cost e¸ ectively utilise all inputs |

| ACTIVITY | WORKLOAD INDICATOR | PERFORMANCE CRITERIA |
|---|---|---|
| **3. SOIL AMENDMENTS**<br>• apply Dolomitic or Agricultural Lime | • based on soil test results and soil pH<br>• as required | • maintain nutrients in the ideal pH range<br>• improve the availability and uptake of nutrients to the turfgrass plants |
| • apply organic matter, such as dynamic lifter | • in autumn as part of the renovation program | • improve the soil activity and moisture and nutrient retention |
| **4. ROOT STIMULANTS**<br>• apply the following mix;<br>Biogain at label rate<br>Acadian or Kelpak at label rate<br>Root growth hormone at label rate<br>Molasses at 500 mls per 100 sq.m. | • Every 4 weeks | • Stimulate root initiation and growth<br>• Improve turf health and vigour<br>• Improve soil biological activity |
| **5. ROLLING**<br>• Football pitch should be rolled in one direction<br>• Football pitch should be rolled in one direction | • once per week<br>• prior to any tournament or major event<br>• immediatly after subsurface aerating and other major cultural work and before mowing | • provides firm, smooth and truer playing surface<br>• restores surface levels and to provide a smooth, firm, true and faster playing surface |
| **6. BRUSHING**<br>• Football pitch should be brushed in one direction using a PTO driven sweeper and collector | • once per week<br>• first thing on Monday or after match | • help to dry out the grass surface and avoid trampling of the grass and surface sealing |
| **7. SUBSURFACE AERATION**<br>• subsurface aerate using the vertidrain and solid tynes as deep as possible | • on two occasions,<br>- once in spring<br>- once in autumn | • destroy the compacted soil layers and conditions that have developed and improve the depth of e, ective topsoil, subsurface drainage, and air movement into the profile |
| **8. TOPDRESSING**<br>• Football pitch should be dusted using suitable sand at the rate of 5-20 cubic metres to the football pitch<br>• Topdressing should be conducted with a topdressing machine then brushed in so that at least 90% of the grass is visible and there is no more than 2mm of sand in any one location | • Every 6-8 weeks<br>• Immediately after dethatching | • Help to dilute the thatch layer and create a much firmer surface |
| • A heavier topdressing should be conducted as part of the renovation program.<br>• The sand should be applied using a topdressing machine and then brushed in to fill the core holes and scarifier grooves so that there is at least 75% of the grass visible and no more than 5mm depth of sand in any one location | • immediately after the football pitch have been cored and scarified as part of an intensive renovation program | • Help to dilute the thatch layer and restore the surface levels |

| ACTIVITY | WORKLOAD INDICATOR | PERFORMANCE CRITERIA |
|---|---|---|
| **9. DETHATCHING**<br>• Football pitch should be dethatched using dethatching reels or a scarifier set to a depth of 6-8 mm | • every 6-8 weeks<br>• ideally before dusting | • reduce the turf density and grain<br>• produce a better playing surface<br>• help to key the sand into the soil profile |
| • dethatching can be conducted in 1 – 2 directions | • depends on the turf density at the time | |
| **10. RENOVATION**<br>• an intensive renovation program should be implemented that helps to reduce the thatch problem and improve the quality of the playing surface and firmness of the surface | • On at least one occasion in spring | • helps to reduce the thatch problem and improve the quality of the playing surface and firmness of the surface |
| • hollow core using an appropriate coring machine and jumbo (5/8" ) tynes to a depth of at least 100mm and then clean up all soil and plant material from the surface | • On at least one occasion in spring | • helps to reduce the thatch problem and improve the quality of the playing surface and firmness of the surface |
| • Scarify in two directions using a TR-50 tractor mounted or a suitable pedestrian scarifier with blades set at a 25mm spacing to a depth of up to 25mm then clean up | • On at least one occasion in spring | • helps to reduce the thatch problem and improve the quality of the playing surface and firmness of the surface |
| • apply granulated organic matter or appropriate substitute at 20 kg per 100 square metres | • while core holes are open | • improved moisture retention and root growth and vigour |
| • topdress with suitable sand using a topdressing machine and then brushed in to fill the core holes and scarifier grooves so that at least 75% of the grass is visible and there is no more than 5mm depth of sand in any one location | • On at least one occasion in spring | • Introduce a more suitable sand into the profile |
| • lightly dust the football pitch as per usual | • 2 weeks after any renovation | • smooth, firm and even playing surface |
| **11. OVERSOWING**<br>• oversow with a suitable turf type ryegrass | • immediately after spring renovation | • maintain a 100% turf sward |
| **12. TURF REPAIR**<br>• repair any weak or bare area on the playing surface with turf sod taken from the nursery | • immediately that a weak or bare area appears | • maintain a 100% turf sward |

| ACTIVITY | WORKLOAD INDICATOR | PERFORMANCE CRITERIA |
|---|---|---|
| **13. WETTING AGENT**<br>• apply wetting according to label rate and recommendation | | |
| • apply wetting agent such as Primer to treat the soil before it becomes hydrophobic | • on two occasions in late August – mid September<br>• 2-4 weeks apart<br>• immediately after vertidraining | • treat the soil to reduce the chances of hydrophobic conditions and improve moisture infiltration |
| • apply wetting agent such as Infiltrix | • 4 week intervals during spring to autumn<br>• immediately after vertidraining | • reduce dry patch, improve water infiltration |
| • wetting agents should be applied separately to other products | | • avoid the potential burning of the turf |
| **14. WEED CONTROL**<br>**a. Broadleaf weeds**<br>• spray broadleaf weeds with a selective herbicide containing one or a combination of the following active constituents for use in turf; MCPA, Dicamba, Mecopropamine and Bromoxynil, using a boom spray applicator | • based on the presence of the weeds<br>• timing should be autumn or spring | • absence of broadleaf weeds such as hydrocotyle, capeweed, jo-jo, flatweeds |
| **b. Poa control and eradication**<br>• Dethatch football pitch then apply a mix of Poacheck (Endothal) at 15 mls per 100 sq.m. and wetting agent at 15 mls per 100 sq.m. | • two applications in autumn at 5-7 days intervals and a fortnight before the major renovation | • absence of Poa annua and maintain a 100% turf sward in the playing surface |
| **c. General Chemical use**<br>• all nozzles should be checked and cleaned, and the tank, hoses and booms thoroughly flushed with clean water.<br>• The sprayer unit should be calibrated using water on a hard stand area to ensure that the application rate is accurate and the coverage pattern is even.<br>• The herbicide should be applied according to the label recommendations.<br>• The spray tank should be half filled with water, the measured amount of chemical added and then the remaining water added.<br>• The herbicide should be thoroughly mixed using the tanks built in agitator | • Before any herbicide application | • Improved operator safety<br>• Improved public safety |

| ACTIVITY | WORKLOAD INDICATOR | PERFORMANCE CRITERIA |
|---|---|---|
| **14. WEED CONTROL**<br>**c. General Chemical use (continued)**<br>• The operator should have a chemical user's certificate and wear the appropriate protective clothing including rubber boots, rubber gloves, coveralls, protective headwear and respirator.<br>• This clothing should be worn during the filling up of the tank and at application | • Before any herbicide application | • Improved operator safety<br>• Improved public safety |
| **15. DISEASE CONTROL**<br>• spray football pitch for turf diseases using the appropriate fungicide on a curative or preventative basis<br>• disease should be correctly identified for appropriate chemical control measures | • as required when the disease first becomes apparent | • absence of diseases such as Dollar Spot, Winter Fusarium, Rhizoctonia, Pythium, Drechslera, Fairy Ring Disease & Yellow turf. |
| • all nozzles should be checked and cleaned, and the tank, hoses and booms thoroughly flushed with clean water.<br>• The sprayer unit should be calibrated using water on a hard stand area to ensure that the application rate is accurate and the coverage pattern is even.<br>• The fungicide should be applied according to the label recommendations.<br>• The spray tank should be half filled with water, the measured amount of chemical added and then the remaining water added.<br>• The fungicide should be thoroughly mixed using the tanks built in agitator<br>• The operator should have a chemical user's certificate and wear the appropriate protective clothing including rubber boots, rubber gloves, coveralls, protective headwear and respirator.<br>• This clothing should be worn during the filling up of the tank and at application | • Before any fungicide application | • Improved operator safety<br>• Improved public safety |

| ACTIVITY | WORKLOAD INDICATOR | PERFORMANCE CRITERIA |
|---|---|---|
| **17. NEMATODE CONTROL**<br>• take a representative series of plugs from the football pitch to determine nematode levels and take appropriate control measures if necessary | • conduct in September<br>• treat for nematodes once a problem is detected | • absence of a nematode problem |
| • all nozzles should be checked and cleaned, and the tank, hoses and booms thoroughly flushed with clean water.<br>• The sprayer unit should be calibrated using water on a hard stand area to ensure that the application rate is accurate and the coverage pattern is even.<br>• The insecticide should be applied according to the label recommendations.<br>• The spray tank should be half filled with water, the measured amount of chemical added and then the remaining water added.<br>• The insecticide should be thoroughly mixed using the tanks built in agitator<br>• The operator should have a chemical user's certificate and wear the appropriate protective clothing including rubber boots, rubber gloves, coveralls, protective headwear and respirator.<br>• This clothing should be worn during the filling up of the tank and at application | • Before any insecticide application | • Improved operator safety<br>• Improved public safety |
| **18. DRY PATCH CONTROL**<br>• aerate the a¸ ected areas using a vertidrain and needle tynes then apply wetting agent in plenty of water | • as required | • reduce dry patch, improved water penetration |

## 4.2 Community Level Football Pitches

This refers to community level and managed football pitches that could be dedicated and enclosed but are often part of a multipurpos sporting area.

Details of the specific maintenance activities, workload indicators and performance criterial for community standard football pitches is presented in Table 5.

TABLE 5 Details of Specific Maintenance Activities, Workload Indicators and Performance Criteria for Community Level Football Pitches

| ACTIVITY | WORKLOAD INDICATOR | PERFORMANCE CRITERIA |
|---|---|---|
| **1. MOWING**<br>• The football pitch should be cut with either a walk-behind quality or ride on quality cylinder type mower and adjusted to the manufacturer's specifications. | • The football pitch should be mown at least 3 times per week (depending on the weather, growth rate of the grass, and time of year). | • Provide a good healthy and vigorous turf cover<br>• Avoid thinning out the turf |
| • The mower should be checked prior to use for any fuel or oil leaks and the cutting height checked by setting the bed knife above a hard surface.<br>• The bed knives should be checked prior to use for wear and damage. | • Each time the football pitch is mown | • Mowers are maintained in good working order and produce an even quality of cut with no scalping |
| • The football pitch should be maintained at a year round cutting height of 25 mm. | • Each time the football pitch is mown | • Provide a true playing surface with good smooth playing surface |
| • The football pitch may be cut at a lower mowing height (at 5mm less than the regular height) prior to major events including a double cut the day before the event and a single cut on the day of the event. | • Prior to any tournament or major event | • Provide a faster playing surface |
| • Collect grass clippings. | • Each time the football pitch is mown | • Playing surface is free of grass clippings |
| • The mowing pattern should be varied so that the mowing pattern is multi-directional. | • Each time the football pitch is mown | • absence of grain, wear patterns and possible scalping |
| • Wash down mower after cutting football pitch to remove all grass clippings and soil. | • Each time the football pitch is mown | • Mowers are clean |
| **2. FERTILISING**<br>• Fertilise football pitch with appropriate nutrients | • Quantities and ratio of each nutrient required is based on results of soil and leaf tissue tests | • Provide a vigorous and healthy growing turf with good shoot density so that no soil can be seen between the blades of grass, good recuperative potential, and a moderate and uniform green colour |

| ACTIVITY | WORKLOAD INDICATOR | PERFORMANCE CRITERIA |
|---|---|---|
| **2. FERTILISING (continued)**<br>• Apply either chelated iron or iron sulphate at 0.1 – 0.25 kg/100m2. | • Based on soil and leaf tissue tests<br>• Prior to any tournament or major event | • Provide improved darker green colour and hence overall appearance as well as a tougher wearing turf cover |
| • Apply either chelated magnesium or magnesium sulphate | • Based on soil and leaf tissue tests<br>• Prior to any tournament or major event | • Provide improved darker green colour and hence overall appearance as well as a tougher wearing turf cover |
| • Apply phosphorus either as superphosphate or as part of the fertiliser mix | • Based on soil and leaf tissue test results<br>• As required | • Provide good healthy root growth, development and turf vigour |
| • Apply calcium in the form of gypsum or calcium ammonium nitrate | • Based on soil and leaf tissue test results<br>• As required | • Maintain calcium at the ideal amount in the soil |
| • Apply trace elements either as a trace element mix or as part of the fertiliser mix | • Based on soil and leaf tissue test results<br>• As required | • Maintain optimal levels of trace elements and avoid issues with turf growth |
| • take one (1) representative soil and one (1) representative leaf tissue sample from the football pitch and have them analysed for pH, salt, and nutrient content | • every 6 months | • To maintain the soil nutrient levels at the following levels;<br>PH (water) 6.5 – 7.0<br>Electrical conductivity (dS/m) <0.34<br>Total soluble salts (ppm) <1000<br>Phosphorus (P) – Olsen (ppm) >150<br>Extractable cations<br>Calcium/Magnesium ratio 2-5<br>Calcium (%) 65-70<br>Magnesium (%) 15-20<br>Sodium (%) <6<br>Potassium (%) 5-10<br>• To maintain the leaf tissue levels at the following levels;<br>Total Nitrogen (%) 3 – 6<br>Total Phosphorus (%) 0.2 – 0.4<br>Total Potassium (%) 2 – 5<br>Total Calcium (%) 0.2 – 0.5<br>Total Magnesium (%) 0.1 – 0.25<br>Total Sulphur (%) 0.2 – 0.4<br>Total Manganese (mg/kg) 25 – 30<br>Total Iron (mg/kg) 50 – 60<br>Total Copper (mg/kg) 6 – 7<br>Total Zinc (mg/kg) 14 – 20<br>Total Sodium (mg/kg) 0.1 – 0.2<br>Total Chloride (mg/kg) 1 - 2<br>• To eÿciently utilise all nutrients<br>• Cost e¸ ectively utilise all inputs |
| **3. SOIL AMENDMENTS**<br>• apply Dolomitic or Agricultural Lime | • based on soil test results and soil pH<br>• as required | • maintain nutrients in the ideal pH range<br>• improve the availability and uptake of nutrients to the turfgrass plants |
| • apply organic matter, such as dynamic lifter. | • based on soil test results as required | • improve the soil activity and moisture and nutrient retention |

| ACTIVITY | WORKLOAD INDICATOR | PERFORMANCE CRITERIA |
|---|---|---|
| **4. ROLLING**<br>• Football pitch should be rolled in one direction | • As required | • provides firm, smooth and truer playing surface |
| • Football pitch should be rolled in one direction | • prior to any tournament or major event<br>• Immediately after subsurface aerating and other major cultural work and before mowing | • restores surface levels and to provide a smooth, firm, true and faster playing surface |
| **5. BRUSHING**<br>• Football pitch should be brushed in one direction using a PTO driven sweeper and collector | • As required | • help to dry out the grass surface and avoid trampling of the grass and surface sealing |
| **6. VERTIDRAINING**<br>• subsurface aerate using the vertidrain and solid tynes as deep as possible | • on one occasion in spring | • destroy the compacted soil layers and conditions that have developed and improve the depth of e, ective topsoil, subsurface drainage, and air movement into the profile |
| **7. TOPDRESSING**<br>• Football pitch should be dusted using suitable sand at the rate of 5-20 cubic metres to the football pitch<br>• Topdressing should be conducted with a topdressing machine then brushed in so that at least 90% of the grass is visible and there is no more than 2mm of sand in any one location | • As required<br>• Immediately after dethatching | • Help to dilute the thatch layer and create a much firmer surface |
| • A heavier topdressing should be conducted as part of the renovation program.<br>• The sand should be applied using a topdressing machine and then brushed in to fill the core holes and scarifier grooves so that there is at least 75% of the grass visible and no more than 5mm depth of sand in any one location | • Immediately after the football pitch have been cored and scarified as part of an intensive renovation program | • Help to dilute the thatch layer and restore the surface levels |
| **8. DETHATCHING**<br>• Football pitch should be dethatched using dethatching reels or a scarifier set to a depth of 6-8 mm | • As required | • reduce the turf density and grain<br>• produce a better playing surface<br>• help to key the sand into the soil profile |
| • dethatching can be conducted in 1 – 2 directions | • depends on the turf density at the time | |

| ACTIVITY | WORKLOAD INDICATOR | PERFORMANCE CRITERIA |
|---|---|---|
| **9. RENOVATION**<br>• an intensive renovation program should be implemented that helps to reduce the thatch problem and improve the quality of the playing surface and firmness of the surface | • On at least one occasion in spring | • helps to reduce the thatch problem and improve the quality of the playing surface and firmness of the surface |
| • hollow core using an appropriate coring machine and jumbo (5/8" ) tynes to a depth of at least 100mm and then clean up all soil and plant material from the surface | • On at least one occasion in spring | • helps to reduce the thatch problem and improve the quality of the playing surface and firmness of the surface |
| • Scarify in two directions using a TR-50 tractor mounted or a suitable pedestrian scarifier with blades set at a 25mm spacing to a depth of up to 25mm then clean up | • On at least one occasion in spring | • helps to reduce the thatch problem and improve the quality of the playing surface and firmness of the surface |
| • apply granulated organic matter or appropriate substitute at 20 kg per 100 square metres | • while core holes are open | • improved moisture retention and root growth and vigour |
| • topdress with suitable sand using a topdressing machine and then brushed in to fill the core holes and scarifier grooves so that at least 75% of the grass is visible and there is no more than 5mm depth of sand in any one location | • On at least one occasion in spring | • Introduce a more suitable sand into the profile |
| • lightly dust the football pitch as per usual | • 2 weeks after each renovation | • smooth, firm and even playing surface |
| **10. OVERSOWING**<br>• oversow with a suitable turf type ryegrass | • As required immediately after spring renovation | • maintain a 100% turf sward |
| **11. TURF REPAIR**<br>• repair any weak or bare area on the playing surface with turf sod taken from the nursery | • immediately that a weak or bare area appears | • maintain a 100% turf sward |
| **12. WETTING AGENT**<br>• apply wetting according to label rate and recommendation | | |
| • apply wetting agent such as Primer to treat the soil before it becomes hydrophobic | • As required | • treat the soil to reduce the chances of hydrophobic conditions and improve moisture infiltration |

| ACTIVITY | WORKLOAD INDICATOR | PERFORMANCE CRITERIA |
|---|---|---|
| **12. WETTING AGENT (continued)**<br>• apply wetting agent such as Infiltrix | | • reduce dry patch, improve water infiltration |
| • wetting agents should be applied separately to other products | | • avoid the potential burning of the turf |
| **13. WEED CONTROL**<br>**a. Broadleaf weeds**<br>• spray broadleaf weeds with a selective herbicide containing one or a combination of the following active constituents for use in turf; MCPA, Dicamba, Mecopropamine and Bromoxynil, using a boom spray applicator | • based on the presence of the weeds<br>• timing should be autumn or spring | • absence of broadleaf weeds such as hydrocotyle, capeweed, jo-jo, flatweeds |
| **b. Poa control and eradication**<br>• Dethatch football pitch then apply a mix of Poacheck (Endothal) at 15 mls per 100 sq.m. and wetting agent at 15 mls per 100 sq.m. | • two applications in autumn at 5-7 days intervals and a fortnight before the major renovation | • absence of Poa annua and maintain a 100% turf sward in the playing surface |
| **c. General Chemical use**<br>• all nozzles should be checked and cleaned, and the tank, hoses and booms thoroughly flushed with clean water.<br>• The sprayer unit should be calibrated using water on a hard stand area to ensure that the application rate is accurate and the coverage pattern is even.<br>• The herbicide should be applied according to the label recommendations.<br>• The spray tank should be half filled with water, the measured amount of chemical added and then the remaining water added.<br>• The herbicide should be thoroughly mixed using the tanks built in agitator<br>• The operator should have a chemical user's certificate and wear the appropriate protective clothing including rubber boots, rubber gloves, coveralls, protective headwear and respirator.<br>• This clothing should be worn during the filling up of the tank and at application | • Before any herbicide application | • Improved operator safety<br>• Improved public safety |

| ACTIVITY | WORKLOAD INDICATOR | PERFORMANCE CRITERIA |
|---|---|---|
| **14. DISEASE CONTROL**<br>• spray football pitch for turf diseases using the appropriate fungicide on a curative or preventative basis<br>• disease should be correctly identified for appropriate chemical control measures | • as required when the disease first becomes apparent | • absence of diseases such as Dollar Spot, Winter Fusarium, Rhizoctonia, Pythium, Drechslera, Fairy Ring Disease & Yellow Turf |
| • all nozzles should be checked and cleaned, and the tank, hoses and booms thoroughly flushed with clean water.<br>• The sprayer unit should be calibrated using water on a hard stand area to ensure that the application rate is accurate and the coverage pattern is even.<br>• The fungicide should be applied according to the label recommendations.<br>• The spray tank should be half filled with water, the measured amount of chemical added and then the remaining water added.<br>• The fungicide should be thoroughly mixed using the tanks built in agitator<br>• The operator should have a chemical user's certificate and wear the appropriate protective clothing including rubber boots, rubber gloves, coveralls, protective headwear and respirator.<br>• This clothing should be worn during the filling up of the tank and at application | • Before any fungicide application | • Improved operator safety<br>• Improved public safety |
| **15. INSECT CONTROL**<br>• spray football pitch using an insecticide containing Merit, chlorpyrifos or an appropriate substitute to control underground cockchafer and similar grubs | • As required<br>• check grass on a regular basis all year round<br>• spray immediately these pests are detected | • absence of grubs |
| • all nozzles should be checked and cleaned, and the tank, hoses and booms thoroughly flushed with clean water.<br>• The sprayer unit should be calibrated using water on a hard stand area to ensure that the application rate is accurate and the coverage pattern is even. | • Before any insecticide application | • Improved operator safety<br>• Improved public safety |

| ACTIVITY | WORKLOAD INDICATOR | PERFORMANCE CRITERIA |
|---|---|---|
| **15. INSECT CONTROL (continued)**<br>• The insecticide should be applied according to the label recommendations.<br>• The spray tank should be half filled with water, the measured amount of chemical added and then the remaining water added.<br>• The insecticide should be thoroughly mixed using the tanks built in agitator<br>• The operator should have a chemical user's certificate and wear the appropriate protective clothing including rubber boots, rubber gloves, coveralls, protective headwear and respirator.<br>• This clothing should be worn during the filling up of the tank and at application | • Before any insecticide application | • Improved operator safety<br>• Improved public safety |
| **16. NEMATODE CONTROL**<br>• take a representative series of plugs from the football pitch to determine nematode levels and take appropriate control measures if necessary | • conduct in September<br>• treat for nematodes once a problem is detected | • absence of a nematode problem |
| • all nozzles should be checked and cleaned, and the tank, hoses and booms thoroughly flushed with clean water.<br>• The sprayer unit should be calibrated using water on a hard stand area to ensure that the application rate is accurate and the coverage pattern is even.<br>• The insecticide should be applied according to the label recommendations.<br>• The spray tank should be half filled with water, the measured amount of chemical added and then the remaining water added.<br>• The insecticide should be thoroughly mixed using the tanks built in agitator<br>• The operator should have a chemical user's certificate and wear the appropriate protective clothing including rubber boots, rubber gloves, coveralls, protective headwear and respirator.<br>• This clothing should be worn during the filling up of the tank and at application | • Before any insecticide application | • Improved operator safety<br>• Improved public safety |

| ACTIVITY | WORKLOAD INDICATOR | PERFORMANCE CRITERIA |
|---|---|---|
| **17. DRY PATCH CONTROL**<br>• aerate the a˜ ected areas using a vertidrain and needle tynes then apply wetting agent in plenty of water | • as required | • reduce dry patch, improved water penetration |

# SECTION 5

## Further Advancements in Football Pitch Surfaces

In recent times there has been more interest in technological advancements that will help to reduce the wear, damage and ultimately the cost of upkeep for a natural turf football pitch.

Advancements include:

- Construction of synthetic sporting surfaces.
- Integration of reinforced turf systems.

### 5.1 Synthetic Turf

Natural turf is the preferred surface for Football in Australia and elite level games are generally played on natural grass.

Synthetic grass technology has advanced considerably in the last decade to the point where synthetic turf football pitches and other sporting surfaces have been constructed. In communities where the demand for sportsfields is great, many ground managers have found that the installation of a synthetic turf field helps to manage traffic on natural turf sports facility.

At the community level the majority of games are currently played on natural grass. Competitions that are affiliated with state or football competition at any level may be played on synthetic turf but they must be to FIFA 1 Star standard. Competitions that are not affiliated with state can be played on any surface.

A-league matches are yet to be played on synthetic turf pitches.

*Synthetic sporting surface*

*Close up of synthetic grass*

The key benefits of a synthetic football pitch surface are:

- Climate; under drought and water restrictions or excessive rain conditions, it can be difficult to maintain a safe and suitable natural grass surface. Synthetic sports surfaces in general are not affected by reduced or increased rainfall.
- Usage; there is a limit to the hours that natural turf can be used before there is a significant impact on the surface condition. A high quality natural turf surface may only withstand use for up to 20 hours per week before it starts to deteriorate. Synthetic turf surfaces can sustain significantly higher use than natural grass with 60 hours plus per week as an acceptable expectation.
- Maintenance; maintaining a natural turf surface can be time consuming, expensive and generally requires a qualified person to do it. Synthetic surfaces require lower on-going maintenance than natural turf surfaces.
- Consistency and Quality of Play; synthetic surfaces provide a consistent and safe surface all year round for all sports to play on, improving the quality of performance for each sport compared with natural turf playing surfaces.

*Synthetic sporting surface*

*Close up of synthetic grass*

Synthetic fields are durable over a wide range of weather conditions and better withstand intense, prolonged use scheduling over a short time span.

Natural turf fields can be protected by scheduling sporting events that require frequent day and high (lighted fields) play onto a synthetic field. This type of field rotation is especially helpful during early spring and late autumn when natural turf fields have low vigour during cold weather.

Synthetic turf fields have high installation costs and require routine maintenance during their life span.

Longer term budgeting needs to include costs of removal, disposal, and surface replacement of worn out synthetic surfaces.

## 5.2 Reinforced and Hybrid Turf Systems

The turf industry is continually searching for ways of increasing the carrying capacity and usage levels that a natural turf surface can accommodate. One innovation that has been used to increase the stability and potential usage capacity of football pitch surfaces is the inclusion of synthetic materials within the rootzone.

Most of the technology has concentrated on the use of synthetic mesh elements and filaments that are incorporated with the sand rootzone layer to improve the stability of the surface. This is especially important to provide much needed stability in situations where the turf cover is worn or in severe cases is lost. This type of synthetic stabilised system is classified as a reinforced system. In Australia the majority of stabilised turf systems used commercially were reinforced root zone system.

In recent times, hybrid systems have also been developed. This is a form of synthetic stabilised system that provides support to both the root zone as well as the upper part of the turf surface. The main difference between the reinforced and hybrid systems is that synthetic fibre of fabric protrudes above the rootzone layer and within the grass surface. The benefit of the hybrid system is that the inclusion of the synthetic fibres and fabric material in the turf horizon will provide support to the turf grass by taking some of the forces from traffic on the surface. This will reduce the load and extent of abrasion and wear that normally occurs to an un-reinforced turf surface.

### 5.2.1 Maintenance Considerations

Reinforced and hybrid pitches have specific additional maintenance requirements which, if not met could result in rapid decline in both agronomic and playing characteristics of the surface.

The success of a reinforced or hybrid turf system will hinge on how the surface is managed going forward.

If fibres end up being buried beyond a certain point they will not benefit surface traction nor overall turf performance. There is also little doubt that maintenance of the turf needs to change dramatically if using a hybrid.

Maintenance of the hybrid system will need to consider what methods of aeration can be used without excessive damage to the synthetic component. The maintenance program will need to identify practical ways to limit and/or remove the build-up of organic matter or any top-dressed materials.

The management of organic matter is pivotal to the long-term success of any hybrid system. New machinery is likely to be needed to renovate the surface without damaging the synthetic component.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