

ADOPTED

# Coal Creek

GOLF COURSE



## Golf Course Improvement Plan

*Submitted:*

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**Coal Creek Golf Course  
Improvement Plan:**

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## **ACKNOWLEDGEMENTS**

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Bob Muckle, Ward I  
Dave Clabots, Ward I  
Sheri Marsella, Mayor Pro-Tem & Ward II  
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## EXECUTIVE SUMMARY

This study explores potential long-range improvements intended to assist the Owner identifying and prioritizing capital improvements directed at improving overall course conditions and playability. This study is not intended as a comprehensive business plan or “feasibility study” but rather as a detailed review of the golf course conditions along with recommendations and cost estimates for improvements.

This study involved interviewing and surveying City of Louisville staff, employees of Western Golf Properties, representatives of the Coal Creek Golf Advisory Board, the Coal Creek Men’s Club and the Coal Creek Women’s Club. In addition, the golf course assessment included a review of the existing irrigation system by Mr. Brian Keighin of Irrigation Technologies, an agronomic review by Mr. Fred Soller of the United States Golf Association (USGA) and an architectural review by Herfort Norby Golf Course Architects, Inc. Lastly, the study included an email survey with nearly 750 responses from area residents on issues relating to course conditioning and priorities for improvement. The study was conducted under the supervision of Kevin Norby, Owner and President of Herfort Norby Golf Course Architects.

The Golf Course Improvement Plan identified four primary areas of improvement including tree removal, repair and replacement of the irrigation system, sand bunker renovation and expansion of the practice facilities. According to the nearly 750 survey respondents, tree removal, bunker renovation and expansion of the practice facilities were the highest priority issues. Also ranking high, were clubhouse improvements. However, our recommendation, given the significant cost and number of required golf course improvements, would be to complete only minimal interior clubhouse improvements at this time to address normal wear and tear and code issues.

### Trees

The most pressing issue facing Coal Creek Golf Course is the impact which trees are having on the safety, playability and maintenance of the golf course. Many of the ditches have become so choked with trees that they obscure the golfer’s view of the golf course and, on many golf holes, trees have created safety issues by obscuring the landing area and unnecessarily forcing golfers to hit the balls towards adjacent neighboring homes or golf holes.

Our recommendation would be to implement a tree removal and replacement program whereby poorly positioned, short-lived or structurally compromised trees would be selectively removed to improve safety, reduce maintenance, improve playability and allow for the establishment of more-desirable, longer-lived trees.

### Sand Bunkers

Over time, the bunkers at Coal Creek have been edged so that the bunkers are now considerably larger than the original bunkers and the “capex” or faces now have nearly vertical slopes on which it is difficult to maintain sand. As the faces get edged and the native soils erode into the bunker, the sand becomes contaminated so that it is no longer able to drain properly. Earlier this year, the contaminated sand in the bunkers was replaced with new sand. However, this is only a short-term, temporary fix since the faces are still eroding.

It is our recommendation that a complete renovation of the bunkers be undertaken to a.) eliminate obsolete or out-of-play bunkers, b.) reduce overall maintenance and repair, c.) improve playability and visual interest and d.) restore the original design intent.

### Practice Facilities

The driving range tee at Coal Creek is conveniently located near the clubhouse and generally of adequate length and width. Unfortunately, the teeing area is too small to allow sufficient time for turf recovery. In addition, the short-game practice area is unsafe and difficult to maintain.

Our recommendation would be to relocate the short-game area to the south end of the practice putting green, expand the driving range tee and install a concrete tee-line with practice mats. Proposed improvements would not only increase turf quality but should allow for increased revenue by increasing the number of teeing stations and extending the practice season.

### Irrigation System

The existing irrigation system at Coal Creek was installed in 1989 but unfortunately appears to have been installed using substandard materials and questionable construction practices. The computerized control system and pumping system were updated in 2005 and 2009, respectively. Unfortunately, the remaining system of pipe, heads and valves is 32 years old and plagued by frequent pipe breaks, fitting leaks and heads which no longer operate properly. According to the USGA Green Section, the expected life cycle of a golf course irrigation system is 25 years.

The current system is not only incapable of providing uniform irrigation coverage but the system is inefficient and wasteful of water resources. A new system would improve overall course conditioning, minimize water usage and reduce unnecessary labor required to maintain the system.

Our recommendation would be to immediately 1.) inspect and replace worn out and broken heads, 2.) repair the disabled 25-horse booster pump near No. 18 green and 3.) prepare a GPS database to improve the operation of the existing system until an entirely new system can be installed. Future improvements should include the installation of a new irrigation system including piping, heads, valves and control wiring.

Additional recommendations include:

1. Correct drainage issues on holes No. 1,2,3,4,5,9,13 and 14.
2. Realign and expand cart paths to improve safety and improve turf quality.
3. Level existing tees to provide a more uniform teeing surface.
4. Improve visibility of signage on highway 36.
5. Replace leaking pond liners.
6. Construct junior tees to encourage youth and family golf at Coal Creek.
7. Construct a nursery green for use in repairing damaged turf.
8. Bathroom facilities and storm shelter south of Dillon Road.

Long range improvements are projected to cost between \$3.7 and \$4.7 million. Some improvements, such as drainage repairs and the bunker renovation, should be completed prior to installation of a new irrigation system in order to minimize future damage or disruption after the new system is installed.



## COAL CREEK GOLF COURSE IMPROVEMENT PLAN

This study explores potential long-range improvements intended to assist the Owner identifying and prioritizing capital improvements directed at improving overall course conditions and playability. This study is not intended as a comprehensive business plan or “feasibility study” but rather as a detailed review of the golf course conditions along with recommendations and cost estimates for improvements.

This study was conducted by assessing the existing golf course and by interviewing representatives of the Coal Creek Golf Advisory Board and the Coal Creek Men’s and Women’s Clubs as well as Director of Parks & Recreation Joe Stevens, Golf Course Superintendent Chris Bradford and Western Golf Property’s Regional Director of Operations Eric Jensen. In addition, an email survey with nearly 750 area residents was conducted by Herfort Norby to give better understanding of local concerns and priorities. The study was conducted under the supervision of Kevin Norby, Owner and President of Herfort Norby Golf Course Architects.

Coal Creek Golf Course was designed by golf architect Dick Phelps and opened in 1990. The course is owned by the City of Louisville and is managed by Western Golf Properties. The course has a spacious routing with good sightlines and nice elevation changes. Putting surfaces and tees are generally well positioned and adequately sized.

## TARGET MARKET

In order to define a long-term vision for the golf course and determine which improvements are most necessary, it is important to first define and understand the niche which a particular golf course occupies or should occupy in the market.

Coal Creek would be best defined as a public daily-fee golf course who’s primary client base consists of residents of Louisville and golfers traveling from the surrounding communities. The course relies primarily on the sale of season passes and daily green fees for revenue.

Because Coal Creek is generally well designed and well maintained, the golf course seems well positioned to function as a public daily-fee golf facility. As such, it is not necessary to make significant changes to the style or character of the course but rather to simply improve playability and conditioning to insure that the course remains enjoyable for a wide range of golfing abilities.

## THE GOLF COURSE

**B**ased on golf courses of similar market and similar operational quality, staffing, economic environment and financial resources, we have assigned a letter grade of B-/B for Coal Creek Golf Course.

This grade is established based on the following analysis:

### *Course Conditioning*

Maintenance and other factors can affect the golfer's perception of the course and their ability to play the course. In looking at course conditioning we attempt to assess whether maintenance or other factors might reasonably meet the golfer's expectations of acceptable playing conditions including turf quality, bunker sand consistency, drainage and course aesthetics. The letter grade from our review process for course conditioning is B/B+.

### *Course Routing & Design*

In looking at course routing and design, we attempt to assess the design of the greens, walkability, pace of play, placement of hazards, the visual quality of the golf course and the relationship of the practice facilities and parking areas to the clubhouse. The letter grade from our review process for routing and design is B+/A-.

### *Course Safety*

Changes in golf equipment technology have significantly impacted the way golfers play the game from that of only a decade ago. In particular, golfers are now hitting the ball further and, consequently, hitting the ball further off-line. In assessing golf course safety, we attempt to determine whether conditions exist which put the golfer or the public at risk or whether conditions exist which may expose the owner to an unacceptable level of liability. The letter grade from our review process for safety is B/B-.

### *Course Playability*

Assessing playability involves looking at whether the course is designed and maintained in such a way as to offer a fair and enjoyable golf experience for the average golfer while at the same time offering the challenge and strategic qualities that the above average player enjoys. We look at the placement of hazards, course length, the placement of tees, the impact of trees, the slope of the greens, shot value and tactical diversity. The letter grade from our review process for playability is C/C+.

## TREES

In our opinion, clearly the biggest issue facing Coal Creek Golf Course is the impact trees are having on the safety, playability and maintenance of the golf course. Most of the trees at Coal Creek are cottonwood and willow which have established themselves in the creek bottoms in the years since the golf course was built. These trees are relatively short-lived, fast growing and have generally aggressive root systems and weak branching structures. The weak branching structures result in increased maintenance required to pick up fallen branches and leaf litter. The aggressive root systems result in root encroachment into putting greens, tee and fairways where they compete with the turf grasses for moisture. The root systems can also damage irrigation pipe, plug drain tile systems and cause damage to mowing equipment. See the attached agronomic assessment of Coal Creek by the United States Golf Association (USGA) for information on the impact which trees have on turf grass.



Dead trees on hole 6.



Roots & suckers in bunker at hole 4 green.

From a playability standpoint, many of the ditches have become so choked with trees that they obscure the golfer's view of the golf course. On holes No. 2, 4, 10 and 14 the trees have created a safety issue by obscuring the landing area and unnecessarily forcing golfers to hit the ball towards neighboring homes. In addition, trees which overhang



Trees left push ball towards houses right on hole 2.



Restricted view to fairway on hole 6 tees.

## TREES (CONTINUED)

greens, tees and fairways create shade which weakens the turf and increases disease pressure, winter damage and overall maintenance costs. Selectively removing these trees would not only improve overall course conditioning but would provide for a safer, more enjoyable experience for golfers. The conditions today are clearly not what the original golf architect envisioned when he designed the course.



*Restricted sightline at hole 17 tee.*

Our recommendation would be to implement a tree removal and replacement program whereby poorly positioned, short-lived or structurally compromised trees would be selectively removed to improve safety, reduce maintenance, improve playability and allow for the establishment of more-desirable, longer-lived trees. Trees which are good for golf courses include Oak, Hickory, Catalpa, Sugar Maple, Red Maple, American Elm (disease resistant), American Linden, Ginko, Hackberry and Pine. Care must be taken to allow for adequate space at maturity. Trees which drop fruit, have thorns or have shallow root systems are generally poor choices for golf courses. These may include, Spruce, Silver Maple, Norway Maple, Cottonwood, Poplar, Walnut, Locust, Ash, Apple, Russian Olive and Willow.



*The addition of trees behind hole 15 green would aid in blocking view to buildings.*



## IRRIGATION SYSTEM

The existing irrigation system at Coal Creek was installed in 1989 and consists of a series of pipes, control satellites, sprinkler heads and a pumping system which delivers water to the golf course from the pump station and wet well located near the pond between hole No. 11 and 12. A new pump station was installed in 2009 and consists of two 70 horsepower vertical turbines and a 25 horse booster pump. Apparently, the booster pump is not being utilized due to a leak. The control system was updated in 2005 with a state-of-the-art Rainbird computerized central control. Unfortunately, the system is not being used to its fullest potential because no GPS database was prepared for use in programming the control system.



The existing piping system consists of Class 160 PVC (poly vinyl chloride) pipe, fittings and valves which are now nearly 25 years old and plagued by frequent leaks and breaks. Of particular concern is the lack of thrust-blocking at fittings, the use of epoxy-coated steel service tees and the use of weaker class 160 PVC pipe. The expected life cycle of PVC irrigation pipe is 25 years.

The original irrigation heads are Rainbird full-circle (model 51) and part-circle heads (models 47 and 95) designed to be spaced at 70 feet on center. However, at Coal Creek, spacing varies widely & ranges between 16 feet to 80 feet on center. In addition, many heads are worn out, broken or out of adjustment. This limited adjustment and poor coverage results in over watering and under watering – often times only a few feet apart. Parts for the existing heads are no longer available so, in recent years, the maintenance staff has begun to replace some broken heads with newer Rainbird Eagle 700, 750 & 900 heads which offer more adjustability and improved precipitation rates.



Leaking irrigation head.



Broken irrigation head.

## IRRIGATION SYSTEM (CONTINUED)



*Overwatering in fairway.*

Immediate improvements to coverage and turf quality could be made by individually inspecting and adjusting or repairing each head to insure that it is functioning properly. Worn out or broken heads should be replaced with new heads. This is only a temporary measure as the poor spacing and continued failure is an on-going issue. In addition, the existing 25 horsepower booster pump near 18 green should be repaired so as to provide adequate pressure on holes 15 and 16.



*Poor irrigation coverage at residential property line.*

Future improvements should include the installation of an entirely new irrigation system including piping, heads, valves and control wiring. The installation of a new irrigation system should improve overall course conditioning, minimize water usage and reduce unnecessary labor required to maintain and repair the system. See the attached detailed irrigation assessment prepared by Irrigation Technologies.



## SAND BUNKERS

**S**and bunkers are one of the most important elements on a golf course. As a flanking bunker, they can visually and strategically frame a green or fairway. As a target or cross-bunker, they can act as an aiming point to aid in alignment. Near water or out-of-bounds, they can act as a savior bunker to protect the golfer from being unfairly penalized.

Bunkers are also often times one of the highest maintenance issues on a golf course. Over the years, the bunkers at Coal Creek have been edged so that the bunkers are now considerably larger than the original bunkers and the “capex” or faces now have nearly vertical slopes on which it is difficult to maintain sand. As the faces get edged and the native soils erode into the bunker, the sand becomes contaminated so that it is no longer able to drain properly. Earlier this year, the sand in the bunkers was replaced with new sand. However, this is only a short-term, temporary fix since the faces are still eroding.



*Beach bunker is difficult to maintain on Hole 2.*



*Collapsing bunker face & contaminated sand.*

It is our recommendation that a complete renovation of the bunkers be undertaken to 1.) eliminate obsolete or out-of-play bunkers, 2.) reduce overall maintenance and repair by eliminating erosion and wash outs, 3.) improve playability and visual interest, 4.) define the individual holes strategically and 5.) restore the original design integrity. As indicated on the master plan, some bunkers will be removed or relocated, some will be reconstructed and some new bunkers will likely be added. By redesigning and reconstructing the existing bunkers and selectively adding new bunkers, it is our belief that Coal Creek Golf Course will provide a more enjoyable golfing experience for golfers of all ages and abilities while, at the same time, minimizing the time and expense of repairing and maintaining the golf course.

It is important to note that, upon completion of the bunker renovation, the City should avoid the use of mechanical bunker raking in order to minimize damage to the bunker faces & contamination of sand. We envision the new bunkers as similar in character to the original bunker style but slightly smaller and easier to maintain without mechanized raking.

## CLUBHOUSE & PARKING LOT

The clubhouse at Coal Creek seems, in general, adequately sized given current levels of play. The clubhouse is dated but overall nicely maintained for the age of the structure. Some obvious improvements such as replacing the torn carpet and replacing windows should be considered. The deck and banquet area appear to accommodate approximately 90 people however, there is insufficient space to accommodate a full shotgun-start golf outing. Although it would be preferable to accommodate a larger number of people, investing significant capital in a clubhouse expansion or renovation would not be advised at this time given the number of improvements required on the golf course.

The clubhouse's location provides for good access to the practice facilities and generally good views of the golf course. Some clearing of trees would improve sightlines between the pro-shop and No. 10 tee.

The first visual impression of the clubhouse is somewhat lacking due primarily to the outdated landscaping and timber retaining walls at the front entry.

The parking area for the clubhouse seems adequate except for larger group outing or special events. The parking lot could benefit from the incorporation of some landscape plantings in the islands in order to define rows of parking stalls, to provide shade and to frame the approach to the clubhouse.

## MAINTENANCE FACILITIES

A typical maintenance facility for an 18-hole golf course would generally include approximately 2,000 square feet of heated office and shop space, 4,000 square feet of equipment cold storage space, a chemical storage facility and exterior storage bins for topdressing mix and bunker sand. The existing maintenance facility at Coal Creek is somewhat undersized to accommodate basic maintenance operations and equipment storage. In addition, the facility lacks an adequate chemical storage facility and exterior storage bins.



*Clubhouse main entrance is overgrown & dated.*



*Timber retaining walls are dated & require maintenance.*



*Maintenance facility is undersized to accommodate equipment storage.*

## PRACTICE FACILITIES

The driving range at Coal Creek is conveniently located near the clubhouse and starting tee area. The length and width are generally adequate but the teeing area is not level and is too small to allow adequate time for turf recovery especially with any significant increase in large events or daily-fee rounds. Leveling and enlarging the tee and adding a concrete tee-line with mats would provide for improved turf quality and reduced pressure on the turf during outings and in the off-season while turf is dormant



*Expanded turf tee & concrete tee line would increase revenue potential & improve turf quality.*

The irrigation coverage at the range, and particularly at the perimeter of the range, is inadequate. Improved irrigation would provide better turf recovery at the tee and would aid in slowing balls hit towards nearby houses or towards No. 1 fairway.



*Short game area is undersized & difficult to maintain.*



*Poor turf condition from lack of irrigation & undersized tee.*

The practice bunker and short-game area are in poor condition and have become difficult to maintain due to years of use and edging. The practice bunker should be reconstructed to reduce the size and to provide for ease of maintenance. The chipping green and adjoining chipping areas should be re-graded and enlarged to provide for improved drainage, ease of mowing and increased usage



## PUTTING GREENS

Currently, Coal Creek Golf Course has nineteen sand-based putting greens which were originally grassed with Creeping Bentgrass. Today, the putting surfaces have been contaminated with annual bluegrass (*Poa annua*). Annual bluegrass, is essentially a weed which very aggressively establishes itself at the lower cutting heights found on golf courses. Unfortunately, annual bluegrass is not shade tolerant, heat tolerant or completely winter hardy. This results in a patchwork pattern of grasses and, with the prevalent shade and irrigation issues, results in a high risk of turf loss due to both winter injury and summer heat stress. In general, the greens are adequately sized and have a sufficient number of areas to cut a cup. Based on our visual review, the greens appear agronomically sound. Aside from fixing a few relatively minor issues with the greens, we would not see reconstruction of the putting surfaces as a high priority issue at this time.

## FAIRWAYS & ROUGHS

Like most public golf courses in Colorado, the existing fairways, tees and roughs at Coal Creek were originally grassed with Kentucky Bluegrass (*Poa pratensis*). Over time the fairways have been contaminated with both annual bluegrass (*Poa annua*) and creeping bentgrass (*Agrostis palustris*). This, again, results in a patchwork pattern of grasses and makes consistent playing conditions and turf management difficult. By reducing shade and with proper aeration and irrigation, one can create a healthy environment which encourages the proliferation of Kentucky Bluegrass. However, without reconstruction and regrassing of the fairways, there will continue to be an increased risk of turf loss due to winter injury and summer heat stress. Short term improvements should include regular aeration and improved irrigation coverage. Long-term improvements may include the regrassing of the fairways with Kentucky Bluegrass to provide a more uniform and more sustainable playing surface.



*Patchwork turf from poor drainage & compaction.*



## TEEING GROUNDS

The tees at Coal Creek are generally of sufficient size given the current level of play. However, many of the tees are uneven so that a good portion of the teeing area is not usable. The tees on holes No. 2,3,5,7 and 14 have become uneven, in part, because trees lining the fairway have made one side of the tee more useable than the other. Regular topdressing has resulted in “domed” or uneven tees. Our recommendation would be to selectively regrade and regrass the tees to provide a level and more uniform teeing surface which will be easier to maintain.

Coal Creek utilizes four-tees ranging from 5,086 yards to 6,879 yards. It may be beneficial to implement a fifth yardage option by simply creating a blue/white scorecard combination tee that would play around 6,000 yards and would make the course more enjoyable for a wider range of golfers. We would also recommend revising the color system from the standard red, white & blue to a color scheme which would encourage the golfer to select the proper yardage. A good example might be black, green, silver & gold.

Lastly, it may be beneficial to construct alternate forward tees on holes 4 and 14 and to implement junior tees on each hole to encourage youth and families to utilize the facilities at Coal Creek.

## DRAINAGE

There are a number of drainage issues at Coal Creek. Many of these are a result of inconsistent irrigation coverage or damage from golf carts near cart paths. However, holes 2,3,5,9,13 and 14 have drainage issues resulting from inadequate surface drainage. These problems can generally be solved by regrading fairways to provide a minimum of 3% slope and by the installation of small catch basins, collection areas and sub-surface drain tile.



*Drainage issue on Hole 5.*



*Drainage issue on Hole 14 fairway.*

## CART PATHS

Cart paths at Coal Creek generally are in good condition, run from tee to green and are constructed of concrete. However, because the cart paths were constructed at only 6 feet wide, wear from tires has resulted in numerous areas which have no turf next to the cart paths. This is particularly an issue at tees and greens and at corners. Lastly, in other areas, cart paths are poorly positioned so as to visually interfere with the golf course or to unfairly direct golf balls out of bounds or towards adjoining properties. Of particular concern are the paths on holes No. 1, 4 and 18.

Our recommendation would be to widen cart paths at tees and greens to eliminate dead turf, standing water and “pot holes” which are unsightly and can be unsafe for golfers.



*Cart paths are too narrow.*



*Typical wear at tees & green.*



*Drainage & wear from carts & foot traffic at hole 6 green.*



## ENVIRONMENTAL STEWARDSHIP

There are a number of improvements which would improve the sustainability of the golf course operation at Coal Creek Golf Course. One of the most noticeable and most beneficial conservation opportunities would come from the installation of a more efficient irrigation system which would allow the flexibility and control to place irrigation water where it is specifically required. New more efficient irrigation heads with more uniform spacing would allow the maintenance staff to more closely monitor and control the application of water to avoid over-watering and turf damage.

In addition, the master plan identifies a number of areas where turf grasses could be converted to low-maintenance grass species. These would include areas near No. 1 tee and green, 4 tee, 5 tee, 9 tee, 14 green and 15 tee. Turfgrass conversion areas would utilize shorter native and non-native grasses such as fescue, Prairie Dropseed and Buffalo grass. The conversion of these native and low-maintenance areas would conserve water, reduce chemical and fertilizer inputs, reduce weekly mowing and provide additional habitat for ground-dwelling birds, rodents and insects.



Additional measures to improve environmental sustainability include the installation of an irrigation weather station to monitor and reduce water consumption, the installation of bird houses and bat houses, the supplemental use of skylights and/or solar panels for the maintenance and clubhouse facilities and the use of porous paving materials at the clubhouse area. Audubon International provides information and certification of golf courses seeking to improve environmental stewardship. Visit their website at [www.auduboninternational.org](http://www.auduboninternational.org).



## COST OF RENOVATION

The long-range master plan prepared by Herfort Norby indicates that, if all recommendations were implemented, the cost of a renovation would likely range between \$3 and \$4 million. If the City should also chose to pursue the maintenance facility improvements and clubhouse improvements, the renovation project could likely increase by roughly \$200 to \$300 thousand.



*Compromised pond liner on hole 11.*

For purpose of prioritizing future projects, we have categorized improvements into critical, competitive and comprehensive. Those items listed as critical are, in our opinion, those improvements which are in greatest need of being addressed and would play the most significant role in reducing or stabilizing repairs and maintenance and in increasing revenue through increased daily fee rounds.

### *Critical*

1. Remove trees to correct safety issues on hole nos. 2, 4, 5, 6 & 10.
2. Remove trees to improve turf quality and maintenance on hole nos. 3, 8, 10, 12, 14, 17 & 18.
3. Repair existing 25 horsepower booster pump near hole no.18 green.
4. Replace existing irrigation system to improve turf conditions & reduce water consumption.
5. Renovate sand bunkers to improve drainage & playability to reduce unnecessary repairs and maintenance.
6. Repair drainage issues on hole nos. 1, 2, 3, 4, 5, 9, 13 & 14.

### *Competitive*

1. Expand driving range tee & add concrete tee line to improve turf quality, reduce winter damage & increase revenue potential.
2. Reconstruct short-game practice area to reduce maintenance & provide better learning experience.
3. Install curbing & expand cart paths at tees and greens to improve turf quality & reduce safety issue.
4. Realign cart path on hole nos. 1, 4 & 18 to improve safety & playability.

### *Comprehensive*

1. Construct new forward tees on hole nos. 4 & 14 to improve playability and increase teeing area.
2. Construct new back tee on hole No. 4 to reduce safety issue & increase overall teeing area
3. Replace or repair pond liners on hole nos. 8, 11 & 12.
4. Construct a nursery green for use in repairing turf loss & damage.
5. Regrass fairways to improve turf quality & reduce turf loss.



## PHASING & DISRUPTION TO PLAY

Generally, when completing a golf course renovation project, it is important to minimize disruption to play. However, when the project is extensive enough, it is often necessary and beneficial to close all or part of the golf course to allow the contractor to quickly and efficiently complete the work and to then open with a new and dramatic look. At Coal Creek, the improvements which are most critical, such as tree removal, bunkers and irrigation, are not particularly disruptive and can be completed while the golf course is still in use. Ideally, the work would be completed in September or October when play is reduced and yet soil and weather conditions are conducive. During this time, temporary greens or tees may be required to keep the golf course playable and provide safe working conditions for the contractor.

It is important to note that, prior to the installation of a new irrigation system, the city should complete the drainage projects & bunker renovation in order to avoid damaging the newly installed irrigation system at a later date.

Some projects such as replacement of damaged irrigation heads and tree removal may be completed by the maintenance staff. Other projects such as the reconstruction of sand bunkers and the construction of new tees should be completed by a qualified golf course contractor that has the proper equipment and experience in golf course construction and sequencing.

## ADDITIONAL RECOMMENDATIONS

We would offer the following additional recommendations:

1. Install junior tees.
2. Install benches at tees on par three holes.
3. Install bathroom facilities & storm shelter near no. 15 tee.
4. Relocate highway sign on No. 16 for improved visibility.
5. Realign & pave maintenance facility service road near no.18 fairway.
6. Implement a “blended” scorecard tee option (combination of blue and white tees) to provide improved playability for a wider variety of golfing abilities.
7. Update clubhouse landscaping, parking lot and practice area landscaping.
8. Consider selling or deeding out-of-play property remnants between home sites and ponds on no. 2, 8, 10, 11 & 14.
9. Install fountain in pond on hole No. 8 to improve visibility of water hazard from tee.



## SUMMARY

**B**ased on our observations and review of the golf course, the primary issue facing Coal Creek Golf Course is the negative impact that trees are having on playability, turf quality and safety.

The key components of this renovation would include 1.) tree removal and replacement to improve turf quality and playability, 2.) a comprehensive bunker renovation to improve the visual character and playability of the golf course, 3.) the installation of a new irrigation system to improve turf quality and playing conditions.

Even a moderate investment directed at improving course conditioning should assist in providing increased value as compared to other areas courses. In addition, the course should benefit from having the ability to attract an increased number of corporate outings, tournaments and fundraising events. These improvements should establish Coal Creek Golf Course as one of the premier public daily-fee golf facilities in the Denver market and should set the course for improved financial stability.



Kevin Norby, President  
Herfort Norby Golf Course Architects, LLC.  
Chaska, Minnesota

# Coal Creek GOLF COURSE

Louisville, Colorado

## Hole 1

|          | Proposed | Existing |
|----------|----------|----------|
| P A R    | 4        | 402      |
| Handicap | 15       | 388      |
|          |          | 352      |
|          |          | 308      |

Golf Course Architect:



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Poor Irrigation in out of play areas. Possible conversion to drought tolerant grasses to reduce maintenance & water consumption.

Tree roots damage equipment & make maintenance difficult.

Raised collar dams water & causes winter injury at front of green.

Approach is poorly drained with run-off from homesites.

Spruce trees too close to fairway creating future issues.

Poorly drained area.

Cart path is visually distracting & directs errant balls toward homesites.

Bunker aids in protecting homesites but bunker faces have deteriorated & contaminated sand with rock.

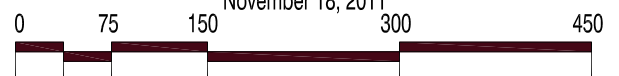
Poorly drained area.

Tree has broken top & is poorly shaped.

Tees point right of landing area towards homesites.

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November 18, 2011







## Coal Creek GOLF COURSE

Louisville, Colorado

### Hole 2

|          | Proposed | Existing |
|----------|----------|----------|
| P A R    | ●        | ● 363    |
| 4        | ●        | ● 347    |
| Handicap | ○        | ○ 312    |
| 11       | ●        | ● 276    |

Golf Course Architect:  
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Congestion from walk-up traffic causes poor turf quality & renders irrigation ineffective.



Trees on left side of hole block view to landing area & create a safety issue for homes on right side. Trees also make left side of tee unusable. Remove 8-10 cottonwood.

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Winter damage on tees from compaction & lack of water during winter use.

Poa annua & bentgrass encroachment on tee requires additional maintenance & increases turf loss.

Poor Irrigation coverage.

Golf course maintains unnecessary property near homesites. Gift or property land to landowners.

Beach bunker creates maintenance issue & is unsightly visual feature.

Drainage from homesites crosses fairway.

Pond liner has failed & needs repair.



*Coal Creek*  
GOLF COURSE

Louisville, Colorado

## Hole 3

|          | Proposed | Existing |
|----------|----------|----------|
| P A R    | ●        | ● 399    |
| 4        | ●        | ● 372    |
| Handicap | ○        | ○ 330    |
| 7        | ●        | ● 291    |

Remove poorly formed trees so stronger & longer-lived trees remain. Remove dead & broken limbs - **safety Issue**.

Poorly drained fairway increases soil compaction & turf loss in fairway.

High water table in fairway causes flooding & turf loss in fairway.

Large area of out-of-play requires irrigation & unnecessary maintenance.

Remnant property difficult to access for maintenance & irrigation.

Cart path bounces errant balls toward the pond.

Algae from stagnant water

Remove 2 trees unhealthy with decay.

Thin strip of land adjacent to property line requires unnecessary maintenance.



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# Coal Creek GOLF COURSE

Louisville, Colorado

## Hole 4

|          | Proposed | Existing |
|----------|----------|----------|
| P A R    | ●        | ● 532    |
| 5        | ●        | ● 521    |
| Handicap | ○        | ○ 484    |
| 3        | ●        | ● 452    |

Golf Course Architect:

HERFORD NORBY

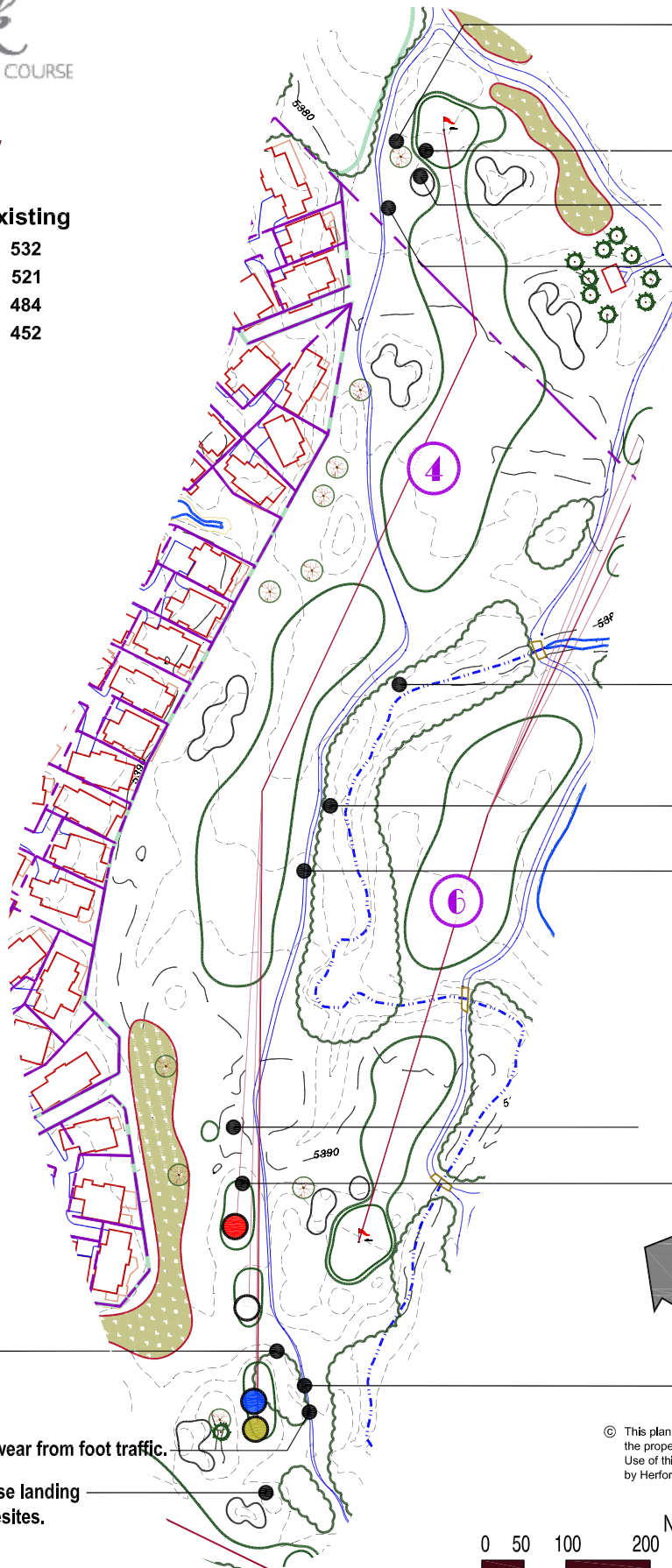
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Tile for green drainage is plugged with tree roots.

Tree roots coming through the putting surface &amp; bunkers.

Roots in bunker & rough cause **safety issue** for golfers & damage equipment.

Wet area from plugged tile or irrigation break.

Trees on right side of fairway force golfers toward homesites and create **safety issue**. Side prune 8 trees.

Trees block east sunlight &amp; cause thin turf &amp; disease pressure.

Cart path restricts landing area.

Possible new red tee at 420 +/- yards.

Hole too long from red tee.

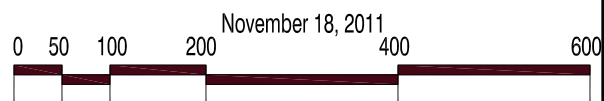
Cottonwood tree shades tee &amp; funnels walk-up foot traffic.

Cart path too narrow at tee causes wear from foot traffic.

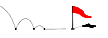
Possible additional length to increase landing area &amp; reduce safety issue for homesites.

8 small trees at tee are in decline.

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# Coal Creek GOLF COURSE

Louisville, Colorado

## Hole 5

|          | Proposed | Existing |
|----------|----------|----------|
| P A R    | ● 3      | ● 175    |
| Handicap | ● 17     | ● 150    |
|          | ○ 17     | ○ 113    |
|          | ● 17     | ● 84     |

Golf Course Architect:

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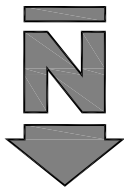
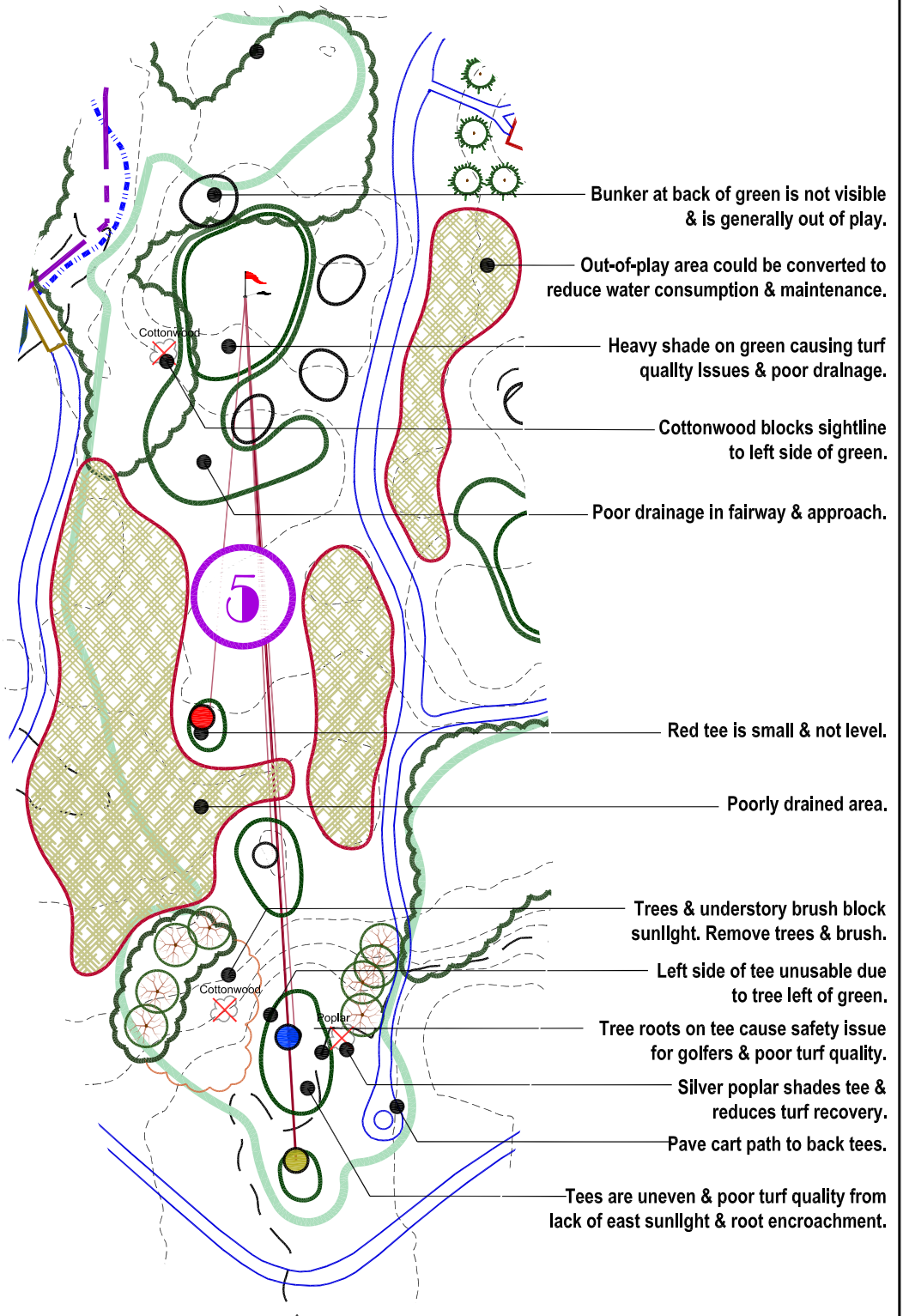
GOLF COURSE ARCHITECTS

100 East Second Street, Suite 200

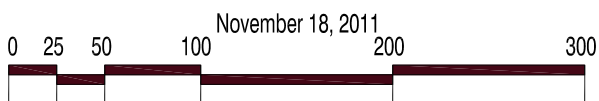
Chaska, MN 55318

(952) 361-0644

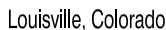
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November 18, 2011

**Proposed**

PAR  
4  
Handicap  
1

## Existing

|                                                                                   |     |
|-----------------------------------------------------------------------------------|-----|
|  | 407 |
|  | 376 |
|  | 338 |
|  | 289 |

**Golf Course Architect:**



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### Dead trees behind green.

**Poor irrigation coverage.**

**Trees south of green shade putting surface & create disease & turf quality issues.**

**Agronomically very poor green - shade, — shallow roots & putting surface holds ice.**

**Leaf litter & roots in bunkers — create safety issue & increased maintenance.**

**Drainage issue at cart path near bridge.**

**4 stem willow blocks sightline to green from fairway.**

**Cottonwood (5) & Willows (6) block sightline to green from fairway.**

**Trees overhanging golf course causing shade, disease & turf recovery issues.**

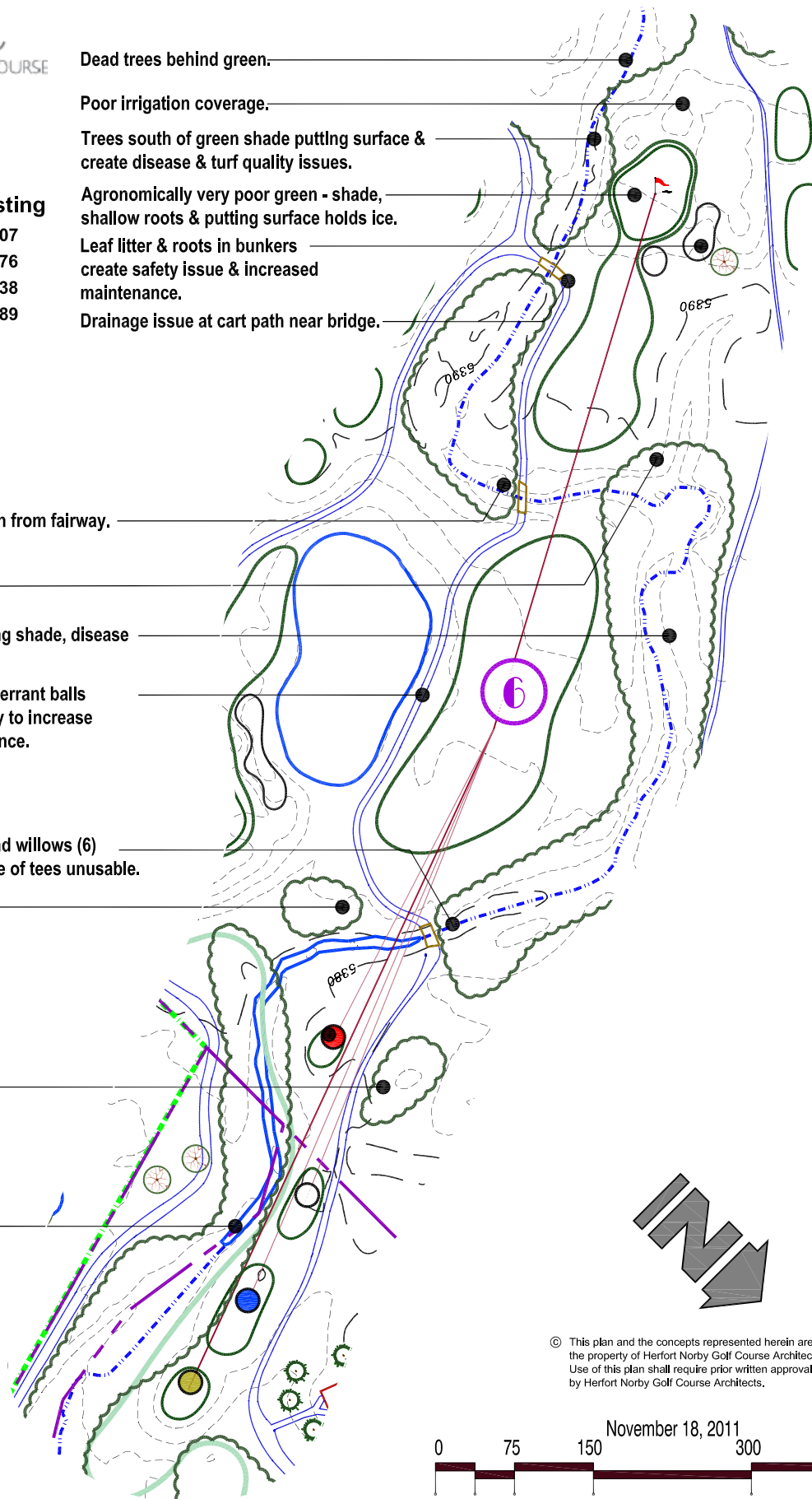
**Cart path restricts fairway & bounces errant balls toward pond. Consider shift of fairway to increase landing area & reduce cart path influence.**

**Cottonwood (5) 12"-15" in diameter and willows (6) \_\_\_\_\_**  
**block landing area and make right side of tees unusable.**

**5-stem ash tree blocks sightline to landing area for red tee**

**Willows (2) block sightline to pond & landing area from back tee.**

**Remove brush & trees to open sightline from back tees & to improve turf quality & maintenance.**



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November 18, 2011

Timeline for November 10, 2011, showing a sequence of events from 0 to 450 minutes. The timeline is marked with intervals of 75 minutes. The events are represented by horizontal bars of different colors: red, green, blue, and yellow. The events are as follows:

| Event            | Start Time (min) | End Time (min) |
|------------------|------------------|----------------|
| Event 1 (Red)    | 0                | 75             |
| Event 2 (Green)  | 75               | 150            |
| Event 3 (Blue)   | 150              | 300            |
| Event 4 (Yellow) | 300              | 450            |



Bunker not visible. Difficult downhill recovery shot toward water.

Nice bunkering but bunkers not edged.

Pond liner may be compromised.

*Coal Creek*  
GOLF COURSE

Louisville, Colorado

## Hole 7

|          | Proposed | Existing |
|----------|----------|----------|
| PAR      | 3        | 208      |
| Handicap | 13       | 172      |
|          |          | 136      |
|          |          | 111      |

Golf Course Architect:



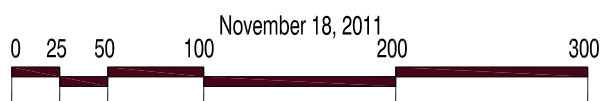
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(952) 361-0644

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Scrub willow trees block out left side of green & make left side of tee unusable.

Tee uneven from topdressing more often on the more frequently used right side.

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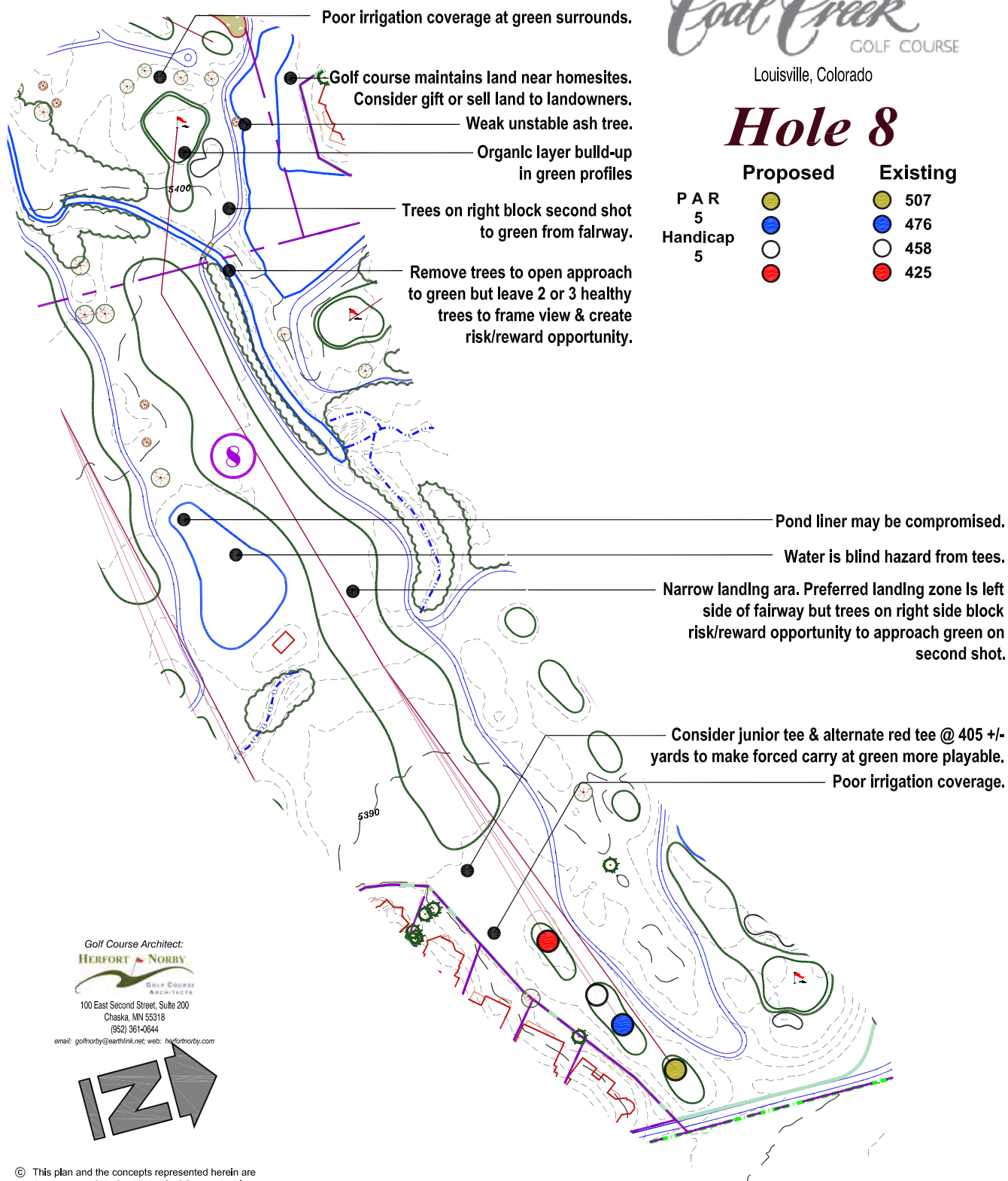
# Coal Creek

GOLF COURSE

Louisville, Colorado

## Hole 8

|          | Proposed | Existing |
|----------|----------|----------|
| P A R    | 5        | 507      |
| Handicap | 5        | 476      |
|          |          | 458      |
|          |          | 425      |



Golf Course Architect:  
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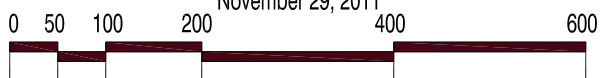
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November 29, 2011





# Coal Creek GOLF COURSE

Louisville, Colorado

## Hole 9

|          | Proposed | Existing |
|----------|----------|----------|
| P A R    | ●        | ● 441    |
| 4        | ●        | ● 408    |
| Handicap | ●        | ● 367    |
| 9        | ●        | ● 322    |

Golf Course Architect:  
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Fairway lacks visual definition on right side.

Possible turf conversion to reduce water usage & maintenance.

Possible safety issue from hole 13 tee.

Poor drainage in fairway causes increased winter kill, disease pressure & golf cart damage.

Bunker is partially obscured by trees at the tee.

**Safety issue** from errant tee balls.

Nice hole with good sightline from tee.

Possible native or low maintenance turf conversion to reduce water usage & maintenance.

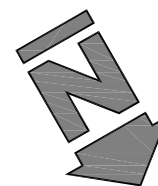
Nice visual of hole from tees.

Tees align right toward homes.

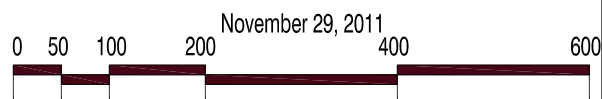
Poor irrigation coverage.

Spectacular view of mountains from tee.

Bunker's faces are collapsed & cause sand contamination.



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# Coal Creek GOLF COURSE

Louisville, Colorado

## Hole 10

|          | Proposed | Existing |
|----------|----------|----------|
| P A R    | ●        | ● 560    |
| 5        | ●        | ● 530    |
| Handicap | ○        | ○ 489    |
| 2        | ●        | ● 430    |

Golf Course Architect:

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Golf course maintains land near homesites.  
Consider gift or sell land to landowners.

Bunker faces are eroded &  
causing sand contamination.

Spruce tree has broken leader.

Lower limbs & scrub brush block sightline to landing area from left  
side of fairway & force golfers to hit toward homesites.

Cottonwoods (2) & 3-stem willow block sightline to landing area from fairway.

Remove lower limbs & cottonwoods (12-15) to open  
sightline to landing area. Leave 3 large cottonwoods.

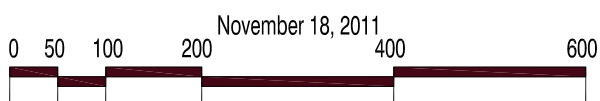
Sightline to fairway obscured by overgrown  
trees in creek. Possible **safety issue**.

Overgrown trees create narrow sightline to blind  
landing area & create **safety issue**.

White tee is too low & positioned  
behind bridge - **safety issue**.



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# Coal Creek GOLF COURSE

Louisville, Colorado

## Hole 11

|          | Proposed | Existing |
|----------|----------|----------|
| PAR      | 3        | 162      |
| Handicap | 14       | 152      |
|          |          | 123      |
|          |          | 98       |

Golf Course Architect:



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Poor Irrigation coverage.

Bunker faces area collapsed & are contaminating sand.

Pond liner is exposed & compromised.

Good medium length par 3.

Nice golf hole with good visibility & playability.

Golf course maintains land near homesites.  
Consider gift or sell land to landowners.

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Tree branches shade turf & require increased maintenance, leaf litter & poor turf quality.

Green holds ice in winter & is ready to play slower in spring due to minimal surface drainage.

Widen cart path at green to reduce wear & control cart traffic.

Tree branches obscure right side of green.

Bunker faces have collapsed & maintenance with mechanized raking is contaminating sand.

*Coal Creek*  
GOLF COURSE

Louisville, Colorado

## Hole 12

|          | Proposed | Existing |
|----------|----------|----------|
| PAR      | 398      | 398      |
| 4        | 380      | 380      |
| Handicap | 333      | 333      |
| 8        | 305/295  | 305      |

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Good medium length par 4 but lacks risk/reward strategy.

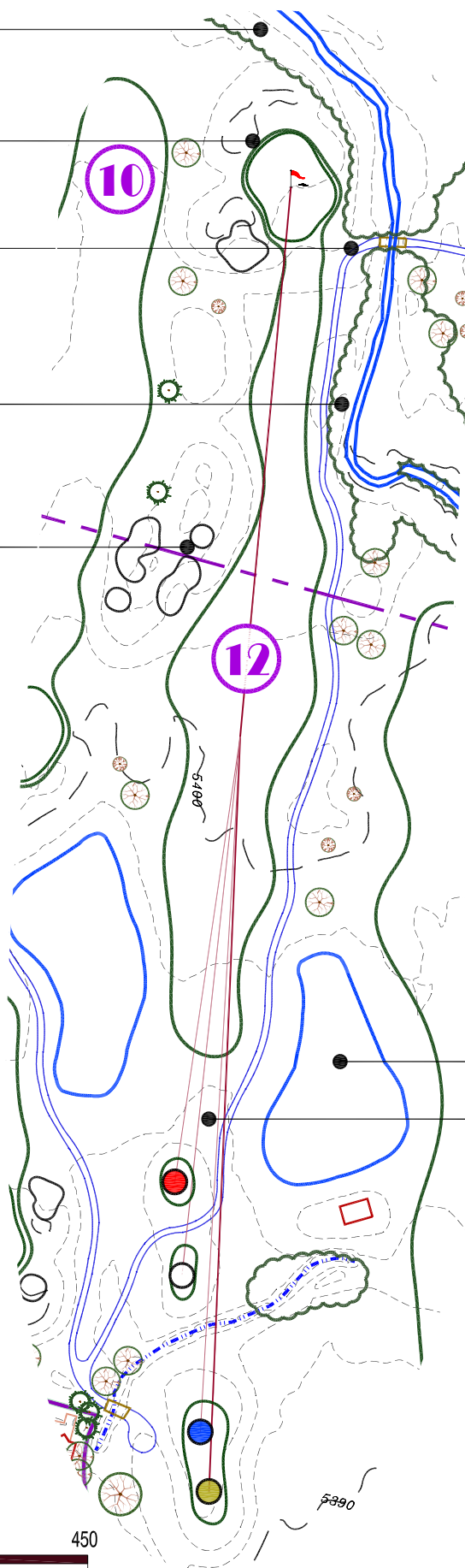
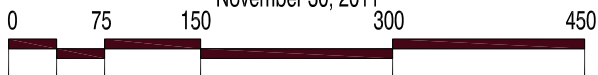
Pond liner may be compromised

Possible junior tee & alternate red tee for increased teeing area & improved playability.



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November 30, 2011



*Coal Creek*  
GOLF COURSE

Louisville, Colorado

## Hole 13

|          | Proposed | Existing |
|----------|----------|----------|
| P A R    | ●        | ● 408    |
| 4        | ●        | ● 371    |
| Handicap | ○        | ○ 327    |
| 10       | ●        | ● 293    |

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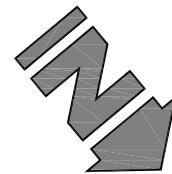
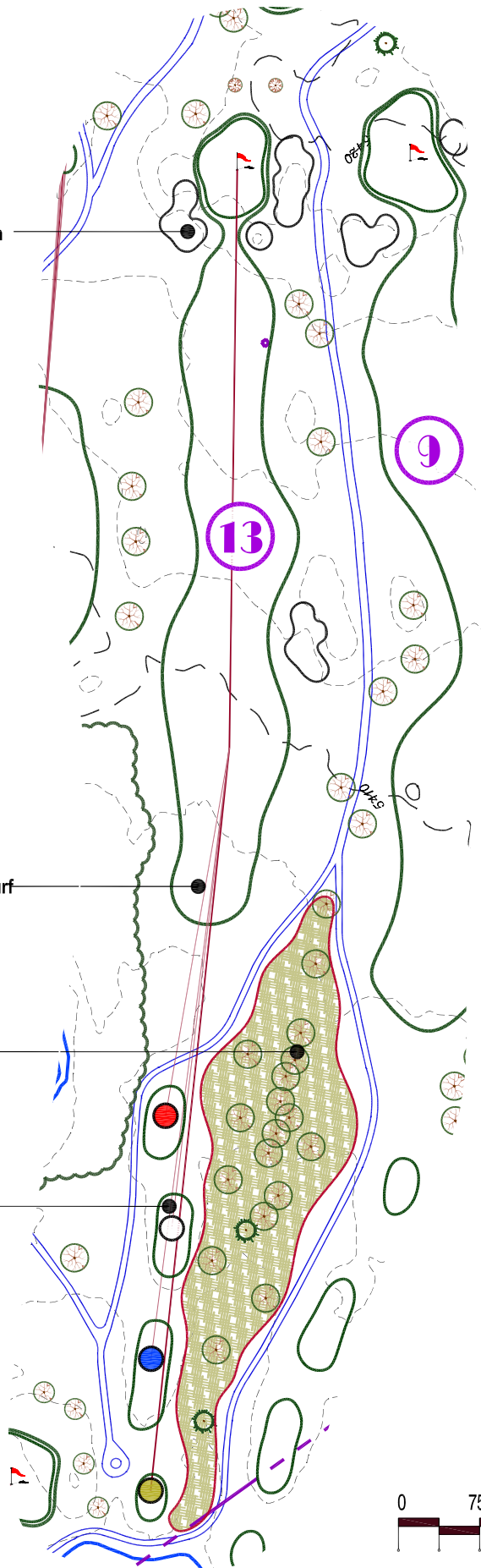
email: golfnorby@earthlink.net; web: herfortnorby.com

Bunker faces are eroded & maintenance with mechanical raking has contaminated sand.

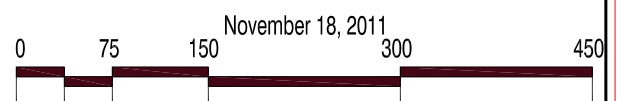
Minimal drainage causes soil compaction, turf damage & increased maintenance & repair.

Large out-of-play area requires irrigation & unnecessary maintenance.

Nice hole visually from the tee.



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# Coal Creek

GOLF COURSE

Louisville, Colorado

## Hole 14

|          | Proposed | Existing |
|----------|----------|----------|
| P A R    | 523      | 523      |
| 5        | 487      | 494      |
| Handicap | 444      | 479      |
| 4        | 405      | 444      |

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Bunker sand is contaminated with rock & soil from mechanical raking & edging.

Bunker is out of play & not visible behind tree line on right side of fairway.

Narrow fairway - trees block sightline to green & forces golfers left.

Remove dead trees - **safety issue**.

Trees on right side block right side of fairway & fairway bunkering forcing golfers toward homesites on the left.

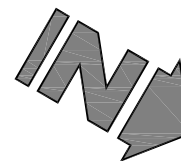
Power lines come into play & visually impact golf hole.

Soil compaction & poor turf quality due to minimal surface drainage.

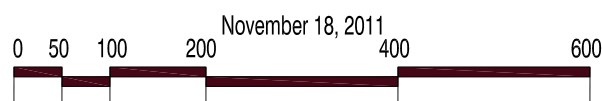
Golf course maintenance turf on back side of pond.  
Consider deed of land to homeowners.

Cart path interferes visually with character of hole.

Hole too long from forward tee.  
Consider new red tee at 405 +/- yards.



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*Coal Creek*  
GOLF COURSE

Louisville, Colorado

## Hole 15

|          | Proposed | Existing |
|----------|----------|----------|
| P A R    | ● 4      | ● 398    |
| Handicap | ○ 12     | ○ 367    |
|          | ● 329    | ● 329    |
|          | ● 285    | ● 285    |

Golf Course Architect:

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Building is directly in sightline behind green & visually distracting. Consider tree plantings.

Large area of out-of-play turf requires water, chemicals & maintenance.

Poor irrigation coverage at green due to lack of pressure & head spacing.

Bunkers poorly located & only come into play on second shot for shorter hitters.

Existing low maintenance area with mixed broadleaf weeds.

Left side of fairway lacks definition.

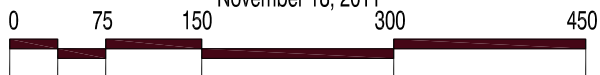
Right rough protrudes into fairway too far & penalizes shorter hitter.

Fairway on left side is generally out of play.

Red tee is too far right which requires forced carry over right rough.

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November 18, 2011



# Coal Creek GOLF COURSE

Louisville, Colorado

## Hole 16

|          | Proposed | Existing |
|----------|----------|----------|
| PAR      |          | 388      |
| 4        |          | 360      |
| Handicap |          | 297      |
| 18       |          | 275      |

Golf Course Architect:



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Narrow cart path causes excessive wear of green.  
Greenside bunker location causes wear from foot traffic to green.

Large area of turfgrass requires irrigation, fertilizer & unnecessary maintenance.

Nice short/medium length par four with good sightlines but lacks risk/reward quality. Consider repositioning fairway bunkers to improve visual character & strategy.

Bunker sand is contaminated from edging & mechanical raking.

Tree in highway right-of-way blocks sign for golf course.

Highway is visually distracting & **safety issue** for errant tee balls.

Medium to short par 4 lacks risk reward strategy.

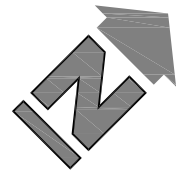
Red tee too far left.

Poor turf quality due to head spacing, irrigation pressure & trees.

Front of blue tee blocks sightline from back of tee.

Location of sign & trees creates wear pattern for foot traffic.

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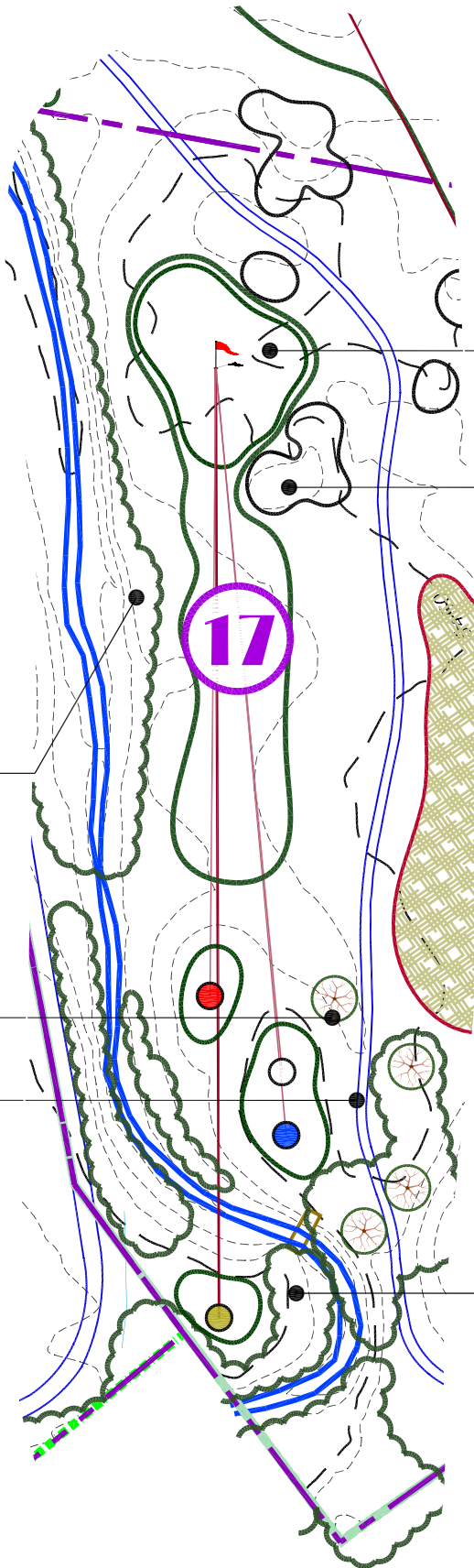


Louisville, Colorado

|          | Proposed                                                                          | Existing                                                                              |
|----------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| P A R    |  |  180 |
| 3        |  |  146 |
| Handicap |  |  134 |
| 16       |  |  119 |

**HERFORD NORBY**  
GOLF COURSE  
ARCHITECTS

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- Bunker face is eroded & sand contaminated.

- Trees shade tee & limit air circulation causing poor turf quality & increased maintenance.



| Meeting Date      | Number of People |
|-------------------|------------------|
| November 18, 2011 | 200              |



# Coal Creek GOLF COURSE

Louisville, Colorado

## Hole 18

Cottonwood tree causes turf damage & increased maintenance due to root encroachment & shade at green.

Lack of irrigation control & coverage causes poor turf quality & increased maintenance.

Trees block sightline to left side of green.

Booster pump is not functioning resulting in poor turf quality on holes 14-17.

P A R  
4  
Handicap  
6

Proposed

Existing



428  
386  
346  
279

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Trees block sightline to right side of green.

Minimal drainage in fairway.

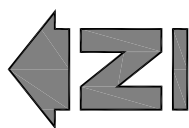
Narrow fairway & poor irrigation coverage makes hole unnecessarily penal.

Maintenance road to turf facility is unsightly & penalizes golfer with unpredictable bounces.

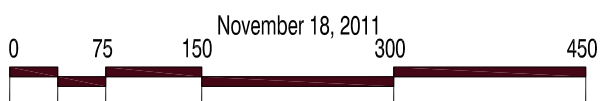
Cart path restricts fairway.

Trees on left side restrict sightline to fairway.

Difficult long par 4.



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November 18, 2011



*Coal Creek*  
GOLF COURSE

Louisville, Colorado

# Practice Range

Golf Course Architect:  
**HERFORD NORBY**  
GOLF COURSE ARCHITECTS

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Lack of irrigation coverage & control  
In rough causes poor turf quality &  
unpredictable bounces.

Target green creates possible **safety**  
**Issue** from tee.

Poor irrigation coverage & turf quality  
results in a lack of defined targets &  
fairway.



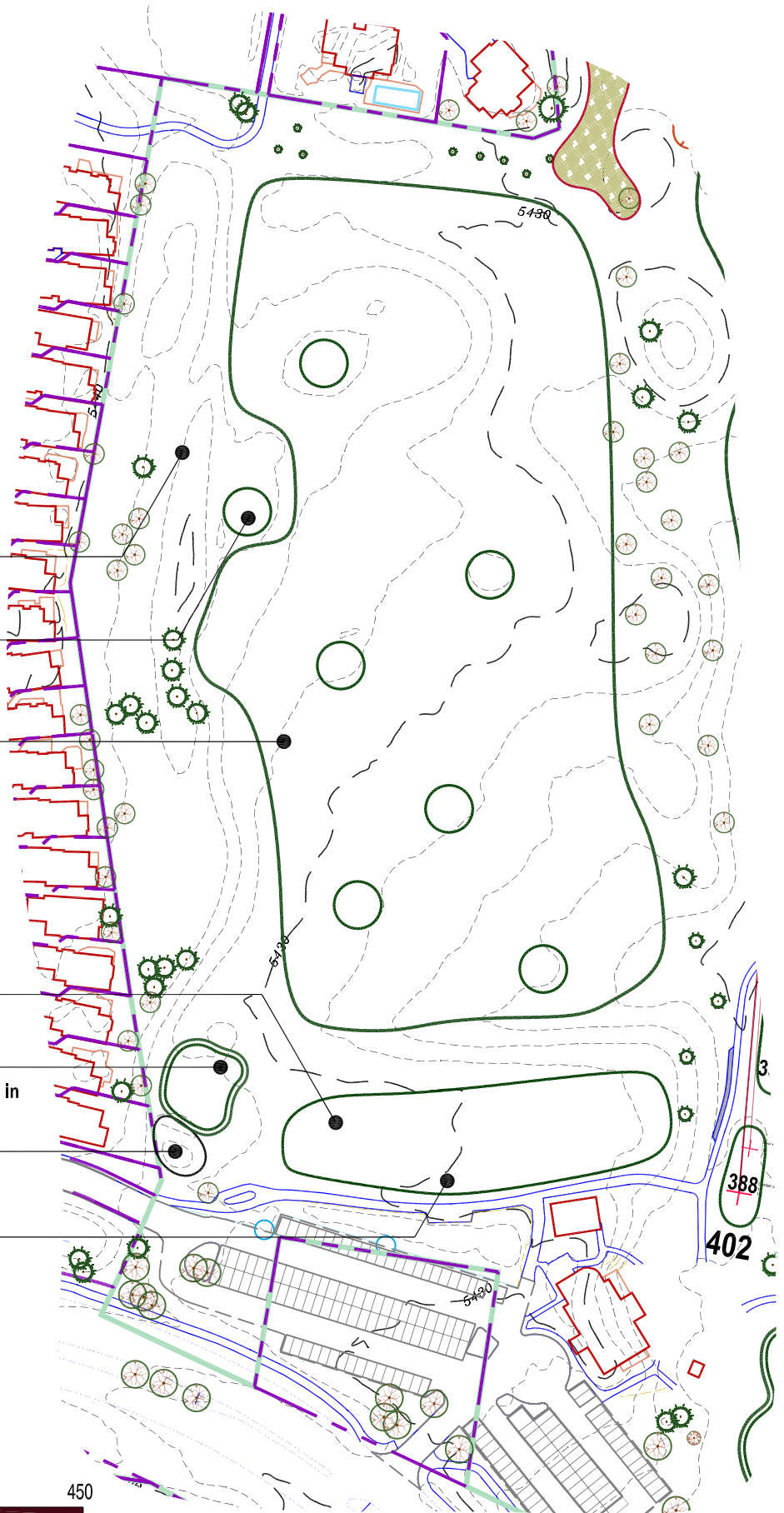
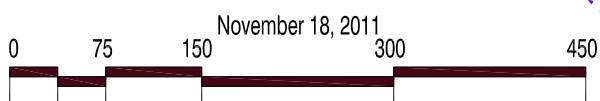
Turf tee too small to allow adequate  
space for turf recovery.

Short game area lacks fairway areas for variety of  
practice shots & is somewhat dangerously located in  
relationship to tee.

Bunker difficult to maintain & not representative  
of bunkers on the golf course

Tee lacks mats & curvature for safety &  
improved turf recovery.

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# ACTION PLAN

## Coal Creek Golf Course

December 19, 2011

| <u>Phase</u> | <u>Description</u>                                                                                                                                     | <u>Projected Cost</u>    | <u>Notes</u>                                                                                                                                                                                                                                                                                                        |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2012         | Tree removal, irrigation parts, GPS mapping and booster pump repair.                                                                                   | \$231,000 – 275,000      | Tee removal and initial improvements intended to maximize the efficiency and operation of the existing irrigation system as required to until a new system can be funded                                                                                                                                            |
| Fall 2013    | Tree removal, new tees on 4,8 & 14 and drainage repairs as well as relocation of fairway bunker and cart path on No. 1.                                | \$234,166 - \$302,131    | Tree removal to improve turf quality. Cart path & bunker relocation on No. 1 and drainage work on holes 1,2,3,4,5,13 and 14 to be completed prior to installation of new irrigation system. Excess soil from drainage repairs will be used to construct new tees to improve playability for youth, women & seniors. |
| Fall 2014    | Renovation of all existing bunkers and leveling of existing tees on holes 1,4,5,8 and 9. Also, reconstruction of driving range tee and practice bunker | \$700,562 - \$1.34M      | Reconstruction of sand bunkers to reduce maintenance and improve playability prior to installation of irrigation system. Reconstruction of driving range tee and practice bunker for increased revenue and improved safety prior to installation of irrigation system.                                              |
| Fall 2015    | Installation of new irrigation system including heads, pipe, road crossings and control wire.                                                          | \$1.83 - \$2.28M         | Installation of irrigation system to improve turf quality, manage water consumption and reduce repairs and maintenance.                                                                                                                                                                                             |
| 2016         | Convert maintained turf to low maintenance grass and expand cart paths at tees and greens.                                                             | \$137,170 – \$174,560    | Convert turf to reduce irrigation requirements. Expand paths to eliminate turf damage & reduce safety issues at tees and greens.                                                                                                                                                                                    |
| 2017         | Highway signage, nursery green, storm shelter, tees, fairway re-grassing and pond liners on holes No. 8, 11 and 12.                                    | \$902,650 – 1.19M        | Re-grass fairways, level existing tees, install new pond liners at irrigation ponds, construct new storm and bathroom shelter near No. 14 green. Relocated highway signage to improve visibility and marketing.                                                                                                     |
|              | Subtotal                                                                                                                                               | \$4.04 to \$5.26 million |                                                                                                                                                                                                                                                                                                                     |
|              | 10% Contingency                                                                                                                                        | \$404,000 - \$526,000    |                                                                                                                                                                                                                                                                                                                     |
|              | TOTAL PROJECT COST                                                                                                                                     | \$4.44 to \$5.78 million |                                                                                                                                                                                                                                                                                                                     |

# COAL CREEK GOLF COURSE - Master Plan Phasing & Cost Estimates

December 19, 2011

|                                                                                                                     | <u>Low Range</u>  | <u>High Range</u> |
|---------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|
| <b>Phase One</b>                                                                                                    | <b>\$ 231,000</b> | <b>\$ 275,000</b> |
| <b>Tree removal and irrigation components</b>                                                                       |                   |                   |
| Tree removal to improve turf quality and safety on holes No. 2, 4, 5, 6, 7, 10, 14 & 18                             | 85,000            | 100,000           |
| Plant new trees                                                                                                     | 20,000            | 30,000            |
| Install new irrigation heads to replace existing defective heads<br>300 heads and swing joints @ \$320 to \$350 ea. | 96,000            | 105,000           |
| Repair existing booster pump at No. 18 green                                                                        | 20,000            | 30,000            |
| Prepare GPS map of existing irrigation system & reprogram central control                                           | 7,500             | 7,500             |
| Prepare irrigation coverage plan                                                                                    | 2,500             | 2,500             |
| <b>Phase Two</b>                                                                                                    | <b>234,166</b>    | <b>302,131</b>    |
| <b>Tree removal, cart paths, drainage repair and practice facilities</b>                                            |                   |                   |
| Tree removal to improve turf quality and playability on holes No. 3, 8, 10, 12, & 17                                | 50,000            | 60,000            |
| Plant new trees                                                                                                     | 20,000            | 30,000            |
| Reconstruct bunker on No.1 and reroute cart path on No. 1 & 18.                                                     | 27,541            | 35,781            |
| 550 lf. cart path on holes No. 1.                                                                                   | 11,550            | 14,850            |
| Demo 550 lf. cart path on hole No. 1.                                                                               | 3,000             | 4,000             |
| Sod repair and finish grading - 225 sy.                                                                             | 563               | 675               |
| Topsoil - 60 cy. @ \$15                                                                                             | 900               | 1,200             |
| Bunker reconstruction 2,000 sf.                                                                                     | 8,500             | 10,000            |
| Grading and feature construction.                                                                                   | 2,500             | 4,000             |
| Bunker sand - 33 ton                                                                                                | 528               | 1,056             |
| Install collection areas and drainage on holes 1, 2 and 3.                                                          | 24,800            | 32,200            |
| 750 lf 4" tile                                                                                                      | 7,500             | 9,000             |
| 7 catch basins                                                                                                      | 3,500             | 5,600             |
| Stripping of sod and grade collection areas                                                                         | 10,500            | 14,000            |
| Sod repair -1,200 sy.                                                                                               | 3,300             | 3,600             |
| Install collection areas and drainage on hole 4,5 and 13.                                                           | 21,750            | 27,000            |
| 700 lf 4" tile                                                                                                      | 7,000             | 8,400             |
| 6 catch basins                                                                                                      | 3,000             | 3,600             |
| Stripping of sod and grade collection areas                                                                         | 9,000             | 12,000            |
| Sod repair - 1,000 sy.                                                                                              | 2,750             | 3,000             |
| Regrade No. 14 fairway, install collection areas and drainage                                                       | 48,625            | 58,500            |
| 850 lf 4" tile                                                                                                      | 8,500             | 10,200            |
| 3 catch basins                                                                                                      | 1,500             | 1,800             |
| Stripping of sod and grade collection areas                                                                         | 4,500             | 6,000             |
| Sod repair (1500 sy.)                                                                                               | 4,125             | 4,500             |
| 30,000 sf fairway slit drainage                                                                                     | 30,000            | 36,000            |
| Regrade No. 9 fairway, install collection areas and drainage                                                        | 17,300            | 21,000            |
| 800 lf 4" tile                                                                                                      | 8,000             | 9,600             |
| 3 catch basins                                                                                                      | 1,500             | 1,800             |
| Stripping of sod and grade collection areas                                                                         | 4,500             | 6,000             |
| Sod repair (1200 sy.)                                                                                               | 3,300             | 3,600             |
| New tees on No. 4, 8 & 14 to improve safety & playability.                                                          | 8,650             | 10,150            |
| Construct new forward tees on No. 4,8 and 14 - 1,600 sf                                                             | 6,800             | 8,000             |
| Hauling of excess soil from bunker excavation & drainage                                                            | 1,000             | 1,200             |
| Amended soil mix - 25 ton                                                                                           | 850               | 950               |
| Final design contract administration                                                                                | 15,500            | 27,500            |

|                                                                                  |                  |                  |
|----------------------------------------------------------------------------------|------------------|------------------|
| <b>Phase Three</b>                                                               | <b>700,562</b>   | <b>1,033,725</b> |
| <b>Bunker renovation and tee reconstruction</b>                                  |                  |                  |
| Renovation of sand bunkers                                                       | 290,350          | 335,500          |
| Remove and re-sod six existing bunkers - 4,000 sf.                               | 8,000            | 10,000           |
| Construct five new bunkers w/ sand, sod and drainage - 5,000 sf                  | 22,500           | 25,000           |
| Renovate 44 existing bunkers w/ sod, sand and drainage - 45,000 sf.              | 202,500          | 220,000          |
| Topsoil (900 cu.yds.)                                                            | 10,800           | 14,400           |
| 3,375 lf. External drainage                                                      | 33,750           | 40,500           |
| Bunker sand - 800 tons Pile #1 or USGA                                           | 12,800           | 25,600           |
| Reroute cart path on No. 18.                                                     | 15,112           | 19,525           |
| 550 lf. cart path on holes No. 18                                                | 11,550           | 14,850           |
| Demo 550 lf. cart path on hole No. 18.                                           | 3,000            | 4,000            |
| Sod repair and finish grading - 225 sy.                                          | 562              | 675              |
| Regrade and level tees on No. 1,4,5,8&9                                          | 86,000           | 107,000          |
| Strip sod and existing tee mix - 20,000 sf                                       | 5,000            | 7,000            |
| Regrade, reorientate and laser level tees - 20,000 sf                            | 15,000           | 20,000           |
| Sod repair - 4,000 sy                                                            | 10,000           | 12,000           |
| Amended soil mix - 200 ton                                                       | 56,000           | 68,000           |
| Range tee (350x128') - 45,000 sf                                                 | 71,000           | 92,700           |
| Strip sod and stockpile existing tee mix - 28,000 sf.                            | 5,600            | 8,000            |
| Amended soil mix - 550 ton                                                       | 15,400           | 18,700           |
| Regrade and laser level tee - 45,000 sf.                                         | 20,250           | 27,500           |
| Concrete tee line 4,500 sf.                                                      | 15,750           | 22,500           |
| 40 Wittek practice mats                                                          | 14,000           | 16,000           |
| Construct short-game practice area and bunker with sod, irrigation and drainage. | 47,100           | 55,000           |
| Practice bunker reconstruction 800 sf.                                           | 3,800            | 5,000            |
| Green 4,000 sf.with sod and drainage.                                            | 24,000           | 28,000           |
| Irrigation                                                                       | 14,000           | 16,000           |
| External drainage - 200 lf.                                                      | 2,000            | 2,400            |
| Sod repair - 1200 sq.yds.                                                        | 3,300            | 3,600            |
| Clubhouse renovation                                                             | 125,000          | 300,000          |
| Plant new trees                                                                  | 20,000           | 30,000           |
| Final design contract administration                                             | 46,000           | 94,000           |
| <b>Phase Four</b>                                                                | <b>1,833,500</b> | <b>2,284,000</b> |
| <b>Install new 18 hole irrigation system.</b>                                    |                  |                  |
| 1,760 to 1950 irrigation heads                                                   | 1,760,000        | 2,145,000        |
| Plant new trees                                                                  | 20,000           | 30,000           |
| Final design contract administration                                             | 53,500           | 109,000          |
| <b>Phase Five</b>                                                                | <b>137,170</b>   | <b>174,560</b>   |
| <b>Cart path repair and conversion of turf to low maintenance areas</b>          |                  |                  |
| Install cart path curbing on holes 1-18 at tees and greens - 1,500 lf.           | 21,000           | 27,000           |
| Expand cart path width at tees and greens on holes 1-18                          | 30,000           | 36,000           |
| Extend cart path paving at No. 5 tee - 960 sf.                                   | 4,320            | 5,760            |
| Reroute cart path on No. 4                                                       | 6,350            | 8,800            |
| 200 lf. cart path on holes No. 4                                                 | 4,800            | 6,600            |
| Demo 200 lf. cart path on hole No. 4                                             | 1,000            | 1,500            |
| Sod repair and finish grading - 100 sy.                                          | 250              | 300              |
| Topsoil - 20 cy.                                                                 | 300              | 400              |
| Convert turf to low maintenance areas - 12 acres                                 | 48,000           | 54,000           |
| Plant new trees                                                                  | 20,000           | 30,000           |
| Final design contract administration                                             | 7,500            | 13,000           |



|                                                                             |                           |                           |
|-----------------------------------------------------------------------------|---------------------------|---------------------------|
| <b>Phase Six</b>                                                            | <b>902,650</b>            | <b>1,188,500</b>          |
| <b>Bathroom facilities, storm shelter, signage and miscellaneous</b>        |                           |                           |
| Install bathroom facilities and storm shelter near No. 15 tee.              | 145,000                   | 225,000                   |
| extend sewer & water                                                        | 75,000                    | 125,000                   |
| building structure                                                          | 70,000                    | 100,000                   |
| Fountain aerator in pond on hole No.8                                       | 15,000                    | 18,000                    |
| Regrassing of fairways with low-mow Kentucky Bluegrass                      | 325,000                   | 400,000                   |
| Regrade and level remaining tees - 78,000 sf                                | 117,000                   | 136,500                   |
| Reconstruct highway sign to improve visibility                              | 25,000                    | 30,000                    |
| Nursery green 10,000 sf                                                     | 70,000                    | 80,000                    |
| Replace pond liners on holes 8, 11 and 12 - no off site disposal or hauling | 126,650                   | 161,000                   |
| No. 8 pond liner - 19,000 sf.                                               | 20,060                    | 28,800                    |
| No. 11 pond liner - 33,000 sf                                               | 33,380                    | 45,600                    |
| No. 12 pond liner - 21,000 sf.                                              | 20,710                    | 30,600                    |
| 3500 ton sand cap                                                           | 52,500                    | 56,000                    |
| Plant new trees                                                             | 20,000                    | 30,000                    |
| Final design contract administration                                        | 59,000                    | 108,000                   |
| <b>Subtotal</b>                                                             | <b>\$4,039,048</b>        | <b>\$5,257,916</b>        |
| Contingency 10%                                                             | 404,000                   | 526,000                   |
| <b>Grand Total</b>                                                          | <b><u>\$4,443,048</u></b> | <b><u>\$5,783,916</u></b> |

Note: Items in phases two and three require grading and potential impact to the irrigation system and are therefore recommended to be completed prior to the installation of a new irrigation system. Since detailed plans have not been prepared, this construction cost estimate is based on previous similar projects and on recent conversations with contractors and suppliers. This estimate is based on the Long Range Master Plan prepared by Herfort Norby and dated December 1, 2011. This estimate assumes current 2012 pricing and does not include estimates for inflationary cost increases for labor or materials.

Kevin Norby, President  
Herfort Norby Golf Course Architects, LLC.

# Coal Creek Golf Course Irrigation System Assessment

September 19, 2011  
Presented by Irrigation Technologies  
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Littleton, CO 80127  
Phone 720-240-6208  
[www.IrrigationTechnologies.biz](http://www.IrrigationTechnologies.biz)

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## **Irrigation System Evaluation**

This evaluation was conducted to review the existing irrigation system at the 18 hole Coal Creek Golf Course. Brian Keighin, Principal from Irrigation Technologies was on site September 6-7, 2011 to examine the current irrigation system, and operational practices.

### **Executive Summary**

The irrigation system is the original system installed during course construction in 1988-89. The system has the Rainbird 51 sprinkler head as the “full circle” head, and the Rainbird 47 or Rainbird 95 head as the adjustable arc or “part circle” sprinkler head. The 47 head is a short radius throw sprinkler head, and the 95 has larger radius of throw. In several areas, residential grade sprinklers have been added to the system.

The central control system has been upgraded from the original Maxi 5 platform, to a current technology Nimbus II platform. A hand held radio remote system (Freedom) is a component of the Nimbus II computer system. The stainless steel field controllers located throughout the golf course have been upgraded from the original Rainbird SBM 1230 electro-mechanical controller, to the Rainbird solid state Par Plus controller.

Some of the heads are single head control, but many of stations control two, and in many cases three sprinklers on a station. Single head control is the preferred method to control golf irrigation heads.

The mainline and lateral pipe infrastructure is the original class 160 (CL160) polyvinyl chloride (PVC) pipe. Fittings (elbows, tees) on the mainline pipe are stamped steel fitting with an epoxy coat covering. The golf course is beginning to see these fittings fail at a high rate, due to the deterioration of the epoxy coating.

The irrigation system has two (2) pumping stations. The main pumping station, located just north of 12 tees, is a new (2009) Rainbird station with a capacity of 1750 gallons per minute (GPM). A booster pump station (original equipment) is located near 18 green and is not currently in use due to failing pipe infrastructure.

The golf course has a construction record drawing also referred to as an as-built that is used sparingly in the operation of the system. The as-built has not been kept up to date and is lacking vital information that if available, would improve labor efficiency.

Coal Creek has one crew member tasked as an irrigation technician maintaining the system. The crew member mows in the morning and then works on irrigation repairs and maintenance after completing the mowing duty. A system that is in this condition requires a full time, highly trained technician just to provide reactive repairs. Currently there are too many issues to provide adequate maintenance.

The course has (2) two water sources available; raw water that is delivered via the ditch system, and re-use water (since 2004) that is delivered by The City of Louisville through their pipe network. The raw water is available from spring start up until July 4 during a typical year. Re-use water is used from July 4 until the end of September. The introduction of the re-use water has placed new restrictions on the application of the water during irrigation cycles, due to the proximity of the houses to the golf course, as well as the original sprinkler head layout.



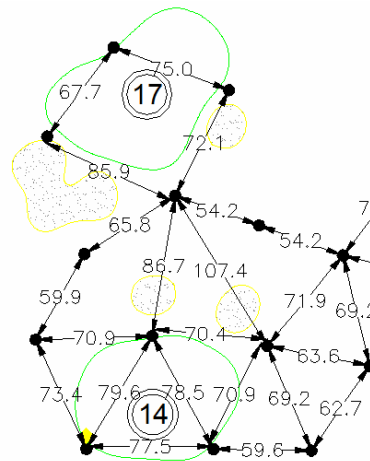
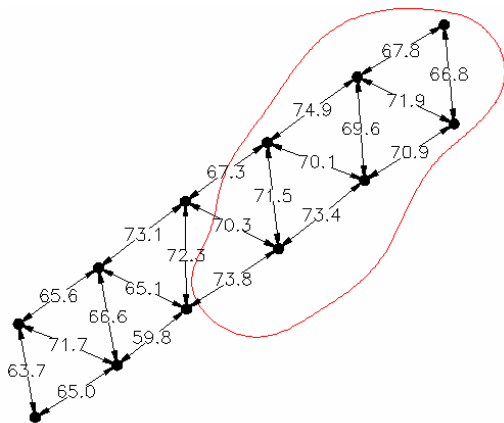


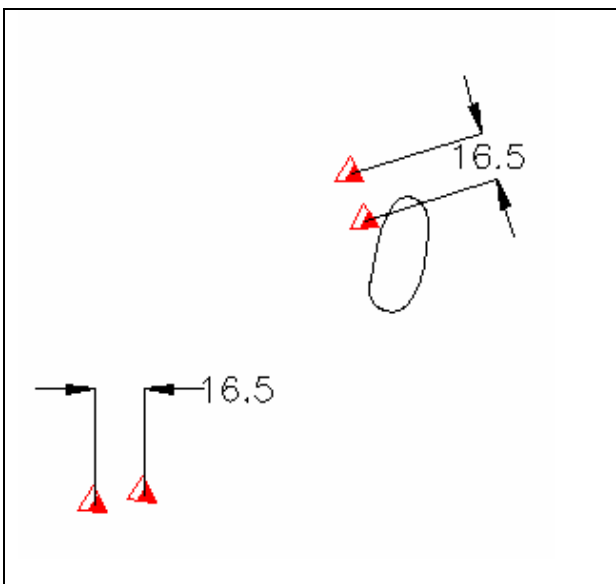
Illustration. 1 Typical head spacing (10 Fairway)

Illustration.2 Head spacing at 14, 17 green complex

### A. Sprinkler Heads

The majority of the sprinkler heads are the original installed equipment, Rainbird 51 (full circle), and Rainbird 47 or 95 (part circle). The heads are spaced throughout the golf course at about 70' in most areas (see illustration. 1). There are some areas, such as greens that the head spacing exceeds the typical spacing on the rest of the course (see illustration 2). Ideal spacing for this sprinkler head is 70'. This head will attain the highest level of distribution uniformity (DU) when spaced at a uniform 70' spacing. Areas that have heads "stretched" can be identified by having thin turf density, and require additional hand/spot watering.

The same holds true performance wise, for heads that are spaced too closely together. As shown in illustration



3, these heads are spaced 16.5'. Heads designed to throw 70' spaced this close together will always leave a wet area, as shown in Picture 1. This scenario is often seen on golf courses that when built, did not have houses adjacent to the property. As the homes were built, the interior head, originally a full circle head, needed to be changed to a part circle head. The change to a part circle head left an area behind the original head without irrigation. The solution that was chosen was to install a head that throws essentially 53.5' farther than needed. The result, an overwatered area in front of the two heads and a wet spot in front of heads. Coal Creek has many heads with this configuration. The proper solution is to install a short radius head along the golf course property line.

Illustration 3. Heads spaced too close together



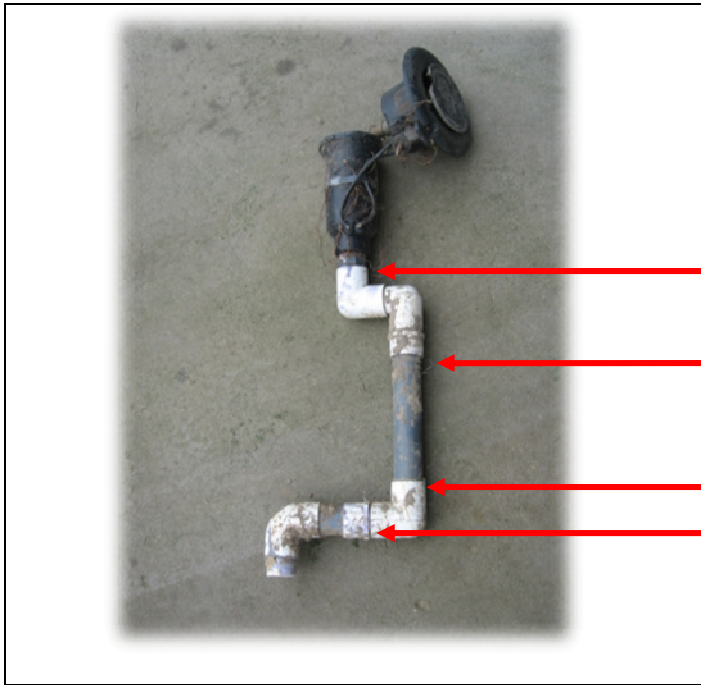
Picture 1. Heads too close to each other create a wet area

As the system has aged, and sprinkler heads have begun to fail, new heads have been installed. The original 51, 47, and 95 heads are no longer manufactured by Rainbird, and repair parts are limited. The old heads are being replaced by Eagle 700 and 750 heads. An inventory needs to be taken to identify heads that are in poor, failing condition and should be replaced as capital dollars allow.

The new heads will perform at the same and perhaps a slightly higher performance level than the original equipment. However, it is important to consider the orientation of the new heads, and the component (swing joint) that connect the sprinkler head to the pipe network. First the head orientation, heads perform best when set level, and at grade. This allows the nozzle stream to distribute water in a uniform manner, and achieve a high DU. A level sprinkler will minimize any stream blockage from ground interference.

It is cost prohibitive to properly adjust the spacing of the installed equipment unless the entire area and/or hole is changed. Varied spacing can only be corrected by installing new heads at the proper spacing. This requires a new irrigation system.

The original swing joint that was installed is a combination of good and bad. The good, o-ring elbows with acme threads. The bad, there are several solvent weld glue joints that are failing (picture 2). Many of the heads that have standing water are swing joints that are leaking. The solution to this problem is to install a unitized sing joint (no glue joints) when a leaking swing joint is discovered.



Arrows indicate glue joints and where leaks have occurred on the swing joint

Picture 2. Swing joint and head

Pressure plays a big part in the sprinkler performance as well. Without adequate pressure, the equipment cannot perform as designed. During the data collection process (illustration 4), three (3) pressure data loggers were placed on the golf course during an overnight irrigation cycle. One logger was located at 5 tees (blue line), one at the pump station (green line), and one at 16 tees (red line).

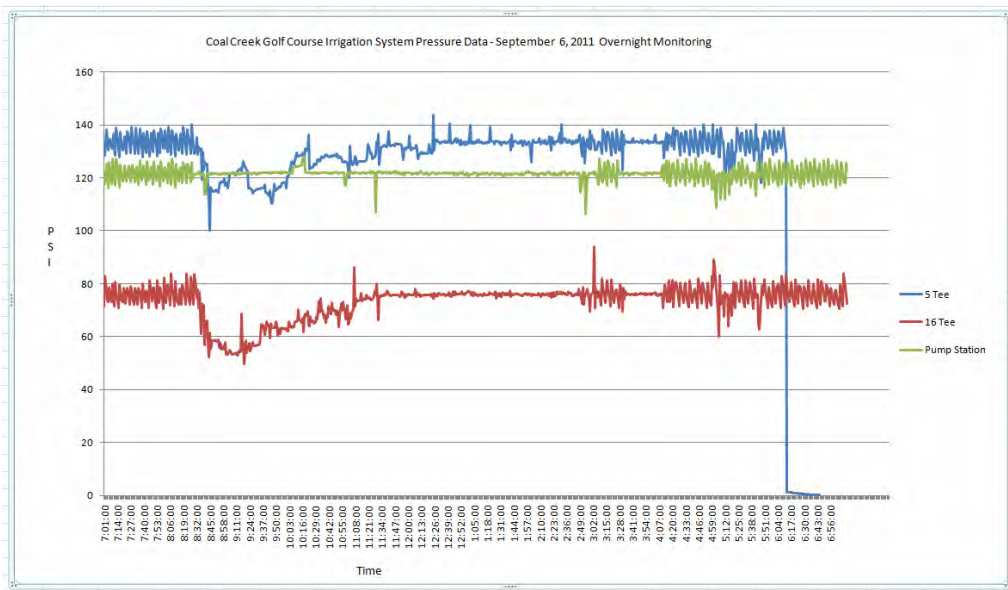


Illustration 4. 3 Pressure monitoring locations (full size graph in appendices)

The saw tooth pattern seen at the beginning of the graph indicates that the pumps are turning on/off with regular frequency. This is a sign of a “loose” system, one that has several leaks and/or weeping heads. The pumps are cycling to keep the irrigation system at the pressure set point. The next component of the graph begins around 8:15pm and coincides with the start of the overnight irrigation cycle. A dip in pressure on the blue line (5 tees) and the red line (16 tee). This indicates that the central computer is turning on more heads than the pipe network can supply. The central computer has a component that will manage the flow, hence the name “Flo Manager”. It is essentially a database that defines how many heads (flow) can be operational at any one time. If the flo manager component is allowed to operate too many heads, the pump station, or in this case the pipe network, will not be able to supply the needed volume. It becomes most important when the pressure drops below the recommended sprinkler pressure, 80psi. The resolution for 5 tees is to review the flo manager component of the database and provide proper flow limits given the existing mainline and lateral pipe sizes. The pressure is always below the 80psi level at the 16 tee site. The solution for 16 tee is to address the issues at the booster pump on hole 18 (see section D).

#### **B. Field Controllers, Central Control and Weather Station**

The irrigation system is controlled by a group of field controllers, commonly referred to as satellites. The Rainbird Par Plus satellites are the stainless steel pedestals located throughout the course. This satellite, (picture 3&4) is a generation behind the current Rainbird offering. Each satellite controls a group of heads within relative close proximity to the satellite. Each satellite is hard wired to the central computer and is identified with a group and channel number, essentially an IP address. The central is a PC based computer that can communicate with each of controllers. The central operates the Rainbird Nimbus II (current Rainbird offering) software to communicate with the satellites. During an overnight irrigation cycle, the central and satellite s communicate the activities of the irrigation cycle. A log file is generated during each irrigation cycle. This information is reviewed by the course superintendent every morning to make sure everything watered as planned. The central computer contains a database that identifies the head type, flow, controller address, flo manager branch/zone, sprinkler precipitation rates, default run times... for each station. After review of the central computer database, it is apparent that the database needs a thorough review focusing on heads type, precipitation rates and flo manager assignments and flow rates. The current build of flo zones is inadequate. Additional flo zone assignments will improve the system performance; reduce pump run time which in turn translates into a lower utility bill.





Picture 3. Irrigation satellite



Picture 4. Satellite face plate

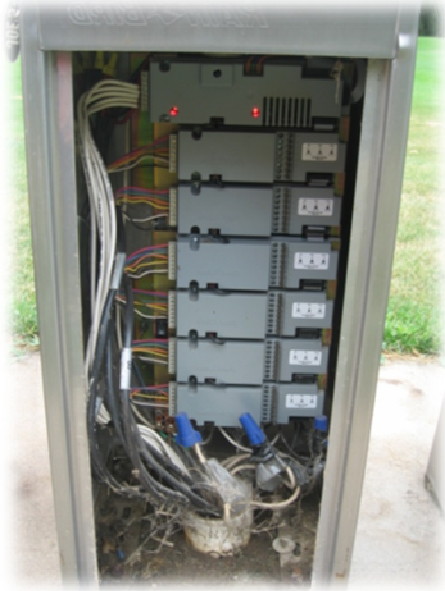
Golf staff can access the satellite and activate heads as needed during manual operation from the satellites. Another method of operation is through the use of a hand held radio remote. The Freedom system allows the user to key in a command string that identifies a specific station to operate for a specified time. The Freedom radios are a very useful tool that can allow the maintenance staff to be very efficient with their time, if the course has an accurate record drawing with the necessary information. Unfortunately, Coal Creek as-built records are lacking.

Upon examination of the controllers, most are at their capacity of 48 stations. Ideally, each head should be controlled individually. This allows for great control of the water being applied. Coal Creek has most of the controller stations actuating 2 and sometimes 3 sprinkler heads. It is very difficult to provide good water management with 2-3 heads being controlled by one station.

The control system at Coal Creek is a good system that lacks the necessary control. To improve control, the latest generation of Rainbird Par Plus ES (extra stations) controllers needs to be installed along with and, in place of the current Rainbird Par Plus controllers. In some cases, additional station wire would need to be installed from the controller to the sprinkler head, to what degree would require additional investigation.

Another tool that Coal Creek has at its disposal is a weather station. The weather station, located just north of the maintenance building, monitors current environmental conditions, and is used to suspend, and in certain cases cease an irrigation cycle. It is used to help determine how much irrigation needs to occur to replace the water that has transpired through the plant, and evaporated from the soil during the past 24 hours. That term, Evapotranspiration (ET) is a calculation based on solar radiation, wind run, and air temperature. The ET value is downloaded daily to the central computer and the golf staff can then adjust the computer to match the days E.T. The current location (picture 7) of the weather station is not ideal. An ideal location is one that closely

matches the target irrigation area. Coal Creek should consider moving the weather station to an area more representative of the golf course.



Picture 5. Satellite interior wiring



Picture 6. Central computer and freedom radios

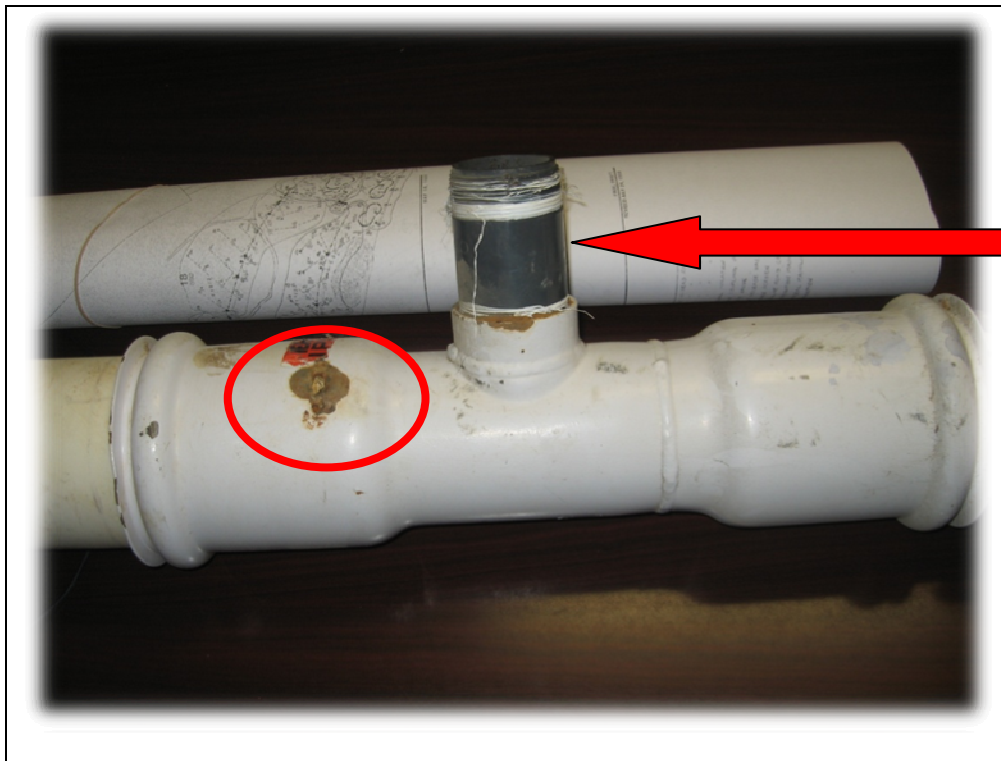


Picture 7. Weather station

### **C. Mainline & Lateral Pipe Infrastructure**

The pipe infrastructure (mainline and lateral) at Coal Creek is class 160 (CL160) PVC pipe. The 160 identifies the maximum continuous operating pressure for the pipe. Although the current operating pressure at Coal Creek is 120psi, the CL160 pipe was a poor choice. CL160 pipe is rarely used in PVC golf applications, and selected only as a means to reduce material cost at the expense of system longevity. Golf irrigation systems are large diameter pipe (4", 6" 8" 10" 12") that can have high flow velocities and can experience high pressure surges. The pipe that should have been selected is CL200 PVC pipe. The CL200 PVC has a higher pressure rating due to a thicker pipe wall. The thicker wall also provides additional protection to the rocky soils that surround the mainline and lateral pipe.

The transition between mainline and lateral pipe requires a service tee. The service tee is essentially a transition fitting from the large diameter mainline to the 2" pipe that supplies water to the sprinkler. The service tees used at Coal Creek are stamped steel fitting with an epoxy coat finish. The steel fitting has the strength to prevent any stress related failure, but is susceptible to oxidation when the epoxy coat finish fails (picture 8). After 23 years of direct moisture contact, that is exactly what is happening to the 300+(approx. 230 service tees approx. 70 mainline tees, elbows) fittings in the ground. Repair records indicate that there are 6-10 service tee/ mainline fitting failures per season. Coal Creek can expect the failure rate to hold steady and perhaps increase as these fittings continue to fail. There are other courses in the Denver Metro area that have this type of fitting and are experiencing similar failures. The solution to this issue is to repair the failed fittings with ductile iron fittings as they fail, and eventually replace the mainline with HDPE (high density polyethylene) pipe and fittings.



2" Nipple to  
Threaded Elbow  
(not shown) to  
Lateral Isolation  
Valve

The Red Oval  
Identifies A Dime  
Size Hole In The  
Service Tee

Picture 8. Failed service tee with a 2" threaded nipple to isolation valve (not shown)

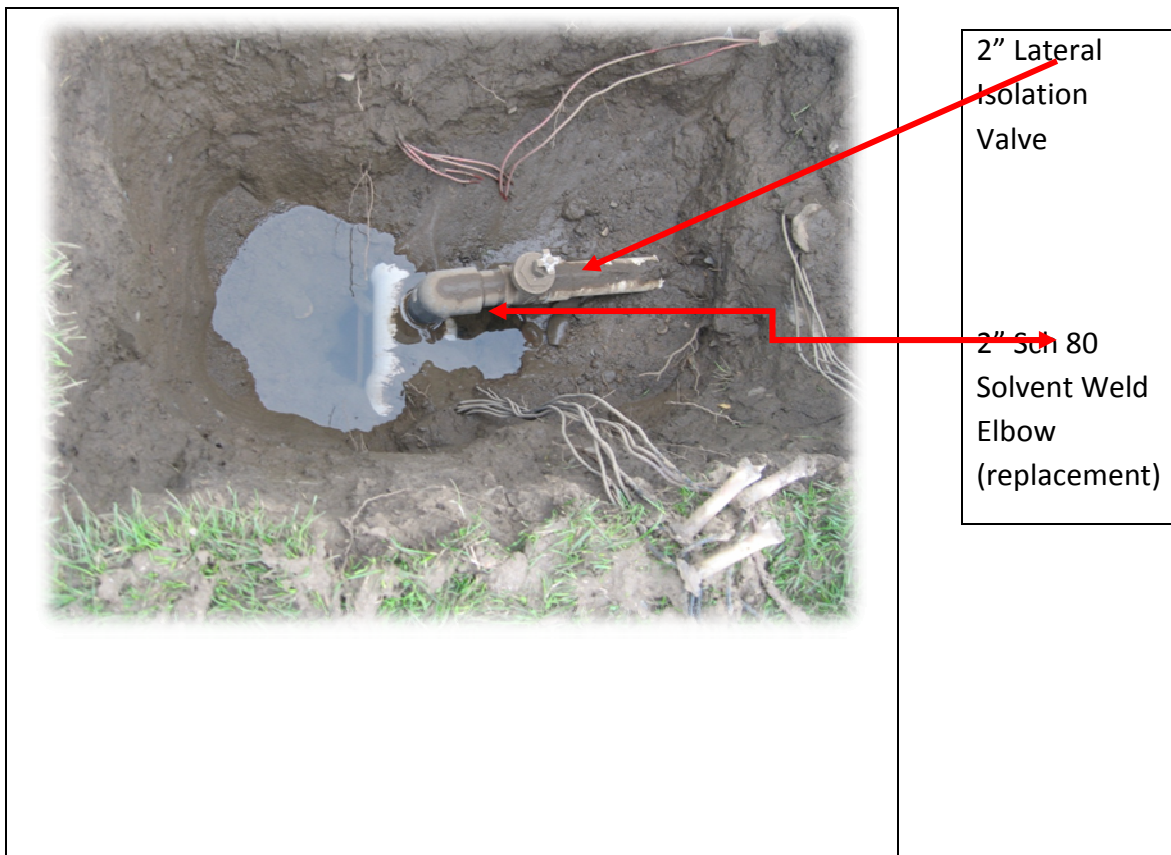
At each service tee is a lateral isolation valve (see picture 9). A 2" Schedule 80 (Sch80) nipple is threaded onto a 2" Sch40 elbow, (the schedule value relates to component strength, high Sch value equals greater strength). With increasing frequency the Sch40 elbow is split (appendices picture). A Sch40 threaded nipple was the wrong component to use in such a high stress area. As these are repaired, crews are using a solvent weld (can't be over tightened, greater strength) sch80 elbow. Research data indicates that a 2" Sch40 threaded elbow should not be exposed to an internal pressure greater than 83 psi. A Sch80 solvent weld elbow can be exposed to 243psi without expected failure (see appendices). Solution to this issue is to repair as they fail with solvent weld Sch80 elbows, with eventual replacement of the lateral isolation valve configured as a angle valve eliminating the elbow altogether. These recurring failures from this section are indicators that the irrigation system is reaching the end of its useable life.

As the staff identify and repair mainline leaks on the system, they have discovered a lack of physical restraint devices (thrust blocks) on the mainline change of direction fittings. Each mainline change of direction (22°, 45°, 90°, tee, dead end) should have had a thrust block installed during construction. A thrust block consists of a poured concrete block that is in contact with the fitting and backed to undisturbed native soil. The function of the thrust block is to prevent the fitting from moving after installation. Without proper thrust blocking, the fittings can be pushed off simply by the system operating pressure with a mainline failure result. The only way to determine if the fittings have thrust blocks in place, is to dig up and examine the fitting and not something that is recommended. One stop gap measure would be to reduce the operating pressure of the system. Unfortunately, lowering the system pressure would have consequences for the high elevation sections of the



course. There is no good interim solution to the lack of thrust blocks, other than replacing the failed fittings with ductile iron fittings and pouring properly sized thrust blocks.

The question has been asked if the mainline supply to the booster is adequately sized. Based on the measured irrigated area for holes 14-18 (23.7 acres), the 6" mainline pipe across Dillon Road is adequate to allow for up to 400GPM. This translates to about a 0.27" application of water in 8 hours. The 0.27" application rate is about the highest application rate that the golf course will see during a normal season. The record drawing indicates that the 6" pipe is steel. That information needs to be verified to insure that is correct. The condition of the pipe needs an evaluation as well. In the likely event that the pipe is in a deteriorated condition, it would be advisable to install several new HDPE pipes to serve as mainline sleeving, communication sleeving and mainline pipe.



Picture 9. Service tee/ lateral isolation valve assembly

#### **D. Pumping Stations - Pictures 10 & 11**

The golf course has two pumping stations, a main station near 12 tees and a booster station near 18 green. The main station has (3) 60hp premium efficient motors each coupled to a vertical turbine pump. To maintain system pressure there is a 3hp pressure maintenance pump. Each pump is controlled by a Variable Frequency Drive (VFD) that acts like a dimmer switch. The motors operate at the speed needed to maintain to 120psi set

point. That may require one pump operating at 60% of the rated capacity or all three at 100%. The VFD component is an energy conservation tool that will save Coal Creek significant utility line item dollars.

The station has a 1750 GPM capacity and provides water to the entire course. The discharge pressure is set to 120psi and supplies adequate volume for the entire 18 holes and adequate pressure for the entire course with the exception of 15 mid fairway to green, and 16 tee to mid fairway. Installed in 2009, this is a replacement to the original, and is properly sized to irrigate the 105 acres of turf at Coal Creek. The station communicates directly with the Nimbus II central computer and can react to anomalies that may occur during an overnight irrigation cycle, such as a mainline pipe break. The main station has many years of service remaining and can be re-used in the event a new irrigation system is installed.



Picture 10 & 11 Main pump station & booster station building

The 25hp booster has not been in use since September 2010. There is a mainline leak underneath the structure that needs to be repaired for the pump to operate. This is a top priority repair. The main pump station cannot provide the needed pressure for upper portion of hole 15 and 16. Note Illustration 4 pressure graph earlier in this report.

The current booster location is not in the ideal location to perform its function of lifting water to the highest section of the golf course. It is located in the proper location relative to the availability of 3 phase power. The proper location would be in the native area between 15 and 16 fairway. Although the cost to install power from Dillon Road to the native area between 15 and 16 (2100') would be high, the size of the motor could be smaller and the operational cost would be less than half than when the pump was operational. Power maybe available in the cul-de-sac nearer the proposed site, and should be researched.

In the event a new irrigation system is installed, additional hydraulic evaluation may identify a scenario that would allow for the booster pump to be removed completely.

#### **E. Record Drawings and Field Documents**

The golf course does have a record drawing (as-built) and field set documents that are referenced occasionally during operation. The in shop as-built is lacking some vital information, as well as accuracy. Heads that have been added since the initial installation have been drawn in by pen. Head types are identified, as full or part but not by model (51, 47, 95, 700, 750). Station assignments are in place but reference the previous control system station assignments. Area labels that allow for easy use of the Freedom system are not noted on either set. Mainline sizes are not noted/incorrect, mainline and lateral valve locations are not identified, quick couplers used for hand watering are not identified. The as-built record /field set documents are important maps that when accurate, are referenced daily by the superintendent and irrigation technician. An accurate as-built is vital to tracking changes, noting repairs and operating the most expensive piece of equipment on the golf course.

It is recommended that Coal Creek have a GPS as-built created. The as-built document will be used for current operation as well as a valuable reference if the club decides to install a new system in the future. Please reference the appendix for samples of the existing as-built document, field set, and an example of a GPS generated as-built document. Note the difference of the information provided in each document.

#### **F. System Maintenance and Repair Personnel**

Without well trained personnel the performance of the system will suffer, and has. It appears that due to lack of personnel, routine maintenance has taken a back seat to reactive repairs.

The Coal Creek irrigation technician is a relatively new employee, in a seasonal position. His irrigation experience is limited as would be expected with a seasonal position. It would benefit the course to have the irrigation technician position be a full time, year round position that would attract a technician that has experience working with older systems that are beginning to fail.

### **G. Water Source**

Coal Creek is in a unique position to have two water sources. Each source appears to be able to supply more than adequate volumes of water to the course. Unfortunately when the club is irrigating with the re-use water, the Colorado department of health regulation 84

(<http://www.cdphe.state.co.us/regulations/wqccregs/100284wqccreclaimedwater.pdf>)

is an important component of the operation. The regulation restricts where and when re-use water can be applied. With homes in close proximity to the golf course, and the current sprinkler head locations, it is difficult to provide high quality turf at some peripheral areas. As shown in picture 12, this head originally a full circle head is now required to be a part circle head. Part circle heads are available in a “part circle tail” configuration that irrigates the area behind the head with a reduced radius (15’-30’) of throw. The part circle tail is one solution that will have limited results. The best solution is to develop a sprinkler head layout the fits the golf course boundaries.



Picture 12. Part circle head with low turf quality behind the head



## ***H. Conclusion***

After review of the components noted in this report, the irrigation system at Coal Creek is near the end of its lifecycle. The City of Louisville will need to replace the irrigation system within 2-3 years. The failures that are occurring are standard indicators seen with systems of this age and components used. The good news is that the main pump station and central computer components are items that can be integrated into a new system to help offset the cost of a new system. The city should initially 2.2 - 2.5 million dollars for replacement.

A review of the annual water use, and using completed comparable projects, Coal Creek will realize water savings of approximately 15.6 million gallons of water annually (48 acre feet) through improved system performance alone. The golf course architect may be able to identify areas on the course where turf reduction can be implemented that will not impact the design intent of the course. The new system layout will take into account the mature tree locations and established boundaries that were not in place during the original construction.

***I. Appendix Additional Pictures and Larger Size Graphs***

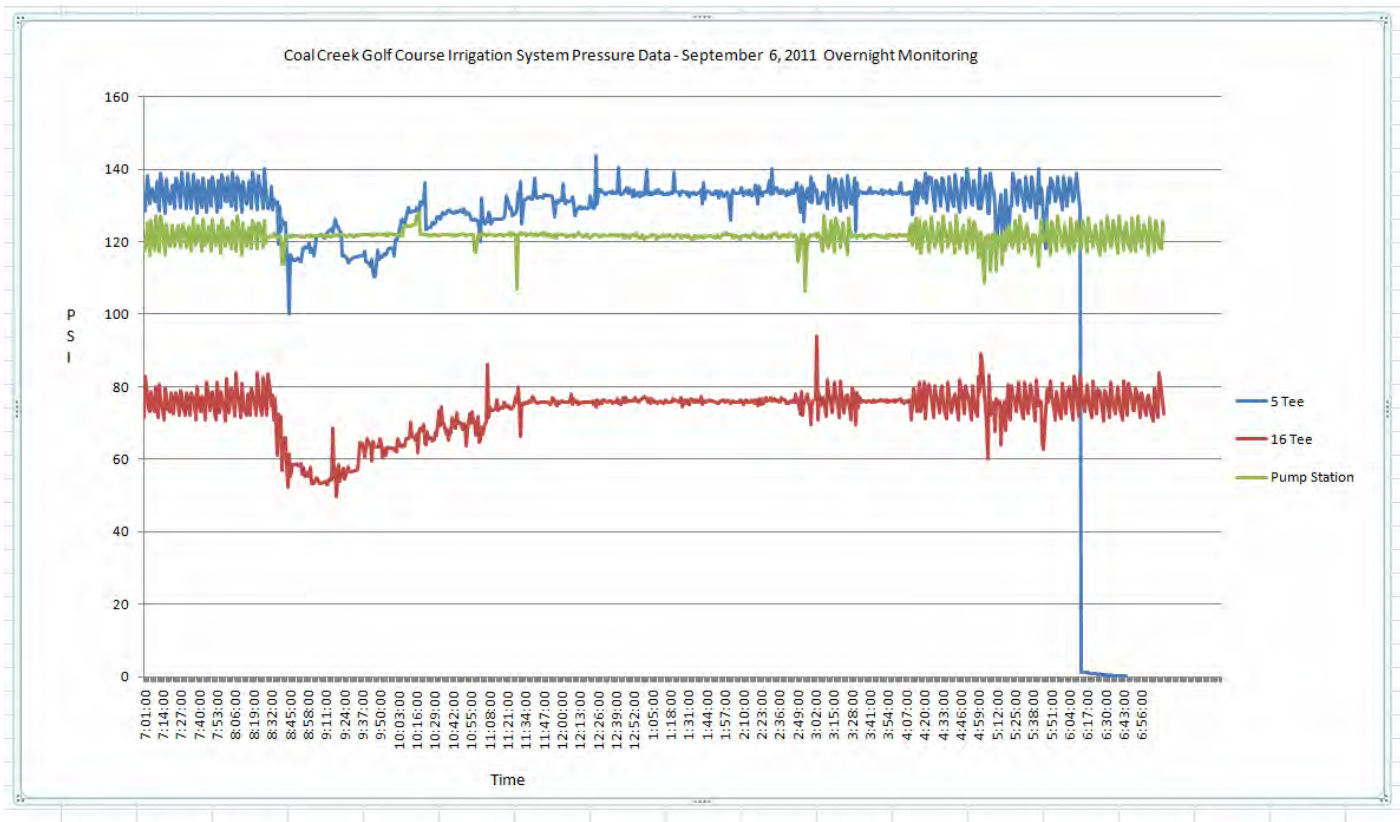


Illustration 4



Split Sch 40 elbow



Unitized swing joint (left), swing joint with solvent weld fittings (right)



Head set too low, will affect performance





Multiple heads on one station, one head is in a shaded area, one in a sunny area, can't control the water for the two different water requirements.



Trees blocking the sprinkler stream = dead turf – 16 tees



Sprinkler head outside of the formal grass limits, impacts sprinkler performance, wastes water



Broken head needs to be repaired

# **USGA Green Section Turf Advisory Service Visit**



**Coal Creek Golf Club**

**Louisville, Colorado**

**September 7, 2011**

**Present:**

Mr. Kevin G. Norby, RLA, Golf Course Architect  
Mr. Chris Bradford, Golf Course Superintendent  
Mr. Fred E. "Derf" Soller, Jr., USGA Green Section



It was my pleasure to visit Coal Creek Golf Club on September 7, 2011, on behalf of the USGA Green Section.

This Turf Advisory Service (TAS) report provides an unbiased review of the golf course management operation. Thank you for the opportunity to openly share my thoughts and suggestions as discussed during the visit and found in this report.

The main focus of the visit was to review current agronomic practices and how these relate to a long-range master plan. Evaluations, observations and recommendations discussed in this report will help to identify and prioritize improvements to the golf course for the long term. Some agronomic and cultural practices discussed can be implemented immediately for improved turf health and playability of the golf course.

Main topics discussed during the visit included master plan evaluations, irrigation system, maintenance standard document, tree management plan, aeration needs, general putting green maintenance, approach, tees and fairway recommendations, and staffing review and its limitations.

## **EXECUTIVE SUMMARY**

This summary provides a brief description of the recommendations found within the main body of the report. The remainder of the report contains several visual observations and specific recommendations highlighted here.

### **Irrigation System**

- Proper irrigation applications = good playing conditions.
- System components showing age and failing regularly and rapidly.

### **Maintenance Standards Document**

- Create a standard of maintenance desired, then the budget to fund it.

### **Tree Management Plan**

- Master plan will likely address removal of numerous trees.
- Removal and thinning of trees and ground cover in select locations will have an immediate impact on improving turf health and, more importantly, course playability.



## Aeration

- Walking core aeration equipment is needed now to begin important cultural practices.
  - Aerator is key for long-term putting green health and playability.
- Compaction relief required for fairways and rough areas.

## Greens

- Search and locate greens drains to verify that they are performing as designed.
- Deep tine aeration in spring should continue.
- Core aeration can't come soon enough this year.
- It is recommended to reintroduce the spoon feeding program throughout the summer.

## Approaches

- Organic thatch layer in approaches is holding excess water.
- Consider increasing aeration, verticutting and topdressing to firm up approaches for improved playability.

## Tees

- Layering in upper profile shows need for increased aeration and topdressing.
- Select tees are in need of leveling.

## Fairways

- Organic buildup not as evident, but reducing compaction is important for turf health and flushing salts to below rootzone.
- Locating fairway drains and 'refreshing' drain lines is recommended.
- Large-area French drains on fairways of hole Nos. 9 and 14 should be in the long-range improvement plan.

## Staffing

- Staffing levels should reflect maintenance standard document.
- Golf maintenance mechanic and irrigation technicians should be considered full time positions.
- No maintenance staff in the winter should mean no golf in the winter.

## Miscellaneous Topics

- Regardless of who owns or manages the golf course, there needs to be some entity responsible for the long-range planning, capital improvements, equipment replacement and basic protection of the golf course asset.

## IRRIGATION SYSTEM

**Observations** – The current in-ground irrigation system is starting to show its age. Many components are starting to fail on a regular basis. When trying to irrigate a golf course, the ability to apply water where and when it is needed is critical. The unreliability of many of the underground components is making this difficult to achieve on a day-to-day basis. Improper head spacing and old, outdated, un-replaceable impact heads make it impossible to provide individual head control for even irrigation. This certainly affects maintenance operations and, more importantly, is detrimental to playing conditions.

**Recommendations** – It is time to look at making improvements to the aging irrigation system. Attached with this report are some general guidelines as to the life expectancies of various golf course components. While none of these time frames are carved in stone, this is certainly a good indication of the need to plan for infrastructure replacement on a long-term basis.

Conducting a complete audit as to what is currently in the ground, precipitation rates for all heads and reprogramming the existing software would go a long way toward utilizing the current system to its full capacity. Even then, as previously mentioned, the aging components should be cause for concern. It is recommended to start planning for phasing in a new system.

## MAINTENANCE STANDARDS DOCUMENT

**Observations** – Discussions with Mr. Bradford indicate that with the current budget and labor, the maintenance staff is just keeping its head above water. Developing a maintenance standards document is important for all golf courses to help identify and understand the desires of players and management and to create a budget to fund that level of maintenance.

**Recommendations** – Identifying key daily activities such as mowing greens, tees and fairways would be a good starting point for a maintenance standards document. Regular cultural practices such as aeration, topdressing, etc. should also be included. Find attached some information on creating such maintenance standard documents.

## TREE MANAGEMENT PLAN

**Observations** – The golf course appears to be getting smaller. Many trees, especially located near creeks and drainage, have certainly grown since the inception and construction of the golf course. Master planning discussions will likely discuss removal of numerous trees throughout the property. There are many locations across the golf course where tree removal will provide immediate and positive improvement on playability.

**Recommendations** – Removal and thinning of trees and ground cover at select locations is recommended. It is likely that Mr. Norby will discuss these at length during his master plan discussions, but there are things that can be done as soon as this winter that will improve agronomics and playability.

Many trees have grown to the point that original tee box space is unusable due to tree encroachment from the left or right. This is the case at many tee boxes across the golf course. As originally designed by golf course architect Mr. Dick Phelps, these trees were not to be a hindrance. It is recommended to remove these trees as soon as possible to protect the integrity of the design.

Many surface tree roots are also negatively affecting turf health, playability and safety. The narrow-leaf willows and poplars, in particular, can be especially shallow-rooted in golf course settings. This is certainly the case at Coal Creek Golf Club.



Removal of six to eight trees along the left side of No. 2 will immediately open the entire fairway landing zone. Currently, the left half of this tee is unusable and the most direct shot is toward the lake, toward adjacent houses. Other quick examples where playability and maintenance could be immediately improved include:

- Hole No. 4: Removal of two trees just left of the putting green would decrease tree root encroachment into the green and the bunker short and left.

- Hole No. 6 (already the number one handicap hole): Removal and/or thinning of numerous trees along the left side of the tees would make the tee usable and make the lake left of the landing zone visible from the tee. Once into the landing zone, widening the very narrow shoot through the trees and over the next creek, particularly all the vegetation to the right, would provide dramatic improvement in playability and visibility of this golf hole.
- Hole No. 10: It is highly recommended to open up the tee shot avenue.
- Hole No. 12: Consider clearing trees along the right side to make the putting green visible.



Major thinning of trees and undercover is needed to the left of the tees on Hole No. 6. Golfers should be able to see the fairway and the water hazard just to the left of the landing area.

Many other locations on the left and right sides of tees should also be evaluated for better playability and safety. Shots should be directed into the middle of fairways and away from the houses on either side. This can be accomplished through proper tree removal and possibly some thinning.

## AERATION

**Observations** – Numerous soil profiles taken during the visit revealed layering of organic matter at the top of the soil profiles. It was disheartening to hear that the club currently does not have any aeration equipment in the maintenance fleet.

**Recommendations** – Core and solid tine aeration for compaction relief in fairways and roughs is certainly a cornerstone to good turf health. Having aeration equipment in the maintenance fleet is highly recommended.

A walking aerator can be used on putting greens, as well as tees and putting green approaches. A versatile unit can pull cores, as well as needle or solid tines, making it useful throughout the heat of summer. Compaction relief will be required on all fairway and rough



areas. This is important for water infiltration and gas and air exchange at the rootzone. With the reclaimed water used for summer irrigation, this will also help keep salt levels below the rootzone in the soil profiles.

## PUTTING GREENS

**Observations** – Despite the severe wet and hot weather experienced in the Denver region this summer, the putting greens were generally in good health on the day of the visit. Putting greens do, however, require much more than mowing throughout the summer.

**Recommendations** – It was good to hear that Mr. Bradford did perform deep tine aeration of the putting greens this spring. Evidence of this procedure is still visible on many of the putting surfaces, as this is where the healthiest turf was noted. Core aeration is the cornerstone of proper management of highly maintained turf areas, and putting greens are at the top of this list. Deep tine aeration should continue on putting green No. 8, where a silt layer from a previous flood episode is visible. It will be critical to turf health to monitor this layer.

One area of concern during the visit was the amount of water starting to back up on putting surfaces. At the end of the visit, Mr. Bradford was able to produce some as-built maps from the original construction. These do show subsurface drainage in the putting greens. It is recommended to find these exit drains and verify there is positive drainage coming through the drain lines. Many of the drains cross under the newly installed cart paths and cross adjoining fairways. Locating these drains was discussed with Mr. Bradford. It is recommended to probe to find the drain lines, dig down with a shovel, slit the top and install a hose from a quick coupler and flush until the drain exit can be visually verified. With the use of the non-potable reclaimed water, flushing salts through the putting green profiles will only be possible if the internal drainage system is functioning as designed.

It was good to hear that with no equipment, Mr. Bradford has plans to contract core aeration of the putting surfaces. This cannot happen soon enough. As shown here at No. 1 green, there is a rather dramatic layer building at the top of the soil profile which impedes water and air and gas exchange. This should be broken up as much as possible through annual core aeration.



Layer near the top of green No. 1 shows need for aeration to disrupt the organic matter to improve water infiltration and turf health.

With proper labor available at the golf course, Mr. Bradford would be able to return to a spoon feeding program throughout summer for the putting greens. Reintroduction of this very effective program is highly recommended.

## APPROACHES

**Observations** – Many approaches on the golf course are much softer and contain much higher organic/thatch than the putting greens or fairways. This photo of the No. 4 approach shows a distinct layer a couple inches below a dramatic organic buildup in the top. Just gently squeezing this profile makes the water that was retained in this layer extremely visible.



Approach on No 4 green has various layers of organic buildup and some sand from previous years of some topdressing.



Gently pressing on the organic layer at the top of the turf on No.4 approach, demonstrates the water holding ability of too much thatch.

**Recommendations** – Consider increasing aeration, verticutting and topdressing of approaches to help firm these areas for improved playability. Many golf course superintendents are now treating approaches the same as putting greens as to cultural frequencies and even spoon feeding. Firming up approaches will provide players the opportunity to hit just short of putting greens and bounce onto the putting surface for forward hole locations.

## TEES

**Observations** – While many of the tees are certainly large enough, much of the square footage is unusable because of tree encroachment, as previously discussed. Some of the more heavily used tees and par-3's where irons are struck, and that have been heavily sand topdressed over the years, have become crowned over time. These would be easy to level during a master plan renovation.

**Recommendations** – Removing sod, leveling the subsoil and replacing sod would again provide level teeing ground.

There is some layering in the upper profiles of tees. This indicates the need for increased aeration and topdressing. Tees are sometimes forgotten when it comes to cultural practices, but they need some attention for good turf health and playability.



## FAIRWAYS

**Observations** – There was not as much organic matter buildup in fairways as in other areas of the golf course. Reducing compaction will still be important for turf health going forward, though.

**Recommendations** -- Mr. Bradford is aware of the need for salt flushing, but a solid tine aeration device is needed. This device will be critical for providing compaction relief and proper water infiltration through the soil profile. One unit being used at many golf courses in the Rocky Mountain region is the First Products AeroVator with its partner slicing unit. Both of these would be extremely beneficial for reducing compaction and improving water infiltration. For more information, visit: <http://www.1stproducts.com/categories/1/products/2/First-Products-AERA-vator>.

Mr. Bradford is aware of some surface drainage at the golf course, but the exit points may be somewhat suspect. As with putting greens, it is recommended to identify and verify that drainage is functioning properly. Drains installed typically remain functional as far as the pipe and gravel are concerned, but organic matter and turf impede the ability of surface water to enter the drain lines. Refreshing or removing of these impediments will certainly improve surface drainage on the golf course.



Two large areas that will require some extensive drainage and/or a lot of dirt work during renovation are hole Nos. 9 and 14. These areas should certainly be included in the long-range plan for some improvement due to their inability to move surface water off of playing areas. It may be appropriate to consider installing large French drains throughout these fairways, and exiting them off the golf course.

## STAFFING

**Observations** – Staffing levels at a golf course and the maintenance department, in particular, should reflect understanding of what needs to be done on a day-to-day and month-to-month basis. The maintenance department will need to be supported as to labor and budget (equipment, etc.). As mentioned earlier, the unreliability of the irrigation system and constant maintenance required is draining the available labor. This makes it impossible to complete many of the necessary maintenance activities to meet golfer expectations and provide healthy turf. Freeing up these extensive labor hours from chasing irrigation repairs would go a long way toward improving the golf course.

**Recommendations** – Golf maintenance in the Colorado region requires good machinery and irrigation. Both of these require preventative upkeep and continual repair. It is disheartening to hear that the club only has a mechanic on a part time basis. Sharing a mechanic with another golf course during the off season may be appropriate. During the onslaught of summer, though, a full time mechanic is needed to keep reels adjusted and perform regular preventative equipment maintenance. An irrigation technician is also a full time employee at many golf courses. Golf course irrigation systems are intricate. Proper repair, programming and irrigation can only be performed by those with proper training.

It was interesting to hear the club's philosophy of allowing practically unlimited play during the winter months. Mr. Bradford cannot monitor the entire property by himself. This photo is evidence of damage from the inability to monitor and move people around the golf course in certain in-play areas. This damage occurred during the winter when turf was not actively growing. Damage is not noted until the heat of the golf season when these areas should be at their prime. High volume play on limited areas of dormant turf almost always leads to compromised turf health in the heart of the playing season. It is recommended to increase staff to monitor wear and tear and putting green moisture levels throughout the winter.



Winter damage is still visible from golfer traffic. Staffing should be adequate to not only monitor where golfers play from in the winter, but also to have time and equipment to repair these areas in spring.



## MISCELLANEOUS TOPICS

Even though Coal Creek Golf Club is owned by the City of Louisville and independently managed, it is important that capital improvement and ongoing upkeep are addressed. Identifying responsible parties during the contract negotiation would be most appropriate. Long-term protection of the City's asset should be identified and implemented.

## CONCLUSION

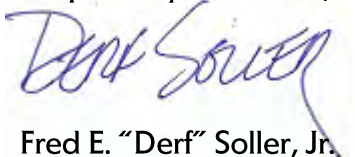
Thank you for the opportunity to provide this USGA Green Section Turf Advisory Service. Please feel free to contact me at any time throughout the year with questions to take full advantage of the TAS program. Discussing and reviewing your golf course maintenance operation is a step toward providing the best golf course possible.

The USGA Green Section produces a free weekly update on all things golf. Would you like to receive the Green Section's electronic version of the Green Section Record? It's free, informative, and short. All you have to do is click the link:



You may also visit <http://www.usga.org/Content.aspx?id=26223> for regional updates from the Northwest and all the Green Section Regions.

Respectfully submitted,

A handwritten signature in blue ink, appearing to read "Derf Soller".

Fred E. "Derf" Soller, Jr.  
Agronomist, Northwest Region  
USGA Green Section

Distribution:

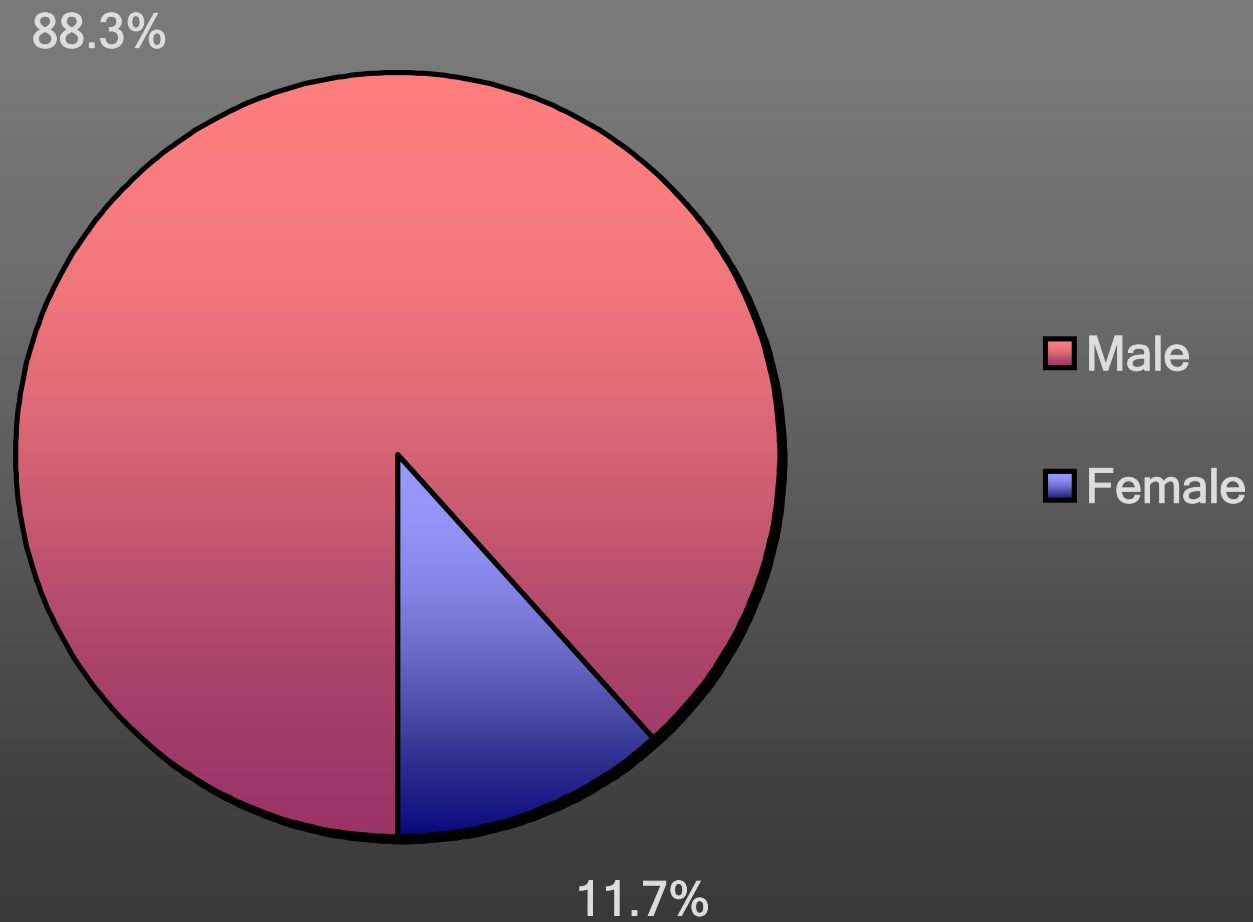
Mr. Kevin Norby (3)



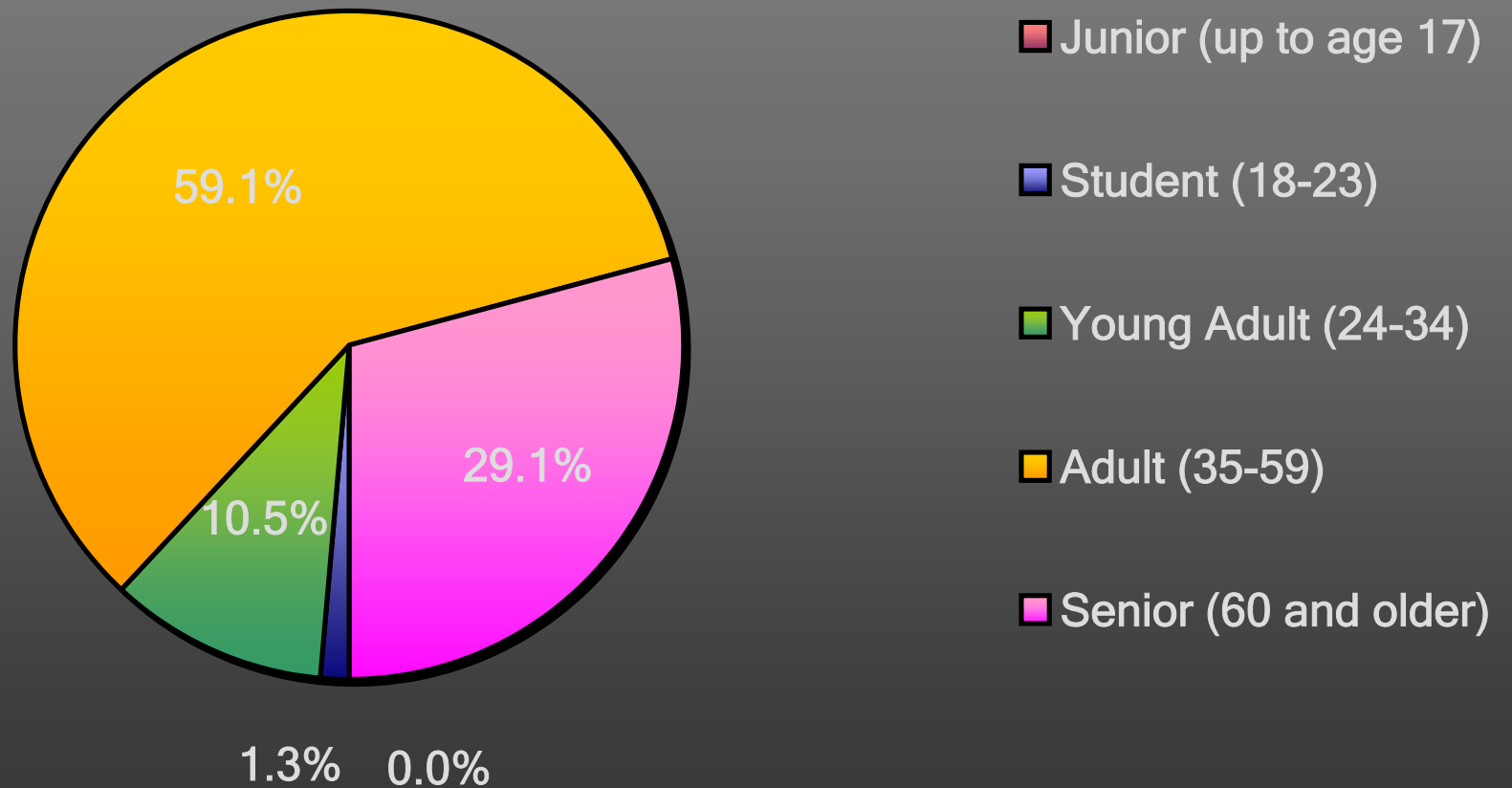
**Reprints:**

Golf Course Component Life Expectancy Chart  
Define Desired Conditioning as You Engage 2011  
Setting Standards  
The Truth About Trees

# What is your gender?

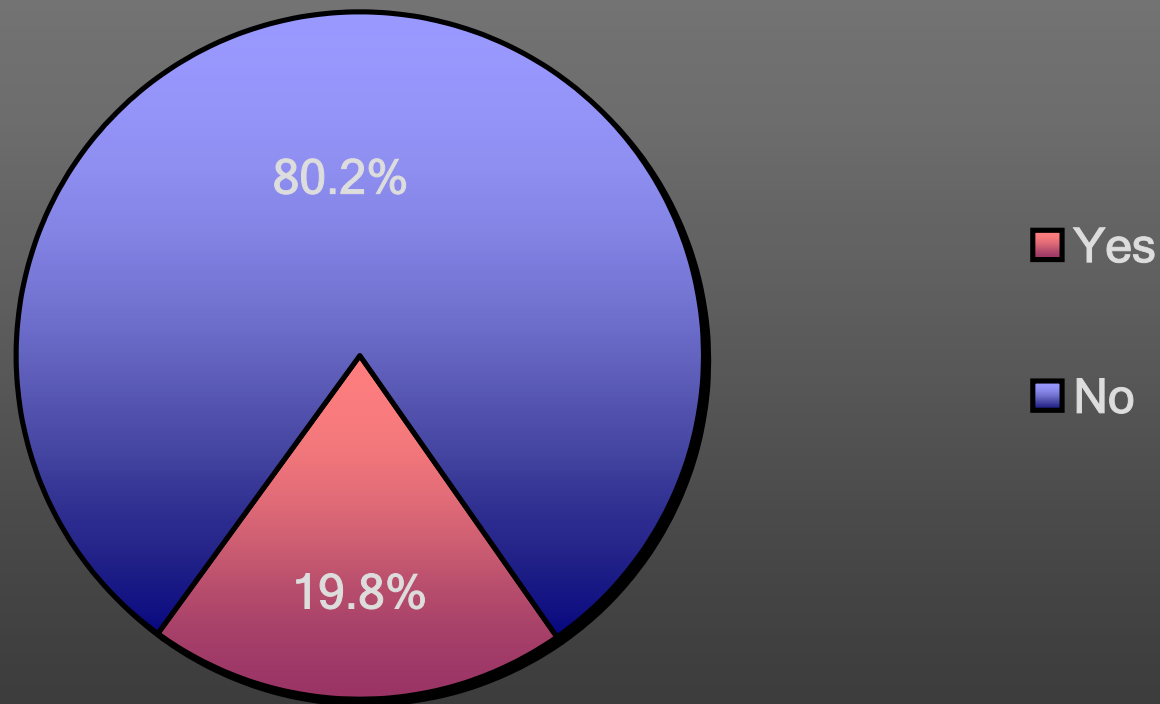


# What is your age group?

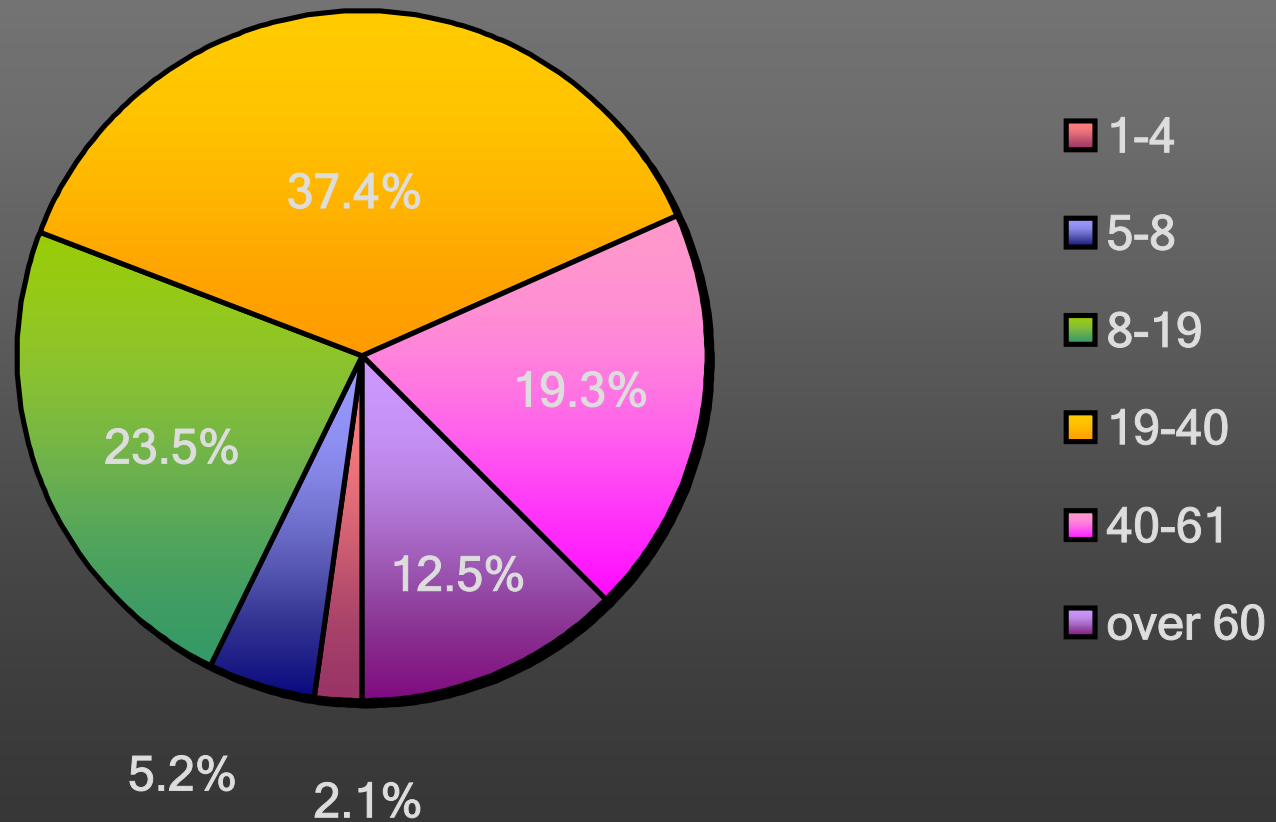




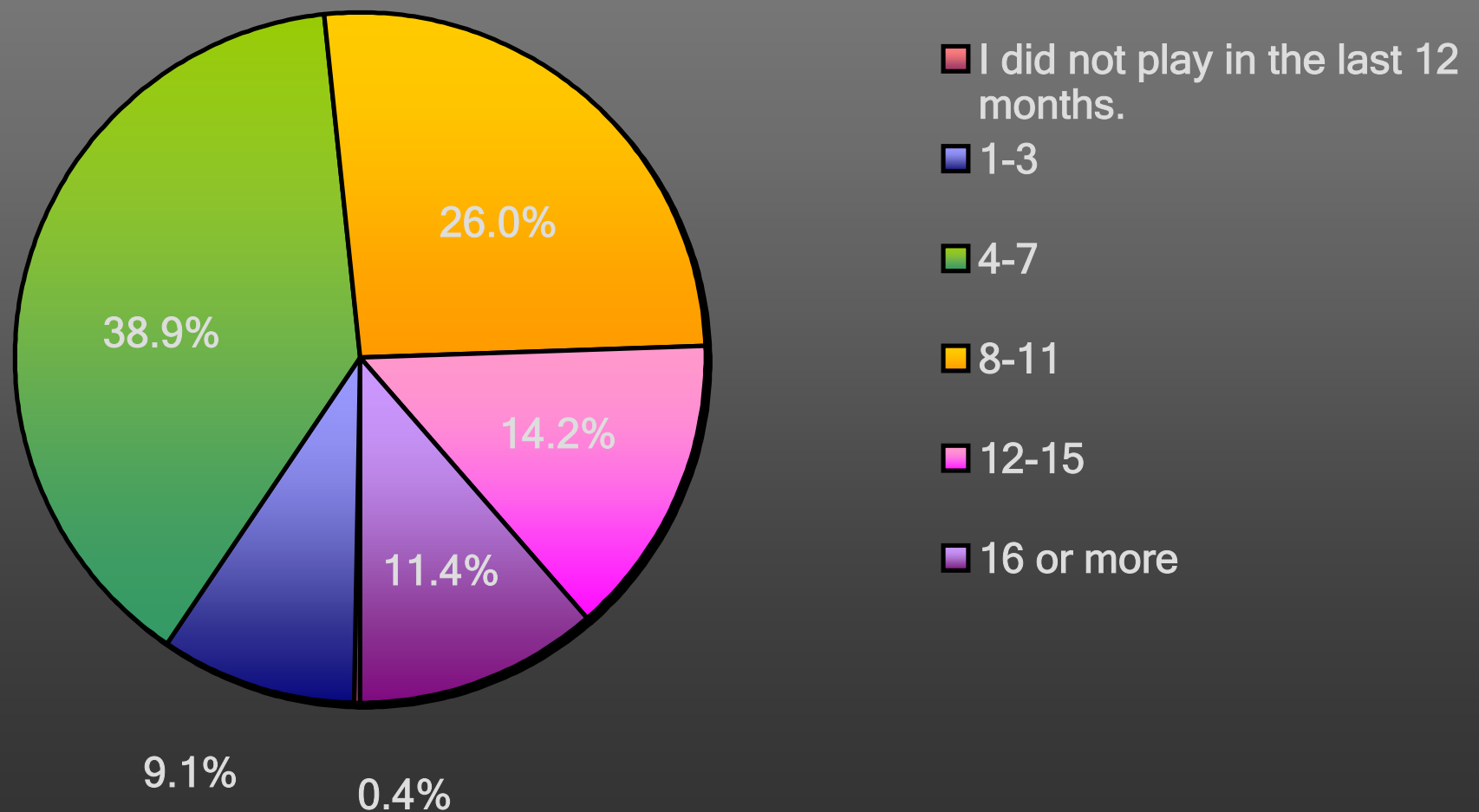
# Are you a season pass holder at Coal Creek Golf Course?



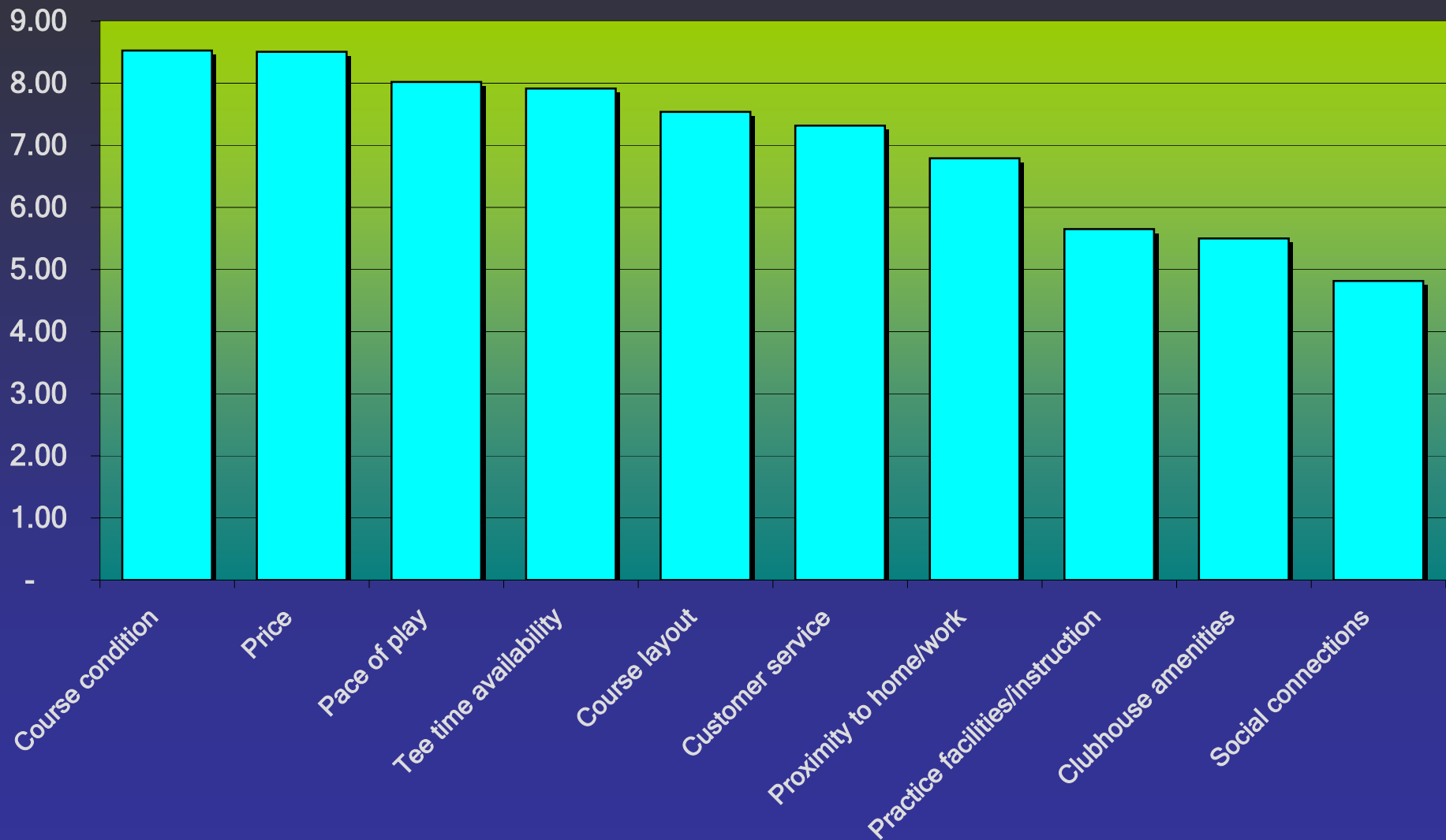
# How many times do you usually play golf each year?



# How many different courses have you played in the last 12 months?

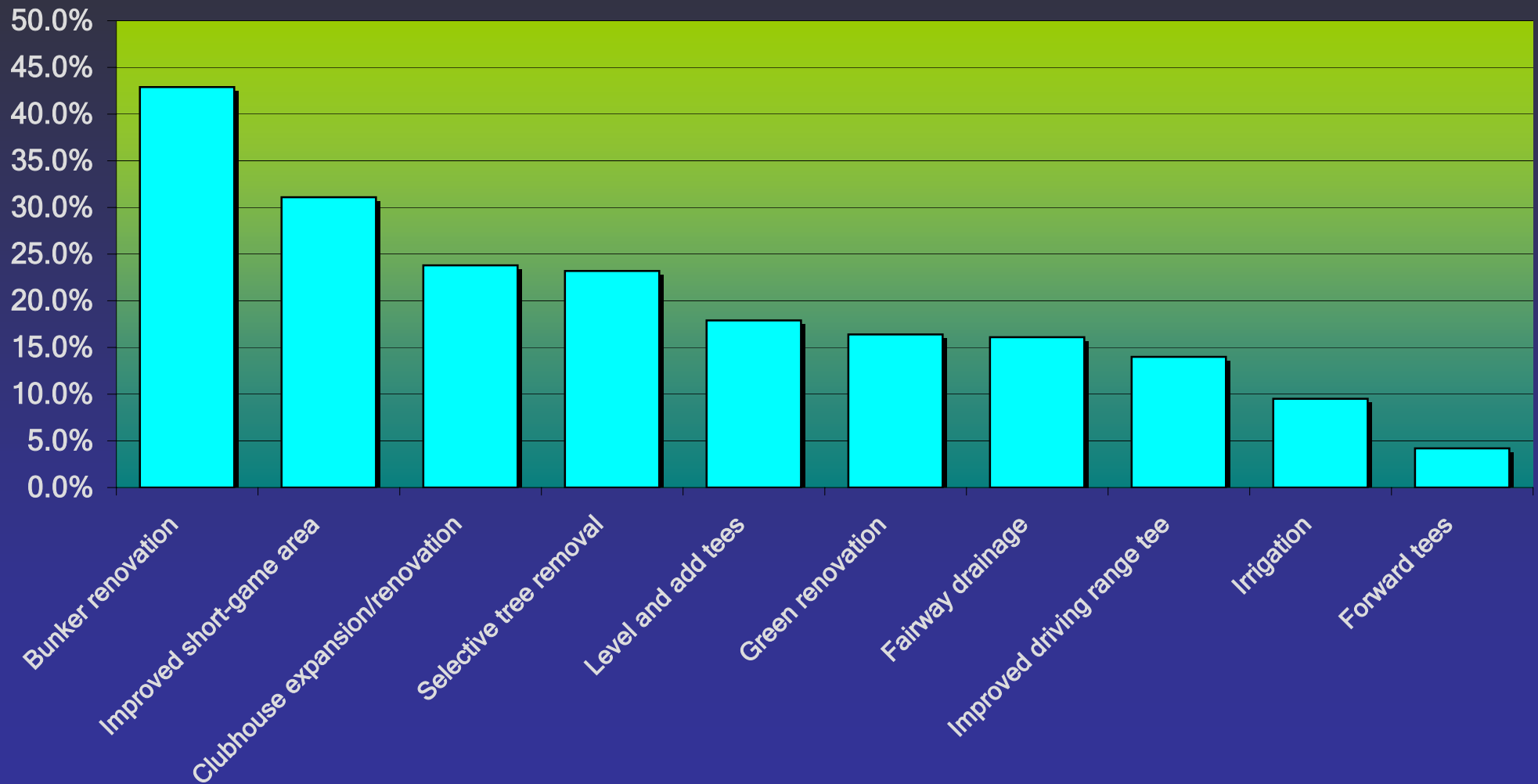


# What factors are important to you in selecting one course over another?

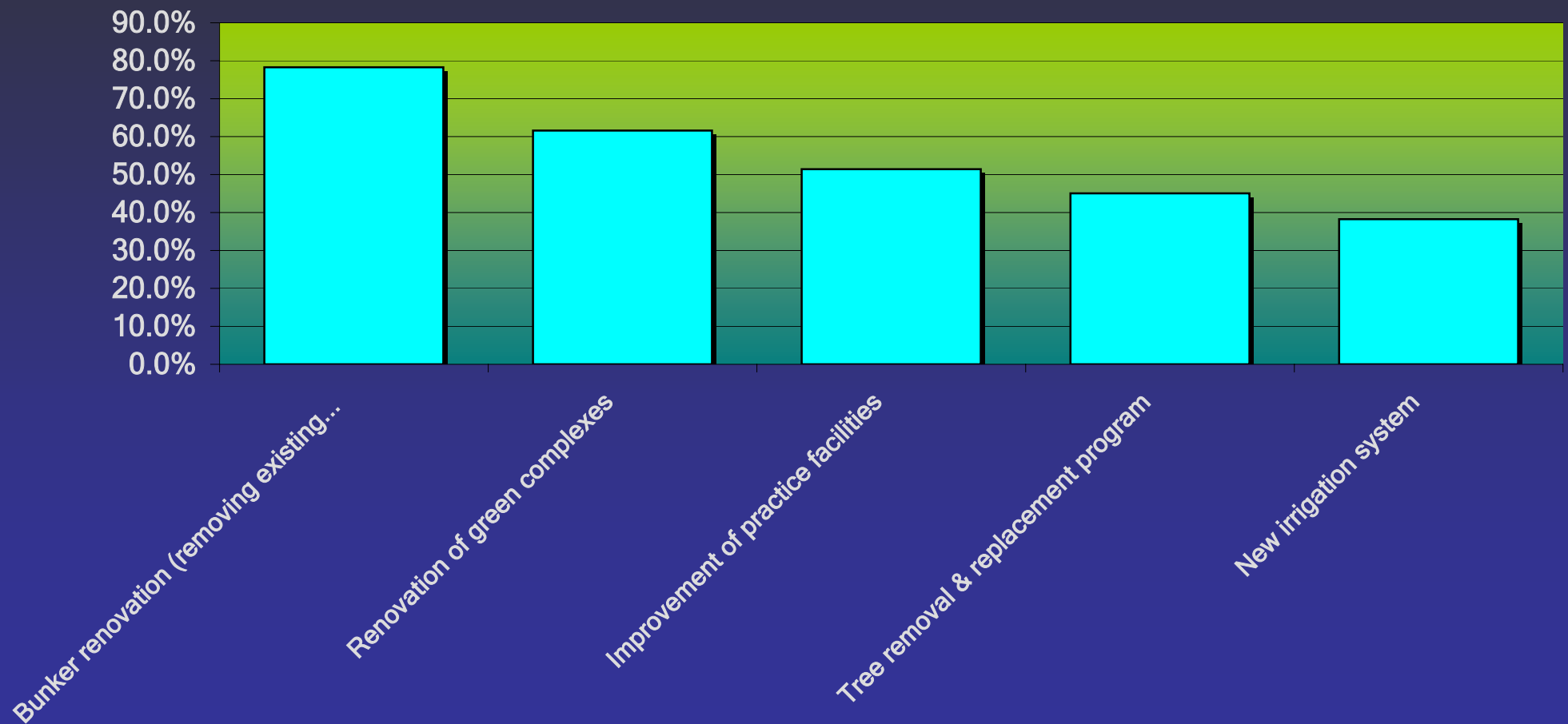




# What improvements would you like to see at Coal Creek Golf Course?



What is the top capital improvement you would like to see completed in the next five (5) years  
(rate the top 3)?



# Coal Creek

GOLF COURSE

Louisville, Colorado



Golf Course Superintendent:  
Eric Jensen  
Western Golf Properties

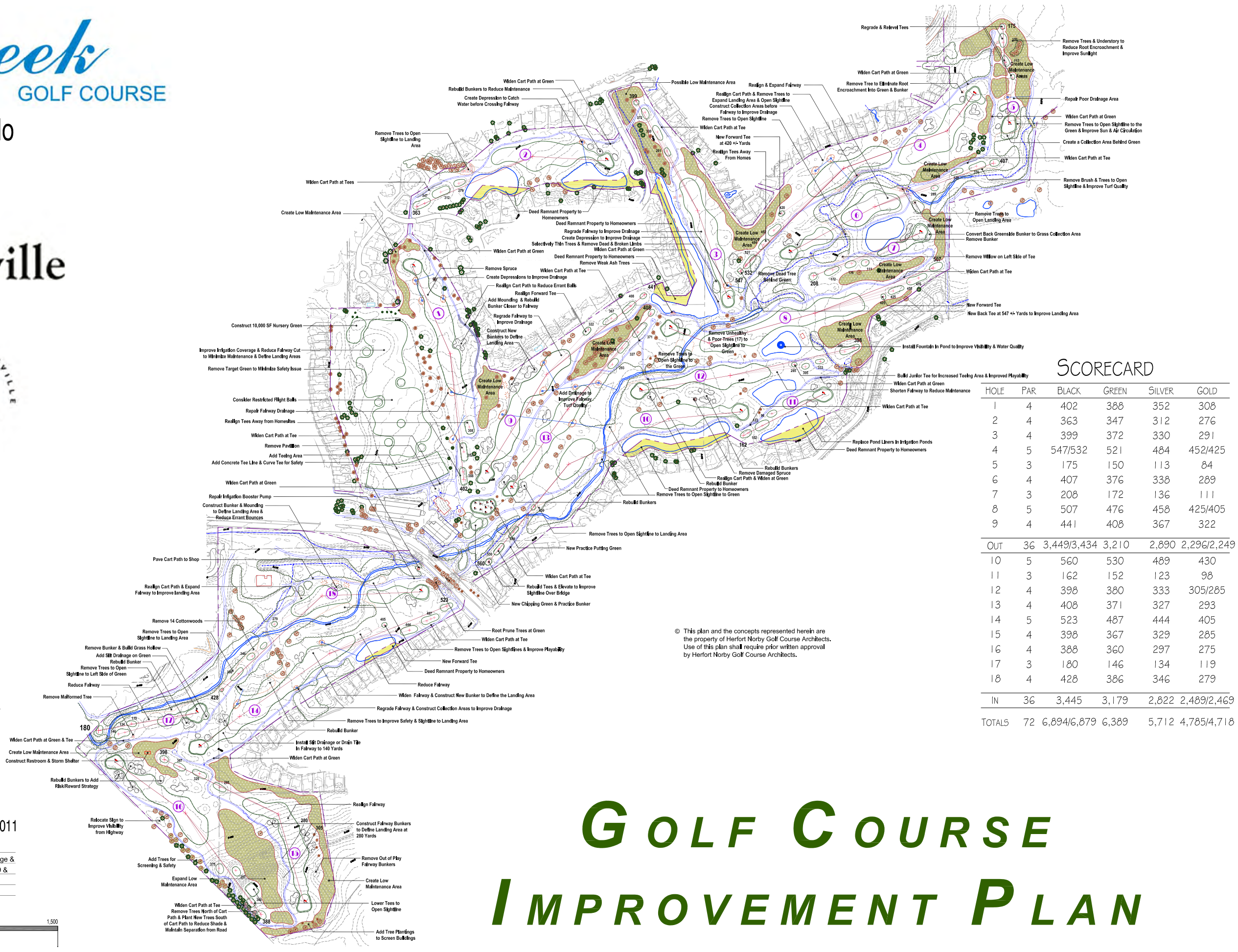
Golf Course Superintendent:  
Chris Bradford

Golf Course Architect:  
**HERFORD NORBY**  
GOLF COURSE ARCHITECTS  
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Chaska, MN 55318  
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October 17, 2011

Revisions:  
11-11-11: Revise cart path exp, low maint areas, etc.  
11-18-11: Revise after presentation-notes, practice range & short game facility, no. 18 landing area, drainage on 9 & out-of-play area on no. 3.  
12-19-11: Drainage area on hole 3.



## SCORECARD

| HOLE   | PAR | BLACK       | GREEN | SILVER | GOLD        |
|--------|-----|-------------|-------|--------|-------------|
| 1      | 4   | 402         | 388   | 352    | 308         |
| 2      | 4   | 363         | 347   | 312    | 276         |
| 3      | 4   | 399         | 372   | 330    | 291         |
| 4      | 5   | 547/532     | 521   | 484    | 452/425     |
| 5      | 3   | 175         | 150   | 113    | 84          |
| 6      | 4   | 407         | 376   | 338    | 289         |
| 7      | 3   | 208         | 172   | 136    | 111         |
| 8      | 5   | 507         | 476   | 458    | 425/405     |
| 9      | 4   | 441         | 408   | 367    | 322         |
| OUT    | 36  | 3,449/3,434 | 3,210 | 2,890  | 2,296/2,249 |
| 10     | 5   | 560         | 530   | 489    | 430         |
| 11     | 3   | 162         | 152   | 123    | 98          |
| 12     | 4   | 398         | 380   | 333    | 305/285     |
| 13     | 4   | 408         | 371   | 327    | 293         |
| 14     | 5   | 523         | 487   | 444    | 405         |
| 15     | 4   | 398         | 367   | 329    | 285         |
| 16     | 4   | 388         | 360   | 297    | 275         |
| 17     | 3   | 180         | 146   | 134    | 119         |
| 18     | 4   | 428         | 386   | 346    | 279         |
| IN     | 36  | 3,445       | 3,179 | 2,822  | 2,489/2,469 |
| TOTALS | 72  | 6,894/6,879 | 6,389 | 5,712  | 4,785/4,718 |

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# GOLF COURSE IMPROVEMENT PLAN