



# **Will Soil Testing and Fertilizer Recommendations Reduce Fertilizer Use?**

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# Will Soil Testing and Fertilizer Recommendations Reduce Fertilizer Use?

## Executive Project summary

The goal of this project was to determine if providing site specific soil testing and lawn care best management practices (BMPs) to homeowners will reduce use of fertilizers and increase adoption of BMPs. Soil samples and site conditions were gathered from 44 lawns in Minneapolis and Lauderdale, most within the Mississippi Watershed Management Organization boundaries. Soils were analyzed and the University of Minnesota Soils Laboratory and recommendations based on the soil tests and lawn care BMPs were written and distributed to each project participant. Participants were surveyed before and after the soil sampling. Fifty-five percent of participants responding to the post-survey said they had made changes, and another 10% said they planned to make changes after receiving the soil test results and site-specific lawn care recommendations. Although it was difficult to determine if this project reduced fertilizer use, it did increase awareness and adoption of better lawn care practices. If participants follow the soil test recommendations as many indicated they would, a reduction in fertilizer use should result. Most soil test recommendations for fertilizer use are much lower than what is recommended on fertilizer bags. Healthier lawns resulting from adoption of BMPs will result in less runoff or leaching of nutrients to surface and groundwater. Information collected during the project provided insight into where additional education is needed on lawn care practices.

## Overview

Homeowners often rely on manufacturer's recommendations (on the bag) for fertilizer which are two to five times higher than needed to maintain healthy turfgrass. Poor turfgrass maintenance practices result in nutrient loading to both surface and groundwater. The restriction of phosphorus in fertilizers has helped reduce this source. However, some fertilizers still contain phosphorus (all can contain up to 0.67%), phosphorus fertilizers are readily available for purchase and people may not be aware of the law. Nitrogen is another fertilizer nutrient that is a pollutant to surface and groundwater. About 95% of the potassium in fertilizers is potassium chloride. Many twin cities metro area lakes and streams are impaired for chloride. Poorly maintained turfgrass results in unhealthy conditions allowing phosphorus, nitrogen, and sediment to run off to surface waters and leach into groundwater.

Nutrient loading to lakes results in eutrophic conditions including algal blooms and excessive weed growth. Poor water quality limits aquatic recreation, which in turn has economic impacts on these areas both in loss of visitors and reduction in property values. Many best management practices (BMPs) focus on removing pollutants from the waste stream rather than prevention. Removal of pollutants from stormwater or in-lake is only partially effective and is costly. The least expensive and most effective means to limit contamination of water by phosphorus, nitrogen and chloride is to reduce the use of these nutrients, thereby reducing pollutant loads to our waters.

Literature and other education on lawn care practices results in some BMP adoption, but more is needed. Some sources focus more on maintaining a green lawn rather than a healthy more sustainable lawn, resulting in use of more fertilizer than is needed. Site-specific information may be more appealing to some homeowners, potentially increasing the likelihood they will reduce fertilizer use and adopt better lawn care practices.

This project was conducted working with homeowners or renters in Minneapolis. The project partners included Fortin Consulting (FCI), the Mississippi River Watershed Organization (MWMO), and the Minneapolis Park Board (MPB). MWMO and MPB work together to host the Mississippi River Green Team (MRGT), a two-year employment and conservation program for Minneapolis youth between the ages of 14 and 16. The MWMO and the Minneapolis Park and Recreation Board created the Green Team as an opportunity for youth to have a mentored job experience, learn about environmental careers and acquire new skills. Green Team members come from North and Northeast Minneapolis. The MRGT was involved in soil sampling and gathering site-specific information. The knowledge gained by the MRGT will help influence lawn care practices beyond the project completion.

## **Goal**

The goal of this project was to determine if providing site specific soil testing and lawn care BMPs to homeowners will reduce use of fertilizers and increase adoption of BMPs.

## **Methods**

### **Selection of Participants**

Participation in the project was solicited by offering free soil testing and site-specific recommendations. Participants were selected based on a few factors. Originally, the properties were to be located within the MWMO boundaries, but since there was room for more in the project (limit of 50), the boundary was expanded to surrounding watersheds. The MWMO email address list was used to solicit participation, offering a free soil test and recommendations for environmentally friendly lawn care to participants. The initial email was sent out in April and May. The email list included watershed residents, but also many others. Respondents to the initial email were asked to complete a survey which included location, fertilizer practices and more (see below). Many respondents were not located in the watershed. Letters were sent out to the watershed residents indicating they were chosen to participate. Since there were less than the 50-participant limit, letters were also sent to some possible participants with additional information requested. Preference was given to participants who were in the MWMO Watershed boundaries and participants who fertilized their lawn. A few homeowners that did not use fertilizer were also chosen to participate since there was still space in the program and it would increase the data points.

Initial requirements to participate in project:

- already using fertilizer on your lawn
- allow project volunteers and staff on your property (front yard) to collect soil samples
- complete a pre-soil sampling survey
- complete a follow-up survey

### **Surveys**

Survey Monkey was used to administer the pre-and post-sampling surveys. MWMO staff administered the surveys developed by FCI and provided the results to FCI. MWMO staff sent out the initial survey to their email list. Selected participants were contacted via email to complete a presurvey about lawncare practices. A postsurvey was sent to all participants after they received soil test results and had the opportunity to make changes to their practices. Participants who did not participate in the post survey were contacted via phone and direct email to increase participation.

### *Pre-sampling survey*

The pre-soil sampling survey was conducted in May. All forty-four participants who were chosen for lawn sampling completed the presurvey (Appendix A). This survey focused mainly on fertilizer application and knowledge. The fertilizer application questions were based on fertilizer BMPs for lawns and included questions about timing, rate, application, and some questions on lawn care practices needed to complete the University of Minnesota (UMN) soil survey test form. Participants were assigned a code that was used on the soil test information sheet to track them and pair with the site assessment information, soil test results, and Survey Monkey surveys.

### *Post-sampling Survey*

A post-sampling survey was developed to assess changes in practices (Appendix B). It was decided to wait to conduct the post survey in 2020 since the results and recommendations were sent in the middle of the fertilizing season. The Twenty-one participants responded to the post-sampling survey. The post survey mainly repeated the same questions that were asked in the pre survey so responses could be directly compared. Respondents were also asked if they made changes because of the soil test results and what the changes were in addition to a few more questions.

## **Soil Sampling and Lawn Assessments**

On June 26 and 27, 2019 soil samples were collected, and a site assessment completed at each location. Training of the MRGT occurred the morning of June 26, initially a short presentation in the MWMO office, followed by a demonstration at the first sampling site. The Mississippi River Green Team split into two groups and was accompanied by a MRGT leader/driver and Fortin Consulting (FCI) staff to sample the selected lawns over 2 days. Due to inclement weather a few lawns were sampled later by an MWMO Green Team Alumni Intern.

At each location, a composite soil sample was taken in the front lawn following the [University of Minnesota sampling directions](#) for a lawn and supplemental written protocols prepared by FCI (see Appendix C). An assessment based on lawn characteristics and environmental conditions was also completed for each lawn (Appendix D). The MRGT took turns collecting samples and data while FCI ensured the samples were gathered correctly and the data was accurate. At the end of the sampling, soil samples and test forms were delivered to the University of Minnesota Soils Laboratory for analysis.



*Green Team member taking a soil sample*





*Quality of turf varied from site to site. Weed presence, bare patches and turf appearance were noted for each site.*

## Recommendations

Along with the soil test report (example Appendix E), a six-page recommendation sheet was provided. These recommendations were specific to the soil test results for each property. Three different versions were made based on the soil test fertilizer recommendations; 1) lawns with phosphorus recommendation, 2) lawns required no phosphorus, 3) and one for a lawn that required no phosphorus but had low pH and a lime recommendation. The mailing also included directions on how to use the soil test report to choose and buy the correct fertilizer, and recommendations based on these results including and tips for applying fertilizer were sent to the homeowners (Appendix F). This information was sent at the end of August along with a reminder to track practices and expect a follow up survey.

## Results & Discussion

### Applicants

One hundred and twenty-two applications were received from the email solicitation. Because the MWMO email list included watershed residents and others, the results were sorted based on location and fertilizing practices. An MWMO intern mapped the addresses to determine in what watershed they were located. Many were not located in the MWMO watershed. Letters were sent out to those that were chosen. Since it was less than the 50-participant limit, letters were also sent to some possible participants in the Minnehaha Creek Watershed with additional information requested. Forty-one participants were chosen, including some in a neighboring watershed to increase the sample numbers. The locations needed to be somewhat close to each other to try to sample them within the time budgeted. Three additional sites were added later, for a total of 44 participants. All were single family homes except one which was an apartment building. The resident from the apartment building planned to share results with the building maintenance company.

### Soil Test Results

A summary of the soil test recommendations from samples collected at the 44 sites is shown below. Appendix G contains a full list of results. Samples were analyzed for the three macronutrients required by turfgrass: nitrogen, phosphorus and potassium, plus organic matter, and pH. Nitrogen is always recommended. It is not sampled in soils because it changes readily. Nitrogen recommendations are

based on how the lawn is maintained (clippings management and irrigation) and the organic content of the soil. Phosphorus was recommended in 34% of the samples and potash in 84% of the samples. The phosphorus free lawn fertilizer restriction (Minnesota law) has been in place since 2004 in the Twin Cities Metro area and the City of Minneapolis zero phosphorus lawn fertilizer ordinance started in January 2002. If no phosphorus was used on these lawns since those dates, there may be some depletion of phosphorus in the soils.

### Summary of Soil Test Results- overall nutrient & lime recommendations

Recommendation Summary	# times recommended	% of samples recommending nutrient
Lime	1	2.3%
Nitrogen	44	100%
Phosphate	15	34.1%
Potash	37	84.1%

A summary of the nutrient recommendations in pounds per 1000 square feet per year is shown below. Although the University of Minnesota recommendation for nitrogen range from 0.5 to 4, the highest recommendation for the 44 sites tested in the project was 2.5 lbs./1000 sq ft/year. Most sites (29) had a recommendation for zero phosphorus with the highest recommendation of 1 lb./1000 sq ft/year but most at only 0.5 lbs. The potassium levels measured in the soils had a wide range of 96 to 287 parts per million (ppm). With this wide range in potassium levels, potash recommendations also had a wide range from 0 to 4 lbs./1000 sq ft/year, with most at 1 lb. or less. A summary of the soil test results is also included below.

### Summary of Soil Test Results- recommended application rates

Nutrient	Application rate (lbs./1000 sq ft/year)							
	0	0.5	1	1.5	2	2.5	3	4
Nitrogen	0	1	26	5	6	6	0	0
Phosphate	29	13	2	0	0	0	0	0
Potash	7	8	15	0	7	0	5	2

### Soil Test Result Summary

	Organic matter (%)	pH	Bray 1 Phosphorus (ppm)	Potassium (ppm)	Lime Recommendation (lbs/1,000 sq ft)	Nitrogen Recommendation (lbs/1,000 sq ft)	Phosphate Recommendation (lbs/1,000 sq ft)	Potash Recommendation (lbs/1,000 sq ft)	Total Nutrient Product Recommendation (lbs/1,000 sq ft)
Average	7.0	6.7	33.1	109.4	1.1	1.4	0.2	1.3	2.9
Minimum	3.9	5.3	7	38	0	0.5	0	0	1
Maximum	23.7	7.5	63	287	50	2.5	1	4	7
Median	6.3	6.7	32.5	96	0	1	0	1	2.5

### Soil Texture results- number of tests per category

Estimated Soil Texture Summary	Coarse	Fine	Medium	Total
	12	1	31	44

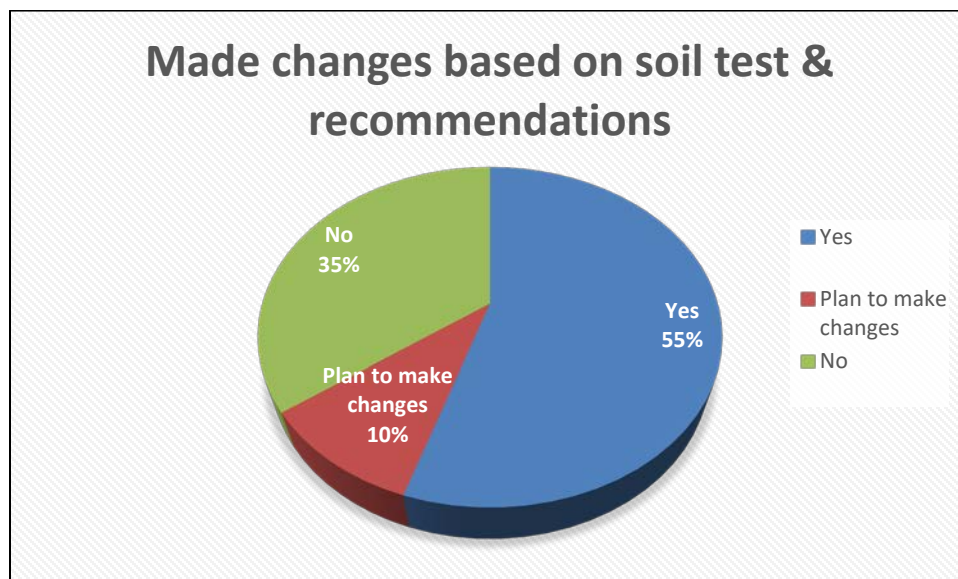
Most of the soils were rated as medium texture.

### Fertilizer Application Practices Before and After Participation

The pre-soil sampling survey was conducted in May of 2019 with 44 completing the survey. The post-sampling survey was conducted in August-September of 2020 to assess the practices completed in late 2019 and in 2020 after they received the results and recommendations. Twenty-one responded to the survey (47.7%), however, one had moved so did not supply answers to the survey questions bringing the actual usable responses to 45.5%. A summary of the responses is included below. The low number of responses make it difficult to determine if the change in practices is significant.

#### *Did you make changes based on the recommendations?*

Of 20 post-sampling survey respondents, 19 read the results of the test. One of the respondents who read the results of their test moved shortly after receiving them so answered “no” but stated that “the information that was provided was helpful in giving direction on how to care for the yard if we had stayed”. Of the responses that received from the postsurvey, 65% reported that they made changes (11) or plan to make changes (2) based on the soil test results. These stated changes included following the recommended fertilizer ratio, adding a soil amendment, and planting of edibles based on soil quality. Many more changes were made based on the survey results.

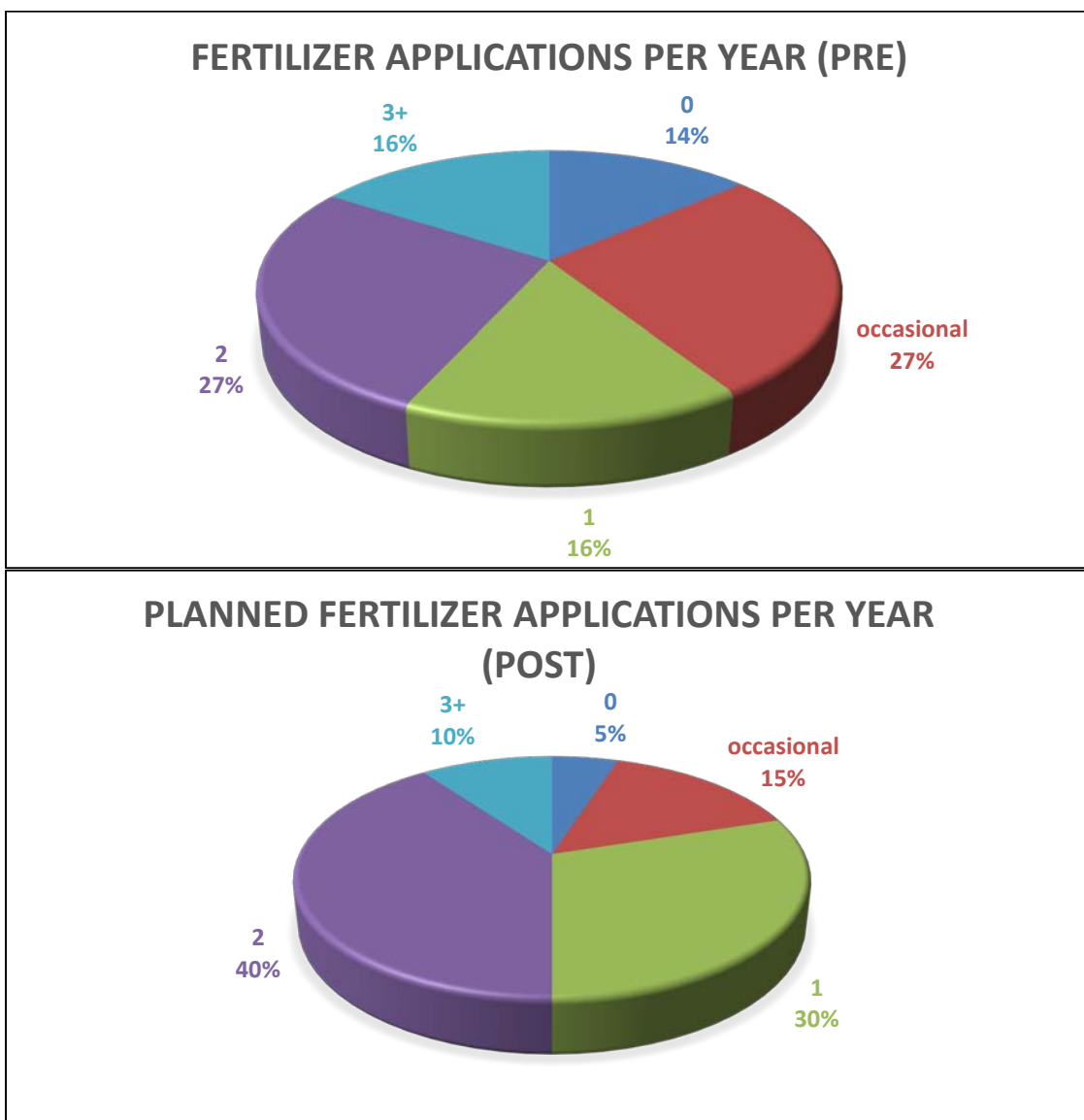




Changes made?	Post-sampling n=20
Made changes	55% (11)
Plan to make changes	10% (2)
No changes	35% (7)

#### *How often do you usually fertilize your lawn?*

Prior to the sampling, participants were asked how many times per year on average they fertilize their lawn. In the post survey, they were asked how often they planned to fertilize their lawn. There was a drop in the percent that fertilize three or more times, but there was an increase in those that fertilize twice a year; and there was an increase in the number that fertilize one time per year, but a decrease in those that fertilize only occasionally.



<b>Fertilizer applications</b>	<b>Pre-sampling n=44</b>	<b>Post-sampling n=20</b>
None	13.6% (6)	5% (1)
Occasional	27.3% (12)	15% (3)
1 per year	15.9% (7)	30% (6)
2 per year	27.3% 12	40% (8)
3+ per year	15.9% (7)	10% (2)

*Do you apply fertilizer yourself, or hire someone to do it?*

Most homeowners apply fertilizer themselves rather than hiring a lawn care company.

<b>Who applies fertilizer?</b>	<b>Pre-sampling n=44</b>	<b>Post-sampling n=20</b>
Homeowner	75% (33)	70% (14)
Hired out	22.7% (8)	30% (6)
No response	2.3% (3)	0% (0)

*When do you fertilize your lawn?*

Participants were asked what time of year they apply fertilizer. The most common fertilizer application timing was two applications, one in the spring and one in the fall. For the pre-sampling survey, Spring was the second most common time to apply fertilizer, followed by fall. This reversed in the post-sampling survey. If only one application is done, fall is the best time. In the post survey, only two respondents cited applying in Spring, Summer, and Fall. No one responded that they applied fertilizer later than October 15 when soil temperatures limit uptake of nitrogen and leaching or runoff is more likely to occur.

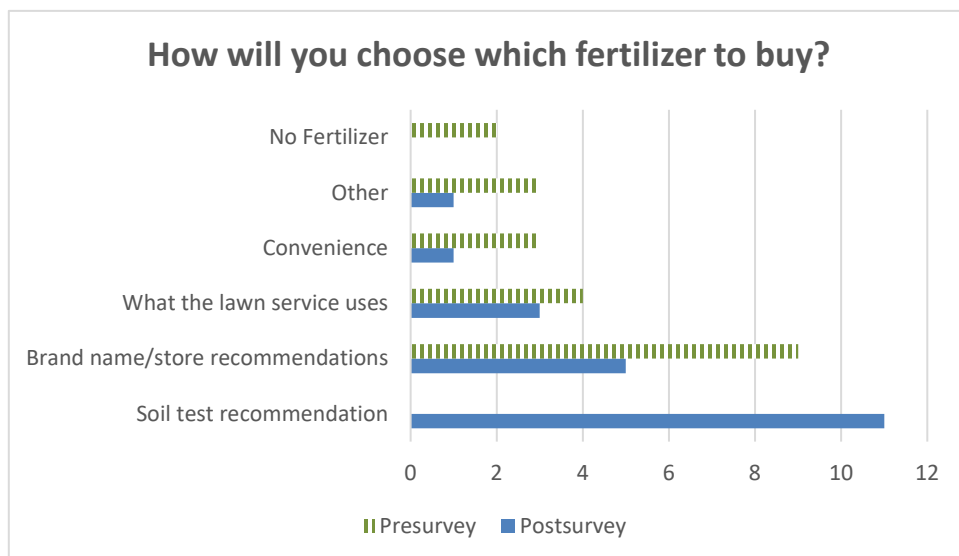
<b>Fertilizer timing</b>	<b>Pre-sampling n=44</b>	<b>Post-sampling n=20</b>
Spring	25% (11)	15% (3)
Summer	0% (0)	0% (0)
Fall	18% (8)	20% (4)
Spring & Summer	2% (1)	5% (1)
Spring & Fall	27% (12)	45% (9)
Spring, Summer & Fall	14% (6)	10% (2)
Summer & Fall	2% (1)	0% (0)
No response	11% (5)	5% (1)

The post-sampling survey also included a question on when they applied fertilizer during the project period. Nine of the 20 participants did not fertilize. Three applied fertilizer in the Fall of 2019, and one in the fall of 2019 and 2020. Two applied only in the spring. One applied three times in 2020, spring, summer, and fall; and one applied four times in 2020, spring, summer, fall and late fall. Those with the high number of applications hire a lawn service.

### *How will you choose which fertilizer to buy?*

A comparison of presurvey results and postsurvey results from those who participated in both surveys can be seen in the chart.

Out of answers received in the postsurvey, 11 responded they would follow the soil test recommendations when selecting a fertilizer. Of the people who selected other answers, five responded they would rely on a lawncare companies' recommendations, four responded they would rely on store recommendations and one said they would choose a brand name product. No one relied on soil test recommendations before participation.



Of the people who said they would use the soil test recommendations, five said they relied previously relied on store recommendations or brand names to choose a fertilizer, two relied on a lawn care company recommendation, two relied on what they had on hand/their own research and two previously did not fertilize.

### *Do you know what the ratio on the fertilizer bag means (example: 16-4-8)?*

The soil test report and lawn care recommendations provided did not appear to change the number of people that know that the ratio on the fertilizer bag is the percent of the macronutrient's nitrogen, phosphorus, and potassium in the bag. About half do not know what these numbers mean. It would be difficult to choose the correct fertilizer without understanding the ratio.

Ratio awareness	Pre-sampling	Post-sampling
Yes	43.2% (19)	45% (9)
No	50% (22)	55% (11)
No response	6.8% (3)	

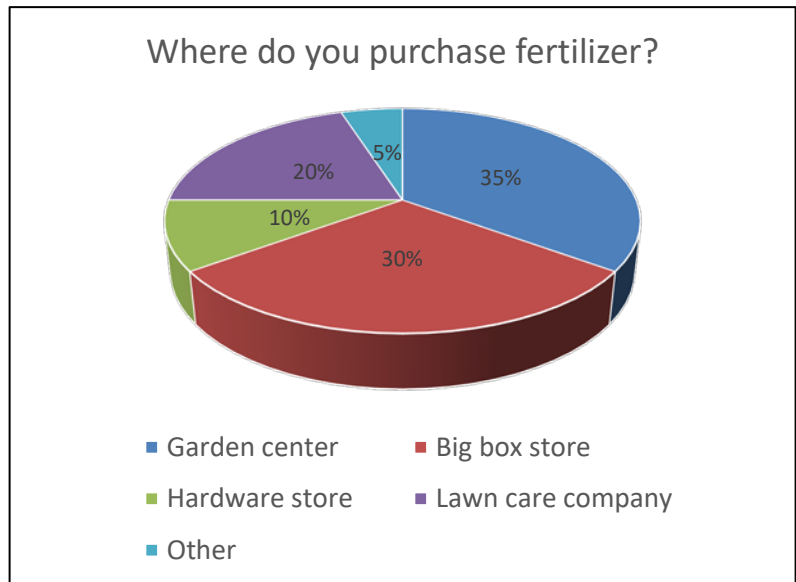
### *Did you use fertilizer containing phosphorus (middle number on bag greater than 0)?*

The post-testing survey included a question on if they used fertilizer containing phosphorus. Nineteen of the 20 respondents responded "no", and one did not respond.

### Where do you purchase your fertilizer?

In the second survey, participants were asked where they purchased their fertilizer. The majority purchase from a garden center or big box store (such as Home Depot, Target, etc.).

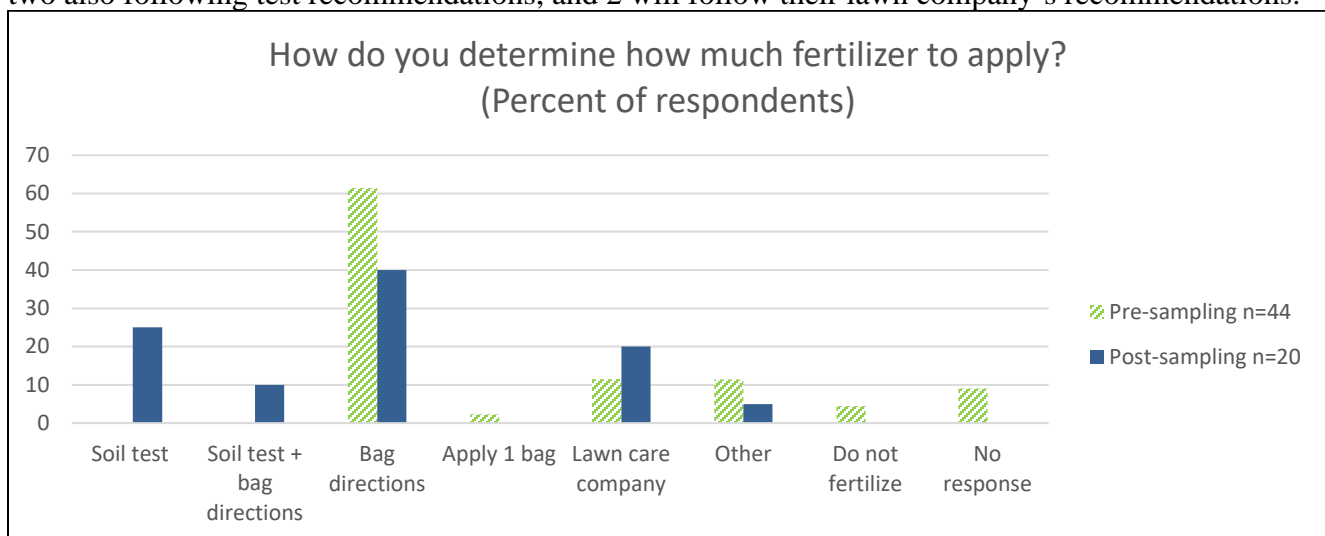
Fertilizer purchased	Post-sampling n=20
Garden center	35% (7)
Big box store	30% (6)
Hardware store	10% (2)
Lawn care company	20% (4)
Other	5% (1)



### How will you determine how much fertilizer to apply?

From the post survey, eight respondents will follow soil test recommendations when deciding on the rate of fertilizer application, eight will follow directions on the bag, four will follow their lawn care companies' recommendations and one person answered "other".

In the pre survey the most popular answer when determining the rate of fertilizer was based on the directions on the bag (27 respondents or 61.4%). After the results and recommendations were distributed, this dropped to 40% that rely on bag directions. Thirteen of the respondents who previously applied fertilizer based on the recommendations given on the bag responded to the follow up survey. Six will follow soil test recommendations, 5 respondents will continue to follow directions on the bag with two also following test recommendations, and 2 will follow their lawn company's recommendations.



<b>How do you determine how much fertilizer to apply?</b>	<b>Pre-sampling n=44</b>	<b>Post-sampling n=20</b>
Soil test	0% (0)	25% (5)
Soil test + bag directions		10% (2)
Bag directions	61.4% (27)	40% (8)
Apply 1 bag	2.3% (1)	
Lawn care company	11.4% (5)	20% (4)
Other	11.4% (5)	5% (1)
Do not fertilize	4.5% (2)	
No response	9.1% (4)	

#### *Are you aware of the Minnesota Phosphorus Restriction Law?*

A Minnesota state law that restricts the use of phosphorus on lawns was enacted in 2004. Almost ¼ of the survey participants were unaware of the law. Following the soil sampling and recommendations, the number that responded they were not aware of the law was 65%. The reason for this increase is unknown. Perhaps they misunderstood the question and after reading about the law realized they had not really known about it.

<b>Aware of Phosphorus law</b>	<b>Pre-sampling n=44</b>	<b>Post-sampling n=20</b>
Yes	75% (19)	35% (7)
No	22.7% (22)	65% (13)
No response	2.3% (1)	0% (0)

#### *How do you Manage Grass Clippings?*

Participants were asked how they manage their grass clippings. The majority leave them on the lawn which is a best management practice that reduces the amount of fertilizer needed. The percentage of those leaving clippings on the lawn increased by 10% following the survey.

<b>Clippings management</b>	<b>Pre-sampling n=44</b>	<b>Post-sampling n=20</b>
Leave on lawn	75% (33)	85% (17)
Remove	22.7% (10)	15% (3)
No response	2.3% (1)	0% (0)

#### *Using Weed and Feed Products*

The number of respondents that reported using “weed and feed products dropped from 75% to 55% after the soil test results and directions were provided. However, some respondents who previously reported using weed and feed products did not report using them in the second survey while some who did not use them in the first survey report that they used them.

Use weed & feed	Pre-sampling n=44	Post-sampling n=20
Yes	75% (33)	55% (11)
No	22.7% (10)	40% (8)
No response	2.3% (1)	5% (1)

#### *Using and Calibrating a Fertilizer Spreader*

Only 13.6% of participants in the pre-sampling survey responded that they calibrated their fertilizer spreader. This increased to 55% in the second survey. Thirty people reported using a spreader to apply fertilizer in their lawn in the presurvey. In the follow-up survey, 7 of 8 people who had reported not using a fertilizer spreader previously said they will use one. Seven out of the 19 people who plan to use a spreader report that they plan to or have calibrated their spreader.

Calibrate spreader	Pre-sampling n=44	Post-sampling n=20
Yes	13.6% (6)	55% (11)
No	79.5% (35)	40% (8)
No response	6.8% (3)	5% (1)

#### *How often do you water your lawn?*

Respondents were asked about their irrigation practices in both surveys. This is one of the practices used to determine nitrogen recommendations. Irrigated lawns require more nitrogen. Less irrigation was reported in the second survey, especially those that had reported they irrigated 3 or more times per week.

Watering (times/week)	Pre-sampling n=44	Post-sampling n=20
Never	13.6% (6)	25% (5)
Occasionally	59.1% (26)	60% (12)
1 time/week	13.6% (6)	10% (2)
2 times/week	4.5% (2)	5% (1)
3+ times/week	9.1% (4)	0% (0)

#### *At what height do you mow your grass?*

This question was only asked in the post survey. Fifty-five percent answered that they mowed at 3” or taller. Mowing lawns to a height of 3” or taller is a best management practice. Twenty-five percent do not know what height they are mowing their lawn.

Mowing height	Post-sampling n=20
2 – 2.5”	20% (4)
3 – 4”	45% (9)
>4”	10% (2)
I don’t know	25% (5)

#### *Where to you look for information on lawn care?*

Participants were asked where they looked for information on lawn care which could be helpful for determining where to target education efforts. Multiple answers were permitted. A total of 62 answers



were given. The majority get their information from the internet. The percent that use the University of Minnesota as a source of information on lawn care more than doubled between the surveys.

Get info on lawn care	Pre-sampling n=62	Post-sampling n=31
Internet	38.7% (24)	45.2% (14)
Store/garden center	22.6% (14)	12.9% (4)
University of MN	9.7% (6)	25.8% (8)
Watershed	6.5% (4)	9.7% (3)
City	3.2% (2)	3.2% (1)
Lawn care company	1.6% (1)	3.2% (1)
Master water stewards	1.6% (1)	
I don't know	16.1% (10)	

## Conclusions & Recommendations

The original goal of this project was to determine if providing site specific soil tests and recommendations would reduce fertilizer use. The results do not specifically answer this question. We can say that lawn care practices changed because of the project. Many reported practices changed from poor practices to BMPs, which likely resulted in reduced fertilizer use.

Sixty-five percent of participants stated they have made or plan to make changes because of the project. Based on the survey results, about half of participants reported changing their practices because of receiving site specific soil test results and recommendations. Changes can be seen when looking at the answers of how respondents select the type and amount of fertilizer to apply. Previously no participants relied on a soil test to decide which fertilizer to apply. Of the respondents who answered, about half said they will use the soil test recommendations when selecting fertilizer type and amounts to apply. This change may reduce over or unnecessary application of nutrients by these participants. Many fertilizer bag instructions are for application of 1 lb. nitrogen/1000 square feet, but also recommend multiple applications, with some suggesting up to eight times more than may be needed. The amount of phosphorus and potassium applied depends on the nutrient ratio on the bag.

All but one that responded they apply fertilizer 3 or more times per year use a lawn service. They did not change on the post survey. In many cases, depending on the soil test results, one application per year is possible.

Some reductions in the timing of fertilizer applications were found. For example, some that were fertilizing once in the spring, responded they would fertilize once in the fall. This is the recommended practice. There was also a positive change in the way fertilizer was applied. More people reported using and calibrating a spreader after participating. Participants received detailed instructions on how to apply fertilizer using a spreader and a link to an instructional calibration video. By using a calibrated spreader, participants will reduce the likelihood of accidental over-application of fertilizer.

Although weed and feed products were specifically mentioned as a poor practice, we did not see a reduction in the number of participants who use these products. This could be related to the convenience of these products or where the participants purchase their lawn care products.

Restrictions on phosphorus fertilizers have been in place since 2002 (Minneapolis) and 2005 (State of MN). There was an effort to educate the public about the new law for the first few years. However, since then there has not been a lot of education regarding the law. As shown in this survey, many are not aware of the law. A renewed education effort may help increase awareness of the law.

Some participants that did not fertilize stated they would fertilize once a year in the post survey. This may indicate an increase in fertilizer use from those participants. However, if their lawns are in poor health with thin turf and/or bare areas, use of fertilizer may improve the health of the lawn and reduce runoff of phosphorus that occurs with the soils on thin turf.

Education on lawn care could focus on the areas where survey participants were not using best management practices, or where a lack of understanding is evident. For example, the use of weed and feed products, calibration, understanding fertilizer ratios, and the zero-phosphorus fertilizer law.

The anticipated outcomes of the project were:

1. *20 to 25 individuals trained in soil testing and lawn care BMPs.* We were able to train 20 Mississippi River Green Team members plus their 2 supervisors in soil testing and some lawn care BMPs. We weren't able to offer a follow-up training the MRGT due to their schedules.
2. *Estimated reduction in fertilizer use of 25 to 50%.* Specific changes in fertilizer use could not be measured with this project, but adoption of BMPs likely will result in improved use of fertilizer, including reductions. The soil tests provided to participants indicated how much of each nutrient to apply per year. If participants follow these recommendations rather than those on the fertilizer bag, they are very likely to reduce fertilizer use. For those whose soil tests indicated the need for phosphorus, an increase in the use of phosphorus may occur. However, if the lawn is not healthy with bare or thin turfgrass, use of the recommended fertilizer should improve lawn health and reduce runoff and leaching of fertilizers into surface and ground water.
3. *Estimated increase in the number of lawn care BMPs implemented.* The post-sampling indicated adoption of new practices in 65% of participants.

## **Other Considerations**

### *Selection of participants*

Participants were selected based on a variety of factors. Preference was given to participants who were in the MWMO Watershed boundaries and participants who fertilized their lawn. People outside of MWMO's boundaries and people who did not fertilize were included in the sampling. If this project is recreated in the future, it may make sense to coordinate with a neighborhood organization for contacts. This may reduce the distance between sampling sites and minimize travel time and expense.

### *Number of Survey Responses*

Responses to the post survey were lower than planned. The time between the soil test and the follow up survey likely contributed to a lower participation rate. It was necessary to wait until the next season to

determine if participants changed their behavior. In the future, incentivizing the response to the follow up survey with a small gift card may increase survey responses.

#### *Lawn Care Companies*

Several respondents reported using lawn care companies to apply fertilizer. While one respondent reported using their recommendations with their lawn care company one respondent reported trouble being able to use their soil test results. They reported that after calling two lawn care companies, neither were able to customize their fertilizer to meet the recommendations of a soil test. The other respondents who use lawn care companies did not report using the soil test results or recommendations when consulting with their lawn care companies. It may be worth examining how to encourage lawn care companies to meet the recommendation of soil tests.

#### *Participation of Mississippi River Green Team Members*

The MRGT helped with the field portion of the project. They were quick to learn to soil sampling procedure and were able to collect soil samples and perform site assessments simultaneously. With the extra help, the site assessment and soil sampling took less time than if FCI completed them on their own. The project also provided a hands-on learning experience for the MRGT.

#### *Comments from Participants*

All the comments received from participants reported a positive experience or had no comment (Appendix H). Half of respondents commented that participation in the project was “informative” or “helpful”. Two people, although had positive comments, reported that they wished the results were delivered to them faster. This was a fair assessment. Due to other commitments, the results were sent out a little later than planned. One participant noted that it would be helpful to have a follow up conversation to help explain the results instead of an email. This is true; however, they all were invited to contact FCI staff with any questions. Possibly offering a short evening class or posted video would be helpful.

#### *Technical and Economic Feasibility*

This type of project could be repeated in the future. There are no technical limits. The Lawn Care guides have already been developed and could be used again. This would decrease the cost. One option to make it even more affordable is to offer a free soil test with a convenient drop off site, such as the MWMO office or a location close to the area where homeowners will test their soils. Homeowners would collect their own soil samples, complete the soil sample submittal form, and drop them off at the MWMO or designated location. This may decrease the number of interested participants since the samples would not be collected by others but could increase participation if offered on a schedule that would allow people to drop off samples to be delivered to the soils lab once a week early in the growing season, or on a set schedule. We had invited MWMO Minnesota Water Stewards to participate. However, no one showed interest. If collection of samples was desired, trained Water Stewards could do this.

#### *Potential improvements*

The lower response to post-sampling surveys may have been due to the long time between the two surveys. To conduct them in the same year the initial survey would have to have been completed earlier in the year. The timing of the grant award and working with the MRGT schedule made it impossible to

get the surveys developed, participants selected, and sampling and soil testing done prior to spring fertilizer applications.

Participants had agreed to complete the post-sampling survey as part of being chosen to receive the free soil sampling and recommendations. However, this did not seem to be enough of a commitment to get them to complete the survey. A UMN Extension staff member recently said the use of a small monetary incentive improve response rates in a survey they conducted.

A few participants said they did not receive the results when asked to complete the post sampling survey. Once FCI was made aware of this, the results were resent to them. It is possible they were missed or ended up in the junk mail folder. Possibly, a separate email with no attachments could be sent out to confirm receipt of the results and suggest checking the junk mail folder if not received. After receiving the results, one participant completed the survey and stated, “we WILL make changes”.

The amount of fertilizer used was not determined in this project. To assess the amount of fertilizer used, this work would have to be over 2 years and include having residents record their fertilizer ratios and amount of fertilizer applied each year. This would still not be very accurate since homeowners likely buy a different fertilizer and ratio each year since most do not rely on soil tests to choose fertilizer. The best way to estimate fertilizer use may be through combining this type of survey with a survey of stores that carry fertilizer, determining what is being sold.

It was decided to collect information on each lawn during the sampling. This data was not analyzed due to lack of funding to complete this. It is included in the Excel workbook. The amount of data collected in total and the format made it time consuming to analyze. There may be a better way to format the survey to provide for easier analysis of data.

One person suggested offering a discussion session, so they have an opportunity to ask questions about their results and lawn care practices. The emails included an option to call or email any questions. It is difficult to get people to attend in-person presentations, but that would be a possibility. With the new use of live-streaming meetings, this may be a better option to get more people to attend.

## Appendix A: Pre-sampling Survey Questions

### Survey questions:

Name

Address

Email address

Phone number- daytime

Statement regarding agreeing to allow us on their property to collect soil samples.

**On average, how often do you fertilize your lawn? \_\_\_\_ times each year?**

Never, occasionally, 1 time per year, 2 times per year, 3+times per year

**Do you do apply fertilizer yourself or do you hire someone to do it?**

Apply it myself, hire someone

**What time(s) of year do you apply fertilizer?** Spring, summer, fall

**How do you choose which fertilizer to buy?**

Store recommendation, brand name, University of MN recommendation, Other

**How do you determine how much fertilizer to apply?**

I apply one bag to my lawn, by the directions on the bag, University of MN recommendations, other

**Do you know what the ratio on the fertilizer bag means (ex. 16-4-8)?**

yes, no

**Are you aware of the Minnesota phosphorus fertilizer restriction law?**

yes, no

**Do you use “weed and feed” products (contains herbicide and fertilizer)?**

yes, no

**Do you use a fertilizer spreader?**

yes, no

**Have you ever calibrated your fertilizer spreader?**

yes, no

**On average, how often do you water your lawn during the summer?**

Never, occasionally, 1 time per week, 2 times per week, 3+ times per week

**How do you manage grass clippings from mowing?**

Leave them on the lawn, remove them

## Appendix B: Post-sampling Survey Questions

### Soil Testing and Recommendations Post-testing Survey

#### 1. Contact Information

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip code \_\_\_\_\_

Email \_\_\_\_\_ Phone \_\_\_\_\_

**Instructions:** In 2019, your soil was sampled and you were provided the University of MN soil test results with some recommendations on lawn care for your property. You had agreed to participate in a pre and post soil sampling survey as part of a Minnesota Pollution Control Agency Environmental Assistance project conducted by Fortin Consulting and the Mississippi Watershed Management Organization.

**Please choose the answer(s) that best explains your lawn care practices after receiving the soil test results and recommendations.** You may choose more than one answer if it applies. Your contact information will not be provided to anyone not part of the project.

This is a follow-up survey to determine if practices were changed as a result of the project.

**2. Did you read the results of the soil sampling completed for your property last year?** Yes      no  
Other: \_\_\_\_\_

**3. Did you make any changes in your lawn care practices as a result of receiving the soil test results and recommendations?** Yes      no      If yes, please describe:  
\_\_\_\_\_

**4. Did you fertilizer your lawn last fall or this spring or summer?**  
did not fertilize    Fall 2019 (Sept)    Late fall 2019 (Oct1-15)    Spring 2020 (May-June 15)  
Summer 2020 (August)    Fall (September)    Late Fall (Oct 1-Oct15)    Other (please explain):  
\_\_\_\_\_

**5. How often do you plan to fertilize your lawn?**  
never    occasionally    1 time per year    2 times per year    3 + times per year

**6. Did you or will you apply fertilizer yourself or hire someone to do it?**  
I apply it myself      I hire someone to do it

**7. What time(s) of year will you apply fertilizer?**    spring      summer      fall

**8. How did or will you choose which fertilizer to buy?**  
store recommendation      brand name      UMN recommendations      Soil test  
recommendations      other (please specify) \_\_\_\_\_



**9. Where will you purchase your fertilizer?**

Big box store (e.g. Menards, Target, etc.)      Hardware store      Garden Center  
other (please specify)\_\_\_\_\_

**10. How will you determine how much fertilizer to apply?**

I apply one bag to my lawn      by the directions on the bag      Univ. of MN recommendations  
Soil test results and recommendations  
other (please specify)\_\_\_\_\_

**11. Do you know what the ratio on the fertilizer bag means?**      yes      no

**12. Did you use fertilizer containing phosphorus (middle number on bag is greater than zero) on your lawn?**      yes      no

**13. Are you aware of the Minnesota phosphorus fertilizer restriction law?**      yes      no

**14. Will you use “weed and feed” products (contain herbicide and fertilizer)?**      yes      no

**15. Will you use a fertilizer spreader?**      Yes      no

**16. Will you or have you calibrated your fertilizer spreader?**      yes      no      not applicable

**17. On average, how often do you water your lawn during the summer?**

never      occasionally      1 time per week      2 times per week      3+ times per week

**18. How do you manage grass clippings from mowing?**      leave them on the lawn      remove them

**19. At what height do you mow your grass?**      2 – 2.5”      3-4”      >4”      I don’t know

**20. Where do you look for information on lawn care?**

I won’t      store/garden center      City      Watershed      Univ. of Minnesota      internet  
other (please specify)\_\_\_\_\_

**21. Do you have any comments on the project you’d like to share?**

## Appendix C: Soil Sampling Protocol

### Soil Sampling protocol

Remember we will be on private property and we need to respect their property.

#### Protocol at sites

Knock on door to see if anyone is home prior to collecting sample to let them know we are there.

#### Tasks

1. Collect a soil sample (5 people)
  - a. 5 random spots spread out in the front yard (need 2 – 3 cups, to line on bag)
  - b. Dig down 3" to collect the sample and place in a bucket
  - c. Remove the upper surface mat of grass and litter and discard litter onto the lawn and spread out
2. Composite the soil sample
  - a. Combine the 5 separate samples into a single bucket
  - b. Remove any debris such as grass or litter
  - c. Mix up the 5 samples. Pour into the bag. Fold the bag top down several times and then fold in the wire fasteners to hold the bag closed.
3. Label the sample bag and fill out the soil survey form (1 person)
  - a. On the middle left there is a place for a sample name. It will be "FC" + the number from the list of sites for that address.
  - b. Some of the information will be pre-filled in. Complete the section "For Grass Only" using the information from the survey list provided for the address of the site. You will be filling in whether grass is watered regularly and if clippings are removed. If they answered never or occasionally or left it blank for watering, check "no".
  - c. Under "Optional reference" on top, write the address of the site.
4. Complete Site Information form (2 – 3 people)
  - a. Complete site information sheet that describes site type and conditions
    - i. Use ruler to measure average lawn height in several representative places
    - ii. Estimate percentages as best as you can.
    - iii. For storm drain question, look at those on the same side of the street as house
    - iv. Under Notes, record anything that you think might be affecting the health of the lawn.
5. FCI staff take photos and review the completed forms, note which direction the lawn faces

Green Team members can rotate tasks so they can get experience in all aspects of the project.

## Appendix D: Site Information Form

### Soil Testing Project- Site Information

Site # \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_

Sampled by: ☐ Mississippi River Green Team      Other \_\_\_\_\_

Address \_\_\_\_\_ City \_\_\_\_\_

Type of building    ☐ single family home    ☐ duplex/quad    ☐ apartment or condo  
☐ other \_\_\_\_\_

Spoke to homeowner?    ☐ yes    ☐ no

Lawn height (Inches)    ☐ <2"    ☐ <3"    ☐ 3 – 4"    ☐ >4-6"    ☐ >6"

Is yard sunny (open) or shady (tree cover)?    ☐ sunny    ☐ Partly shady    ☐ very shady

Pet waste present in yard?    ☐ yes    ☐ no

Grass clippings/other organic debris visible in curb/street in front of house?    ☐ yes    ☐ no

Closest storm drain    ☐ clear    ☐ small amount of debris    ☐ lots of debris

Bare areas present (% of front lawn):    ☐ none    ☐ <10%    ☐ 10 – 25%    ☐ 25 -50%  
☐ >50%

Weeds present (% of lawn):    ☐ none    ☐ <10%    ☐ 10 – 25%    ☐ 25 -50%    ☐ >50%

Lawn appearance    ☐ healthy, thick turf    ☐ average (not as thick, some weeds)  
☐ poor (thin turf, bare or weedy areas)

Notes:



## **Appendix F: Example Lawn Care Recommendation Guides**

University of Minnesota soil test reports (specific to each lawn) along with lawn care recommendations were sent to each participant. Three different versions were developed and sent based on their individual soil test results. The three Lawn Care Recommendation Guides are included as attachments. The Guide for recommendations for a soil test that reported a phosphorus deficiency includes recommendations for applying phosphorus and when retesting is required as shown in the copy of the text below.

Your soil test also indicated your lawn could benefit from adding Phosphorus (the middle number in your recommendation is greater than zero). The state of Minnesota restricts the application of Phosphorus in order to protect our lakes. We ask that you consider this before buying, and only purchase a fertilizer with Phosphorus if your lawn is not healthy or starts showing signs of poor health, such as slowed growth, thinning out or having a purplish hue. Your soil test allows you to legally apply Phosphorus, in the amount indicated on the soil test, to your lawn for the next three years, should you choose to apply it. If you wish to keep applying Phosphorus after July of 2022, you will need to submit another soil test to determine if it is still recommended.”

Participants who received a soil test that did not have a phosphorus deficiency received information about the Minnesota phosphorus restrictions, why it is in place and were told they must use a zero-phosphorus fertilizer. The third Guide includes a recommendation for addition of lime due to low pH.

## **Appendix G: Data workbook**

A workbook that contains Excel worksheets for the site data collected, the pre-sampling survey, post-sampling survey and some analysis sheets is included as a separate attachment. Names and addresses of participants have been removed for privacy reasons.

## Appendix H: Comments received

### Question: Do you have any comments about the project you'd like to share?

The soil test results were informative, but it took some time to receive them, and it could have used a little more explanation for laypeople

---

Good to get some information about the health of the lawn

---

It's been a while since we did this but it was helpful to have when we were consulting with our lawn care company.

---

Really appreciated it - information on the test results was clear, glad to use the space

---

Just received results. I have contacted 2 commercial companies who can not customize fertilizer to meet Soil Test Report recommendations. We will most like fertilize ourselves this fall.

---

I wish we had stayed in the home so we could utilize the information better

---

Helpful to learn what my lawn needed most

---

Happy to have participated. Was able to adjust our lawncare based on the findings. Look forward to see the impact next year on lawn performance. Thank you.

---

Hard to change behaviors.

---

Thanks. This was very informative and helpful.

---

Very pleased with the testing and results

---

Really cool that you did it, it would be helpful if there was a follow up conversation or resources to help explain results though

---

No, everything went well, I told my friends about it

---

Pleased with the testing, was hoping for a quicker turn around on the results - felt like it took too long

---

I really appreciate the soil test results - I was not aware of the over-abundance of P & K in my soil. 20-0-0 is my new jam. Thanks!

---

Happy that we got the results, wasn't able to make any changes due to personal circumstances though