Sport NZ Guidance Document for Sport Field Surfaces

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Acknowledgements:

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Executive Summary

The key findings from this research showed that the majority of the sports field providers are not looking to provide new sports fields, but more so need guidance on how to ensure their existing sports fields can cope with the expected level of service requirements.

Generally, it is a representative from the local club, school or local authority that gets tasked with making the sports field surface decision. For this one person there are many questions they need to address before recommending a substantial capital and on-going operational expenditure commitment. Sheppard, (2008) discusses in his research when making the sports field surface decision, the importance of assessing sports field demand, levels of proposed use, maintenance and management in order to balance risk against demand. These key elements to making a successful sports field surface decision need to be balanced against findings from our research, workshop and case studies which identified the following main issues for sports field decision makers:

- Limited budgets have meant that shortcuts have been taken when designing sports fields. For example a lack of appropriate drainage or no drainage at all has meant many fields do not drain efficiently and are often closed over winter;
- Limited budgets have meant that shortcuts have been taken when constructing sports fields, which in some cases has led to engaging of an inexperienced contractor leading to poor field construction;
- Lack of maintenance knowledge, and or low maintenance standards have led to deterioration of the fields, leading to a decrease in the lifespan of the field and a decrease in the hours available for community use (if at all);
- Overuse of sports fields has led to poor quality training and competition conditions;
- Inability to find appropriate information to make informed decisions has meant poor choices have been made.

For these reasons, this guidance document has concentrated on four key areas:

1. **Needs Analysis:** A needs analysis to be undertaken to clearly understand who is using the fields, and what they are using the sports fields for. A key factor recognised in the needs analysis is identifying the current level of use and projecting future levels of use. For this reason we have suggested tools, such as the supply and demand approach developed by Longdill (2008). Further factors to consider are the environmental, geographical, and national and regional demographics.

2. **Sports Field Options:** This section discusses the attributes of the three following sports field surface options (with references to other guidance documents that will assist with the decision making process):
   - soil based field with natural grass:
   - sand based field with natural grass;
   - artificial turf.

Other factors that are essential to successful sports field performance are also discussed, this includes; design and ongoing maintenance.
3 **Cost Analysis:** This section considers general figures for construction, maintenance, renewal and cost per hour for sports field surfaces. However, for detailed whole of life costs it is recommended the decision maker should collect costs relevant to the sports field location to ensure a full understanding of the financial commitment required.

4 **Where to Find Advice:** When tasked with making the sports field decision, ensure that reference is made to the organisations and consultants that are discussed in this section to ensure the correct sports field is designed and constructed.

This section provides details on where to get further advice. There are three organisations named in this guidance document which are:

- **Sport New Zealand (Sport NZ)** which will hold additional reference documents that have been named in this guidance document
- **Sports Turf Association of New Zealand (STANZ)** which will list sports field consultants and suppliers on their website. This is to assist with finding local contacts
- **New Zealand Recreation Association (NZRA)** provides a guidance role within the parks and recreation industry through conferences and seminars during the year to assist professionals within the industry.

As stated in the Sport England Guidance Notes for Natural Turf (2011), “good design needs to be based on a sound understanding of the current trends and practices within individual sports, developments in the sport and leisure industry and lessons learnt from the previously built schemes”. In summary, a considered approach that encompasses the key factors discussed throughout this guidance document, a realistic and achievable sports field outcome can be achieved that meets the needs of the local community.

Main Issues facing sports field development:
1. Limited budgets leading to inadequate design
2. Limited budgets leading to inadequate construction
3. Limited or no maintenance leading to poor sports field performance and limited lifespan
4. Over use of the field limited to poor sports field performance and limited lifespan
5. Inability to find appropriate information leading to poor choices
1 Introduction

The turf industry continues to take significant leaps forward with both natural grass and artificial surface technology. This leaves the consumer with many choices but little guidance is provided on how to identify the best way forward.

1.1 Background

As the number of sports field surface options available increase, so too has the level of service expectations from users. No longer is the New Zealand sporting community prepared to put up with sports fields that are closed for weeks in a row or ankle deep mud during their weekend sports matches - instead they are asking for a sports field surface that can be played upon in any weather and a playing surface that lends itself to a quality experience. Local Government Authorities and schools are responding to the requests for better quality sports fields, however, limited research is available to these governing bodies to assist them. This guidance document has been produced to assist the decision making process of what sports field would be most suitable to address the current issues facing the sporting community may be facing. To aid in the decision making process the following case studies have been used to explain the range of current choices available to the New Zealand community. The following case studies have taken into account demographics, geographic locations, type of ownership, budget and natural grass and artificial fields:

Case Study One: Stella Maris Catholic Primary School, Silverdale. Natural grass / soil based sports field

Case Study Two: Trafalgar Park Nelson. Natural grass / glass sand based sports field

Case Study Three: Bruce Pulman Park, Takanini. Natural grass / sand based sports field

Case Study Four: Westlake Girls High School, Takapuna. Artificial sports field.

Case Study Five: College Rifles, Remuera. Artificial sports field.

A workshop which involved a range of people involved in the sports field industry was held to establish key factors facing the sports field decision process. Case studies and the approach detailed in this document are based on the factors identified in the workshop.

1.2 Who is this Guidance Document for?

This guidance document has been established to assist a wide range of providers that make decisions about sports field investment. The providers may include; local authorities, schools, sports clubs and consultants. Since beginning this document the author has been approached by several schools that are currently assessing their sports field requirements.

This document is not intended to provide technical specifications or detailed methodology of how to design and construct a sports field. Some of these technical guidance documents have been listed in the bibliography and will be located on the Sport NZ website.

1.3 Additional Research

The limited scope for this guidance document has meant there are areas that could be examined in further detail. It would be recommended to undertake additional research in the following areas:

1 Including case studies from locations around New Zealand would increase the representation of differing environment, geographical and demographic factors.

2 Including a New Zealand sport field surface evaluation model would assist in an accurate estimate of whole of life costs.

3 Developing technical guidance documents that specifically relate to design, construction and maintenance of sports fields within New Zealand.
1.4 The Sports Field Decision Making Process Diagram

During the course of this research it has become apparent that the factors contributing to the sports field decision making process can be classified within the four sections shown in the diagram on this page. These factors will be discussed in further detail throughout the guidance document.

The Sports Field Decision Making Process Diagram

**Needs Analysis**

- Establish what you have, and what you need
  - **Sports Field Demand** - Clearly identify the current levels of use and look to project future use
  - **Environmental and Geographic Factors**: Understand the surrounding conditions which will have ongoing issues for field maintenance and performance
  - **Sporting Trends**: Identify both national and regional sporting trends and demographics to assist with the sports field demand outcomes

**Sports Field Options**

- Understand your level of service expectations
  - **Soil based field with natural grass**
  - **Sand based field with natural grass**
  - **Artificial sports field**
  - **Factors to be considered for sports field provision**: Undertake careful planning to allow for maximum use, appropriate maintenance to be undertaken and downtime for the field to regenerate (if natural grass)
  - **Advice**: Visit all types of sports fields surfaces and talk to the organisation about their key wins and lessons learnt

**Cost Analysis**

- Understand your budgetary constraints
  - **Construction**: Budget for appropriate design and construction
  - **Maintenance**: Budget for a high level of regular and consistent maintenance, as this is crucial to its performance and lifespan.
  - **Replacement**: Allow for replacement of the chosen surface, and if choosing an artificial turf allow for land fill costs
  - **Lifespan**: Dependant on the quality of the design, construction and maintenance, fields can have quite differing lifespans
  - **Cost per Hour of Use**: As some surfaces can be used for a longer period of time than others, estimate the cost per hour of use for all three surfaces (soil, sand and artificial).

**Where to find advice**

- **Sport New Zealand**: Sport NZ is the government organisation responsible for sport and recreation in New Zealand
- **Sports Turf Association New Zealand (STANZ)**: STANZ provides a guidance role within the turf industry
- **New Zealand Recreation Association (NZRA)**: NZRA provides a guidance role within the parks and recreation industry
- **Consultants**: Choose a recommended consultant that will provide technical assistance with the sports field design, construction and maintenance
- **Procurement**: Ensure the brief and specifications clearly describe the work to be undertaken, and the level of service expectations.
2 Needs Analysis

Undertaking a needs analysis will identify the current allocation of sports fields, the desired level of service to be provided in the community and the resources needed to achieve this level of service.

A needs analysis is used to clearly understand who is using the fields, what are they using the sports fields for and what future trends may affect that use. The following key factors are discussed in a needs analysis:

1. **Sports Field Demand**: The supply and demand approach developed by Longdill (2008) can assist with identifying the current level of use and projecting future levels of use;

2. **Environmental and Geographical Factors**: Understand surrounding conditions which will have ongoing issues for field maintenance and performance;

3. **Sporting Trends**: Identify both national and regional sporting trends and local demographics to assist with the projected sports field demands.

Assessing the key factors listed above will provide the facts and figures to assist in determining what type of sports field is the right choice and this process will also identify any issues that will need to be considered during the design phase.

### 2.1 Sports Field Demand

When deciding which sports field surface will be suitable, it is important to develop a comprehensive understanding of the activities being played on the sports field. It is recommended that a needs analysis is undertaken which discusses factors such as; what type of sports will be played, what age groups will be using the field and what hours are used for training or competition?

Longdill and Associates have developed a sports field strategy (Longdill, 2008), and have used this sports field strategy to assist them when undertaking many sports field demand studies for local authorities around New Zealand. Within their sports field strategy the Longdill peak demand model is presented, which uses a staged approach to identify and quantify capacity shortfall areas in the following areas:

1. Identification of all teams;
2. Determining current field demand;
3. Identification of all fields;
4. Determining current field capacity;
5. Identification of current surpluses and shortfall (hours of use per week);
6. Identification of future surpluses and shortfalls (hours of use per week).

While the process above focuses on the development of new fields the ideas behind it can be applied to sports field surface choices. For example by using this method, Auckland Council was able to identify a severe shortage of field space available for training, and propose upgrades and development of new fields to cope with user demand.

Spend time to determine what type of sports will be played, what age groups will be using the field and what hours will be used for training or competition?
### 2.2 Environmental and Geographical Factors

For many the decision regarding what type of sports field proposed will be guided by environmental and geographical factors. It is important to understand these impacts as it will help to identify feasible solutions. The table below discusses the impacts of these factors for each sports field surface:

<table>
<thead>
<tr>
<th>Field Type</th>
<th>Soil</th>
<th>Sand</th>
<th>Artificial</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Climate</strong></td>
<td>Fields will not perform in extreme climatic conditions, including drought, coldness, wind and high rain periods. Good drainage design will alleviate some flooding issues. Choice of grass type will provide a more durable option.</td>
<td>Fields may perform poorly in extreme climatic conditions including drought, coldness, wind and high rain periods. Good drainage design will alleviate some flooding issues. Choice of grass type will provide a more durable option.</td>
<td>Fields can withstand extreme climatic conditions including drought, coldness, wind and high rain periods. Good drainage design will alleviate flooding issues.</td>
</tr>
<tr>
<td><strong>Heat Factors and Player Health</strong></td>
<td>No Issues</td>
<td>No Issues</td>
<td>Surface retains heat which can lead to heat stress related conditions (this is more of an issue in countries with warmer climates).</td>
</tr>
<tr>
<td><strong>Water Availability</strong></td>
<td>Some breeds of natural grass need less irrigation. The composition of natural sports field surfaces will be affected if they dry out. Provide for water storage on site.</td>
<td>Some breeds of natural grass need less irrigation. The composition of natural sports field surfaces will be affected if they dry out. Provide for water storage on site.</td>
<td>Some hockey artificial turfs use less water than others. Provide for water storage on site.</td>
</tr>
<tr>
<td><strong>Sheltered locations</strong></td>
<td>Can be advantageous for shade. May stop the field from draining properly.</td>
<td>Can be advantageous for shade. May stop the field from draining properly.</td>
<td>Overhanging trees can cause increased maintenance costs because of the need to remove leaf litter and other plant matter.</td>
</tr>
<tr>
<td><strong>Landfill sites</strong></td>
<td>Landfill sites often have gas emission, subsidence and drainage issues that require careful management.</td>
<td>Landfill sites often have gas emission, subsidence and drainage issues that require careful management.</td>
<td>Given the higher capital costs of developing artificial sport fields the siting on landfill sites should be considered very carefully.</td>
</tr>
</tbody>
</table>

Gain a comprehensive understanding of the site through undertaking a:
- Site Survey
- Geotechnical investigation
The sports field design will then reflect any geographical issues.
2.3 Sporting Trends

A detailed understanding of the demographics of the community including sport development growth and population (nationally and regionally) will provide a robust platform for assessing the sporting trends. As part of the analysis of sporting trends, particular attention should be paid to sport development growth factors. This can be completed by analysing relevant research that is available through sports organisations, local authorities and sports field suppliers and consultants, the key organisations that could assist with sport development growth research are listed in the section below.

2.3.1 Sport New Zealand (Sport NZ)

Recently Sport NZ has carried out national facility strategies for the eight targeted sports in NZ including sports fields users; football, hockey and rugby. In regards to future planning for sports fields these strategies give an overview of the general trends of sport development growth and issues facing their respective sport. This has included; the New Zealand Football Facilities Strategy 2010 to 2021 discusses the challenges facing football which include; poor field quality contributing to reduction in player and game quality and difficulty in meeting current and future demand. This report suggests that the regions that will require additional fields (based on NZSTI field capacity estimations) and are shows that Auckland and Wellington will need to establish new fields, however for the smaller regions in New Zealand the main concern will be to deliver quality sports fields that can cope with intense usage. Hockey New Zealand observed in their facility strategy “a low population growth outlook of 0.8% per annum, combined with a trend towards an older population and increasing competition from both formal and informal leisure activity provides a challenging backdrop for any established sport to achieve strong participation levels” (Parkinson, 2010).

In September 2012, Sport NZ released results from the Young People’s Survey. These initial results provided key insights into the way young New Zealanders take part in sport and recreation activities (Sport New Zealand, 2012). One of the key findings concluded that our well-established sports and team sports are still central to young New Zealanders’ sporting lives. The survey found that sports like football, netball and rugby are played by young people of all ages, and are among the sports played regularly and in addition, these three sports are also high up the list of sports that young people want to try or do more of.

2.3.2 Local Authorities (New Zealand’s Regional, City and District Councils)

The role of the local authority is to ensure their communities have access to sport fields that meet a level of service standard. Sport field development and maintenance requires millions of dollars to be invested annually, and generally there are reports and strategies undertaken by local authorities which may help to understand sports field provision in the community.

Further information relevant to the role of local authorities in the sport and recreation sector can be found on the local government website or the Sport NZ website.

2.3.3 New Zealand Population Projections

The following statistics below show trends including; by three fifths of the population growth will be in the Auckland region by 2031 and conversely seventeen territorial authorities will have less population than they have now (“Statistics New Zealand,” 2012a, “Statistics New Zealand,” 2012b). These population projections will have capital development ramifications for Auckland and in contrast smaller regions may need to rationalise sports field provision. In addition, a recent report released from the Ministry of Social Development found baby boomers are likely to invest more to maintain their physical wellbeing, and will have additional finances available (Ministry of Social Development, 2011). Certainly thought should be given to the type of sport field provided and the level of demand required in regions where an ageing population is prevalent.
3 Sports Field Surface Options

Regardless of the sport field surface option chosen, McAuliffe (2011) states that site specific, appropriate renovation and maintenance is essential for ensuring that the playing performance of a sports field is optimised. Solely undertaking capital improvements with no regard to on-going maintenance will lead to low level of service provision and a shortened lifespan of the sports field surface.

The previous section discussed the importance of undertaking a needs analysis. By completing the needs analysis process, boundaries will have been established regarding sports field demand, environmental and geographic factors and sporting trends. This section focuses on the attributes of the three sports field surface options; soil based field with natural grass, sand based field with natural grass and artificial turf.

In addition, this section also gives consideration to common contributing factors that lead to ongoing sports field performance such as;

- Appropriate design and specification for the sports field
- Effective monitoring and management during the construction phase
- Utilisation of reputable contractors and suppliers
- Suitable materials used in construction and maintenance
- Appropriate timing of construction work
- Ongoing and appropriate maintenance
- Controlled usage of the fields through good site management.

Sport England (2011) cites the importance of suitable planning in the early stages of the design of the sports field, and highlight that the outcomes of poor planning will lead to a second-rate sports field which will discourage community participation and may increase maintenance costs. Regardless of the sport field surface option chosen, McAuliffe (2011) states that site specific, appropriate renovation and maintenance is essential for ensuring that the playing performance of a sports field is optimised. Solely undertaking capital improvements with no regard to on-going maintenance will lead to low level of service provision and a shortened lifespan of the sports field surface. As Sheppard, 2008 discusses in the Synthetic Sports Surface Feasibility report, ensuring factors listed above are considered, and then both the level of service expectations and protection of a substantial capital asset will be ongoing.

For further guidance visit the Sport England website:
- Natural Turf for Sport, Design Guidance Note (2011)
- Selecting the Right Artificial Surface (2010)
3.1 Soil Based and Sand Carpet Based Sports Fields

Every winter, weather conditions often require local authorities to close fields as further play could cause long term damage to the surface. An analysis of individual field closure data from Auckland Council booking systems and closure spread sheets showed that the average closure rates across the region was 20.6%. These closure rates vary across the region and findings from Longdill, 2011 show that the closures are largely dependent on drainage issues, field type (sand or soil) and level of use. Longdill, 2008 also found that if there is high demand on all fields, there is no spare capacity to reschedule games to other fields resulting in game or training cancellations. One of the key issues discussed throughout this document is the poor design and maintenance contributing to field closures, which could have a significant negative influence over the players’ perspective of the field and or sport. Bearing this in mind, it is recommended that throughout this section consideration is given to the desired level of service requirements which may include:

- Does the sport field need to be available all day / every day, or for five hours a week?
- What is the scheduled maintenance that the sport field requires?
- What are the implications for the club when the natural grass fields are closed for complete renovation?
- Have the playing and renovation schedules allowed for recovery of the natural grass fields?

Sport England Design Guidance Notes also provides general technical advice to increase the understanding of sports field design. The guidance notes also advise where further information and advice can be found and assist with best practice.

**Soil Base Construction:**

Historically in New Zealand, sports fields have been built using local soil materials, and the performance of these sports fields are governed by a range of geographical and environmental elements. The main limitation of the standard soil-based system is the inability to cope with wet conditions, and in addition, there is also a greater potential for the surface to get overly hard under dry conditions (McAuliffe, 2011).

**Sand Carpet Base Construction:**

A slit drained / sand carpet system involves the primary subsoil lateral drains followed by secondary close spaced and narrow slit drains, with the entire playing surface topped with a sand layer. (Gibbs and Jennings Temple, 2007). The design of sand carpet based fields is constantly evolving including the appropriate breed of grass and the spacing of slit drains.

### 3.2 Factors to be considered for Soil / Sand Based Sports Fields

<table>
<thead>
<tr>
<th>Factors</th>
<th>Soil / Sand Based Sports Field</th>
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<tbody>
<tr>
<td><strong>Standards / Guidelines</strong></td>
<td>The following documents will assist with further information on standards / guidelines for soil and sand based fields in New Zealand:</td>
</tr>
<tr>
<td></td>
<td>Auckland Council - Design Standards for Sports Fields</td>
</tr>
<tr>
<td></td>
<td>Auckland Council - The Upgrade and Renewal of Sports Fields in Auckland City (Sports Surface Design and Management)</td>
</tr>
<tr>
<td></td>
<td>Sport England – Natural Turf for Sport, Design Guidance Note</td>
</tr>
<tr>
<td><strong>Technical Knowledge</strong></td>
<td>Technical knowledge of sports field design, construction and maintenance is required to ensure the field performs to the expected level of service requirements.</td>
</tr>
<tr>
<td></td>
<td>Obtain advice from recommended consultants when planning for the sports field.</td>
</tr>
<tr>
<td>Sports Field Options</td>
<td></td>
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<tr>
<td>----------------------</td>
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</tbody>
</table>
| **Obtain detailed design and maintenance and renovation plans for the sports field.**  
Contact Sport Turf Association New Zealand (STANZ) for consultants’ details. |

<table>
<thead>
<tr>
<th><strong>Drainage</strong></th>
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<tbody>
<tr>
<td>The detailed design plans should consider both primary subsoil lateral drains, secondary close spaced and narrow slit drains.</td>
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<thead>
<tr>
<th><strong>Grasses</strong></th>
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| Warm season grasses including Kikuyu and Couch grass are dense, vigorous turf mats which can sustain high levels of wear. They are also drought tolerant, hold the sport field together and have a high level of self-repair after wear damage.  
Cool season grasses include Perennial Ryegrass and Tall Fescue. |

<table>
<thead>
<tr>
<th><strong>Irrigation</strong></th>
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| Irrigation is generally required to ensure the grass doesn’t get too dry.  
Consideration should be given to the availability of water and whether water can be stored on site. Refer to the Bruce Pulman case study for further details regarding stormwater ponds. |

<table>
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<tr>
<th><strong>Sprays</strong></th>
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| Prevention of weed germination throughout most of the year is a major part of successful natural grass management.  
Consider the following factors; what sprays are allowed on the field and what are the long term implications for spray restrictions? |

<table>
<thead>
<tr>
<th><strong>Fencing</strong></th>
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</thead>
<tbody>
<tr>
<td>Fencing retains balls within the playing area, allows spectators to view the game safely, keeps animals out of the fields and protects the field from vehicles.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Lighting</strong></th>
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</table>
| Floodlighting systems selected should be appropriate to the projected level of use.  
Lighting should be planned in accordance with applicable Australian standards AS2560.2.3:2007 |

<table>
<thead>
<tr>
<th><strong>Renovation</strong></th>
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</table>
| Annual renovation work may include spraying, shaving, scarifying, applications of sand and grass.  
Dependent on the grass used, the grow-in period will be between 10 to 14 weeks. |

<table>
<thead>
<tr>
<th><strong>Renewal</strong></th>
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</table>
| Renewal may be required between five to ten years after the installation of a sand carpet field.  
Causes of deterioration include; sand carpet and underlying slit drains clogged by soil and worms and weed invasion of the selected grass on the sports field. |

<table>
<thead>
<tr>
<th><strong>Crime Prevention Through Environmental Design (CPTED)</strong></th>
</tr>
</thead>
</table>
| The CPTED Guidelines outline how urban planning, design and place management strategies can reduce the likelihood of crime and deliver numerous social and economic benefits in the long-term. Sports fields and sports facilities that are designed with CPTED guidelines in mind will feel safe and attract people, activity and positive social interaction.  
CPTED guidelines can be found at http://www.justice.govt.nz. |

<table>
<thead>
<tr>
<th><strong>Statutory Planning Issues</strong></th>
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</thead>
</table>
| Planning permission may be required for the chosen field, fencing and floodlighting.  
Liaise with the planning department at the local authority to discuss siting and orientation issues of the field, fencing and floodlights. |
3.3 Artificial Sports Fields

Development of the first artificial surfaces began in the United States of America in 1964, during the next twenty years a number of fields were converted to artificial however, the players found the surfaces to be unforgiving leading to increased injuries, and the ball bounce unpredictable (Sheehan, 2011) (Longdill, 2006). The progress of artificial surfaces has meant most recent third generation artificial surfaces are performing more closely to natural turf, however, because artificial turf is still such a new concept in New Zealand (excepting hockey turfs) little is known on the lifespan, maintenance costs, health and safety of the users and any on-going environmental impacts (Sheppard, 2008). Recent research undertaken on artificial surfaces to compare and contrast football matches between artificial and natural surfaces shows artificial turf does not dramatically affect the pattern of a football match and clear similarities were found in the data from the games played on grass turf. The data gathered also suggested that players were able to control the ball easier, have higher pass rates, and were more likely to stand on their feet rather than slide into challenges (Bull & Rovers, 2006).

One of the big differences between natural and artificial sports fields is the hours of use are generally higher on an artificial surface. In general, most artificial surfaces are guaranteed for 40 to 50 hours per week. In comparison research undertaken by Longdill, 2011 suggests that sand carpet surfaces can withstand 18 – 28 hours of use per week, and statistics from Wellington City Council show sand carpet surfaces can only cope with 4 – 8 hours per week during the winter months.

Table X. Summary of Artificial Grass History (Sheehan, 2011).

<table>
<thead>
<tr>
<th>Artificial Grass</th>
<th>Developed</th>
<th>Fibre Length</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd Generation</td>
<td>1970’s</td>
<td>20 – 35mm</td>
<td>Monofilament or fibrillated polypropylene, initially constructed with no shock pad. UK professional soccer played this surface for being unplayable.</td>
</tr>
<tr>
<td>3rd Generation</td>
<td>1990’s</td>
<td>40 – 65mm</td>
<td>Monofilament or fibrillated fibres with a sand or rubber infill. Rugby Union fields constructed with a shock pad for added safety.</td>
</tr>
<tr>
<td>4th Generation</td>
<td>2000’s</td>
<td></td>
<td>Developments for football and rugby are utilising a mix of monofilament, textured fibres of variable lengths (some without shockpads). Developments for hockey include: reducing the sand content of the pitch and, dry pitches for elite level hockey. Developments for athletics fields include super long pile turf to 80mm. Developments for tennis include the development of synthetic clay, which is a waterless alternative to en-tout-cas courts.</td>
</tr>
</tbody>
</table>
3.4 Factors to be considered for Artificial Sports Fields

<table>
<thead>
<tr>
<th>Factors</th>
<th>Artificial Sports Field Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standards / Guides</strong></td>
<td>Currently there is no one New Zealand standard for artificial surfaces, however, the documents listed below provide standards or guidance when selecting an artificial surface:</td>
</tr>
<tr>
<td></td>
<td>• Code of Practice for the Construction and Maintenance of Synthetic Sports Pitches, Sport and Play Construction Association (SAPCA), <a href="http://www.sapca.org.uk">www.sapca.org.uk</a></td>
</tr>
<tr>
<td></td>
<td>• Selecting the Right Artificial Surface – Sport England</td>
</tr>
<tr>
<td></td>
<td>• The Smart Guide to Synthetic Sport Surfaces – The Smart Connection Company</td>
</tr>
<tr>
<td><strong>Drainage</strong></td>
<td>Artificial grass sports fields should always allow for the rapid drainage of water from the surface either through; vertical drainage or horizontal drainage.</td>
</tr>
<tr>
<td></td>
<td>The SAPCA code of practice provides a permeable (sub-surface) system.</td>
</tr>
<tr>
<td><strong>Maintenance Issues</strong></td>
<td>The amount of maintenance required will depend on the surface type.</td>
</tr>
<tr>
<td></td>
<td>It is essential to follow the instructions provided by the manufacturer and installer.</td>
</tr>
<tr>
<td><strong>Irrigation</strong></td>
<td>Irrigation may be required on the field. Irrigation may improve the frictional and traditional characteristics of the surface, reduce heat build-up in the surface, reduce build-up of static electricity, and to improve playing characteristics of the pitch.</td>
</tr>
<tr>
<td></td>
<td>If irrigation is provided, storage tanks will also need to be factored into the sports field design.</td>
</tr>
<tr>
<td><strong>Sprays</strong></td>
<td>Weeds may occur on the surface of an artificial field.</td>
</tr>
<tr>
<td></td>
<td>Removal of the weeds can be carried out manually or sprayed with an appropriate weed-killer.</td>
</tr>
<tr>
<td><strong>Fencing / Screening</strong></td>
<td>Artificial sports fields surfaces need to be protected, and may sustain damage if left unfenced.</td>
</tr>
<tr>
<td></td>
<td>Fencing will retain balls within the playing area, allows spectators to view the game safely, keeps animals out of the fields and protects the field from vehicles.</td>
</tr>
<tr>
<td></td>
<td>On court divider netting and screening may also be required.</td>
</tr>
<tr>
<td><strong>Lighting</strong></td>
<td>Floodlighting systems selected should be appropriate to the projected level of use.</td>
</tr>
<tr>
<td></td>
<td>Lighting should be planned in accordance with applicable Australian standards AS2560.2.3:2007</td>
</tr>
<tr>
<td><strong>Crime Prevention Through Environmental Design (CPTED)</strong></td>
<td>The CPTED Guidelines outline how urban planning, design and place management strategies can reduce the likelihood of crime and deliver numerous social and economic benefits in the long-term. Sports fields and sports facilities that are designed with CPTED guidelines in mind will feel safe and attract people, activity and positive social interaction.</td>
</tr>
<tr>
<td></td>
<td>CPTED guidelines can be found at <a href="http://www.justice.govt.nz">http://www.justice.govt.nz</a>.</td>
</tr>
<tr>
<td><strong>Statutory Planning Issues</strong></td>
<td>Planning permission may be required for the chosen field, fencing and floodlighting.</td>
</tr>
<tr>
<td></td>
<td>Liaise with the planning department at the local authority to discuss siting and orientation issues of the field, fencing and floodlights.</td>
</tr>
</tbody>
</table>
4 Cost Analysis

The design, construction and maintenance of sports fields is a major financial undertaking for any organisation. This section provides general guidelines for the costs that may be incurred, and general tips to remember when undertaking the cost analysis process.

This section considers general figures for construction, maintenance, renewal and cost per hour for sports field surfaces. However, for detailed whole of life costs it is recommended the decision maker should collect costs relevant to the sports field location to ensure a full understanding of the financial commitment required. Historical findings show that inadequate budgets have led to poor design and low maintenance standards leading to a low level of service provision.

4.1 Cost Analysis Models

For the purposes of this guidance document it is recommended that the work undertaken by the Victorian State Government - A Surface Evaluation Model and the cost benefit analysis (CBA) work undertaken by Dr Richard Gibbs both provide a starting point to aid in the cost analysis. The Australian figures used for the surface evaluation may not be accurate to New Zealand figures, and therefore these should only be used as a guide.

4.2 Construction

As a general guide the construction figures for all three sports field surfaces have been provided below. The figures below are only estimates and will vary dependant on a number of external factors as discussed in section three. Furthermore, the overall cost will be completely dependent on what skills and services may be available, for example, the Stella Maris Primary School case study was used to demonstrate that a sports field costs can be kept low if the skills and services are available through sponsorship or voluntary means.

These construction costs estimates use a single generic sports field size (1 hectare) and do not include local site specific factors.

<table>
<thead>
<tr>
<th>Item</th>
<th>Soil</th>
<th>Sand Carpet</th>
<th>Artificial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sports field (including drainage)</td>
<td>40,000 - 100,000</td>
<td>150,000 - 210,000</td>
<td>800,000 - 1,200,000</td>
</tr>
<tr>
<td>Shockpad</td>
<td>-</td>
<td>-</td>
<td>200,000</td>
</tr>
<tr>
<td>Surrounds</td>
<td>-</td>
<td>-</td>
<td>150,000</td>
</tr>
<tr>
<td>Floodlights</td>
<td>-</td>
<td>-</td>
<td>250,000</td>
</tr>
<tr>
<td>Sub-total</td>
<td>40,000 - 100,000</td>
<td>150,000 - 210,000</td>
<td>1,400,000 - 1,800,000</td>
</tr>
<tr>
<td>Preliminary and General (5%)</td>
<td>0 - 5,000</td>
<td>0 - 10,500</td>
<td>60,000</td>
</tr>
<tr>
<td>Consents (2.5%)</td>
<td>0 - 2,500</td>
<td>0 - 5,250</td>
<td>30,000</td>
</tr>
<tr>
<td>Professional Fees (12%)</td>
<td>0 - 12,000</td>
<td>0 - 25,200</td>
<td>144,000</td>
</tr>
<tr>
<td>Total</td>
<td>$40,000 - $120,000</td>
<td>$150,000 - $250,000</td>
<td>$1.6m - $2m</td>
</tr>
</tbody>
</table>
4.3 Maintenance

A high level of regular and consistent maintenance of the sports field is crucial to its overall performance and lifespan. Consider carefully the budget is available to maintain the selected sports field surface, as this may determine what type of surface is chosen. Cost estimates to maintain a sports field vary greatly and depend on a wide array of factors that have been discussed in the previous sections. Research by McAuliffe, 2011 shows that typically an Australian club or local authority may spend in the order of $15,000 per hectare / per annum to maintain a community level sports field, alternatively, New Zealand sports field maintenance costs can range from $10,000 to $25,000.

In regards to maintenance required for artificial surfaces, there is research that indicates maintenance costs are lower for artificial surfaces. Although recent figures released from Wellington City Council (2012) shows that maintenance costs can vary from $12,000 to $42,000 per annum (includes power, gas and IRB testing costs), however, this is dependent on the field type and level of service provision. Careful consideration should be given to the level of service to be provided and the hours of use required when comparing maintenance costs between surfaces.

4.4 Whole of Life Costs

It is recommended that if a surface evaluation model was developed for the Sport NZ website and that the discounted cash flow factors are taken into account. An example of a Surface Evaluation Model can be found at www.sport.vic.gov.au.

Discounted cash flow factors in both costs and revenue so it allows for the real value of the dollar over time, i.e. rather than just taking in a fields replacement cost in 10 years’ time, and dividing it by 10 to get the annual cost requirement, the discounted cash flow method allows for factors such as compound interest and inflation to give a more accurate end figure/annual saving rate (State Government of Victoria).

4.5 Cost Per Hour of Use

A key factor in deciding whether to build an artificial turf or a natural grass field is the costs associated with the chosen field. For the purposes of this research we have taken into account the following factors:

- Cost of construction
- Cost of annual maintenance
- Estimated hours of play (per annum)
- Cost to renew the surface
- Lifespan

As a general guide the 10 and 20 year lifespan figures for all three sports field surfaces have been provided below. The figures below are only estimates and will vary dependant on a number of external factors as discussed in section three. For example the hours of play quoted in this table are relevant to Auckland, however, Wellington only has 4 – 6 hours per week hours of play on a sand carpet field.

\[\text{Footnote: These tables below do not consider ‘discounted’ cash flow.}\]
### Table 4-1: Considered over a 10 year lifespan.

<table>
<thead>
<tr>
<th>Item</th>
<th>Soil</th>
<th>Sand Carpet</th>
<th>Artificial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>$120,000</td>
<td>$250,000</td>
<td>$2,000,000</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$125,000 (per 10 years)</td>
<td>$250,000 (per 10 years)</td>
<td>$250,000 (per 10 years)</td>
</tr>
<tr>
<td>Hours of Play (per annum)</td>
<td>4800 (10 hours per week / per 10 years)</td>
<td>8640 (18 hours per week / per 10 years)</td>
<td>28,000 (58 hours per week / per 10 years)</td>
</tr>
<tr>
<td>Renewal</td>
<td>$0</td>
<td>$40,000</td>
<td>$6,500</td>
</tr>
<tr>
<td>Lifespan</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Cost Per Hour of Play</td>
<td>$50</td>
<td>$62</td>
<td>$80</td>
</tr>
</tbody>
</table>

### Table 4-2: Considered over a 20 year lifespan

<table>
<thead>
<tr>
<th>Item</th>
<th>Soil</th>
<th>Sand Carpet</th>
<th>Artificial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>$120,000</td>
<td>$250,000</td>
<td>$2,000,000</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$250,000 (per 20 years)</td>
<td>$500,000 (per 20 years)</td>
<td>$500,000 (per 20 years)</td>
</tr>
<tr>
<td>Hours of Play</td>
<td>9600 (10 hours per week / per 20 years)</td>
<td>17,280 (18 hours per week / per 20 years)</td>
<td>56,000 (58 hours per week / per 20 years)</td>
</tr>
<tr>
<td>Renewal</td>
<td>80,000</td>
<td>556,500</td>
<td>55,000</td>
</tr>
<tr>
<td>Lifespan</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Disposal</td>
<td></td>
<td></td>
<td>50,000</td>
</tr>
<tr>
<td>Cost Per Hour of Play</td>
<td>$38</td>
<td>$48</td>
<td>$55</td>
</tr>
</tbody>
</table>
5 Where to Find Advice

5.1 Sport New Zealand (Sport NZ)

Sport NZ is the government organisation responsible for sport and recreation (formerly SPARC). Sport NZ continually undertake research and has a wealth of information on facility strategies and sporting trends.

The references cited in this document can be found on the Sport NZ website at www.sportnz.co.nz.

5.2 The Sport Turf Association New Zealand (STANZ)

STANZ provides a guidance role within the turf industry and the STANZ website will feature contact details on sports field consultants and suppliers. STANZ is dedicated to sharing information about all aspects of sports field maintenance and administration.

The STANZ website address is: www.sportsturfnz.co.nz.

5.3 New Zealand Recreation Association (NZRA)

NZRA provides a guidance role within the parks and recreation industry. NZRA delivers several conferences and seminars during the year to assist professionals within the industry with best practice and benchmarking.

The NZRA website address is: www.nzrecreation.org.nz

5.4 Consultants

A consultant is an individual or company who have excellent understanding and skills regarding sport field design, construction and maintenance and generally will provide this expertise to a client for a fee. Choosing the right consultant will save time and money and will bring added value to the design, construction and maintenance of the sports field.

Once the needs analysis, sports field options and cost analysis has been completed it is highly recommended contacting three qualified sports turf consultants to visit and undertake a general site assessment. When the consultant is on site take the opportunity to discuss the results of the needs analysis, sports field options and cost analysis. This will assist the consultant to determine what type of surface is suitable.

It is also recommended that before choosing a consultant and contractor undertake site visits to several local sports fields that have similar attributes, and ask for endorsements.

5.5 Procurement

Historically, an insufficient brief or specifications have meant that some sports fields have failed to perform to the level of service expectations. Recently, a number of documents have been developed both nationally and internationally to provide guidance on how to develop a good brief and specifications. A general scope of works for artificial fields can be found within the following documents:


Visit similar sports fields’ and ask about key wins and lessons learnt.
Ask for recommendations for both consultants and contractors.
6 Case Studies

6.1 Case Study One: Stella Maris Catholic Primary School, Silverdale

**Field Type:** Sand Carpet Base Construction  
**Grass:** Kikuyu  
**Cost:** $40,000  
**Consultant:** New Zealand Sports Turf Institute (NZSTI)

**Issue:** The original construction of the field allowed for stormwater outlet drains to be installed at the perimeter but no drains were installed in the field itself. This lack of drainage led to notoriously poor drainage of the soil and typically the sports field has not been able to be used over the winter months (May till September).

**Solution:** The school made several key decisions to progress the reconstruction of the field which included;
1. Selecting a proficient Project Manager to undertake the task;  
2. Deciding on a budget with the key priority being minimising cost and maximising value.

Due to the tight budget NZSTI provided recommendations for the most cost effective option to build and maintain the schools field. A detailed specification of works and drainage (sketch plans) were also provided to the school. The result was a low consultancy cost but effective use of specialist expert input to ensure that the works were completed correctly and the required result was achieved. Following installation in the summer of 2010/11, the winter in 2011 was exceptionally wet however; the field was able to be used throughout winter.

**Lessons Learnt:**
1. If the project management will be undertaken by a person within the School or the local authority, gain independent advice from a consultant before talking to the Contractor  
2. Ensure the sports field is designed to suit the environment, in this case lateral drain and slit drain installation and sand top dressing applications meant the field will now perform under wet conditions  
3. Save costs by choosing the appropriate grass cover for the field, in this case Kikuyu was chosen, which meant the grass was hard wearing and incurred lower maintenance costs in comparison to alternative options  
4. Plan for the future, in this case turf re-establishment and improvement programmes were also implemented.

![Figure 6-1 : Aerial photo of Stella Maris Catholic Primary School, Silverdale](image-url)
6.2 Case Study Two: Westlake Girls High School

Field Type:
Two Football Fields (Ligaturf Premier), Three Netball / Tennis Courts (Laykold), One Cricket Pitch (Supergrasse)

Cost:
- Artificial turf costs $4.8m
- Total complex cost $7.5m

Replacement based on 10 years -2021
- Hockey turf $380,000
- Soccer Turfs (two) $690,000
- Light / external buildings $344,000

Maintenance Costs Per Year
- Night Hockey $27,000
- Day Hockey $15,000
- Night Soccer per turf $18,500
- Cover Courts Nights $23,000
- Cover Courts Days $21,000

Consultant: Sports Technology International (STI)

Issue: Originally the Westlake Girls sports fields were sand carpet based. This meant the fields were available for limited periods and closed when conditions become too wet. Also, Westlake Girls had no hockey turf, so students had to travel to play hockey.

Fifteen years ago, the NZTA required further land to develop a dedicated bus lane. As part of the required land was situated on the Westlake Girls High School site, NZTA entered into negotiations with Westlake Girls. Once an agreement was reached, Westlake Girls elected to invest the capital into developing a world class sporting complex for their students.

Solution: A sporting complex was built which includes: a blue hockey turf, two FIFA class artificial football fields, a cricket oval, two cricket nets and three dual purpose tennis and netball courts. The first part of the Westlake Girls $7.5 million sports facilities upgrade was the new artificial turf complex which was opened in November 2011. Positive outcomes that have resulted from this investment have included: more students playing sport, less travel to alternative venues, economic return on investment.

Lessons Learnt:
1. If building an artificial football field ensure the field meets either FIFA One or Two Star requirements. For further information visit: www.fifa.com;
2. By building a world class facility Westlake Girls has been able to host the Black Sticks, providing exceptional sporting role models for the students;
3. Car parking – when providing for a sporting complex allow for extra car parking, and provide a good in/out flow;
6.3 Case Study Three: Trafalgar Park, Nelson

**Field Type:** Glass based

**Grass:** Rye

**Cost:** $1m

**Consultant:** New Zealand Sports Turf Institute (NZSTI)

**Issue:** When it came time to returf Trafalgar Park as part of a larger $7.4 million upgrade, a lack of appropriate sand for the drainage medium emerged as a significant issue. Unfortunately, local sand did not meet the stringent grading and quality requirements and proved too expensive to process. Trucking-in quarried sand from Christchurch and boating in sand from the North Island was investigated before the innovative solution of glass was suggested.

**Solution:** Two thousand, eight hundred tonne of recycled glass sand was produced by a Christchurch-based recycling operation and transported to Nelson on backloads. The use of glass sand in the one million dollar turf upgrade is apparently a world-first.

In addition, Trafalgar Park has 20 kilometres of new drainage pipework and slit drains. At the lowest layer is the main drainage pipe, and branching out from that a series of lateral subsoil drains wrapped in pea gravel. There are also a series of vertical slit drains effectively, slits cut into the soil and backfilled with pea gravel topped off with blinding sand. To ensure king tide salt water wouldn’t come back up through the drainage system and kill the grass a system of tidal gates was devised to prevent the ingress of salt water into the turf drainage system.

After 40 millimetres of heavy rain in the morning which would have previously closed Trafalgar Park, a Super 15 competition game was played and the new surface coped admirably. In fact, there were horses running across it for the pre-match entertainment.

**Lessons Learnt:**

Consider sustainable options:

- The sports field used 2800 tonnes of glass sand which equates to seven per cent of the total volume of glass that is collected in South Island per annum;
- Look to use efficient lighting systems. Trafalgar Park installed motion activated lighting in the building fit outs;
- Consider water conservation. Water saving flush and tap systems were installed in the new toilet blocks;
- Re-using 5000 cubic metres of cut-to-waste material for the embankment.
6.4 Case Study Four: Bruce Pullman Park

**Field Type:** Sand based

**Grass:**
Main field – Agri Dark and Rye.
Supporting Fields: Agri Dark

**Cost:**

**Consultant:** Sports Surface and Design

**Issue:** In the late 1980’s the Papakura District Council purchased the Park land. Through a unique structure the Bruce Pulman Trust has leased the park from the Council to provide the improvements and amenities. The Trust’s philosophy being that everyone in the community irrespective of age, gender, physical ability or nationality can use the facilities and services provided, for recreation, leisure or sporting pursuits.

**Solution:** The Trust is very conscious of the economic demographics of people who live in this region and the “Bruce Pulman Park Trust” has been set up specifically to maintain and manage the park on a self-funding basis. The Park will also operate as a resource centre for the many minor activities and sports throughout the region who may have fields or playing areas but no clubrooms, computers or administration back up to effectively organise and run their particular activities or train their volunteers.

Eight international standard sports fields have been constructed to provide ideal playing surfaces in all weathers and seasons. All fields are fully drained with irrigation, sand cover with couch grass base stabilising the sand. The main field is under sown with rye grass. The grounds feature a unique environmental friendly gravity drainage system which drains into an adjacent stormwater retention pond. This water is reticulated and used for irrigation. The irrigation and drainage systems ensure the grounds are of excellent standard during all seasons.

**Lessons Learnt:**

- Bruce Pulman Park has a storm water retention pond on site, this provides for irrigation of the fields.
- Bruce Pulman Park has its own grounds staff and a high level of maintenance is provided at all times. These sand carpet fields can have up to 20 hours per week played on them.
6.5 Case Study Five: College Rifles

Field Type: Artificial

Cost:

Consultant:

Issue: The CR facility was previously at a crossroads. The old field, located over a former peat swamp and an interchange of underground Council infrastructural services, performed very badly and was frequently unusable. The old sand carpet approach had not performed as much as it needed to and as a sand carpet, carried high annual operational maintenance and renovation costs. To close the club and to find new facilities was advised to costs millions; and to upgrade the venue only $100,000’s.

Solution: This reality was the essence of working within the context of a funding plan to redevelop. College Rifles Sports is almost unique as a venue, due to a synthetic field that permits an almost total optimisation of the non-building facilities. The Auckland Council funded a significant sum largely due to the failure of their infrastructure beneath the sports fields. The resulting upgrades on pipes enabled the Council to reinstate the ground in a way that substantially undertook the base earthworks for the project.

The building facilities however are also maximised and the income streams for College Rifles show that that club can operate as a profitable business. This facility is a privately owned yet community shared venue, where it is heavily relied on by the local authority and community.

College Rifles has undertaken surveys on the field, and survey results showed that even the thought of going to a different ground with mud was a disincentive. The following comments were made, "Mums love it...you can hop straight back into the car afterwards" and "you can continue your day straight afterwards, and not as much hassle washing gear afterwards".

Maintenance

Grooming is undertaken weekly with specialist equipment; every Friday the surface is groomed with a tines and Brushes approach, with very fine debris collected into a catcher. Grooming maintains the performance of the materials, and ensures the asset endures. With grooming the life of the materials may be extended to 15 years. Human debris (compounding of human hair) is one of the biggest maintenance issues.

Lessons learnt:

College Rifles also has the following reasons for their success:

- Vision
- Governance and Organisational structure
- User Pays approach (including subs being paid in full per season)
- Excellent services and facilities
- Investment in security and staff (based on site)
7 Bibliography


FIFA Quality Concept for Football Turf.


8 Appendices

Workshop invitees:

- Sports Turf Association New Zealand (STANZ)
- New Zealand Recreation Association (NZRA)
- Sport NZ
- Auckland Council
- Wellington City Council
- Rotorua District Council
- Thames Coromandel District Council
- Hastings District Council
- National Sports Organisations
- Regional Sports Organisations
- Regional Sports Trusts
- Bruce Pullman Park
- College Rifles
- Westlake Girls High School
- Stella Maris Catholic Primary School
- New Zealand Sports Turf Institute (NZSTI)
- Sports Surface Design and Management (SSDM)
- City Care
- Sports Surfaces Consultants
- Tiger Turf
- Cervadon
- Longdill and Associates