

Karratha Country Club
Green the Greens Project

**FINAL GOLF COURSE MASTER PLAN
&
IMPLEMENTATION REPORT**

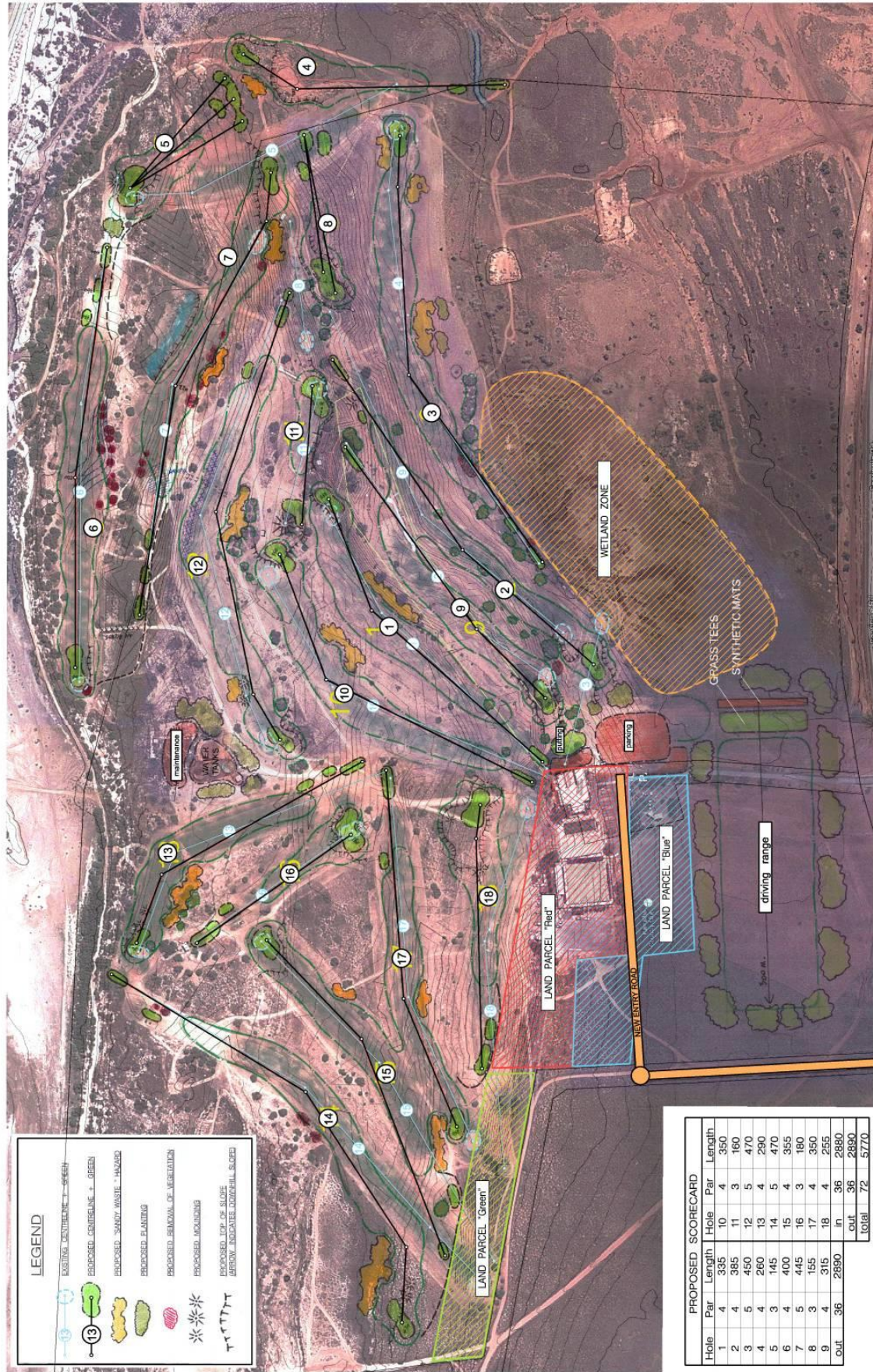
Appendices
May 12, 2014



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Appendix 1
Design Summary - Option 1



Title: Golf Course Concept Plan #1
(Minor Change)

Client: Shire of Roebourne
Project: Karratha Country Club

Scale: 1:1250 (BAO)
Drawing No: KCC-CP-01
Date: March 2014



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Hole 1 – Par 4

This hole will play between 310-340m depending on the final restrictions in the clubhouse development.

The hole plays through the existing fairway corridor however the new green should look for slightly more undulation in the land and moved slightly to the right.

The new “sandy waste” should wrap along the right side of the fairway and sit nicely in against the natural dune.

The new green should be angled from right to left which will mean the players will need to take the risk of hitting it near the sandy waste on the right to obtain the best line to the target.

The small trees dotted on the fairway should remain as they add a certain “quirk” to the aesthetics of the golf hole.

Hole 2 – Par 4

There is an opportunity to swap holes 2 and 9 on this plan. The golf holes are drawn on the plan to walk up the hill (about 150m) from the 1st green to the 2nd tees. This hole is played down the current 9th fairway to a green that sits out in the middle of the current 3rd fairway. Whilst the walk is a little longer it was devised to get the new 9th green closer to the clubhouse and also provide a safer and shorter walk from the 2nd green to the new 3rd tees. Effectively it comes down to a decision of preferring the longer walk from the 1 to 2 or the walk from 9 to 10.

Most of the “quirky” trees should remain on the fairway and the hole should play at a strong 390m.

Hole 3 – Par 5

This hole is effectively the current 4th hole with far better strategy.

In my opinion the tee shot is far too hindered by the trees. Whilst the vegetation down there near the tees is very impressive it is too tight, and unfair, as a tee shot. Some trees need to be removed to provide a fairer shot for all levels of players.

A sandy waste zone should be built on the right side of the fairway to stop the long hitters aimlessly bombing it over the corner. The hole will still play at about 450m however they will need to flirt with this sandy waste to achieve the best line of attack to the green.

Another “carry point” of sandy waste will be situated about 40m short of the green which will require far more thought in the lay-up shot. With the green angled from right to left, the lay-up will need to be hit to this right side to achieve the best angle. The further the golfer bails to the left side the harder the approach shot becomes.

This green has been drawn in a similar location to the current green however with some additional modifications to the fairway it could swing further to the right to become closer to the new 4th tees.

Hole 4 – Par 4

This is a brand new golf hole from tee to green. The current golf hole that hits blindly over the hill is extremely unsafe and we believe this new golf hole is a significant improvement and potentially one of the most exciting on the layout.

There is a strong opinion that the short Par 4 hole is possibly the best and most exciting type of golf hole. The hole needs to be designed at an achievable distance from the tee so that many

players, not just the really long hitters, have a chance to hit the green. If this pinpoint shot is executed well then the possibility of an eagle or birdie is a distinct possibility. Of course the penalty for not executing the perfect golf shot must be severe to ensure a daunting recovery shot.

The terrain up near the current “quarry site” is ideal to achieve this type of golf hole. If the tees are moved back beyond the current 5th tees (about 100m) then this will create a carry point over the quarry edge of about 200-220m which is quite achievable by many. The markers on this new tee should be moved to provide maximum temptation for the golfer. If the golf hole is too long in the prevailing wind and a forced lay-up then the golf hole will not be nearly as effective. We need to entice as many players as possible to “have a go”.

The entire area inside the “quarry” should be converted to short grass so that a low running shot may also run up onto the green. If the tee shot is sliced down onto the lower right side then the recovery will be extremely difficult with a narrow target to aim at and a sandy waste strip behind the green.

Those not attempting the hit to the green will still be faced with decisions for their lay-up position. The left side is definitely preferred to ensure an approach shot towards the best angle of attack.

The green sits up on top the high ground and will obtain the best views on the golf course.

Hole 5 – Par 3

As a result of re-building the new short Par 4 the 5th now becomes a beautiful downhill Par 3 with the fantastic water backdrop. It will likely be used as the “postcard hole” for marketing purposes.

Initially the green was considered to fit in the same space the current 5th green sits however with the low point in the front the space is fairly constrained. The decision was to move the tees forward on the “Moose Hole” and use the entire space, including the 6th tees for a large expansive Par 3 target.

Many pin positions will be presented on this new green and it will be a terrific golf hole with a magnificent view. It should play about 140-150m.

Hole 6 – Par 4

The 6th hole, or “Moose hole” as it is affectionately known, is to be shortened to be a long, strong Par 4. I have little doubt that this will be the Index 1 hole on the layout.

The current tee location, as a Par 5, makes the landing zone quite awkward as the terrain runs away to the edges of the fairway, and often under a bush. The fairway has a “dome” effect and is extremely difficult (and unfair) to hit. The movement of the tees forward reduces this unfairness however the landing area still requires some re-shaping works to provide a more receptive shape.

The left edge of vegetation should be removed so that players are not “dead under a tree” for a tee shot only slightly missing the fairway. The vegetation along the right side of the golf hole should remain intact to abide with the Coastal Dune requirements.

The second shot will still be a narrow difficult approach however the green should be moved forward slightly and raised to bring above the tidal height. This green is one of the lowest points on the property and effected by storm surges and salt issues.

Hole 7 – Par 5

The reduction to a Par 4 for the 6th hole is replaced by the extension to a Par 5 hole for the 7th.

Some work needs to be considered in front of the 7th tees so that the carry distance is not too severe for the shorter hitters. This land is quite low and also affected by salt issues with the rising water table and lying water from flooding. There is a thick bush that also blocks visibility to the left side of the fairway and it should be removed.

There should also be some vegetation removal along the right side of the tee shot to provide a little more reprieve on a very difficult driving hole.

As we get past the current green site it climbs slightly up the hill to a spare area of land in the middle of the current 5th fairway. This land has been made available with the re-adjustment of the current 5th hole.

In an effort to create as much variety as possible with the green sites we had been looking for an opportunity to build a green atop the strong ridge and this is our best opportunity. The Par 5 will not be overly long, about 460m, but the approach to the green will feature some really interesting and tricky terrain.

There is a natural indentation of the terrain to the right of the current 7th green that would be ideal to introduce some sandy waster and this will work beautifully with the angle of the green on top of the ridge. Those attempting to get home in two shot will need to carry this sandy waste zone and those laying up will need to position their ball close to it for the best line in.

The left side of the green will be mown short and if the golfers hits the approach slightly left it will run the ball some distance from the green. The right side of the green will be less severe and definitely the side to “miss” the target.

We believe this new green site will make it a far better Par 5 than the current 6th hole.

Hole 8 – Par 3

With the extension of the 7th hole the 8th will need to move to the southern side of the ridge line for safety. The golfers will walk back down the current 5th fairway to a new tee that plays towards the current 9th tees. There is certainly some interesting and subtle movement in the land there that will allow the creating of an interesting green complex.

The lay of the land will slope down from right to left and this will create an opportunity to bounce the ball in from the right while some testing “carry points” can be injected into the left side of the new green.

This green can be built long and narrow and will present lengths between 130-150m.

Hole 9 – Par 4

As mentioned earlier there is the opportunity to swap the proposed 2nd and 9th holes. If the longer walks are accepted then the golfers will walk past the 2nd tees and play the 9th (which is the current 2nd hole).

The green will be much better situated a little longer and right of the current target. This will basically sit atop a ridgeline and require precise approach shots. This will not be a long Par 4 at about 310m however the placement of tee shot is paramount.

The steep slope off to the right side will capture many tee shots and leave a very awkward angle of approach. The new green will be situated much closer to the hub of the clubhouse precinct.

Hole 10 – Par 4

The 10th hole basically plays in its current form however careful placement of the tees are required to ensure safety to the new 9th green and the proximity to the proposed clubhouse enlargement.

The hole swings gently to the right and an area of sandy waste built into the right side of the fairway. The green could also be moved slightly to the right in the search for more movement in the natural terrain.

We should look at subtle design features so that the 1st and 10th holes have their own individuality even though they are both Par 4's that bend slightly to the right.

There is also the idea to add a particularly exciting feature to the design of any future clubhouse works. With the focus for golfers congregating on the first floor of the future clubhouse deck there might be an opportunity to build an artificial tee on the same decking area. This tee could be used as a tiger tee for the 10th hole. There is a similar tee built on the first hole at Royal Sydney and it is only used in significant championship events. It would create a very exciting feature for the golf club if it can be executed safely.

In addition to providing a Tiger Tee on the 10th hole it may even be able to be utilised for a chipping tee to the 18th green. This could provide a really fun activity at the end of the weekly game when all of the participants are out on the decking area.

Hole 11 – Par 3

Depending on tee and green locations this golf hole can play between 130-150m.

The tee currently sits atop a small mound and the tee could move slightly right and have the playing line hug the edge of the strong sand dune on the right. The green could be built in the same location or slide it further back towards the current 8th green site. The green could be a little more generous in size with some of the right side pin locations slightly blind to the players on the tee.

The keys to building a good Par 3 is to provide variety in the various pin locations and this green site could prove to be very good. The finer details of this location will be determined in the detailed design phase.

Hole 12 – Par 5

With the removal of the current 8th hole there is the opportunity to extend the length of the 12th. The tees can move back up to 30m longer as required. There had been some concern from the long hitters reaching the 10th green and by moving the tees back this will improve its safety.

The fairway also has an awkward run off zone to the right side off the tee and appears to run a lot of golf balls down towards the 7th. There should be some earthworks undertaken to soften this effect and create a more receptive fairway shape.

The implementation of some sandy waste zones, left off the tee and then on the right as we approach the new green, will inject far more strategy into the golf hole not just hitting it as far as possible. The green could be moved a little to the left, which will shorten the walk to the next tee and almost create an unusual green sloping from front to back into the natural ground.

There should also be some significant planting done on the right to camouflage the maintenance area and effluent storage tanks.

Hole 13 – Par 4

Whilst certainly blessed with some of the best grass coverage on the fairway this golf hole is quite simple in appearance yet quite impressive.

There is a nice tree close to the green on the left side however I believe this hole could be another short Par 4 that tempts the golfer into the heroic shot. With the tees moved up and the green moved forward, in front of the feature tree, the hole will play very well at about 290m.

The green should be built up and angled towards the tee. This will tempt the golfer to clear the new wasteland area and get close to the green. Those spraying the tee shot away from the danger on the right will be faced with a more difficult line in.

The slope away from the right side of the green should be accentuated and provide an awkward chip shot. Those not opting to attack the green from the tee will need to lay up close to the sandy waste on the left for the best line of approach.

Hole 14 – Par 5

This Par 5 plays though the same fairway corridor however restrictions near the green for future development mean the new green needs to swing to the right into the spare land. This change is certainly not a negative factor as it will create a more strategic shot into the green.

From the tee there should be some minor tree clearing along the right side to allow the golfers to take a short-cut to the green. Once the tee shot has been hit there will be the choice to lay-up or attack the green.

The green will sit into a slope and the front edge can be guarded by sandy waste. This will create a diagonal hazard that will ask the golfer to chew off as much as they dare with their approach to the green. The hole will play at about 470m so the temptation for the longer hitters to reach the green is there but will require a more heroic shot than the current golf hole.

There is ample land on the left side to lay up however subtle variations in the green shape will demand a slightly different lay-up point for each pin location.
This golf hole will be better off for the forced change.

Hole 15 – Par 4

With the restrictions imposed for the possible future development this hole has been shortened by about 40m. It would be ideal if there can be space provided during the planning phase to retain as much length as possible.

The hole will play as a solid mid-length Par 4 into a predominant prevailing wind.

The green will feature some subtle terrain movement in front and to the sides to receptively receive a golf shot. The tee shot should probably remain hazard-free from bunkering to give the golfers a fair chance to play the golf hole, often into a prevailing wind.

Hole 16 – Par 3

The current 16th hole is possibly one of the more mundane and least impressive on the current layout. There are some unusual plantings of small trees on the fairway that do not appear to add much by way of aesthetics or strategy.

A new green will be produced that is fairly expansive and will feature a variety of pin locations. This Par 3 should still remain as the longest and strongest however with a far more interesting target.

Hole 17 – Par 4

The subtle movement in the fairway terrain is definitely one of the features of this golf hole. The subtleties in the terrain movement typifies true links golf where little bounces here and there can send a golf ball into the best playing line or away from it. These inconsistencies are part of the game, some call it “rub of the green”, and it is why links golf is so popular throughout the world.

Unfortunately the hole must also be shortened due to the future development area however as with the 15th every effort should be made to maintain a space and maximise the distance of the golf hole.

The hole will still gently flow to the left and there might be an addition of a sandy waste zone on the left side off the tee. This will force many to the right however with a green shaped from left to right the angle of approach will be much more daunting.

This hole currently features some Palm trees at the rear of the hole and generally do not suit the openness and links nature of the golf course. The palette of tree species and vegetation chosen should be native types and proven to thrive in the area. There may be other opportunity to move these Palms to other areas away from the golfing precinct.

Hole 18 – Par 4

The 18th hole is one of the trickiest to adjust with the new development restrictions in force. The tees immediately need to be moved down the hill however the most care should be directed towards the safety on the right side of the hole.

Whilst there are no definitive regulations regarding the proximity of housing/roads and golf holes there is a general consensus amongst reputable golf course architects that the centreline of a golf hole should be no closer than 60m from the property boundary. Whilst this may appear to be a “safe” distance on paper, we all realise that golf balls can be hit in some extremely erratic directions and the safety distance would need to be much further than 60m to be 100% safe. We ultimately need to decide on a safe distance that the golf course can function effectively whilst providing a fairly safe surrounding for other pieces of infrastructure.

In saying that, the golf hole needs to be moved further to the north to ensure adequate distance on the right side. The resulting space will present a fascinating short Par 4 that should provide

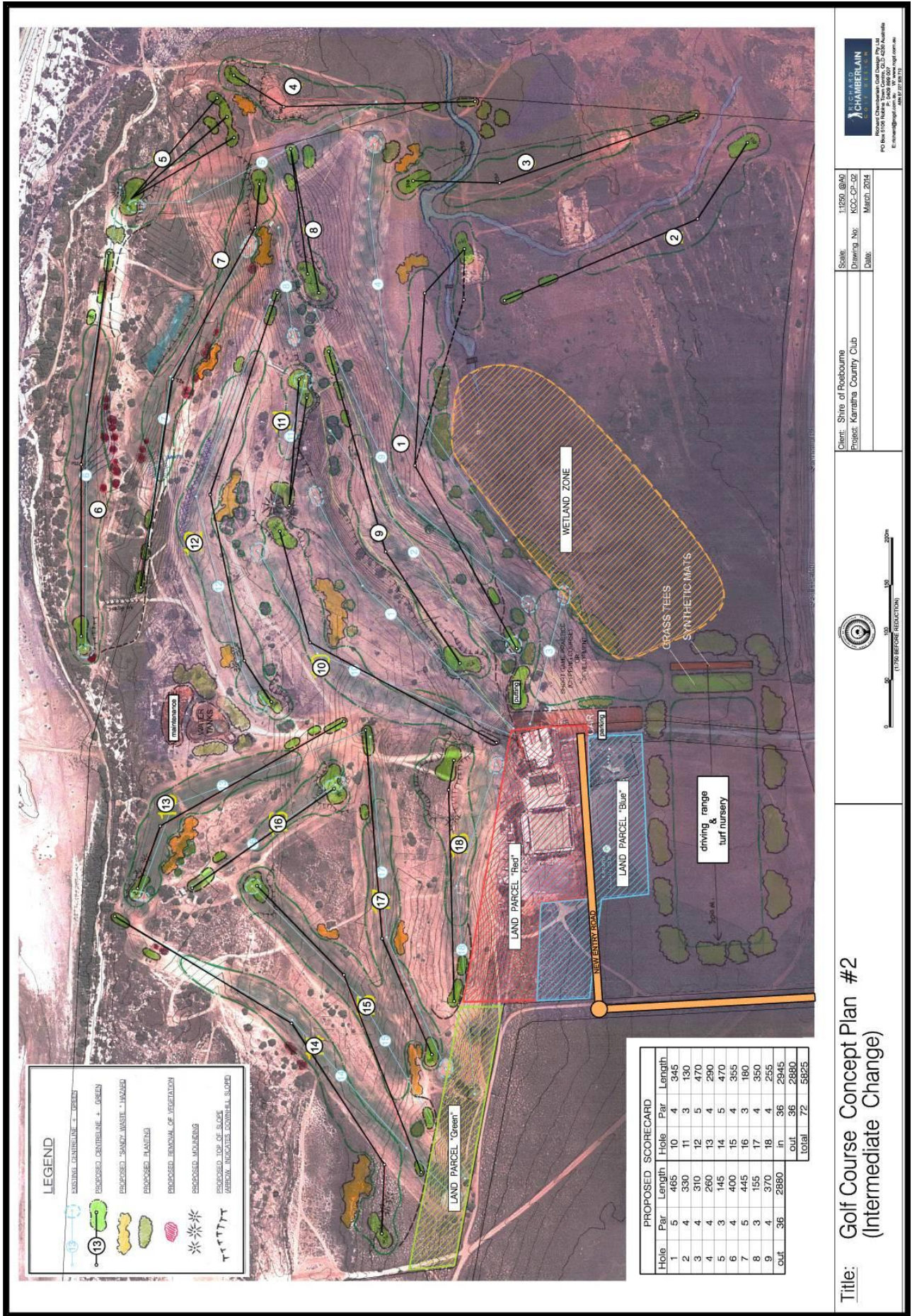
terrific climax to the round at Karratha. The golf hole may only be 240-260m however it will possess the same enticement and excitement levels as the new 4th and 13th holes.

With the last tee shot of the day the golfer will have the opportunity to hit a narrow “landing pad” in front of the fairway that will allow the ball to chase up on the green. A well-executed shot will result in many birdies, eagles and possible even some aces. It is likely to leave the golfer with a very positive feeling at the end of the round.

Of course, in the tradition of great short Par 4 golf holes there needs to be significant penalty for missing the target. There is already a low hollow in between the clubhouse and the 18th green and whilst the green is moved further away for safety this hollow should be retained and emphasised. There should be a severe drop off on the right side of the green so that recovery shots from this right side will be treacherous. The difficulty of this penalty must be enforced to ensure the “maximum risk” and “maximum reward” for the shot selection.

Viewing this hole from the clubhouse, during major events will be particularly entertaining and a fantastic viewing opportunity.

Appendix 2
Design Summary Option 2A



Hole 1 – Par 5

With a much more generous space available the new 1st tees can be built on the site of the current 2nd green. The hole can be directed towards the current 4th fairway however kept to the left on the group of Eucalypts on the lower side of the land. These trees are very beautiful and with the fairway structured like this the entire row of trees can be kept and used as a great aesthetic feature of the golf hole.

An area of sandy waste has been shown on the plan at the end of the fairway which is fundamentally a sight line to indicate the end of the short grass.

The advantage of creating a wider creek bed is the ability to gain more material to build up other fairways and greens out of the lower flat land. This will be particularly significant on the next hole.

Hole 2 – Par 4

After reaching the edge of the current layout the 2nd hole heads due south and plays as a Par 4 of about 320 – 340m.

This hole is built on very flat, lifeless land and some earthworks will be required to create some shape and subtlety in the terrain. The advantage of this hole is that it almost reached Sea Ripple Road and can be clearly visible from the roadway. This feature was requested during our initial meetings.

The golf hole will be quite simple in its architecture but the meandering creek line will again provide a great strategic element to the hole. Hit near the creek line to achieve a better line in and hit away from it and be punished.

Hole 3 – Par 4

The brand new 4th hole is another short Par 4 of about 310m that is featured with a green positioned close to the new creek. Some golfers may try to hit a long tee shot up the right side, carry the creek and obtain a much easier flick in. Those laying up will need to consider the position carefully for the best angle in.

Once again earthmoving will be required to achieve a nice golf hole however it is certainly achievable.

Hole 4 – Par 4

(Refer Layout 1 Description)

Hole 5 – Par 3

(Refer Layout 1 Description)

Hole 6 – Par 4

(Refer Layout 1 Description)

Hole 7 – Par 5

(Refer Layout 1 Description)

Hole 8 – Par 3

(Refer Layout 1 Description)

Hole 9 – Par 4

The 9th hole on this layout is very similar to the hole in Option 1 however with the tees slightly lower into the hillside.

Hole 10 – Par 4

(Refer Layout 1 Description)

Hole 11 – Par 3

(Refer Layout 1 Description)

Hole 12 – Par 5

(Refer Layout 1 Description)

Hole 13 – Par 4

(Refer Layout 1 Description)

Hole 14 – Par 5

(Refer Layout 1 Description)

Hole 15 – Par 4

(Refer Layout 1 Description)

Hole 16 – Par 3

(Refer Layout 1 Description)

Hole 17 – Par 4

(Refer Layout 1 Description)

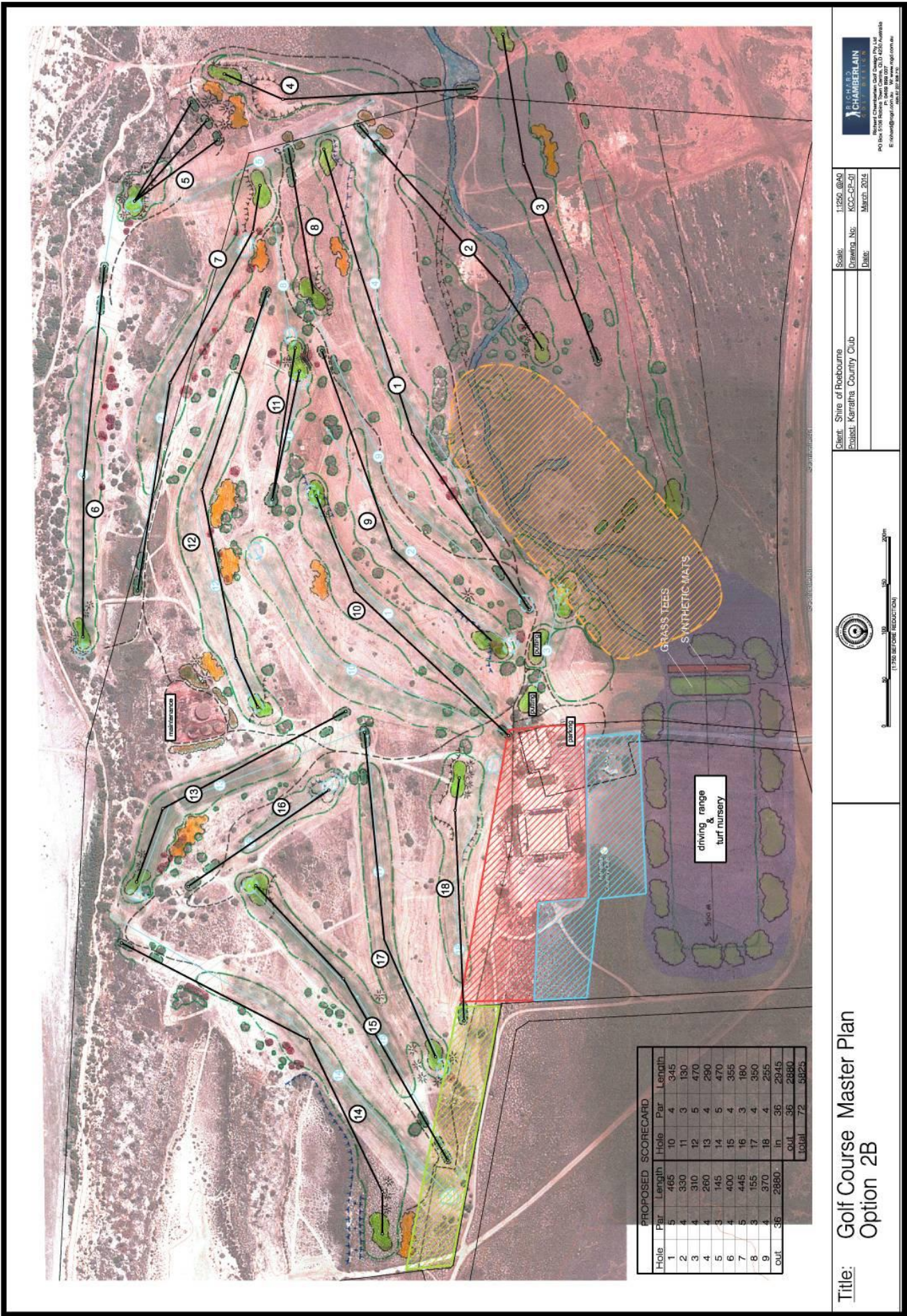
Hole 18 – Par 4

(Refer Layout 1 Description)

Appendix 3

Master Plan Option 2B

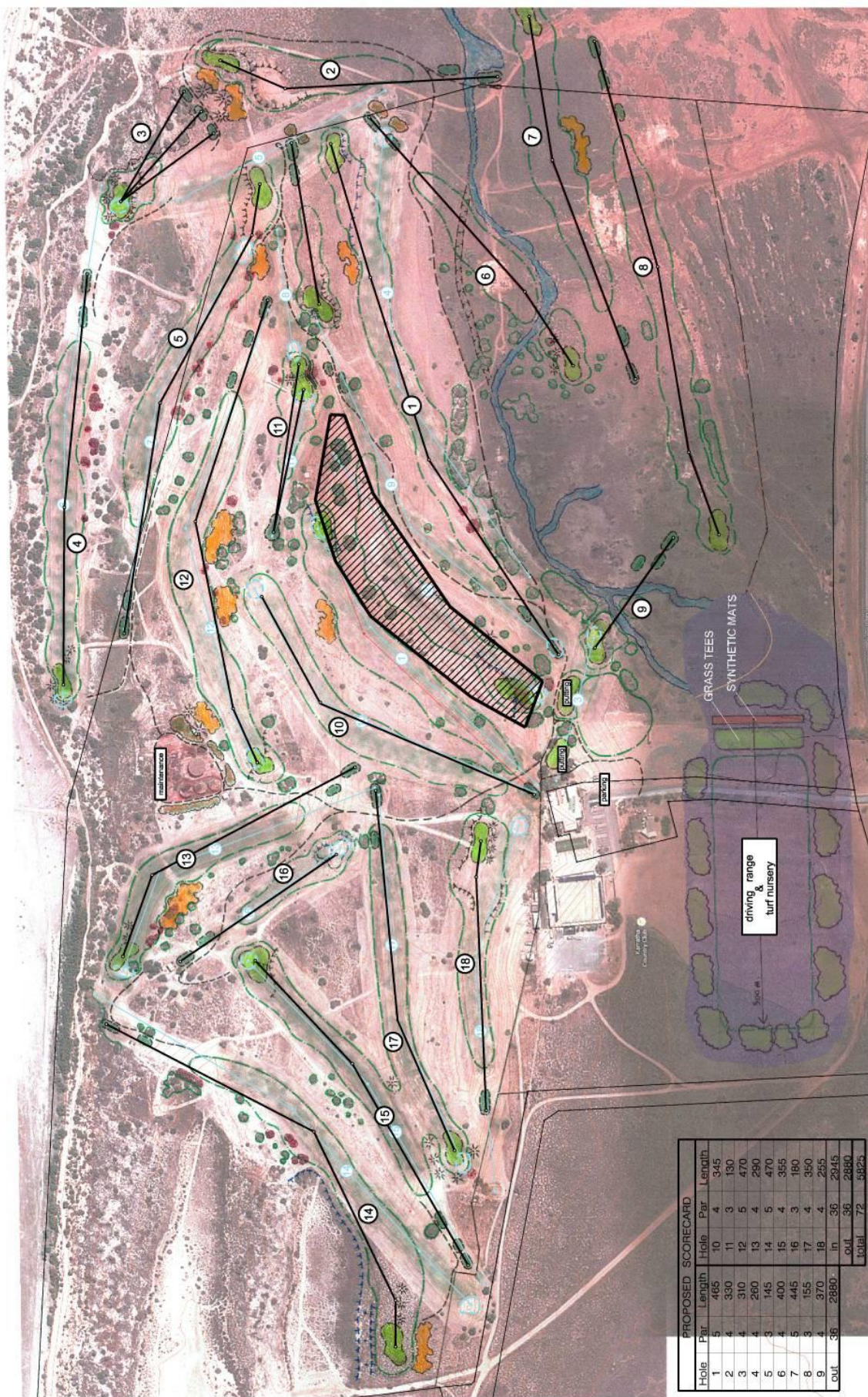
Individual analysis discussed in the main body of this report



Appendix 4

Master Plan Option 2C

Individual analysis discussed in the main body of this report



PROPOSED SCORECARD				
Hole	Par	Length	Hole	Par
1	5	465	10	4
2	4	330	11	3
3	4	310	12	5
4	4	260	13	4
5	3	145	14	5
6	4	400	15	4
7	5	445	16	3
8	3	155	17	4
9	4	370	18	4
out	36	2880	in	36
			total	72

Title: Golf Course Master Plan
Option 2C



0 50 100 150 200m
1:2500 REFERENCE REDUCTION

Client: Shire of Rockbourne
Project: Karatha Country Club
Scale: 1:2500 @A0
Drawing No: KCC-CP-23
Date: March 2014



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Appendix 5
Design Summary - Option 3

Hole 1 – Par 3

A brand new Par 3 is created which heads due south from the clubhouse. This hole can work very well along the edge of the wetland area and utilise the feature trees in the area.

Hole 2 – Par 4

At this point the 2nd hole can be played as a very long Par 5 up to 520m in an eastward direction and within view of Sea Ripple Road.

This hole will again require earthmoving to create subtle features and not a dead flat fairway surface. There appears to be plenty of decent vegetation in this area of the site and we can carefully plot the way through to maximise the use of good feature specimens.

We have ample room to make this a very strong Par 5 of 500m + and use sandy wastes, vegetation and possibly another small creek to use as design and strategic features.

Hole 3 – Par 4

(Refer Layout 2 Description of 3rd hole)

Hole 4 – Par 4

(Refer Layout 1 Description)

Hole 5 – Par 3

(Refer Layout 1 Description)

Hole 6 – Par 4

(Refer Layout 1 Description)

Hole 7 – Par 5

(Refer Layout 1 Description)

Hole 8 – Par 3

After the new green site on the 7th hole the tees can be situated down the hill a little on the existing 5th fairway on the southern side of the crest.

A Par 5 will allow the first tee shot to be played in the direction of the current 4th fairway (in reverse). The development zone appears at the 290m mark of the hole so it should be very safe from errant tee shots.

The latter half of the hole plays along the lower part of land and hugs the nice row of feature Eucalypts. Most trees along this left edge should be able to be retained.

The new green, at a length of about 485m will sit just in front of the current 9th green.

The green should be designed in a way that is more receptive from a shot hit in from the left side of the fairway. Whilst the centreline of this new 9th hole is 60m from the edge of the development zone more golfers will aim up the left side of the fairway and effectively make the safety angle better.

Hole 9 – Par 4

After playing the Par 5 the 9th tees are to the right up the hill, against the development zone. These were positioned intentionally to hit away from this zone.

This Par 3 will be a shortish, “drop shot” type of hole downhill to a green positioned in the lower parts of the current 3rd fairway.

It was also considered to finish this loop of holes with a par 3 8th, then a Par 5 9th however it was deemed safer to the development area with the Par 5 as the 8th.

Hole 10 – Par 4

(Refer Layout 1 Description)

Hole 11 – Par 3

(Refer Layout 1 Description)

Hole 12 – Par 5

(Refer Layout 1 Description)

Hole 13 – Par 4

(Refer Layout 1 Description)

Hole 14 – Par 5

(Refer Layout 1 Description)

Hole 15 – Par 4

(Refer Layout 1 Description)

Hole 16 – Par 3

(Refer Layout 1 Description)

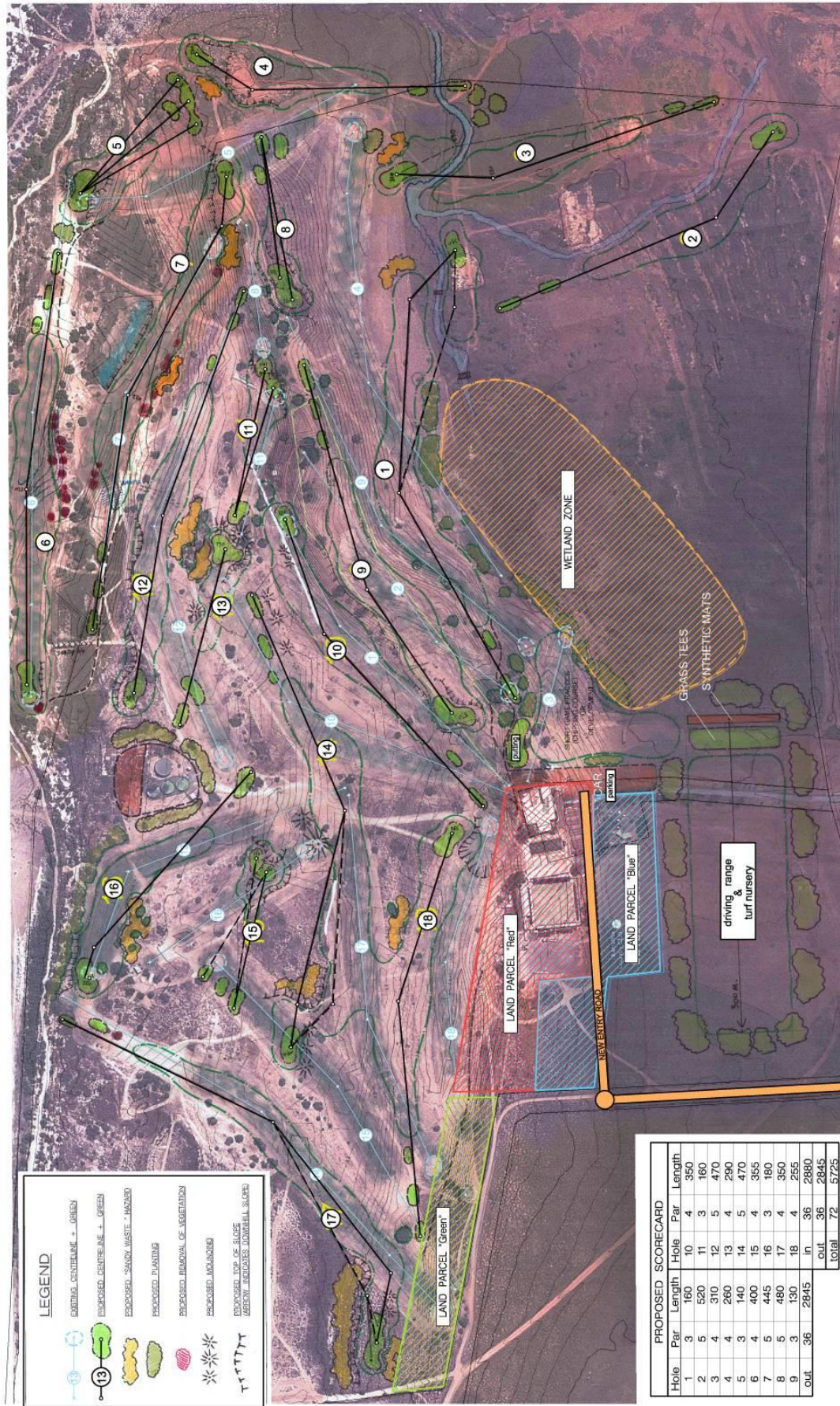
Hole 17 – Par 4

(Refer Layout 1 Description)

Hole 18 – Par 4

(Refer Layout 1 Description)

Appendix 6
Design Summary - Option 4



Title: Golf Course Concept Plan #4
(Intermediate Change with revised back nine)



Client: Shire of Rockbourne
Project: Karratha Country Club

Scale: 1:250 @A0
Drawing No: KCC-CP-04
Date: March 2024

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Appendix 7

Maintenance Practices

ADDITIONAL PRACTICES

Until the course has undergone the construction phase I feel there is no need to change what are currently the maintenance practices.

As mentioned in the return brief, there should be an immediate implementation of a program to control the broadleaf grasses which have plagued the Santa-Anna fairways, surrounds and tees. This program will be a visual yellowing of the leaf and phototoxicity of the plant. The products to be used will have the active of MSMA however the directions on the label must be strictly adhered to in order to reduce damage to the current couch species. I feel several applications will be needed in order to control the problem species and will continue forward. The above practice coupled with the fertilisation program is essential for good plant health but may need to be increased due to the stress on the plant to cope with the herbicide treatments. Only a visual on the plant health at the time will determine the severity of the herbicide and the amount of fertiliser needed during this time. The current renovation practices of aeration, decompaction, deep slicing, vertimowing and sweeping should continue.

EQUIPMENT

The machinery equipment which is currently being used on the course such as the Toro 6700 and the Kubota 54" zero turn can continue to be used in their current duties. We will utilise this equipment during the grow-in stage of the course prior to the purchase of new equipment being used. We will also source 2 x second hand cylinder mowers to also be used during the growing in process for cutting greens and a tri-plex tees/surrounds mower as well. These mowers will from time to time need further sharpening as the dirt and sand will affect the precision cutting of the mower heads. This is always an unknown figure when trying to determine a budget.

GROW-IN STAGE

When the course is being grown-in, the surfaces will need to be kept wet to allow the stolons to grow roots and establish themselves. It may be thought that there is far too much water being used at this time but this is not the case.

Any assistance to the maintenance staff by way of edging around the perimeter of the green/collar to keep the Santa-Anna out of the playing surfaces will be of great help (similar to that of edging the current sand greens). Also pulling out weeds throughout the surfaces will also help with the establishment phase.

MACHINERY OPERATION

CUTTING GREENS AND COURSE SETUP

TRIPLEX GREENS

- * Repair all pitch marks around cup first before cutting (3mtrs).
- * 1st cut along edge must be done of green
- * Ensure all lines are straight when cutting.
- * Beware of green edges when cutting perimeter.
- * No Sharp turns when on triplex.
- * NO MISSES ON PUTTING SURFACES.

COURSE SETUP

- * Putting cup 3.0m from side of green.
- * Must be 2mts of flat area around putting cup away from slopes.
- * Repair all pitch marks around cup (3mtrs).
- * Align all tee markers to the centre of fairways or greens.

TIME MAXIMUM FOR DUTIES

Triplex Greens – 3.5 No Lap, With Lap 4hrs

Course Setup – 2.5hrs

CLEAN UP DEBRIS/RUBBISH IN WORKING AREAS BEFORE MOVING ON TO NEXT AREA

TEES, COLLARS & APRONS

A: TEES

- * Remove Markers & all debris (including TEE Stubs) before cutting.
- * Flatten all sand piles from filled divots before mowing.
- * Perimeter cut must be done last.
- * Align all tee markers to the centre of fairways or greens.

B: COLLARS

- * Cut all collars with 1 full width around greens
- * Beware of green/collar edges.
- * Check for debris etc before mowing.

C: APRONS

- * Cut in a horse shoe pattern around green unless otherwise stated.
- * Beware of green/surround/bunker edges.
- * Beware of steep areas around greens and aprons.
- * Remove all clippings and debris from the work area close to greens.

TIME MAXIMUM FOR DUTIES:

Cutting Tees – 4hrs

Cutting Collars – 2.5hrs

Cutting Aprons – 3.5hrs

CLEAN UP DEBRIS/RUBBISH IN WORKING AREAS BEFORE MOVING ON TO NEXT AREA

FAIRWAYS

- * Fairways to be completed in one day.
- * **Perimeter cut must be done last.**
- * Give way to golfers and keep clear of golf balls.
- * All lines must be kept straight.
- * Be aware of wet areas!

TIME MAXIMUM FOR DUTIES -

Cutting Fairways – 7.5hrs

BUNKERS

- * Rake bases with machines where possible otherwise hand-rake all bases.
- * Repair all wash-outs as you go.
- * Any missing rakes **must** be replaced or reported.
- * Place rakes in bunkers as shown by supervisors.
- * **Remove any all grass/debris/weeds as you go.**
- * Push sand back in bunker after sand-pro has exited from bunkers.
- * Make sure bottoms of bunkers are flat.

TIME MAXIMUM FOR DUTIES -

Bunkers – 0hrs or as Required

CLEAN UP DEBRIS/RUBBISH IN WORKING AREAS BEFORE MOVING ON TO NEXT AREA

ROUGH

SHORT and LONG ROUGH

- * Do not spread clippings to bunkers/waterways/buggy paths.
- * Watch out for golfers and give way.
- * Stop when golfers are near/idle back machine.
- * Report any broken green valve lids.
- * Cut any unsightly weeds under trees.

TIME MAXIMUM FOR DUTIES:

Cutting – 1.5 days

GENERAL

- * Give way and be courteous to all players
- * Perform daily services to equipment before and after daily use/grease, fuel, air filters, chains ETC.
- * Complete all allocated duties in allocated times.
- * Oil leaks/hydraulic problems go straight onto long roughs if possible. Do not drive back into shed.
- * Report any dis-colourations/discrepancies/damage DAILY
- * Fill up machinery in afternoon.

WATERING OF GREENS & ISOLATED DRY PATCH AREAS

1. Syringing only used to cool plant – not to water (not needed when overcast) 3 – 5 minutes maximum.
2. When hand watering, pick up collars as well – use probe to check moisture before watering.
3. Clean up areas as you go around.
 - * Pitch marks.
 - * Bird damage.
 - * Straighten signage.
 - * Pick up rubbish as you go.
4. Key on sprinklers in isolated areas when possible.

Appendix 8
Leased Maintenance Equipment (estimate)

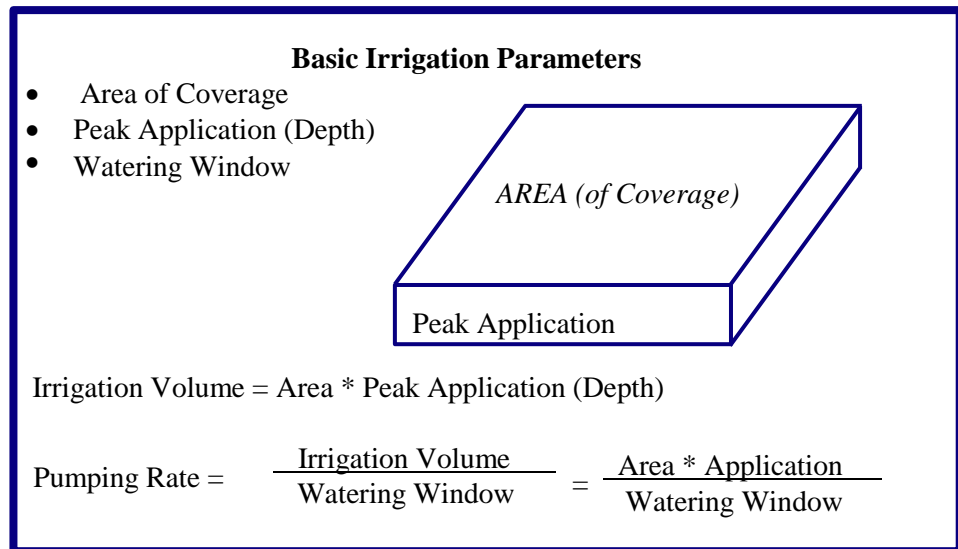
Equipment description	Qty	Equipment Cost	Trade Description	Finance Lease
Toro 360	1	\$ 34,000.00	Roughs Mower	\$ 584.18
Toro HDX sprayer + PP 200	1	\$ 64,000.00	Heavy Duty Spray Unit	\$ 1,099.64
MDX- D	1	\$ 18,000.00	Workman	\$ 309.27
procore 648	1	\$ 30,000.00	Coring Machine	\$ 515.45
Toro 3400 + verticutters	1	\$ 52,000.00	Greens Mower - Grooming	\$ 893.45
Toro 3400	1	\$ 46,250.00	Tee and Collar Mower	\$ 794.66
Toro 7000	1	\$ 80,700.00	Fairway Mower	\$ 1,386.57
Toro 3500	1	\$ 35,400.00	Surrounds Mower	\$ 608.24
Toro Greens roller	1	\$ 15,000.00	Greens Roller	\$ 257.73
Proforce blower	1	\$ 11,000.00	Blowing machine	\$ 189.00
Gr1000	1	\$ 6,000.00	Walk Behind Mower	\$ 103.09
				\$ 6,714.29

Appendix 9

Irrigation

BASIC IRRIGATION PARAMETERS

- Area of Coverage (relates to the number of sprinklers)
- Peak Application (Depth of Water Applied)
- Watering Window (Time to pump the required volume) In a diagram:



For general information on the Basic Irrigation Parameters, please refer to HydroBull Nos 1, 2 and 3 available on our web site at: <http://www.hydrogold.com/education.html#hydrobull>

Area of Coverage

The sprinklers cover the tees, the core of the fairways (essentially 2-row) and the greens. Quick Coupling Valves are provided for hand-watering.

The Preliminary Overall Layout shows the sprinkler coverage for the first 9 holes and the practice area. The sprinkler plot for Holes 1 to 9 is used to estimate the number of sprinklers in Holes 10 to 18.

The sprinkler quantities are summarised as:

Description	Tee	Fwy	Grn	Comment
Holes 1 to 9	64	205	49	As per Sprinkler Plot
Holes 10 to 18	64	205	49	Estimated
Practice	10		5	As per Sprinkler Plot
Sub-Total	138	410	103	
Total	651			

Peak Application

This is the amount (depth) of water that will be applied to the irrigated area during a full irrigation cycle (watering window).

The irrigation design is based on the Peak Application so that the irrigation system is capable of watering the irrigated area during the highest water demand (hottest, driest) periods. During normal operation the Irrigation Pump Station will still operate at its designed (maximum) flow but the watering window will be shortened

- Reference Evapo-Transpiration (ET_o):
 - Our tabular Climate Data contains our ET calculations. The basis for these calculations is the Penman-Monteith equation. This is the same equation that is used to calculate ET in weather stations.
 - The seven parameters used in our calculations include:

Average High Temperature

Average Temperature

Average Low Temperature

Relative Humidity

Wind Speed

Sunlight Duration (based on latitude)

Solar Radiation (based on latitude)

This provides an objective evaluation of ET_o based on what is (normally) readily available climate data.

- Peak Application - 10 mm per day (2.76 inches per week)
 - In determining the peak application to design the irrigation system for, we need to apply a "Crop Factor" to ETo.

Peak Application = Peak ETo * Crop Factor

The Crop Factor will depend of the:

Plant material (differs for different varieties of turf)

Soil structure

Desired plant quality

The Crop Factor (and therefore the resultant Peak Application) should be verified by Geoff Bennell. For our preliminaries, we have used a Crop Factor of 0.9 to determine the Peak Application.

The Crop Factor is not a "hard number" in that it can be varied by management (in consultation with an Agronomist) to achieve desired outcomes. Eg. A lower Crop Factor could be used to conserve water but would leave the turf looking less lush with longer recovery from damage (eg, divots and buggy/machinery & foot traffic). A higher Crop Factor would produce a lush turf with quicker recovery from damage. The Crop Factor is also influenced by the soil structure and turf cultivation practices.

- Watering Window
The watering window is the time taken to complete a full irrigation cycle. There being no night golf (that would restrict the available watering window), we have used a watering window of 10 hours. Typically this could be from 7 pm to 5 am.

WATER USE ESTIMATES

IMPORTANT NOTES:

The calculations are based on several assumptions as noted below. While the figures are indicative, a variation of 50% (perhaps more) on these estimates may occur due to differences to actual conditions and our assumptions.

Limited Overview - Not a Water Balance Study

This analysis is a limited overview of the water demand only. The water supply and storage elements of a Water Balance Study are not included. A Water Balance Study is time consuming and not within our scope of works.

More information on Water Balance Studies is available on our web site at:
http://www.hydrogold.com/documentation_wms.html

Climate Data

Only averages are used which does not provide any indication of ranges or variability from year to year. There will be significant differences between a wet and dry years.

EvapoTranspiration

Is estimated on the basis of available climate data and our experience.

Rainy Days

Are days on which irrigation is not required and has been calculated using an empirical formula. There will be some inaccuracy for this particular site. Even in months where rainfall exceeds ET, there will still be some irrigation required since the rainfall is not evenly distributed on each day of the month. The number of Rainy Days factors this into our calculations.

Irrigation Efficiency

Will be affected by watering practices, which depend on factors such as the person in charge and the soil structure.

Hand Watering Estimates

Are typical but will vary with landscape design and management objectives.

Management Decisions

Will have a large impact. The desire to maintain a level of green in the turf or the implementation of water conserving strategies to minimise water use may double or halve the water used.

Construction Schedules

These are most likely to be different. A 12 month turfing program with a 4 month grow in period has been assumed. This is not likely (and may not even be practical) to be the actual construction schedule but is included for indicative purposes only. That is, to indicate the difference in watering requirements during construction and after establishment.

Evaporation and Seepage

Seepage and evaporation from water bodies has not been taken account of.

Simplicity of Calculation

For simplicity of calculation the number of sprinklers has been evenly divided between all the holes. While there are large differences between the number of sprinklers on a par 3 and par 5, it does not significantly affect the overview (particularly considering the overall inherent inaccuracies).

MONTHLY CLIMATE DATA - TABULAR FORMAT		
Latitude (South of the equator is negative)	Degrees	(20)
	minutes	-42
	Decimal	-20.7
Altitude (Elevation Above Sea Level)	m	5

Includes Penman-Monteith calculation for ETo based on:

- Latitude (to determine daylight hours and solarradiation) Altitude
- Temperature (Average High, Average & Average Low)
- Humidity (Average)
- Wind Speed (Average)

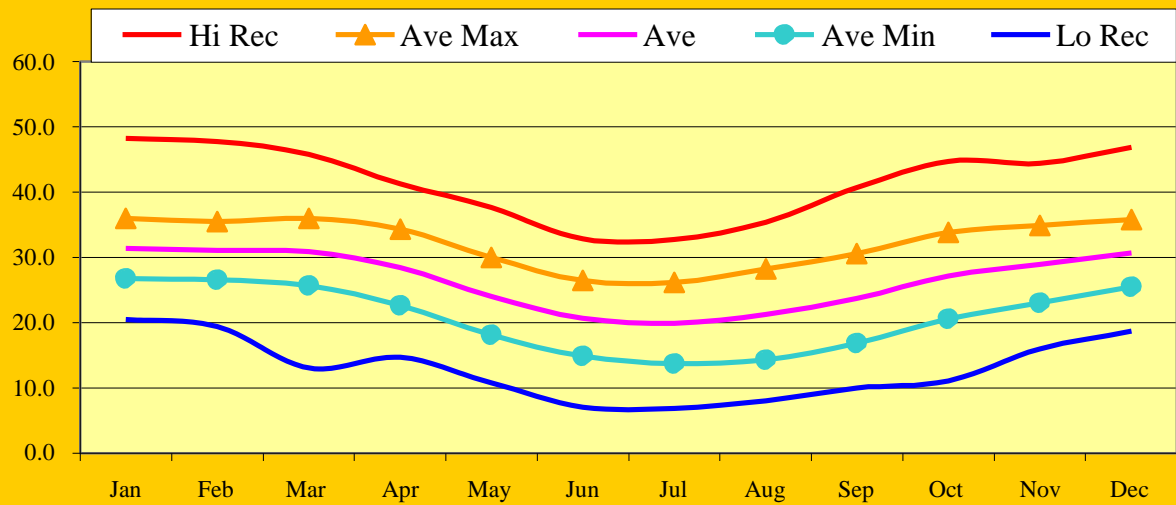
Description	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Average
** Temperature - Highest Recorded	Celsius	48.2	47.7	45.8	41.3	37.6	32.8	32.7	35.4	40.7	44.7	44.4	46.9		41.5
Temperature - Average High	Celsius	36.0	35.5	36.0	34.3	30.0	26.5	26.2	28.2	30.6	33.8	34.9	35.8		32.3
Temperature - Average	Celsius	31.4	31.1	30.9	28.5	24.1	20.7	20.0	21.3	23.8	27.2	29.0	30.7		26.5
Temperature - Average Minimum	Celsius	26.8	26.6	25.7	22.6	18.1	14.9	13.7	14.3	16.9	20.6	23.0	25.5		20.7
** Temperature - Lowest Recorded	Celsius	20.5	19.4	13.0	14.7	10.8	7.1	6.9	8.0	10.0	11.1	16.0	18.7		13.0
Relative Humidity - Average	%	55.0	59.5	50.0	43.5	43.5	45.5	42.5	37.0	38.0	39.0	42.0	49.0		45.4
Wind Speed - Average	km/h	23.8	22.6	21.7	19.7	21.0	22.2	21.5	22.0	22.8	24.1	25.0	24.8		22.6
** Precipitation - Average	mm	49.2	77.7	49.0	17.6	25.2	35.6	13.9	4.6	1.4	0.5	1.5	14.9	291	24
** No of Rainy Days	No	4.3	5.4	4.0	1.8	3.2	3.3	2.0	1.2	0.5	0.3	0.4	1.4	27.8	2.3
Temperate - Average - Previous Month	Celsius	30.7	31.4	31.1	30.9	28.5	24.1	20.7	20.0	21.3	23.8	27.2	29.0		
Temperate - Average - Next Month	Celsius	31.1	30.9	28.5	24.1	20.7	20.0	21.3	23.8	27.2	29.0	30.7	31.4		
Day of Year for middle of month	No	15	46	74	105	135	166	196	227	258	288	319	349		
Sunlight Duration (Daylight Hours)	h/day	13.3	12.8	12.2	11.6	11.1	10.9	11.0	11.4	11.9	12.5	13.1	13.4		12.1
Nighttime Hours	h/day	10.7	11.2	11.8	12.4	12.9	13.1	13.0	12.6	12.1	11.5	10.9	10.6		11.9
Clear-Sky Solar Radiation	MJ/m ² /day	31.5	30.0	27.4	23.3	19.7	17.8	18.5	21.5	25.5	28.9	31.0	31.7		25.6
Net Solar or Net Shortwave Radiation	MJ/m ² /day	24.4	23.3	21.2	18.1	15.3	13.8	14.3	16.6	19.7	22.3	23.9	24.6		19.8
Net Radiation	MJ/m ² /day	20.1	19.2	16.4	12.4	9.0	7.3	7.6	9.7	13.1	16.1	18.2	19.7		14.1
Reference EvapoTranspiration (ETo)	mm/day	10.3	9.3	9.8	8.9	7.4	6.3	6.3	7.6	8.8	10.5	11.1	10.9		8.9
	mm/month	319.2	261.2	303.1	266.3	229.7	188.2	196.5	235.8	265.5	324.7	333.8	338.3	3,262	271.9

NOTE: This data is collected and collated from various sources. If this data is not representative of the site, please inform us immediately.

** These values are not used in the ET Calculation but included to give a better overall view of the climate

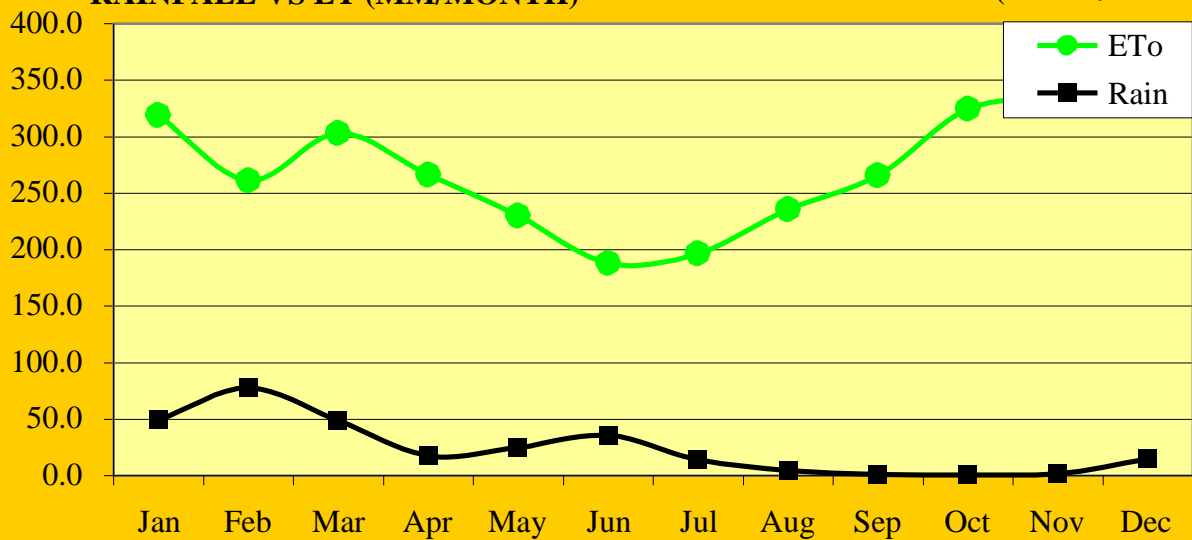
MONTHLY CLIMATE DATA - GRAPHICAL FORMAT

TEMPERATURE (CELSIUS)



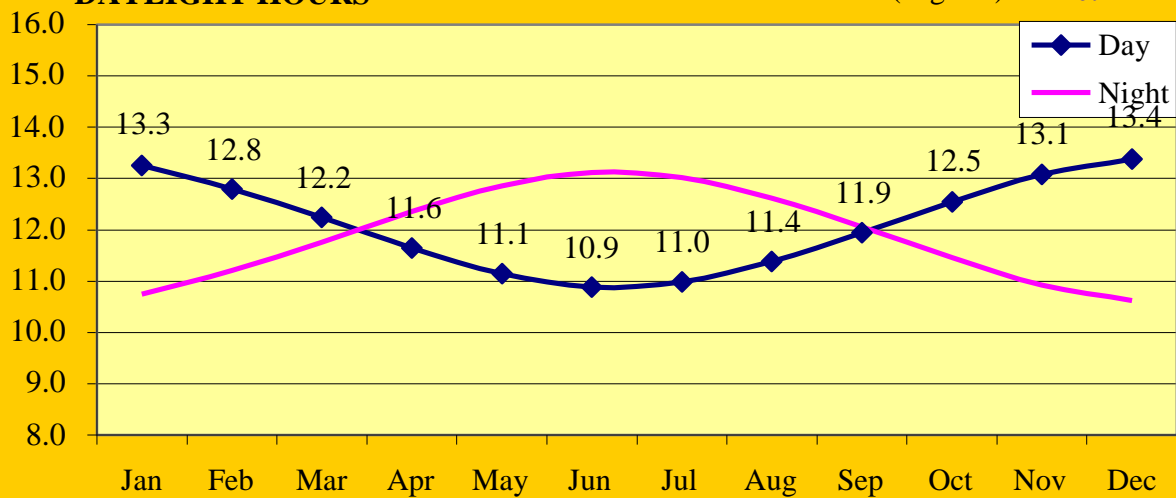
RAINFALL VS ET (MM/MONTH)

Total Annual Rainfall (mm) 291



DAYLIGHT HOURS

Latitude (degrees) = -20.7



ESTIMATE OF GOLF WATER USE DURING CONSTRUCTION AND AFTER ESTABLISHMENT (Refer to important assumptions affecting validity of calculations)							
Peak ETo - as per Monthly Climate Data	mm/day	11.1					
Crop Factor (for in-play areas)	k	0.90		KEY WATER USE STATISTICS (After Establishment)	Quantity	Unit	% of Peak
Peak Application - Monthly	mm/day	9.99		Daily Irrigation Use - Peak for Irrigation Design	1,811	m^3/day	100%
Peak Application - Daily for Irrigation Design	mm/day	10.00		Daily Irrigation Use - Water Conserving Strategy	1,129	m^3/day	62%
	mm/month	300.0		Average Water Use	1,479	m^3/day	82%
	Inches/Week	2.76		(includes Irrigation and Hand Watering)	539,987	m^3/yr	N/A
	m^3/day	1,811					
No Holes of Golf		18					

DAILY AUTOMATIC IRRIGATION WATER USE

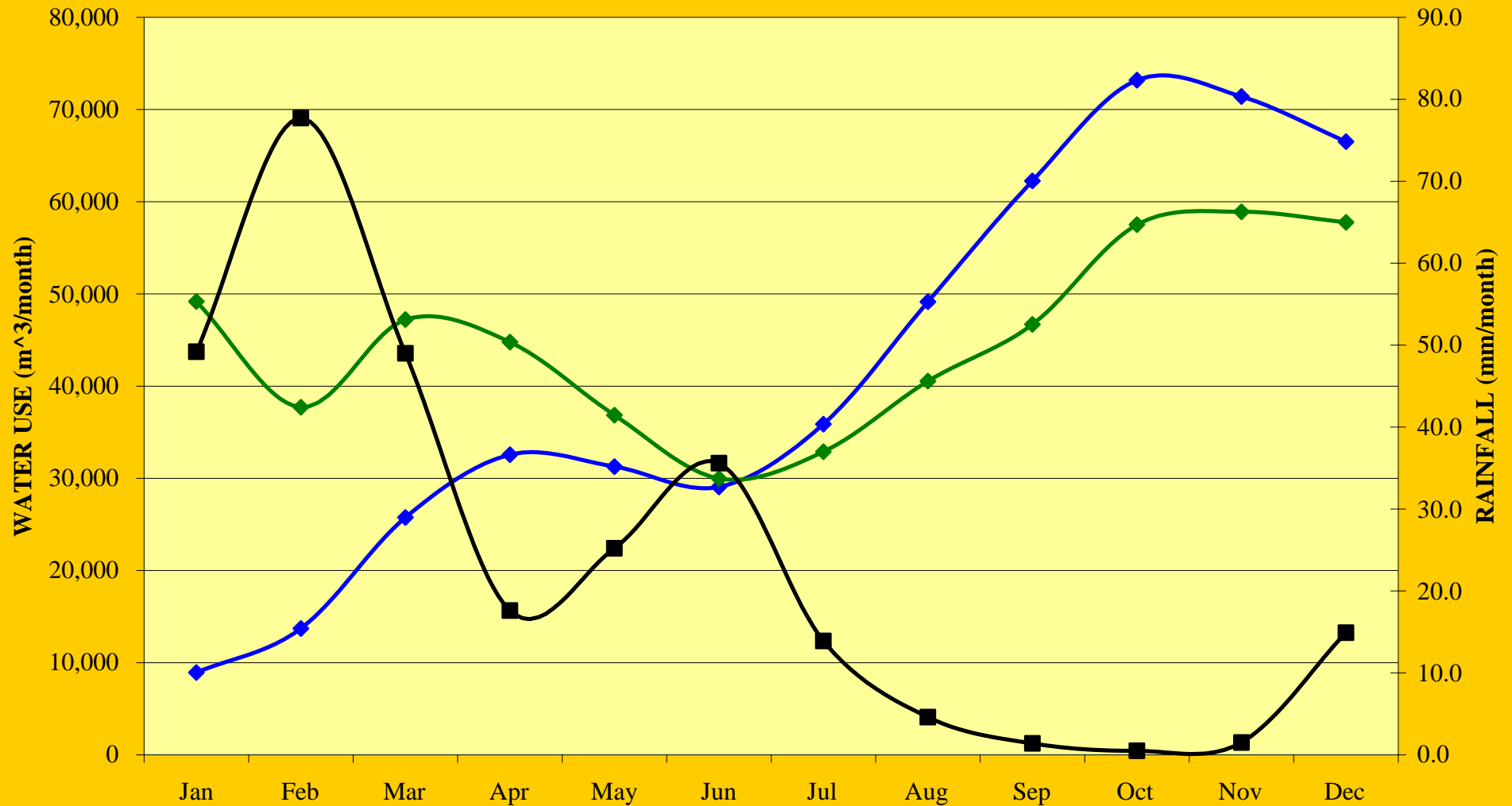
Description	Unit	Sprinkler Types							Total
Sprinkler Type		Tees	Fwy	Grn	Grn	PG	DR Tee	DR Tee	
No of Sprinklers	No	128	410	32	66	5	5	5	651
Spacing	m	15.0	19.0	22.0	19.0	22.0	19.0	19.0	
Spacing Patern	Tri/Sq/Si	Sq	Tri	Tri	Tri	Tri	Tri	Tri	
Sprinkler Arc	Degrees	180	360	360	360	360	360	180	
Peak Application (Design)	mm/day	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Irrigated Area (Nominal)	Ha	1.4	12.8	1.3	2.1	0.2	0.2	0.1	18.1
Irrigation Volume (Peak)	m^3/day	144	1,282	134	206	21	16	8	1,811
Irrigation Volume (Average)	m^3/day	(Not including Hand Watering)							1,345
Irrigation Volume (Water Conserving Strategy)	%	80%	50%	100%	100%	100%	50%	50%	
	m^3/day	115	641	134	206	21	8	4	1,129

MONTHLY WATER USE ESTIMATES																
Description	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	AVERAGE	
During Construction																
Grown in - No Holes	No	2	4	6	8	8	8	8	8	8	6	4	2			
Application	mm/day	13.9	12.6	13.2	12.0	10.0	8.5	8.5	10.2	11.9	14.1	15.0	14.7		12.1	
Established - No Holes	No	0	0	0	0	2	4	6	8	10	12	14	16			
Application	mm/day	9.2	8.4	8.8	8.0	6.7	5.6	5.7	6.8	7.9	9.4	10.0	9.8		8.0	
Golf Irrigation	m^3/month	7,450	11,425	21,464	27,137	26,055	24,214	29,891	40,954	51,879	60,996	59,504	55,435	416,405	34,700	
Hand Watering (20%)	m^3/month	1,490	2,285	4,293	5,427	5,211	4,843	5,978	8,191	10,376	12,199	11,901	11,087	83,281	6,940	
Total	m^3/month	8,940	13,710	25,757	32,564	31,266	29,057	35,870	49,145	62,255	73,196	71,405	66,522	499,685	41,640	
After Establishment																
Application	mm/day	9.2	8.4	8.8	8.0	6.7	5.6	5.7	6.8	7.9	9.4	10.0	9.8		8.0	
Golf Irrigation	m^3/month	44,699	34,274	42,928	40,705	33,500	27,241	29,891	36,859	42,447	52,283	53,553	52,517	490,897	40,908	
Hand Watering (10%)	m^3/month	4,470	3,427	4,293	4,070	3,350	2,724	2,989	3,686	4,245	5,228	5,355	5,252	49,090	4,091	
Total	m^3/month	49,169	37,701	47,221	44,775	36,850	29,965	32,881	40,545	46,692	57,511	58,909	57,769	539,987	44,999	
Base Monthly Climate Data																
Eto	mm/day	10.3	9.3	9.8	8.9	7.4	6.3	6.3	7.6	8.8	10.5	11.1	10.9		8.9	
	mm/month	319.2	261.2	303.1	266.3	229.7	188.2	196.5	235.8	265.5	324.7	333.8	338.3	3,262	272	
Rainfall	mm/month	49.2	77.7	49.0	17.6	25.2	35.6	13.9	4.6	1.4	0.5	1.5	14.9	291	24	
No Rainy Days	No	4.3	5.4	4.0	1.8	3.2	3.3	2.0	1.2	0.5	0.3	0.4	1.4	28	2	

ESTIMATE OF GOLF WATER USE - See Important Assumptions

Estimated Annual Water Use in cubic metres (after establishment) = 539,987

- Construction
- Established
- Rainfall



DEFFERING OF WORKS

Comments on Water Use

- Peak daily use would be 1,811 m³/day.
- A water conserving strategy would reduce that to 1,129 m³/day.
- Watering just the greens alone would require 361 m³/day.

It is noted that the average daily water use is expected to be 1,479 m³/day compared to the current average use of 1,000 m³/day (anecdotal). This is a result of adding in the greens as well as better irrigation of the tees and fairways.

The regular 19-m triangular sprinkler spacing will provide an incomparably better uniformity (irrigation efficiency).

Description	Tee	Fwy	Grn	Comment
Holes 1 to 9	64	205	49	As per Sprinkler Plot
Holes 10 to 18	64	205	49	Estimated
Practice	10		5	As per Sprinkler Plot
Sub-Total	138	410	103	
Total	651			

Irrigation Preliminaries and Bill of Quantities

1 IRRIGATION BILL OF QUANTITIES - PREAMBLE

1.01 IMPORTANT NOTES REGARDING THIS BILL OF QUANTITIES

*** ALL INFORMATION IN THIS DOCUMENT IS PRELIMINARY.**

*** IT MUST NOT BE USED FOR QUOTATIONS OR PURCHASING.**

*** REFERENCE MUST BE MADE TO THE SPECIFICATIONS, DRAWINGS AND CONTRACT DOCUMENTS FOR COMPLETE INFORMATION. THIS BILL OF QUANTITIES IS NOT A COMPLETE DESCRIPTION OF WHAT IS REQUIRED.**

*** THERE ARE MANY ITEMS NOT SPECIFICALLY MENTIONED IN THIS BILL OF QUANTITIES THAT MAY NEED TO BE PROVIDED: FILTER DISCHARGE PIPE, TRANSFORMERS/REGULATORS/SURGE PROTECTION, LATERAL FITTINGS, SLEEVES, PRIMER, SOLVENT CEMENT, LUBRICANT FOR RUBBER RING JOINTED PIPE, THREAD SEAL, STABILISERS FOR QUICK COUPLING VALVES, CONCRETE FOR THRUST BLOCKS, NUTS, BOLTS, WASHERS, ETC.**

1.02 Nominal PVC pipe diameters refer to Inside Diameter.

Nominal HDPE pipe diameters refer to Outside Diameter.

If a substitution is allowed, the equivalent Inside Diameter pipe must be used.

Eg. 63 mm HDPE pipe must be substituted for 50 mm PVC pipe.

1.03 DESCRIPTION. Both metric and imperial descriptions are provided.

1.04 CONSULTANT QUANTITY is the consultant's estimate for the design as drawn. This is a 2 dimensional take-off (does not take account of contours) with no allowance included for wastage, shrinkage, minor on-site alterations or manufacturers' shipping quantities.

1.05 CONSULTANT UNIT is the unit that the consultant's estimate is based on. Estimates appear in both metric (which takes precedence if there is any conflict) and imperial units.

1.06 MATERIAL RATE is the cost of the materials. Used as a base to assess payment of materials delivered to site (if applicable).

1.07 INSTALL RATE is the cost of the installation.

1.08 COMBINED RATE is the MATERIAL RATE plus INSTALL RATE.

1.09 TOTAL is the QUANTITY multiplied by the COMBINED RATE.

1.10 INDUSTRY STANDARD ABBREVIATIONS:

FIPT (Female Iron Pipe Thread), MIPT (Male Iron Pipe Thread), M/F (MIPT*FIPT), SLIP (Solvent Welded Joint), TBE (Threaded Both Ends) TOE (Threaded One End)

2 IRRIGATION PUMP STATION - To supply, install and commission pump station and all ancillaries.

2.01 Irrigation pump station (Variable Frequency Drive) 1 item 180,000.00 180,000.00

Flood Suction				
MAIN PUMPS (All equal capacity)				
Number of Main Pumps	4	No	4	No
Number of Stand-By Pumps	1	No	1	No
Number of Duty Pumps	3	No	3	No
Combined Flow of 3 Duty Pumps (without jockey or standby pumps)	56	L/s	889	USGPM
	202	m ³ /h		
Effective Total Dynamic Head of Pump Station, <u>not</u> including frictional losses in suction pipe, pump, discharge head or manifold.	74.6	metres	106	PSI
	7.31	Bar	244.7	feet
Maximum Lift to Pump discharge	0.0	metres	0.0	feet
Pressure at Pump Discharge (at Lowest Water Level) (upstream of the filter)	74.6	metres	106	PSI
	7.31	Bar	244.7	feet
Nominal Rotation Speed to be less than	2,900	RPM	2,900	RPM
JOCKEY PUMP (Submersible or Turbine) - Nominal Flow	6	L/s	95	USGPM

2.02 Filter and fittings 1 item 30,000.00 30,000.00

The filter will be carbon steel body, automatic self flushing 300 micron (50 mesh) screen filter sized to suit the nominated total flow rate of the pump station. The filter is to have a maximum 0.30 Bar (4 PSI) pressure loss across it. It will be pressure rated to at least the maximum discharge pressure of the pump station. The pump station will be able to operate at full flow during the backflush cycle.

2.03 Fertigation System including tanks & ancillaries 1 item 30,000.00 30,000.00

The injection rate will be proportional to the flow through the pump station discharge line. Pressure based injection units are not acceptable

	Metric	Imperial
No of Mixing Tanks	1 no	1 No
No of Storage Tanks	1 no	1 No
No of injection heads	2 no	2 No
Injection rate of each head (1 pump per head)	113 L/h	30 US Gal/h

2.04 Hot-dip galvanised steel pipe (Z-Leg) & transition fittings to PVC mainline 1 item 4,500.00 4,500.00

3	IRRIGATION MAINLINE PIPEWORK (uPVC) - To supply, install, pressure test, compact, etc. The unplasticised Poly Vinyl Chloride (uPVC) pipe is to be: a) Rubber Ring Jointed (RRJ) supplied in nominal 6 m (19.5 feet) lengths b) Pressure rated to a minimum of 12 Bar (176 PSI) and conforming to AS1477 PN 12 c) Mainline fittings (tees, elbows, reducers, etc) to be Rubber Ring Jointed ductile/cast iron fittings. No PVC or steel fittings allowed. Includes either thrust blocks or Joint Restraint System.			
3.01	200 mm mainline pipe	62 m	83.40	5,170.80
	8" mainline pipe	203 ft		
3.02	150 mm mainline pipe	1,890 m	42.30	79,947.00
	6" mainline pipe	6,199 ft		
3.03	100 mm mainline pipe	5,334 m	30.00	160,020.00
	4" mainline pipe	17,496 ft		
4	IRRIGATION MAINLINE ISOLATION VALVES (uPVC MAINLINE) To supply and install bell-mouthed, cast iron gate valves including thrust blocks, etc. They will be of quality Cast Iron construction with Stainless Steel non-rising spindle and bronze trim, manufactured to British Standard BS4504. These valves will be rated to a working pressure of 14 Bar (200 PSI).			
4.01	200 mm cast iron gate valve	1 item	2,175.00	2,175.00
	8" cast iron gate valve			
4.02	150 mm cast iron gate valve	10 item	1,425.00	14,250.00
	6" cast iron gate valve			
4.03	100 mm cast iron gate valve	12 item	825.00	9,900.00
	4" cast iron gate valve			
4.04	50 mm square drive nut to replace valve handle	23 item	30.00	690.00
	2" square drive nut to replace valve handle			
4.05	Carson 910 valve box with bolt-down lid	23 item	30.00	690.00

-
- 5 IRRIGATION MAINLINE TAPPING WITH ISOLATION VALVE**
 To supply and install mainline tapplings for lateral take offs including VIH lateral lines, RCVs, QCVs attached to mainline, air valve assemblies on underground mainline, etc.
- Tapping Saddles will be of Cast/Ductile Iron construction with a flat stainless steel strap to secure the saddle to the mainline. Alternatively, they may be of Stainless Steel or Bronze (Zinc free) construction. HDPE and plastic saddles are not acceptable. The brand and model must be approved by the Employer prior to the placement of the purchase order. Stainless steel bolts and nuts will be installed.
- Isolation valves will be Philmac Blue Handle Ball Valves or approved equivalent. They will be rated to a working pressure of 16 Bar (232 PSI).

5.01	200 * 50 mm tapping saddle 8" * 2" tapping saddle	1 item	267.00	267.00
5.02	150 * 50 mm tapping saddle 6" * 2" tapping saddle	66 item	130.50	8,613.00
5.03	100 * 50 mm tapping saddle 4" * 2" tapping saddle	198 item	123.00	24,354.00
5.04	50 * 350 mm PN16 Polypropylene TBE nipple 2" * 14" PN16 Polypropylene TBE nipple	1 item		
5.05	50 * 250 mm PN16 Polypropylene TBE nipple 2" * 10" PN16 Polypropylene TBE nipple	66 item		
5.06	50 * 150 mm PN16 Polypropylene TBE nipple 2" * 6" PN16 Polypropylene TBE nipple	198 item		
5.07	50 mm PN16 Polypropylene MIPT X FIPT M/F Elbow 2" PN16 Polypropylene MIPT X FIPT M/F Elbow	265 item		
5.08	50 * 50 mm PN16 Polypropylene FIPT X FIPT Tee 2" * 2" PN16 Polypropylene FIPT X FIPT Tee	0 item		
5.09	50 mm PN16 Polypropylene MIPT X MIPT Nipple 2" PN16 Polypropylene MIPT X MIPT Nipple	0 item		
5.10	50 * 25 mm PN16 Polypropylene MIPT X FIPT Bush 2" * 1" PN16 Polypropylene MIPT X FIPT Bush	0 item		
5.11	50 mm ball valve 2" ball valve	265 item		

6	AIR VALVES ON BURIED IRRIGATION MAINLINE	18 item	675.00	12,150.00
	To supply and install assemblies to underground PVC pipe. Air valves will be 50 mm (2 inch) Bermad 02-ARC Combination Air Release Valve or A.R.I. D-40-P rated to 16 Bar (232 PSI) or approved equivalent. Air valves will release large volumes of air upon filling of the pipe, allow air to enter when the pipe is drained and release accumulated air while the system is pressurised.			
6.01	50 * 25 mm PN16 Polypropylene MIPT * FIPT Bush 2 * 1" PN16 Polypropylene MIPT * FIPT Bush	18 item		
6.02	25 mm PN16 Polypropylene MIPT X FIPT M/F Elbow 1" PN16 Polypropylene MIPT X FIPT M/F Elbow	18 item		
6.03	25 * 300 mm schedule 80 articulated o-ring riser 1" * 12" schedule 80 swing joint o-ring riser	18 item		
6.04	50 * 25 mm PN16 Polypropylene FIPT * FIPT Coupling 2 * 1" PN16 Polypropylene FIPT * FIPT Coupling	18 item		
6.05	50 mm combination air valve 2" combination air valve	18 item		
6.06	Carson 1419 valve box with bolt-down lid	18 item		
7	QUICK COUPLING VALVES	76 item	-90.00	-6,840.00
	These will be Plasson PN8 plastic quick coupling valves attached to swing joint o-ring riser. Risers are to be Lasco or Dura Schedule 80 swing joint o-ring risers or an approved equivalent . To supply and install assemblies including:			
7.01	25 * 300 mm schedule 80 articulated o-ring riser 1" * 12" schedule 80 swing joint o-ring riser	76 item		
7.02	25 mm QCV 1" QCV	76 item		
7.03	Carson 910 valve box with bolt-down lid	76 item		
8	LATERAL TAKE OFFS - VIH	95 item	249.00	23,655.00
	To supply and install assemblies including:			
8.01	50 * 50 mm MIPT X SLIP Valve Take-Off Adapter 2" * 2" MIPT X SLIP Valve Take-Off Adapter	95 item		
8.02	Carson 910 valve box with bolt-down lid	95 item		

9	LATERAL TAKE OFFS - 50 mm (2") REMOTE CONTROL VALVE	152 item	268.50	40,812.00
	The Remote Control Valves will be: a) Rain Bird PES-B PRS-D or Toro P-220G Series b) Of plastic construction c) Fitted with adjustable pressure regulator modules that can be adjusted through the valve box. To supply and install assemblies including:			
9.01	50 mm PN16 Polypropylene TBE nipple 2" PN16 Polypropylene TBE nipple	152 item		
9.02	50 mm Remote Control Valve 2" Remote Control Valve	152 item		
9.03	3M DBY/R wire splice joiner for RCV	304 item		
9.04	50 * 50 mm MIPT X SLIP Valve Take-Off Adapter 2" * 2" MIPT X SLIP Valve Take-Off Adapter	152 item		
9.05	Carson 1419 valve box with bolt-down lid	152 item		
10	LATERAL TAKE OFF - 40 mm (1.5") REMOTE CONTROL VALVE	39 item	225.00	8,775.00
	The Remote Control Valves will be: a) Rain Bird PES-B PRS-D or Toro P-220G Series b) Of plastic construction c) Fitted with adjustable pressure regulator modules that can be adjusted through the valve box. To supply and install assemblies including:			
10.01	50 * 40 mm PN16 Polypropylene MIPT * MIPT nipple 2 * 1.5" PN16 Polypropylene MIPT * MIPT nipple	39 item		
10.02	40 mm Remote Control Valve 1.5" Remote Control Valve	39 item		
10.03	3M DBY/R wire splice joiner for RCV	78 item		
10.04	40 * 50 mm MIPT X SLIP Valve Take-Off Adapter 1.5" * 2" MIPT X SLIP Valve Take-Off Adapter	39 item		
10.05	Carson 1419 valve box with bolt-down lid	39 item		

11 LATERAL PIPEWORK & FITTINGS - PVC				
To supply and install pipes including fittings, compaction, etc.				
The uPVC (unplasticised PolyVinylChloride) pipe is to be:				
a) Solvent Weld Jointed supplied in 6 m (19.5 feet) lengths				
b) Pressure rated to a minimum of 12 Bar (176 PSI) and conforming to one of the following standards:				
ASTM 2241 Class 200, BS3505 Class D, AS1477 PN 12				
uPVC lateral pipe fittings are to be ASTM schedule 40, BS3505 Class F or AS1477 Class 18				
11.01	50 mm lateral PVC pipe including fittings	11,983 m	18.90	226,478.70
	2" lateral PVC pipe including fittings	39,304 ft		
12 SPRINKLERS				
To supply & install sprinkler assemblies including Lasco or Dura (or approved equivalent) Schedule 80 swing joint o-ring risers.				
Where available, ACME threads will be used in the base of the sprinklers.				
Riser thread to match the sprinkler base.				
12.01	Type 1 - E900 / DT54 - Full Circle VIH - 22 m Spacing	42 item	397.50	16,695.00
12.02	Type 2 - E950 / DT55 - Part Circle VIH - 22 m Spacing	0 item	397.50	0.00
12.03	Type 3 - E700 / DT34 - Full Circle VIH - 19 m Spacing	61 item	367.50	22,417.50
12.04	Type 4 - E751 / DT35 - Part Circle VIH - 19 m Spacing	0 item	367.50	0.00
12.05	Type 5 - E700 / DT34 - Full Circle Non-VIH - 19 m Spacing	415 item	322.50	133,837.50
12.06	Type 6 - E751 / DT35 - Part Circle Non-VIH - 19 m Spacing	5 item	322.50	1,612.50
12.07	Type 7 - E700B / DT34B - Full Circle Non-VIH - 15 m Spacing	128 item	187.50	24,000.00
12.08	Type 8 - E751B / DT35B - Part Circle Non-VIH - 15 m Spacing	0 item	187.50	0.00
NOTE: Thread on Riser must match Sprinkler Base				
12.09	40 * 300 mm schedule 80 articulated o-ring riser	42 item		
	1.5" * 12" schedule 80 swing joint o-ring riser			
12.10	32 * 300 mm schedule 80 articulated o-ring riser	481 item		
	1.25" * 12" schedule 80 swing joint o-ring riser			
12.11	25 * 300 mm schedule 80 articulated o-ring riser	128 item		
	1" * 12" schedule 80 swing joint o-ring riser			
12.12	3M DBY/R wire splice joiner for VIH Sprinklers	206 item		

13	IRRIGATION CONTROL SYSTEM - DECODER - Supply, install and commission:				
	Software and firmware to be latest available at time of ordering.				
13.01	Master computer, software and interface unit to field.	1 item		28,800.00	28,800.00
13.02	Line Termination Box	1 item		15,000.00	15,000.00
13.03	1 Address - 1 Solenoid decoder	191 Item		202.50	38,677.50
13.04	4 Address - 4 Solenoid decoder	38 Item		333.00	12,654.00
13.05	3M DBY/R wire splice joiner for Decoders to Comm. Line	458 item			
	COMMUNICATION CABLE				
	To supply & install cable approved by the manufacturer of the irrigation control system including:				
13.06	#14 Manufacturer approved comm. cable - Path 1	2,595 m 8,512 ft		5.25	13,623.75
13.07	#14 Manufacturer approved comm. cable - Path 2	2,595 m 8,512 ft		5.25	13,623.75
13.08	#14 Manufacturer approved comm. cable - Path 3	2,595 m 8,512 ft		5.25	13,623.75
	24 VOLT SOLENOID VALVE CABLE - From Decoders to VIH sprinklers & remote control valves.				
	To supply and install low voltage cables. Cables will be supplied on drums with a minimum length of 500 m (1500 feet) and will be one of:				
	a) Paige P7079D-Rev 7 single strand soft annealed copper with Polyethylene insulation (Preferred)				
	b) Paige P7001D-Rev 1 single strand soft annealed copper with PVC insulation.				
	c) PVC sheathed, double insulated cable, manufactured to British Standard BS6346 and suitable for direct burial.				
13.09	2.0 sq mm active control cable	5,532 m		2.85	15,766.20
	#14 active control cable	18,145 ft			
13.10	2.0 sq mm common control cable	5,532 m		2.85	15,766.20
	#14 common control cable	18,145 ft			
13.11	Surge Protection Unit	18 item		97.50	1,755.00
13.12	Copper clad earth stakes with exo-thermic welded joints (Cadweld or approved equivalent). The rods will have a solid steel core and be 16 mm (0.625 inches) diameter and 2.5 m (8 feet) long with a 250 micron (0.010") copper cladding.	57 item		300.00	17,100.00
	The joint will be housed in a Carson 610 Valve Box.				
13.13	Earth Plate	57 item			
13.14	Earth Enhancing Material	57 item			

14 CONTRACTOR'S ITEMS

The Contractor may, at their discretion, add specific items in this section. However, it remains the Contractor's responsibility to allow for sufficient materials regardless of the items or quantities mentioned in this Bill of Quantities.

To supply and install the following items not mentioned elsewhere in the Bill of Quantities.

14.01	Mobilisation	1 item
14.02	Insurances	1 item
14.03	Documentation (As-Built Drawings, Manuals)	1 item
14.04	Demobiliation	1 item

COLLECTION FOR IRRIGATION BILL OF QUANTITIES

SUB TOTAL FROM PAGE 1	(Preamble - Nothing to include in Grand Total)
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SUB TOTAL FROM PAGE 3	272,842.80
SUB TOTAL FROM PAGE 4	33,234.00
SUB TOTAL FROM PAGE 5	28,965.00
SUB TOTAL FROM PAGE 6	49,587.00
SUB TOTAL FROM PAGE 7	425,041.20
SUB TOTAL FROM PAGE 8	186,390.15
SUB TOTAL FROM PAGE 9	165,000.00
GRAND TOTAL	1,405,560.15

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