

Eckelson Lakes Golf Club

Helping Golf and the Environment

Chris Harris
2005 Undergraduate Capstone Project

Project Introduction

Over the second half of the 20th century and early into the 21st century, the golf course industry has boomed and thousands of courses have been built. Beautiful courses have been carved out of unused land, mountains, prairies, lake and ocean sides, deserts, and even landfills. However, golf courses all too often use an excessive amount of water, even in North Dakota. Desert golf courses use so much water to thrive that it is impractical to build them. Excessive water use causes the price of playing to rise and affects the area's water supply substantially.

The project type for my thesis is an 18-hole golf course next to the western shore of Eckelson Lakes in North Dakota. The main purpose of the project is to design a more sustainable course that conserves, stores, and reuses water on the course. The other goals are to create an affordable golfing experience for the average consumer, make a resort-like atmosphere, while making the course easier to maintain for the employees. Adaptive reuse is incorporated into this project by using land that is currently used for grazing, and converting it into a course that will leave much of the existing native grasses.

The golf course design will be laid out to use the site's varying topography, rather than "building" a course and moving earth. The purpose of this project is to use land that is currently being grazed by cattle. In addition, the site's terrain is too hilly for farmland. This project turns it into usable land for a golf course. This course would contain areas for water to drain into detention ponds and stand until suitable time for pumping it into the sprinkler system occurs. More and more courses are now using detention ponds to add to their irrigation systems, but they still rely on a municipal water source as their main water supply. Eckelson Lakes Golf Club makes an effort to use the detention ponds as the main water source by being supplemented by water wells. When the ponds drop to a certain level, the water well pumps water into the detention pond, where it is then pumped into the irrigation system.

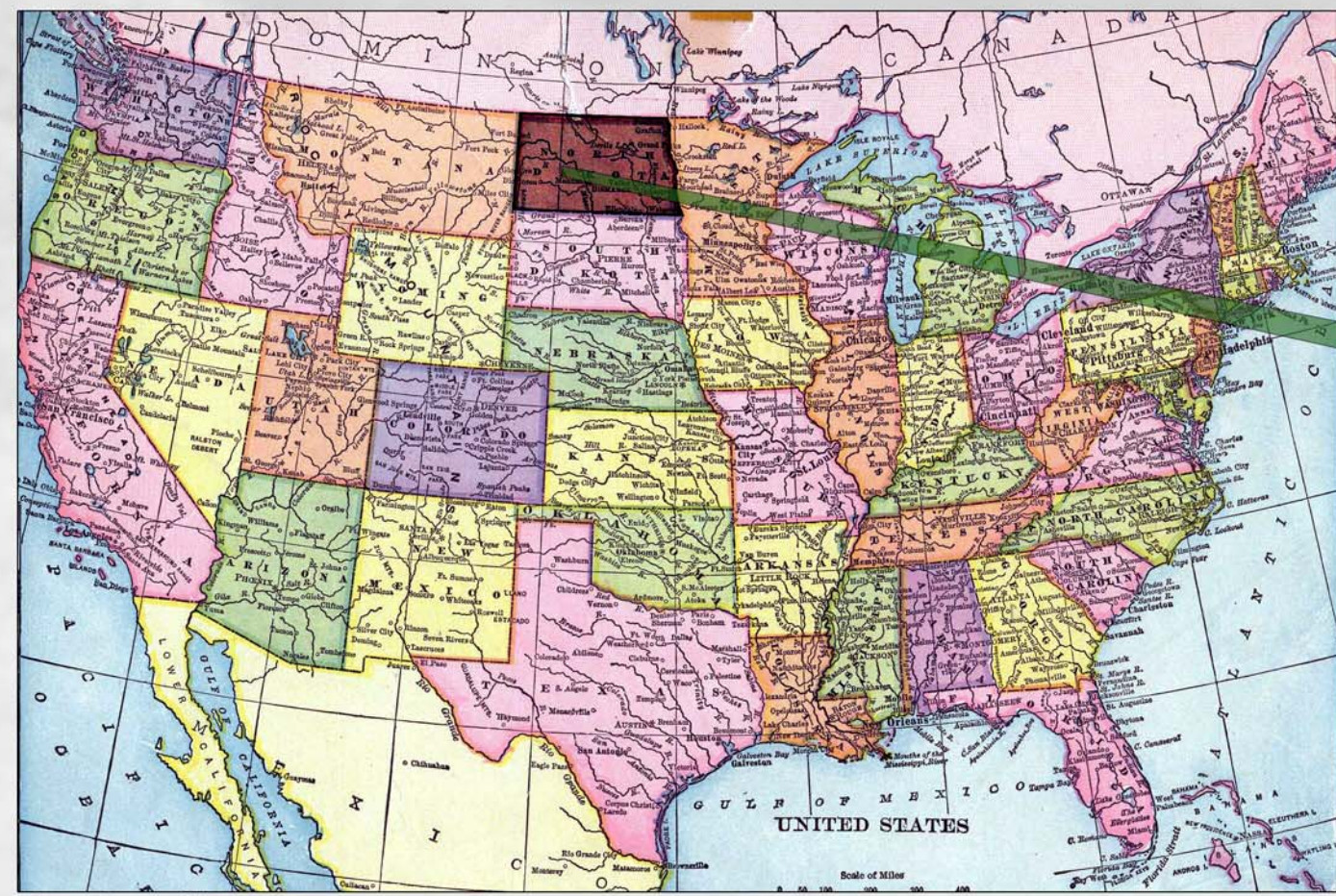
Project Justification

The game of golf has become a very popular sport in recent years and is finally starting to take care of the environment. There are only a handful of courses Audubon International recognizes as good stewards of the land. Every course should really strive to sustain and create natural communities and environments as Audubon International desires. Golf courses need to save water, use fewer pesticides, and create and preserve natural habitats for wildlife. I also feel this project is justified because it will show that a course can have lower maintenance, lower costs, and be environmentally sensitive, while still providing a championship course.

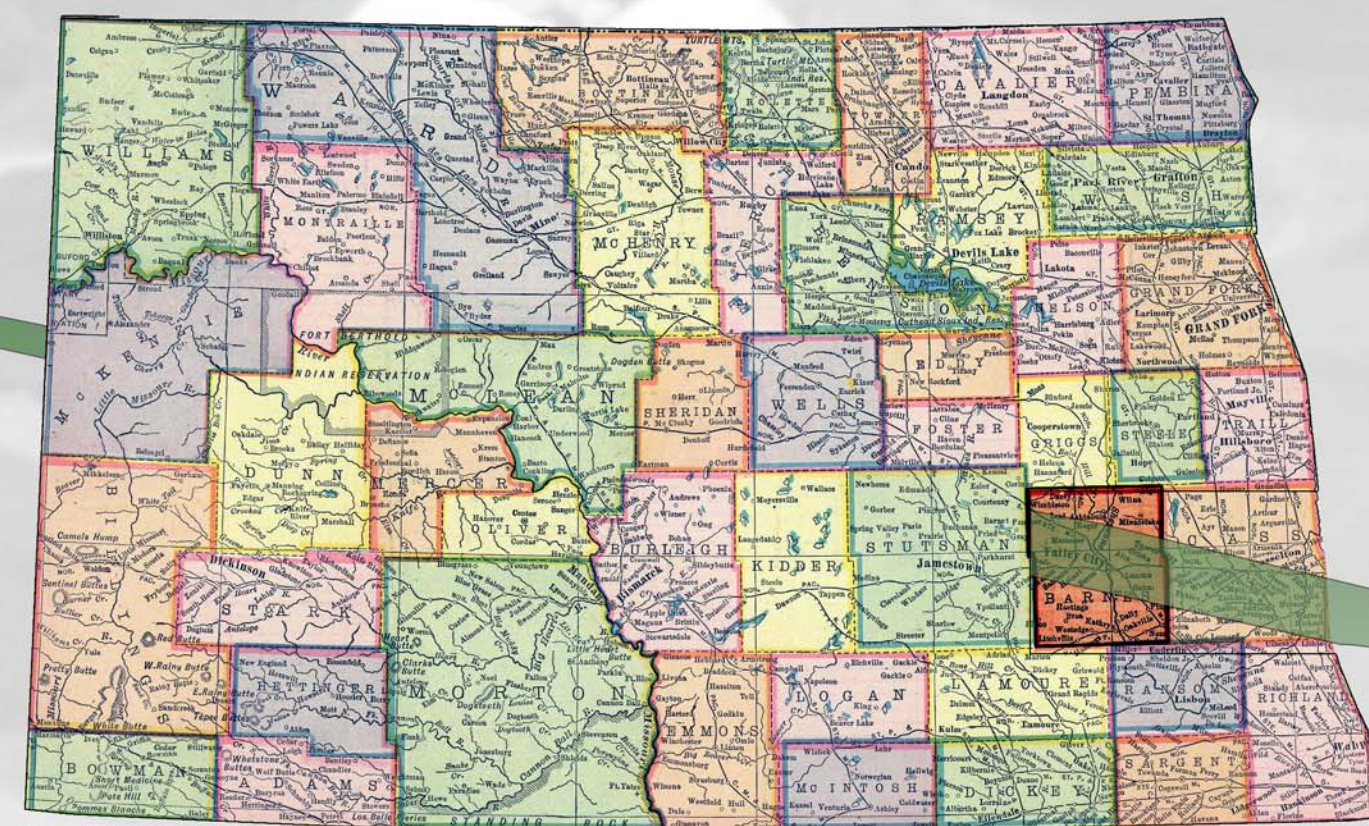
North Dakota has a short playing season, so golf courses help get people out of the house and into nature. The course's relatively remote location will give people a rural feeling and hopefully help them forget about the city for awhile. Since North Dakota has a short playing season, it's not known as a great golfing state. Other than a few courses such as The Links of North Dakota (Ray), Bully Pulpit (Medora), and Hawktree (Bismarck), there are no nationally recognized courses. I would like this course to be nationally recognized to show that North Dakota can be a great golfing state.

Finally, my personal reason for justifying this is because designing golf courses was my reason for choosing landscape architecture as a major and a profession. As an avid golfer I have played in many different states and have seen many styles of courses and I know what kind of course I like. To put it simply, I've waited 5 years to do this project.

Site Orientation



United States of America



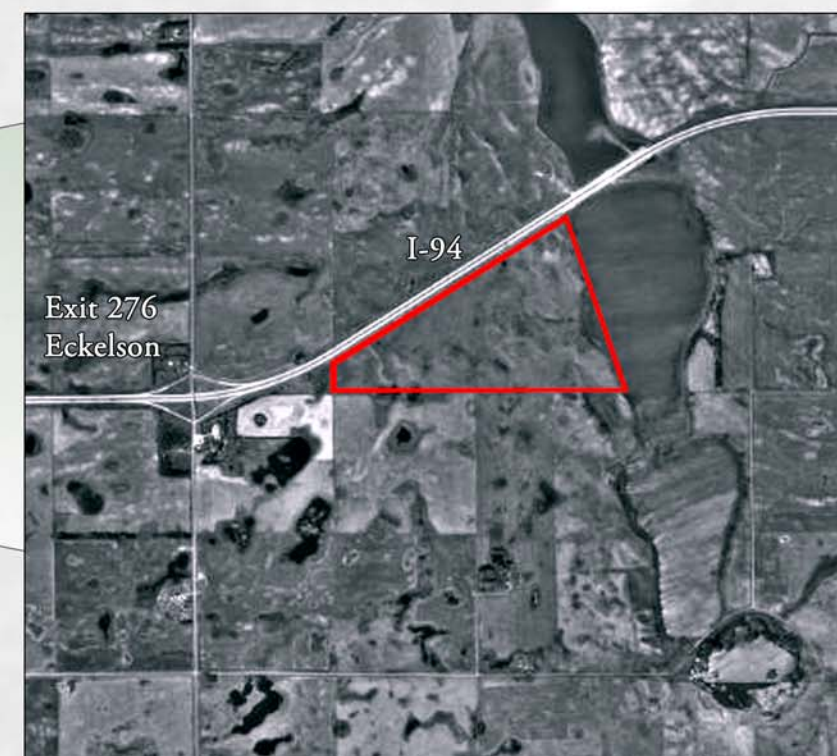
North Dakota

Eckelson Lakes is split by Interstate-94 at mile marker 278 in Barnes County in south central North Dakota.

The site for the course is on the south side of interstate and on the western side of the lake, approximate five miles southeast of the town of Eckelson. It is 14 miles from Valley City (population - 6,826) and 15 from Jamestown (population - 15,527), and 75 miles west of Fargo (90,599).



Two miles away from the site is the Prairie Haven Campground that can accommodate 20 motor homes and 80 tents.



Eckelson Lakes - The Site



Barnes County



Site History

The owner rents out the land to a local rancher who uses it as grazing land for cows.

Prior to being grazing land, this area was strictly mixed-grass prairie consisting of:

- Big Bluestem (*Andropogon gerardii*)
- Little Bluestem (*Andropogon scoparium*)
- Indiangrass (*Sorghastrum nutans*)
- Prairie Junegrass (*Koeleria macrantha*)
- Western Wheatgrass (*Agropyron smithii*)



Design Emphasis

Water use is the main focus for this project. The existing native prairie grasses will be adaptively reused as they will act as the rough which will save on water use. The only changes to the land will be for the irrigation systems, tees, fairways, greens, water hazards, sand bunkers, cart paths, and the clubhouse. Using the native grass as the rough will make less maintenance work for the employees as well as provide challenging shots, while looking aesthetically pleasing.

A quality 18-hole course layout created off of the undulating topography of the site. The course itself manipulates the land as little as possible to minimize the areas to be seeded with grass for the tees, fairways, and greens. However, some land is graded for flatter tee boxes and green playability and drainage.

A proper circulation pattern for golf carts will also have to be created. The maintenance shop location is located in a convenient place for the crew to be able to maintain the course in a timely manner.

Large detention ponds will be placed in optimal areas to collect runoff water to be reused into the irrigation system, thus cutting down on the use of water once again. The site naturally has slope that would be conducive for good drainage and storage in detention ponds.

The clubhouse is a pivotal part of a golf course. It provides the service of golf, convenience, and usually food and beverage needs. Having a good route to the clubhouse from off-site is very important because first impressions go a long way. Good circulation from the course to the clubhouse is also crucial for emergencies and convenience.

Design Methodology

Case studies were a major part of my research process as they helped show me how the irrigation system is assembled. I looked on the Audubon Society's webpage and found numerous courses that had contributed to sustaining the environment. In addition, a few books I have purchased on golf course architecture helped me get the details and basics of turfgrass management as well as tee box, fairway, and green design. Finally, a part I feel is extremely important and crucial to a successful design is that I drew on my own golfing experiences. As an avid golfer, I feel courses should be designed by golfers.

Case Study #1 - Prairie Dunes Country Club Hutchinson, Kansas



Prairie Dunes Country Club is a private 18-hole golf course located in the Great Plains ecological region. The course is laced with tall grass prairie, the dominant plant community of the region. This course used Wildlife and Habitat Management to keep 75% of the property as natural habitat, prescribed burns to maintain the tall-grass prairie, cleared invasive tree species, and provided an area where Tabor College researchers could compare bird species distribution on naturalized golf courses and parkland.

Prairie Dunes Country club also used Resource Conservation to minimize their water use by installing an on-site weather station and weather satellite that is connected to the club's irrigation system. In a unique attempt to reuse water, the course would pump condensation water from air conditioners into an irrigation lake which could provide up to 187 gallons per minute. Finally, they used spot pesticide treatment to reduce the need for widespread spraying.

Case Study #2 - Colonial Acres Golf Course Glenmont, New York



Colonial Acres, a public nine-hole course, is in a suburban landscape in upstate New York. Since joining the Audubon program, one-third of the course has been naturalized, providing valuable open space in an otherwise developed neighborhood. Colonial Acres golf Course used Wildlife and Habitat Management that converted two acres of previously maintained turf to naturalized 'no-mow' areas, built a naturalized area with soil from irrigation pond and seeded with fescue grasses, and planted 40 native trees.

Colonial Acres Golf Course used Resource Conservation to expan their irrigation pond by 1,000,000 gallons. This pond is fed by run-off and rain and supplies 100% of the irrigation for the course.

Case Study #3 - Westlake Golf & Country Club Westlake, New Jersey



Westlake Golf and Country Club is in Westlake, New Jersey. They installed 60-inch polyethylene pipe to construct an efficient stormwater management system. "With a residential development of this size, and the significant change in topography for the course itself, there will be a tremendous demand on proper stormwater management," said Tony Radoszewski, ADS director of marketing and business development. "With that in mind, over 20,000 ft of pipe will be needed, including 3000 ft of 60-in. diameter pipe to effectively handle the demand." Basically what they needed all of this pipe for is to dump water in depressions, creating retention ponds that serve as water hazards. Westlake has 16 ponds joined by the 60-inch pipe to attempt to keep the ponds relatively level.

Case Study #4 - Kampen Course Purdue University



The Kampen Course at Purdue University did research on how wetlands help protect the environment from pollutants. A study found that as a wetland ages, the better it works for the environment. From this research, they are trying to determine if urban areas should have golf courses with wetland to protect the surrounding environment.



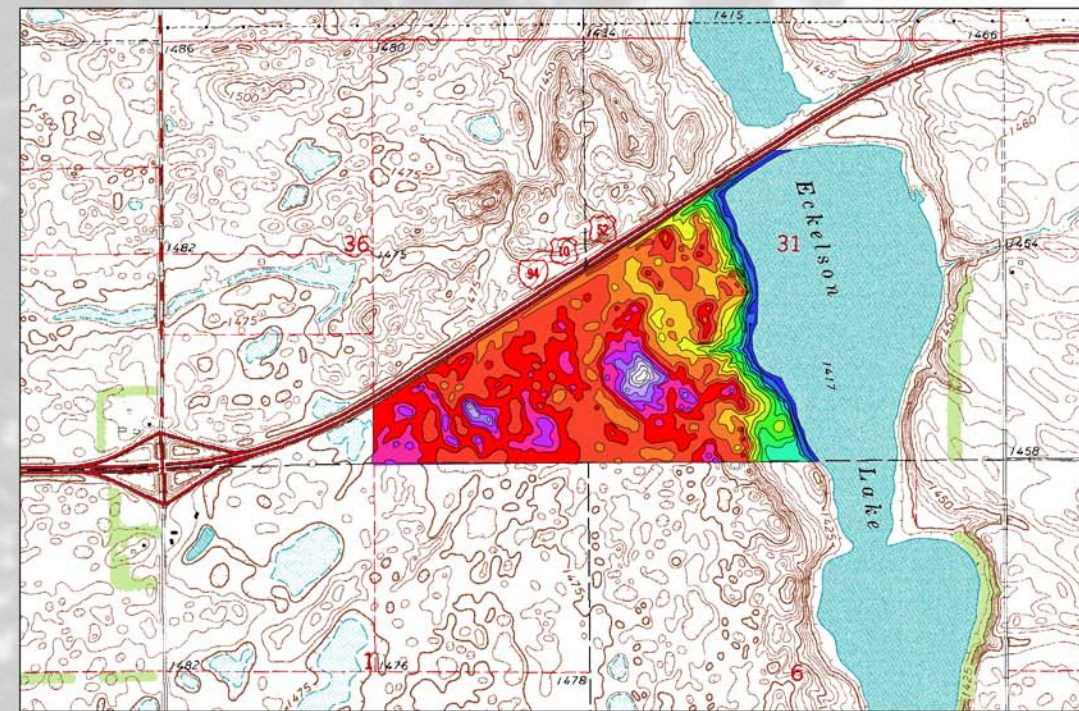
Eckelson Lakes Golf Club

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Site Inventory and Analysis

The site is characterized as rolling, undulating land that was once home to a mixed grass prairie. Currently, it's being used as grazing land for cows, which have trampled the grass down.

The topography of the site is quite variable. There are large areas of flat land, but it is predominately a rolling site. Eckelson Lake is at 1415 feet above sea level and the tallest hill on the site is 1505 feet above sea level. Water drains into the lake and some areas show evidence of erosion from drainage because there are a few valleys worn into the banks. The following topography map shows the elevation changes. Each color represents 5 feet of elevation change.



Each color = 5 feet

Soils



- 23F - Buse-Barnes loams at 15 to 35 percent slopes
- 14C - Barnes-Buse loams at 6 to 9 percent slopes
- 17B - Barnes-Svea loams at 2 to 6 percent slopes
- 14D - Barnes-Sioux loams at 1 to 6 percent slopes
- 16C - Vallers-Parnell complex at 0 percent slope

In general, these soils are deep, well-drained, moderately slowly permeable soils formed from glacial till.

Goals and Objectives

- Design a golf course that is championship caliber and stands out from other courses in the area.
- Design a more sustainable course that conserves, stores, and reuses water on the course.
- Preserve the natural habitat of the inhabiting wildlife.
- Create an affordable golfing experience for the average consumer.
- Create a resort-like atmosphere, while making the course easier to maintain for the employees.
- Use land that is currently used for grazing, and convert it into a course that will leave much of the existing native grasses.



Prairie Haven Campground Office

Located two miles west of the site. It that can accommodate 20 motor homes and 80 tents.

Opportunities & Constraints

Opportunities

- Located next to Eckelson Lakes
- Lake views
- Located next to Interstate-94 creating high visibility
- Adequate amount of space
- Rolling topography
- Existing native grasses
- A few miles away from the cities of Sanborn and Eckelson
- ½ mile from Prairie Haven Campground
- A lot of wildlife such as birds

Constraints

- Located next to Interstate-94 and vehicle noise
- Somewhat rural location
- Currently no roads leading directly to site, other than a worn path

View turning onto 37th St. SE From 101st Ave. SE



Worn path into site boundary

Site Pictures



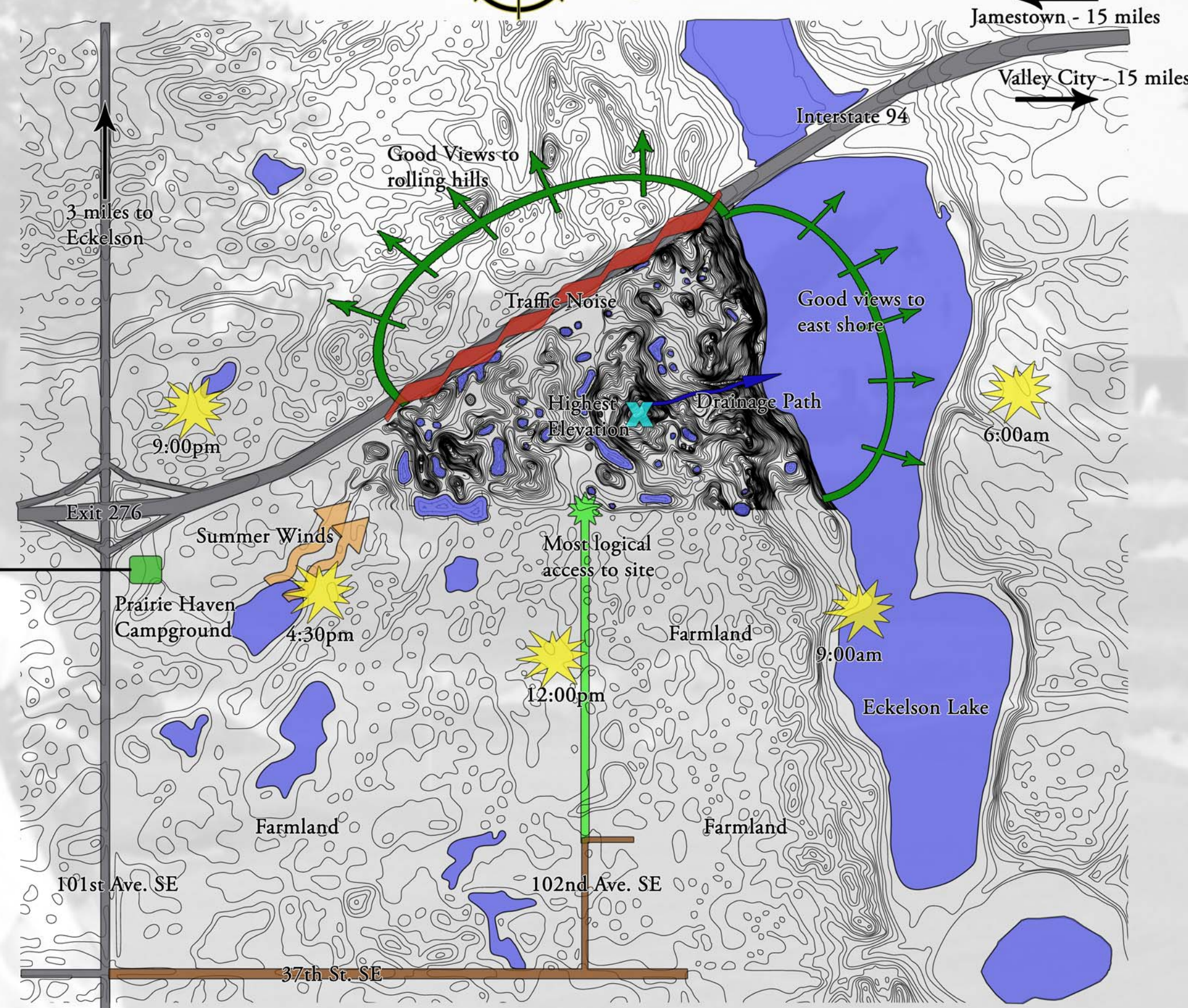
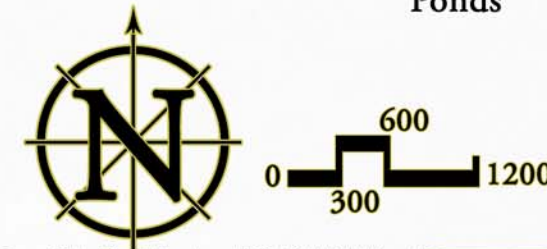
View from Interstate 94 going west



Ponds

Views from High Point and at High Point

West Side of Eckelson Lake



Looking southeast on western edge of site



Looking south



View to east shore



Looking north along west shore



View from south of the site on the lake



View from south of the site on the lake

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Design Influences / Experiences

As an avid golfer of 13 years, I have come across and played many courses across the United States. Fortunately, most of the courses I've played outside of my hometown of Jamestown, North Dakota, have been documented by photographs. I've seen many different designs and have found what types of courses I like to play. As an avid golfer I believe golf courses should be designed by golfers. The following photographs illustrate the kinds of characteristics I would like to see on my own course design. They demonstrate elevated tees, fairways, and greens, undulating fairways and greens, blind shots, and dramatic views.



Great View - Whistling Straits - Haven, Wisconsin



Great View/Elevated Fairway - Whistling Straits - Haven, Wisconsin



Great View - Big Sky Golf Club - Big Sky, Montana



Elevated Green - Trapper's Turn - Wisconsin Dells, Wisconsin



Great View - The Links of North Dakota - Ray, North Dakota



Elevated Fairway Shot - Hawktree - Bismarck, North Dakota



Great View - Big Sky Golf Club - Big Sky, Montana



Elevated Tee Box - Hawktree - Bismarck, North Dakota



Extremely High Elevated Fairway/Green - Hudson Golf Club - Hudson, Wisconsin



Rolling/Slanting Fairway - Trapper's Turn - Wisconsin Dells, Wisconsin



Elevated Green - Hawktree - Bismarck, North Dakota



Extremely High Elevated Tee - St. Croix National - Somerset, Wisconsin



Extremely High Elevated Tee - St. Croix National - Somerset, Wisconsin



Extremely High Elevated Tee - Hawktree - Bismarck, North Dakota



Extremely High Elevated Fairway - Blackwolf Run - Kohler, Wisconsin

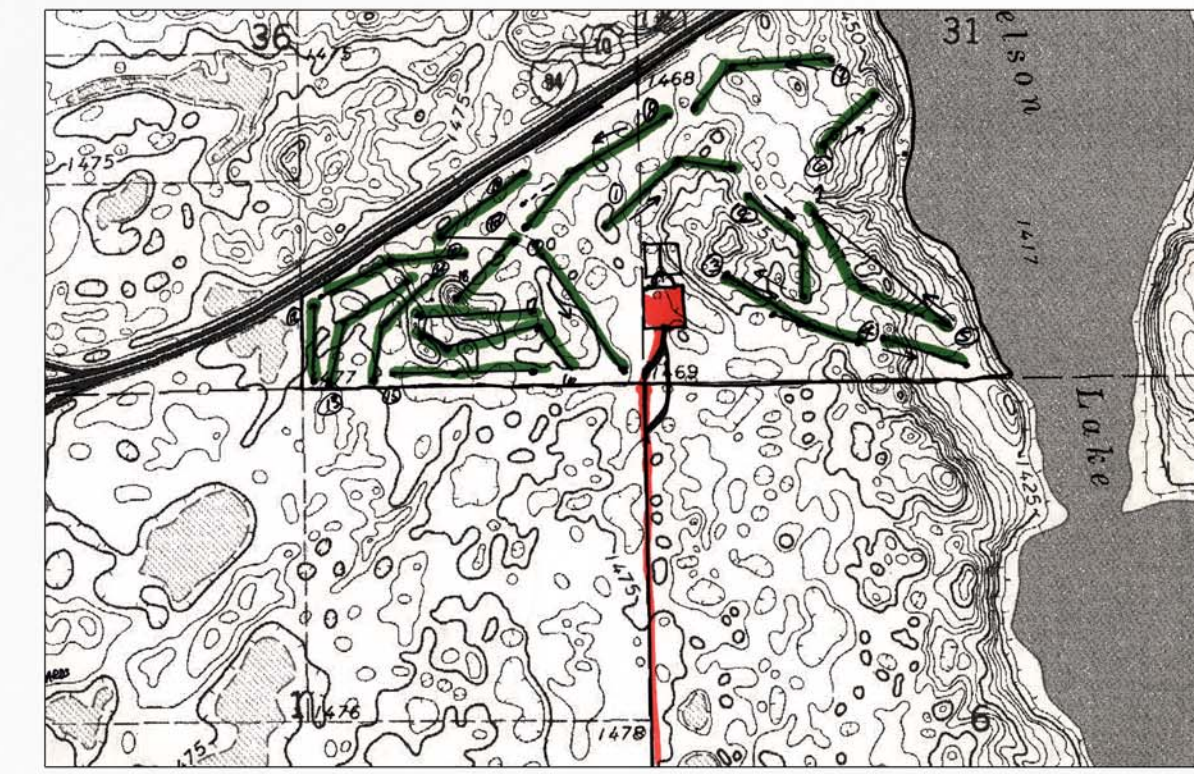


Elevated Fairway - St. Croix - Somerset, Wisconsin



Rolling Fairway - Blackwolf Run - Kohler, Wisconsin

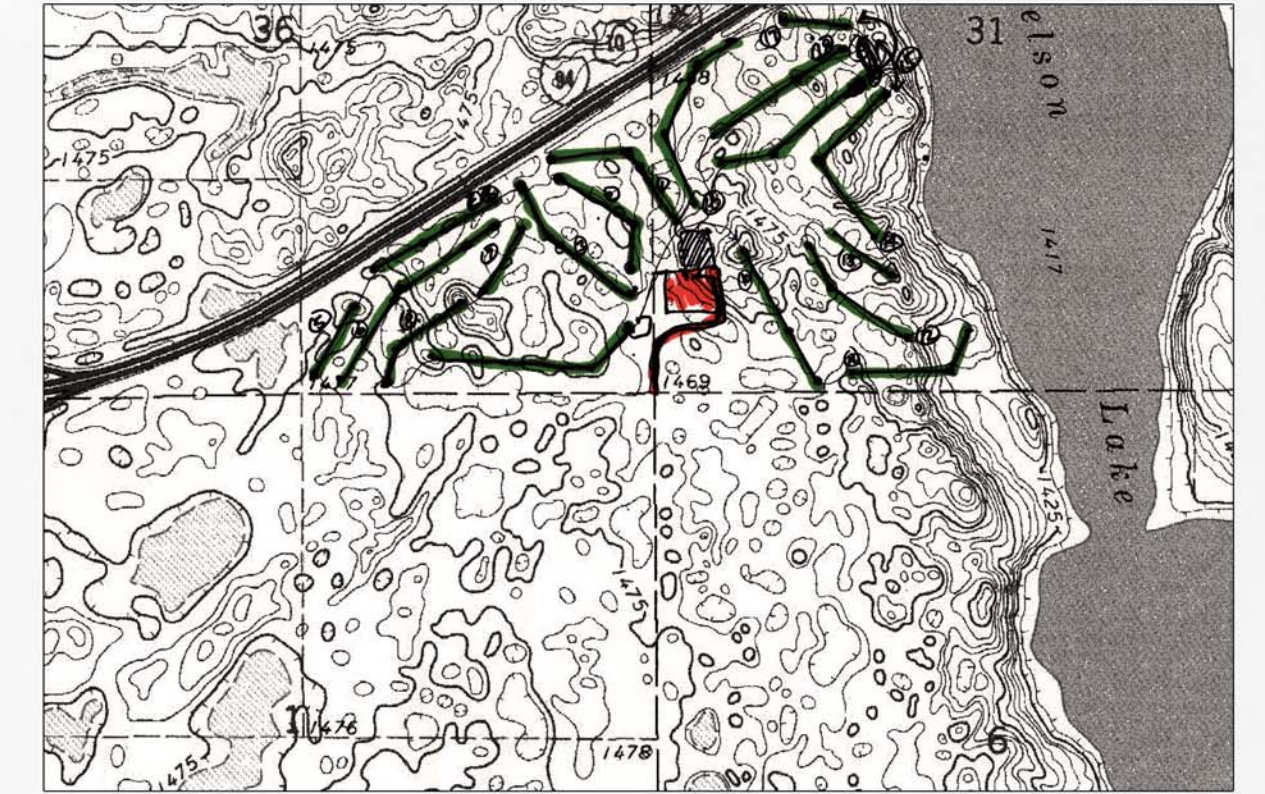
Design Concept / Development



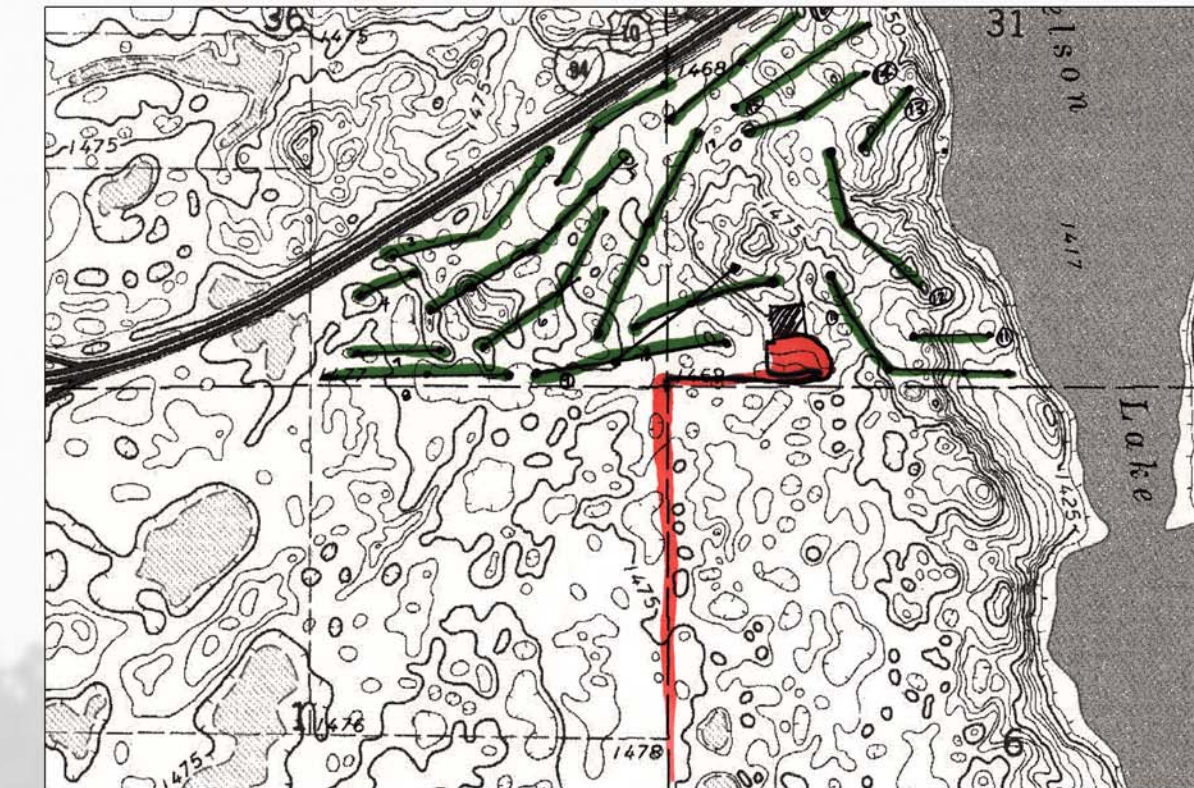
Initial hole layout thoughts with clubhouse on high ground over looking a large pond on the site.

My first instincts upon entering the site boundary was to find an ideal location for the clubhouse while still leaving the best views for the course itself. From my experiences, the clubhouse usually is in the middle of the course so the first nine holes is on one side and the second nine on the other. I chose to follow this tradition and to find a centrally located clubhouse where a relatively flat area was close by for a driving range.

Next, I wanted to get the holes along the lake established because I felt the lake views were the showcase of the site.

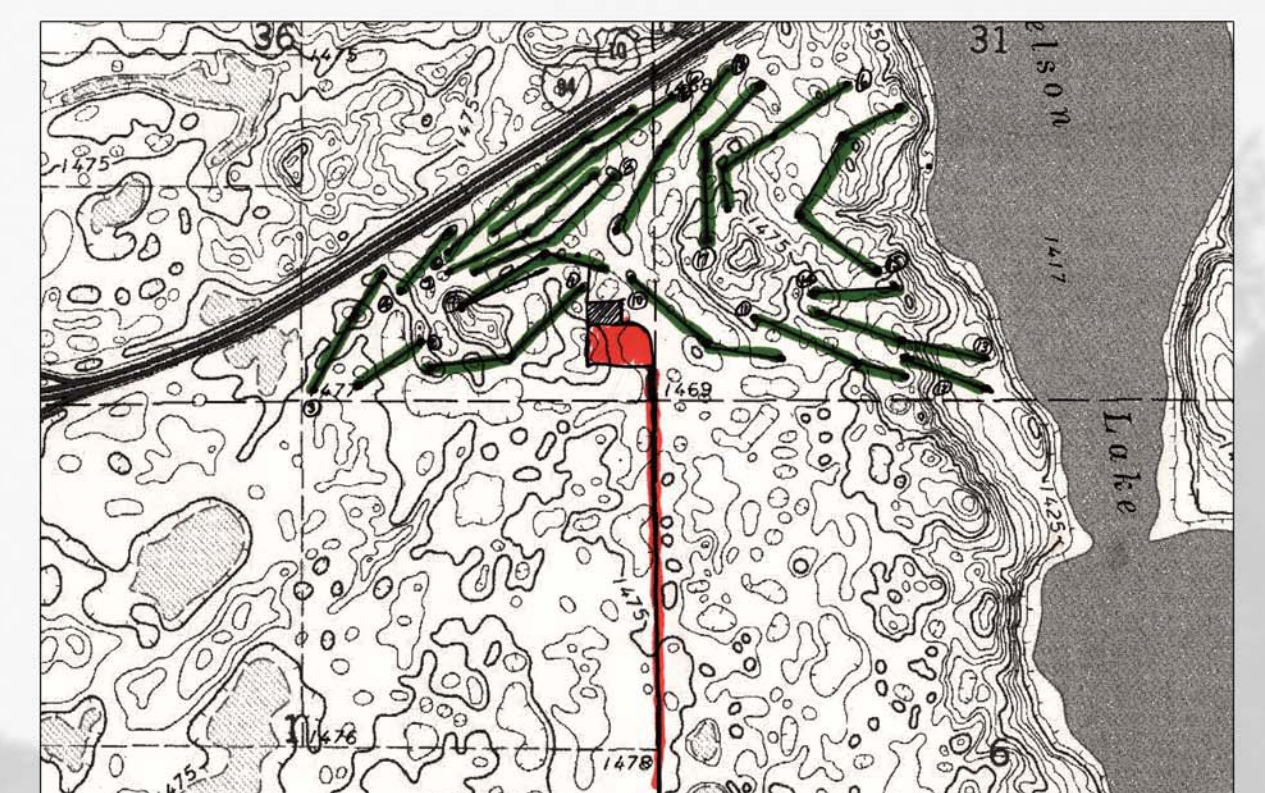


Second thoughts on hole placement with a lot of doglegs still.

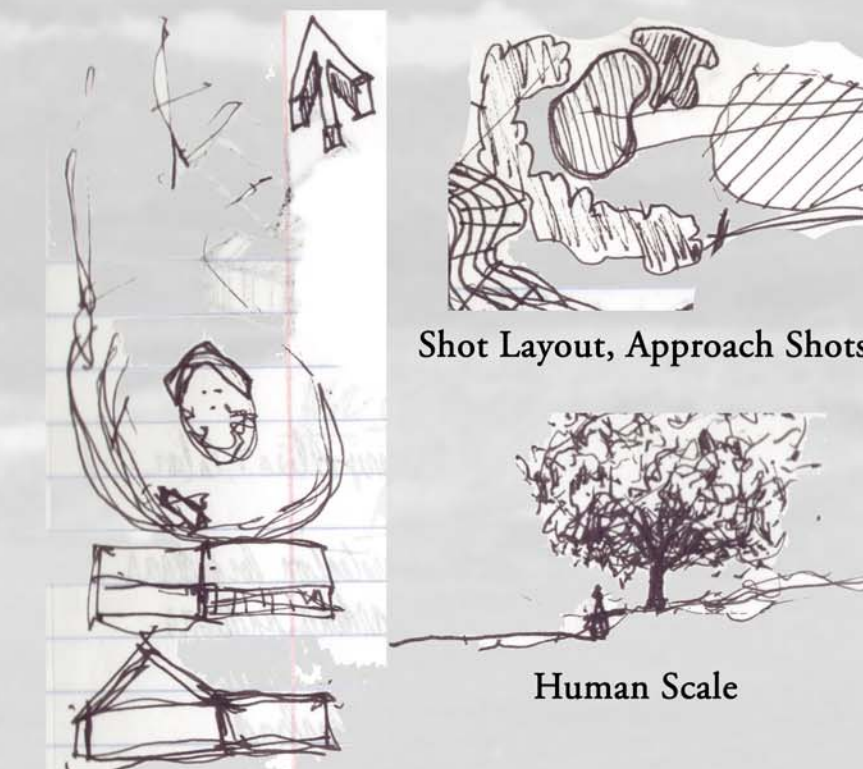


Third plan development changed the location of the clubhouse, which in turn changed the course layout. The more linear design shown here gave me inspiration to take a new look at the site.

I ran into a little trouble trying to start with the lake views first because of the doglegs I had envisioned previously caused a lot of land area to be consumed, and I was not able to fit the entire 18 holes. Slowly, I began to moderate the extent to which the holes curved and started developing more linear holes. I felt that the undulations in the land would still make a very exciting hole even if the hole was a straight shot due to the prevailing winds in the summer. I chose to change my original hole placement ideas but I kept views to the lake in place.



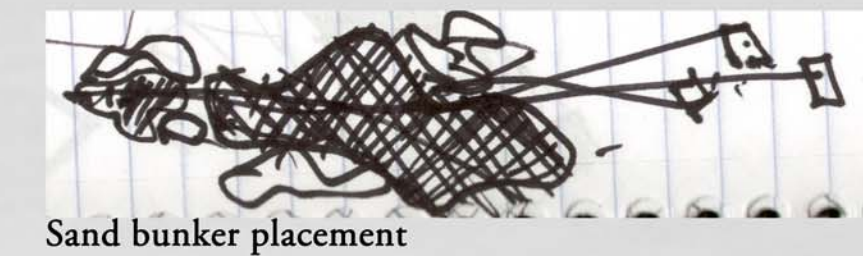
Fourth plan development changed the location of the clubhouse back to the original thought I had. The course now took on a more linear look, but didn't suffer in terms of playability or aesthetic beauty.



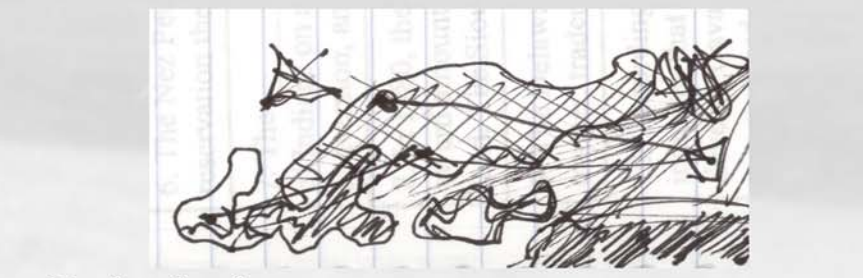
Shot Layout, Approach Shots

Human Scale

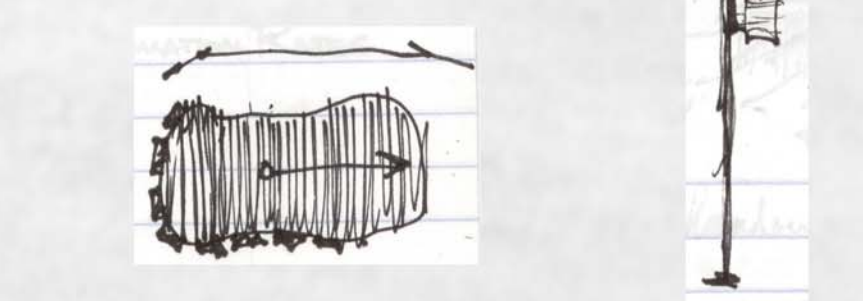
Clubhouse drop off area concept



Sand bunker placement



Dogleg development



Tee to Green Development



Beginning to finalize master plan by measuring the length of the holes and the water capacity of the ponds. Parking lot and clubhouse square footage measured.

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Eckelson Lakes Golf Club Eckelson, North Dakota

Hole	1	2	3	4	5	6	7	8	9	Out
Blue	410	240	380	180	590	590	150	445	460	3445
Red	360	200	350	170	500	550	425	410	405	3370
Yellow	310	150	310	130	430	475	375	340	320	2840
Par	4	3	4	3	5	5	4	4	4	36

Date _____ Scorer _____

The Rules of The United States Golf Association Govern Play.
-Distances are measured to front of green.
-Out of Bounds defined by boundary fence.

Designed By Chris Harris

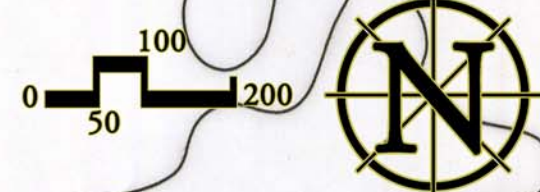
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Eckelson, ND 58413
(701) 555-5555

	10	11	12	13	14	15	16	17	18	In	Tot
Blue	500	205	440	470	240	580	430	440	410	3715	7160
Red	480	180	400	430	200	540	405	400	370	3405	6775
Yellow	425	170	340	360	150	430	340	310	290	2815	5655
Par	5	3	4	4	3	5	4	4	4	36	72

Attest _____

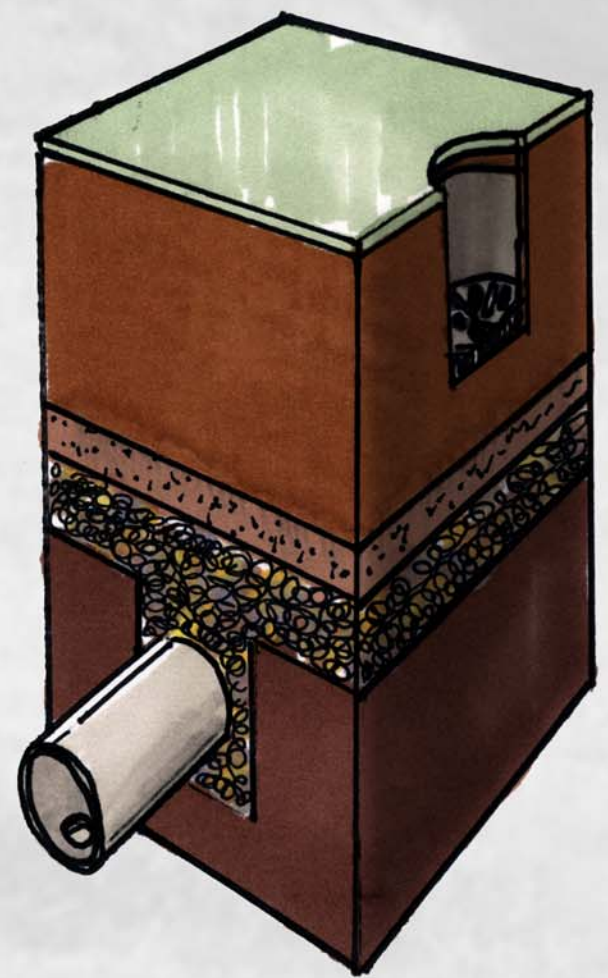
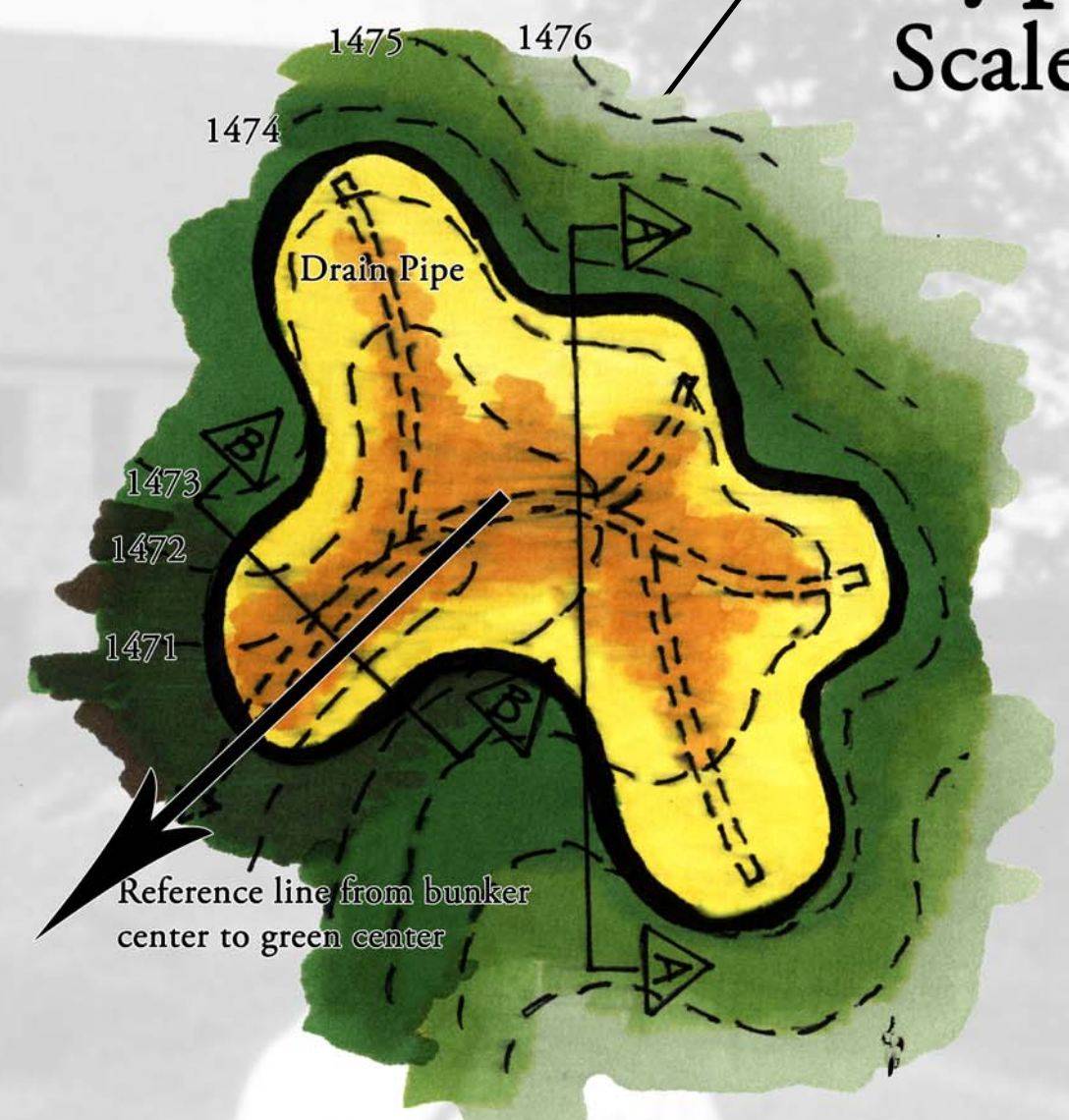
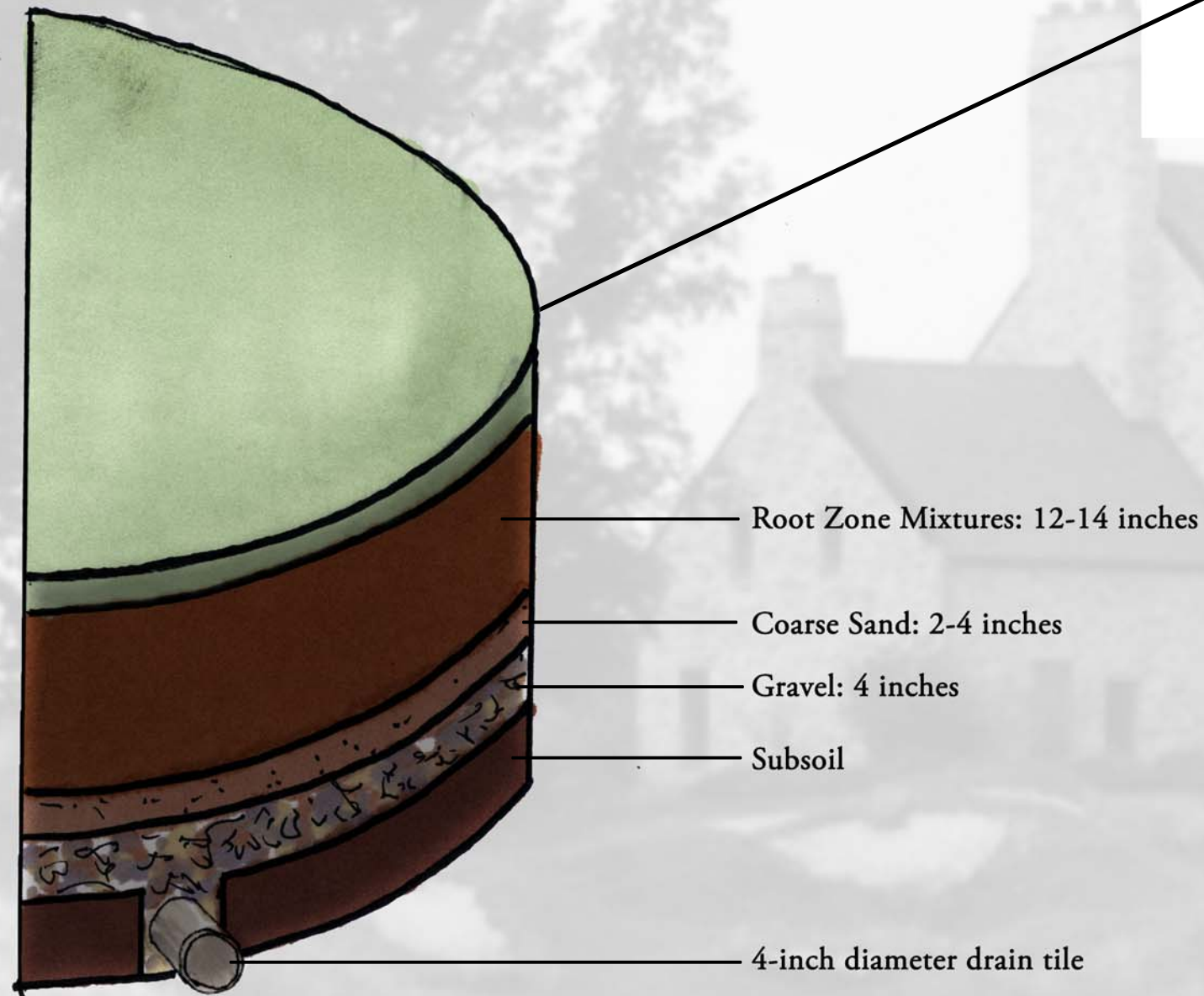
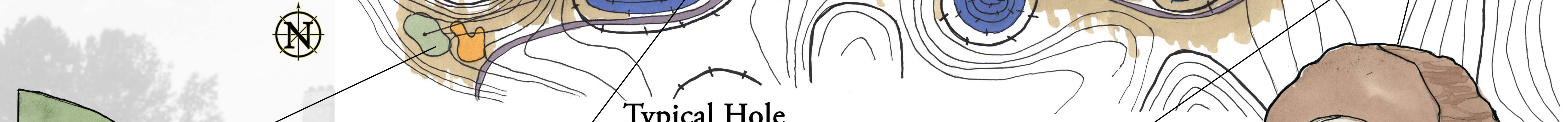


Site Plan
Scale 1" = 200'

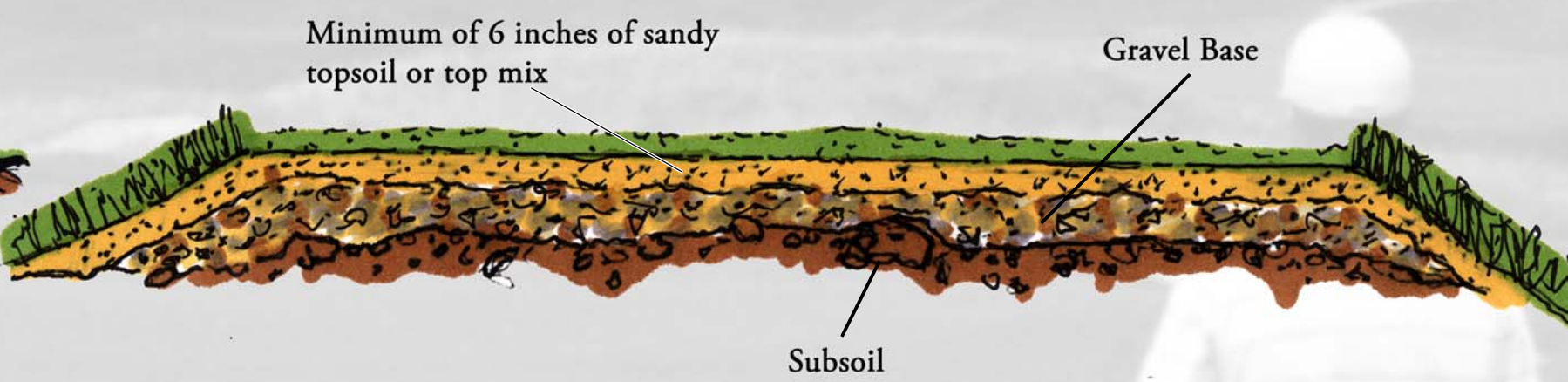


Typical Hole Details

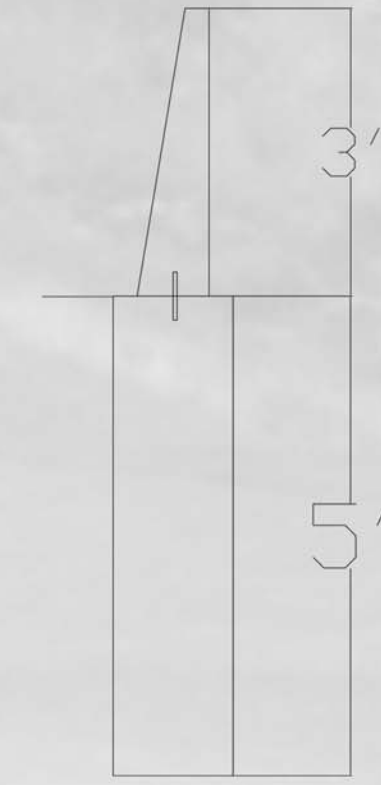
Scale Varies - See Details



The type of grass the greens will be planted with is Creeping Bentgrass (*Agrostis palustris*).
It is a cool season grass that is most commonly used on golf courses in North Dakota.



The tees will have a Kentucky Bluegrass and Perennial Ryegrass mixture. These two grasses are drought tolerant and able to handle a lot of foot traffic.



Stone Sign with sandblasted imprint of yardage and hole map.
Waterproof sealant at base.

Typical USGA Green Detail
No Scale

Typical Bunker Detail
No Scale

Typical Tee Detail
No Scale

Hole Sign Detail
1/4" = 1'

Eckelson Lakes Golf Club

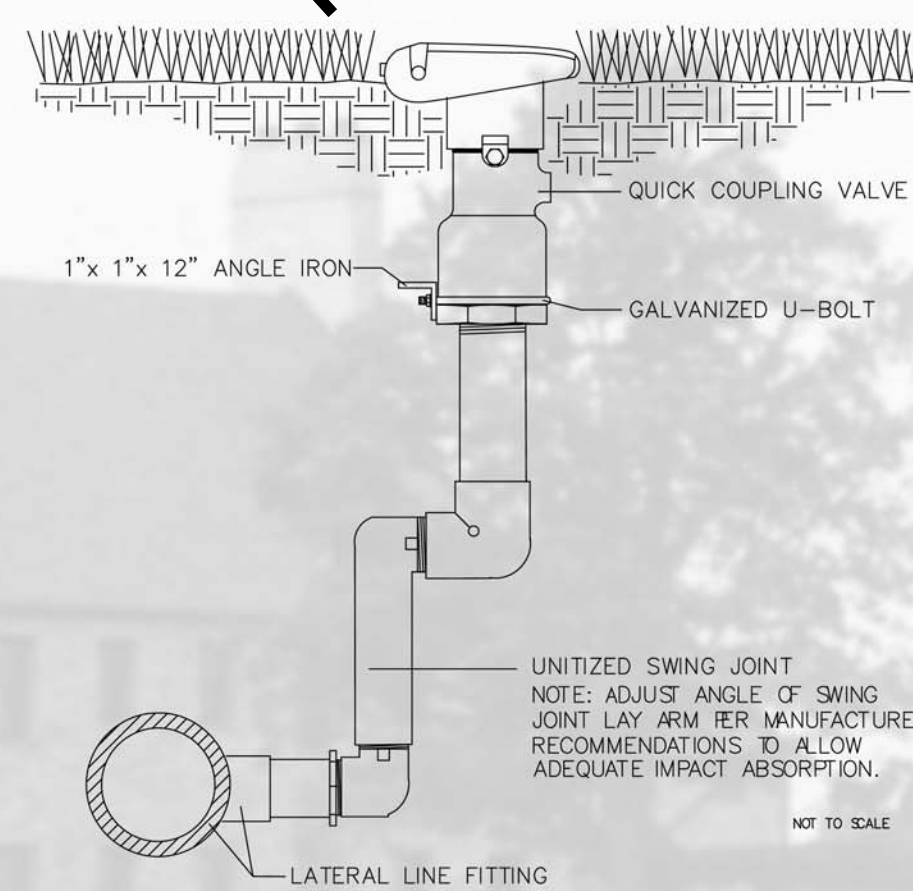
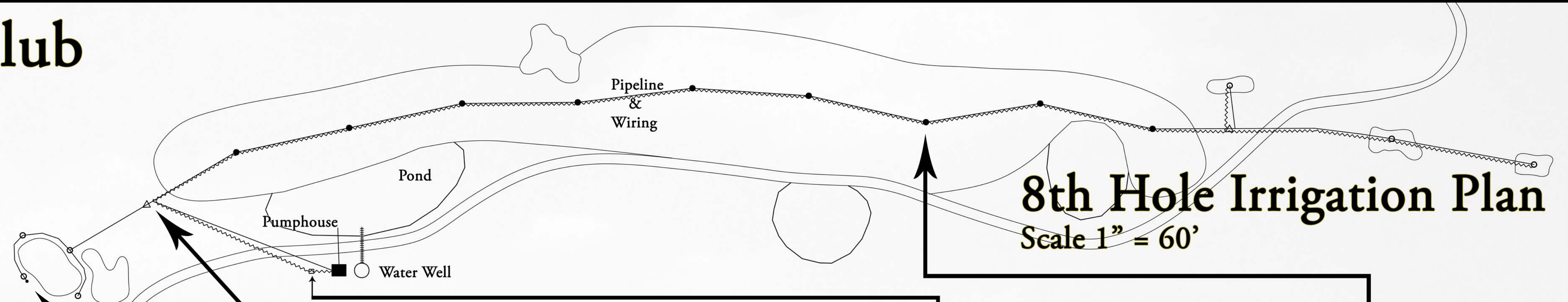
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Irrigation From Ponds

Irrigation on golf courses is complex. Irrigation designers must factor in the water supply (typically municipal supply), soil type, climate, topography, evapotranspiration, pressure, velocity, and pressure loss; each have their own formulas to calculate. Once they calculate this information, they then must select the appropriate equipment such as pressure systems, pipes (PVC - polyvinyl chloride or PE - polyethylene), valves, sprinklers, controllers, to computer systems.

The irrigation system at Eckelson Lakes is slightly different from other golf courses. In an attempt to cut down on the cost and use of water from a municipal water supply, water wells are drilled in close proximity to the many ponds to pump in water. It's possible to pump water out of the lake, but it would have to be pumped up a substantial elevation at an angle to get to the ponds, requiring a quite large pump and a more complicated system of piping. The wells on this course will be drilled down into the water table, where then a pump will bring the water toward the surface and emptying into a pond. Also next to the pond and more than likely housed with the well, will be a pumphouse that brings the water into the irrigation system. A controller will turn on the pump and the sprinklers and water will be forced out into the water table, where then a pump will bring the water toward the surface and emptying into a pond. Also next to the pond and more than likely housed with the well, will be a pumphouse that brings the water into the irrigation system. A controller will turn on the pump and the sprinklers and water will be forced out into the water table, where then a pump will bring the water toward the surface and emptying into a pond. Also next to the pond and more than likely housed with the well, will be a pumphouse that brings the water into the irrigation system. A controller will turn on the pump and the sprinklers and water will be forced out into the water table, where then a pump will bring the water toward the surface and emptying into a pond.

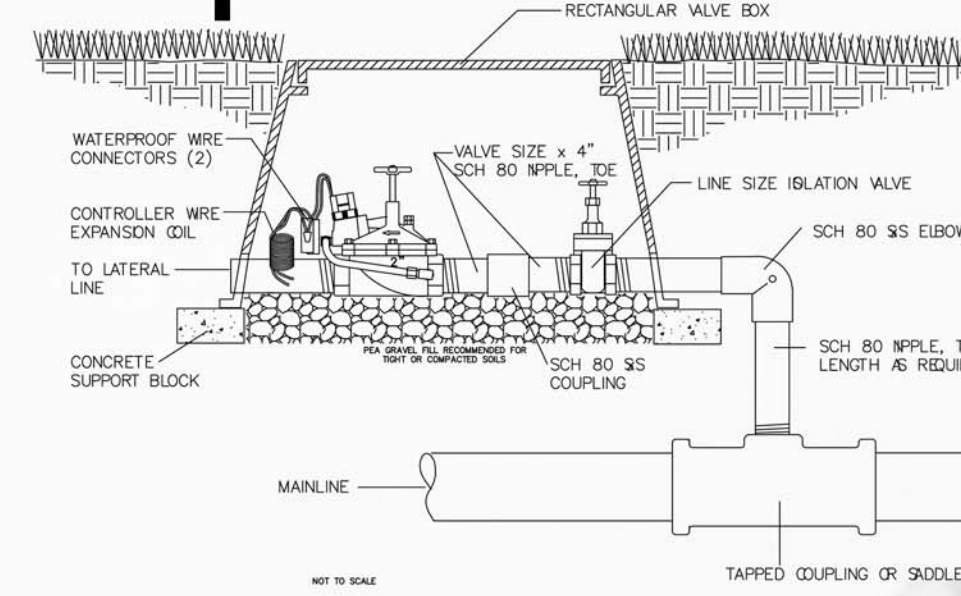
The ponds at Eckelson Lakes Golf Club contain a minimum of 4,500,000 gallons, assuming each pond is 3 feet deep. More than likely they are roughly 2 times deeper because ponds with a 3 foot depth are more likely to evaporate quickly and only be "large puddles." So this gives an estimate of 9,000,000 gallons contained in the ponds. Village Green Golf Course in Moorhead, Minnesota, uses approximately 400,000 gallons of water to irrigate per day. The average watering season on golf courses in North Dakota is roughly 90 days, so that brings the yearly irrigation total to 36,000,000 gallons per golfing year. That means roughly 27,000,000 gallons are needed to adequately water the course, and that's where the wells come into play. In addition, the fact that Eckelson Lakes Golf Club has native grasses for rough instead of being planted with another type of grass, water will be saved. The details to the right show the equipment used and where they are generally placed.



Quick Coupling Valve Detail - No Scale

Quick Coupling Valves used to be used to manually operate the irrigation system. Obviously this is a lot of labor compared to the automatic systems of today. Today, quick coupling valves are primarily around the greens to irrigate during dry times or during hot days to syringe the greens.

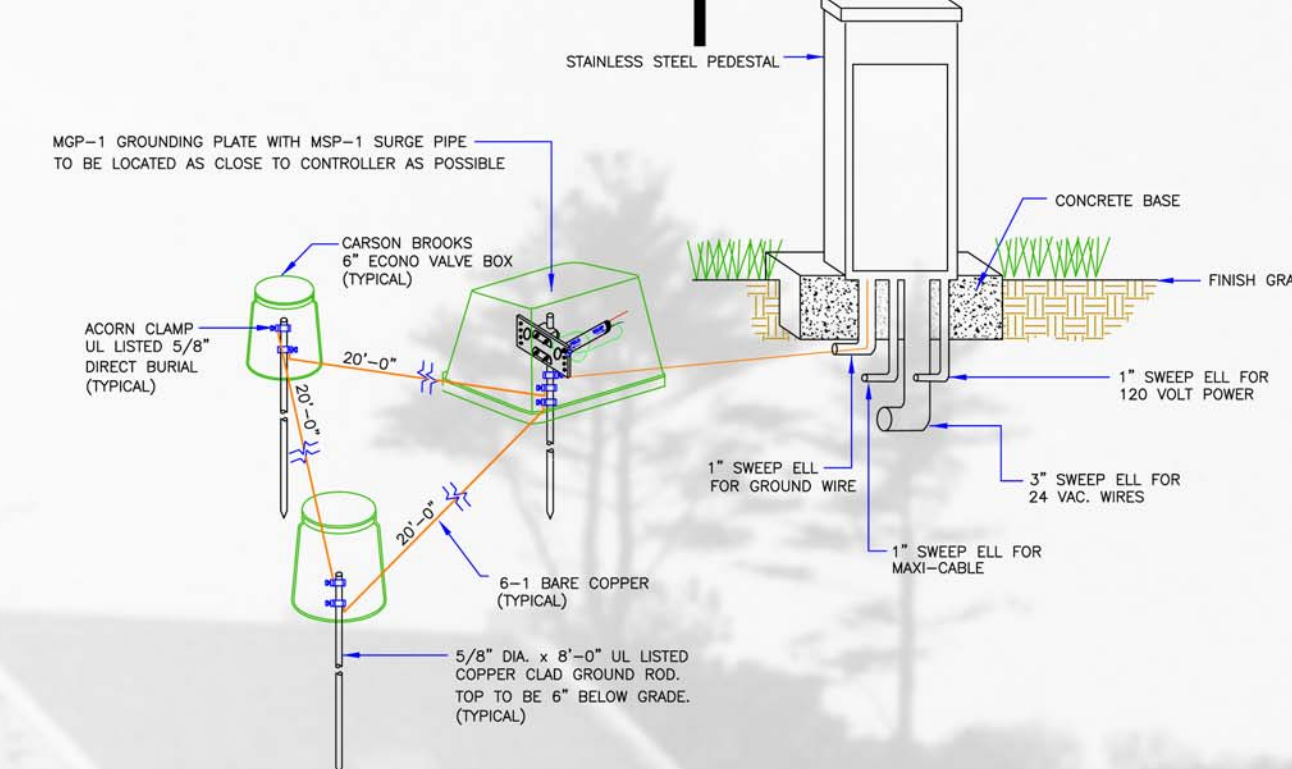
*Detail found at Rainbird's Website:
<http://www.rainbird.com/golfspecifier/cad.htm>



Valve Detail - No Scale

Valves are used to control the flow of water in the irrigation system. They can be operated manually or by remote control. The valve in this case opens to allow water through the pipe to the green.

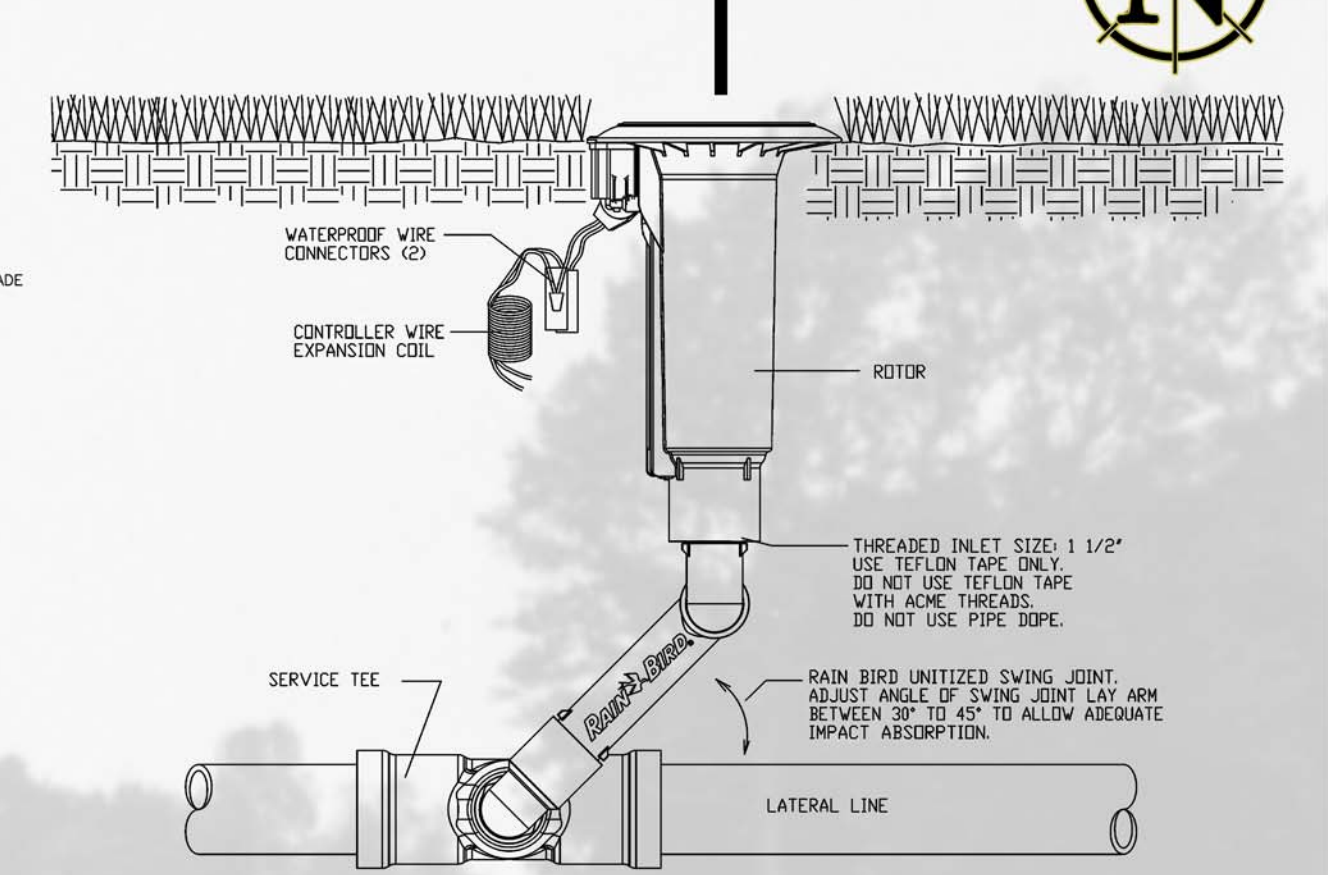
*Detail found at Rainbird's Website:
<http://www.rainbird.com/golfspecifier/cad.htm>



Typical Grounding and Electrical Sweeps Detail Stainless Steel Satellite Controller - No Scale

The Controller is exactly what it sounds like. It is in charge of starting and stopping the irrigation system. Many controllers today are linked to an on-site weather station that gets weather data and determines whether or not to start the irrigation system, saving water and money.

*Detail found at Rainbird's Website:
<http://www.rainbird.com/golfspecifier/cad.htm>

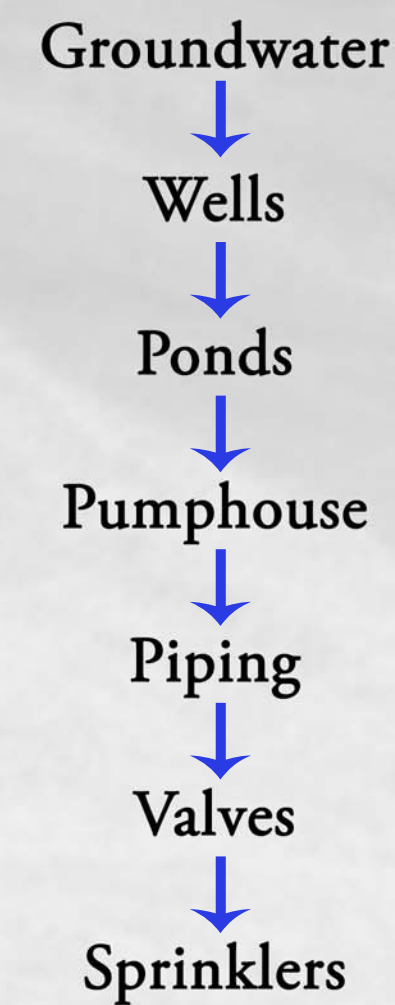


Electric Valve-In-Head Sprinkler - No Scale

Electric valve-in-head (EVIH) sprinklers are the most common type for golf course use. Each head has a solenoid which is activated by electric wiring going back to the controller. There are two wires on each solenoid, a signal (control) wire and a common ground. These sprinklers are able to spray water in a hundred foot radius.

*Detail found at Rainbird's Website:
<http://www.rainbird.com/golfspecifier/cad.htm>

Eckelson Lakes Irrigation Concept

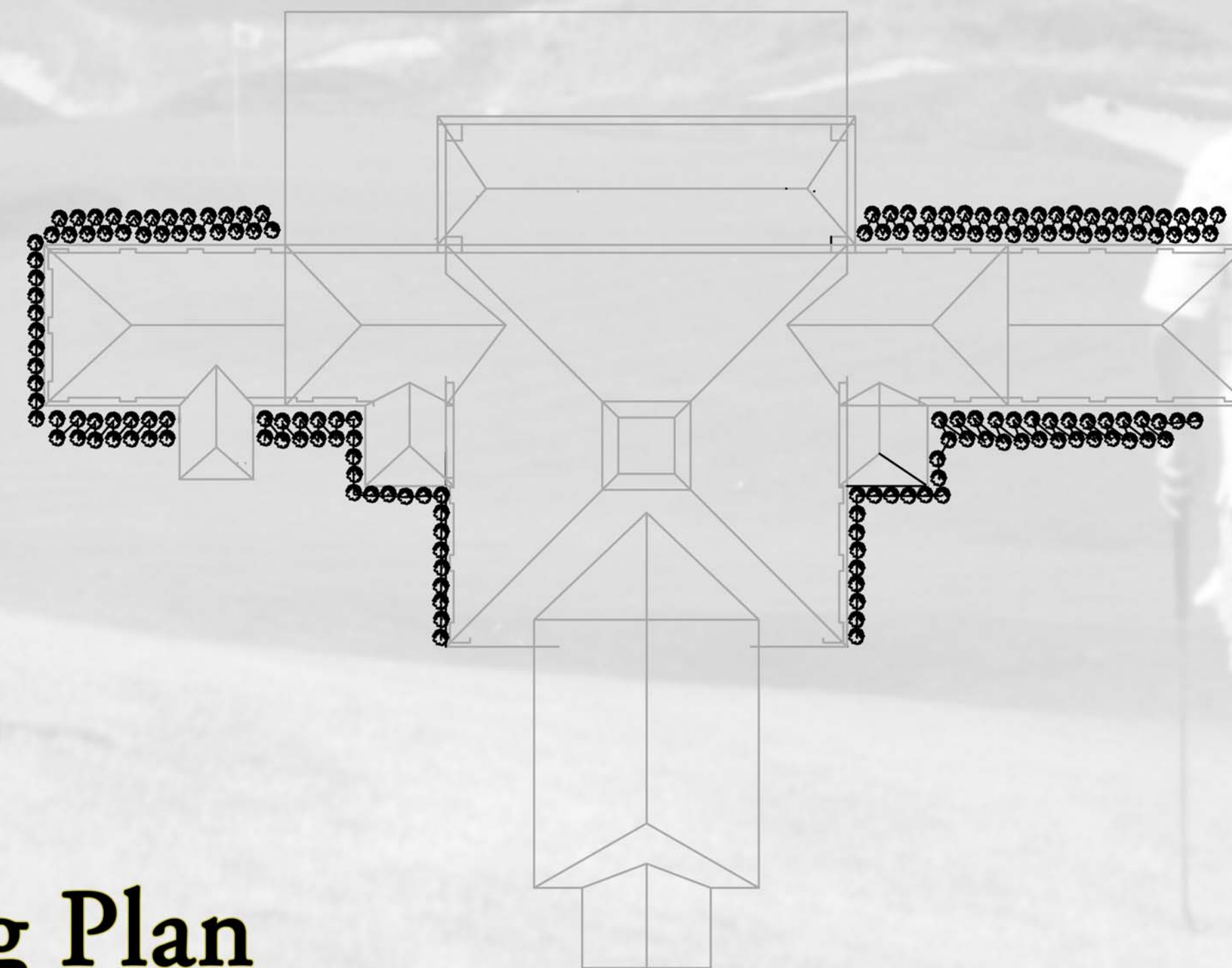


Clubhouse Vegetation

The vegetation planted around the clubhouse is meant to be colorful while not taking too much attention away from the beauty of the native prairie grass. Stella d'oro daylilies were chosen for their bright yellow petals and for the fact that before they bloom, they resemble a clump of grass. Red Magic daylilies were chosen for the same reason, but their petal color is red. The daylilies will grow well on the west and south sides of the clubhouse. Patriot and Montana Hostas go on the north side of the clubhouse because they require shady conditions. They were chosen because of their variegated leaves look like large blades of grass. In both cases, the species alternate off each other.

Planting Plan

Scale 1/16" = 1'



Plant Name	Scientific Name	Quantity
Red Magic Daylily	Hemerocallis 'Red Magic'	41
Stella D'Oro Daylily	Hemerocallis 'Stella D'Oro'	42
Patriot Hosta	Hosta 'Patriot'	33
Montana Hosta	Hosta 'Montana'	32