

Eckelson Lakes Golf Club



Helping Golf and the Environment

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Fifth Year Thesis

North Dakota State University

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ECKELSON LAKES GOLF CLUB

HELPING GOLF AND THE ENVIRONMENT

A Design Thesis Submitted to the
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By

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Abstract

Over the second half of the 20th century and early into the 21st century, the golf course industry boomed and thousands of courses were 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.

My project uses land that is used for cattle grazing whose terrain may be too rough for farming and 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. Drains on the course are tunneled to other areas to be pumped into the sprinkler system as well. This creates a hybrid between nature and man; nature providing rain and man manipulating where the water is finally sprayed.

After all the research is done for this project, hopefully it will bring new light and ideas on how to minimize use of water keep the art of golf course architecture practical.

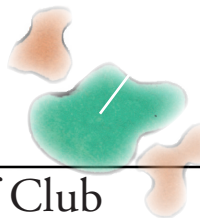


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Project Introduction

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.



Figure 1



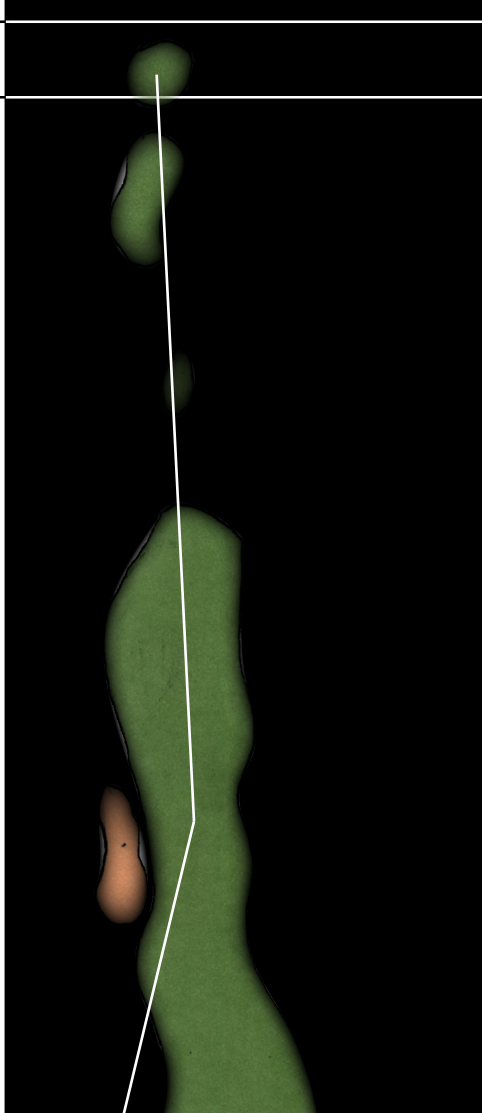
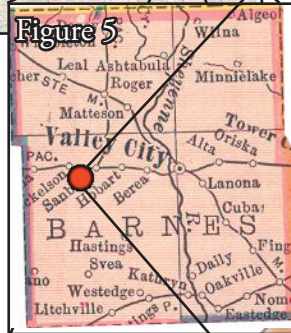
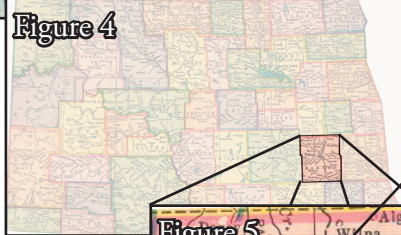
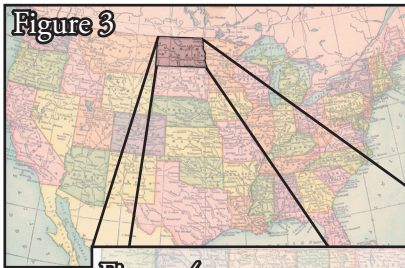
Figure 2

Site Orientation

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 18 from Jamestown (population - 15,527), and there are many more just over an hour away.

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



Site History

The owner rents out the land to a local rancher; and is currently being used as grazing land for cows.

Prior to being grazing land, this area was tallgrass prairie consisting of:

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



Figure 7

Goals & Objectives

- Design a golf course that is championship caliber and stands out from other courses in the area.
- Create a golf course that has Audubon International's goals in mind, such as taking positive environmental steps through a set of educational programs to create a more sustainable design.
- 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 converting it into a course that will leave much of the existing native grasses.



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.



Design Emphasis

Water management is the main focus for this project. The existing native prairie grasses will be adaptive reuse 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.

Golf Course Architecture

- A quality 18-hole course layout can be created off of the undulating topography of the site.
The course itself will manipulate the land as little as possible to minimize the areas to be seeded with grass for the tees, fairways, and greens.
However, some land will have to be 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 will be located in a convenient place for the crew to be able to maintain the course in a timely manner.



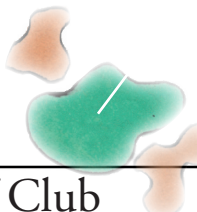
Design Emphasis

Site Drainage, Detention Ponds, and Water Reuse

- 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.

Clubhouse and Transportation

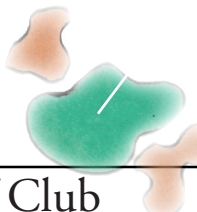
- The clubhouse is a pivotal part of a golf course. It provides the service of golf, convenience, and usually food and beverage needs.
- Having a good route to the clubhouse from off-site is very important because first impressions go a long way. Good circulation from the course to the clubhouse is also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



Design Methodology

Case studies will be a huge part of my research process as they will help show me how my irrigation system will be assembled.

In addition, a few books I have purchased on golf course architecture will help me get the details and basics of turfgrass management as well as tee box, fairway, and green design.



History of Golf Course Architecture

Scotland is credited with the modern day game of golf. Golf evolved on the links of Scotland on undulating land sparsely covered with grazed fescues, broom, and other links plants found along the coasts of the British Isles. Over 500 years later the game is stronger and more popular than ever.

Two technological advances occurred in the mid-nineteenth century that enabled the spread of golf from Scotland. First was the gutta percha ball which flew further and was more durable than previous ball designs. Second was the British railway system which allowed people from London to reach Scotland in less than a day to watch professional golf matches.

The first golf course designers were professional golfers who staked out exciting courses. Three of such professionals were Allan Robertson, who helped design a portion of St. Andrews, known as the birth place of golf, Tom Morris, who also contributed to designing St. Andrews, was known as "Old Tom" for his long, white beard, and Tom Dunn who designed numerous layouts inland instead of on the coast.

Golf eventually came to North America in 1872 when courses were constructed in Canada. Roughly 10 years later, the United States started building golf courses.

Charles MacDonal was the first person to use the term "golf architect" and became known as the father of American golf course architecture. By the 1890's, he started building courses in Chicago.



Figure 8
Old Tom Morris



Figure 9
Charles MacDonal

History of Golf Course Architecture

In 1913, the popularity of golf skyrocketed when Frances Ouimet, an American amateur, beat British professional, Harry Vardon, at the U.S. Open. Soon after, golf became an American game and expanded a lot in the 1920's. However, the depression in the '30's slowed growth as many courses were closed.

The next boom in golf architecture was after the Korean War in the 1950's. This era is known as the Robert Trent Jones era. Robert Trent Jones designed over 400 courses and influenced golf like no other architect before him.

The next era was in the 1970's and is known as the age of Pete Dye. Dye's style called for moving immense amounts of earth to create giant mounds, pot bunkers, and undulating greens to make a Scottish links style course.

During the 1990's, the natural style of leaving the terrain as it existed returned. Golf course architects started to focus on environmental issues as well as human issues such as handicap accessibility.

Golf is a game of tradition. Over 500 years of the sport and the same basics apply such as the tee boxes, fairways, greens, bunkers, and water hazards. The size, shape, how they have been built, and maintenance changed, but amazingly the new courses haven't deviated completely from their predecessors.



Figure 10
Frances Ouimet

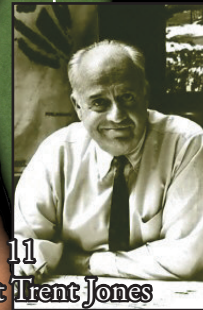


Figure 11
Robert Trent Jones



Figure 12
Pete Dye

Case Studies

Prairie Dunes Country Club Hutchinson, Kansas

Prairie Dunes Country Club is a private 18-hole golf course built in the 1930's on nearly 200 acres of sand dunes. Located in the Great Plains ecological region, the course is laced with tall grass prairie, the dominant plant community of the region. Rangeland, housing development, and remnant prairie border the course; thus, the golf course serves as an integral part of the larger green space corridor in the area.

Wildlife & Habitat Management

- Maintain over 75% of the property as natural habitat: 100 acres of undisturbed prairie encircle the course and 75 acres of prairie habitat are maintained throughout golf play areas
- Developed a comprehensive prescribed burn plan to maintain the tall-grass prairie
- Created a brush pile from 100 invasive trees that were removed from the course
- Serve as a research site for Tabor College researchers comparing bird species distribution on naturalized golf courses and parkland

Resource Conservation

- Minimize water use through an on-site weather station and weather satellite that is connected to the club's irrigation system
- Pump condensation water from air conditioners into an irrigation lake, providing up to 187 gpm
- Use spot pesticide treatment to reduce the need for widespread spraying.
- Built a new self-contained chemical storage facility in 1997 to reduce potential pollution



Figure 13

Case Studies

Gainesville Golf & Country Club Gainesville, Florida

Gainesville Golf and Country Club is a private country club and residential community built in the early 1960's on 200 acres of pine-oak woodland and prairie of the Southeast Coastal Plain ecological region. The course retains 80- acres of woods and 10-acres of prairie which serve as its primary wildlife habitat. Though the property adjoins several residential areas, it also is adjacent to the Paynes Prairie State Preserve, 20,000 acres of protected wilderness that provides significant open space and wildlife habitat in the area.

Wildlife & Habitat Management

- Created corridors of native pines, oaks, and prairie areas throughout the course
- Added aquatic plants to enhance pond habitat
- Removed exotic , invasive vegetation to promote regionally native habitat
- Maintain 15 nest boxes for cavity-nesting birds
- Maintain a detailed wildlife inventory of over 75 species

Resource Conservation

- Reduced disease occurrence and improved playing conditions by decreasing irrigation
- Created no-spray zones around all ponds to prevent nutrient loading
- Established water quality monitoring program for surface waters on the course
- Maintain clean, organized, environmentally-responsible maintenance facility



Figure 14

Case Studies

TPC at River Highlands Cromwell, Connecticut

The Tournament Player's Club at River Highlands is a private course bordered by the Connecticut River and Appalachian Oak Forest. An additional twenty acres of forest, along with wetlands and ponds on the property, make the course part of a significant open space riparian corridor. The PGA Tours' Canon Great Hartford Open attracts over 300,000 spectators annually, giving TPC at River Highlands an excellent opportunity for environmental education.

Wildlife & Habitat Management

- Invested \$12,000 in trees and shrubs to provide food and shelter for wildlife
- Enhanced pond habitat by creating shoreline buffers of aquatic vegetation

Resource Conservation

- Expanded the use of natural organic fertilizers after favorable results were recorded
- Integrated commercially-produced compost into landscape beds and topdressing to improve soil fertility
- Saved \$3500 in electricity costs by upgrading their irrigation system
- Worked with CT Department of Environmental Protection to construct a "model" maintenance facility
- Installed a state-of-the-art irrigation system to reduce water consumption



Case Studies

Colonial Acres Golf Course Glenmont, New York

Colonial Acres, a public nine-hole course, is situated on 35 acres nestled 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.

Wildlife & Habitat Management

- Converted two acres of previously maintained turf to naturalized “no-mow” areas
- Added berry-producing shrubs and bluebird nest boxes to increase food and cover sources for birds
- Built a 10,000 square foot naturalized area with fill from an irrigation pond project and seeded with fescue grasses
- Planted 40 native trees
- Maintain a wildlife inventory which includes 32 species of birds and 15 species of mammals

Resource Conservation

- Expanded irrigation pond by 1,000,000 gallons, which is fed by run-off and rain. This pond supplies 100% of the irrigation water for the course
- Documented through detailed budget records that ACSP recommended projects reduced labor, turf input, and equipment costs

“What was once a flat and mostly open (and boring) landscape, now has some definition. There is no doubt the local wildlife approves based on the frequent sightings of deer, wild turkey, heron, fox, ducks, geese, and many species of birds.”

-Fred Budzyna, Asst. Manager of Pro Shop, 1998



Case Studies

Carolina National Golf Club Bolivia, North Carolina

Carolina National Golf Club at Winding River Plantation in Bolivia, NC received designation as an Audubon International Certified Cooperative Sanctuary Golf Course in the fall of 1998. As part of our participation in the program, we naturalized 30 acres to create wildlife habitat, decrease maintenance, and enhance the look of the course. Built in 1997, the 1100-acre residential community and golf course is located in the scrub oak - pine forests of southeastern coastal North Carolina near Southport. The primary native vegetation includes wild blueberry, lovegrass, wiregrass, broomsedge, little bluestem, bracken and cinnamon fern, wax myrtle, various oak and pine trees (including live oaks) and spartina. Because they are so abundant we chose to highlight and continue using these species as our primary landscape feature.

Goals

- Continue to create and enhance the naturalized areas on course.
- Utilize native species, such as wiregrass, broomsedge, and big and little bluestem, in naturalized areas.

Savings are Significant

- If you reduce manicured turfgrass by 30 acres, you can save up to \$1800 (if your treatment costs are \$60/ acre) by eliminating pre-emergent herbicides. Add to this the cost of fertilizer (\$40/ acre) and mowing (\$15/ acre) etc., and you can see that over time this can result in significant savings. This does not include the cost of added wear on equipment or time lost for other maintenance duties.
- They estimate that it cost \$10,000 to implement the natural areas and calculate the savings to be about \$15,000 for 30 acres of naturalized areas.



Case Studies

Carolina National Golf Club Bolivia, North Carolina (Continued)

Recommendations to other courses that wish to implement this project

- Try to allocate natural areas during construction if possible.
- When creating native areas, make sure all turfgrass is removed. This will decrease the amount of maintenance needed.
- Try a small, out of way area first, making every effort to its success before implementing large scale projects. Show off all of the positives and let it become the club's or owner's idea to expand. Also, on older, established clubs members may not like the changes and may perceive them as unnecessary, new hazards. Use the look sparingly at first; bring it into play slowly if at all.
- Choose plants best suited for your particular location. These will thrive best once established and help you attract beneficial wildlife. We have gone through a tremendous learning curve here and have transplanted and replanted many times. In order to find the best place for each species you may need to try different plants or techniques.
- Clearly mark naturalized areas to minimize concern over lost balls. Natural areas should be marked as if they were lateral water hazards. It is really no different than having 12 to 15 holes playing along some form of water feature. We use the lateral hazard rule as that provides each golfer with more options.
- Be responsive to golfer's needs. As we determine those areas that do not fit in well to the golfers' play lines we are either reducing or eliminating them altogether. Fortunately, we have had minimal need to reduce natural areas at Carolina National.



Case Studies

Westlake Golf & Country Club Westlake, New Jersey

This article appeared in Public Works Magazine

Retention Ponds Serve Dual Life as Water Hazards
Caruso Excavating, Inc. (Howell, NJ) counted on 60-in. diameter polyethylene pipe from Advanced Drainage Systems (ADS), Inc. (Columbus, OH) to construct an efficient stormwater management system at the Westlake Golf and Country Club development, completing the \$5 million-plus job on time and within budget.

Caruso, responsible for doing the rough earthwork and putting in the drainage system, started clearing the 500-acre property in March. Lot development began in October 1999.

“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.”

The 60-in. N-12 HC(r) pipe is the latest in large diameter pipe made by ADS. It is being used in a rather unique way in this adult golf course community.

“What we’re doing here at Westlake, is creating retention ponds that will also serve as water hazards for the championship golf course,” said Chip Caruso, president of Caruso Excavating Company. “First we install a network of pipe used in collecting the stormwater runoff. These pipes range in diameters of 12 to 48 inches depending on the anticipated stormwater flow throughout the community. The collected stormwater is then directed to the retention ponds,” Caruso explained.

“What’s unique here is that 16 ponds will be joined using the 60-in. N-12 pipe with the goal of maintaining equal water levels. But the size of these lakes,” some over 3 acres, will create a significant flow of water back and forth,” Caruso said. “As a result, there are three runs of 60-in. pipe, over 600 ft for each run between some of the holes, to effectively manage the water.”



Figure 18

Case Studies

Kampen Course Purdue University Golf Course Wetlands Prove Valuable Environmental Tool

Appeared in *San Diego Earth Times*

Golfers may see it as just another water hazard, but, in fact, the constructed wetlands on Purdue University's Kampen Course prevent potential pollutants from damaging the environment. A study also has revealed that the constructed wetlands' efficacy in enhancing water quality improves as the system ages, according to Purdue researchers. Their findings could provide solutions for protection of similar areas by using urban golf courses.

The cleanup occurs when microscopic organisms (primarily bacteria), wetland plants, sediments and golf course grass trap and use much of the residue that otherwise might harm environmentally sensitive areas, the researchers said.

"This is an ongoing study of how created wetlands on a golf course can filter water from commercial and residential areas to protect the environment," said Zac Reicher, Purdue Department of Agronomy turf specialist. The five-year water monitoring project, begun in 1998, uses three wetland cells (ponds) incorporated into the renovated Pete Dye-designed golf course.

The researchers wanted to determine whether constructed wetlands on a golf course could substantially improve water quality by reducing or even eradicating chemicals such as atrazine, chloride, nitrogen nitrate, ammonia nitrogen, organic carbon, phosphorus, aluminum, iron, potassium, manganese and various solids before the water entered natural waterways. In this study, the recovering natural wetland is West Lafayette's Celery Bog bordering the Kampen Course, part of Purdue's Birck Boilermaker Golf Complex.

"We already knew that proper use of fertilizers and pesticides on golf courses does not add any chemicals to surface or ground water," Reicher said. "In fact, the grass itself actually will use or trap most of the nutrients and chemicals contained in runoff from adjacent areas."



Figure 19

Case Studies

The tracts from which runoff flows into the golf course wetland system includes not only the golf course but also two residential highways, a motel parking lot, a gas station and 200 homes.

“This system has allowed us to integrate golf aesthetics with the protection of natural wetland systems,” said Ron Turco, soil microbiologist and director of the Purdue Environmental Sciences and Engineering Institute. “Although we knew that both wetlands and golf courses can improve the quality of runoff water, studying how they work together will help us incorporate constructed wetlands into existing settings and to optimize their use.”

Design of the wetlands is important in maintaining plant life and microbes that remove chemicals from the water, Turco said. Currently, most wetlands are designed for aesthetics rather than to optimize protection of the environment. In order to understand the water flow and chemical behavior in the wetland, the researchers use two types of dyes that are harmless to plants and animals to track how fast water moves through the wetland system.

“Through this research, we have discovered that we need to vary both the speed at which the water moves through and also the water’s depth,” said Amanda Lopez, a research team member and agronomy graduate student. “It’s good to have a mixture of deep and shallow water so that we have a varied population of microbes, thus improving the efficiency of the constructed wetlands.”

The three constructed wetland ponds, along with a water retention pond, are situated so they will catch most of the runoff water from the golf course and the adjacent urban area. Water travels through the constructed wetlands to the retention pond and then is recycled for golf course irrigation before draining into Celery Bog. Prior to the course renovation, most of the water went directly into the natural wetland without benefit of cleanup by the constructed wetlands.



Case Studies

The researchers use six water quality monitors, or water samplers, located along the wetland system. The first is at the inlet to the golf course's east end, which monitors content of water entering the course. The sixth monitor, at the outlet of the course's northwest end, shows the amount and types of chemicals still in the water when it enters Celery Bog. These water samplers measure oxygen, conductivity of chemicals, temperature and pH level.

The study has yielded some surprising information, including showing that oil and grease are almost nonexistent in water entering the constructed wetlands despite the adjacent highways and parking lot. In addition, no heavy metals, such as mercury or lead, have been detected.

The latest chemical analyses of the runoff water exiting the golf course offer a positive environmental outlook: no unusually high levels of any potential pollutants were detected. Some aluminum, magnesium and silicon were occasionally recorded, but that was most likely erosion from bunker sand, researchers said.

The amount and type of pollutant varies depending on the season of the year, with the wetlands' cleaning of the water being more efficient during the spring and summer, the researchers said. During storms, the amount of chemicals also can differ. For instance, during storms in June 1998 and April 2001, atrazine was detected in water entering the course. However, the number of contaminants found in the runoff water exiting the golf course has steadily declined as the constructed wetlands system has matured.

"Wetlands can be more than just a challenge to golfers," Reicher said. "They also can benefit people and the environment. Use of wetlands in conjunction with golf courses can make those 18 fairways and greens good neighbors by cleaning up the water."

The U.S. Golf Association and the U.S. Environmental Protection Agency are providing funding for this research.



Site Inventory

Soils

Soils on the site are:

- **Buse-Barnes loams** at 15 to 35 percent slopes
- **Barnes-Buse loams** at 6 to 9 percent slopes
- **Barnes-Svea loams** at 2 to 6 percent slopes
- **Barnes-Sioux loams** at 1 to 6 percent slopes
- **Vallers-Parnell complex** at 0 percent slope

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



Site Inventory

Existing Vegetation

The site consists mostly of native prairie grass, but also has a few trees.

The grasses on the site are:

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

Site Characteristics

The site is rolling, undulating land that was once home to a mixed-grass prairie. There are large areas of flat land as well as numerous areas of hilly terrain. There is one main area where water drains into Eckelson Lake and it has been eroded noticeably

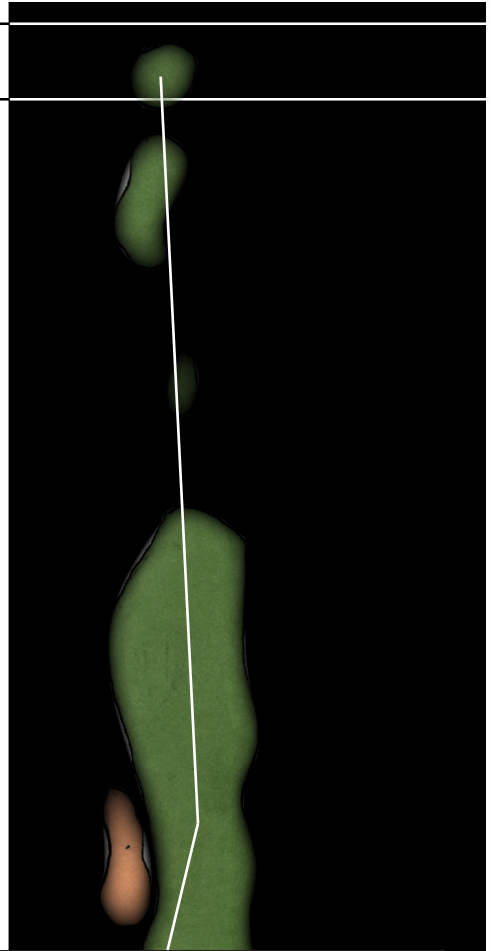


Figure 21

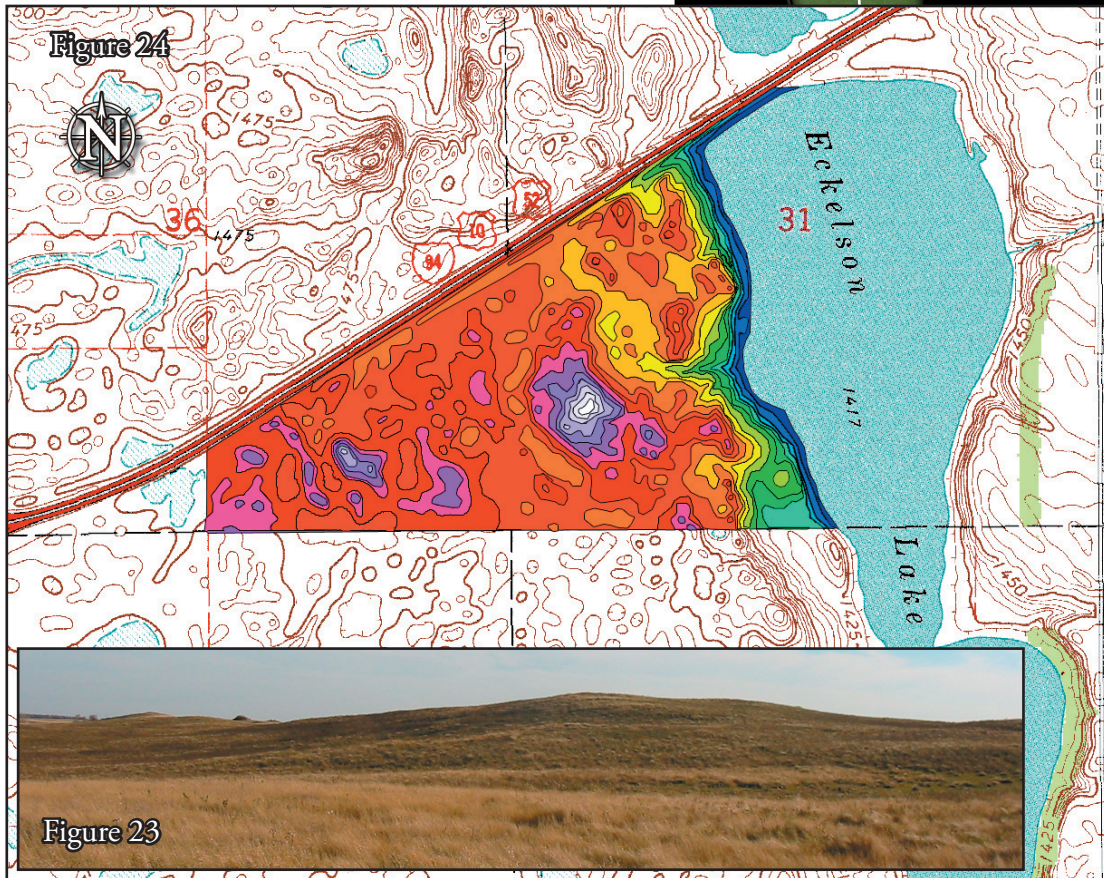


Figure 22

Site Analysis

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

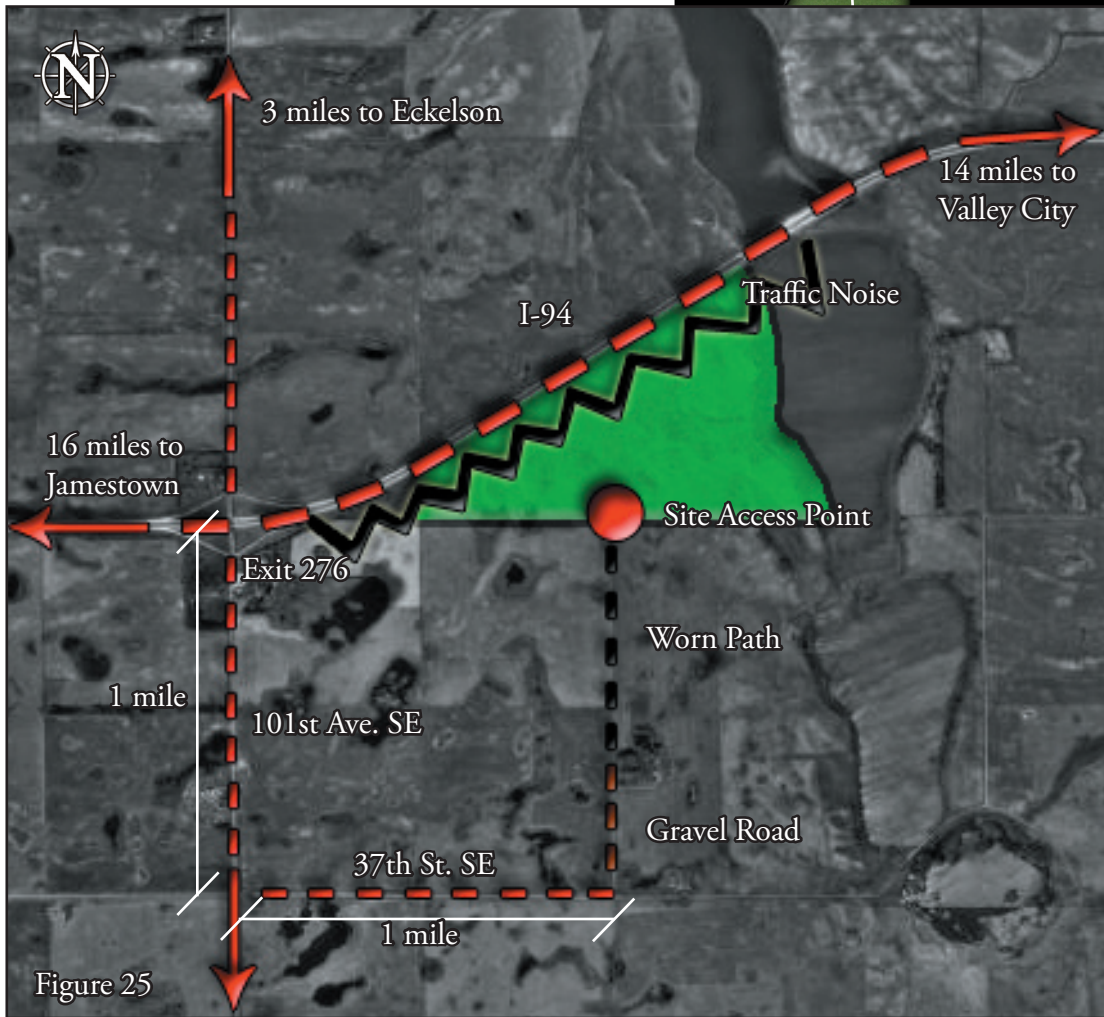
The topography of the site is quite variable. There are large areas of flat land, but it is predominately a hilly site. Eckelson Lake is at 1417 feet above sea level and the tallest hill on the site is 1505 feet above sea level. Water drains into the lake and some areas show evidence of erosion from drainage because there a few valleys worn into the banks. The following topography map shows the elevation changes. Each color represents 5 feet of elevation change.



Site Analysis

Circulation & Traffic Noise

The site runs along Interstate 94 which provides quick access to the site, but also traffic noise is heard on areas next to the traffic. To get to the site, take exit 276 south for one mile, take a left to east for one mile, and finally one more left and one more mile.



Site Analysis

Prairie Haven Campground

The Prairie Haven Campground is located one mile from the site. It has RV hookups and room for 30 tents, 70 RV's, and a cabin for rent. There are 2 small ponds that are full of fish located next to the campground. In addition they have fuel for vehicles, propane, small playground, and a basketball court.

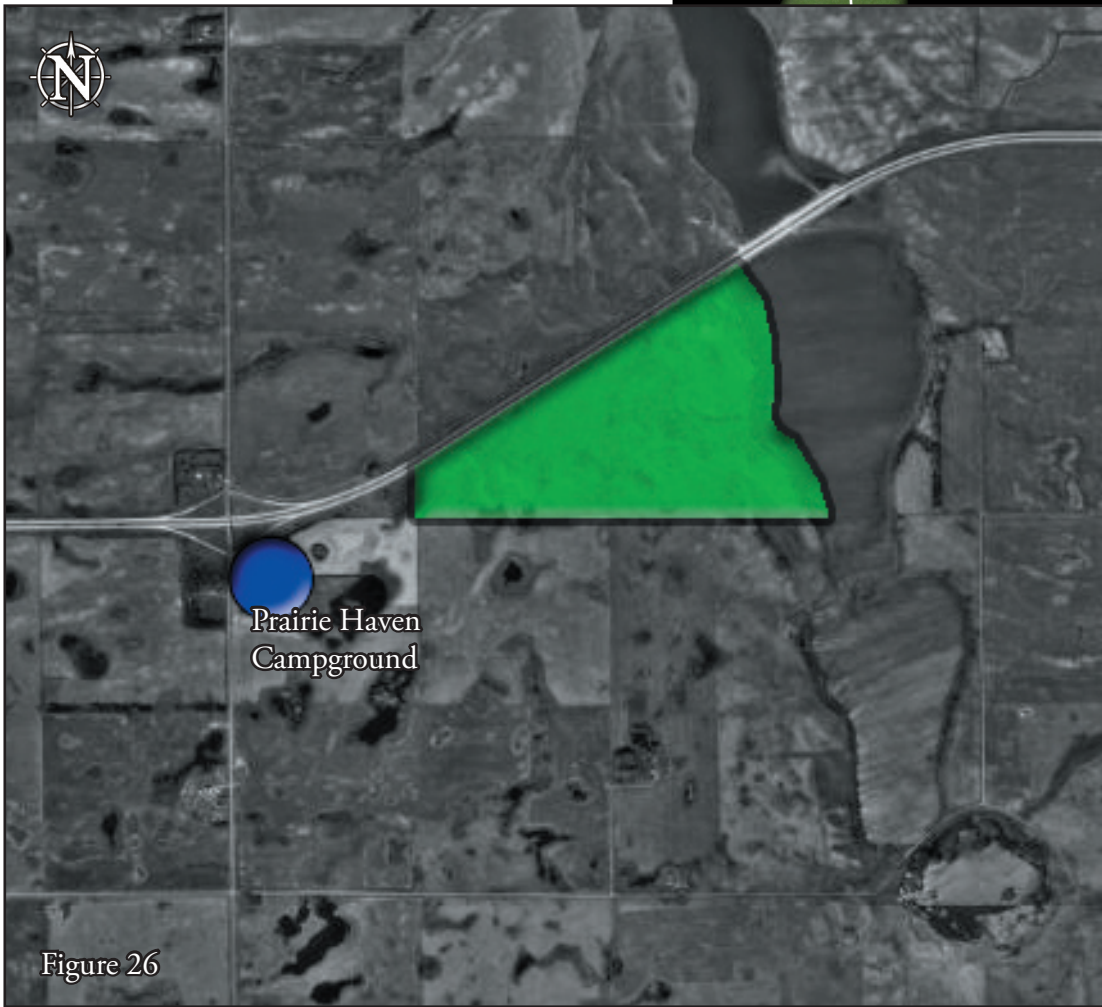


Figure 26

Site Analysis

Hydrology

The site is located on the west banks of Eckelson Lakes. The lakes attract wildlife such as Canada Geese and Waterfowl. Directly south of the lakes is a wetland that is also a Waterfowl Production Area.

There is one main area where the water drains off the site into the lake and it cuts a hole through the terrain.



Site Analysis

Views

The site has numerous nice views of the local terrain. Compared with the rest eastern North Dakota the site a lot of topography, so it is a welcomed site. In addition, the lake views are extremely nice addition to the rolling land that surrounds it.

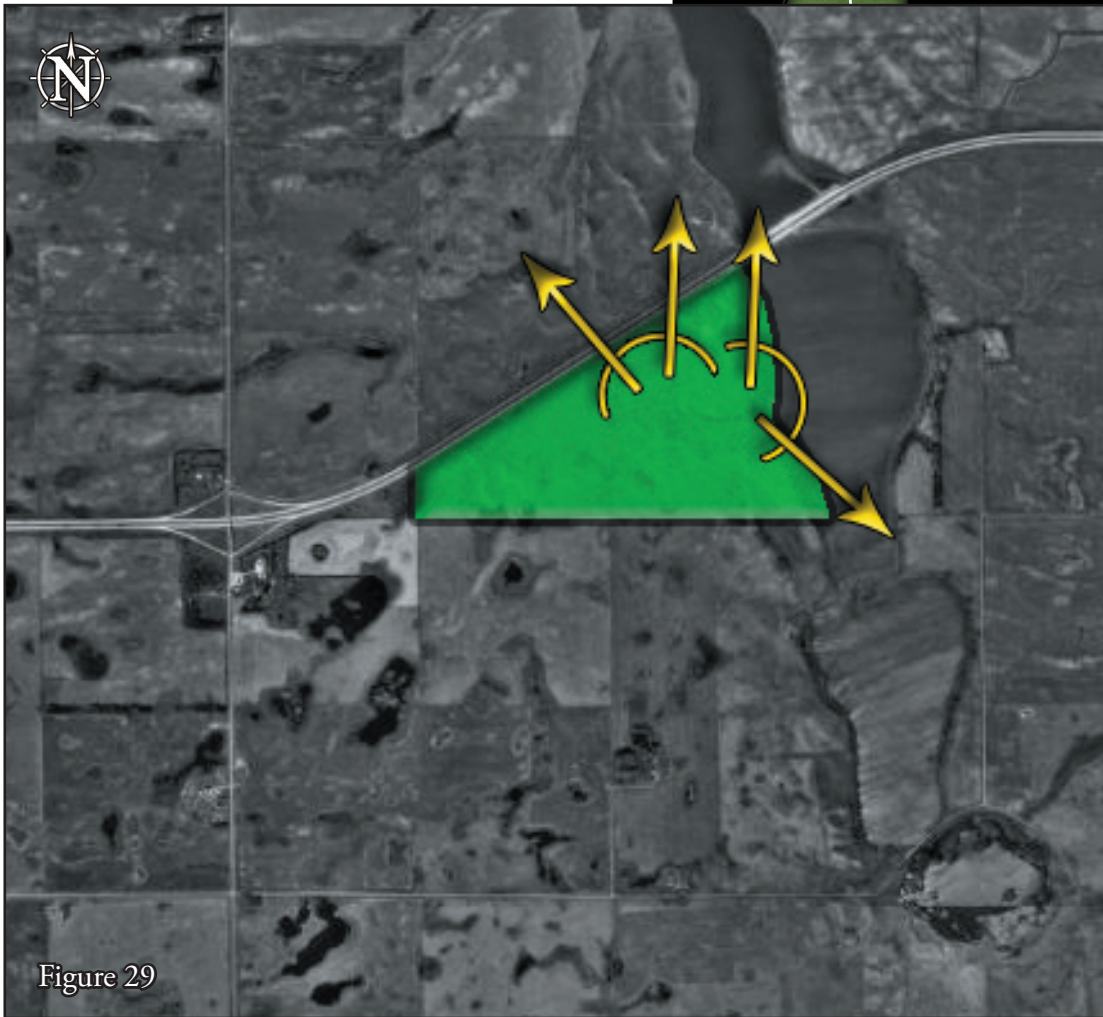


Figure 29

Site Analysis

Climate

The site has a lot of exposure to the sun, rain, and wind. Typically the winter winds come out of the north-northwest, while the summer winds vary from the south, southeast, and southwest. Since the golf season runs from April to October, usually every kind of wind direction is experienced throughout the playing year, making the holes play different at the change of seasons.

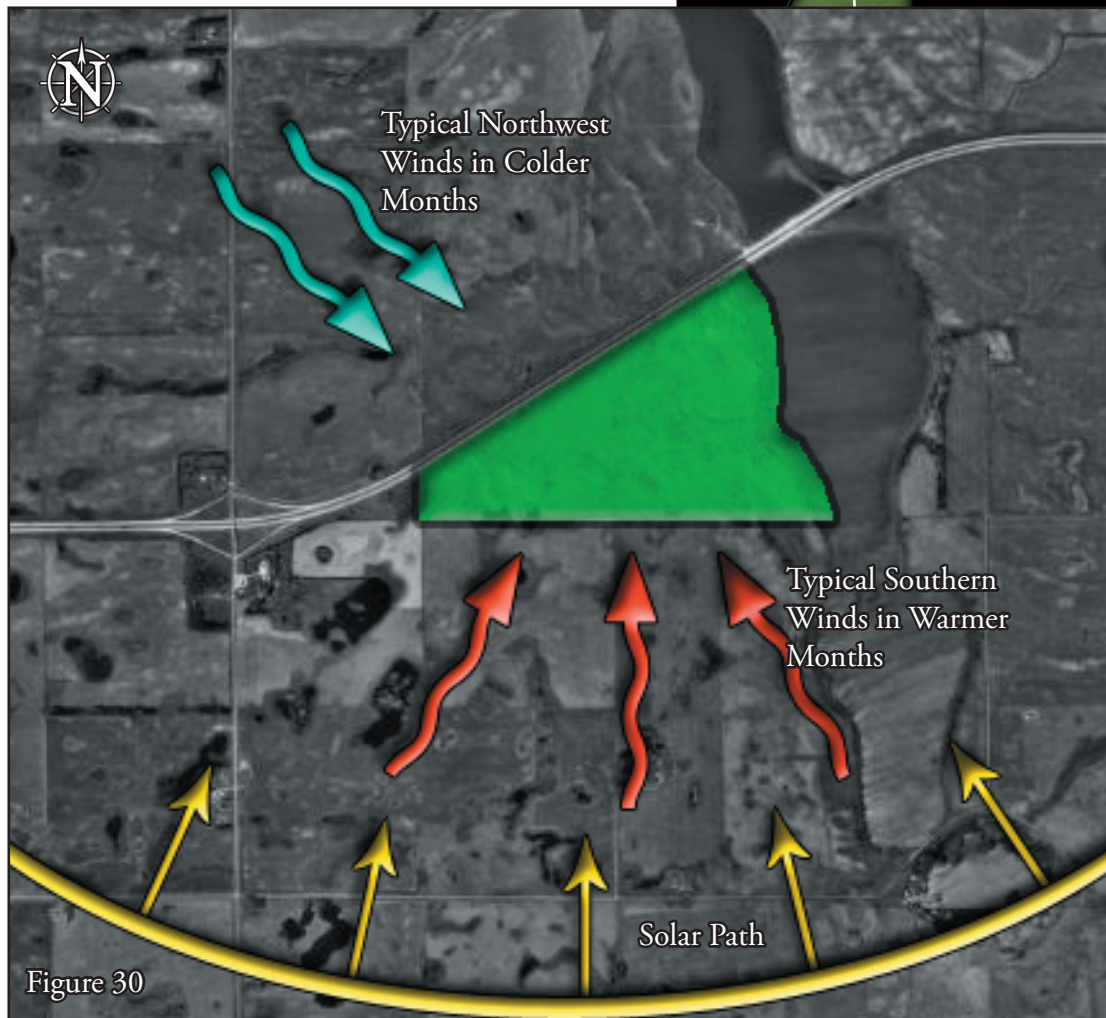


Figure 30

Site Analysis

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



Figure 31

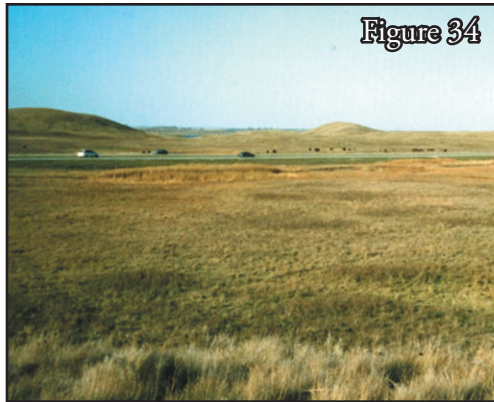
Site Analysis

Opportunities

Lake Views



Proximity to I-94



Prairie Haven Campground



Project Elements

Tee Boxes

Tee boxes are where each hole starts and their designs are basically the same for each one, except for the shape of the tee box. Below are some typical tee box dimensions and details.

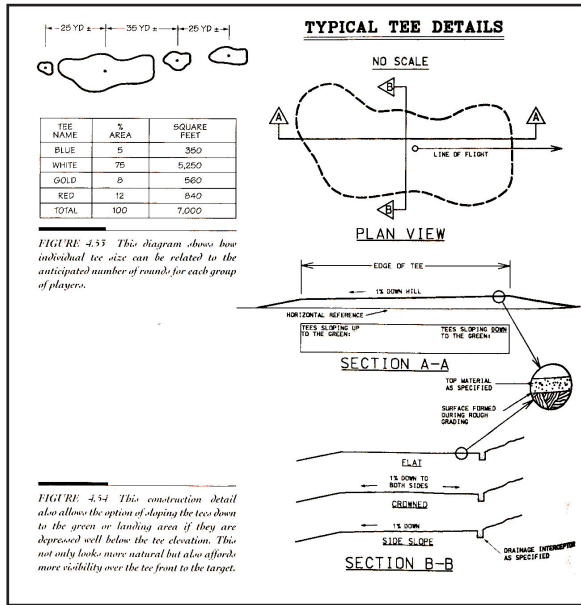


Figure 36

Fairways

Fairways are where the players want to hit their ball from the tee because the grass is cut short, making it easier to hit the ball. Fairways can be many different shapes and sizes and help dictate where the player will aim the shot.

Rough

The rough is on the outside of the fairway and acts as a small hazard. In my golf course like many European courses, the rough will be a tough hazard as the grass will be long and difficult to hit the golf ball out.

Project Elements

Putting Greens

The green is where the hole is cut and where the player wants to get the ball. The grass is cut extremely short, sometimes 1/32 of an inch. The greens are very expensive to build and maintain. Below are example of typical green construction and drainage construction:

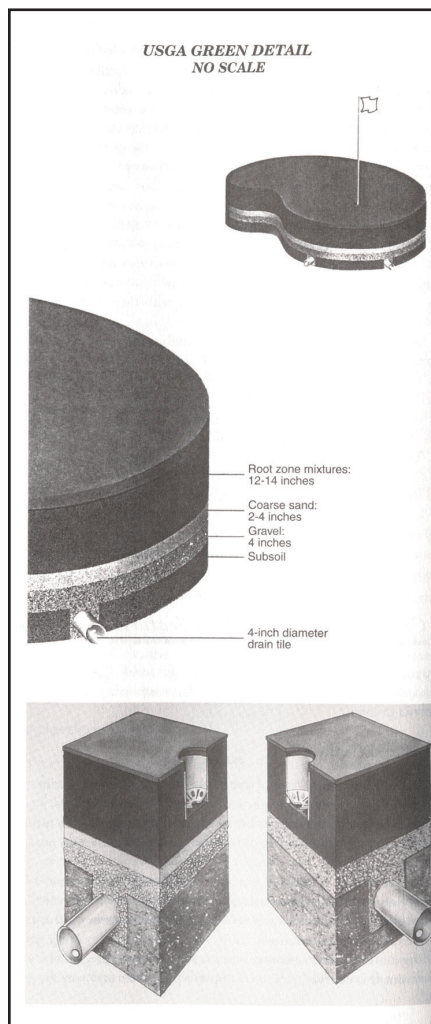


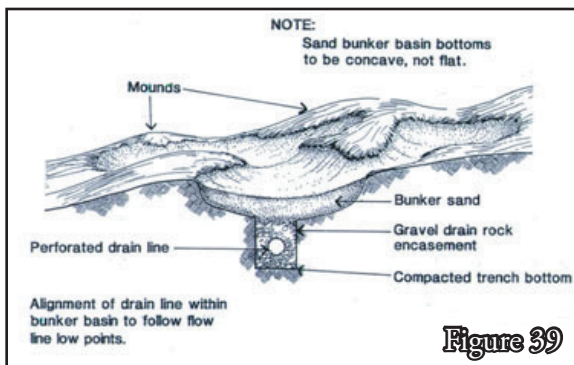
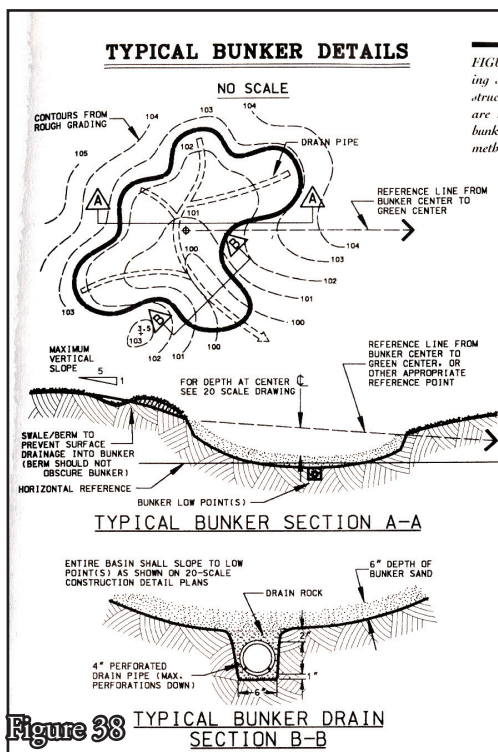
Figure 37



Project Elements

Bunkers

Bunkers are hazards that are added along the course to increase the difficulty of play. They can be placed in or along side the fairway as well as surrounding the green. They help dictate how the player will attempt to play the hole. Below are typical examples of bunker construction and drainage construction:



Project Elements

Water Hazards

Water hazards add even more difficulty to a golf course. They force the player to hit the ball completely over this type of hazard or a penalty stroke is incurred. Water hazards are many different shapes and sizes and help dictate where the player decides to hit the ball.

Vegetation

Vegetation plays a key role in golf course design. Most courses have trees that screen and beautify the course, while others have many small shrubs and/or native grasses to add a different kind of beauty.

Clubhouse

The clubhouse is the main hub of a golf course. This is the place where the golf is paid for as well as the rentals, food, beverage, and merchandise. It is also the place that has emergency equipment and shelter from storms. Clubhouses are usually the first thing a person sees on a golf course and makes the first impression.



Project Elements

Parking

Parking lots need to be of appropriate size for the golf course and need to have safety in mind when designing them. Basic parking lot construction should be followed as well as locating the lot away from the course so stray golf balls don't come into the lot.

Practice Facility

The practice facility generally consists of a driving range, putting green, and a practice bunker. The driving range is where the players use clubs that hit the ball a substantial amount of distance. The putting green is where the players hone their skills and to get a feel of how fast the rest of the course's greens are. The practice bunker is a sand bunker that players use to hit ball out onto a green to hone their skills at bunker shots.

Usually along with a practice facility golf courses usually have a club pro who is a member of the Professional Golfer's Association and is recognized as a Teaching Professional. The club pro gives lessons on all aspects of the game of golf and also is responsible for running the business side of the pro shop.

Cart Paths

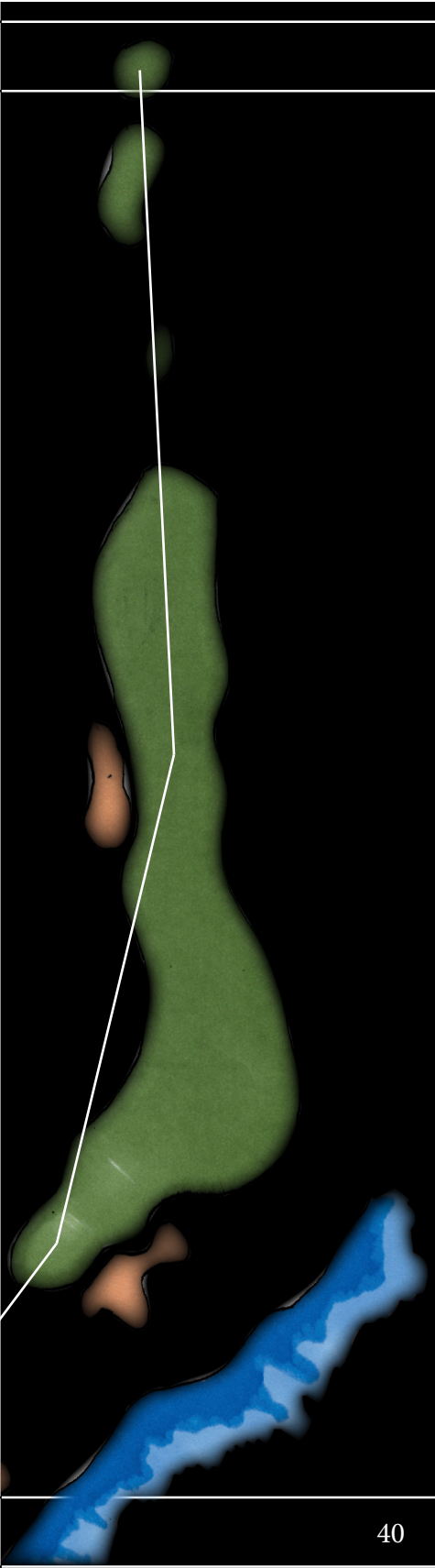
Cart paths are important to a golf course to show where the next hole is and to also take the golf cart traffic off of the grass. Many courses are now having a continuous cart path to encourage people to keep on the path at all times to help save the grass.



Project Elements

Maintenance Building

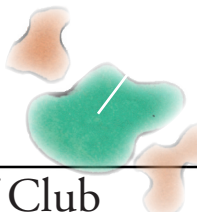
The maintenance building is the place where the green and fairway mowers are stored, as well as the equipment for the golf course such as hole/cup cutters, employee golf carts, drainage pipe, and general tools.



Golf Course Grasses

Temperature is the single most important factor in determining the adaptability of grasses. Humidity also has an effect on whether grasses will grow.

In the northern plains, bentgrass is typically used most often on golf courses. The reason for this is it grows in a cool-temperate climate zone, it has good salt resistance, good acidity tolerance, good heat tolerance, and outstanding cold tolerance.



Irrigation/Detention Pond System

Irrigation systems apply water where it is needed and when it is needed. On this course, they will be designed to focus on the tee boxes, fairways, and greens.

The best sources of irrigation water are existing lakes, ponds, canals, and rivers or streams that flow throughout the drier summer months. Eckelson Lakes will be a great source of water as well as the detention ponds, or the water storage ponds.

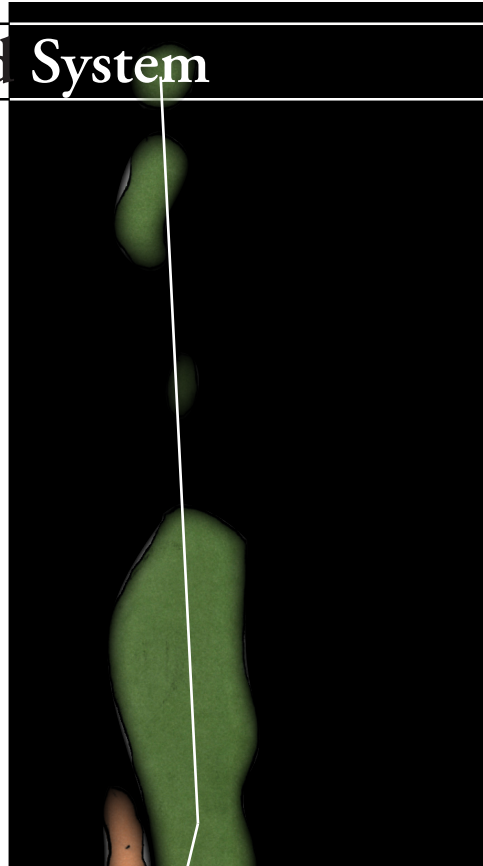


Figure 40

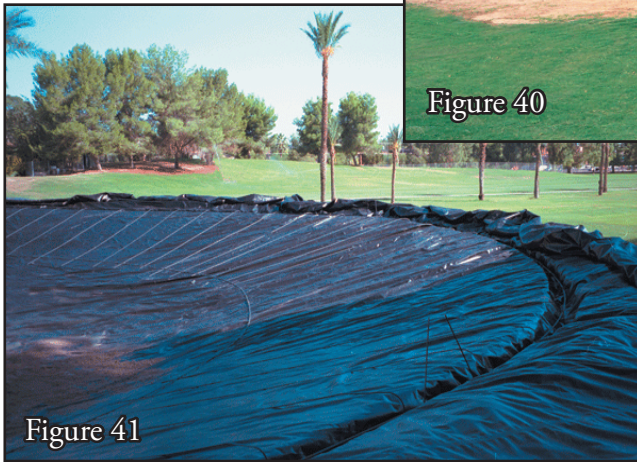
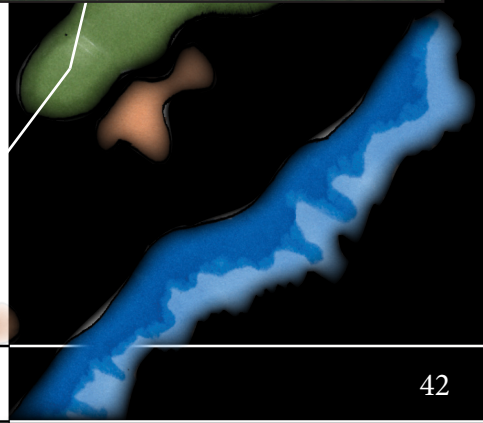


Figure 41



User/Client Profile

Eckelson Lakes Golf Club will be designed as a recreation facility for the general public at an affordable price. This is a course that Jamestown, Valley City, and other surrounding community golfers will drive 20 minutes to play and become members. At an affordable rate with a country club feel, Eckelson Lakes Golf Club will attract people traveling along I-94, and being visible from the interstate is great advertisement as well.

Personnel can be 6 employees in the pro shop and restaurant, and 5-10 on the maintenance crew. Typical operation time periods are from May 1 to Oct/Nov 1. The hours are sunrise to sunset.



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Appendix

Statement of Intent Xeriscaped Golf Course That Uses Rain and Retention Ponds to Irrigate

In North Dakota along the south side of I-94 at mile marker 278 at Eckelson Lakes, Barnes County.

Over the second half of the 20th century and early into the 21st century, the golf course industry boomed and thousands of courses were built. Amazingly beautiful courses have been carved out of unused land, mountains, prairies, lake and ocean sides, deserts, and even landfills. Constructing golf courses like these is possible, but they all too often use an excessive amount of water when the sprinklers turn on in the mornings and evenings, 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.

My project uses land that is used for cattle grazing whose terrain may be too rough for farming and turns it into usable land for a golf course. The site for the course is by mile marker 278 on the south side of I-94 in North Dakota, directly adjacent to Eckelson Lakes which would provide some of the irrigation. Located 15 miles from Valley City and 20 from Jamestown, a quality course at an affordable price will attract players from both cities and surrounding local communities. This golf course would contain areas for water to drain and stand until suitable time for pumping it into the sprinkler system occurs. Drains on the course are tunneled to other areas to be pumped into the sprinkler system as well. This creates a hybrid between nature and man; nature providing rain and man manipulating where the water is finally sprayed. Vegetation is key in this process as well. Plant material would consist of native grasses, shrubs, and trees to conserve even more water.

The goal of this project is to create a quality golf course, while demonstrating minimal outside use of water on a golf course is possible. As a result of conscientious use of local resources, economic benefits include lower overall maintenance costs; with those savings being passed on to the user through lower prices. By taking advantage of the local resources, lower overall costs, and allow for more play by lower prices. The underlying premise of this project is that our pastimes must bend and adapt to the needs of the natural world.



Appendix

Thesis Proposal

A. Title

Eckelson Lakes Golf Club: Helping Golf and the Environment

B. Project Type

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.

C. Theoretical Basis or Unifying Idea

Over the second half of the 20th century and early into the 21st century, the golf course industry boomed and thousands of courses have been built. Beautiful courses can be carved out of unused land, mountains, prairies, lake and ocean sides, deserts, and even landfills. Constructing golf courses like these is possible, but they 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 region's water supply substantially. The theoretical basis of this project is to create a quality golf course, while demonstrating minimal outside use of water on a golf course is possible.



Appendix

D. Project Justification

In recent years, the game of golf has experienced another boom thanks to the young generation of stars playing professional golf. Many new players have emerged in all areas of the United States, as well as the world as a result. With this new popularity, golf courses can be built in locations with little population and still become successful financially, including in North Dakota.

In addition, the site for the course is highly visible from Interstate-94 and is located in between the cities of Jamestown and Valley City, two miles away from the course site is the Prairie Haven Campground. If the use and cost of water is minimized, and a quality course is built, all persons involved benefit.

E. Emphasis

- **Golf Course Architecture**

A quality 18-hole course layout can be created off of the undulating topography of the site. The course itself will manipulate the land as little as possible to minimize the areas to be seeded with grass for the tees, fairways, and greens. However, some land will have to be graded for flatter tee boxes and green playability and drainage. Numerous holes will have unobstructed views of the lake and the surrounding countryside. The native grasses already on the site would be left to use as the rough. A proper circulation pattern for golf carts will also have to be created. The maintenance shop location will be located in a convenient place for the crew to be able to maintain the course in a timely manner.



Appendix

- **Site Drainage, Detention Ponds, and Water Reuse**

The site naturally has slope that would be conducive for good drainage and storage in detention ponds. Once in the detention ponds, the water would be piped into the sprinkler system for reuse on the course when needed. Drains would be added throughout the course in low parts of the fairways and just off of greens.

Also, special care will be taken to the sand bunkers so they drain more efficiently in the case of a heavy rain.

- **Clubhouse and Transportation**

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.



Appendix

F. Site

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. Two miles west of the site is the Prairie Haven Campground that can accommodate 20 motor homes and 80 tents. It is 14 miles from Valley City (population – 6,826) and 18 from Jamestown (population - 15,527), and there are approximately 180,000 people within a 60-mile radius.

The immediate surrounding area is predominately agricultural land consisting of barley, wheat, corn, sunflowers and grazing land for cattle. The site itself is currently being used as grazing land for cattle. Soils on the site are Buse-Barnes loams at 15 to 35 percent slopes, Barnes-Buse loams at 6 to 9 percent slopes, Barnes-Svea loams at 2 to 6 percent slopes, Barnes-Sioux loams at 1 to 6 percent slopes, and Vallers-Parnell complex at 0 percent slope. In general, these soils are deep, well-drained, moderately slowly permeable soils formed from glacial till.

As a decent sized body of water for eastern North Dakota, Eckelson Lakes attracts a lot of wildlife. Numerous local fishermen have stated that 15 pound Northern Pike (*Esox lucius*) have been caught regularly. Canada Geese are frequently seen while they are on their migratory paths. Many other different kinds of birds are seen in the area as well. South of the site is the Knudtson Waterfowl Production Area.



Appendix

G. Major Project Elements

- Irrigation/Drainage Systems
 - Sprinklers/Layout
 - Drains
 - Detention Ponds
 - Piping

- Course Layout
 - Hole Design
 - Golf Cart Path
 - Restrooms
 - Bunker Drainage
 - Water Hazards
 - Practice Range/Green

- Tee Box/Green Grading

- Maintenance Shop

- Clubhouse
 - Parking
 - Entrance
 - Cart Storage
 - Patio
 - Orientation

- Transportation
 - Circulation
 - On-site
 - Off-site



Appendix

H. User / Client Description

Eckelson Lakes Golf Club will be designed as a recreation facility for the general public at an affordable price. This is a course that Jamestown, Valley City, and other surrounding community golfers will drive 20 minutes to play and become members. At an affordable rate with a country club feel, Eckelson Lakes Golf Club will attract people traveling along I-94, and being visible from the interstate is great advertisement as well.

Personnel can be 6 employees in the pro shop and restaurant, and 5-10 on the maintenance crew. Typical operation time periods are from May 1 to Oct/Nov 1. The hours are sunrise to sunset.

I. Design Methodology

Course layout will be studied in detail to create seamless circulation paths and hole design will be researched to provide an enjoyable golf experience. Designing irrigation and drainage systems are the major parts of the course. Case studies will be a key part in researching the unique drainage systems that are needed for this project.

J. Realization of the Design Method in the Design Process

The design method realization should occur to the users after playing the first hole or two. After that, lake views will be showcased on most of the holes throughout the course, providing scenic views. In addition, the native prairie grasses still remaining on the course will still let them know they are on the prairies of North Dakota.



Appendix

K. Schedule

Fall Semester 2004

T	24 Aug	Classes begin
T	24 Aug	1st Thesis meeting during AR/LA 561 Course
F	27 Aug	1st Draft of Thesis Statement of Intent due, 1:00 pm Arch 106. 3 copies distributed to faculty for review.
W	01 Sept	Thesis Statements returned to Arch 106 office by faculty
R	02 Sept	Thesis Statements returned to students in class
M	06 Sept	Labor Day Holiday
R	09 Sept	Revised Thesis Statement of Intent due to AR/LA 561 Instructor
R	16 Sept	Marked-up Thesis Statement of Intent available in AR/LA 561
R	07 Oct	Thesis Proposal due: to AR/LA 561 Instructor (2 copies)
R	07 Oct	Student critic preference slips & faculty preference slips available
R	14 Oct	Students and Faculty return preference slips to main office
R	21 Oct	Primary and Secondary Critics announced
R	28 Oct	Last day of AR/LA 561 Class
R	11 Nov	Veterans' Day Holiday
M-F	15-19 Nov	Final week of AR/LA 571 Design Studio / presentations
W	24 Nov	Draft Thesis Program due to Primary Critic (1 copy)
R-F	25-26 Nov	Thanksgiving Holiday
R	09 Dec	Final Thesis Program due to Primary Critic (1 copy)
F	10 Dec	Last day of classes
R	16 Dec	Program grade due to AR/LA 561 course instructor
M-F	13-17 Dec	Final Examinations

Appendix

Spring Semester 2005

T	11 Jan	Classes begin
M	17 Jan	Martin Luther King, Jr. Holiday
M	21 Feb	President's Day Holiday
M-F	07-11 Mar	Mid-semester Thesis Reviews
M-F	14-18 Mar	Spring Break
W	23 Mar	4th year Statements of Intent due in AR/LA 472
F-M	25-28 Mar	Easter Holiday
M	25 Apr	Thesis Projects due at 4:30pm in the Memorial Union Ballroom
T-W	26-27 Apr	Annual Thesis Exhibit in the Memorial Union Ballroom
R-R	28 Apr-05 May	Final Thesis Reviews
F	29 Apr	Draft of Thesis document due to Primary Critics
F	06 May	Last day of classes
M-F	09-13 May	Final examinations
R	12 May	Final Thesis Document due at 4:30pm in the Department office
F	13 May	Commencement at 4:00pm Fargodome

Appendix

L. Documentation of the Design Process

My documentation of the design process will be kept through taking pictures, drawing sketches, using Adobe Photoshop, AutoCAD, Microsoft Word, and Sketchup by dating them.

M. Bibliography

Cornish, Geoffrey S. and Graves, Robert Muir. Classic Golf Hole Design: Using the Greatest Holes as Inspiration for Modern Courses. Hoboken, NJ. J. Wiley & Sons, 2002.

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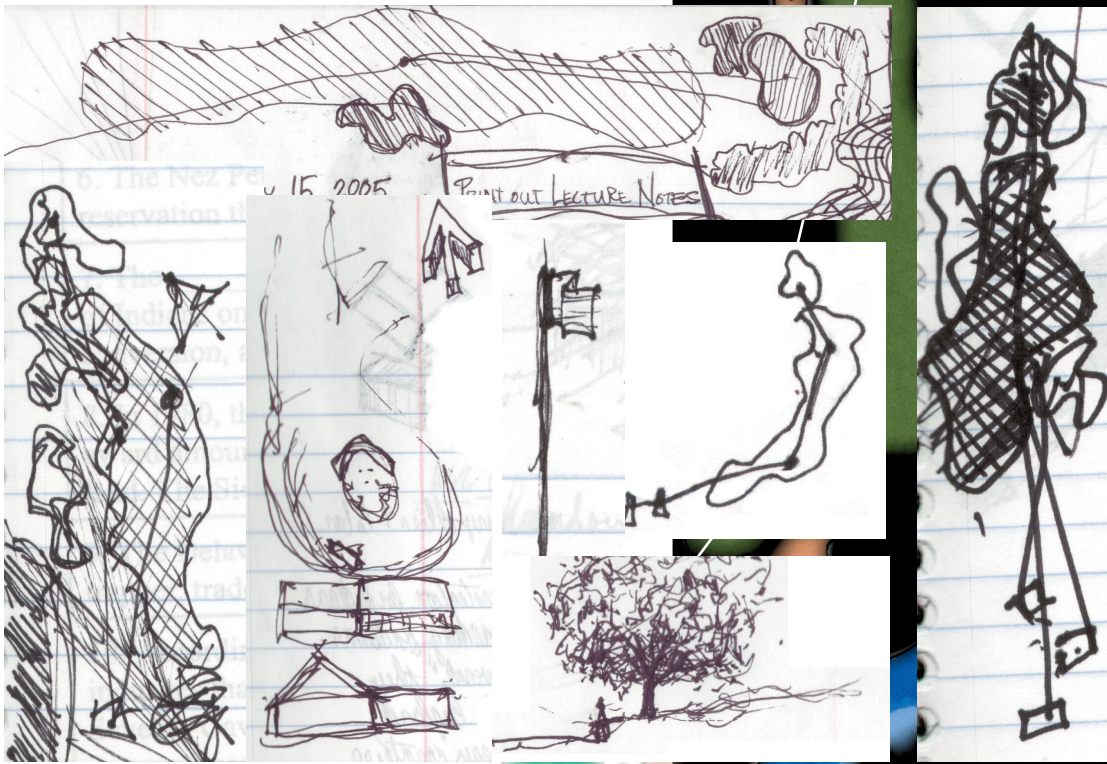
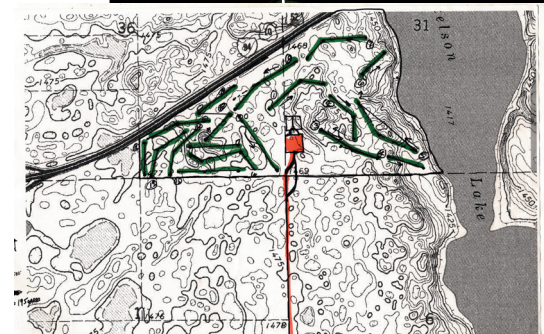
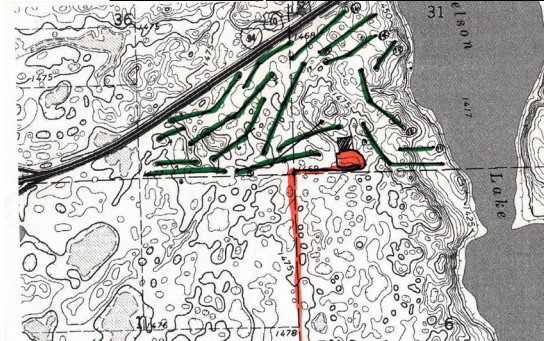
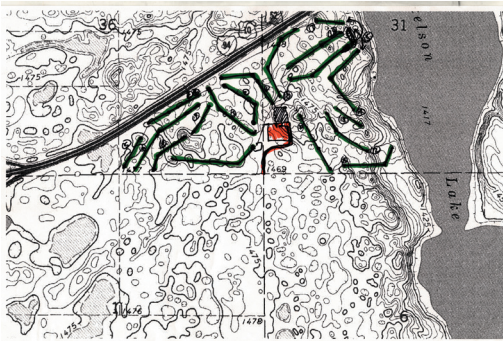
Appendix

N. Previous Design Studio Experience

	Fall	Spring
2nd Year	Tim Kennedy -Six Pack Design -Precedents Study -Design Scenarios -Plains Art Museum Café	Dennis Colliton -Camp Wilderness -Amphitheater -Devil's Lake Open Space and Park Development -NDSU Fountain Plaza
3rd Year	Josh Walter -Car Park Ideal Design -Sheyenne National Grasslands Campground	Tim Kennedy -Pool Area Perspective -Camp Cormorant Graphics -Upper Landing Housing Development -Masonry Competition
4th Year	Josh Walter Mark Barnhouse Cindy Urness -Fargo Downtown Revitalization	Angela Hansen -Broadway Square -Fort Totten Historic Preservation -Stone Competition



Design Development



Design Development



RAIN BIRD

900E

New high performance remote controls enable water only, remote to large ducts, new systems. Distribution is designed to control watering and high wind environments.

1.5" CR and 1.5" CR height control allow for surrounding turf.

One piece snap cover locks assembly directly in place.

Top adjustable pressure regulator allows convenient access to controls.

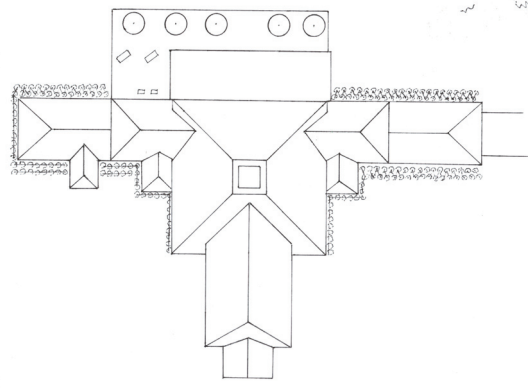
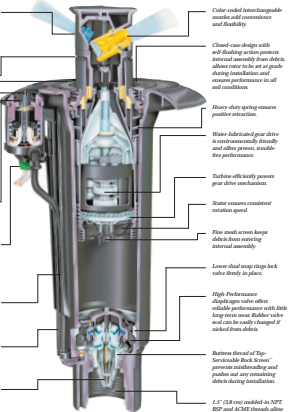
Manual operation selector provides convenient on-the-spot on and off ability.

Heavy-duty iron plate shielded solenoid supports 150 and 200 amp without contamination by the pressure regulator system with die.

Reinforced polypropylene case provides excellent protection from outside elements.

Reinforced metal gate valve and solenoid packing prevent die flow.

Patented Top-Serve-able Back-Serve™ and Hydraulic Valve that allow for die flow removal at installation or later to build up over time.



Final Boards

Eckelson Lakes Golf Club Helping Golf and the Environment

Project Introduction

Over the course of the last 20 years, the golf course industry has blossomed and thousands of courses have been built. The most significant courses have been carved out of wooded lands, and the most significant courses have been carved out of wooded lands. The most significant courses have been carved out of wooded lands. The most significant courses have been carved out of wooded lands.

The major goal for this project is to create an affordable golfing experience for the average consumer, make a resort-like atmosphere while making the course easier to maintain for the owners, and restore 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 owners, and restore water on the course.

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 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 avoid any water supply pumping it into the sprinkler system. 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. The detention ponds for the main water source by being supplemented by rain water. When the ponds drop to certain levels, the water will pump water into the detention ponds, which it 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 that have been built in wooded areas as good examples of environmentally sensitive courses. 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 that have been built in wooded areas as good examples of environmentally sensitive courses.

North Dakota has a short history of golf courses, so golf courses help our 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 history of golf courses, it's not known as a great golfing state. Other than a few courses such as the Links of North Dakota (Burlington, ND) and Hawkeye (Bismarck, ND), 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 courses and have seen many types of courses. I know what kind of course I like. To put it simply, I've wanted 5 years to do this project.

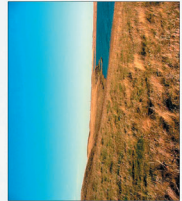
Site Orientation



Eckelson Lakes Golf Club is located 84 miles north of 278 in Barnes County in north central North Dakota.

The site for the course is on the south side of Interstate 94 and on the east side of the town of Eckelson. It is 14 miles from Valley City (population - 6,830) and 15 from Jamestown (population - 15,577), and 75 miles west of Fargo (96,959).

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



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*)
- Prairie Junegrass (*Koeleria macrantha*)
- Western Wheatgrass (*Arrhenathera elatior*)

Design Emphasis

Water use is the main focus for this project. The existing native prairie grasses will be adaptively reused as they will not be as tough which will save on water use. The only changes to the land will be for the irrigation systems, i.e., furrows, grasses, water basins, sand basins, and the clubhouse. Using the native grass as the rough will make less maintenance work for the employee as well as provide challenging holes with varying undulating topography.

A quality 18-hole course layout centered off of the undulating topography of the site. The course itself manipulates the land as little as possible to minimize the area to be seeded with grass for the trees, fairways, and greens. However, some land is graded for future use for green playability and drainage.

A proper circulation system 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.

Larger detention ponds will be placed in optimal areas to collect runoff water to be reused into the irrigation systems, then carrying down on the use of water once again. The site naturally has slopes that would be conducive for good drainage and storage in detention ponds.

The clubhouse is a central part of a golf course. It provides the services of golf, maintenance, and quality food and beverage service. Having a good room to the clubhouse from off-site is very important because first impression goes a long way. Good circulation from the course to the clubhouse is also crucial for maintenance and convenience.

Design Methodology

Course design was a mix of research, process, and design. I looked at the clubhouse, Society's website, and found someone course that had contributed to maintaining 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 tree, lawn, fairway, and green design. Finally, a part I feel is extremely important and crucial to a successful design is that I show on my own golfing experiences. As an avid golfer, I feel course 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 seeded with tall grass prairie, the dominant plant community of the region. This course was designed to maintain the natural beauty of the site. The project was designed to maintain the natural beauty of the site. The project was designed to maintain the natural beauty of the site.

Prairie Dunes Country Club also used Resource Conservation to minimize their water use by installing an on-site weather station and weather sensitive that is connected to the club's irrigation system. In a treatment to reduce the need for widespread spraying.

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

Colonial Acres, a public, state-held course, is a suburban landscape in western New York. Since joining the Hudson River, one-third of the course has been naturalized, providing valuable open space in an area with soil from irrigation pond and seeded with fence grasses, and planted 40 native trees.

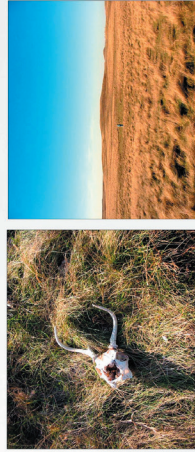
Colonial Acres Golf Course used Resource Conservation to expand their irrigation pond by 100,000 gallons. This pond is fed by run-off and rain and supplies 100% of the irrigation for the course.

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

Weatfield Golf & Country Club is a Weatfield, New Jersey, 18-hole club which plays on an offshore management system. "It is a wonderful demonstration of the use and application of an irrigation system for the course itself. There will be a tremendous demand for water for the course, and the system is designed to meet that demand. With that in mind, over 20,000 ft of pipe will be needed, including 3,000 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 basins. Weatfield has 16 ponds joined by the 60-inch pipe to attempt to keep the ponds relatively level.

Case Study #4 - Karpman Course
Purdue University

The Karpman Course at Purdue University did research on how wetlands help restore 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 wetlands to process the surrounding environment.

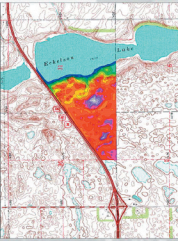


Eckelson Lakes Golf Club Helping Golf and the Environment

Site Inventory and Analysis

The site is characterized by 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 predominantly a rolling site. Eckelson Lake is at 4415 feet above sea level and the tallest hill on the site is 1905 feet above sea level. Water drains through 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

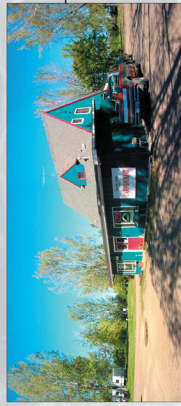


- 242 - Blue-Brown loams at 15 to 37 percent slopes
- 14C - Brown-Brown loams at 6 to 9 percent slopes
- 17B - Brown-Silver loams at 2 to 6 percent slopes
- 1D - Brown-Silver loams at 1 to 6 percent slopes
- 16C - Yellow-Brown complex at 6 percent slopes

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, saves, and preserves the natural habitat of the inhabiting wildlife.
- Create an affordable golfing experience for the average golfer.
- 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 have minimal effect on existing native grasses.



Located two miles west of the site.

It can accommodate 20 motor homes and 40 tents.

Opportunities & Constraints

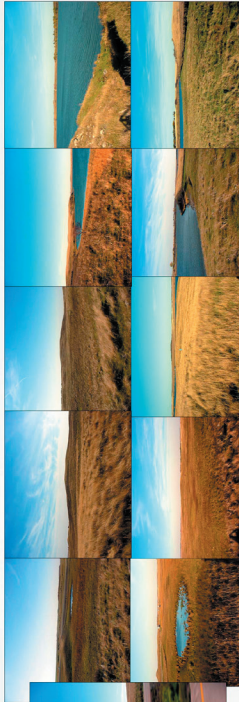
Opportunities

- Located east to Eckelson Lakes
- Located east to Interstate 94 creating high visibility
- Adequate amount of space
- Rolling topography
- A few miles away from the cities of Saksom and Eckelson
- 1/2 mile from Prairie Haven Campground
- A lot of wildlife such as birds

Constraints

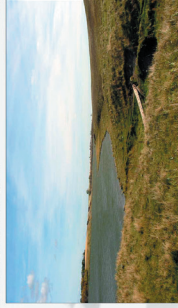
- Located east to Interstate 94 and vehicle noise
- Currently no roads leading directly to site, other than a worn path

Site Pictures



West Side of Eckelson Lake

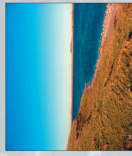
Views from High Point area at High Point



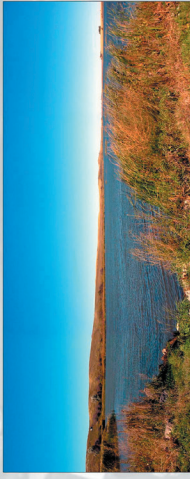
Looking southeast on western edge of site



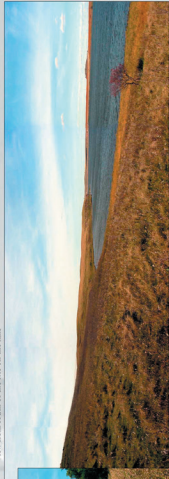
Looking south



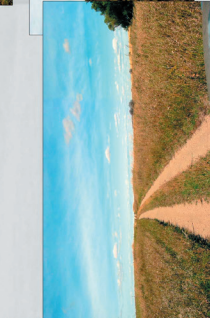
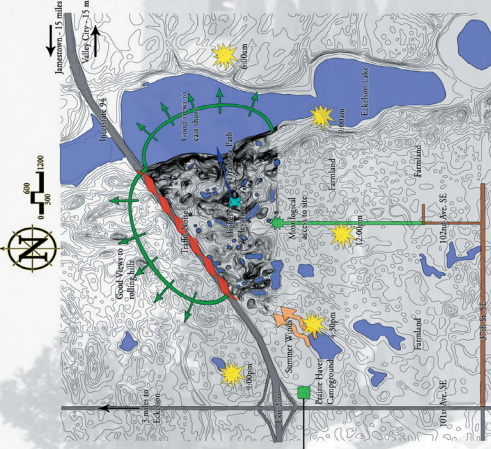
View from east-chute



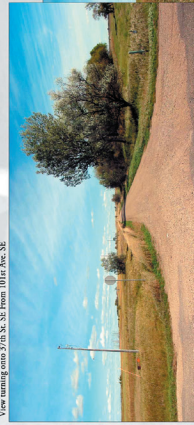
View from north of the site on the lake.



View from north of the site on the lake.



Worn path into site boundary



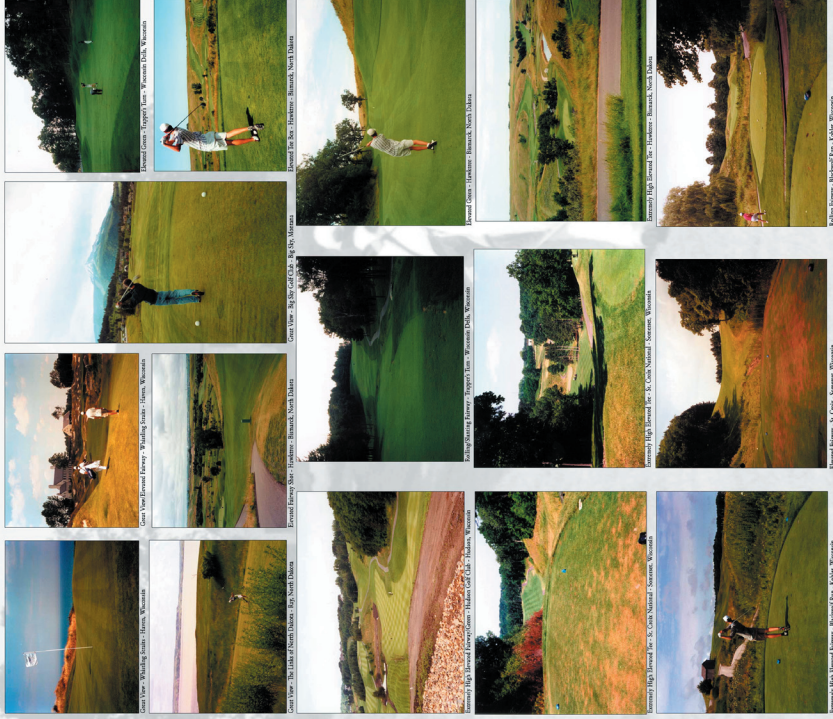
View from north of the site on the lake.

Final Boards

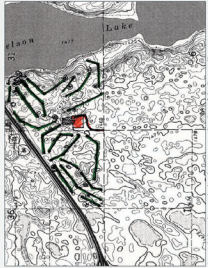
Eckelson Lakes Golf Club Helping Golf and the Environment

Design Influences / Experiences

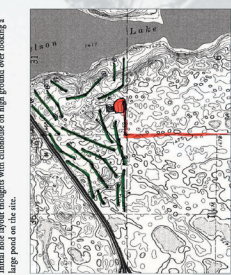
As an avid golfer of 13 years, I have come across and played many courses across the United States. Notably, most of the courses I've played outside of my hometown of Janesville, Iowa, Dakota, have been in the Midwest. I have been inspired by the design and architecture of many of these courses and I would like to see on my own course design. The photographs illustrate the look of characteristics I would like to see on my own course design. They demonstrate advanced tees, fairways, and greens, kind shots, and dramatic views.



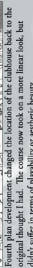
Design Concept / Development



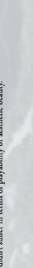
My first instinct upon entering the site boundary was to find an ideal location for the clubhouse. I had a general idea of where the clubhouse usually is in the middle of the course so the first hole would be on the side of the clubhouse. I wanted to follow that tradition and to find a centrally located clubhouse where a relatively flat area was close by for a parking garage.



I ran into a little trouble trying to start with the clubhouse because I felt the lake views were the draw of the site.



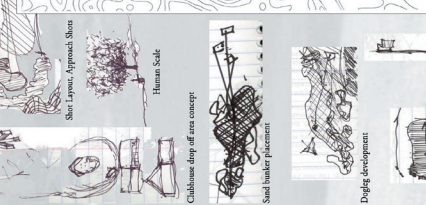
I ran into a little trouble trying to start with the clubhouse because I felt the lake views were the draw of the site.



I ran into a little trouble trying to start with the clubhouse because I felt the lake views were the draw of the site.



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.

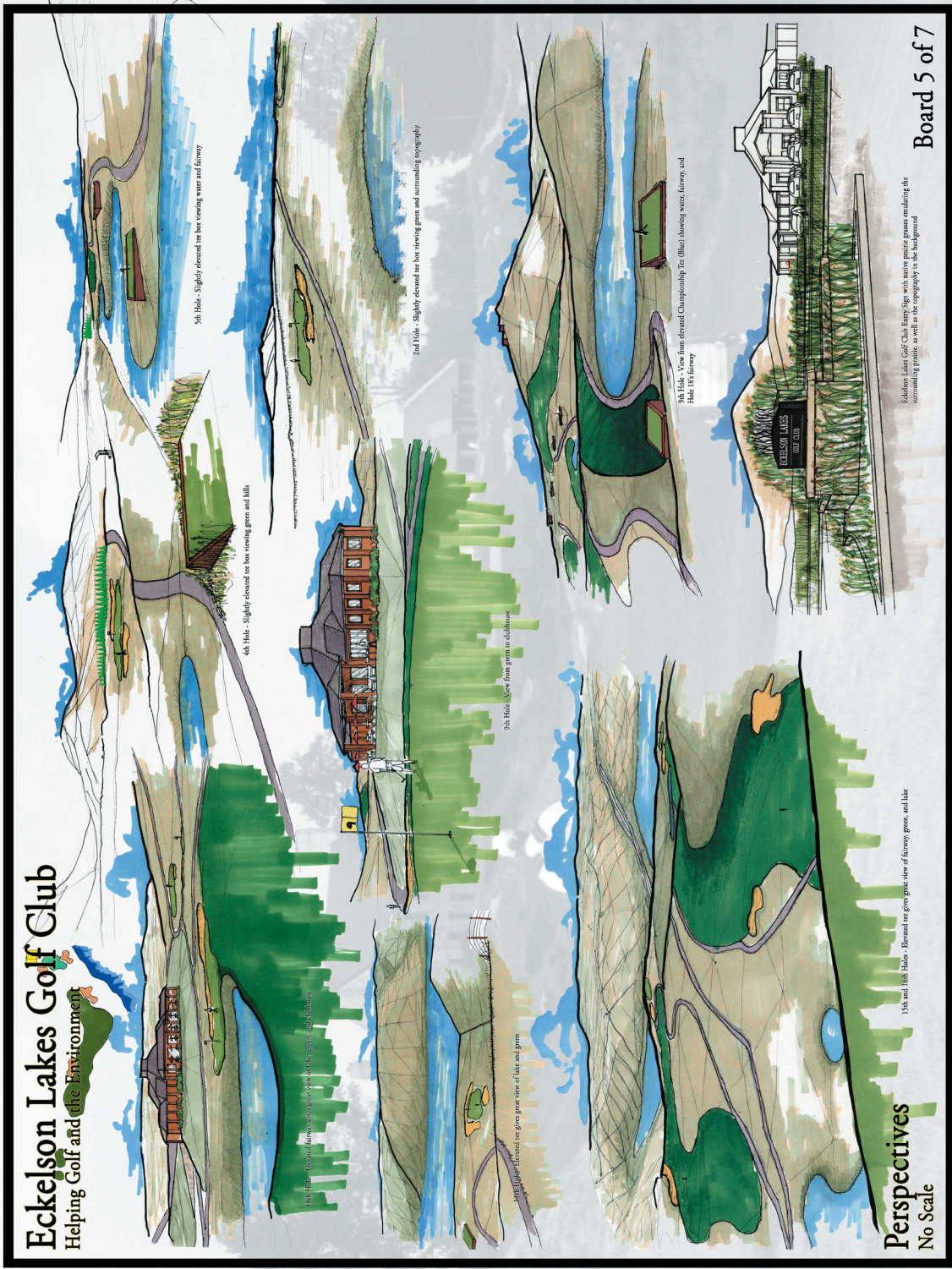


Tier to Green Development

Final Boards



Final Boards



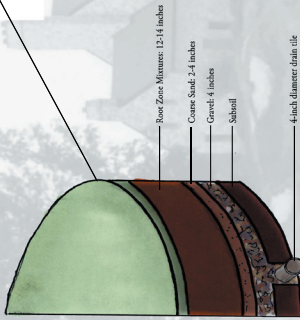
Final Boards

Eckelson Lakes Golf Club

Helping Golf and the Environment

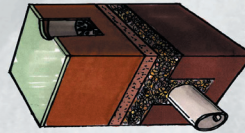
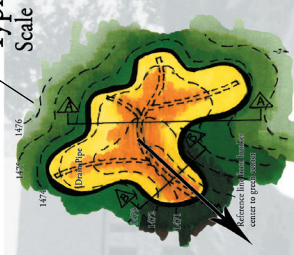
Typical Hole Details

Scale Varies - See Details



Typical Hole

Scale 1" = 60'



Typical USGA Green Detail

No Scale



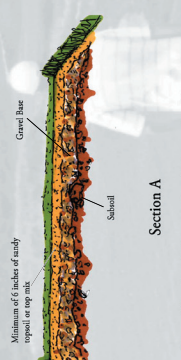
Typical Bunker Detail

No Scale



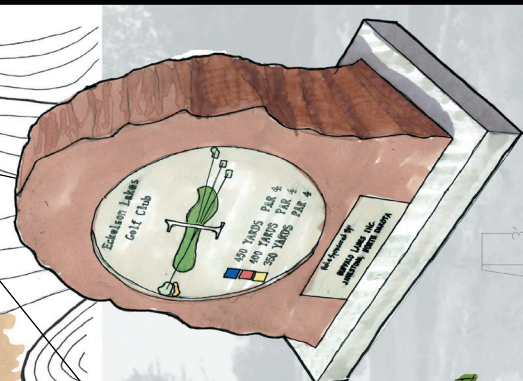
Typical Tee Detail

No Scale



Hole Sign Detail

1/4" = 1'



Sign: Sign with multicolored imprint of yardage and hole map.
 Warpwood finish at base.

Final Boards

Eckelson Lakes Golf Club Helping Golf and the Environment

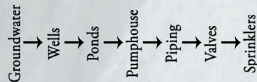
Irrigation From Ponds

The irrigation system at Eckelson Lakes is slightly different from other golf courses. In an attempt to cut down on the use of chemicals, fertilizers, herbicides, insecticides, and pesticides, the water supply is specifically treated to supply all types of climate, topography, vegetation, soil, and water. The water is treated in a way that it can be used for its own formula to calculate. Once they calculate this information, they then must select the appropriate equipment such as pressure systems, pipe (PVC or polyethylene), valves, sprinklers, controllers, or computer systems.

The ponds at Eckelson Lakes contain a minimum of 4,500,000 gallons, assuming each pond is 1/2 acre and 10 feet deep. The water is pumped out of the ponds to pump to water. It's possible to pump water out of the hole, but it would have to be pumped up to a natural elevation at an angle to get to the ponds, requiring a quite large pump and a more complicated system of piping. The water on this course will be drilled down into the water table, where there is a pump well bringing the water up to a pump house that brings the water into the irrigation system. A controller will turn on the pump, and the sprinklers and water will be forced out of the sprinklers. When the ponds water is running low, the well pumps on them as they will be started from ponds on other holes. A little noise will be heard from the pumps, but not enough to affect the golfer's experience. The slight noise is the cost of trying to stay away from a municipal supply.

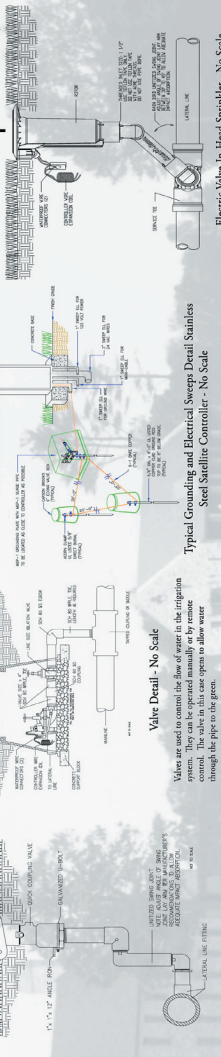
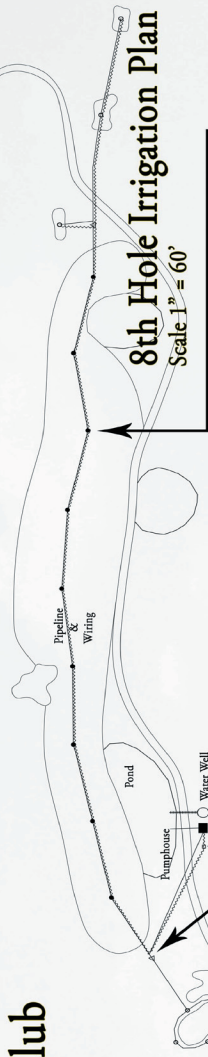
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Eckelson Lakes Irrigation Concept



Clubhouse Vegetation

The vegetation planned around the clubhouse is meant to be colorful while not taking too much attention away from the clubhouse. The plants are chosen for their ability to grow in the shade and for their ability to tolerate the heat. The plants are chosen for their ability to grow in the shade and for their ability to tolerate the heat. The plants are chosen for their ability to grow in the shade and for their ability to tolerate the heat.



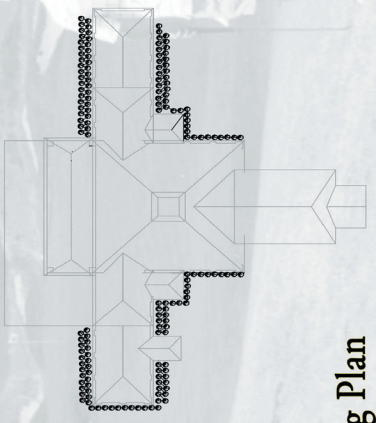
Quick Coupling Valve Detail - No Scale
 Quick Coupling Valves used to be used to manual operate the irrigation system. Obviously this is a use of labor compared to automatic operation. The valves are generally found in the times or during low days to irrigate the greens.
 *Detail found at Rainbird's Website: <http://www.rainbird.com/golfpiper/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/golfpiper/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 timing and 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/golfpiper/cad.htm>

Electric Valve-In-Head Sprinkler - No Scale
 Electric valve-in-head (EVI) sprinklers are the most common type for use in golf courses. They are designed to be installed in the ground, with the wiring going back to the controller. There are two wires on each sprinkler, a signal (control) wire and a common ground. These sprinklers are the to spray water in a localized foot radius.
 *Detail found at Rainbird's Website: <http://www.rainbird.com/golfpiper/cad.htm>

Plant Name	Scientific Name	Quantity
Red Magic Daylily	Hemerocallis 'Red Magic'	41
Sella D'On Duilly	Hemerocallis 'Sella D'On'	42
Parrot Hosta	Hosta 'Parrot'	35
Montana Hosta	Hosta 'Montana'	32



Planting Plan Scale 1/16" = 1'

Personal Page



I'd like to thank my family for all of their support during my years at NDSU.

Chris Harris