

6.0 DISCUSSION AND RECOMMENDATIONS

Tim O'Hare Associates LLP has carried out an agronomic assessment to assess the quality of the existing soils and turf within the sports pitches at Marble Hill Park.

6.1 Site Conditions

The site constraints in relation to sports use are considered below.

Levels and Microrelief

Major modifications to the overall levels of the pitches should not be required, although selective re-grading is recommended, particularly across the football pitches, to remove surface undulations and to create a suitably flat playing surface.

Rugby Pitch 2 could potentially be shifted southwards to avoid the bank rising to the north-east.

Drainage System

There is currently no drainage infrastructure present on the site. It is understood that fixtures are frequently cancelled during the winter and Football Pitch 3 and Rugby Pitch 2 are commonly out of action due to waterlogging. As such, drainage assistance is likely to be necessary for the winter sports pitches to prevent cancellations and potentially increase pitch usage hours.

As cricket is played during the drier summer months and it is a lower impact sport, formal drainage infrastructure is unlikely to be necessary in this area.

More detailed discussion on drainage is given in Section 6.8 below.

Flooding

It is understood that the southwestern part of the site is susceptible to flooding from the River Thames, which can disrupt use of the rugby pitches whilst the area is flooded. To reduce the amount of lost usage, it is suggested that allowance is made for appropriate repair and reinstatement works once the water has dissipated. This will require sufficient capital to be set aside within the maintenance budget.

The most significant problems associated with flooding, aside from disruption of fixtures, are 'silt capping' resulting in loss of surface connection to any new drainage system, together with damage to the grass sward. If a drainage system is to be installed in this zone, it would be sensible to allow for the re-installation of secondary drainage (e.g. sand grooves) following flooding events to maintain the surface connection with the primary drains.

Shade

The rugby pitches and many of the football pitches may be susceptible to shade and leaf fall. As such, the selection of seed mixes and maintenance operations would need to take this into account.

Pitch Orientation

The current orientation of Pitch 6 (Junior 7 v 7 pitch) would fall outside the recommended range, however, nearby mature trees to the south alongside the river and to the west may mitigate the effects of low sun in the west.

6.2 Soil Quality

The main limitation posed by the topsoil within the sports pitches is associated with its fine texture and broad particle size distribution. Such soils typically have low structural strength and are therefore prone to structural degradation and compaction, especially when they are in a wet and plastic state. These conditions affect the function and usage of the sports pitch, and this is exacerbated if the usage hours over the winter months are high. This is demonstrated by the reduced infiltration recorded in Football Pitch 1, which is understood to be heavily used.

The soils may restrict drainage from the overlying topsoil during periods of heavy or prolonged rainfall. The performance of the soil for sports pitch use could potentially be improved with some form of drainage assistance.

The overall stone content of the topsoil within the sports pitches was low, however occasional subangular small to medium sized stones (20-50mm) were recorded. As such, the overall proportions of stone should not constitute a limitation for the sports pitches, *provided* the soil profile remains undisturbed and good grass cover is maintained. If any regrading is proposed in future, it may be prudent to carry out a stone reduction exercise during the works.

The chemical composition of the soils is generally acceptable for sports pitch grass cultivars, provided the nutrient levels are supplemented by an appropriate annual fertiliser regime. The soil pH in the cricket outfield area was found to be strongly acid (pH 5.0) and as such, application of agricultural grade lime could be beneficial. Perennial ryegrass typically prefers a slightly acid to slightly alkaline pH range (pH 5.5 – 7.5).

6.3 Turf Quality

The overall quality of the turf is moderately high in relation to use for the sports catered for. Evidence of wear was observed in play 'hotspots', such as football goal mouths and centre circles. Significant surface undulations were recorded within these hotspots and as such, localised infilling and regrading may be necessary here.

With reference to the supplied background information, the existing maintenance schedule is fairly comprehensive and includes important operations such as aeration, overseeding, localised topdressing and a fertiliser regime. This has achieved a good quality sward on the whole. However, a more intensive maintenance programme may be considered (depending on budget constraints etc) to further improve the resilience of the sward and complement any new drainage infrastructure. Further discussion and recommendations are given below in Section 6.6. Appropriate management of usage should also be considered (see Section 6.11 below).

6.4 Current Quality and Usage Potential

The overall condition and quality of the existing sports pitches was good, with satisfactory overall ground cover, soil depths, root development and grass species.

Football and Rugby Pitches

The limitations for the winter sports pitches appear to be high usage levels, drainage restriction, and uneven microrelief. The high usage levels on certain pitches have resulted in a deterioration of the playing surface within goal mouths and centre circles. If the same level of usage is to be sustained or increased, additional treatments are recommended to maintain a satisfactory playing surface.

The pitches are currently undrained. With the existing soil conditions, this would generally allow up to 3 hours of junior play or 1-2 hours of adult play *per pitch per week* without a high risk of deterioration.

Sport England considers the following 'guideline' weekly usage hours to be applicable to the following drainage system types (although this does not necessarily consider other factors, such as soil type, climate and maintenance regimes):

Table 10: Sport England Guideline Weekly Usage

Drainage Type	Adult weekly use hours	Youth (15 years or below) weekly use hours*
Undrained	Up to 2	Up to 3
Pipe Drained	2 – 3	3 – 4.5
Pipe drained with mole drains	2 – 4	3 – 6
Pipe drained with sand grooves	3 – 6	4.5 – 9
Pipe drained with slit drains	3 – 6	4.5 – 9
Pipe drained with topsoil and drainage layer	3 – 6	4.5 – 9
Pipe drained with suspended water table	4 – 6	6 – 9

* Usage hours for players 15 years or younger will increase by approximately 50% compared to that of adults.

Cricket Outfield

As cricket is a summer sport, it is usually played during warmer and drier conditions. Furthermore, there is less wear from the nature of the sport, e.g. no tackling or scrummaging. As such, the sport places fewer demands on the sward. However, the summer months can present other considerations such as drought, and therefore a resilient sward is necessary to prevent generation of unsightly bare patches.

The physical characteristics of the existing soils within this area, including infiltration and drainage, appear to be sufficient to support grass for summer sport. However, the sward does appear to be a little 'hungry' in places and moss is occasionally present. As such, it may be beneficial to address the strong acidity and low fertility status of the topsoil in this area to support an improved sward.

The microrelief within the cricket outfield is reasonably even and this factor could be considered less crucial for this sport.

6.5 Pitch Improvement Options

Football and Rugby Pitches

Football and rugby are winter sports and are therefore often played during wet weather. This means that the grass surface can be subject to wear and tear in unfavourable conditions. Good drainage is essential to support play and potentially increase pitch usage.

In order to increase the quality of the football and rugby pitches and usage hours, a programme of improvements could be considered. A phased approach could be carried out as follows (depending on budget constraints):

- Short-Term Plan Upgraded maintenance
- Medium Term Plan Surface improvement
- Long-Term Plan Regrading and draining the pitches

Further discussion on these improvement options, together with outline budget costs are given in Appendix 5.

Depending on budget constraints, it may be desirable to focus these improvements on the adult football pitches and rugby pitches. Junior players will subject the pitches to less impact and as such, improvements to the smaller pitches may be less important at this stage.

Cricket Outfield

As mentioned above, the quality of the existing cricket outfield is largely satisfactory and the current maintenance regime would be considered sufficient for the most part. However, some additional treatments could be beneficial to improve the colour and vigour of the sward (see Section 6.6 below in relation to the cricket outfield).

6.6 Upgraded Maintenance

Football and Rugby Pitches

In the short term, a more intensive maintenance programme could be considered to encourage a more resilient grass sward to sustain and potentially increase the existing usage levels.

The following additional maintenance treatments are suggested for the football and rugby pitches:

- Topdressing over the whole pitch rather than just the goal mouths
- Two fertiliser applications per annum

These recommendations are discussed below. An estimated budget is indicated in Appendix 5.

Topdressing

Budget permitting, sand top dressing over the whole of each pitch could be considered rather than just within goal mouths. Sand top dressing, especially when used in conjunction with aeration treatment, improves and maintains water infiltration and surface wear. Application with a drop spreader with drag mat immediately after spiking/verti-draining allows some of the sand to enter the voids created, and encourages grass roots to grow deeper. If it is carried out year on year, it partially replaces the surface soil layer and thereby improves the wear and tear properties of the pitch. Usually an application rate of between 60-80 tonnes per hectare is recommended.

Use of a pure sand topdressing is recommended as opposed to a sand/compost or sand/soil mix. The product should be selected to ensure that the grading of the topdressing sand is compatible with that of the topsoil to reduce risk of particle interpacking.

Fertiliser Application

At present fertiliser application is carried out once a year during Spring renovation works. Based on the findings of the Soil Resource Survey, the topsoil is deficient in phosphorus and potassium. Phosphorus is important for root growth and potassium is often needed to improve grass wear tolerance and resilience to cold, heat or drought stress. In order to provide greater input of nutrients to the soil over the year, improve colour and prepare the sward for winter, we would suggest also allowing for an Autumn fertiliser application.

Cricket Outfield

Most of the annual maintenance work to the cricket field focusses on the surrounds of the synthetic wicket (5 metres beyond the edge). This is considered acceptable on the whole as this is where play is typically focused.

An additional fertiliser application is recommended in Spring to prepare the grass for the season.

Lime application is also suggested to raise the pH and improve sward colour. Lime is normally applied every 2 to 3 years. Suitable lime products can include agricultural grade lime or crushed chalk, although some liquid products are also available.

It may be beneficial to carry out fertiliser and lime applications to the whole outfield to improve overall sward quality. Some localised moss treatment may also be necessary in the cricket outfield.

6.7 Surface Improvement – Winter Sports Pitches

Smearing of the topsoil surface on winter sports pitches will reduce infiltration, particularly as the season progresses. Whilst the twice monthly aeration treatment and recommended annual topdressing will help to mitigate this, there are two additional treatments that would improve the general wear tolerance and infiltration of the topsoil. These are topsoil sand amelioration and installation of sand grooves.

Amelioration of the topsoil surface with a heavy application of sand could be made to create a more resilient layer. This would typically involve placing a 25-50mm layer of sand and incorporating it into the upper 25mm of the topsoil surface (e.g. using a power harrow).

To be effective, this operation would necessitate prior removal of the existing grass (e.g. by herbicide application or using suitable equipment such as a Koro Field Top Maker) and followed by establishment of a new sward. The replacement grass will need a period of 'Establishment Maintenance' – see Section 6.9 below for recommendations.

Sand grooves will provide an efficient means of carrying water off the surface and through the topsoil layer. These are small slits (typically 150mm deep and 20mm wide) that are cut into the topsoil at 260mm centres and filled with washed sand. These grooves are forced into the soil with a tine rather than excavating a trench. Therefore, no arisings are created. Sand grooves usually need to be reinstalled every 3-5 years and topdressing is important to retain the integrity of the surface to reduce smearing and capping over the sand grooves.

Sand groove installation alone would not necessitate prior removal of the grass sward, although overseeding is recommended afterwards.

Effective sand groove installation will require the topsoil to be sufficiently consolidated. Therefore, if these works are carried out in conjunction with topsoil sand amelioration, the replacement grass sward should be allowed to establish satisfactorily before installing the grooves.

6.8 Regrading and Drainage Installation – Winter Sports Pitches

Regrading the ground surface to improve microrelief, together with drainage installation could be considered. These works will require considerable capital investment to initiate and will need to be maintained appropriately.

Regrading and drainage installation will cause significant disruption during the works. As such, it is recommended that these operations are carried out in tandem with one another. To minimise disruption, the works could potentially be carried out within one or two pitches at a time. However, it should be noted that this can make drainage installation more complex and imbalance material volumes during regrading.

The appointment of a specialist sports pitch construction contractor is recommended for any drainage and regrading work. The contractor should be a member of relevant reputable trade organisations such as SAPCA (Sports and Play Construction Association) and LDCA (Land Drainage Contractors Association).

Regrading

The microrelief of the football pitches in particular is currently considered quite variable and will adversely affect ball roll during play. In addition, the presence of hollows could encourage water to collect.

Regrading can be carried out in two main ways, either by regrading the topsoil surface or by first stripping the topsoil and regrading the subsoil beneath, prior to replacement of the topsoil to a smooth even grade. The method used will depend on the topsoil depth and height of the undulations. The existing topsoil depth range is reasonably thick and as such, it is unlikely that the topsoil would need to be stripped beforehand, although deeper hollows (e.g. worn goal mouths) are likely to need infilling. Further modelling of levels and determination of topsoil depths at higher resolution will be required to confirm the extent of any regrading works.

These works will disturb stones present in the topsoil and as such, stone removal is recommended prior to final levelling and seeding to remove stones from the surface.

Regrading will necessitate prior removal of the existing grass sward, followed by establishment of a new sward. The replacement grass will need a period of 'Establishment Maintenance' – see Section 6.9 below for recommendations.

Drainage

To provide a good playing surface, especially for winter games pitches, it is necessary to have well-drained turf. Experience has shown that winter pitches with consistently dry turf will withstand a large amount of play and only require minor renovations. Turf surfaces used for sport should be moist enough to sustain grass growth, but the surface should not be so moist as to adversely affect the quality of play.

Drainage assistance is often necessary in order to enable more play to take place and to reduce the risk of pitch deterioration. Three games a week can damage a pitch intensely and four games a week can be critical if the pitch is too wet and non-drained. One game played on a very wet pitch can damage the sward so intensively that the playing quality is affected for the rest of the season. Management of the pitches to prevent excessive wear when wet is therefore of vital importance (see Section 6.11 below).

It should be noted that the types of sports played on the playing field will influence usage hours. Winter sports such as football and rugby are considered higher impact and will subject the pitch to more wear and tear, particularly as they are typically played during the wetter months. Summer sports such as cricket are lower impact and the pitch surface is often drier in summer.

Problems of Poor Drainage

Poor drainage quickly becomes apparent as soon as too much play is permitted with wet ground conditions. By then it may be too late to rectify the situation until the winter is over and in the meantime the players have to contend with poor playing conditions, cancellations and disruption to fixture lists. It is however, the long-term effects which are likely to be the most damaging.

It is understood that poor drainage is currently restricting use of Rugby Pitch 2 and Football Pitch 3.

Excessive moisture on the surface will generally lead to:

- reduced aeration of the soil
- reduced root development
- no resistance to wear
- less drought resistance
- slow growth in Spring
- susceptibility to disease

The final result is a grass coverage that has no durability and that will not support the amount of play expected from a winter sports pitch.

Pitch Usage and Drainage Design

The extent to which drainage is required depends not only the natural drainage of the site, but also on the amount and type of use. There are a number of possible options for the drainage of the sports pitches, depending on the quality of pitch required, the hours of usage and the level of on-going maintenance provided.

The removal of excess water from the surface can be achieved by a number of means, some of which are discussed in the above report sections, including:

- decompaction treatments (e.g. verti-draining, groundbreaker)
- heavy sand top dressing
- installing a primary land drainage system
- installing sand slits/bands (secondary drainage)
- ameliorating the existing soils with sand
- importing a new rootzone material

In this instance, the performance and the potential usage capacity of the pitches could be improved by some form of positive drainage (e.g. pipe network with sand grooves). Furthermore, sand amelioration and ongoing topdressing (as discussed above) are essential to maintain the topsoil's resistance to smearing and compaction, and the connection between the surface and the drainage system.

If a piped positive drainage system is to be considered, a suitable outfall will be required. Sustainable drainage principles would need to be considered to retain drainage water on site to manage the flow of the water at the discharge point. The presence of London Clay beneath the site is likely to restrict the use of soakaways, although options to reduce flow at the discharge point(s) (e.g. attenuation basin and / or hydrobrake) could be considered. Outfall into existing surface water sewers or watercourses would require the necessary discharge consents to be obtained.

6.9 Establishment Period Maintenance (After Topsoil Sand Amelioration or Regrading) – Winter Sports Pitches

If the existing grass sward is removed and replaced to allow for sand amelioration or regrading works, a programme of maintenance is essential after seeding and before the pitches are used. This is referred to as the Establishment Period and involves a selection of treatments to encourage the growth and establishment of a tight grass sward.

Treatments will usually include:

- Mowing
- Irrigation
- Rolling
- Spiking
- Scarifying
- Harrowing
- Levelling hollows and bumps
- Fertiliser application
- Relieving turf compaction
- Weed and pest control

6.10 Post Flooding Treatment

In addition to the more routine maintenance operations, further treatments to repair the surface after any flooding events will be required within the affected area of the Rugby Pitches. It would be sensible to set aside a supplementary budget for re-installation of any sand grooves (if installed) and reseeding of damaged grass areas.

6.11 Management of Usage

Careful management of pitch usage is important to prevent unnecessary damage and prolong the life of good quality playing surfaces.

Natural turf pitches that are used in the non-growing season for four games a week spread out over a seven day period will not wear as fast as pitches that accommodate four consecutive games on the same day or on consecutive days. Cancelling matches when ground conditions are not suitable will ensure increased use in the long term, as the pitch will not become as severely damaged as if it would if played on in poor weather conditions.

Acceptable limits of usage need to be made so as not to make the game either dangerous or unacceptable, and to enable the structure of the surface to be retained to allow future games to take place without weeks of renovation being required.

When a pitch is played on in poor weather the surface can become denuded very quickly, this may substantially increase the cost of renovation works at the end of the season. One game played upon a pitch after or during inclement weather can seriously destroy the structure of the surface; in some instances making the pitch almost unplayable for the rest of the season.

7.0 FURTHER WORK

In light of our findings, the following additional input is suggested to inform future improvement works to the sports pitches.

- In order to determine the requirements for regrading and drainage works, detailed assessment and modelling work using the existing topographic survey information would need to be carried out.
- It is recommended that a performance led specification is produced for the selected playing field improvement works to ensure that the work can be priced on a like for like basis and to ensure that the desired standard is achieved.
- If drainage installation work is to be carried out, a detailed drainage layout should be produced to indicate the correct orientation and positioning of the required infrastructure and discharge point(s).
- Soakage tests are recommended to determine the feasibility of soakaways as a means of drainage outfall.

If you would like to pursue any of these items, we will be happy to discuss the relevant issues in further detail.

TOHA would like to thank English Heritage for entrusting the practice with this commission. TOHA trusts this report meets with your approval and provides the necessary information. Please do not hesitate to contact the undersigned for further assistance.

Ceri Spears
BSc MSc MISOilSci
Senior Associate

Tim O'Hare
BSc MSc MISOilSci MBIAC CSci
Principal Consultant

For and on behalf of Tim O'Hare Associates LLP

Report Qualifications

TOHA's interpretation of the soil and turf conditions is based on observations made during the site investigation. This report presents the site observations and test results and TOHA's interpretation of those observations and results. On any site there may be variations in soil and turf conditions between these exploratory positions. TOHA can therefore not accept any responsibility for soil and turf conditions that have not been exposed by this investigation.

This investigation considers the quality and usage potential of the existing sports pitches at Marble Hill Park, Twickenham. It should not therefore be relied on for alternative end-uses or for other schemes. This report has been prepared solely for the benefit of the client English Heritage. No warranty is provided to any third party and no responsibility or liability will be accepted for any loss or damage in the event that this report is relied upon by a third party or is used in circumstances for which it was not originally intended.

Appendix 1

Site Plan Pitch Locations and References