Sustainable Turf Management

Prepared by

Students in HORT 4061W: Turf Grass Management
(Instructor: Eric Watkins)

On behalf of
The City of Rosemount

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Section 1

Ames Soccer Complex at Dakota County Technical College

By Ben Persson, Aaron Mehus, and Joey Brettingen

Ames Soccer Complex

at Dakota County Technical College

Ben Persson, Aaron Mehus, and Joey Brettingen

16 December 2014

<u>Site:</u> (Certain information from Jim Koslowski of the city of Rosemount)

The Dakota County Technical College (DCTC) Ames soccer complex is comprised of three regulation soccer fields. The two fields to the West (field W) do not have lights, whereas the main field to the East (field E) has lights, which makes for overuse of this field especially.

Current weed and turf species:

All three fields are made up of mostly Kentucky bluegrass (60%) (*Poa pratensis)* and perennial ryegrass (30%) (*Lolium perenne)*. Despite much of the site being covered with these two species, there are evident infestations of annual bluegrass (5%) (*Poa annua*) and crabgrass (5%) (*Digitaria sanguinalis*). The annual bluegrass is more apparent in lighter green patches in the healthier portions of turfgrass. The crabgrass can also be seen as lighter green patches, but with noticeably wider leaf blades and taller growth than the bluegrass or ryegrass. Besides the two weedy turf species, there was only one small patch of prostrate knotweed (*Polygonum aviculare*) that was found on field W.

Drainage:
Field E has a crown draining system where the water runs off the the north and south ditches where the water is displaced by drain tile. Field W does not seem to have a particular drainage system. Both of these fields are very flat, which suggests that the water that needs draining either infiltrates into the soil or justs sits on the surface until it evaporates. This could be one of the explanations as to why field W is in worse shape than Field E.

Soil Info:

Estimated Soil Texture	pH Level	Bray Phosphorous ppm P	Potassium ppm K	Compaction Level
Medium Loam- Silt Loam	7.4 ***Slightly Basic***	40 ***Very High***	168 ***High***	High

Current Pesticide and Fertility Program:
An herbicide is applied twice a year on all three of the fields. Fertilizer is used twice per year. In June, a 25-0-0 7% sulfur (U-Maxx) slow release fertilizer was put down at a rate of 1 lb N/acre. In September, a 25-0-15 slow release fertilizer was also put down at 1 lb N/acre.

Irrigation:
All fields are irrigated about 2 times per week at a rate of a ½ inch. Timing of the watering depends on the schedule of the fields, so there is no exact schedule. Irrigation is also based on rainfall as well.

Cultivation:
Core aeration is performed every other month during the growing season across all three fields.

Mowing:
Mowing is performed three times per week for all three fields.

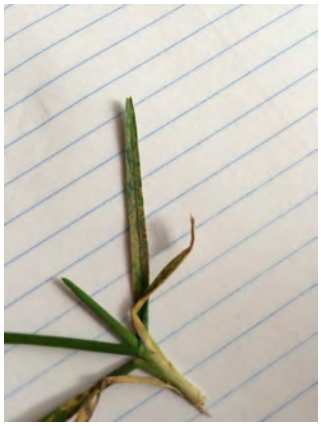
Other:
Topdressing and dormant seeding are two procedures that are also utilized on the three fields. A 70% sand 30% peat moss mixture was used to topdress the fields last fall. It was then dormant seeded with a 30% perennial ryegrass (Arctic Green) and 70% Kentucky bluegrass mixture (Guinness & Princeton) late last fall. The two practices are to be performed again this fall. Different cultivars are later discussed in the recommendations section.

Typical Use:
All three fields are used at an extremely high rate from the beginning of April until the end of October. Field E gets even more use due to the lights that are of use. Youth Leagues begin in April during the evenings and run through August. Three to four youth tournaments are also held during the summer months. Adult leagues are held on Sundays from May through mid-September. DCTC also runs camps 3-4 times during the summer. In the fall, both the DCTC mens and womens teams begin full practice during the days with games at night under the lights of Field E. On nights that neither of the teams play, there are youth league games that occupy the fields. Overall, the use is so frequent that the turf simply never gets a break.

Problem Areas:
The biggest concern for all three fields are the bare spots that have developed in the most highly used areas (goal placement, midfield, corners where corner kicks are performed). Along with the bare spots, most of the turf lacks uniformity (density, color, species, etc.) with some exceptions coming on the east end of field E where the stand of turf is the most dense and maintains the best uniformity. In general, field E is in a little better shape overall based on appearance and density. This may have something to due with the proper drainage that field E possesses over field W that does have a specific drainage system. The lack of drainage does not allow the turf to breathe and grow properly under some circumstances (heavy rains) which can lead to unhealthy turf.

Another issue worth pointing out is the presence of rust on the leaf blades of the Kentucky bluegrass and perennial ryegrass. Rust is most likely present in this situation due to the lack of health. Compaction and lack of nitrogen are two of the main factors for rust. Susceptible varieties of both species to rust may also be present. It was hard to come across leaf blades that did not have the rust spores present upon them among all three fields.





<u>Management Issues:</u>
Drainage: Not necessarily a management issue, but field W is not receiving adequate drainage in order to maintain healthy turf.
Fertility Program: As far as N goes, the current program is set up where nitrogen is being put down, but potentially not the right amounts and at the wrong time. Phosphorus is currently being put down, when it should not be. According to the soil test results, phosphorus is very high in the soil. Plant growth regulators are currently not being used, but should be considered when mixing with line paint.
Mowing: Mowing too low during the summer months (less than 3 inches), can be detrimental to turf health. Not lowering mowing height in the fall (2-2.5 inches) can also be detrimental to the turf going into the winter months by leaving enough plant material for diseases to develop.
Other: The process of topdressing and aeration can also be modified. Topdressing is not being applied at the proper time or the right amounts. The timing of aeration can be improved to better the health of the turfgrass.

Recommendations:

Fertility Program: As far as nitrogen goes, suggestions can be made to apply more, but at lower rates. Michigan State University Turf Extension offers a couple different plans for managing a sports turf field primarily made up of perennial ryegrass and Kentucky bluegrass. For the Ames soccer complex, we would recommend either nitrogen plan for the native soils. This program is set up to evenly feed the turf nitrogen in the spring when it is coming out of dormancy, then providing it at a higher amount when it is under the most stress during the college season of soccer. Nitrogen is one of the most important nutrients for sports fields, and a lot of the times is what the turf lacks the most of. The presence of rust on the playing fields could also be reduced with an increase in N applications.

Month	Slow Release (lbs per 1000 sq. ft.)	Fast Release (lbs per 1000 sq. ft.)
April	1	1
May	0	.5
June	1	.5
July	.5	0
August	0	.5-1
September	1-1.5	1
Total N per year	3.5-4	3.5-4

October-March N/A Michigan State Extension

Another nitrogen practice widely used and praised is late fall fertilization. It is hypothesized that late fall fertilizations aid the turf in carbohydrate storage, color, and overall turf quality. The only issue with this practice is the unknown of correct application rates. Bauer et al., 2012, suggest that more research specific to certain climates (cool season turgrasses) is to be done in order to determine the correct application rates. With that being said, we encourage looking into this practice, but suggest to investigate with caution.

Phosphorus is another very important nutrient used in sports fields due to the continuous repair of the turf. This nutrient is normally used when establishing new turf by seed or sod. However, Since there is such a high rating of phosphorus in the soil already, it is recommended to stay away from using it when establishing new turf. If applied, there is a high risk of runoff.

Plant growth regulators (PGRs) could also be considered into the management program. PGRs are not only useful for reducing the amount of mowing that has to be done, but they encourage lateral

growth of the turf (in this case, the KBG). PGRs are not recommended to be used on the entire field due to their cost and frequency of application to be effective. However, they can be utilized by mixing with paint. For athletic field turf, mixing PGRs with line paint can be a big advantage. Primo, for example, can be mixed with paint in order to greatly reduce the frequency of repainting lines on the fields. To date, little research data is available on how well this works (as far as wear tolerance and turf density), but it is clear that this practice reduces frequency of painting (Ohio State Turf Extension, 2005).

Mowing: Mowing height should be slightly raised to 3 inches in the summer months to protect the roots and maintain a dense stand of turf. Since the optimal temperatures are not present during this time, increasing mowing height by even a quarter or half inch can help maintain a healthy root system (DeBels et al., 2012). The height should then be gradually lowered in the fall to 2 inches to prevent diseases from developing during the winter months (Kowalewski et al., 2010). Be sure to continue to change mowing patterns on a regular basis to prevent wear damage from the equipment.

Use: With the use of the fields being extremely high during all growing months of the year for the turf, it is extremely difficult to repair areas that sustain great damage during the season. Continuing to shift the fields as much as possible is in the best interest of the fields overall health. Evening out the wear as much as possible is very important. As far as aeration, topdressing and sodding, a few changes could be made. Aeration should be continued at the every other month interval to ensure that compaction is reduced. Once the season has subsided in the fall, it is very important aerate again since the turf has optimal growing temperatures. Sodding the bare spots in the fall may be the most effective way to produce healthy turf when the spring rolls around.

Topdressing: More sand based soils are preferred for sports fields due to their good drainage and low compaction qualities. If the field is primarily clay based, which in this case it is, compaction and drainage can be a big issue. However, it has been proven that sand topdressing to a depth of 1 inch over two years provides the highest quality turf (Kowalewski et al., 2010). Topdressing can be completed multiple times throughout the summer months and fall to achieve these depths. Since little sand is put down during each application, this will not interfere with regular play.

Overseeding: Dormant seeding in the fall should be continued, but with a slight change in cultivars. For cultivar selection for perennial ryegrass and Kentucky bluegrass it is important to choose ones that will perform best in MN. The current Arctic Green perennial ryegrass cultivar was ranked 30th overall in Minnesota based on the Cultivar Evaluation Results of 2012 from the U of MN turf extension service. However, Arctic Green is the best commercially available cultivar. Be on the look out for improved cultivars of perennial ryegrass in the near future to minimize the future risk of rust.

For Kentucky bluegrass, instead of using Guinness or Princeton, we suggest to use one of the top rated cultivars from the 2011 National Turf Evaluation Program for Minnesota. One of these cultivars is Blue Note. Its noted as having excellent color, density, texture and high use tolerance. Its high recommendation for use on sports fields makes this cultivar an excellent choice for Ames Soccer Complex.

Overview: Best Recommendations Within Budget

- Improving nitrogen application plan
- Focus on mowing height
- Improving topdressing program
- Using better quality cultivars when overseeding
- Mixing plant growth regulators with paint (Primo)

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Section 2

Brockway Disc Golf Course

By Christina Graber, David Fauth, Erin Melzer

Christina Graber, David Fauth, Erin Melzer

Brockway Disc Golf Course

11/24/14

Brockway Disc Golf course is a valuable resource and one of the most popular parks for the city of Rosemont. It offers a spectacular amenity and source of recreation for many of the residents. However, recently the course has been facing issues as dirt patches are increasingly replacing once healthy green grass. Throughout this report there will be an analysis of the site, a description of the problems found at the site as well as research-backed recommendations. Finally a complete remediation program is presented to the City of Rosemont.

Identification of Existing Species

We determined the disc golf course consisted largely of Kentucky bluegrass. The course was designed in the middle of a forested area and the forested species consisted largely of oak and sumac. There were a significant variety of weeds which are listed in the table below.

Table 1: List of species found on site

Common Name	**Scientific Name**
Tree	
White Oak	*Qeurcas* alba
Pin Oak	*Quercus* palustris
Bur Oak	*Quercas* macrocarpa
Sumac	*Rhus*
Turf	
Kentucky bluegrass	*Poa* pratensis
Weed	
Quackgrass	*Elymus* repens
White Clover	*Trifolium* repens
Black Medic	*Medicago* lupulina
Bull Thistle	*Cirsium* vulgare
Dandelion	*Taraxacum* officinale
Crabgrass	*Digitaria*

Existing Microclimates

The course is cooler than adjacent areas due to a high percentage of shade encompassing the course itself. The large mature trees growing in the forested area block a significant portion of the sunlight from getting to the turf. Tree cover also blocks a large percentage of the wind from hitting the site.

Assessment and Description of the Challenges at the Site

Issues within the site stemmed from extreme compaction due to foot traffic and heavily shaded portions of the site. Secondary issues observed included minor over-saturation in the lower portions of the topography of the site due primarily to variations in topography as well as some portions of ground-out stumps with possible burrowing infestation of a species. There was a large amount of weed infestation amongst the turf including a large infestation of broadleaf plantain and along the edge portions of the site crabgrass was an issue due to a large area of rough cut grass that started within a foot of some portions of the course.

The primary issues plaguing the site as a whole stem from the fact that a large portion of the disc golf course is situated within the remnants of a forested area and is a heavily trafficked area. The turf is a typical Kentucky Bluegrass Blend that works well in the outskirts of the course in the areas presently in a large portion of sunlight. As the turf progresses from the well lit areas to the inner portions of the site the gradient in terms of turf quality lowers as the grass dies out and increasingly becomes thinner until there are portions within the inner site that are down to bare soil due to the inability of the turf to survive in such conditions. A secondary issue

that is stemming from the tree canopy cover is the leaf loss that occurs in the fall. Given that the site has a feel of a more naturalized park the amount of leaf cover that is present within the course boundaries varies from minimal to a depth of 1-2" above the turf. This magnifies the effects of sunlight loss which can then have compounding effects as the leaves begin to degrade as well as become water logged. This opens opportunities for the turf to be plagued by disease of fungi as well as die out and leave increasing amounts of bare patches.

A popular disc golf destination in the Twin Cities metro area, the turf here absorbs a lot of foot traffic. Current cultural management for compaction reduction are nonexistent and therefore the site is suffering from extreme compaction. High compaction especially near the starting holes is evident by the lack of turf growing in these spaces. The only species that are growing in the most compacted zones consist largely of weeds that can tolerate higher levels of compaction. Compaction was also evident in attempting to secure soil samples as it was extremely difficult to get the probe past the first few inches. Significantly higher levels of long term compaction leads to extreme stress placed upon the turf.

Table 3. Clipping yields, visual quality, and verdure as influenced by soil compaction (C), preconditioning (NC = no compaction, ST = short-term compaction, LT = long-term compaction), and moisture stress preconditioning (M) (well-watered = irrigation at - 0.045 MPa and water-stressed = - 0.400 MPa).

Growth characteristic	Date	Well-watered NC	Well-watered ST	Well-watered LT	Water-stressed NC	Water-stressed ST	Water-stressed LT	LSD (0.05) C	LSD (0.05) M	LSD (0.05) CXM
		mg dm-'								
Clipping yield	12-18 June	385	346	276	274	271	189	40	33	NS
	18-26 June	509	302	461	562	334	431	59	NS	NS
	26 June-12 July	819	642	901	723	714	572	91	74	120
		1 to 9 rating								
Visual quality	18 June	9.0	9.0	8.9	9.0	9.0	8.9	NS	NS	NS
	26 June	9.0	8.4	9.0	9.0	8.3	9.0	0.1	NS	NS
	3 July	9.0	8.7	9.0	9.0	8.8	9.0	0.1	NS	NS
	12 July	8.0	6.6	7.3	6.3	7.1	5.9	NS	0.8	1.0
		g dm-'								
Verdure	12 July	3.7	3.0	2.6	3.9	3.2	3.3	0.3	0.2	NS

t Rating scale: 9 = ideal turf, 1 = no live turf.

As seen in table 3 of Agnew's article, high compaction on a site immediately affects a site in terms of clipping yields and visual quality in particular (Agnew, Carrow, 1985). In high compacted zones turf species are unable to adequately grow healthy roots and water uptake is severely limited. The availability of oxygen in compacted soil as well as an increase in carbon dioxide severely limits growth and stresses turf to a point in which the turf is effectively killed off. In the table quoted, long term compaction, most relatable to the site as there is no current aeration method in place, a 1.7 visual quality rating within the first 4 weeks is observed. That number is in an environment in which irrigation is adequate. The Brockway park lacking irrigation is going to face dramatic declines in turfgrass quality if proper aeration methods are not observed. If the city implements an adequate aeration system turf visual quality has the potential to increase greatly. A 10% increase was noted in the stuy without any other cultural changes implemented. While results may not be identical due to a number of other factors it is important to not the potential aeration has to offer.

The topography of the site funnels pedestrian traffic in a strict manner throughout the site. A series of low and high points throughout the course, many of which are direct pathways for specific holes, leads to higher traffic patterns along these topography changes. The changing topography and increased traffic use creates wear patterns along these points degrading and killing the turf leading to bare spots within the turf. This presents issues with erosion and is evident in spots throughout the course where increased traffic wear has lead to soil eroding down the slope further damaging turf further down the slope.

Another large secondary issue facing the site is the infestation of weeds including a large number of Broadleaf Plantain and crabgrass in some portions of the site. The Broadleaf Plantain

is most prevalent in the area of the first hole of the course due to the sunlight nature and openness of the space. The Plantain also spreads into the lower areas of some of the topography off to the side of the open space which reveals that the moisture within that area is higher than some of the other areas as well as the sunlight is significant enough to allow for the survival of the species. Large portions of rough cut grasses persist around portions of the site facing the development. These sections of rough cut are leading to higher levels of crabgrass to persist within the site however, it is largely contained to the edges of the site as the current bluegrass is outcompeting the weeds in that particular section of the site due to high sunlight and adequate irrigation conditions. Other small weed issues revolve around some of the paver starting pads of some holes as the weed whipping has not occurred frequently enough and has allowed a number of weeds to take hold.

The last issue on a small portion of the site are holes left from stump grinding. A number of mounds point to possible underground vermin issue. This persists largely in the rough cut drainage basin patch that is adjacent to the first hole of the site. The trees that had been growing in the rough cut were cut down and ground out to increase the overall square footage of the disc golf portion of the park. The potential vermin

infestation occurs in the same area as the ground out trees most likely as the vermin utilized the taller grasses as habitat.

There are no drainage issues with this site. The soil consists mostly of sand and gravel which has very high drainage. There are a few clay pockets, but they do not affect the drainage of the site. (Jim Kowalski, interview 1, 2014). The topography of the site likely helps with drainage, as there are small scale hills and valleys throughout the course.

Management decisions are what can turn this site into a successful turf area. Currently there is one management technique, weekly mowing, in use (Jim Kowalski, interview 1, 2014). There is no fertility or cultivation, weed control, pest control or other common turf practices. While this can keep tall weeds down and keep the area usable, it does nothing to allow the turf to survive adequately. With this information in mind we can easily create a management plan for healthy turf.

Recommendations for Changes

The Brockway disc golf faces a few issues that can be adequately remedied through better cultural management practices and better cultivar selection. Yearly fertilization of 1 lb. of nitrogen utilizing a 20-10-20 fertilizer should be implemented to provide adequate nutrients to turf species to prevent added stress as well as allowing for the turf species to better compete with weed species. Treatment for weed species utilizing a broadleaf herbicide can be implemented to limit infestation of broadleaf plantain however it is not 100% necessary. It is recommended that cultural practices be implemented as well as turf species remedied to better prove competition amongst species prior to introducing herbicides to the site.

Table 2: Soil information based on soil tests from University of Minnesota Twin Cities

Categories	Results and Recommendations
Soil Texture:	Medium
Organic Matter (%):	5.9%
Soil pH:	6.6
Phosphorous ppm:	20
Potassium ppm:	99
Lime:	None
Nutrient recommendations:	1.0LBS/1000 SQ. FT. of Nitrogen
	0.5LBS/1000 SQ. FT. of Phosphate
	1.0 LBS/1000 SQ. FT. of Potash.
Fertilizer Ratio:	20-10-20

Application should be done once in late summer.

Soil tests were taken and the soil on the site is prime for turfgrass growth, and with proper maintenance and application of fertilizer, the turf stand will thrive. Soil organic matter is within the range for optimum organic matter but could be improved so as to help reduce future compaction. Phosphorous levels are near the high range as is typical of many lawns due to high phosphate usage in the past however it is not exceedingly high. Potassium levels are right in the middle of the recommended parts per million and can be fertilized effectively in a 20-10-20 along with nitrogen and phosphorus on an annual basis. Soil pH is 6.6 and is suitable for turfgrass growth and therefore for no lime usage is necessary. With this information in mind a it is recommended to the city of Rosemont, that a yearly application of a 20-10-20 fertilizer be applied at a rate of 1lbN/1000ft^2 in order to promote growth and healthy stands of turf.

An aeration program should be implemented twice a year, once in the spring and once in the fall to relieve extreme compaction on the site. A lack of aeration leads to major soil issues including lack of water infiltration and percolation rates, increased gas buildup, lack of oxygen and a number of other issues (Sharman, 1988). A hollow core aerator should be utilized and it is recommended to aerate deeper the first few years due to an excessive buildup of compaction. A

smaller tine aerator can be utilized when extreme compaction is noticed so as to mitigate disruption to the site. Compaction is currently hindering the site's success and needs to be remedied immediately.

A simple program of mulching or removing leaf matter in the fall should allow for turf to get adequate sunlight. A trimming of large overhangs of branches to allow more sunlight to reach the turf along the course. Overseeding with a mix of fescue and shade tolerant bluegrass would allow for fuller turf and allow stronger healthier turf that can withstand traffic.

According to the University of Minnesota Extension service a turf seed mix consisting of improved KBG (Kentucky Bluegrass), tall fescue and fine fescues would adequately meet the need of high traffic as well as improving shade tolerance within the site. The mix should consist of 50% improved KBG and 30% tall fescue as they have a wear tolerance and are suitable for athletic and heavy use surfaces. The remaining 20% of the mix should consist of a fine fescue mixture in order to provide adequate fullness to the turf as fine fescues offer great shade tolerance benefits. A mix consisting of 50% fine fescue can be implemented in areas that are less traveled throughout the park due to their inability to withstand heavy traffic. By increased implementation of fine fescue, the turf would succeed better as there is no irrigation currently on the site. It is recommended that the seed mixture be seeded at approximately 6 to 8 pounds per 1000 square feet. This can be accomplished through overseeding done after an aeration cycle to allow for mixing of variety and higher germination rates.

The Brockway Disc Golf site is a piece of property that has great value to the community and is a wonderful asset. From a turf grass standpoint the issues plaguing the site stem largely from a lack of cultural practices being implemented onto the site. A developed plan put into

place would allow for the success of the site and the improvements should be visible in a matter of weeks. The site overall is not in bad shape. Overseeding with shade tolerant species as well as cultural practices and the site should function and be aesthetically pleasing for years to come.

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Section 3

Innisfree Park

By Veronica Prickel, Ryan Schwab, Peter Yank

Innisfree Park:
Recommendations for Turf Management

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Dec, 2014

Innisfree Park is a 55.82 acre park built in 2002 that was turned over to the city of Rosemount for maintenance in 2007. It is currently situated in the middle of Rivermoore neighborhood in Rosemount, MN. The park consists of an open lawn area surrounded by a walking path that leads through the neighborhood and other nature areas. There is a playground area with a picnic shelter on the southwest end of the grounds. Uses of the park include casual sports, children's activities, picnicking, neighborhood aesthetic or trail use.

The area is mowed twice a week on Monday and Thursday with Toro or John Deere zero turn riding mowers. Fertilizer is applied in two slow release applications. The first application is in June with a 25-0-0 and 7% sulfur mix. The second is in September with a 25-0-14 mix. The area is irrigated twice a week for an hour for a total of 1 inch of water per week. Core aeration is performed once a year in fall and dethatching is done every spring. Some plowing is done during the winter on the trails as needed, but no deicing agents are used.

The problem brought to our attention as being of most concern was the overflow of water from the residential area on the east side of the park that resulted in the waterlogging and washout of the soil and premature degradation of the asphalt path. Part of the problem is that the water is discharged quickly from some unknown source uphill. This combines with the installed irrigation system on the turf area to produce more water than the soil can absorb in a several day period. In areas where the runoff reaches the turfgrass, there are patches of less dense turf, eroded soil, and weeds. Management of this issue should address both a reduction of the runoff of water from uphill and provide a stronger turf to handle large amounts of water. The runoff path can be seen along the trail in **Photo 1** below. This is where algae growth is occurring which causes slippery conditions for walkers on the trails.

Ideally the solution would be to prevent water from reaching the path and subsequently pooling on the grass by creating a ditch and a depression at the low point where the paths intersect. This would hold water and allow it to slowly infiltrate. A buffer strip comprised of native plant species should also be planted on the hill and into the swale to aid in reducing runoff volumes and help absorb the water. A variety of forbs such as blazing star, smooth aster, harebell, or wild bergamot can be used on the sloped areas (University of Minnesota Extension, 2014). Alongside the trail, native grasses can be used to reduce runoff amounts from reaching the trail. Switchgrass has been found to be an effective long-term runoff reducer (Lee et al., 1998). Other good deep-rooting native grasses are prairie cordgrass, big bluestem, and little bluestem. If it is chosen to retain turfgrass alongside the trail perpendicular to the slope, the mowing height should be raised. Although there are small trees and other plants on the hillside as a natural buffer (**Photo 1)**, raising the mowing height of the grass alongside the trail may further reduce runoff volume, as well as nutrients in the runoff (Bell et al., 2006), which are aiding algae growth. Since the core aerator used on the managed area is most likely too wide to be used on the pathside turfgrass, a smaller, manual core aerator can be used in these areas. This will reduce the uphill runoff from reaching the path and into the open field (Rice and Horgan, 2011).

Photo 1. Sediment from the uphill residential area can be seen along the paved trail. The runoff travels from uphill, over the trails, and into the managed turf area on the left.

One problem with soil moisture being held on the surface of the open lawn for long periods of time can be thatch buildup and/or poor soil drainage. Thanks to practices such as regular fertilization and dethatching, this does not appear to be an issue. However, a distinct change in the soil profile is observed at only 3 or 4 inches depth. The top layer is a darker loam texture with a lesser quality sublayer of more silt or clay texture. With this sublayer, water will infiltrate at slow rates, creating a perched water table, which may be why the open field is often waterlogged. Based on assumptions of standard construction procedure, this is probably the result of low quality fill being top dressed with high quality topsoil. Annual aeration in the fall is most likely helping mitigate any issue this could cause considering most of the open sections of the lawn did not appear to have any issue with turf quality. However, this may be a more prominent factor in the area mentioned above, alongside the trail that was experiencing water logging. A second core aeration can be performed in the spring to decrease water saturation at the beginning of the growing season, after snowmelt accumulations.

The city's irrigation plan should be altered as well. The one inch of water per week that is being currently applied is sufficient, but should be planned around weekly rainfall, if this is not already practiced. Where the uphill runoff meets the open field, the top layer of soil appears to be washed out and is hard and dry. After the surface runoff from uphill is effectively reduced, tilling, adding nutrient-rich topsoil and seeding the dead patches with certified Kentucky bluegrass seed should be performed before an invasion of weedy species.

Another noticeable concern was the invasion of creeping bentgrass (*Agrostis stolonifera*) grouped near the center of the managed area. These patches were distinct, displaying a lighter green color and dense appearance (**Photo 2)**. The bentgrass invasion greatly reduced the uniformity of the Kentucky bluegrass. Creeping bentgrass can easily spread out of control in a

Kentucky bluegrass stand. Its dense mats will remain wet from dew, irrigation, or rainfall for longer periods of time (Christians, 2011), which may eventually lead to a disease problem. The creeping bentgrass further reduces the area's quality with unsightly scalping from lawn mowers (**Photo 3**). There are two options in this situation. The first option would be to effectively kill the bentgrass and replace it with more Kentucky bluegrass. The resulting bare areas can either be seeded or sodded. If sodding is a desirable method, ensure the sod purchase was grown in a similar medium-textured soil to ensure good root performance (Christians, 2011). The main drawback to this solution is obviously the increased cost from labor and material. The second and less expensive option is to accept the creeping bentgrass invasion and raise the mowing height to prevent scalping.

Photo 2.
The lighter green patches on the managed area is creeping bentgrass. The difference in color and texture presents poor uniformity.

Photo 3.
In the dense mat of creeping bentgrass, the crowns have been damaged by mowing heights that are too low.

If removal is desired, then Tenacity (mesotrione), a selective herbicide may be used to kill off the creeping bentgrass. Dernoeden et al. (2008), showed that the application of 4 fl oz per acre of mesotrione was found to be a success in the elimination of creeping bentgrass in a Kentucky bluegrass stand when applied three times. However, the Tenacity label suggests 5 fl oz per acre of its application. When applied at this rate, the product may be more efficient in three applications. Tenacity should be mixed with a label-recommended amount of 30 gallons of water and be reapplied in 2-3 week intervals. The application is label-recommended to be applied in the early fall, but can be used in the spring when the grass is actively growing. Mesotrione application recommendations must be followed carefully.

Tilling, raking, and then seeding or sodding the area with a certified Kentucky bluegrass mixture should be performed once the creeping bentgrass is removed. If seeding is the chosen option, cultivars with higher-rated density are preferred as they will better compete with any future weed invasions. Cultivars such as Kenblue or Keeneland can be used for this purpose (NTEP, 2013). The newly established areas should be monitored for returning creeping bentgrass through the next growing season.

Another issue is the competition from trees particularly around the playground and the native hillside area on the east side of the field. Generally, Kentucky bluegrass is not very shade tolerant (Ward, 1969), hence density of turf in these areas along the treeline appears lower, but overall quality is mostly acceptable. Other areas showed lower quality due to competition with tree roots (**Photo 4**). Overseeding in the spring or fall with a more shade and drought tolerant species will improve density. Rather than use a different shade tolerant species such as fine fescue, a preferable choice would be the use of a Kentucky bluegrass cultivar to keep overall

uniformity of the lawn. In 2013, the National Turfgrass Evaluation Program rated quality of cultivars under shade conditions for their 2011 test. Two better performing Kentucky bluegrass cultivars in that evaluation were Keeneland and Kenblue (NTEP, 2013). Rutgers University trials of Kentucky bluegrass cultivar shade tolerance suggest Diva, Prosperity or Rhapsody. High-rated drought tolerant cultivars in the Rutgers trials to be seeded under the dry tree canopies would include Columbus, Rhapsody, and Brilliant (Cross et al., 2010). This issue is primarily an aesthetic problem

Photo 4. The competition with shallow tree roots has decreased the Kentucky bluegrass density in this area.

Some of these areas display bare spots, particularly on the slopes and around trees, from mowing traffic (**Photo 5)**. The zero turn mowers are compacting, sliding, or turning too sharply in these areas. Because the soil is so moist, the plant roots will never need to grow deeper in search for more water and are subsequently not as strong. This allows the mower's movement to force the turf out of place more easily. Although not available to the Rosemount Parks and Recreation Department, a simple solution would be the use of lighter push mowers on the sloped areas to reduce the stress, compaction, and sliding exhibited by much heavier equipment. Steering around trees or other obstacles should be minimized or done with a trimmer. Driving

equipment in a different pattern each visit will help give the traffic-stressed turfgrass time to recover. Mowing during the late morning or whenever the turfgrass and topsoil are dry will reduce damage as well.

Photo 5. The tire tracks from a heavy mower can be seen as it has damaged the turf with repeated mowing routines

During our examination, three separate soil tests were done with similar results. With fertilizer being applied in the spring (25-0-0) and fall (25-0-15), the city is doing well at supplying nutrients needed for healthy looking turfgrass. However, the soil test results suggested a 33-0-0 fertility plan which would eliminate the need for potassium that is currently being used in September each year. The results propose two pounds of nitrogen per 1,000 feet squared per year, which can be split into the two applications. However, a change in the fertility program will not do much to fix the major problems Innisfree park exhibits.

The extent to which suggestion will be implemented will obviously be restricted by the available maintenance resources and level of user tolerance. Because of a limiting maintenance budget and relatively high tolerance, most of these suggestions will probably not be cost effective. This examination simply shows that there are management solutions available to the

major park grounds issues. With many options, and smart management practices, Innisfree Park can be a safer, better looking area for the Rosemount community.

Suggested Adjustments

Concern	**Suggested Solution**
Uphill Runoff	swale and/or native buffer strip
Waterlogging	addition of spring aeration, schedule irrigation around rainfall
Shade or Tree Competition	seed suggested Kentucky bluegrass cultivars*
Creeping Bentgrass Invasion	mesotrione application and reestablishment of suggested Kentucky bluegrass cultivars*
Traffic Damage	change mowing pattern, use lighter mowers, mow when dry, reduce sharp turning

* cultivars listed in following table

Kentucky Bluegrass Cultivar Suggestions

Areas	**Suggested Varieties**
Shady	Keeneland, Kenblue, Diva, Prosperity, Rhapsody
Dry (under tree canopies)	Columbus, Rhapsody, Brilliant
Reestablished Patches (after weed or bentgrass control)	Keeneland, Kenblue

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Section 4

Meadows Park

By Shay Lunseth, Ashley Trout, and Matt Wildenauer

Meadows Park - Rosemount, MN

Group 2: Shay, Ashley and Matt

Meadows Park is 26.44 acres and was built in 2006. It is used for small children recreation – specifically a playground, soccer field and little league baseball. Five soil tests were taken from different sections of the park. These sections were divided and analyzed separately based on their irrigation schedule, use and management issues. Out of the five areas, areas 3 and 5 are not irrigated (see Table 1). These two spaces are reserved for a natural park experience and will remain minimally managed. Therefore, they will not be considered in our recommendations. Areas 1, 2 and 4 (see Table 2a) include the soccer field, baseball field and playground area. These will be the areas of our focus.

Table 1 – Park areas defined

Soil Test Name	Reference	Description
MEA1	Area 1	Spectator area
MEA2	Area 2	Soccer and baseball fields
MEA3	Area 3	East side of soccer field
MEA4	Area 4	Playground area
MEA5	Area 5	Turf along north walking path

Table 2a – Meadows Park Soil Test Key Code with Map

Table 1b – AREA 1 (pink spectator area), AREA 2 (yellow outfield area), AREA 4 (purple playground area)

The soil throughout the park is a medium texture silt loam with a medium (normal) amount of organic matter. The soil pH varies between 7.4 and 7.5, which is typical for Minnesota. The soil test results from the University of Minnesota soil testing lab are listed in Table 2b. Based on these results, we would recommend an organic fertilization program. Organic fertilizer is a great option for public spaces, especially those that are heavily used by children and their families. Not only is organic fertilization a good choice for grass and soil nutrients, but one that the public perceives positively. This choice would have minimal burn potential, provide a slow-release of nutrients, and increase microbial activity. We would recommend Sustane 8-6-4 fertilizer (turkey liter) plus corn gluten meal of 10-0-0 for our nutrient program. The cost and schedule for this can be found within Table 8 and Table 9.

Table 2b – Soil Test Results

Location	Organic Matter %	pH	Nitrogen Recommendation	Phosphate Recommendation	Potash Recommendation
MEA1 Spectator area behind baseball diamond with compacted soil, wet soil and large creeping bentgrass invasion	3.9	7.5	2.0lbs/1000 ft^2	0.5lbs/1000 ft^2	0.0lbs/1000 ft^2
MEA2 Outfield and soccer field with bentgrass invasion	3.3	7.5	2.0lbs/1000 ft^2	0.5lbs/1000 ft^2	0.0lbs/1000 ft^2
MEA3 East area of soccer field with no irrigation and bare patches	3.3	7.4	1.0lbs/1000 ft^2	0.5lbs/1000 ft^2	0.0lbs/1000 ft^2
MEA4 Playground area, no bentgrass invasion	3.7	7.4	2.0lbs/1000 ft^2	0.5lbs/1000 ft^2	1.0lbs/1000 ft^2
MEA5 Walking trail with no irrigation, no inputs, natural	3.2	7.4	1.0lbs/1000 ft^2	0.5lbs/1000 ft^2	1.0lbs/1000 ft^2

There are currently five management issues at Meadows Park, which include:

1. A large creeping bentgrass invasion
2. Turf areas with poor water infiltration
3. Shallow grass roots
4. Weed encroachment
5. Scalped areas around trees and bare soil areas

Creeping Bentgrass Invasion

Currently, Meadows Park consists of primarily Kentucky bluegrass. The major problem is the introduction and spread of creeping bentgrass. This is the key issue because the invasion is widespread and will continue to spread if not addressed. Once present in a Kentucky bluegrass stand, bentgrass increases its coverage via stoloniferous growth that forms into circles of dense mat-like covering. These patches present an aesthetic issue, as they disrupt the uniformity of the Kentucky bluegrass stand (see image 1). Creeping bentgrass is particularly tolerant of flooding, which is why it is thriving in the water-soaked turf areas at Meadows Park (Christians, 2011). It reproduces not only by stolons, but also by seed that can be dispersed by water (Utah State Extension, n.d.). To get rid of this unwanted grass a 3-step process will need to followed.

Image 1 – creeping bentgrass invasion

Lighter green patches of grass are creeping bentgrass - found throughout baseball and soccer areas

1. Utilize new research for a selective herbicide that can successfully eliminate creeping bentgrass from the Kentucky bluegrass stand
2. Re-establish the desired turf
3. Improve cultural practices so the environment is less favorable to creeping bentgrass

Previously, non-selective herbicide was the only way to successfully eliminate creeping bentgrass from a Kentucky bluegrass turf. Research now has found that a selective herbicide called

mesotrione (Tenacity™) effectively eliminates creeping bentgrass (Christians, 2011). Mesotrione is an herbicide that can control creeping bentgrass, while not harming the surrounding turf that would consist of Kentucky bluegrass, perennial ryegrass and tall fescue species. This treatment allows the surrounding Kentucky bluegrass to survive the treatment and fill in the missing grass areas. It will be important to target the creeping bentgrass aggressively to ensure a high removal success rate. A 2006 study showed that mesotrione had 92% or greater control of creeping bentgrass when applied at least two times in a season (Beam, Barker, & Askew, 2006). This percentage increased when applied in the fall. Therefore, we recommend applying mesotrione 2 times in the fall, within 6 weeks of each other.

After the creeping bentgrass is eliminated, seeding will be necessary. We recommend using grasses that are wear-tolerant, easily handle full sun, drought tolerant and would have a respectable visual appearance. Recommendation for seed would include a mix of 50% Kentucky bluegrass, 20% fine fescue, 15% tall fescue and 15% perennial ryegrass. This mixture would do well in Meadows Park considering the amount of sunlight, use of the park and proposed management. The mix includes several varieties of Kentucky bluegrass at 50%. Kentucky bluegrass will do well in the sun and has very good recuperative qualities (Christians, 2011). We included 15% perennial ryegrass for its quick establishment and wear tolerance. Tall fescue would comprise 15% of our mixture because of its excellent wear tolerance. Lastly, we incorporated 20% fine fescue because of its low nitrogen requirements and adaption to cool and wet conditions (Christians, 2011). The seed mixture contains several cultivars, which are chosen based on top rated options for MN in the latest National Turfgrass Evaluation Program – NTEP. The Kentucky bluegrass cultivars listed on Table 3 are based on color quality throughout the year. The perennial ryegrass cultivars are based on color quality, as well as winter hardiness. The fine fescue data was based on color quality and wear-tolerance. The tall fescue cultivars were suggested based on quality, color and leaf texture.

Table 3 – NTEP Cultivar recommendations for new seed mixture

Kentucky bluegrass	Perennial ryegrass	Fine Fescue	Tall Fescue
Pick 4340	APR 2320	Radar (MVS-FRC-101)	Monet (LTP-610 CL)
Blue Note	Bar LP 10972	Fairmont (TCD)	Essential (IS-Tf-154)
SRX 4338	Rad – PR55R	Longfellow 3 (IS-FRC-33)	Faith (K06-WA)

Changing management practices at Meadows Park is the final step to ensure the successful eradication of the unwanted creeping bentgrass. Providing a remedy for the poorly drained areas will be extremely helpful, as well as raising the mowing height and continuing to maintain an aeration schedule. Deep, infrequent irrigation and a mowing height of 3" will help the Kentucky bluegrass compete with creeping bentgrass (Utah State University, n.d.). Aeration also helps the soil increase its water-holding capacity. Therefore, it is important to continue to aerate once in the fall. If budget friendly, we would recommend adding a second or more aerations each year to combat compacted soil and increase the infiltration of water within the soil. The combination of a higher mowing height, changing the irrigation schedule and core aeration will all decrease the chances of a creeping bentgrass re-infestation, while also addressing the water-soaked turf conditions.

Poor Water Infiltration

The next management issue to address is poor water filtration. This could the direct cause of the creeping bentgrass infestation. We first recommend decreasing the irrigation schedule. Meadows Park is currently being over-watered and altering the irrigation schedule is necessary. This will not only help with current management issues, it would also decrease water

Image 2 – poorly drained soil

costs. Currently, the infested area is irrigated 2x per week for varying durations. The water-soaked area (Area 1 - table 2a and 2b) is irrigated for 15-20 minutes, while the field area (Area 2 – table 1a and 1b) are watered for about one-hour. The slope of the playing fields allows water to run from the field areas (Area 2) to the spectator areas (Area 1). Therefore, the irrigation system must be changed. The system should run in the field area (Area 2) only. This should be scheduled for 1 hour, 1x per week or when 1" of water is reached throughout.

We also recommend adding landscaping features to help with the water infiltration issue. First, we would install native prairie grass along the wettest parts of the park. This would not only divide some of the larger areas into more intimate spaces, but will also assist with water absorption. There are several drains located in low spots (see Image 2), yet the soil is still holding water. Planting native grasses in these areas will absorb the majority of excess water. There would be two different options we would propose for the native grass areas. Based on price, the square foot installation area would be determined based on budget. This project is proposed as a way to solve the soil drainage issue and could be implemented in stages as budget allows. Prairie Restoration Inc, a seed company located in Princeton, Minnesota, has a Northern Wet Meadow Grass mixture that would work well to plant around the drain pipes on site. This mixture consists of 15% pointed broom sedge, 10% Virginia wild rye, 10% tall manna grass, 8% rattlesnake manna grass, 6% fringed brome, 6% knot sheath sedge, 3% caterpillar sedge, 2% cordgrass, by bulk weight, 12% blue joint grass, 12% green bulrush, 10% wool grass, 4% big bluestem, 2% Canada wild rye by

pure live seed weight. There is also the Tall Wet Grass mixture that consists of 44% big bluestem, 15% Indian grass, 6% blue joint grass, 6% Canada wild rye, 6% green bulrush, 5% switch grass, 4% little bluestem, 2% wool grass by pure live seed weight, 10% cord grass, 3% knot sheath sedge, 2% tall mannagrass by bulk weight.

Table 4 – Native grass pricing

Name	Seeding Rate	Price per ½ pound	Price per pound
Northern Wet Meadow Grass Mix	½ pound/1,000 ft^2	$67.00	$122.25
Tall Wet Grass Mix	3lbs/10,000 ft^2Drill: 8-10 lbs./acre	$27.00	$49.50

Second, we would incorporate raingardens to help in the lower areas that have drainage sewers. This would utilize the excess water. By reducing stormwater runoff, rain gardens are a valuable asset to shifting these trends. While an individual rain garden may seem to have minimal impact, collectively they provide substantial neighborhood, community and environmental benefits. Rain gardens serve us in several ways; increasing the amount of water that infiltrates the soil, which recharges the local and regional aquifers. This helps to protect communities from flooding and drainage problems. They also help protect streams and lakes from pollutants created by urban storm-water runoff. This includes fertilizers, pesticides, and numerous other harmful substances that wash off roofs and paved areas. Rain gardens enhance the beauty of yards and neighborhoods; providing valuable habitat for birds, butterflies and many beneficial insects.

A misleading question that comes up with communities is that rain gardens can be very hard to maintain, as people don't have the time for the upkeep. Actually, rain gardens can be maintained

with little effort after the plants are established. Table 5 shows low-maintenance flower options and Table 6 shows other low-maintenance plants that would work well at Meadows Park. Some weeding and watering will be needed in the first two years and perhaps some thinning as the plants mature. If you do all the work, but used purchased prairie plants, a rain garden will cost approximately $3-$5 dollars per square foot, but if you have a landscaper come in and do everything, it will cost approximately $10-$12 dollars per square foot. It may appear easier to sow native wildflower seed over the garden, but research shows that seeding a rain garden has its problems. Protecting the seed from flooding, weeds and garden pests is difficult, as the rain garden will mostly be weeds for the first two years. Growing plugs from seed or dividing plants is preferred, as you are waiting to transplant mature roots that are healthy. If you are planting in the springtime, you may want to consider planting 25% potted plants and 75% plugs so that your garden has a fuller look throughout the first summer. If planting in the fall you will only see the garden for a short time so 100% plugs would be the most economical choice.

Image 3 – Proposed Landscaping Plan

Table 5 – Flowers

Common Name	Scientific Name
Sweet flag	(Acorus calamus)
Canada anemone	(Anemone canadensis)
Swamp milkweed	(Asclepias incarnata)
Panicled aster	(Aster lanceolatus)
New England aster	(Aster novae-angliae)
Red-stemmed aster	(Aster puniceus)
Joe-pye weed	(Eupatoreum perfoliatum)
Grass-leaved goldenrod	(Euthamia graminifolia)
Sneezeweed	(Helenium autumnale)
Wet sunflowers	(Helianthus sp.)
Common ox-eye	(Heliopsis helianthoides)
Blue flag iris	(Iris versicolor)
Tall blazing star	(Liatris pycnostachya)
Blue lobelia	(Lobelia siphilitica)
Obedient plant	(Physostegia virginiana)
Mountain mint	(Pycnanthemum virginianum)
Brown-eyed Susan	(Rudbeckia subtomentosa)
Arrowhead	(Sagittaria latifolia)
Tall meadow rue	(Thalictrum dasycarpum)
Blue vervain	(Verbena fasciculate)
Culver's root	(Veronicastrum virginicum)
Golden Alexander	(Zizia aurea)

Table 6 - Grasses, Sedges and Ferns

Common Name	Scientific Name
Fringed brome	(Bromus ciliatus)
Blue joint grass	(Calamagrostis canadensis)
Water sedge	(Carex aquatilis)
Bottlebrush sedge	(Carex comosa)
Caterpillar sedge	(Carex crinita)
Porcupine sedge	(Carex hystericina)
Lake sedge	(Carex lacustris)
Pointed broom sedge	(Carex scoparia)
Fox sedge	(Cares vulpinoidea)
Virginia wild rye	(Elymus virginicus)
Soft rush	(Juncus effuses)
Sensitive fern	(Onoclea sensibilis)
Royal fern	(Osmunda regalis)
Switch grass	(Panicum virgatum)
Green bulrush	(Scirpus atrovirens)
Wool grass	(Scirpus cyperinus)
River bulrush	(Scirpus fluviatilis)
Soft stem bulrush	(Scirpus validus)
Giant bur-reed	(Sparganium eurycarpum)
Cord grass	(Spartina pectinata)

Shallow Grass Roots

Shallow roots is another problem that is identified at Meadows Park. The desired Kentucky bluegrass is not growing as well as creeping bentgrass because the soil is compacted and has poor water absorption. Deep grass roots create a healthy turf in many ways. It allows plants to better withstand drought periods, allows water to better infiltrate the soil and creates thicker turf that naturally crowds out weeds. Excessive irrigation can encourage short root growth and a plant that can become stressed more easily in the dry hot summer. The current irrigation regimen provides too much water and is creating an environment that favors shorter grass roots. Therefore, altering the irrigation schedule (as stated earlier) will help with the shallow grass roots at Meadows Park.

To increase root depth, a fertilization and aeration schedule will also help. Currently, core aeration is being completed one time per year in the fall. If budget allows, this should be increased to twice per year. Core aeration can improve compacted soil, improve water-holding capacity and allow for moisture to travel further into the soil (Christians, 2011). Core aeration will allow deeper grass root formation and create an environment that will better support our desired grass species. Overseeding should be completed with each aeration as part of good cultural practices. We suggest doing so in the fall, so new growth has less weed emergence to compete with. The overseed mixture should include our proposed mixture of 50% Kentucky bluegrass, 20% fine fescue, 15% tall fescue and 15% perennial ryegrass mixture. Fertilizer containing phosphorus would also be used to ensure successful germination (we would recommend Sustane 8-6-4). For overseeding, the manufacturer recommends 25lbs/1000 ft^2. We would complete this in conjunction with our fall aeration. This will also create a thicker and more diverse turf that will improve the performance of the playing fields.

The fertilization program should also be altered. Currently, the park is fertilized 2x per year – in the spring with a synthetic 20-0-0 and in the fall with a synthetic 20-0-15. We would alter this to an organic program and switch to an organic 8-2-4 in combination with corn gluten meal of 10-0-0. Organic fertilizer creates a deeper root system, which would help the shallow grass root issue. This would also be a beneficial component for the children and pets that use the park, as a safer alternative to synthetic fertilizers. It could be marketed as kid and pet friendly to encourage more park use.

Image 4 – broadleaf weeds

Weed Issues

Weeds found throughout Meadows Park include broadleaf plantain (*plantago major*) dandelion (*taraxacum officinale*), Canada thistle (*Cirsium arvense*), annual bluegrass (*pan annua*) and prostrate knotweed (*polygonum aviculare*) (see Image 4). The current use of pesticides is varied and only completed as necessary (see Table 7). When conditions are warm, Battleship III is a broadleaf herbicide that is used at a rate of 3.5 pints per acre. When conditions are cold, Trimec 992 (also a broadleaf herbicide) is applied at 4 pints per acre. We suggest eliminating the current synthetic herbicide use as it is now. In place of that, we recommend a corn gluten regimen, which would

provide an organic approach to weed control. Corn gluten meal is an organic pre-emergent weed control. It contains proteins that obstruct the root formation of a young weed plant, thus acting as a pre-emergent weed control. This pre-emergence characteristic will last for 5-6 weeks, while also providing beneficial nitrogen (Christians, 2011). We recommend two applications of corn gluten meal each year. One in the spring, while the other in late summer. The late summer application would be timed to stop the pre-emergence of fall weeds, while the spring application would combat the early summer weeds. These applications would be implemented once the creeping bentgrass is eradicated and new seed is successfully established. This is because corn gluten prevents the germinating plant from fully forming roots, yet does not affect the established grass plant (Christians, 2011). Applying corn gluten in the fall is not recommended because that is when

Table 7 – current herbicide products

Battleship III ingredients	%
Dimethylamine Salt of 2-Methyl-4-Chlorophenoxyacetic Acid	37.84%
1-Methylheptyl Ester of Fluroxypyr: ((4-amino-3-5-dichloro-6-fluoro-2-pyridinyl)oxy)acetic Acid, 1-methylheptyl ester	4.45%
Triethylamine Salt of 3,5,6-Trichloro-2-Pyridinyloxyacetic Acid	4.07%
Other Ingredients	53.64%
	100%

Trimec 992 ingredients	%
Dimethylamine Salt of 2,4-dichlorophenoxyacetic acid	30.56%
Dimethylamine salt of (+)-(R) -2-(2 methyl-4-chlorophenoxy) propionic acid	8.17%
Dimethylamine salt of dicamba 3,6-dichloro-o-anisic acid	2.77%
Enert	58.5%
	100%

overseeding takes place. Corn gluten takes about 3 years to achieve its best success. Therefore, spot-spraying in the fall can be completed if necessary. When doing so, we would recommend to do so in the most environmentally-friendly way. This would mean integrated pest management or IPM. We would recommend doing so in the fall only when the weeds are already in a weakened state and when many summer annuals are reaching the end of their lifecycle. The current chemical broadleaf control options could be used in this way.

Scalped areas around trees and other bare soil patches

As Image 5 demonstrates, many of the trees throughout Meadows Park have experienced scalping. Aeration, overseeding and a revised irrigation schedule will help with this issue. We would also recommend changing the mowing practices. Specifically, decrease the mowing around the tree areas, eliminate mowing in wet conditions and changing the mowing pattern. Elimination of the circular mowing around the trees is necessary. Straight mowing should be practiced throughout.

Image 5 – scalped areas around trees

The grass areas around the trees should be mowed once every 2 weeks or until 3" grass height can be maintained. We would also recommend increasing the size of the mulch rings around each tree to help with this scalping issue.

Conclusions

Here is a step-by-step guide to improving the turf quality at Meadows Park.

1. Change irrigation system to run in field area 2 only. Water deep and infrequent. We recommend 1" per week.
2. Raise mowing height and reduce mowing frequency. Make sure to maintain a 3" grass height in non-playing areas. Stop mowing around trees until enough grass is present to avoid scalping. Stop circular mowing.
3. Start an organic fertilizer and weed-control program.
4. Aerate yearly and multiple times in a year as budget allows.
5. Overseed yearly with a variety of grasses and cultivars.

Our new lawn care management program is shown in Table 8. The costs associated with this are shown in Table 9. By altering the current management to an organic approach, we will not only create a healthy turf but will also appeal to the public that currently uses the park. We will create pathways through the new native grass area and rain garden feature to engage the families that use the space. We would add signage throughout the site to inform the public of the changes and why they were made. This would also describe the positive characteristics of our new native prairie grass and rain garden features and how they can be enjoyed by all. Education for everyone will be important part of our recommendations.

Table 8 – New Turf Management Program

Meadows Park	Application
Early Spring	100% organic fertilizer Corn gluten meal
Late Summer	Corn gluten meal
Fall	100% Organic Fertilizer Aeration Overseeding Spot-spray for broadleaf weeds as needed

Table 9 – Cost per Area at Meadows Park

MEA1 – spectator area (51,000sf)	Cost
Early Spring organic fertilizer and CGM	$600.00
Early Spring aeration	$300.00
Late Summer CGM	$600.00
Fall aeration	$300.00
Fall overseeding	$500.00
IPM spot-spray for weeds	$200.00
TOTAL	$2400.00

MEA2 – outfield and soccer field (113,000sf)	Cost
Early Spring organic fertilizer and CGM	$1200.00
Late Summer CGM	$600.00
Fall fertilizer	$1000.00
Fall aeration	$600.00
Fall overseeding	$1000.00
IPM spot-spray for weeds	$400.00
TOTAL	$4800.00

MEA4 – playground area (33,000sf)	Cost
Early Spring organic fertilizer and CGM	$400.00
Late Summer CGM	$200.00
Fall fertilizer	$300.00
Fall aeration	$200.00
Fall overseeding	$300.00
IPM spot-spray for weeds	$100.00
TOTAL	$1500.00

References

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Photograph and Table References