MIKLAGARD GOLF

Måldokument for Miklagard Golfbane

MIKLAGARD GOLF

Contents

MIKLAGARD GOLF`S VISJON

Norges Beste Golfbane, en av Europas beste golfbaner – “the passion of Golf”

Kjennetegn for en visjon med høy kvalitet er:

- Drøm
- Glød
- Oppnålig
- Utfordrende
- Inspirerende

HOVEDMÅL

Alt vi leverer skal ha beste mulige kvalitet. Servicegrad skal være meget høyt og holdningene blant ansatte og andre skal være på et høyt nivå. Aksjonærer og deres gjester skal prioriteres høyt og alltid gis den beste mulig tilgjenglighet og kundebehandling. Våre mål er

- Konkrete
- Realistiske
- Målbare
- Utviklende

Miklagard Golf er tuftet på godt samarbeid og kvalitet i samarbeidet. Dette muligjøres av følgende verdier

- Gjensidig respekt
- Kommunikasjon
- Ærlighet
- Positiv innstilling
- Arbeidsvillighet
- Samhørighet
- Fleksibilitet

SPRÅK

Måldokumentet er skrevet på engelsk fordi flesteparten av våre greenkeepere er fra England/Skottland.

INNLEDNING

Dette dokumentet erstatter tidligere dokument som er utarbeidet for å orientere om Miklagard Golf sitt ambisjonsnivå på banesiden. Dokumentet er ment som en mal på hvordan et systematisk banevedlikehold skal og bør se ut på en bane i europeisk toppklasse.

Formålet med dokumentet er at aksjonærene til enhver tid skal vite Miklagards langsiktige og kortsiktige mål. Endringer fra måldokumentet vil bli gjort og nye forslag vil alltid bli vurdert i forhold til dette dokumentet. Det kan eksempelvis være endringer som presenteres på en generalforsamling med tanke på ny teknologi, ny krav og foreskrifter med mer.

Dokumentet skal også forebygge eventuelle misforståelser mellom medlemmenes forventninger og styrets ambisjoner.

Dokumentet skal også ses på som et hjelpemiddel for å øke forståelsen mellom styret, komiteene, proene, administrasjonen og baneavdelingen.

Når generalforsamlingen har vedtatt målene for banens utvikling, standard og egenart basert på dagens forutsetninger vil dette dokumentet være retningsgivende for banens langsiktige profil, Det er viktig at man er lojal mot et demokratisk valgt mål, selv om vi ikke personlig er enige i alle beslutninger i forbindelse med dokumentet.

Miklagard
17.01.2009

Tore Waagø	John Coleman	Hasse Iwarsson
Daglig leder	Course superintendent	Styrets leder
Miklagard Golf	Miklagard Golf	Miklagard Golf

INTRODUCTION

Effective management of the course requires a cohesive long term plan to better forecast expenditure of any remedial design and maintenance works. A policy document which has been fully approved will give confidence that progress is being made towards agreed objectives that have been implemented and adhered to. Such a document should explain what the club expects of its course, lay down course management principles, define standards for different areas of the course and state the resources necessary to achieve those standards. This should then lead to easier day-to-day planning and a clearer understanding by members and staff alike about what they are trying to achieve with the course. This policy document in its entirety has been recognized by the European Tour.

Miklagard Golf Club was established in 2000. It was designed by Robert Trent Jones II and is described by him as*…"a breathtaking 6,765 meter championship golf course set in a beautiful farming landscape, its grasses burnished with northern summer sun and glistening in the champagne snow of winter. This is a big, brash course, as impressive as its Norwegian Viking history. It takes fierce, strong men to match its hilly terrain and beautiful Nordic ladies to charm its lake lined and flower laden spring. We are proud to welcome Miklagard into our worldwide family of golf courses".* The design intent was to create a golf course capable of hosting international golfing events and at the same time offer unrivalled day-to-day quality for the general membership to enjoy. Miklagard's infrastructure sees it positioned close by an international airport, rail link, motorway and only 30minutes drive form Norway's capital city, Oslo.

The course itself is expansive enough to easily accommodate large crowds without any compromise to the course layout. The course specification briefly comprises the following:

- USGA standard greens sown to creeping bent.
- A minimum of four tees on each hole to maximise strategy.
- The whole course is surface drained and have over 200 catch basins
- The course is equipped with a SUB AIR Elite system on all greens
- A fully automatic Irrigation system
- 13000m^2 of greens
- 10500m^2 of bunkering, a total of 82 bunkers

MISSION STATEMENT

Miklagard Golf course shall have the best possible quality and maintenance based on geographical and climatic conditions. The course shall be leading in maintenance and quality among the courses in Norway and one of the best in Europe.

The course will meet or exceed the standards and quality necessary for hosting international tournaments to the standard as established by The European Tour.

AIM

The aim of this Course Management Policy Document is to set out details of the management of the golf course in order to implement a structured and clear forward plan and to promote good communication.

ROLES & RESPONSIBILITIES

General

The management of the Golf course involves a wide range of people and it is essential, therefore, that their roles and responsibilities are clearly defined at the outset.

The Board

The Board is responsible for the overall direction and control of the Club, including forward policy, plans and financial control. The board is elected by the shareholders and members on the general assembly which takes place in April every year. The board consists from 3 to 7 people and each member of the board is elected for a period of two years at a time.

The General Manager

The General Manager, in conjunction with the Board and the Course Superintendent is responsible for the management of the golf course, course maintenance, course standards and improvements, recommending any significant course changes, the submission of annual budgets, as well as long term capital expenditure plans and projects. He is also responsible for in-year Course Budgeting and Capital Expenditure.

The Course Superintendent

The Course Superintendent is responsible, in conjunction with the General Manager and the Board for the implementation of this Policy in all its aspects, which includes but is not limited to:

- Planning maintenance schedules in relation to tournaments and general bookings
- Liaising with the General Manager on any problem areas
- Machinery maintenance and repair
- Planning and preparation of annual and long term budgets
- Attending Board Meetings when invited to and reporting on agenda items
- Maintenance of schedules and records relating to machinery and staff

- Personnel education - training, discipline, allocation of tasks to the Head Greenkeeper

- Implementation of the Club's Health & Safety policy
- Purchase and storage of fertilizers, dressings, pesticides, fungicides and chemicals
- Storage and safety of all equipment and materials
- Ecology
- Recruitment of all Greenkeeping Staff
- Present a monthly report on the status of the course

RESOURCES

Agreed staff numbers:

- Course Superintendent
- Head Greenkeeper
- Mechanic
- Greenkeepers – 7
- Student/Part Time Greenkeepers - 6

This number is considered adequate at the moment but is in constant review. The General Manager shall undertake an annual salary review for all staff.

FINANCE

The Board is committed to the allocation of sufficient Miklagard Golf Club funds to achieve the policies set out in this document.

GREENKEEPING FACILITIES

The existing facilities which are rented from Kristian Kjos are situated adjacent to the $7^{th}/8^{th}$ hole, and consist of :

- Course Superintendent/Head Greenkeeper's office including computerized control system of the irrigation system and the SUB AIR system
- Staff Canteen
- Toilets and Shower Room
- Workshop/Grinding Room
- Main Building housing most of the Club's machinery
- Dangerous and hazardous chemical storage
- An irrigation system pump house situated adjacent to the 8^{th} fairway

- Vehicle wash down area/fertilizer mixing plant

- Sand storage bays x 2
- A new facility is in the planning and is scheduled to be in place at the latest by May 2010.

- The facilities will be modern and meet all the requirements regarding environmental rules and laws.

MACHINERY & EQUIPMENT

The Board regards the provision of the necessary machinery and equipment as an essential pre-requisite in achieving the policies set out in this document. To ensure this, a rolling five-year capital expenditure program is submitted for Board approval as part of the annual budget cycle. This program will be reviewed and updated on an annual basis. Additionally, as part of the annual depreciation exercise, all equipment will be reviewed and disposals made as necessary. The Course Superintendent has a responsibility to keep himself up-to-date with developments in golf course machinery, and to bring his recommendations to the notice of the General Manager, including competitive quotations for acquisition and disposal of machinery. The Course Superintendent through the Mechanic is also responsible for the maintenance of all machinery in all its aspects, including all health and safety requirements, as well as records of use, preventative maintenance, major servicing, adjustments, etc. He will recognize the heavy investment that has been made out of Club funds, and prudently preserve these investments.

The Mechanic is required to provide a yearly review and cost analysis of all items of equipment during the month of November. The review will include running hours on all the machinery. The club has a preferential agreement with the turf care equipment manufacturer John Deere that grants a large discount on new equipment purchases. The agreement is reviewed on a yearly basis to ensure the club continues to receive a competitive pricing arrangement when compared to other manufacturers.

All the machines used at Miklagard will be CE marked and insured according to Norwegian law. All drivers of machines will be given proper education in driving and operating the machinery. There will only be used original parts for the machinery at Miklagard Golf.

TRAINING

Training is an essential element in achieving a well-trained and motivated staff. Miklagard Golf Club is committed to help and encourage training and education through approved colleges. All permanent green staff are encouraged to further their education to the maximum of their individual abilities. In-house training days are

encouraged but should be arranged only when it is unsuitable for the staff to be on the course, i.e., large competition days.

OBJECTIVES

The objectives will necessarily alter as year's progress. The objectives are that Miklagard Golf Course should retain its position as the best-maintained and prestigious course in Scandinavia, and one of the best in Europe. The aim is to achieve international class playing conditions for as much as the Scandinavian golfing season will permit and at the same time cement a good basis for provision of the same the following year. It is to be maintained in excellent condition for the enjoyment of members of all handicaps and visitors. There will be an unabated drive to ensure that the course receives the correct maintenance required to minimize the effects of winter damage.

ORGANISATION

Working instructions is an important part of a good working environment. All greenkeepers will receive these upon signing of contracts. In order to keep a good working relationship among the workers a weekly meeting between the course superintendent, the head greenkeeper and the workers will be held. The General Manager will do his best to attend these meetings once every second week and the chairman of the board will attend the meetings twice a year.

All bills regarding maintenance will be signed and checked by the course superintendent or head greenkeeper.

TIMING OF WORK ON THE COURSE

General

Much essential work has to be completed before a certain time each day and within certain timescales during the season. Moreover there are times when play on the course will have to be restricted to allow the green staff to “set up the Course” for special events. As far as possible these restrictions will be kept to an absolute minimum. During special instances a policy of closing individual greens/holes may occasionally be adopted, in order to permit uninterrupted essential work to be carried out. Any such program will be notified to Members well in advance.

It is the insistence of the Board, that the General Manager and the Course Superintendent plan essential course work well in advance. Members will be kept informed via Miklagard’s web site and emails of any essential work and restrictions on play. The co-operation and understanding of Members will, however, be required if the Club is to maintain the present high standards, as well as seeking to achieve longer-term improvements.

Green staff shall have priority on the course ahead of competitions commencing prior to 9am. The course may be closed ahead of a limited number of published major events.

In order to limit the interruption of play for the players all the maintenance will be done in reverse order from hole 18 and backwards. If the maintenance or special occasions demands a different plan it will be changed without prior notice.

Hours of Work

The Green Staff work a flexible shift pattern depending upon the time of year, and the available light but is generally as follows: -

- ***April to September***
  7 a.m. - 3 p.m. – Though this may vary for big events

- ***October to March***
  8.00 a.m. – 4.00 p.m.

Additionally, all staff is rota’d for weekend and public holiday working, at the appropriate overtime rates, to provide for hole and tee marker changes, bunker raking and greens mowing.

THE COURSE

General

The Course is built on a heavy clay base. Clay is prone to compaction and is not suited to prolonged wet conditions where it will smear and compact resulting in loss of turf cover. Over use of the course by golf buggies is a particular problem when the clay is in a wet state and therefore buggies are limited to a maximum of fourteen. Restrictions on the use of buggies will only be imposed when it is deemed absolutely necessary due to very poor soil conditions.

Compaction has occurred in many areas around the course, especially around tees and adjacent to some greens, this is to be expected. The agreed policy will be to relieve compaction by intense aeration programs whenever possible. There is a general policy of incorporating more sand throughout the course to dilute the clay. This will improve macro-porosity and reduce the effects of compaction. Dressing and recycling will be done on a regular basis.

Clay also expands and contracts when exposed to large variations in temperature. Because of the extreme variation in soil temperature between winter and summer in this part of the world, soil expansion and contraction can adversely affect surface levels. This is a particular problem on the greens. Wherever an area of a green has "sunk" it renders it predisposed to winter damage.

There are few trees on the course. This open type of course lends itself to the integration of a natural looking "native grass" that adds a dimension that would otherwise be lacking. Without deep rough open courses tend to look more parkland in appearance and lack interest. However, this rough should not be penal and should allow the golfer to find his ball after an errant shot. In order to keep the "native grass" fences will be incorporated whenever necessary.

TEES

The tees are constructed with the same soil as the greens but to a depth of 200mm instead of 300mm. The sub-base that the soil rests on has a 2% slope. The idea behind this form of construction is that water should pass through the soil until it reaches the sub-base and then follow the 2% slope and exit by means of "seepage" through the tee bank. Regrettably, the tee banks are constructed with the natural clay from the site which prevents much seepage from taking place. The tees therefore retain the water and simply fill up to their surface. This type of construction method even when seepage does work makes for very wet areas around the tees which the Board regards as unacceptable.

Tees require hard wearing grasses that recover quickly from divots. The preferred grass species for our tees at Miklagard is a mixture of Poa Pratensis, Festuca and to a smaller

degree Lollium Perenne. Because the tees retain so much water prior the winter they are liable to suffer excessive winter damage. We generally experience over 90% kill on the tees and therefore have to overseed them at the beginning of each season. Because the tees are "bare" at the start of the season it renders them prone to Poa Annua invasion which is not an acceptable species of grass, which adversely affects both the appearance and infill properties of the tees. The future plan is to install a drainage system in all of the tees which will improve the grass's chance of survival through the winter and so afford the greenstaff a better chance of maintaining the correct species of grass on the tees.

Good maintenance of the tees is essential. Cutting to the correct height to encourage the desired species of grass, aerification, scarifying, top-dressing and fertilizing are all undertaken on a programmed basis.

The day-to-day maintenance of the tees

- Movement of tee markers on a daily basis
- Emptying of rubbish bins on a daily basis
- Divotting of any major damage, coupled with the removal of old divots on a daily basis
- The tees will be cut a minimum of 4 times per week at appropriate heights, ensuring care is taken not to scalp into the longer grass surrounding the tee. Tee markers will only be placed outside of the teeing area immediately prior to cutting and replaced immediately when cutting has been finished.

- The tees will be cut with single movers.
- Each tee's shape will be reviewed at the start of every season and new edges marked where necessary to ensure the corners are at 90° and all lines are exactly straight.
- Trimming of the stone tee markers on a weekly basis
- Regular inspection for weeds
- Aeration and scarification as necessary
- Top-dressing as necessary
- Watering as necessary
- If the tees experience excessive winter damage the tees will be closed until the surface can take the play without being destroyed. In this period markers will be moved to different tees.

FAIRWAYS

The fairways have shown marked improvement over the last couple of years, due to excessive dressing and recycling, nevertheless they can still improve in order to reach top standard. The general problem is the clay that the fairways are constructed of and the poor surface levels on some of the fairways. A decision was taken during the 2003 season to begin a program of dilution of the clay with sand to promote better grass growth and improve the surface levels. To facilitate this proposal a ″recycler dresser″ was purchased. This machine cuts thin channels through the length of the fairway and as the name suggests, recycles the channeled material and then spreads it on top of the fairway for re-integartion. This process typically generates approx. 100tons of material per Ha. A further 200 – 300tons of pure sand is then spread on top of this and mixed together by brushing. The third stage of the process is to incorporate the now mixed material into the upper profile of the fairways by shallow punch tinning. The fairway is then re-seeded and fertilized. The result of this effort is a better growing medium for the grass and a smoothing of the surface levels.

The fairways that have so far received this management have improved a great deal. Both the surface levels and growth are better and so far as we can tell the winter damage on these fairways has been less.

Another problem associated with the fairways is the areas that immediately surround the sprinkler heads. The reason for this is described in Appendix (Irrigation)

The maintenance of the fairways

- The fairways will be cut 3-4 times per week. On some occasions growth regulators will be used to reduce the frequency of cut and to encourage lateral growth
- The fairways will be cut in a 50/50 pattern or be “striped” in order to give the best visual effect
- The fairways will be cut between 12mm and 15mm in height
- Divotting of any major damage, coupled with the removal of old divots on a monthly basis
- Each fairway’s shape will be reviewed at the start of every season and new lines marked where necessary to ensure the edges and all lines are exactly according to the design plans from RTJ II.
- Regular inspection for weeds

- Aeration and scarification as necessary
- Top-dressing as necessary
- Watering as necessary
- Re seeding minimum once a year
- Verti cutting minimum once a year
- The cutting width will follow the cutting plan
- If the fairways experience excessive winter damage they may be closed until the surface can take the play without being destroyed
- Drainage works whenever necessary
- All CB`s will be controlled to ensure that they are working properly once pr year

SURROUNDS/COLLARS/CUT ROUGH AND NATIVE ROUGH

The distinction between the different playable areas that make up the course is achieved by “profile cutting”. Profile cutting is simply the term used for making these different areas distinct from one another by using different cutting heights and cutting patterns. Good use of profile cutting techniques has a marked visual impact on the course.

The maintenance of the semi rough & rough

- The semi rough will be cut 2 times per week. On some occasions growth regulators will be used to reduce the frequency of cut and to encourage lateral growth.
- The semi rough will be cut without displaying any discernable stripe pattern.
- The semi rough will be cut between 40mm and 60mmm depending on tournaments etc.
- Each area of semi rough shape will be reviewed at the start of every season and new lines marked where necessary to ensure the edges and all lines are exactly according to the design plans from RTJ II
- Regular inspection for weeds will be peformed
- Aeration and scarification will be undertaken as necessary
- Re seeding as required.
- Verti cutting minimum once per year.
- Drainage works whenever necessary.
- All CB`s will be controlled to ensure that they are working properly once per year.

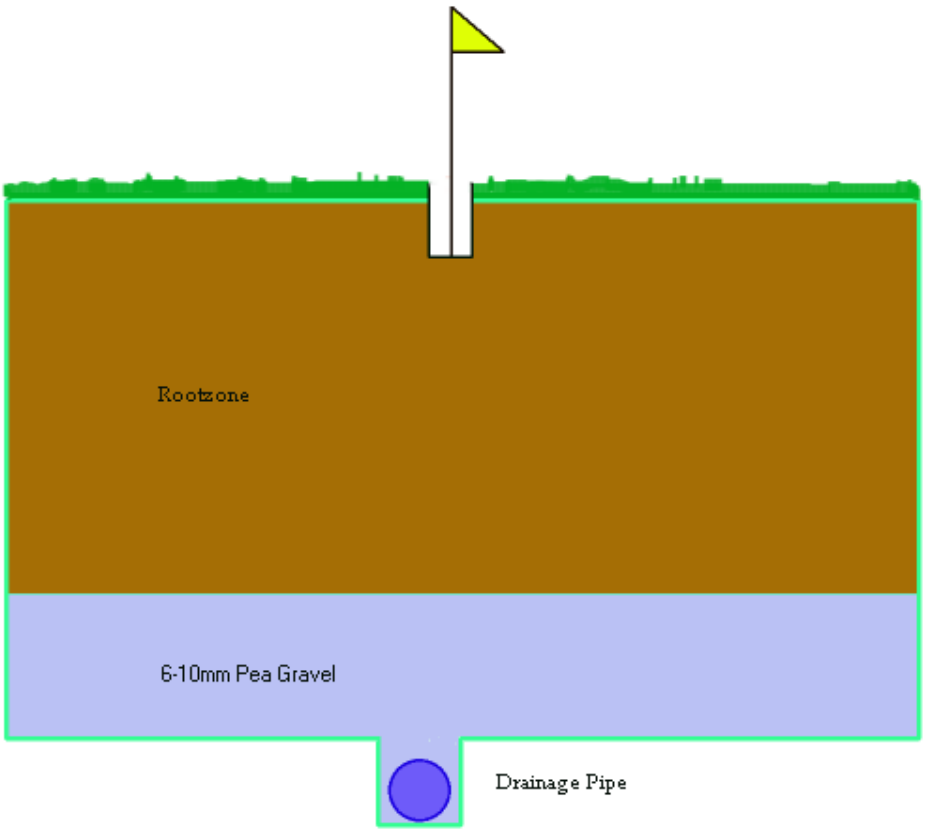
CUTTING HEIGHTS

A collar will be formed one greens machine width around each green (21″) and cut to a height of approx. 11mm. The approaches will be cut to the same height as the collars to a distance from the green of approx. 15 – 20m. All approaches will be changed to creeping bent grass as tied in with the SUB AIR system as soon as possible. Immediately adjacent to the collar will be an intermediate cut to a height of 20mm and a width 1.5m This intermediate cut will join with the intermediate cut that surrounds the fairway. The surrounds to the green will be cut to a height of 40mm - 50mm and join with the "cut rough" that surrounds the intermediate cut around the fairways - this should enable the ball to remain visible, yet slow it down. Any area outside of the cut rough identified as being well off-line, will be left in their natural state, for ecological and practical reasons. See cutting plan below:

Miklagard Golf, Hole #3

GREENS

It is currently the policy of Miklagard Golf Club to produce greens with Creeping Bent as the favored species of grass. When maintained correctly, creeping bent will produce the best possible putting surfaces which are true and firm with minimal nap. This species of grass also has a good reputation for surviving the harsh winter in Scandinavia/North America. It is true that creeping bent requires an intense maintenance program, but the rewards are in line with the general policy of the club - to provide an international standard golf course in every respect.
The construction specification is USGA which facilitates rapid drainage but with good water holding capacity. See Construction Specification Diagram below:



The Course Superintendent monitors the suitability of new cultivars of creeping bent for use on the greens. The basic criteria when assessing new cultivars is a particular grass's tendency to produce thatch, it's shoot density, disease tolerance, closeness of cut and winter survival. As yet no cultivars have been produced that are superior to what we use at the moment (G2/G6/A1/A4). The Course Superintendent has also initiated Miklagard Golf Club's own trial plots to assess the suitability of other species of grass for use on the greens. This is a long term initiative that will necessarily take a number of years to gain insight as to whether other species of grass are a suitable alternative to creeping bent. This is because of the protracted time required to assess a grass's suitability at surviving winter conditions and simultaneously provide an acceptable quality for tournament play,

MAINTENANCE

Much debate surrounds the maintenance practices here at Miklagard and how the club achieves its excellent standard of putting surfaces. The following is a brief synopsis of the general maintenance procedures undertaken to achieve international standard greens

Turf Maintenance

Creeping bent is stoloniferous. This means the grass propagates vegetatively by means of lateral growth via stolons. A grass that propogates vegetatively produces more shoots which

predisposes it to producing thatch and becoming "puffy". A puffy green is one that footprints and spikes up easily. Puffiness also makes it difficult to gain a true cut as the

mower tends to "dig in" when traversing across a slope resulting in a tram line effect that the golf ball bounces over. It is therefore essential that the greens are maintained in a manner that limits puffiness. When a green has become puffy the only effective method to eradicate it is to aggressively scarify it out. This tends to thin the green and puts the grass under stress. The secret is to maintain the greens in a way that stops the puffiness forming in the first place. To do this the greens have to be cut at a continuously low height of cut (approx. 2,5 – 3.5mm) which requires all aspects of the grass's general health to be strong and therefore able to withstand the stress that such low heights put the grass under. The grass also has to be frequently "lifted" and cut to limit lateral growth. This is achieved by either using brushes directly in front of the mowing reel before cutting or light "verti-cutting" prior to mowing. Limiting lush growth by restricting the amount of nitrogen that is applied the greens also prevents puffiness. At Miklagard the nitrogen content is frequently monitored by tissue analysis to maintain optimum levels. Puffiness can arise even when all of the aforementioned maintenance practices are in place. The reasons for this range from disease stress, drought stress, excessive rainfall and overplay that requires the height of cut to be lifted. When this occurs it is important to take corrective action as soon as possible by scarifying the puffiness out. This weakens the greens and temporarily may make them look objectionable. The skill is to know how to get the greens back to best condition as quickly as possible. To do this takes experience and knowledge and is difficult to prescribe in print.

Thatch

The more a grass has a tendency to produce excessive shoot density; the more likely it will produce thatch. Thatch is simply an accumulation of un-decomposed shoots, roots and stolons near the surface of the green. Some thatch accumulation is inevitable and, in fact, is desirable to give some cushioning effect against the abrasiveness of a high sand content rootzone. However, if left to produce unabated the effects on the quality of the green become adverse. Limiting the puffiness of the green by using the methods mentioned earlier helps to reduce the accumulation of thatch but, accumulation will nevertheless outpace decomposition. Other supplementary procedures to keep thatch in check are frequent high sand content dilution through top-dressing and physical removal of the thatch via mechanical processes. High sand content dilution creates better macroporosity which creates more oxygen for aerobic bacteria to function and so decomposition of the thatch is hastened. Mechanical removal of the thatch takes the form of either “plugging” the thatch out or deep vertical scarification to remove it. The maximum percentage via plugging that can be removed in one operation is approx. 10%. Deep vertical scarification will remove closer to 20% in one operation depending on the proximity of the tines to one another and the individual thickness of the tines used. It is important to know roughly what percentage accumulation of thatch is likely to occur over the duration of a season so that the amount of thatch removal operations can be planned in advance and the most appropriate method(s)

of removal applied. The organic matter content on the greens at Miklagard was measured in June 2004. The measurement was taken in the top 20mm of the rootzone and measured 1.9%. The original rootzone when installed in 2000 had an organic matter content of 0.4% which translates to an annual accumulation of approx. 20%. In order therefore to maintain

the current level of organic matter in the greens they would either have to be plugged on two occasions or deep vertically scarified on one occasions (percent accumulation minus percent removal).

Poa Annua

One of the most harmful aspects when the greens lose grass cover as a consequence of winter damage is the opportunity it provides for the ingression of Poa annua. Poa annua is an opportunistic grass that is capable of becoming the dominant species in golf greens when allowed to proliferate. This grass is capable of producing good quality greens with a slight modification in management practice, but unfortunately, it takes too long to recover from the winter. This would shorten an already brief season and therefore we must put measures in place to combat its ingress. At Miklagard, we have seen no large scale ingress of Poa annua. This is because of the maintenance practices throughout the year purposely favored a

strong, tight-knit sward that prevented the Poa from getting a foothold. However, in a year with extensive winter kill the greens will be open for the ingression of Poa annua. The policy for Miklagard will be to work constantly with keeping the Poa annua out of the greens by maintenance or by re turfing the green surface. The maintenance plans will also include reduce the Poa annua through appropriate maintenance. It should be noted that this is very difficult to achieve and the membership's patience is requested.

GREENS WINTER DAMAGE

Winter damage is probably the most difficult aspect of golf course maintenance in Scandinavia. It can be soul destroying for all personnel who are concerned with the running of the club and has obvious effects on the moral of the members. It is the firm policy of the Board that every possible explanation of why winter damage occurs on the greens is explored and potential solutions formulated. The general consensus of the other clubs in Norway has given the impression that many of them simply accept the damage caused by winter and "sidestep" the issue. This attitude is wholly unacceptable and we have therefore taken the lead in an attempt to secure a long term solution. The course Superintendent has pinpointed the scientific reasons that cause the death of the grass during winter and has conducted several tests in collaboration with educational establishments in an effort to find a long term solution to the problem.

The current initiative to combat winter damage has been the installation of a sub surface aeration system in all 18 of the main greens. A basic understanding of the mechanisms behind freeze injury and anoxia is necessary to develop a successful winter management

program if any chance of minimizing the winter damage on the greens is to be accomplished. The basic principles causing winter damage are set out below:

Freeze injury

This mode of injury occurs when a plant is subjected to extremely cold temperature or a rapid and severe drop in temperature. Exposure to the cold temperatures causes water to freeze within the plant. Ice crystals can form in and around the cells and, in doing so, can cause physical damage to cell membranes and cell organs. Turfgrass exposed to extremely cold temperature is often damaged in this way. At Miklagard the time of greatest succeptibility to this form of winter injury arises during the night time when decreases in temperature to less than zero celcius occur following the previous days partial thaw. This happens towards the end of the winter period when clear skies through the day initiate a thaw. However, the lack of cloud cover predisposes that a freeze will occur through the night and consequently winter injury ensues.

Suffocation (anoxia)

This mode of injury occurs when turf is trapped beneath ice or is under some other type of impermeable cover for an extended period. Soil microbes and the plants under the ice cover utilize oxygen as they respire. An anaerobic condition develops as the oxygen is depleted. The anoxic condition can kill the plant directly or predispose it to freeze injury. The trapped gases produce a foul, unforgettable odour that is due to the production of Hydrogen Sulphide Gas (H_2S) by Sulphur reducing bacteria. H_2S presence in late winter or early spring is the first indication that big problems may lie ahead. It should be noted that whilst the presence of H_2S indicates anaerobic conditions, it may be a by-product of microbial respiration associated with the decay of dead plant tissue as opposed to live tissue. This is undoubtedly the reason why sometimes the greens can survive even although the H_2S odour is present.

Picture showing water holding portion of green on RHS and unaffected free draining portion on LHS

STEPS TO MINIMIZE WINTER KILL AT MIKLAGARD

Height of Cut

It is important raise the height of cut in late summer to improve the plant's ability to photosynthesize and produce carbohydrates more efficiently. This has to be offset against leaving the height of cut too high as this can predispose the plant to grater instances of disease attack.

Affects of Shade

Turf growing in sunny environments also have a lower tissue moisture content and increased cell wall thickness. We continue to thin any trees causing shade problems (18th green)

Potassium

We supplement the fertility program with potassium to eliminate deficiencies. Potassium is an important nutrient used by the plant during the hardening process. Initiate the applications in mid August ready for the period when the hardening-off process of the plant begins.

Nitrogen

It is important to avoid heavy nitrogen applications during August and through September. Nitrogen applications that promote excessive shoot growth at the expense of carbohydrate storage and root development will negatively affect the greens chances of winter survival. Late fall dormant nitrogen applications made with a controlled-release nitrogen source should not impact the hardening-off process.

Water

The almost complete cessation of irrigation applications is necessary during September and October to reduce plant hydration. Predisposing the turfgrass to moderate drought stress will lead to greater hardiness and improve the plant cells' ability to survive the vagaries of winter damage.

Use of the Sub Surface Aeration System

The SubAir System can work in two modes – Vacuum and Pressure. We use the vacuum mode as we enter the winter period to mimimize the amount of water that the greens profile is holding (see point e. above). By removing as much water as possible from the green profile, macroporosity should be maintained which will help during the closing stages of the winter when the system is again operated in vacuum mode to help remove water from the surface during the thaw cycles. The system is also operated in pressure mode on an intermittent basis throughout the winter period to combat anoxic conditions. Pressure

mode is also employed during the day of the freeze/thaw cycle period at the closing stages of the winter to increase the speed with which the soil thaws. A typical pattern of use is shown below:

- 19:00 – 09:00 Pressure mode
- 09:00 – 19:00 Vacuum mode

It should be made clear that although the SubAir System is a valuable tool in the struggle to combat winter damage, it is also important to take other steps to increase the advantages that the SubAir System can provide. These steps include:

- Proactive removal of ice as conditions dictate
- Removal/reapplication of snow as conditions dictate
- Use of insulating sheets during cold nights to reduce the affects of freezing temperatures damaging the plant
- Use of barriers where applicable to stop water running on to the greens from higher surrounding land

A couple of final point associated with the SubAir system at Miklagard:

1. We currently have no “as built” greens drainage plans. This is important because the SubAir system requires that all exit points of the drainage underneath the greens is sealed when the system is in operation. If any exit point is not sealed then adequate pressure/vacuum force is not achieved and the system will fail to function. It is probable that at least a couple of greens have exit points that we have been unable to locate and it is therefore proposed that we subcontract a Ground Penetrating Radar survey of the greens to ensure we have adequately connected all possible drainage pathways. This will be undertaken during season 09.

2. Current observations indicate that where we have drainage channels connected to the SubAir system that circumvent any portion of the green; there is an almost 100% prevention of surface water running on to the green from the surrounding vicinity. This is significant because of the drive towards ensuring the greens surface is kept free from ice build up through the night to prevent winter damage in that form. It is therefore proposed that every green with surrounding land that is of a higher elevation should have a SubAir “interceptor” drain installed. This will be undertaken during the season 09.

NURSERY GREENS

As a precautionary measure it was decided that the club should hold its own stock of nursery grass for the greens in order to provide an instant fix if large scale winter damage occurs. There is now almost 3000m2 of Nursery grass available to utilize if required.

GENERAL DAY TO DAY GREENS MAINTENANCE

- (In normal circumstances) the greens are cut every day by pedestrian mowers.
- The cutting height is approx 2.5 to 3.5 millimeter. Whenever necessary rolling of greens will be done in order to increase green speed and ensure true putting surfaces.
- The greens will be “stimped” every day. In general the speed will be around 10’ on a normal day and between 11’ and 13’ on tournament play.
- Top-dressing occurs approx. every 10 days or as required.
- The pin is moved approx. 4 times per week. Members can get information about the pin positions on a pin placement map located in the pro-shop.
- The greens are brushed approx. 3 times per week to prevent lateral growth.
- The greens are lightly verti-cut/groomed approx. every 7 – 10 days.
- The greens are fertilized approx. every 10 - 14 days at very low rates
- 1 x tissue sample is taken from 3 greens every 10 – 15 days
- Chemical is sprayed only as required
- Water is applied only as required
- Water injection is administered as required
- Use of the Sub Surface aeration system is utilized when required.
- Re-seeding is undertaken as required.

IRRIGATION

Judicious use of the automatic irrigation system, coupled with some hand watering is essential in relation to the prevailing climatic conditions and soil moisture content. Watering should not, however, be used as a means of creating artificial holding conditions for balls being played into greens, which is contrary to policy. Similarly, hand watering is used solely to alleviate stress and prevent the risk of dieback in hot, dry or drought conditions. Irrigation is used as a means of elongating the roots to provide as deep a reservoir as possible for them to tap into. This is achieved by "deep watering" infrequently when conditions permit there bye making the roots delve deeper in search of water. Through time the frequency with which watering is required lengthens and so a firmer surface ensues. The overall purpose of this policy is not to provide firm putting surfaces per se, it is rather a consequence of encouraging deep rooting to ensure the healthiest possible grass able to accept close cutting heights for the reasons cited earlier.

The irrigation system is under-specified and a rolling program of upgrading the system was begun in 2004. The following upgrades will be implemented over the next 4 – 5yrs:

- Back-to-back valve-in-head sprinklers installed around the greens
- Swing joints attached to all irrigation heads enabling proper leveling of all sprinkler heads throughout the course. (this is the reason why the levels around the sprinkler heads are so poor)
- Increase the number of sprinkler heads around the tees
- In-field remote control operation to limit disruption to play
- Re-positioning of valve boxes from the fairways to the roughs
- Installation of a weather station integrated with the irrigation system

BUNKERS

There are two major areas of concern with respect to the bunkers, sand consistency and the native grass that encroaches into some of the bunkers. Bunker sand is an emotive issue that most clubs have trouble with. It is the policy of Miklagard Golf Club that a more suitable sand is acquired that has better colour and compaction properties. The club will be testing various sands in a few bunkers throughout 2009 and will hopefully be in a position to confidently select the new sand for use during the season 2010.

The long grass around some of the bunkers serves two purposes, to better integrate the bunkers into the overall design concept of the course and for practical reasons. The Board are in agreement with this logic but are keen to stress that the grass should not be too thick around the bunkers enabling the players ball to be easily found and also straightforward enough for him/her to play from. To this end, grass surrounding any bunker on the course not fulfilling these criteria will be either cut short, or the existing grass removed and replaced with fescue dominant species which will grow “wispy”.

Bunker fringes should be edged and trimmed to a height that will permit a ball to be gathered into the hazard. Each bunker is to have its own rake, 2 - 5 rakes for the larger bunkers. Rakes should be placed inside bunkers.

The maintenance of the bunkers

- The bunkers will be raked mechanically 3-4 times per week.
- The bunkers will be inspected for weeds once per week and any found will be removed.
- The edges of the bunkers will be trimmed every 7-10 days
- The depth of sand will be maintained at a consistent 100mm. All bunkers will be soaked and vibratory compacted once per year.
- The sand will meet the standard set out by The European Tour
- The construction of the bunkers will avoid standing water.

WATER FEATURES

Miklagard Golf has 5 substantial lakes that run through the middle of the course. All water used for irrigation is supplied from the lakes and all drainage throughout the course is diverted to the lakes (recapture system). The lakes at Miklagard will all be deemed “lateral water hazards” and will be clearly marked with red stakes or paint in accordance with R&A rules. It will be an objective to keep all water bodies free of algae and cleaning of the lakes will generally be undertaken once per year.

THE PRACTICE FACILITY

The practice facilities on Miklagard consist of:

- A driving range of 300 meters in length with Titleist NXT Tour range balls
- Two grass tees totaling 4500 square meters.
- A pitching green and a practice bunker
- A short hole course consisting of six holes from 70 to 145 meters.

The training facilities are maintained in the same manner as the rest of the course. The cutting height on the range will ensure that ball picking on the range is possible in a prompt and efficient way. The greens on the training facility will be as close in quality to that of the main course as possible.

The board has initiated an improvement program geared towards improving the training facility with additional putting and chipping greens. It is the clubs aim that this facility will become the best training location in Norway.

PATHS AND RUNWAYS

In order to maintain the course in an efficient order a course needs paths and runways. On Miklagard we have a large number of paths and runways and it is a goal to improve these constantly.

The paths and runways at Miklagard should be defined and marked out with stakes. Paths and runways that damage the surrounds of greens and tees are to be avoided. The paths and runways will be the main transport line for all machinery including buggies and course marshals.

FERTILIZER AND CHEMICALS

Fertilizer requirement on the course is determined by the use of leaf tissue analysis, soil analysis and visual interpretation. Adjustments are implemented where necessary according to the prevailing and forecast weather patterns. The nutrient requirements on the various areas of the course are largely dictated by the conditions at that time but all applications are administered to prevent any leaching of nutrient in to water ways etc. Miklagard employs a “little and often” policy of fertilizer management.

CLOSING OF THE COURSE

The Course may be closed on the authority of the Course Superintendent/Head Greenkeeper when unusual weather conditions have occurred and damage to the Course would result if play were permitted. Such conditions would exist if the greens were waterlogged, if the course was flooded and during severe frost or snow. During a competition the Course may be closed by the General Manager, or any authorized individual supervising the competition, if they consider that the course has become unsuitable for play due to any reason such as flooding, thunder/lightning, fog, snow, or any other reason. The General Manager will ensure that competitors are made aware of this advice. This advice is designed to be of help and guidance. Miklagard Golf Club is not liable for any damage or injury caused by the following of this advice. A decision to re-open the Course may be taken at any time after an inspection by the aforementioned authorized persons, who will ensure that it is safe to resume play. The following signals will be used to announce decisions:

- One prolonged klaxon blast (repeated) Suspension of play
- Two short klaxon blasts (repeated) Resumption of play
- Four short klaxon blasts (repeated) Cancellation of play

When play is suspended, if the players in a match or group are between the play of two holes, they shall not resume play until a resumption of play has been signaled. If they are in the process of playing a hole, they shall discontinue play immediately and shall not thereafter resume play until a resumption of play has been signaled. If a player fails to discontinue play immediately, they shall be disqualified unless circumstances warrant waiving such penalty as provided in Rule 33-7. On the signal for suspension of play being given Competitors, Caddies and Spectators should proceed to the nearest shelter or vacate the course. However, if the suspension is due to the proximity of an Electric Storm, golfers or caddies should leave clubs well away from where they are sheltering. They should **NOT** walk or shelter under trees; stand on high ground; shelter in any building with a metal roof, put up an umbrella; use a mobile phone. They should keep as low as possible, if necessary crouching in the nearest bunker. Resumption of play will be signaled by two blasts of the

klaxon. . Competitors and Caddies, sheltering in the Clubhouse, will be informed that play will be resumed shortly, and will be given sufficient time from this notification to the two blasts of the klaxon, to reach the point on the golf course where they were when play was suspended. When Competitors and Caddies have been given chance to get back to where they were when play was suspended, the klaxon will be sounded (two short blasts).

No Competitor shall resume play until the two klaxon blasts have been blown. Failure to comply (Rule 6-8b) shall lead to the Competitor being disqualified.

ETIQUETTE AT MIKLAGARD

[ALWAYS REPAIR ANYTHING YOU SEE, EVEN IF YOU DID NOT DO IT YOURSELF]

- "Please Repair Pitch Marks"
- "Please Rake Bunkers" Push the sand towards the bunker faces, do not pull it to the rear. It is no excuse if there is no rake available, a club can always be used "Please Replace Bunker Rakes" Rakes should be replaced inside bunkers.
- "Please Replace Divots" Whilst not all replaced divots take, a high percentage do and thus help the course recover more quickly.
- "Pick up any litter" Take it and discard it in the nearest bin. There is one by every tee
- "Buggies, Electric and Pull Trolleys" Do not take them on to tees, greens, green approaches and surrounds, and between bunkers and greens.
- "Keep Dogs on a Lead" Members are only permitted to take dogs on the course on a lead
- "Clean up Dog Dirt" Dog dirt should be collected immediately by the owner and removed from the course, as it represent a Health and Safety hazard whilst grass cutting etc.

COMPLAINTS

Members and visitors may not, under any circumstances, complain about the conduct of a member of Staff, nor about the state of the Course, to any member of the Green Staff. Any complaint must be made to the General Manager, who will investigate the matter together with the Course Superintendent or in his absence the Head Greenkeeper. If they cannot deal with the complaint themselves, the matter will be submitted to the Board.

ECOLOGY

Miklagard Golf Club is committed to working in conjunction with its natural surroundings and the general ecological environment. We believe that to neglect our obligations in this respect would be detrimental to the enjoyment that the members receive when playing their round of golf. An ecological audit will be performed once every 3 yrs and posted on the clubs web site.

HEALTH & SAFETY

The General Manager is the Clubs Health and Safety Officer, and co-ordinates all Health and Safety issues throughout the Club. Miklagard Golf Club maintains a Health & Safety Policy, which shall be distributed to all members of the greenkeeping staff, together with a comprehensive Risk Assessment policy. The Course Superintendent is responsible for maintaining and updating the Club's policies relating to greenkeeping issues, in consultation with the General Manager. All accidents and/or incidents must be reported to the General Manager as soon as possible, for recording into the Clubs accident/incident book. Players have a responsibility for the Health and Safety of themselves and others whilst on the course.

COURSE PLANNER

Miklagard Golf Club is committed to maintain an accurate, quality course planner for sale in the Professionals shop. The course planner is reviewed every second year by the general manager and the superintendent, and the sales manager who is in charge of designing the course planner.

WEB SITE

Miklagard Golf Club is committed to provide comprehensive details of the course via the Clubs web site www.miklagardgolf.no. The web site is reviewed constantly by the clubs webmaster.

INFORMATION

General information from the greenkeeping staff will be communicated thru the website and thru Miklagard's mailsystem.

All daily information regarding work on the course will be communicated on the first tee, thru the administration and in the Proshop.

Once a year a meeting between the different departments will be held in order to get information regarding the quality on the course, and how we can best preserve it. This is done so that everybody working on the facility can answer questions about the course when enquiries are received from the players.