

**Capital Improvement Plan
Fiscal Year 2014-2015 through 2018-2019
Project Description**

I. Requesting Department: Planning and Development

II. Project Title: Satterfield Landing Disc Golf Course

III. Project Description:

Project will install a disc golf course in the area around the playing fields of Satterfield Landing.

IV. Project Justification: (What need is being met, how does this project address the need?)

This will create a new recreational opportunity in Town and will fulfill a recommendation of the Parks and Recreation Plan

V. What Board Goals Does This Project Meet?

- Livable Neighborhoods
- Family Friendly
- Choose an item.
- Choose an item.
- Choose an item.
- Choose an item.

VI. Project Location: (Attach a map if applicable)

Satterfield Landing Park

VII. Department Priority: (Choose One) Does the requested project:

- | | | |
|--|---|--|
| a. Correct an unsatisfactory level of service? | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> |
| b. Maintain a current level of service? | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> |
| c. Increase a level of service? | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |
| d. Represent a "vision"? | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |

VIII. Departmental Rank: (Prioritize your request in relation to other departmental project request)

3 of 3

IX. Project Alternatives:

This project can be scaled back to 9 holes at a less expensive price

X. Project Dependency:

Coordination with the County; Public Works for installation and on-going maintenance

XI. Negative Impacts:

Could bring additional usage to the park

XII. Other Considerations:

Neighborhood to the south may be concerned about disc golf. Course lay out should be done to avoid conflict with adjacent neighbors.

XIII. Additional Funding Sources:

Are there grants or additional funds which might be used in conjunction with the CIP to fund this project:

Yes No If YES, describe: OBVB

**CAPITAL IMPROVEMENT PROGRAM
ITEM/PROJECT DESCRIPTION FORM**

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XIV. ESTIMATED COSTS

a. Capital/ One Time Costs	Description of Capital/One Time Costs	Cost (Round to Nearest \$)
	18 hole basic configuration to include Tee Signs, Rules Signs, Baskets, and Freight	\$ 9,000
	Landscaping materials for T boxes	2,000
		Click here to enter text.
	TOTAL Capital (One Time Costs)	\$ 11,000
b. Continuing Annual Operating Costs	Description of Continuing Annual Operating Costs	
	On-going maintenance	\$ 3,000
	Click here to enter text.	
	Click here to enter text.	
	Click here to enter text.	
	TOTAL Continuing Annual Operating Costs	\$ 3,000

XV. Fiscal Year Requested:
FY 2014-2015

Priority Recommendation: (By CIP Committee)





Disc Golf Course Design and Cost Analysis for Town of Nags Head, NC

By: Thomas Shreve

May 20, 2013

As a requirement to PLAN 4099
Planning Program
East Carolina University
Spring 2013

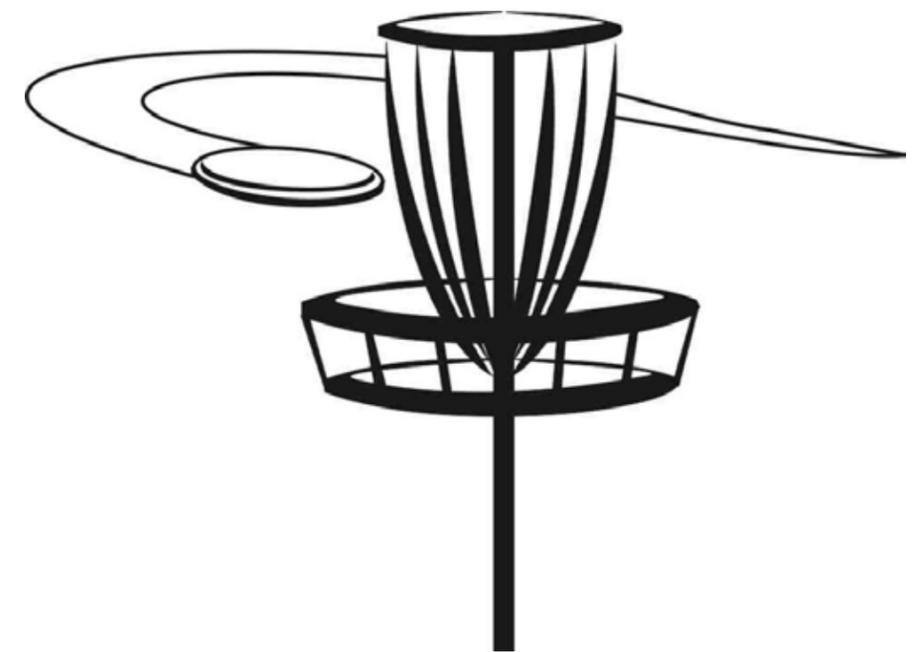
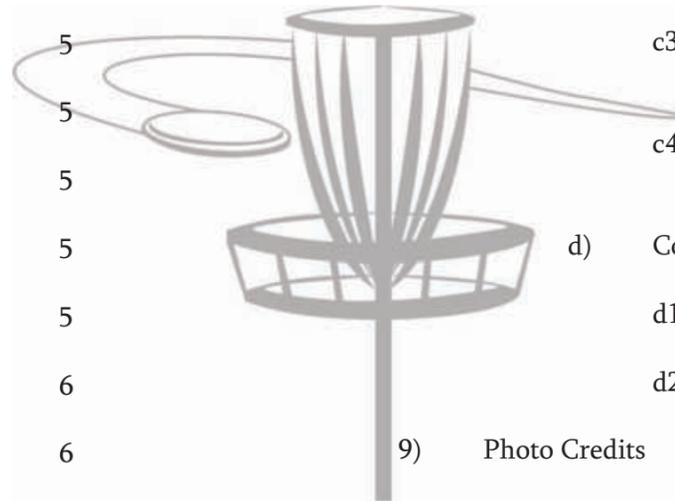


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Executive Summary:

The Town of Nags Head, NC approached the East Carolina University Planning Program, asking for a design for a disc golf course. They requested a feasibility study on an 18-hole disc golf course that is to be integrated within existing park infrastructure. They requested that the course include a constructed wetland in an area prone to flooding, and a play area near the existing ball fields.

The location for the future disc golf course is approximately 13.4 acres and is located on the sound side of Bodie Island. The surrounding land uses include industrial, residential, and conserved land. Existing park infrastructure includes county ran ball fields, a field house, and a parking area. The Town of Nags Head, NC has made clear that part of the conservation land adjacent to the site is available for use in the design and development of the disc golf course.

To complete the design of the disc golf course, a three step design procedure was used. The three steps include:

1. Preliminary Site Visit
2. Integrating Design Standards
3. Cost Analysis

On January 18, 2013, a preliminary site visit was conducted to the future location of the disc golf course. During the visit a meeting was held with the Planning Director for the Town of Nags Head, Elizabeth Teague. During this meeting we outlined the parameters of the project, and conducted a tour of the site.

The second step in the design procedure was to integrate design standards. This was done in two stages. The first was the use of the Professional Disc Golf Association's Disc Golf Course Design Recommendations. This document is divided into ten sections that include guidelines and recommendations on all aspects of disc golf course design. The second stage of integrating design standards is the use of experience playing disc golf courses in both Raleigh and Greenville, NC. The three courses utilized for this section include Middle Creek Disc Golf Course in Cary, NC; West Meadowbrook Park Disc Golf Course in Greenville, NC; the Old East Carolina University Disc Golf Course in Greenville, NC; and the New East Carolina University Disc Golf Course in Greenville, NC.

The third step in the design procedure was the cost analysis. To complete the cost analysis, guidelines developed by two disc golf equipment companies were utilized: Disc Golf Association, and Innova Disc Golf. The range for the cost of installing a disc golf course will be from a minimum of \$5,000 to \$20,000 based on course packages retrieved from the disc golf equipment companies listed above. The cost for the different course packages were determined by the amount of amenities included. This ranges from the basic

package which includes tees, baskets, and tee signs, to the championship level package which includes everything need to create a tournament ready course.

After completing the design procedure, it is recommended that the Town of Nags Head implement a basic course which will include baskets, tees, and signage. This will allow for the town to have some flexibility in regards to the future expansion of the disc golf course. Along with the use of a basic course configuration, it is also recommended that non-permanent tees and baskets be used in the early stages of the disc golf course to change the layout of the course if necessary. The estimated total cost for the project excluding the constructed wetlands, playground, and site furniture will be approximately \$8,390.00.

The design and development of a disc golf course was a goal of the Parks and Recreation Plan adopted by the Town of Nags Head. This project will provide the community of Nags Head and surrounding areas with a recreational option that is beneficial to the community and playable by any age.



Introduction:

Disc Golf is growing in popularity in the United States. In the year 2000 there were approximately 873 disc golf courses according to the Professional Disc Golf Association or PDGA (PDGA, 2013). This number grew substantially to 2,484 in 2009; that is a growth rate of approximately 64.9% over those nine years (PDGA, 2013). Along with a multitude of benefits such as economic, community health, environmental, safety, education, and community involvement; it is not surprising why many municipalities are looking to develop disc golf courses. While 84% of disc golf courses in the world are located in the United States, seven other countries including Peru, Mexico, Belgium, Iceland, France, Hungary, and the Czech Republic have all built disc golf courses (Siniscalchi, 2004).

History of Disc Golf:

While the popularity of disc golf is skyrocketing, the origins of disc golf are disputed. There are many different historical accounts about the origins of disc golf; some accounts even pre-date flying plastic discs (Palmeri, 2008). Each of the accounts mentioned above are isolated instances of the advent of disc golf (Palmeri, 2008). One of the first known accounts of the appearance of disc golf occurred in Vancouver, British Columbia in 1926 (Palmeri, 2008). This version of disc golf was developed by a group of school kids who developed a course on the grounds of their school. They used tin lids as discs and called the game “Tin Lid Golf” (Palmeri, 2008). While this is one of the earliest accounts of the game of disc golf being played, other accounts similar to this have occurred from the 1930s to 1960s (Palmeri, 2008). In 1960 there was a commercialization attempt by Copar Plastics Company (Palmeri, 2008). The packaged game called “Sky Golf” “never became successful because the popularity of the Frisbee had not taken off yet (Palmeri, 2008).

In the 1960s, the Wham-O MFG Company included a disk golf event in their All Comers Frisbee meet, based on an idea from George Sappenfield (Palmeri, 2008). After this event, Wham-O no longer promoted or held any disc golf event for around seven years (Palmeri, 2008). Despite this, the sport of disc golf thrived on a local level. One location in particular is Rochester, NY. In August of 1970 the City of Rochester had a competitive disc league, and by 1972 it had established a city championship (Palmeri, 2008). Over the next few years, the popularity of disc golf grew, until in 1975 Wham-O included a disc golf event in their World Frisbee Championship (Palmeri, 2008). A year later, in 1976, the Disc Golf Association Company was founded (Palmeri, 2008). After the founding of the Disc Golf Association, the sport of disc golf grew rapidly in popularity, and new courses kept popping up across the country (Palmeri, 2008).

Disc Golf:

Although very popular with many, disc golf is still very much an emerging sport. While wildly popular in some areas of the country, some areas do not have a very large following. Sometimes referred to as “Frisbee Golf”, disc golf is very similar to the game of golf (Siniscalchi, 2004). Both games have tee boxes, and holes. Another similarity is that the objective of both sports is to get the ball or disc in the hole in as few strokes as possible. The major difference is in golf players use a variety of golf clubs to get the ball in the hole, whereas in disc golf, the ball is replaced with specialized discs (Siniscalchi, 2004). Other major differences include: the lack of green fees, no need to rent a cart, and players do not need to schedule tee times (PDGA, 2013). Some disc players carry very few discs, and some carry many, but the three basic types of discs used include the driver, an approach disc, and a putting disc. One major draw for people to the sport of disc golf is the ability for anyone to play the sport. Disc Golf has become readily available due to many cities having invested in the development of disc golf courses. Even if a course is not conveniently located, many players make their own (PDGA, 2013). The majority of disc golf courses are either 9 or 18 holes according to the Professional Disc Golf Association’s “Disc Golf Course Design Guidelines”. While finding courses with an “odd” number of holes such as 12, 24, or 27 is not uncommon, the PDGA dictates that the number of hole be divisible by three. An 18 hole championship level course can be built on 30 to 40 acres of land whereas a 9 hole course can be put on as little as 5 acres (PDGA, 2013). Disc golf courses are usually designed using the natural topography of the site, employing obstacles such as ponds, dog legs, and vegetation to challenge the player (Siniscalchi, 2004). This relative simplicity in design allows for the placement of a disc golf course in many environments from beaches, to open fields and forests (Siniscalchi, 2004). This relative ease of placing a disc golf course within a city or county is yet another reason this sport is becoming increasingly popular.



Disc Golf:

The sport of disc golf provides players and municipalities with tangible and intangible benefits. The benefits of disc golf include: economic, community health, environmental, safety, education, and community involvement benefits. The following table shows a breakdown of the benefits listed above.

Economic	<ul style="list-style-type: none"> • Low cost of construction, maintenance, and play. • Attracts players to the local community.
Community Health	<ul style="list-style-type: none"> • Provide a low impact and safe means of exercise for all age groups and genders. • Mental strategy is involved in negotiating obstacles. • Reduction of mental fatigue.
Environmental	<ul style="list-style-type: none"> • Aesthetic enhancement of park. • Low resource impacts.
Safety	<ul style="list-style-type: none"> • Crime deterrent as the park is utilized more by people.
Education	<ul style="list-style-type: none"> • Schools may introduce the course into their curricula for physics, physical fitness, ecology, planning, and others.
Community Involvement	<ul style="list-style-type: none"> • Formal and informal games and tournaments bring community members together. • Families and friends can share time together.

Source: Siniscalchi, 2004, p. 06

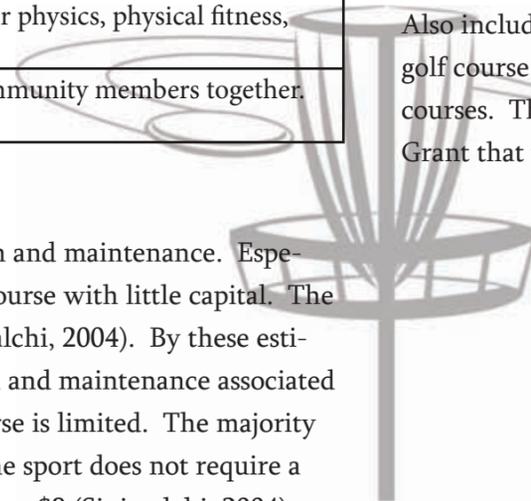
The most important factor listed in the above table is the low cost of construction and maintenance. Especially in the recession and economic downturn, cities can design and install a disc golf course with little capital. The approximate cost per hole for a disc golf course is around \$500 to \$1000 per hole (Siniscalchi, 2004). By these estimates, the cost to design and build a disc golf course is significantly less the construction and maintenance associated with a lighted tennis court (Siniscalchi, 2004). The maintenance cost for a disc golf course is limited. The majority of maintenance needed is routine park maintenance (Siniscalchi, 2004). Even playing the sport does not require a large amount of financial capital, most of the first time players use discs that cost as little as \$8 (Siniscalchi, 2004).

Another economic benefit is the attraction a disc golf course has for the surrounding communities. Disc golf courses can in some instances create revenue for a town or municipality (Siniscalchi, 2004). For example, The PDGA championship which is held in Augusta, Georgia is estimated to bring in around \$1.8 million (Siniscalchi, 2004). Normally a disc golf course will not come near this, but there is still the opportunity to gain revenue. This can be achieved in two major ways. The first is the implementation of tournaments, that could attract anywhere between 30 and 100 participants into the area for a day or weekend (Siniscalchi, 2004). The second option is more associated with private course, but a user fee could be charged (Siniscalchi, 2004).

Objective/Purpose:

The purpose of this research is to design and develop a plan for a disc golf course in the Town of Nags Head, NC. The town has approached East Carolina University Planning Program, to aid in the design and development of a disc golf course in one of the town's existing parks and recreation facilities.

The expected outcomes for this project will be in two parts. The first part of the project will be the feasibility study of the disc golf course. This will include the existing conditions of the site, and multiple options of the layout of the disc golf course. One option for the layout of the disc golf course will include an option (if feasible) that will be up to tournament quality according to the guidelines set forth by the PDGA. Some of the requirements for the design of the disc golf course set forth by the Town of Nags Head include: an 18 hole course, preferably in a loop, the possible inclusion of putting greens, and the inclusion of a reconstructed wetland. The second portion of the project will be a supplemental report describing the development of the disc golf course. This will include a cost estimate for the baskets, construction of the tee boxes, and many other ancillary costs associated with the project. Also included in this section will be the research gathered from my site visits to the proposed location of the disc golf course and other disc golf courses in the region, and research conducted on the benefits and effects of disc golf courses. The Town of Nags Head has also made a request to answer questions included in a Dare County Tourism Grant that will help account for some of the costs related to the project.



Town of Nags Head, NC and the Need for a Disc Golf Course:

The town of Nags Head is located in Dare County, NC. A beach community on the Outer Banks, the population of the town is around 2,700 people. Approximately 200 miles east of Raleigh, NC, the town of Nags Head is served by two major thoroughfares. Connecting the town of Nags Head to the Roanoke Island and then to the Main Land is highway 64. The second major thoroughfare is highway 158 which runs north and south along the outer banks, eventually travelling east to connect the Outer Banks with Currituck County. Other major transportation routes include Highway 12 that stretches the entire length of the Outer Banks, and serves as the major thoroughfare for the majority of the Outer Banks. The town of Nags Head has a large attraction for tourists. This is due to its beaches and other tourist attractions such as Jockey's Ridge State Park. Nags Head, NC is located very near to other coastal communities such as Kill Devil Hills, Manteo, Kitty Hawk, and Duck.

On January 25, 2012 the town of Nags Head, NC adopted a Parks and Recreation Plan which is intended to evaluate "the town's current recreational facilities, identify the recreational needs of all ages and recommends actions for the town to consider into the future" ("Town of nags," 2012) The goals of the plan are as follows:

- A. Serve all ages and physical abilities;
- B. Create opportunities for community interaction;
- C. Strive for continual improvement of existing facilities;
- D. Increase access to the sound;
- E. Create pedestrian and bicycle connectivity throughout the Town of Nags Head;
- F. Acquire Property for the purpose of parks and conservation;
- G. Develop new recreational opportunities; and
- H. Implement plan goals on an on-going basis.

For each of the goals listed above, the town has developed a set of objective and action items for each goal. The objective and action items for the development of new recreational opportunities include the design and install of a disc golf course within the Town Park and adjacent Nags Head Woods areas, along with at the YMCA ("Town of nags," 2012).

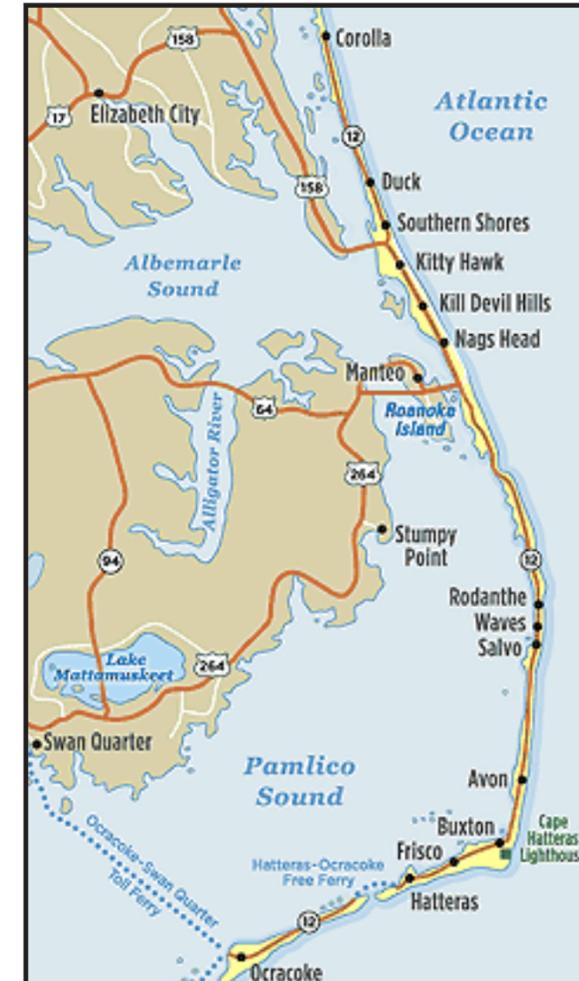
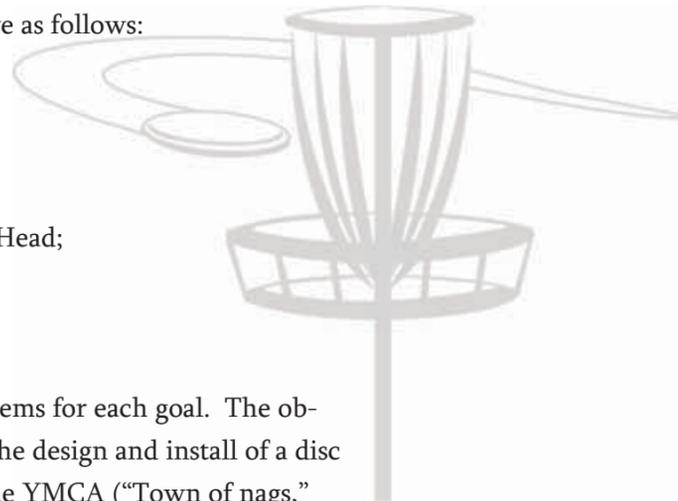


Figure 1: (Above) A Map showing the location of the Town of Nags Head, NC in relation to other communities on the Outer Banks.

The site in question is approximately 13 acres and already has existing parks and recreation facilities including multiple soccer fields. The majority of the site is occupied with the existing facilities with the exception of a large wooded located along the southeastern property line. There are two small triangular areas on the northeast side of the parcel, and a drainage area that is prone to flooding. Adjacent to the site on the southwestern side of the parcel is a conservancy area known as Nags Head Woods. According to Elizabeth Teague, the Planning and Development Department Director, a small portion of this site will be useable in the design and development of the disc golf course. There are two land uses surrounding the site. On the north edge of the parcel there is an industrial area that is largely composed of warehouses. On the eastern and southern property lines, there are residential land uses. The southern property line has already established residential housing, and the eastern side is the location of a future residential development. Some of the design considerations that will need to be considered include: protected vegetation, protected conservancy land, existing park infrastructure, and the design requirements from the Professional Disc golf Association.

In the area that the proposed disc golf course there are two protected species of tree, the live oak, and bay trees. These trees are protected and cannot be removed from the area. Another conservancy issue is associated with the Nags Head Wood conservancy area. This is the area on the western side of the proposed location can be used for the disc golf course, but in a limited capacity. Of the area within the parcel, the majority of the land is occupied by park facilities such as parking, ball fields, and restroom facilities.



Figure 2: (Left) An aerial photo of the proposed location for the Nags Head Disc Golf Course

Methodology:

In developing the design and cost analysis for the Nags Head Disc Golf Course, I consulted three major sources. The first is the PDGA Disc Golf Course Recommendations. This document is the guidelines that the Professional Disc Golf Association has published for the purpose of designing disc golf courses to their specifications. The second source are my own experiences playing disc golf at courses in other municipalities in North Carolina. Finally, product manuals from the Disc Golf Association and Innova disc golf were utilized to determine the cost of the equipment needed for the course.

Review of course design specifications:

The governing body of disc golf, the Professional Disc Golf Association, supplies municipalities with a set of guidelines the municipality can use to design and build their disc golf course. The five main goals of the “Disc Golf Course Design Guidelines” include:

1. Satisfy the design requirements of the people and organizations who approve use of the land and fund the equipment for the course;
2. Design the course to be safe for both players and non-players who may pass near or through it;
3. Design course with the potential for multiple configuration to serve not only beginners but players with advanced skills; consistent with the budget and design needs in goal 1;
4. Design a well-balanced course with a wide range of hole lengths and a good mixture of holes requiring controlled left, right and straight throws; and
5. Utilize elevation changes and available foliage as well as possible. Take care to minimize potential damage to foliage and reduce chances for erosion. (PDGA, 2013)

The guidelines are then broken down into 10 sections each regarding a different design element of the disc golf course.



Section 1: Space:

The first design element is space. According to the design guidelines, a well-developed course will be both in and out of the woods. Typically fairways in the woods are 20-40 feet in width. The guidelines also recommend developing a course with two sets of tees to accommodate people of all skill levels. The amount of land needed depends on the style of course. A championship course can sometimes use as much as an acre per hole whereas a recreational course can fit 2-3 holes per acre (PDGA, 2013). Table 2 is a “Disc Golf Course Acreage Guide” that is used to determine the number of acres needed for disc golf courses of different skill levels.

Player Skill Level	Foliage Density	Minimum (P56)		Average (P61)		Championship (P67)		Acre Factor
		Feet	Acres	Feet	Acres	Feet	Acres	
Gold Tees 1000 Rating	Scattered	6,900	26	8,450	32	10,350	39	165
	Average	6,400	18	7,750	22	9,350	27	125
	Corridor	5,900	14	7,150	16	8,650	20	100
Blue Tees 950 Rating	Scattered	5,500	21	6,900	26	8,600	33	165
	Average	5,000	14	6,250	18	7,750	22	125
	Corridor	4,500	10	5,650	13	7,050	16	100
White Tees 900 Rating	Scattered	4,150	16	5,475	21	7,025	27	165
	Average	3,650	10	4,875	14	6,325	18	125
	Corridor	3,550	8	4,575	11	5,825	13	100
Red Tees <850 Rating	Scattered	3,200	12	4,450	17	5,950	23	165
	Average	3,100	9	4,100	12	5,300	15	125
	Corridor	2,600	6	3,525	8	4,675	11	100

Source: PDGA, 2013

Section 2: Hole Count:

The second element addressed by the PDGA Disc golf Course design guidelines is the number of holes on a course. Similar to regular golf, the appropriate number of holes per course is 18. According to the PDGA a 9 hole course is also common. While there are courses with an “odd” number of holes such as 12, 24, or 27 the tradition is that the total number of holes be divisible by three (PDGA, 2013).

Section 3: Length of Course:

The third element is length. As mentioned earlier, the guidelines require a configuration for beginners and recreational players. This usually averages around 250 feet per hole or a total of 4500 feet for an 18 hole course (PDGA, 2013). The preferred overall distance for an 18 hole course is between 3600-4300 feet. The PDGA guidelines state that no hole should be shorter than 120 feet and that 150 feet should be the minimum distance for a hole (PDGA, 2013). Longer configurations can be achieved by the development of alternative tees. To determine the length of a hole, one measures from the front of the tee along the intended flight path to the hole.

Section 4: Hole Notes:

The fourth element specified is hole notes. This section describes specific needs of each individual hole that are not detailed above. Some requirements in this section include the need for each hole to be negotiable for the skill level it is designed for, and by more than one flight path or type of throw (PDGA, 2013). This section also states that there should not be too many objects within a 33 foot radius of each target/hole, and that any objects within this radius should not be too large that a player cannot find an unobstructed flight path to the target/hole (PDGA, 2013). One final stipulation in this section states that the closest hole to the target/hole should not have a flight path over water that is 18 inches deep (PDGA, 2013).

Section 5: Tees:

Section 5 details the PDGA requirements for the tees. The tees are preferred to be made from concrete or asphalt, and are to be 5 feet wide by at least 12 feet long. The maximum size for tees allowed by the PDGA is 6 feet by 18 feet long with the back end flared out to 10 feet wide. In order to save materials, it is recommended that tee boxes are shorter for downhill holes and longer for uphill holes. If tees are not made from concrete, asphalt or any other hard surface, the area should be an even surface without any protruding rocks or roots. These areas should be level from left to right and should not slope sharply from front to back. If there is no hard surface tee box, the front of the tee should be indicated by the front edge of a tee board buried flush with the tee surface area, or by the imaginary line between two flags or stakes. The tee box should have ample room around and in front of the tee so that a player’s follow through is unobstructed. There should be no major obstructions severely blocking the flight path within 20 feet of the tee box. On courses with alternative tees, the tee in the shortest position should be of better or equal quality to those in the longer position. Each different set of tee is to be color coded so as to distinguish between the different skill levels. These colors are as follows: Gold, Blue, White, or Red (PDGA, 2013).

Section 6: Targets:

The next section details the requirements or the targets/holes. This section states that any marked object or post could serve as a target but the basket/chain targets/holes are the preferred format. Homemade targets should not be able to cause injury to players or damage discs. This section also recommends that only 6 of 18 targets should be installed outside of the manufacturer recommended height from ground to rim of basket of 76-88 cm (PDGA, 2013).

Section 7: Signs:

There should be a regulation sign located prior to the first tee. If there is no sign, the regulations should be posted on an information board nearby. Located on each hole there needs to be a sign indicating the direction to the next tee, indications of out of bounds, a permanent sign at each tee box displaying: length(s), hole number, teeing direction, and par for the hole. If a hole has more than one target location, then the current location of the target/hole should be annotated on the tee sign. If possible, try to have a sign at each alternative tee displaying at minimum the hole number and length (PDGA, 2013).

Section 8: Par:

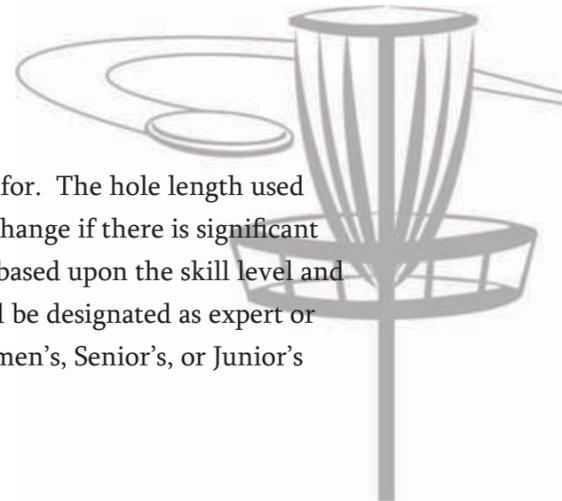
Par need to be set for each hole based upon the skill level that course is designed for. The hole length used to determine par needs to be adjusted up or down based on a 3 to 1 factor for elevation change if there is significant upslope or downslope on the hole. Par should be indicated on scorecards, and tee signs based upon the skill level and the color associated with that skill level. If using less precise estimates of par, par should be designated as expert or pro for the longer tees, and amateur or standard for the shorter tees. Terms such as Women's, Senior's, or Junior's should not be used to describe Par (PDGA, 2013).

Section 9: Layout:

Fairways should not cross, and should be far enough apart so that errant throws are not crossing into other fairways on a regular basis. Fairways should not be located near streets, sidewalks, or private property. Avoid a course layout that will cause blind shots into areas where non-players could be standing. Avoid dangerous foliage, and locate tees and targets far enough from other tees, targets and fairways of other holes. The tee box for the first hole should be closest to the parking area, along with the target for the last hole. If possible locate a middle hole near the parking area to allow for people to play a portion of the course without having to walk a long distance back to the parking area (PDGA, 2013).

Section 10: ADA Compliance:

An effort should be made to make a portion of the disc golf course accessible to those with disabilities to give everyone the opportunity to play disc golf. In some cases, a multiple hole loop that is accessible to those with disabilities is an alternative (PDGA, 2013).



Review of course design specifications:

As a designer and player of disc golf, I have experienced some of the many courses that are already established in NC. Four of the courses that I have played are implemented within existing park infrastructure. These courses include: the Middle Creek Disc Golf Course in Cary, NC; The former East Carolina University Disc Golf Course in Greenville, NC; The new East Carolina University Disc Golf Course; and The West Meadowbrook Park Disc Golf Course in Greenville, NC. From my experience playing these courses, it allows me to better understand the layout of the course.

The Middle Creek Disc Golf Course is located in Cary, NC was designed with the assistance of PDGA Hall of famer Carlton Howard ("Middle Creek 18-hole," 2013). The 18-hole course readily utilizes the topography and vegetation of the area to create obstacles. This golf course is a well balanced mix of holes that are in the woods, in the open, and a combination of both. Spread out through existing park infrastructure including: multi-purpose fields, playgrounds, and a softball complex, this course is an ideal model for the integration of a disc golf course into existing park infrastructure ("Middle Creek 18-hole," 2013).

Very similar to the Middle Creek Course, the West Meadow Brook Park Disc Golf Course in Greenville, NC integrates a disc golf course into existing park infrastructure. This course does not feature the amount of topographical challenges that the Middle Creek course does, but it utilizes the existing park infrastructure and surrounding vegetation to create obstacles and challenges for the players. Like the Middle Creek Course, this course has a balance of holes in the woods, out of the woods, and both in and out of the woods.

Like the West Meadowbrook course, the next two courses are also in Greenville, NC. The former East Carolina University Disc Golf Course was located near Clark Le-Claire Stadium in East Carolina University's athletic complex. This course largely utilized the vegetation of the area to create challenges. This course was known for its 13th hole that was lined by large trees; this course fell into disrepair and was demolished during the development of East Carolina University's new Olympic Sports Complex. This course was replaced and a new course was built at the university's North Recreational Sports Complex. Very similar to the old course in that it largely utilizes vegetation as the majority of its obstacles, however this course is longer and easier to navigate.



Design Procedure:

The design procedure utilized in the development of the Nags Head Disc Golf Course was in three stages. The first stage was a preliminary visit to the location for the proposed disc golf course. The second stage was to integrate design standards from the PDGA. The final stage of the design procedure was the development of a cost analysis.

Preliminary Site Visit:

On January 18, 2013 a site visit was conducted to the proposed location of the disc golf course. The majority of the site is occupied by the ball fields that are managed by the county, and infrastructure such as parking, and bathroom facilities. Adjacent to the site on two sides are residential areas, one already established and one yet to be built. Also adjacent to there are an industrial area and a conservancy area known as Nags Head Woods. After the preliminary site visit, the portion of the site best suited to locate the disc golf course is the wooded strip along the southeastern property line. This area is sparsely wooded with some under growth. According to Elizabeth Teague, the majority of the underbrush can be cleared with the exception of the Live Oak and Bay trees. This restriction limits the use of the area along the Northwestern Property line due to the amount of protected vegetation in the area. One major issue that will need to be dealt with is the barbed wire fence that separates the Nags Head Woods area from the town park. This will become an issue because a portion of the disc golf course is to be located in that area. An additional issue that has come to light in the early portion of the project is size restrictions; the majority of the site is taken up by existing parks and recreation infrastructure. In order to meet the request for an 18 hole disc golf course the holes may need to be shorter than what the PDGA recommends. A solution to this issue could be the recommendation of designing a 12 hole disc golf course utilizing double tees.



Figure 3: (Right) An example of a Disc Golf Course Map. The map depicted shows the layout of the West Meadowbrook Park Disc Golf Course in Greenville, NC

Integrating Design Standards:

The literature used to complete this research falls under three categories. The first category is the information retrieved from the Professional Disc Golf Association and disc golf equipment companies. The three sources that were used were the PDGA website or Professional Disc Golf Association, the DGA website or Disc Golf Association, and the Innova website. The PDGA website was where information regarding the history of disc golf was retrieved. It was also where the technical guidelines were found. This includes the disc golf design guidelines, disc golf acreage guide and other information regarding the design and layout of disc golf courses. Included with the Guidelines and information about the history of disc golf was the study detailing the benefits of disc golf, and other news articles describing the various benefits associated with playing disc golf. The other websites mentioned above, the DGA and Innova websites were the sources for the majority of the information used in the cost analysis. The course options detailed in the cost analysis section came from these websites and served as the basis for determining the cost of the project. The final source of information used in the cost analysis section includes the information on the cost per acre of reconstructed wetlands, and the information regarding the price of playground equipment and site furniture.

The feasibility study for the Nags Head Disc golf course largely consists of two forms of research. The first will be researching information retrieved from the Professional Disc Golf Association and other disc golf organizations and publications, and the second will be site visits. On the PDGA website, they provide a multitude of different forms of information that will aid in the design and development of the disc golf course. The web page includes guidelines for designing disc golf courses, and additional information regarding the history and benefits of disc golf. These sources (listed in the previous section) will aid in the development of the disc golf courses. The second form of research which will be conducted includes site visits. One site visit to the proposed location of the disc golf course has already been completed. In the future other site visits may be completed in order to get feedback on a proposed layout for the course, or to collect more information. The second form of site visit that will be conducted is to visit other courses in the Central and Eastern parts of North Carolina in order to aid in the design of the course.

As mentined previously the expected outcomes for this project will be in two parts. The first part of the project will be the feasibility study of the disc golf course. This will include the existing conditions of the site, and multiple options of the layout of the disc golf course. One option for the layout of the disc golf course will include an option (if feasible) that will be up to tournament quality according to the guidelines set forth by the PDGA. Some of the requirements for the design of the disc golf course set forth by the Town of Nags Head include: an 18 hole course, preferably in a loop, the possible inclusion of putting greens, and the inclusion of a reconstructed wetland. The second portion of the project will be a supplemental report describing the development of the disc golf course. This will include a cost estimate for the baskets, construction of the tee boxes, and many other ancillary costs associated with the project. Also included in this section will be the research gathered from my site visits to the proposed location of the disc golf course and other disc golf courses in the region, and research conducted on the benefits and effects of disc golf courses. The Town of Nags Head has also made a request to answer questions included in a Dare County Tourism Grant that will help account for some of the costs related to the project.



Cost Analysis:

There are two major manufacturers of disc golf equipment need to establish a disc golf course. The first is the Disc Golf Association. They offer multiple packages that are aimed at presenting numerous possibilities for course configurations. The DGA provides information for three different course configurations.

The first configuration is an entry level course. The DGA describes this course as “Geared towards churches, camps, and schools the Basic Disc Golf Course features either 9 or 18 Mach II or Mach V Disc Pole Holes and a rules sign” (DGA, 2013, p. 9). The second course option which is called the Advanced Course is described as a course ideal for the local community and an attraction for players from out of town (DGA, 2013). The third and final option is the championship option. This option according to the DGA is ideal for professional tournaments, large universities, and corporate campuses (DGA, 2013). The following tables show a cost break down for the different course configurations.

Equipment	9-Hole		18-Hole	
Mach New II	Mach New II (no frills)	\$2,295.00	\$4,590.00	
	Rules Sign	\$60.00	\$60.00	
	Grand Total	\$2,355.00	\$4,650.00	
Mach V	Mach V (no frills)	\$2,925.00	\$5,850.00	
	Rules Sign	\$60.00	\$60.00	
	Grand Total	\$2,985.00	\$5,910.00	

Source: DGA, 2013, 9. 08

Equipment	9-Hole		18-Hole	
Mach New II	Mach New II (no frills)	\$2,295.00	\$4,560.00	
	Practice Basket	\$255.00	\$255.00	
	Standard Tee Signs	\$540.00	\$1,080.00	
	Rules Sign	\$60.00	\$60.00	
	Grand Total	\$3,150.00	\$5,955.00	
Mach V	Mach V (no frills)	\$2,925.00	\$5,850.00	
	Practice Basket	\$325.00	\$325.00	
	Standard Tee Signs	\$540.00	\$1,080.00	
	Rules Sign	\$60.00	\$60.00	
	Grand Total	\$3,850.00	\$7,315.00	
Mach III	Mach III (no frills)	\$3,330.00	\$6,660.00	
	Practice Basket	\$385.00	\$385.00	
	Standard Tee Signs	\$540.00	\$1,080.00	
	Rules Sign	\$60.00	\$60.00	
	Grand Total	\$4,450.00	\$8,455.00	

Source: DGA, 2013, p. 09

Equipment	9-Hole		18-Hole	
Mach V	Mach V Deluxe	\$3,330.00	\$6,660.00	
	Practice Basket	\$370.00	\$370.00	
	Number Plate Conversion	\$270.00	\$540.00	
	Sponsor Tee Sign	\$945.00	\$1,890.00	
	Rules Sign	\$60.00	\$60.00	
	Grand Total	\$4,975.00	\$9,520.00	
Mach III	Mach III Deluxe	\$3,780.00	\$7,560.00	
	Practice Basket	\$420.00	\$420.00	
	Sponsor Tee Sign	\$945.00	\$1,890.00	
	Rules Sign	\$60.00	\$60.00	
	Grand Total	\$5,205.00	\$9,930.00	

Source: DGA, 2013, p. 10



Design Procedure Continued

Similarly to the DGA another disc golf company, Innova, also provides customers with a general idea of cost. The like the DGA have compiled a group of Disc Golf course Packages to aid in the determining of cost. The Innova Company has developed four course packages that present four different course configurations. The first course package is the Eco Course Package. The Eco Course is described as a “no-frills option that is both economical and ecological” (Innova Disc Golf, 2013). This course represents the bare minimum for a disc golf course. It is a low impact option because the baskets are the only permanent additions to the land (Innova Disc Golf, 2013). The following table shows the costs for the Eco Course option from Innova:

	9-Hole	18-Hole
DISCatcher Pro 28	\$2,925.00	\$5,580.00
Freight	\$350.00	\$700.00
Grand Total	\$3,275.00	\$6,550.00

Source: Innova Disc Golf, 2013

The second course option in the Basic Course, this option is described as “ideal for towns, camps, and schools looking for an economical disc golf solution” (Innova Disc Golf, 2013). The cost estimate for this course option is as follows:

	9-Hole	18-Hole
DISCatcher Pro 28	\$2,925.00	\$5,850.00
INNOsign Tee Signs	\$360.00	\$720.00
INNOsign Rules Sign	\$40.00	\$40.00
Freight	\$350.00	\$700.00
Grand Total	\$3,675.00	\$7,310.00

Source: Innova Disc Golf, 2013

The third option is the Deluxe Course option. This course has more amenities than that of the Basic Course. The following table shows the cost estimate for Innova’s Deluxe Course option:

	9-Hole	18-Hole
DISCatcher Pro 28	\$2,925.00	\$5,850.00
INNOsign Tee Signs	\$360.00	\$720.00
INNOsign Rules Sign	\$40.00	\$40.00
Practice Target	\$325.00	\$325.00
Freight	\$390.00	\$740.00
Equipment Total	\$4,040.00	\$7,675.00
Option Costs		
Concrete Tees	\$1,800.00	\$3,600.00
Course Design	\$2,700.00	\$5,400.00
Install Materials	\$330.00	\$660.00
Option Total	\$4,830.00	\$9,660.00
Project Total	\$8,805.00	\$17,270.00

Source: Innova Disc Golf, 2013



Design Procedure Concluded

The final course option from the Innova Company is the Championship Course package. This course is aimed at “large, high profile parks, college campuses, and corporate grounds” (Innova Disc Golf, 2013). This option is the most expensive and has the most amenities. The cost estimate for the Championship Course is listed in the following table:

	9-Hole	18-Hole
DISCatcher Pro 28	\$2,925.00	\$5,850.00
INNOsign Tee Signs	\$360.00	\$720.00
INNOsign Rules Sign	\$40.00	\$40.00
Practice Target	\$325.00	\$325.00
Freight	\$390.00	\$740.00
Equipment Total	\$4,040.00	\$7,675.00
Option Costs		
Concrete Tees	\$1,800.00	\$3,600.00
Course Design	\$2,700.00	\$5,400.00
Install Materials	\$330.00	\$720.00
Alternate Tees	\$1,800.00	\$3,600.00
Alternate Tee Signs	\$360.00	\$720.00
Option Total	\$6,900.00	\$13,980.00
Project Total	\$10,990.00	\$21,615.00

Source: Innova Disc Golf, 2013

Other costs that will be associated with this project include will be the inclusion of benches, a playground, and the Town of Nags Head has also requested that reconstructed wetlands be researched as a solution to a flooding issue. The playground that is to be put in place at the proposed disc golf course site could range anywhere from \$3,000.00 to over \$100,000.00 (Gametime, 2013). The benches are also a variable cost in that the cost per bench will determine the total amount. The reconstructed wetlands are estimated to cost anywhere from \$3,500.00 to \$80,000.00 per acre (White). The amount per acre depends on how complicated the wetlands are, along with other variables such as the amount of soil replaced, the amount grading that is needed, and the amount of trees and shrubs that need to be planted (White). Without the addition of the playground, benches, and wetlands the overall total capital needed to complete the Nags Head Disc Golf Course could range from \$5,000.00 to over \$20,000.00.



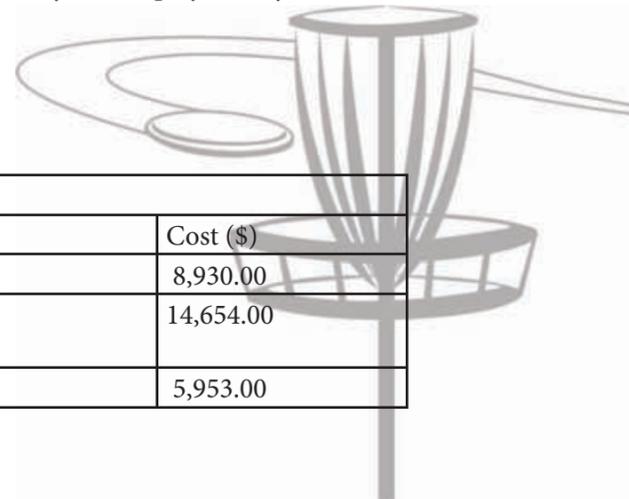
Conclusions and Recommendations:

Based upon the research conducted during the feasibility study, I have determined that of the three proposed layouts for the Nags Head Disc golf course that a basic course configuration would be the best option for the Town of Nags Head. Due to the nature of the site, I recommend that the Town of Nags Head choose to install the Basic Course options offered by both the DGA and Innova Disc Golf. This will minimize the initial cost of the project, and allow for expansion as the course attracts more people. Along with the implementation of a basic course, I also recommend the use of non-permanent tees and baskets for the initial few months the course is open, this will allow for changes to the course layout before the hole and tee placement becomes permanent. Overall the project will cost at minimum approximately \$7,130.00 for the Tee Signs, Rules Sign, Baskets, and freight. This accompanied by the approximate \$1,440.00 for the basket installation, and \$360.00 for the signage installation. This will bring the total cost for the Disc Golf Course to approximately \$8,930.00. This estimate does not include the cost of the playground, site furniture such as benches and trashcans, and the cost of the reconstructed wetland. With the development of this disc golf course, the Town of Nags Head will a have developed a new recreational activity that is playable by all ages, that will attract people to the town.

Summary of Results:

Table 10: Summary of Feasibility Study

No.	Description	Length (mean)	Acreage (mean)	Par	Cost (\$)
1	18-Hole Basic Configuration	4,537.5 Feet	13.67 Acres	56	8,930.00
2	18-Hole Championship Configuration	7,237.5 Feet	22.00 Acres	67	14,654.00
3	12-Hole Basic Configuration	3,025.0 Feet	9.11 Acres	44	5,953.00



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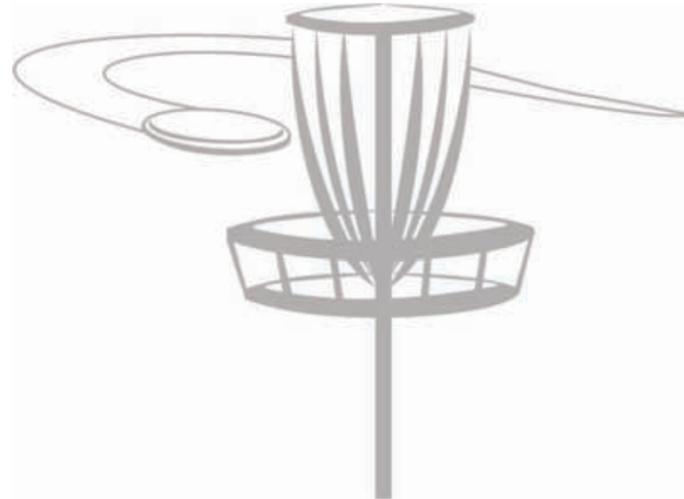
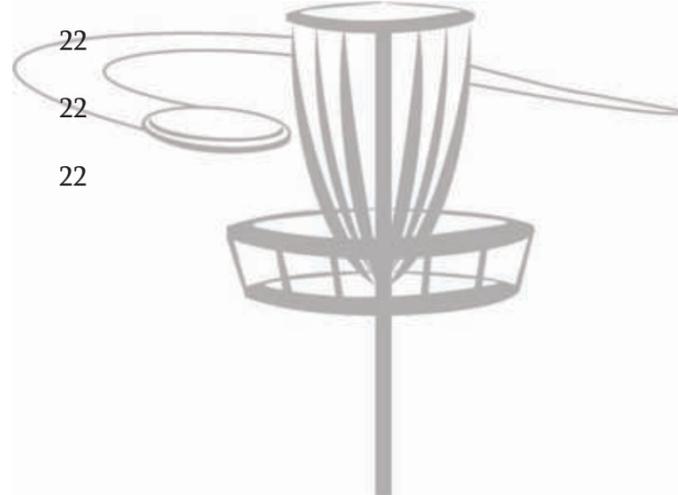


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Glossary of Disc Golf Terminology:

Ace - known as a hole in one in ball golf. An ace occurs when a player makes their first shot, or drive, into the basket. One of the unique practices in disc golf is to have all participants in the ace group or all spectators sign the “ace disc.” Aces are more common in disc golf than ball golf as the top pros boast as many as 100+ aces in their careers.

Anhyzer - A disc’s flight arc that fades to the right for a right-handed backhand throw.

Birdie - Completing a hole one stroke under par.

Approach - usually the second shot of a hole, designed to place the disc within putting distance.

Drive - any throw off of the tee pad, or a throw from the fairway designed for maximum distance.

Driver - A disc designed for fast, long-distance flight. The driver is the most difficult to control.

Hyzer - A disc’s flight arc that fades to the left for the right-handed backhand throw.

Lie - the spot where the disc comes to rest. This is often marked by a mini-disc marker.

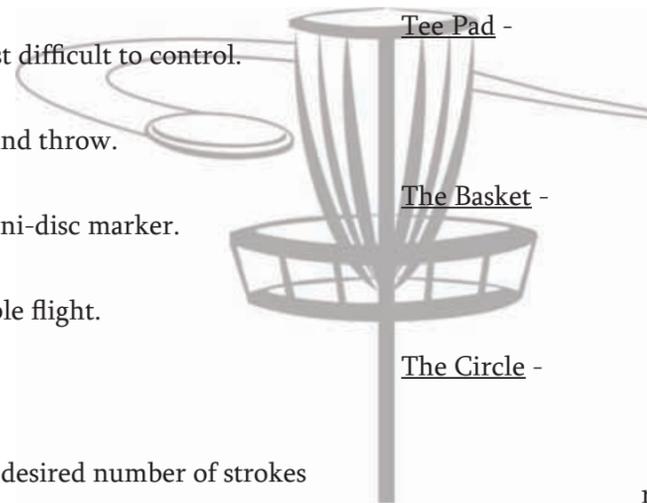
Mid-range - A mid-range disc is a driver disc designed for slower and more stable flight.

Mini / Marker - A small disc used to mark a player’s lie.

Par - like in ball golf, each disc golf hole has a posted par. The par is the desired number of strokes that a player would need to complete the hole. To the competitive disc golfer, every hole is a par three, making the total par for 18 holes always 54. This serves to simplify the game.

Pole hole or basket - The target for catching the disc. Pole Hole is short for Disc Pole Hole.

Putt - The final throw(s) of the hole aimed at getting your disc to come to rest in the trapper basket. Any throw within the circle (10 meter radius).



Putter - Putters or Putt and Approach discs are designed for short-distance and stable flight. Usually used within the circle.

Roller - A rolling disc advance (e.g., the disc rolls along the ground).

Stability - Stable: Flying straight; when released flat, a disc has a tendency to fly straight.

Understable - when released flat, a disc has a tendency to fly right.

Overstable - when released flat, a disc has a tendency to fly left. (When thrown the right arm and back handed.)

Tee Pad - The location or designated area in which the first throw of the golf hole is suppose to take place from. Tee Pads are typically be made of concrete or rubber. A portion of a side walk or a utility marker flag or spray painted box may also be used as a tee pad.

The Basket - Born of the original pole hole, the game of disc golf advanced rapidly with the invention of “Steady” Ed’s Disc Pole Hole or “Basket” as it is commonly referred to by disc golfers. Once a disc comes to rest in the basket, the hole is considered complete.

The Circle - This is what helps defines a true disc golf putt. If a player is throwing his/her disc at the basket with in a 10 Meter or 30 Ft circle of the basket, they must follow an additional set of putting rules defined by the PDGA. Basically if you’re in the circle, your disc has to come to rest in the basket before any part of your body touches past the mini marker towards the basket. Failure to do so can lead to a “falling putt” penalty stroke.

Throw - The act of advancing the disc towards the basket. This can be accomplished by many different throwing styles; Backhand, Forehand, Rollers. Each throw is counted towards the player’s score.

Tomahawk - An overhand throw at a vertical angle.

Appendix B: Disc Golf Course Design

Course Specifications:

- Total Length: 3,773 Feet
- Par: 56
- Number of Par 3: 16
- Number of Par 4: 2

Course Features:

- Two Basket Putting Area
- Constructed Wetlands
- Playground Area

Estimated Total Cost:

\$20,908.50 to \$135,733.00*

* Cost estimate includes the cost of playground equipment and constructed wetlands which varies by size and complexity.

Legend:

-  Tee Boxes
-  Baskets
-  Flight Path



Nags Head Disc Golf Course:

1)	200 Feet	Par 3	4)	250 Feet	Par 3	7)	150 Feet	Par 3	10)	180 Feet	Par 3	13)	175 Feet	Par 3	16)	225 Feet	Par 3
2)	150 Feet	Par 3	5)	184 Feet	Par 3	8)	175 Feet	Par 3	11)	244 Feet	Par 3	14)	180 Feet	Par 3	17)	300 Feet	Par 4
3)	230 Feet	Par 3	6)	300 Feet	Par 4	9)	205 Feet	Par 3	12)	150 Feet	Par 3	15)	250 Feet	Par 3	18)	225 Feet	Par 3

PDGA Disc Golf Course Design Recommendations

The PDGA does not design nor certify course installations. These recommendations share best practices developed by experienced course designers over 35 years of development, refinement and play.



Disc Golf Course Design Goals

1. Satisfy the design requirements of the people and organizations who approve use of the land and fund the equipment for the course. That includes meeting local, state and federal construction and safety requirements.
2. Design the course to have sufficient visibility of players, pedestrians and vehicles who may pass near or through it.
3. Design course with the potential for multiple configurations to serve not only beginners but players with advanced skills; consistent with the budget and design needs in Goal 1 above.
4. Design a well balanced course with a wide range of hole lengths and a good mixture of holes requiring controlled left, right and straight throws.
5. Utilize elevation changes and available foliage as well as possible. Take care to minimize potential damage to foliage and reduce the chances for erosion.

Course Design Assistance

There are several documents available on the PDGA website to help with course design at: www.pdga.com/course-development. There are additional design resources available online, primarily at the websites of basket manufacturers. Contact information for manufacturers of PDGA approved targets can be found in this area: www.pdga.com/tech-standards. Course design has gotten more sophisticated over the years and there's nothing like seeking experienced design help from qualified individuals. Experienced designers can be well worth their fees by guiding clients thru the process, recommending cost effective processes and equipment alternatives, and perhaps most important, reducing chances for visibility and interference related problems. This document can help you select a designer: www.pdga.com/documents/choosing-a-course-designer and a resource to find experienced designers is here: <http://www.discgolfcoursedesigners.org/discgolfwiki>. Consider contacting the PDGA office: office@pdga.com to locate qualified designers in your area if you still need assistance.

Course Design Elements

1. SPACE: The first decision is to determine what type of course you would like to develop and whether enough space is available for that type of course. The amount of space available can sometimes depend on whether brush and trees can be removed to create fairways. Ideally, a well balanced course has a mixture of holes that go completely thru the woods, partially thru woods and mostly in the open. Typically, fairways in the woods range from 20-40 feet wide. This usually means that some larger trees sometimes need to be removed to create fair flight paths.

Most new courses are being developed with two sets of tees to better serve the different skill levels of players in the community, even if both sets aren't installed right away due to budget constraints. Four levels of player skills (Gold, Blue, White and Red) have been defined with design guidelines for each level (see www.pdga.com/documents/design-skill-level-guidelines). Public courses are usually designed with a combination of Blue & Red or White & Red tees to meet the needs of most players.

Well developed disc golf markets and private facilities can sometimes justify installing a few of the longest, most challenging courses that include Gold tees for the highest level of players, although it still makes sense to install a set of shorter tees for White or Red level players.

A full length Championship course can require more than one acre per hole depending on foliage density (more trees, less acreage required). However, a small recreational course can sometimes fit 2-3 holes per acre depending on terrain. (Read the document on Acreage Guidelines for more detailed information at www.pdga.com/documents/course-design-acreage-guide)

2. HOLE COUNT: Most courses are either 9 or 18 holes. There are several with 12, 24 or 27 holes. Tradition appears to dictate that the number of holes be divisible by 3. It's better to install a well designed, dual tee 12-hole course than it is to install a cramped 18-hole course on the same piece of land.

3. LENGTH: Most courses should have at least one configuration for beginners and casual recreational players that rarely averages more than 250 feet per Par 3 hole (75 meters). This works out to a maximum of 4500 ft (1350m) for an 18-hole Par 54 course or 2250 feet (675m) for a 9-hole Par 27 course. The shortest length range is 3600-4300 feet (1080-1290m) for a land constrained 18-hole Par 3 public course. No hole should be shorter than 120 feet (35m) even on courses for beginners, but 150 feet (45m) is the "normal" low end limit. If land is available, recreational courses should have several par 4 holes and even a par 5 hole for the beginner skill levels which would get the course in low 5000s overall footage range.

Longer configurations are achieved by installing another set of tees and/or target positions on most holes. Typical 18-hole course setups for amateur White level players range from 4500-6000 feet (1350-1800m). Course setups longer than 6000 feet (1800m) ranging up to 10,000 feet are primarily for better players at the Blue or Gold level, and for tournament play. These courses should again have several par 4s and even a par 5 or two as land is available. There is no maximum length allowed for a hole. The longest holes in the world can get to 1500 feet (458m). See document: Course Design Guidelines for PDGA Skill Levels & Divisions.

Hole length is measured from the front of the tee to the target along the fairway route the designer intended players of that skill level to throw. In the case of doglegs or water carries, the only time the straight line, crow flies, measurement should be used is if the designer intended players of that skill level to be able to throw over the tree tops to shorten the dogleg or throw straight over the water.

4. HOLE NOTES: There should be at least one flight path that can be negotiated at the skill level the route is designed for. There should be more than one flight path or type of throw (including rollers) available on several of the holes. There should not be too many objects within 33 ft (10m) of each target. An object near the target should never be so large that a player cannot find an unobstructed flight path by stretching sideways, throwing from a low stance, throwing through or over the top of the object.

No player throwing from the shortest (or only) tee on a hole should ever be "forced" to throw over water that is normally greater than 18" deep (50cm). Design an alternate flight path (usually to the left) that gives player the option to not cross water. Any normally dry trenches or bodies of water under 18" deep that are regularly in play should have appropriate paths down and out to be able to throw and/or retrieve discs.



5. TEES: Hard surface tee pads of textured cement or asphalt are preferred. Preferred size is 5 ft wide by at least 12 ft long (1.8x3m). Maximum size is 6 ft wide by 18 ft long with the back end flaring out to 10 feet wide. If you need to conserve materials, make tee pads shorter on short or downhill holes and longer on long holes. For example, a hard surfaced tee pad at the top of a hill on a short hole might only need to be 8 ft long because most players will just stand at the front edge of the tee to make their throws.

Non-hard surface tee areas should be even surfaced and not contain protruding rocks or roots. Tee areas should be level from left to right. They should not slope too sharply from front to back. Without hard surfaced or rubber tee pad, the front edge of tee area must be indicated by the front edge of a tee board buried flush in the ground or by the imaginary line between two stakes or flags that mark the front edge.

Beyond the front of each tee pad and either side should be adequate room for follow-thru so a player doesn't risk twisting an ankle, falling off a ledge or whacking their arm on a tree or sign. If possible, provide adequate level ground for a run-up behind each tee pad, especially on longer holes. Avoid major obstructions that severely block the flight path up to 20 feet in front of tee.

On courses with alternate tees on some holes, the tee areas in the shorter positions should always be better or at least equal in quality to those in longer positions. For example, avoid designs where the long tee pads are cement and short tee pads are grass or dirt, especially when there are no tee signs.

The designated color for each set of tees used for course layout identification on scorecards should match one of the four recognized player skill levels that set of tees was designed for: Gold, Blue, White or Red. Sometimes there's no room for two tees on every hole. Just make sure to mark each tee on single tee holes with both colors.

Course managers are encouraged to move toward these color guidelines when the opportunity presents itself for new installations, redesigns or course upgrades when their current color(s) do not match the PDGA guidelines.

6. TARGETS: Any marked object or post could serve as a target but the basket/chain style are preferred. Make sure homemade targets do not have sharp edges to injure players or damage discs. Locally fabricated targets for sale or to be installed on public land must not have elements that violate any target manufacturers' patents. Higher tier PDGA sanctioned events are expected and sometimes required to use better and more consistent target models. PDGA approved targets at the Basic, Standard and Championship levels are listed here: www.pdga.com/tech-standards

Manufacturers are required to produce targets so the height of the basket rim above the playing surface will be 82 cm +/- 6 cm. However, course developers may install some targets where the height falls outside the 76-88 cm manufacturing range. The PDGA Course Committee suggests that no more than 6 targets out of 18 be installed outside the manufactured height range with just 2 or 3 being preferred. Targets suspended from above can be fun for recreational play but there should be a way to secure it from swinging freely during sanctioned play.

7. SIGNS: Install a rules sign prominently before the first tee or post the rules on an information board (if there is one). Signs or marker arrows on or near each target should indicate the direction to next tee (as needed). Signs should indicate Out-of-Bounds (OB) boundaries and any other areas players should avoid. Ideally, the OB lines bordering non-uniform boundaries like water/grass or gravel/grass should be identified with markers flush with the ground or stakes if possible.

The primary tee on each hole should have permanent signs indicating the hole number, length(s), teeing direction (if needed) and par for that skill level (see next section). When a hole has more than one target location, it's helpful if the current location can be identified on the sign. Try to have some sort of sign at the alternate tee positions even if it's just the hole number and length.

8. PAR: Par should be set for each tee/basket position combination on a hole based on the player skill level they were designed for. www.pdga.com/documents/design-skill-level-guidelines provides assistance to determine pars. This document: www.pdga.com/documents/par-guidelines provides a more specific way to determine par based on length and foliage elements of holes for each player skill level. The hole length used to determine par (not for the signs) should be adjusted up or down based on a 3-to-1 factor (i.e. 30 feet adjustment for every 10 feet elevation change) if the hole has a significant upslope or downslope.

So players know what standard has been used for par, it should be indicated on scorecards and tee signs as Blue Par or Red Par, which hopefully matches the tee color(s) used. When less precise estimates are used to determine par (i.e., not using color skill levels), use the terms Expert or Pro Par for longer tees and Standard or Amateur Par for shorter tees. The terms Womens, Seniors or Junior tees should not be used.

9. LAYOUT: Fairways should not cross one another and should be far enough apart so errant throws aren't constantly in the wrong fairway. Fairways should not cross or be too close to public streets, sidewalks or too near private property and other busy areas where non-players congregate. Absolutely avoid designs where players might throw into blind areas where non-players could be walking on a well-defined park pathway. Avoid hazardous areas such as swamps and thorny or poisonous foliage. Tees and targets should be far enough from the targets and fairways of other holes.

The tee for the first hole should be the closest to the regular parking area. The target for the last hole should not be too far from the parking area and relatively close to the first tee. If possible, try to locate at least one other hole in the middle of course near the parking area. Try to minimize the amount of walking between holes while keeping paths as much out of other fairways as possible.

10. ADA COMPLIANCE: Sections of many disc golf courses are accessible to many people with a disability other than wheelchair bound. With the exception of some disc golf courses on ball golf courses, carts are not utilized as a regular part of the disc golf game. The normal challenges presented by the sometimes rough terrain utilized for courses make it unrealistic to accommodate everyone on every hole. Unlike golf where golf carts and constructing a 48" cart path throughout the course are common, the cost of a similar path on disc golf courses would be an undue cost burden in relation to the typical budget for installing courses and never be used by carts. Efforts can and have been made to provide an opportunity for those with disabilities to play at least some holes, even if not all holes are easily accessible. In some cases, designing a multiple hole loop on part of the course may provide that opportunity.

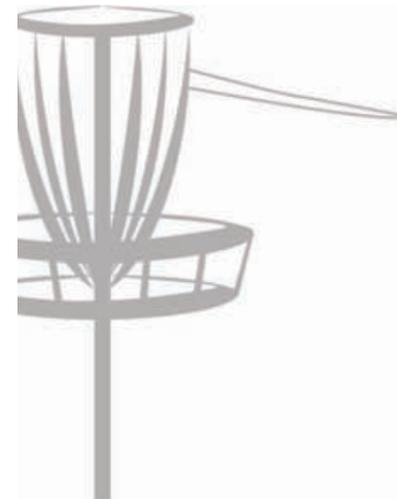
March 4, 2013

Original Document can be found at:

http://www.pdga.com/files/documents/PDGA_Course_Design_Guides_March_2013d.pdf

Disc Golf Course Acreage Guide

Player Skill Level	Foliage Density	Minimum (P56)*		Average (P61)		Championship (P67)		Acre Factor
		16-Par 3, 2-Par 4		12-P3, 5-P4, 1-P5		8-P3, 7-P4, 3-P5		
		Feet	Acres	Feet	Acres	Feet	Acres	
Gold Tees 1000 Rating	Scattered	6900	26	8450	32	10350	39	165
	Average	6400	18	7750	22	9350	27	125
	Corridor	5900	14	7150	16	8650	20	100
Blue Tees 950 Rating	Scattered	5500	21	6900	26	8600	33	165
	Average	5000	14	6250	18	7750	22	125
	Corridor	4500	10	5650	13	7050	16	100
White Tees 900 Rating	Scattered	4150	16	5475	21	7025	27	165
	Average	3650	10	4875	14	6325	18	125
	Corridor	3550	8	4575	11	5825	13	100
Red Tees <850 Rating	Scattered	3200	12	4450	17	5950	23	165
	Average	3100	9	4100	12	5300	15	125
	Corridor	2600	6	3525	8	4675	11	100



* (P56) = estimated course par for that player level

Original Document can be found at:

<http://www.pdga.com/files/documents/AcreageChart.pdf>

Determining Par for Each Tee Color Based on Hole Length and Foliage Density

		Foliage																																			
		160	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	925	950	975	1000	1100
Gold Tees 1000 Rating	Light	Par 2				PAR 3										PAR 4					PAR 5																
	Heavy	Par 2	PAR 3								PAR 4					PAR 5			Par 6																		
Blue Tees 950 Rating	Light	Par 2	PAR 3							PAR 4								PAR 5																			
	Heavy	PAR 3					PAR 4					PAR 5					PAR 6																				
White Tees 900 Rating	Light	PAR 3						PAR 4									PAR 5				Par 6																
	Heavy	PAR 3				PAR 4					PAR 5					PAR 6																					
Red Tees 850 Rating	Light	PAR 3					PAR 4					PAR 5																									
	Heavy	PAR 3			PAR 4					PAR 5																											
Foliage		160	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	925	950	975	1000	1100

 Designing Par 2 holes is not recommended. The lengths are shown as cautionary indicators that a hole is likely too short for that player level.

Original Document can be found at:

<http://www.pdga.com/files/documents/ParGuidelines.pdf>

PDGA Course Design Guidelines for each Player Skill Level **February 2009**

Element	All Divisions			
General Principles	<p>In Pro events, the Men's Open & Masters criteria should be the primary guidelines for design since they typically account for 3/4 of the field. At Am events, the Advanced Men criteria should be the primary design elements. For many courses, it will not be necessary to have alternate course configurations for each division group indicated below except sometimes for the very skilled and youngest groups. However, a course with several holes: (a) requiring significant power to throw across water or valleys, (b) long throws to forced doglegs or, (c) long throws through rocky terrain to reach a desired landing area, is a candidate for alternate tee or pin placements appropriate for the division groups as shown below. If it appears you need to have at least one hole with a different setup, try and plan for at least 4-5 different holes for a lower-division group, even some which may be longer if the lengths are appropriate for that group. Different setups on just 1 or 2 holes might get missed by some groups. EM&A in 5 different holes will put divisions on alert to check that they are playing the right setup on each hole.</p>			
Par	<p>Courses will typically have pars marked on tee signs varying from 3 to 5. For sanctioned events, it's necessary to indicate pars on the event flyer for all holes to provide for the proper penalty if a player is late. For tournament play, holes from the Gold or Blue tees up to 3500 feet will be usually par 3 based on their difficulty. Holes with effective lengths over 3000 feet are candidates for par 4s and holes over 4000 feet are candidates for par 5s. There are a handful of par 6 holes in the World over 1200 feet. Some challenging holes in heavy woods could have a par higher than 3 or 4 even if they aren't as long as the reference lengths stated above. Not every length is good for all divisions. There are certain lengths that are better than others depending on the skill level intended to play the hole. For example, holes where most players in a division level would likely struggle the same some probably should be lengthened, shortened or lengthened to provide a better challenge to speed their scores.</p>			
Signs	<p>All divisions, the hole number and length(s) should be indicated either on a sign or printed on the tee pad, board or marking stone. On uncut courses and blind holes, it's valuable to indicate the flight path(s). If the hole has multiple pin placements, their locations should be indicated on the sign. If all placements are blind on a hole, a compass rose to indicate on the sign where the pin is located that would be useful. Make sure there are appropriate signs at all tees being used. A week prior to tournament time, it can be helpful to print notices on the ground directing players to the next tee, especially on courses with temporary tees or routing for an event with many out-of-town players expected. If possible, provide some form of primary markers such as paint, ribbon or posts indicating distance from the located vicinity of the 100' and 200' positions.</p>			
Tee Pads	<p>Mostly the tee pads should all be the same type (i.e. all natural grass/soil or all hard surface). If pavement, make them near 5'x22' with some pads longer on long holes. Consider making tee pads even wider at the back.</p>			
Ratings	Gold tees: Over 969 rating	Blue tees: Over 924 rating	White tees: Over 874 rating	Red tees: Under 875 rating
Majors Am Majors Pro	MA1 MPO & MPM	MM1, MJ1, MJ2 FPO, MPG, MPS	FW1, MA2, MG1, MS1 FPM	FW2-3, FJ1-4, MA3-4, MJ3-4 FPG, FPS, FPL, MPL
Daily Am Daily Pro	Open (if tees available)	Advanced Open, Master & Grandmaster	MM1, MA2, MJ1 & MJ2 Open Women & Sr GM	All Females & other Males Women over 39 & Legends
Effective Length*	<p>The effective lengths for reachable holes typically range from 230 - 350 feet. Ideally several holes will be over 500 feet with a few over 600 feet. Courses are usually over 7000 feet for 18 holes. A Majors course layout should ideally have a Scratch Scoring Average at least 58.</p>	<p>The effective lengths for reachable holes typically range from 165 - 310 feet. There should be several holes over 400 feet with a few over 700 feet. Courses will typically be over 5000 feet for 18 holes.</p>	<p>The effective lengths for reachable holes range from 150 - 270 feet. There should be several holes over 375 feet, some which likely are par 4. Course length will typically be under 4000 feet for 18 holes. If they're the shorter tees on a Gold course, the length could be up to 6000 feet.</p>	<p>The effective lengths for reachable holes typically range from 130 - 200 feet. There should be some holes over 325 feet, which might be considered par 4. The total course length will typically be under 3000 feet for 18 holes.</p>
Approach Throws	<p>The lengths for open approach throws range from 150-250 feet with a minimum of 300 feet from the desired landing area. More constrained approaches range from 100-225 feet.</p>	<p>The lengths for open approach throws should range from 120-240 feet with a minimum of 255 feet from the desired landing area. Relatively constrained approaches range from 80-200 feet.</p>	<p>Approach throws should typically range from 90-180 feet with a minimum of 230 feet from the desired landing area. Relatively constrained approaches range from 65-135 feet.</p>	<p>Approach throws should typically range from 70-140 feet with a minimum of 165 feet from the desired landing area. Relatively constrained approaches range from 50-120 feet.</p>
Water & Doglegs	<p>Players should ideally be given the option to throw around water. However, if the terrain forces a throw across water, the far side of the water should be no more than 265 feet (effective length) from the landmark. A player should not be forced to make an open throw over 255 feet (effective length) from the tee to the corner of a dogleg where a shorter throw will not allow the player to reach the basket (or next landing area) with a good next throw.</p>	<p>Players should ideally be given the option to throw around water. However, if the terrain forces a throw across water, the far side of the water should be no more than 230 feet (effective length) from the landmark. A player should not be forced to throw over 250 feet (effective length) from the tee to the corner of a dogleg where a shorter throw will not allow the player to reach the basket (or next landing area) with a good next throw.</p>	<p>Design an alternate flight path where this route does not cross water. A player should not be forced to throw more than 200 feet (effective length) from the tee to reach the corner on a dogleg hole where a throw any shorter will not allow the player to reach the basket (or next landing area) with a good next throw.</p>	<p>Design an alternate flight path where this route does not cross water. A player should not be forced to throw more than 170 feet (effective length) from the tee to reach the corner on a dogleg hole where a throw any shorter will not allow the player to reach the basket (or next landing area) with a good next throw.</p>

* The Effective Length is a hole's measured length (by laser, tape, flight/PSI or other) plus or minus the elevation adjustment. The elevation adjustment is calculated by taking the vertical elevation change, multiplying it by 3, then adding it to the hole's measured length for aqueducts and subtract it for down-slopes to calculate a hole's effective length.

Original Document can be found at:

http://www.pdga.com/files/documents/PDGA_Skill_Guides_2009.pdf

Appendix D: Cost Analysis

Disc Pole Holes			
Item	Cost per Item (\$)	Amount	Total (\$)
DGA Mach V*	325.00	18	5,850.00
Locking Collar Assembly	15.00	18	270.00
Anchor Assembly	25.00	18	450.00
Concrete (Approx. 1 cu. ft. per hole)	4.00	18	72.00
Total			6,642.00
Tee Pads			
Concrete (Approx. 34, 60 lbs. Bags)	68.00	18	1,224.00
Forms	12.00	18	216.00
Total			1,440.00
Tee Signs			
Standard Tee Signs	60.00	18	1,080.00
Concrete (Approx. 1 cu. ft. per hole)	4.00	18	72.00
Total Tee Sign Costs:			1,152.00
Message Board and Trash Cans			
Message Board	200.00	1	200.00
Trash Cans	30.00	18	540.00
Total			740.00
Installation Labor Estimates @ \$20 per hour			
Baskets (4 hours each) 72 hrs.	20.00	72	1,440.00
Tee Pads (8 hours each) 144 hrs.	20.00	144	2,880.00
Signage (1 hour each) 18 hrs.	20.00	18	360.00
Total			4,680.00
Summary Totals			
Baskets			6,642.00
Tee Pads			1,440.00
Tee Signs			1,512.00
Message Boards and Trash Cans			740.00
Installation Labor			4,680.00
Total Estimated Costs			
Total Estimated Costs			14,654.00

Source: DGA, 2013, p. 07

Item	Cost per Item (\$)	Amount	Total (\$)
Disc Golf Baskets			
DISCatcher Pro 28	325.00	18	5,850.00
Locking Collar Assembly	15.00	18	270.00
Anchor Assembly	25.00	18	450.00
Concrete (1 cu. ft. per hole)	4.00	18	72.00
Total			6,642.00
Tee Pads			
Concrete (34, 60 lbs. Bags)	68.00	18	1,224.00
Forms	12.00	18	216.00
Total			1,440.00
Signage			
INNOsign Tee Signs	40.00	18	720.00
INNOsign Rule Sign	40.00	1	40.00
Concrete (1 cu. ft. per Hole)	4.00	18	72.00
Total			832.00
Freight			
Total Freight			700.00
Site Features			
Playground Area*	3,000.00-100,000.00	1	3,000.00-100,000.00
Constructed Wetlands**	3,500.00-80,00.00	.233	815.50-18,640.00
Total			3,815.50-118,640.00
Auxiliary Items			
DISCatcher Traveler	129.00	18	2,322.00
Tee Markers	13.25	36	477.00
Total			2,799.00
Installation Labor Estimates @ \$20 per hour			
Baskets (4 hours each) 72 hrs.	20.00	72	1,440.00
Tee Pads (8 hours each) 144 hrs.	20.00	144	2,880.00
Signage (1 hour each) 18 hrs.	20.00	18	360.00
Total			4,680.00
Total Estimated Cost			
Total			20,908.50-135,733.00

Source: Innova Disc Golf, 2013

* price of constructed wetlands is determined by the complexity of the wetland

** price of playground ranges from \$3,00.00 for a toddler play space to \$100,000.00 for large play areas

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Introduction:

- Retrieved From: <http://www.snowbasin.com/mountain/discgolf/>

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- Retrieved From: http://www.visitob.com/outer_banks/trip/map.htm
- Retrieved From: <http://daregis.darenc.com/website/dare/viewer.htm>

Methodology:

- Retrieved From: <http://www.gettingoutside.com/Disc-Golf>
- Retrieved From: <http://www.cornellcollege.edu/intramurals/disc-golf/index.shtml>
- Retrieved From: http://www.townofcary.org/Departments/Parks_Recreation_Cultural_Resources/Parks_and_Greenways/Parks/Middle_Creek_School_Park/Middle_Creek_18-Hole_Disc_Golf_Course.htm

Design Procedure:

- Retrieved From: http://www.dgcoursereview.com/course_files/859/73c2f5d7.jpg
- Retrieved From: http://www.discgolfstation.com/How-To-Become-a-PDGA-Member_c_239.html
- Retrieved From: <http://www.discgolf.com/>
- Retrieved From: <http://discgolfreviewer.com/discraft-vs-innova/>
- Retrieved From: <http://cindydauer.hubpages.com/hub/Disc-Golf-Courses-near-Corvallis-Oregon>

Conclusions and Recommendations:

- Retrieved From: <http://www.playitagainsportshickory.com/equipment>

Works Cited:

DGA. (2013). *Disc golf course development guide*. Retrieved from <http://myinsideraccount.com/publication/?i=147367>

Gametime. (2013). *Playground equipment*. Retrieved from <http://www.gametime.com/products/playground-equipment-products/play-systems-products/>

Innova Disc Golf. (2013). *Course packages*. Retrieved from <http://www.innovadiscs.com/course/course-packages.html>

Middle creek 18-hole disc golf course. (2013). Retrieved from http://www.townofcary.org/Departments/Parks_Recreation_Cultural_Resources/Parks_and_Greenways/Parks/Middle_Creek_School_Park/Middle_Creek_18-Hole_Disc_Golf_Course.htm

Palmeri, J. (2008, september 21). *Brief history of disc golf*. Retrieved from <http://www.pdga.com/history>

PDGA. (2013). *A guide to disc golf from the pdga*. Retrieved from <http://www.pdga.com/introduction>

PDGA. (2013). *Pdga course development*. Retrieved from <http://www.pdga.com/course-development>

PDGA. (2013, March). *Pdga disc golf course design recommendations*. Retrieved from http://www.pdga.com/files/documents/PDGA_Course_Design_Guides_March_2013d.pdf

Siniscalchi, J. M. (2004). *The personal and community benefits of disc golf to rural America(and beyond)*.

Town of Nags Head, Parks and Recreation Committee. (2012). *Town of nags head parks and recreation plan*. Retrieved from website: http://www.nagsheadnc.gov/vertical/sites/{B2CB0823-BC26-47E7-B6B6-37D19957B4E1}/uploads/Adopted_Plan_for_distribution.pdf

White, K. U.S Department of Energy, Brookhaven National Laboratory. (n.d.). *Wetlands restoration/ constructed wetlands*. Retrieved from website: <http://www.bnl.gov/erd/peconic/factsheet/wetlands.pdf>

