EVALUATING THE TREE POPULATION OF A GOLF COURSE

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Nearly everone is aware that trees play a role on the golf course. To the casual observer, the greenery and texture of trees provide a pleasant contrast to the stark concrete and bustling streets of the city. To the golfer, who finds his ball snuggled against the buttress root of a forty-foot silver maple, with three feet of solid timber between his dimpled orb and the green, trees possess an entirely different significance.

So it is accepted that trees play a role and, therefore, have some value. But, for all of their redeeming qualities, the values of trees have always been defined in intangible terms like sturdy, rugged, graceful, bigger than yours, etc. In 1947, the National Shade Tree Conference (presently the International Shade Tree Conference), together with the National Arborist Association, moved to develop a systematic method of evaluating trees in their landscape setting. The Shade Tree Evaluation Committee was formed. Their task was to place a monetary value on trees.

Ten years were spent studying the problem. Finally, in 1957, the committee published a booklet entitled "Shade Tree Evaluation." The booklet described a method which divided the value of a tree into three basic components:

1. the size of the tree (i.e., the cross-sectional area)
2. the type of tree — genus, species, variety
3. the general condition of the tree

Each of the above factors has a value assigned to it. They will be described in more detail later.

Our involvement with this method began in an effort to evaluate the plantings at Blackhawk Country Club. The reasons that prompted the evaluation were these:

1. to create an inventory of the trees, both natural and planted, on the course
2. to make a map showing the location of each tree and devise a key which uniquely associated each tree to its location on the map — the map would also demonstrate the species distribution of the trees on the course
3. to calculate the replacement value of the trees

Making the Map:

Before any calculations regarding the value of the trees could be made, a map had to be drawn showing the position of each tree. Fortunately, air photos had been taken of Blackhawk within the past five years as a prelude to some construction work on the course. The photos had been enlarged and made into contour maps showing the entire course. Unfortunately, while the map showed the larger trees fairly clearly, very few of the younger trees could be seen. The new plantings, as well as those trees that had been removed recently, had to be drawn on, or excluded from, the map.

Drawing the new plantings on the map proved to be a long, arduous process. Using the larger trees as reference points, we would find two trees that a smaller tree lay between. A line was drawn between the two reference trees. The same thing was done using two other trees from a different direction. The intersection of the lines pinpointed the location of the smaller tree. This method was an expedient as any we tried, yet accurate to allow anyone to take the map into the field and find whatever tree he might be looking for.

Once the trees were drawn in, we traced the map to eliminate some of the background confusion (buildings, contour lines, etc.). A grid system was then drawn on this tracing. The grid was typical of those found on most road maps. It was necessary to subdivide the course in this way so that when the key (a listing of all the trees, their identity, condition, and value) was made, finding a tree and all the pertinent information about it would be easier.

The next step was to take the tracing to a blueprinting company where we had blueline copies of the map made. These copies were to be used in the field when we started the identification and measuring phase of our project. We walked the course again, stopping at each tree, measuring it, identifying it down to the species level, assigning it a number in the key, evaluating its condition and noting its position on the map. When we were finished, we had found over forty different species of trees and had catalogued thirty pages of notes.

Using the Shade Tree Evaluation Method:

In the first few paragraphs of this report, a brief description was given of the evaluation method we used to determine the value of the trees at Blackhawk Country Club. In this section we will present a more detailed account of the process, as well as some of the problems we encountered while using it.

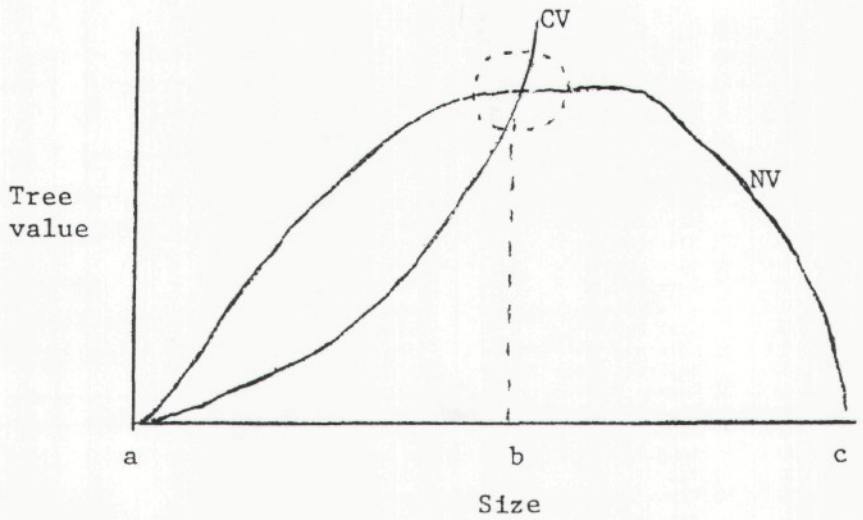
As was mentioned earlier, the value of a tree was subdivided into three components: size, types and condition.

1. Size. The size is represented by the cross-sectional area of the trunk at breast height (4 1/2 feet above the base).
   a) for large trees, where it is easier to measure the circumference (c), the forumla: Area = 0.0796 c^2 should be used.
   b) for smaller trees, where it is possible to measure the diameter (d) with a caliper, the forumla: Area = 0.7854 d^2 should be used.

The National Shade Tree Conference adopted a price of $6.00 per square inch of cross-section as a conservative, yet reasonable value for the size component of a tree. So, once the area is calculated, it is simply multiplied by the six dollar figure to obtain the size value.

However, when we started to calculate the size value of the smaller trees, we discovered a problem, as illustrated in the following graph.

Line CV, in the above graph, represents the calculated value (CV) of trees using the Shade Tree Evaluation Method. One can see



that between points a and b, the calculated value is less than the nursery value (NV). But the calculated value continues to escalate with each increase in the diameter of the tree. On the other hand, the nursery value is subject to market pressures. As the tree grows larger, the market for it decreases and therefore its value plateaus until, at some point, it literally grows out of any market and its value plummets. At some theoretical point, b, lines CV and NV will intersect. After that point, the calculated value is going to be greater than the nursery value. With the prices of the trees leapfrogging each other in this way, the dilemma of which value is the more accurate arises.

We settled on this solution. The committee report suggests that where an exact replacement value can be obtained for a tree, this is the value that should be assigned to the tree. To get this information we used the 1979 prices found in the Charles Fiore Nurseries catalogue.[1/] For those trees that were clearly too large to be carried on a nursery's inventory, we used the calculated value. This still left us with one troublesome group of trees. The trees in this group lay somewhere in the area represented by the dashed circle on the graph. The sizes of the trees were such that they were larger than those listed in the nursery catalogue but in part of the circle, the calculated value is less than the nursery value. To solve this problem, we extrapolated the nursery prices to fit the size of the tree, than calculated the value using the Shade Tree Evaluation method, and assigned whichever value was greater to the tree.

2. Type. The Shade Tree Evaluation Committee spent a great deal of time classifying trees regarding their value within geographic-climatic boundaries. The boundaries were necessary because trees perform differently in different parts of the country. The committee report lists the genus and species of the trees under one of five groups. The groups range from 100% to 20%. The most preferred trees within a region would naturally be placed in the 100% group; the poorest in the 20% group. While the lists of trees in each region are quite extensive, we did find trees on the course that weren't rated in our particular region. In these cases we borrowed the ratings from neighboring regions.
3. Condition. This component of the evaluation was dependent to a great extent on the judgment of the evaluator. The National Shade Tree Conference suggests that the image of a perfect specimen be kept in mind while evaluating the subject tree. By comparing the tree with this mental image, the evaluator assigns a relative percent value to the tree.

The report goes on to say that flexibility is important to the assessment. If the subject tree has some remarkable quality or its position in the landscape is significant, then the value of the speciment may be of more value than the perfect specimen. In our evaluation, we assigned a value of 100% to a perfect specimen and, because a tree can play an important role in how a hole will be played, we added on a percentage factor that reflected the tree's influence on the hole.

Other problems:

1. Multiple trunked trees. How do you measure them? We measured the diameter at breast height of each trunk and added the diameters together.
2. Small conifers and deciduous trees. All conifers and those deciduous trees with a diameter of less than one inch are listed by height in nursery catalogues. This meant one more trip out on the course to measure the heights of the trees that fell into this size category.

A Sample Calculation:

As was mentioned earlier, the values for smaller trees were obtained directly from the Charles Fiore Nursery catalogue. The nursery value was multiplied by the condition factor to reflect the tree's overall health.

Calculating the value for the larger trees was a simple matter of plugging the numbers for each of the components into this formula:

Value = \$6.00(area in ^{2}) (type%) (condition%)

So, for a burr oak, with a 9'3" circumference and a condition rated at 130%, the value would be:

Area = .0796 c^2 = .0796(111 in^2) = 980.75 in^2

Value = \$6.00(980.75 in^2) (100%) (130%)

= \$7,650

A Few Words About the Key:

The key has been referred to several times in this report without any real explanation of what it is or how it works. The twelve pages of numbers that appear at the end of the report, like something out of an accountant's nightmare, constitute the key. It works like this. Suppose that you discover late in December that one of your white fir trees has been sawed off at the base (and is presumably decking

[1/]Charles Fiore Nursery; Season Wholesale; Prairie View, Illinois (60069)

someone's halls with a lot of fa la la la la). For insurance purposes, you have to submit an estimate of the tree's value. To do this you then go to you map and locate the tree. The tree will lie within one of the squares on the grid that was described earlier. Each square is identified by a letter on the vertical axis of the map and a number on the horizontal axis. Assume that the square is F12. Now you turn to the key and find the trees listed under F12. There you should find the code number — F12WF. (WF = white fir; abbreviations for all types of trees are listed in Table 1, preceding the key). Behind the code number will be listed the type rating, the size, the condition rating, and the value of the tree.

Summary:

While we found that the Shade Tree Evaluation method was not devoid of weaknesses, we also discovered that it was a workable system, capable of transforming the intangible qualities of trees into more concrete terms—money.

Editor's Note: The authors completed this project as a part of the requirements for a Coordinative Internship project at the University of Wisconsin — Madison CALS Turf Management Program. The total value of the trees on the golf course exceeded $1.5 million.

Table 1. Tree Abbreviations

Symbol	Common Name	Scientific Name
A	Alder	Alnus glutinosa
AL	American Linden	Tilia americana
AP	Austrian Pine	Pinus nigra
ARB	Arbor Vitae	Thuja occidentalis
BE	Box Elder	Acer negundo
BHS	Black Hills Spruce	Picea glauca densata
BL	Black Locust	Robinia pseudoacacia
BLO	Black Oak	Quercus velutina
BO	Burr Oak	Quercus macrocarpa
C	Catalpa	Catalpa speciosa
CA	Crab Apple	Malus spp.
CBS	Colorado Blue Spruce	Picea pungens glauca
CGS	Colorado Green Spruce	Picea pungens viridis
CH	Common Horsechestnut	Aesculus hippocastanum
CO	Chestnut Oak	Quercus prinus
CsH	Cockspur Hawthorne	Crataegus crusgalli
DF	Douglas Fir	Pseudotsuga menziesii
E	Elm	Ulmus americana
GA	Green Ash	Fraxinus pennsylvanica
GL	Honeylocust	Gleditsia triacanthos
GsL	Greenspire Linden	Tilia cordata 'Greenspire'
Hb	Hackberry	Celtis occidentalis
L	Larch	Larix decidua
LLL	Littleleaf Linden	Tilia cordata
MA	European Mountainash	Sorbus aucuparia
MJ	Mountbatten Juniper	Juniperus chinensis 'Mountbatten'
NM	Norway Maple	Acer platanoides
NS	Norway Spruce	Picea abies
P	American Plum	Prunus americana
PB	Paper Birch	Betula papyrifera
PO	Pin Oak	Quercus palustris
Pop	Poplar	Populus spp.
RB	River Birch	Betula nigra
RdL	Redmond Linden	Tilia euchlora 'Redmond'
RO	Red Oak	Quercus rubra
RP	Red Pine	Pinus resinosa
SbGL	Sunburst Honeylocust	Gleditsia triacanthos 'Sunburst'
SH	Shagbark Hickory	Carya ovata
SiM	Silver Maple	Acer saccharinum
SM	Sugar Maple	Acer saccharum
SP	Scotch Pine	Pinus sylvestris
WA	White Ash	Fraxinus americana
WC	White Cedar	Juniperus virginiana glauca
WF	White Fir	Abies concolor
WO	White Oak	Quercus alba
WP	White Pine	Pinus strobus

RANDOM SAMPLE PAGES FROM EVALUATION

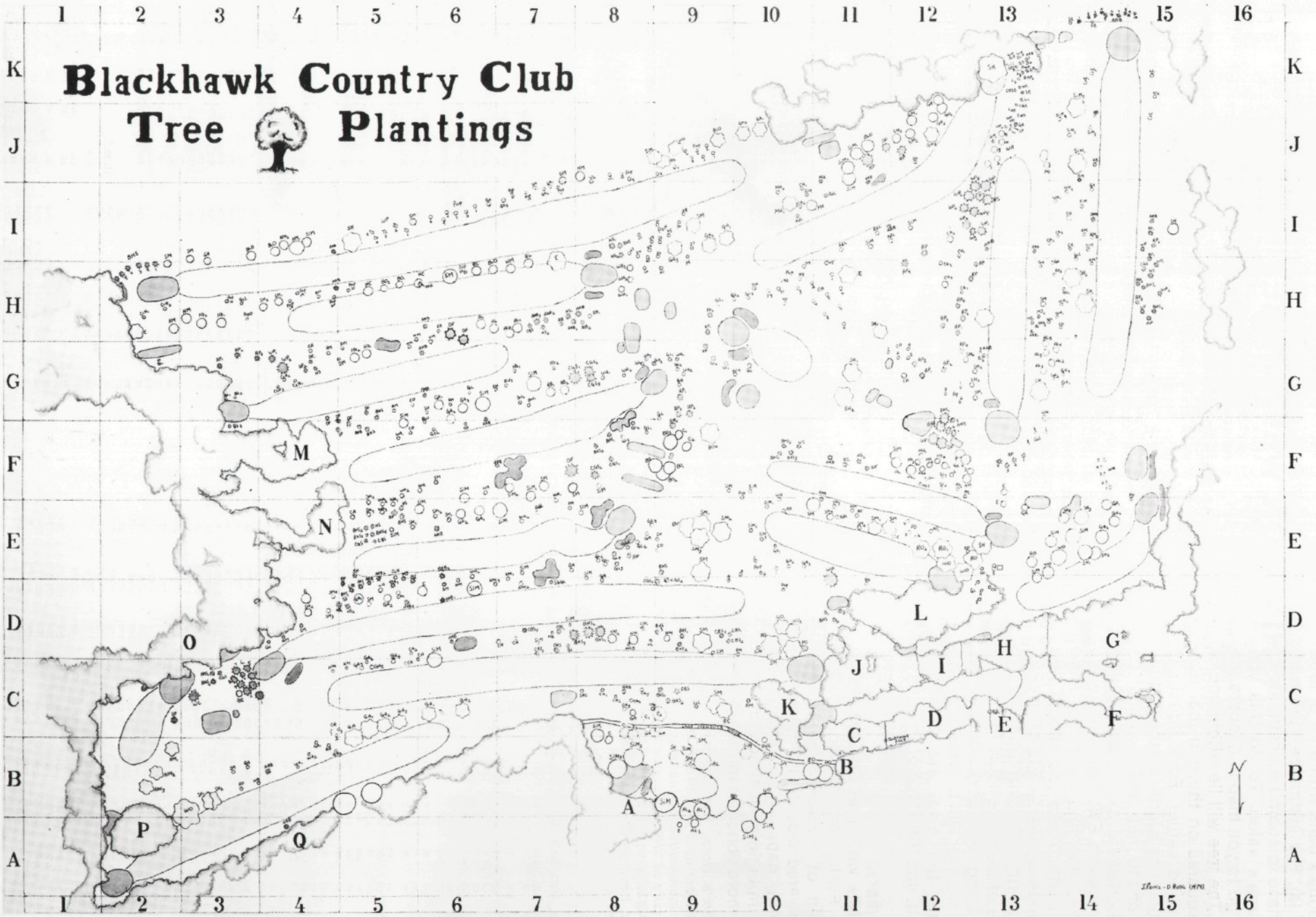
Location	Class	Cond.	Size*	Cost
A2 RO	100	100	7'4"C	$2900
AB2-3 WO	100	120	7'4"C	3487
A4 ARB	100	80	3.5'HT	30
A9 E	80	100	4'C	880
A9 AL_3	40	100	3'1"C	262
AB9 AL_2	40	110	7'6"C	1702
AB9 AL_1	40	110	6'8"C	1345
A10 SiM_2	20	70	4'4"C	181
AB10 SiM	20	100	6'7"C	596
B2 NM_1	100	90	4'6"C	1253
B2 NM_2	100	90	3'9"C	870
B2 NM_3	100	100	3'5"C	803
B3 SH_1	80	100	3'4"C	611
B3 SH_2	80	100	3'3"C	581
B3 SM	100	90	1.5"D	50
B3 RO	100	100	.75"D	36
B3 GA	80	100	1.6"D	60
B3-4 WA	80	100	2"D	85
B4 ARB	100	90	6'HT	40
B4 WA_1	80	70	1.5"D	75
B4 WA_2	80	100	1.6"D	75
B4 GA_1	80	100	1.75"D	70
B4 RO	100	100	.75"D	36
B4 GA_2	80	90	1.75"D	70
BC4 CA	100	100	2.5"+3"D	143
BC5 GA	80	80	5'HT	1100
B8 SiM_1	20	40	8'9"+6'5"C	1294
B8 C	20	70	3'4"C	107
B8 SiM_2	20	70	5'4"C	274
B8 SiM_3	20	70	8'9"C	737
BC8 C_1	20	90	6'9"C	564
BC8 C_2	20	100	6'8"C	611
B9 SiM	20	120	8'11"C	2625
B9-10 BO	100	100	5'3"C	1896
B9 SM_1	100	120	4'2"C	1433
B9 SiM	20	120	7'5"C	908
B9 SM_2	100	120	5'6"C	2497
B9 SH	80	120	6'1"C	2443
B9 AL	40	120	4'8"+5'+8'C	5152
B10 WO	100	120	7'6"C	4642
B10 SiM_1	20	60	7'11"C	517
B10 SiM_2	20	60	9'1"C	681
B10 SH	80	100	4'6"C	1114
B10-11 BO	100	100	7'6"C	3869
B10 RdL	100	100	2'8"C	552
B11 BO	100	100	5'6"C	2080

Location	Class	Cond.	Size	Cost
C2 DF	80	95	2.5"D	$ 208
C3 CGS	80	100	.75"D	29
C3 BHS_1	80	100	.75"D	27
C3 BHS_2	80	100	.75"D	27
C3 WC	100	90	4'10"+3'7"C	4385
C4 CA	100	100	2.25+2.50D	106
C4-5 CA	100	100	3.5+1.75D	130
C4 NM	100	100	2.5"D	29
C5 CA	100	100	1"D	16
C5 GA_6	80	90	1.75"D	60
C5 GA_5	80	100	6.25"D	147
C5 GA_7	80	100	5.5"D	114
C5 NM	100	100	.75"D	28
CD5-6 CA	100	100	.75"D	16
C5 GA_4	80	100	1'9"C	168
C5 GA_1	80	100	3'9"C	774
C5 GA_2	80	100	4'5"C	1285
C5 GA_3	80	100	3'7"C	706
CD6 SiM	20	100	4'9"+4'5"+5'4"C	2892
C6 GA_1	80	100	4'10"C	1285
C6 GA_2	80	90	3'4"C	550
C8 SRC	100	100	1.25"D	40
C8 C 1	100	100	1.25"D	40
C8 C 2	100	100	.75D	40
C8 ARB	100	100	8'HT	56
C8 C 3	100	80	6.75"D	172
C8 GA	80	100	2'5"C	321
C8 C 4	100	100	.75"D	40
C8 C 5	100	100	.75"D	40
C8 C 6	100	100	3.6"D	61
C8-9 C_1	20	60	5'1"C	213
C8-9 C_2	20	130	8'10"C	1395
C8 WA	80	100	8'25"D	2570
C8-9 WA	80	90	2'5"C	290
C9 GA	80	100	7"D	185
C9 BHS_1	80	100	4'HT	36
C9 BHS_2	80	100	3'HT	27
C9 CBS	80	100	4'HT	39
C9 LLL	100	100	6"D	170
C9 SM	100	20	7'5"C	739
C9 BE	20	70	7'10"C	590
C9 WA	80	100	3"D	95
C10 RM	100	60	6'HT	14
D4 E	80	100	3'11"C	837
D4 SM	100	100	1.75"D	34
D4 NM	100	100	3.5"D	100
D4 GL	100	100	2.25"D	95
D4 SM_2	100	100	3.2"C	679

*circumference (C), diameter (D), and height (HT).

Location	Class	Cond.	Size	Cost
Group L				
RO	100	140	7'8"C	$5659
RO	100	140	6'8"C	4279
RO	100	140	6'7"C	4173
WO	100	140	4'7"C	2023
WO	100	140	6'7"C	4173
WO	100	140	5'4"C	2739
WO	100	140	4'1"C	1605
WO	100	140	5'2"C	2570
WO	100	140	4'6"C	1950
WO	100	140	5'4"C	2739
WO	100	140	4'9"C	2172
WO	100	140	6'4"C	3862
WO	100	140	6'3"C	3761
WO	100	140	6'8"C	4279
PO	100	140	7'9"C	5783
RO	100	140	7'10"C	5908
RO	100	140	6'9"C	4387
WO	100	140	6'3"C	3761
WO	100	140	5'5"C	2825
PO	100	140	6'7"C	4173
PO	100	140	6'7"C	4173
PO	100	140	7'11"C	6034
E	80	140	3'4"C	1182
RM_b	20	140	2'7"C	92
Group M				
BO	100	120	3'4"C	917
BO	100	120	2'11"C	1470
BO	100	120	3'3"C	872
BO	100	120	4'1"C	1376
BO	100	120	3'2"C	828
BO	100	120	2'11"C	585
BO	100	120	8"D	464
BO	100	120	4'2"C	1433
BO	100	120	2'10"C	663
BO	100	120	4'5"+4'C	5846
BO	100	120	4'7"C	1734
BL	20	120	4'4"C	1310
BO	100	120	4"D	232
BO	100	120	2'8"C	587
E	80	120	3'C	743
BL	20	120	3'9"C	232
BL	20	120	3'9"C	232
Group N				
BO	100	150	9'5"C	9148
RO	100	150	4'10"C	2410
RO	100	150	4'3"+3'9"C	6603
RO	100	150	3'4"C	1146
BO	100	150	5'6"C	3121
BO	100	150	2'4"C	562

Location	Class	Cond.	Size	Cost
Group N (cont)				
BO	100	150	5'5"C	$3027
BO	100	150	4'4"C	1937
BO	100	150	8'7"C	7600
BO	100	150	6'4"C	4138
BO	100	150	3'8"C	1387
RO	100	150	3'3"C	1090
RO	100	150	4'7"C	2167
RO	100	150	5'8"C	3313
RO	100	150	4'2"C	1791
BO	100	150	4'11"+3'3"C	6880
BO	100	150	3'C	1944
BO	100	150	5'3"C	2843
BO	100	150	4'C	1651
BO	100	150	4'5"C	2012
BO	100	150	3'4"C	2400
BO	100	150	2'C	413
BO	100	150	1'9"C	316
BO	100	150	3'5"C	1204
BO	100	150	3'9"C	3038
BO	100	150	5'4"C	2934
BO	100	150	7'C	5055
PB	100	110	10'HT	100
DF	100	110	11'HT	176
RO	100	110	6'4"C	3034
BO	100	110	4'11"C	1829
BO	100	110	4'11"+3'5"C	5254
RO	100	140	7'C	4718
RO	100	140	6'9"C	4173
PO	100	140	5'3"C	2654
PO	100	140	5'7"C	3002
ARB	100	140	25'HT	245
PO	100	140	4'8"C	2097
DF	80	140	2'2"C	362
PO	100	140	5'8"C	3092
PO	100	140	6'9"C	4387
RO	100	140	3'10"C	1415
SH	80	140	4'1"C	1284
PO	100	140	6'3"C	3761
BO	100	140	6'9"C	4387
Group O				
SiM	20	100	4'3"+5'5"+ 4'5"C	2728
GA	80	100	4'2"C	955
AL	60	100	7'2"C	2119
AL	40	100	3'10"+3'7"+ 3'4"C	3179
AL	40	100	6'2"+3'5"C	2527
AL	40	100	4'7"+4'6"C	2269
AL	40	100	6'5"C	1133
C	20	100	5'8"C	442
C	20	100	3'8"C	185


Blackhawk Country Club
Tree Plantings
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