TORV
Sustainable Agronomics

June 3, 2021

Kaleb Anderson
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Maroon Creek Club
10 Club Circle
Aspen, CO 81611

Kaleb,

Once again thanks for having me out to do your soil and water testing. The course looked great. Overall, the soil tests looked good. Note that I made a few recommendations to correct a couple of minor deficiencies on greens and tees which the exact reason why we do the testing. The water tests results are consistent with those done in the past and the recommendation to handle the ultra-pure water is the same and I suspect will be in the future. Adding gypsum to your program will be important to keep the soil flocculated.

I wish I had a "miracle cure" for the rough. I don't. The best recommendation that I could come up with is "spot treating" areas that are not performing with cultivation and/or additional fertility. For me, 10 surrounds behind the green stick out as a perfect area to try additional nitrogen and see what happens. I know that is just one spot of many I'm sure you have noted. Having treated the fairways differently over time compared to the roughs is no doubt part of the equation. Adding additional fertilizer or cultivation to areas that DO NOT need it, is not going to help. I think maintaining what is acceptable now and "spot treating" what is unacceptable maybe a viable approach.

If you have questions, as always, reach out.

Thanks again and practice up!

Best Regards,

Eric Foerster, CGCS, MG
TORV, LLC

How to interpret these results

The Minimum Levels for Sustainable Nutrition (MLSN) guidelines are applied in this report. These guidelines are developed and based on two key principles (Global Soil Survey):

1. Excellent turf conditions can be produced when essential nutrients are present in the soil at or above the MLSN guideline. As long as the element of interest remains above the MLSN guideline, adding more of that element is not expected to confer an improvement to turfgrass performance.
2. The amount of nitrogen supplied to the grass controls the growth rate and consequently the uptake of mineral nutrients by the grass.

How and why MLSN works

It works by ensuring the grass is supplied with all the nutrients it can use while keeping a safe amount of each nutrient untouched in the soil as a reserve. The MLSN calculation identifies the amount of nutrients the grass uses at a particular site. It then ensures the grass is either supplied with 100% of those nutrients from fertilizer, from soil, or from a combination of soil and fertilizer (Woods et al., 2014).

This approach recognizes that grass uses nutrients. Rather than trying to maintain all the nutrients the grass could ever use, and then some, in a hypothetical optimum soil that doesn't exist, the MLSN approach makes a careful estimate of plant use and makes sure the grass is supplied with that much while still keeping a safe amount in reserve, untouched, in the soil. This approach puts the turfgrass manager in control.

"The fundamental principle of successful greenkeeping is the recognition of the fact that the finest golfing grasses flourish on poor soil and that more harm is done by over-, rather than underfertilizing" (MacKenzie, 1998).

Why MLSN is needed

Conventional soil test interpretation is based on guidelines that are higher than required to produce high quality turf. Turner and Waddington (1978) described this problem 40 years ago:

"Unfortunately, turfgrass recommendations appear to be based on research done with other crops, such as forages, results from turfgrass fertility studies not designed to relate to soil testing, and the best judgement of the agronomist making the recommendations."

Carrow et al. (2001, p. 164) wrote about this problem in their Turfgrass Soil Fertility book:

"In some cases, turfgrasses have been placed in a 'high' P and K requirement category, while pasture grasses were in a 'low' category. This decision was based on economics, not agronomics. The cost of fertilization was not considered of primary importance for turf."

The MLSN approach to soil test interpretation is designed to make a fertilizer recommendation that is based on supplying the grass all the nutrients that it can use, while ensuring a safe amount remains in the soil. This solves – or more precisely, avoids – many of the problems of conventional soil test interpretation.

The following "Frequently asked questions" is directly from Dr. Micah Woods's "MLSN Cheat Sheet", February 1, 2018.

Frequently asked questions

How do I know the nutrients are available?

You know the nutrients are available because you've done a soil test. That's what a soil test is – by definition it produces a nutrient availability index. If you don't trust the soil tests, then I suggest skipping them altogether. Instead, assume the soil can supply nothing, and supply to the grass 100% (or a little more) of its possible use of each element. This isn't the most efficient way to do it, but you won't need to worry about availability, and it is guaranteed to supply all that the grass can use.

MLSN guideline, target level or minimum level?

Conventional soil test interpretation may give the impression that there are target or optimum levels in the soil. The MLSN guideline is a minimum value – minimum is the M in MLSN so we haven't always repeated that – that one doesn't want to drop below. It's not a level below which one will have deficiency. It's not a target level that one ideally will have the soil at. What the MLSN guideline represents is a level in the soil with enough of that element to produce high quality turf. There is high quality turf in soils with less of that element too, and that's why we are confident the MLSN guideline is a safe level. But there aren't a lot of soils with less, so we suggest keeping the soil from dropping below the MLSN guideline.

Seriously, the same minimum for every grass, soil, and location? No regional customization?

We are confident that the MLSN guideline is enough to produce high quality turf for every grass, everywhere. MLSN has the ultimate customization, however, because the grass use of elements is entirely site specific. In order to ensure the soil doesn't drop below the MLSN guideline, one has to estimate the expected nutrient use by the plant over time. That's where the customization comes in.

How is this different than conventional soil test interpretation?

The focus of MLSN is on keeping the soil from dropping below a known safe level. To do this, one must account for how much the grass uses over time. The MLSN approach explicitly calculates the grass use. The conventional interpretation (Carrow et al., 2004) is about classifying based on soil levels.

What about micronutrients?

I don't worry about them. They are used in tiny amounts by the grass. The grass uses about 400 times as much N as it does the most used micronutrient. The grass probably can get all the micronutrients it needs from the soil, because it uses such small quantities of them. And because it uses such small quantities of them, if you are worried about it, apply micronutrients. It doesn't cost much and is easy to do.

What about salinity?

Salinity can kill the grass. That's a major problem. To keep the grass from getting killed by high salinity, one needs to leach the salts from the soil. I wouldn't worry much about soil nutrient levels or MLSN if I have a salinity problem. I would leach the salts, and I would supply 100% or a little more than the grass can use.

Turf growth potential model

Found within this report will be growth potential models for the greens, tees, and fairways. These models are based upon the estimated annual nitrogen input that was provided. The temperature and rainfall data is provided by weatherbase.com and is specific to your location. Pace Turf, LLC (Gelernter and Stowell, 2005) developed the growth potential model to explain the myriad of ways in which weather impacts turf growth. The model considers turf growth to be good when the GP is between 50% and 100% (the best possible growth occurs at a GP of 100%). However, when weather conditions are either too hot or too cold for optimal turf growth, the GP falls below 50%, and turf becomes progressively more stressed. When the GP falls to 10% or lower, growth is extremely limited. Appearing below is an example of the model you will see in this report. Note: the data shown in the example is not specific to your location.

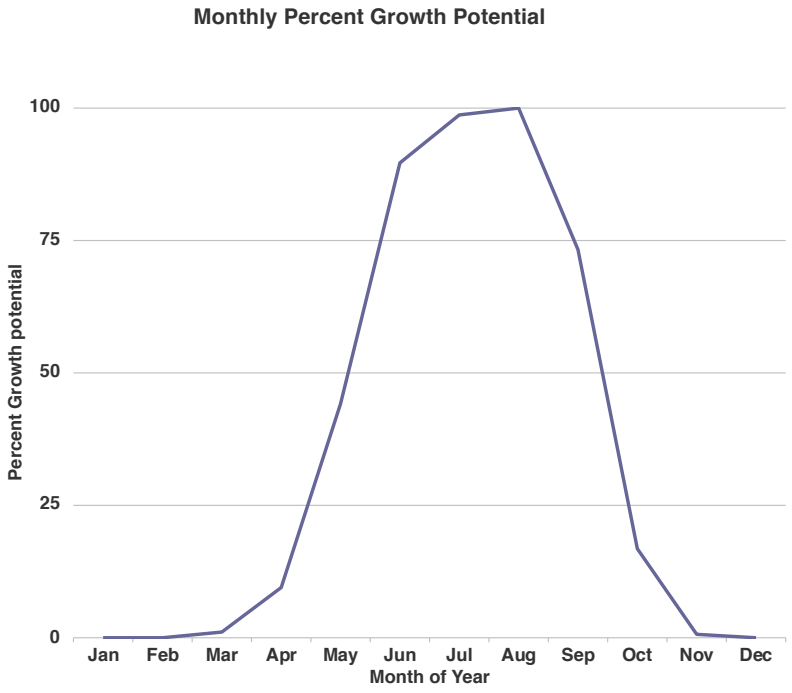
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg T (F)	24.3	29.6	38.0	46.3	55.2	63.3	69.7	67.9	60.1	49.1	36.1	25.9
Rainfall (in)	1.50	1.20	1.40	1.60	1.40	1.10	1.20	1.50	1.60	1.50	1.10	1.30

Grass Maximum N/month lb/1000 sq ft = **0.81**

Optimum Growth Temperature (F) = *68* *Set to 68 for cool season and 88 for warm season grass*

Variance = *10* *Set to 10 for cool season and 12 for warm season grass*

% Growth Potential	0	0	1	9	44	90	99	100	73	17	1	0	Total lb/1000 sq ft	Removed from Soil ppm	Plus MLSN ppm
N lb/1000 sq ft	0.0	0.0	0.0	0.1	0.4	0.7	0.8	0.8	0.6	0.1	0.0	0.0	**3.51**	NA	NA
K lb/1000 sq ft	0.00	0.00	0.00	0.04	0.18	0.36	0.40	0.40	0.30	0.07	0.00	0.00	1.76	57	94
P lb/1000 sq ft	0.00	0.00	0.00	0.01	0.04	0.09	0.10	0.10	0.07	0.02	0.00	0.00	0.44	14	35
Ca lb/1000 sq ft	0.00	0.00	0.00	0.01	0.04	0.07	0.08	0.08	0.06	0.01	0.00	0.00	0.35	11	342
Mg lb/1000 sq ft	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.05	0.04	0.01	0.00	0.00	0.22	7	54
S lb/1000 sq ft	0.00	0.00	0.00	0.01	0.03	0.05	0.06	0.06	0.04	0.01	0.00	0.00	0.26	9	15
Fe lb/1000 sq ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.018	1	45
Mn lb/1000 sq ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.007	0	6



Executive Summary of Nutrient Recommendations Based on Findings using MLSN Guidelines

The following are a total summary of recommendations by area using MLSN nutrient guidelines in conjunction with provided annual nitrogen application rates and growth modeling, and water analysis.

Greens

- Apply ferrous sulphate as needed based on visual observation and goals
- Maintain current cultural practices to keep OM% at desirable levels for playability and surface health
- Apply N as needed. Acidifying N sources are recommended
- Apply boron per manufacturer recommendations if desired
- Apply K at a ratio of 1 : ½ N:K
- Apply P with a corrective application of .43 lbs. per 1000 sq. ft.
- Apply Magnesium sulfate with a corrective application of .25 lbs. per 1000 sq. ft.

Tees

- Apply ferrous sulphate as needed based on visual observation and goals
- Apply K at a ratio of 1 : ½ N:K
- Apply boron per manufacturer recommendations if desired
- To reduce the "spongy" feeling on the tee surface, dilute the surface with sand to match the growth rate via regular cultural practices. This includes regular topdressing, verti-cutting, and aerification.

Fairways

- Apply ferrous sulphate as needed based on visual observation and goals
- Apply boron per manufacturer recommendations if desired
- No other amendments as fertilizer are recommended at this time
- Continue to apply acidifying fertilizers when possible
- Verti-drain when possible
- Consider using an Aerway with the sports tine on a regular schedule. Drive the existing OM into the soil profile. As the OM breaks down, it will provide beneficial organic acids within the soil
- Consider topdressing with a LOW nitrogen organic compost prior to verti-draining and/or Aerway. Introduce organic compost into the soil profile when possible. Given time, the physical characteristics of the soil will change.

Rough

The rough exhibits consistency issues with overall quality to include density, thatch, playability, color, and general appearance. There was nothing found within the current soil test sample results to suggest any major deficiencies that would contribute to consistency issues.

An approach to consider may be to "spot treat" areas of concern with cultivation and additional nitrogen input outside of the normal blanket applications. For example, 10 green surrounds could be an area that additional nitrogen could be applied. Observe and adjust accordingly. Identifying areas that should be "spot treated" for additional fertility and/or cultivation will overtime blend into well performing areas.

- Similar to fairway cultivation, perform the following in identified "spot treatment" areas:
    - Apply acidifying fertilizers when possible
    - Verti-drain when possible
    - Consider using an Aerway with the sports tine on a regular schedule. Drive the existing OM into the soil profile. As the OM breaks down, it will provide beneficial organic acids within the soil
    - Consider topdressing with a LOW nitrogen organic compost prior to verti-draining and/or Aerway. Introduce organic compost into the soil profile when possible. Given time, the physical characteristics of the soil will change.
- Treat all rough with gypsum applications related to ultra-pure water at same rate as fairway applications.
- Treat all rough areas with acidifying fertilizers when possible

Water

- As identified in 2020, ultra-pure water is being used for irrigation. There are no new recommendations to be made based on current water test sample results. The water continues to exhibit ultra-pure characteristics
- Apply gypsum at 13 lbs. per 1000 sq. ft. per acre foot of water applied. 1 acre foot is 325,800 gallons. This will offset the current EC_w of .12 with an EC_w effect of .5. This is the same goal effect that was used in 2020
- Continue monitoring water for EC_w changes and adjust gypsum application amount accordingly
- Consider gypsum injection equipment to reduce labor.

Greens

This is a summary and recommendations for green samples 1, 2, 17, 4, 6, 8, 10, 12, and 16. Recommendations are based on the **average results for samples** unless otherwise noted and an annual nitrogen input of 2.25 lbs. per 1000 sq. ft.

pH (H_2O 1:1) The average pH is 7.21. This is within the optimum range for soil microbial activity and soil nutrient availability. The 2020 average was 7.17. With the pH in this range, there is a chance of seeing some iron chlorosis. If this does occur, you can fix it by making foliar applications of ferrous sulfate.[1]

Organic matter The average organic matter percentage is 1.15%. This is normal and indicates that your current maintenance practices are keeping the organic matter percentage in an ideal range. The 2020 average was 1.75%

Available Nitrogen (NO_3-N) The average total available nitrogen is .52 ppm. This is slightly below normal. It indicates that the grass roots have been able to use almost all of the nitrogen in the soil.

Potassium The average potassium is 48 ppm. This is BELOW the minimum MLSN guideline of 74 ppm. Apply K in a 1 : 1/2 ratio, N : K. Apply K in spring and summer. Late season K applications have demonstrated an increase in winter snow mold pressure. The 2020 average was 77 ppm.

Phosphorus The average Mehlich III phosphorus is 33 ppm. This is above the minimum MLSN guideline of 30 ppm. HOWEVER, 8 (.30 lbs.), 12 (.10 lbs.), and 16 (.43 lbs.) are slightly deficient. Consider corrective applications to these three greens OR treat all greens with a corrective application of .43 lbs. P per 1000 sq. ft. The 2020 average was 43 ppm.

Calcium The average calcium is 478 ppm. This is above the minimum MLSN guideline of 338 ppm. None is required. The 2020 average was 569 ppm.

Magnesium The average magnesium is 49 ppm. This is BELOW the minimum MLSN guideline of 52 ppm. Consider a corrective application of magnesium sulfate at .25 lbs. per 1000 sq. ft. Note that there is a slight sulfur deficiency, and this application will correct this as well. The 2020 average was 71 ppm.

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[1] See this article from the University of Nebraska for more about this: https://turf.unl.edu/turfinfo/6-7-Iron-Chelates.pdf

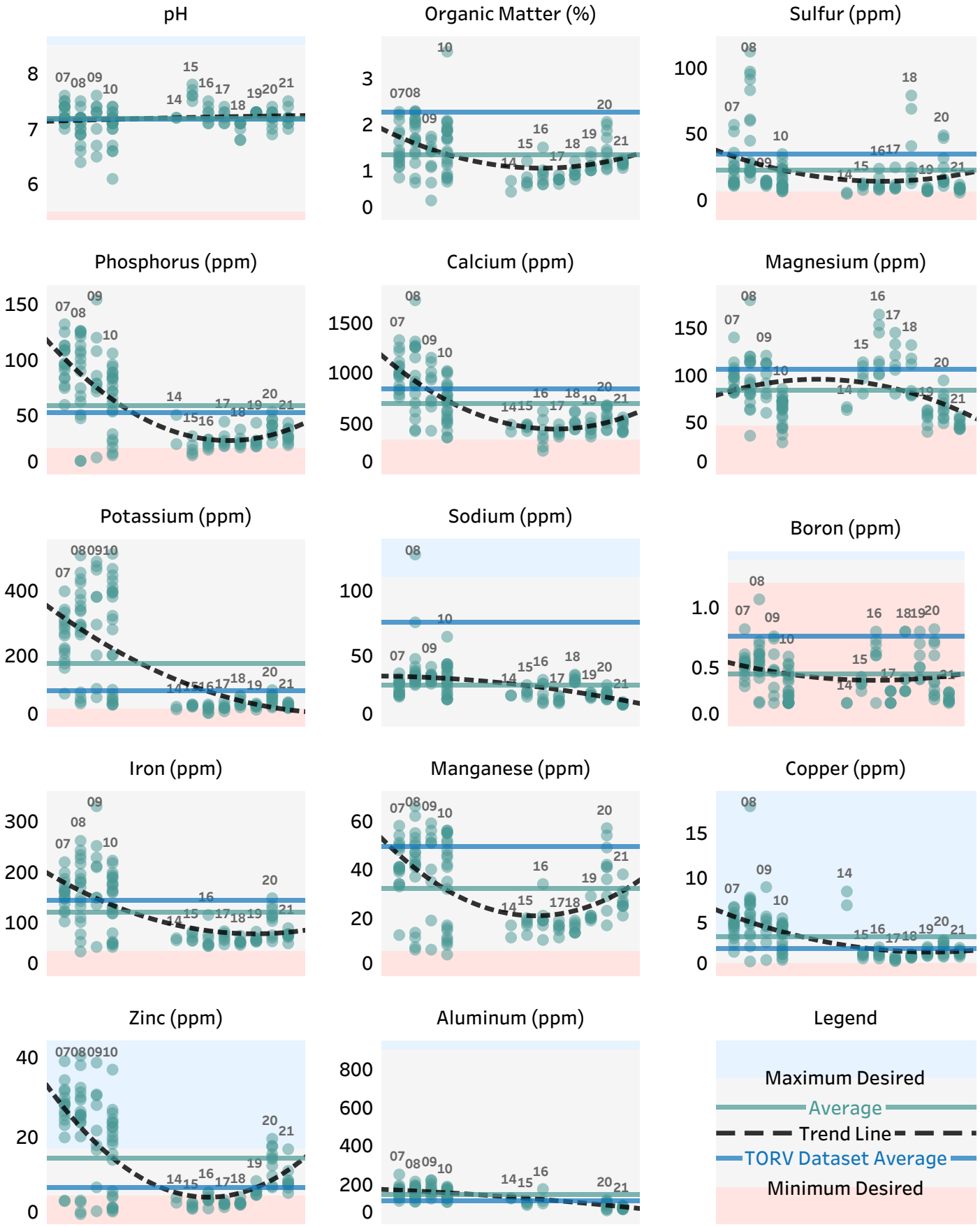
Sodium The average sodium is 14 ppm. This is well below 110 ppm and will not have a negative effect on turfgrass performance. The average was 21 ppm.

Sulfur The average sulfur is 9 ppm. This BELOW the minimum MLSN guideline of 12 ppm. *See corrective note in* ***Magnesium***. The 2020 average was 14 ppm.

Micro-nutrients Boron consistently falls below the recommended 1.2 -1.4 ppm. The average boron is .24 ppm. Consider applying a boron supplement per manufacture's direction to correct deficiency. Boron is an essential micro-nutrient that is thought to play a part in the plant's ability to translocate carbohydrates. Note that boron can become increasingly toxic to the plant when exceeding 1.4 ppm.

As described in the pH section, foliar applications of iron may have a good effect if you see iron chlorosis.

Soil Testing | Greens



Tees

This is a summary and recommendations for tee samples 1, 2, 17, 4, 6, 8, 10, 12, and 16. Recommendations are based on the **average results for samples** unless otherwise noted and an annual nitrogen input of 2.00 lbs. per 1000 sq. ft.

pH (H_2O 1:1) The average pH is 7.34. This is within the optimum range for soil microbial activity and soil nutrient availability. The 2020 pH average was 7.03. With the pH in this range, there is a chance of seeing some iron chlorosis. If this does occur, you can fix it by making foliar applications of ferrous sulfate.[2]

Organic matter The average organic matter percentage is 1.5%. This is normal and indicates that your current maintenance practices are keeping the organic matter percentage in an ideal range. However, while the lab value would indicate a normal OM%, as discussed, some of the tees observed felt "spongy". For example, tee 4. As discussed, dilution of the tee surface area with sand to match the growth rate via topdressing, verti-cutting, and during aerification events should help to alleviate the "spongy" feel OVER TIME. The "spongy" feeling occurs when growth of the plant exceeds the ability to dilute the growth with sand. Reducing nitrogen inputs and/or applying growth regulation will aid in ability to dilute existing organic matter material. Review current watering practices to ensure that surfaces are not being over saturated. It was observed that tee 12 Black had very little root mass. Shade in the immediate area is likely the cause for the shallow rooting. The 2020 average was 1.47%.

Available Nitrogen (NO_3-N) The average total available nitrogen is .54 ppm. This is slightly below normal. It indicates that the grass roots have been able to use almost all of the nitrogen in the soil.

Potassium The average potassium is 61 ppm. This is BELOW the minimum MLSN guideline of 70 ppm. Apply K in a 1 : 1/2 ratio, N : K. Apply K in spring and summer. Late season K applications have demonstrated an increase in winter snow mold pressure. The 2020 average was 78 ppm.

Phosphorous The average Mehlich III phosphorus is 63 ppm. This is above the minimum MLSN guideline of 29 ppm. None is required. The 2020 average was 62 ppm.

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[2] See this article from the University of Nebraska for more about this: https://turf.unl.edu/turfinfo/6-7-Iron-Chelates.pdf

Calcium The average calcium is 529 ppm. This is above the minimum MLSN guideline of 338 ppm. None is required. The 2020 average was 522 ppm.

Magnesium The average magnesium is 67 ppm. This is above the minimum MLSN guideline of 51 ppm. None is required. The 2020 average was 70 ppm.

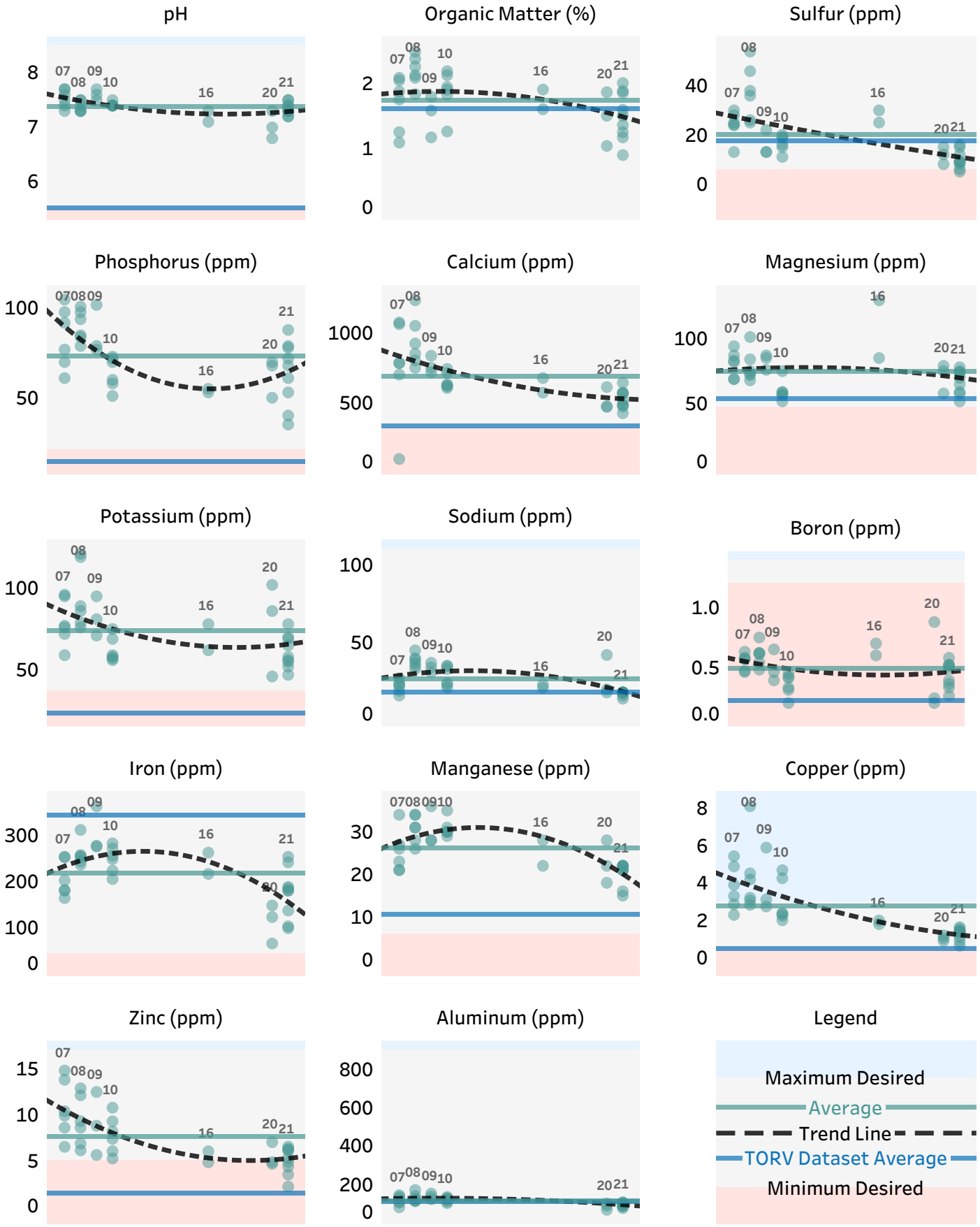
Sodium The average sodium is 17 ppm. This is well below 110 ppm and will not have a negative effect on turfgrass performance. The 2020 average was 27 ppm.

Sulfur The average sulfur is 10 ppm. This slightly below the minimum MLSN guideline of 11 ppm. There is enough sulfur in the irrigation water to provide for any deficiencies. None is required. The 2020 average was 12 ppm.

Micronutrients Boron consistently falls below the recommended 1.2 -1.4 ppm. The average boron is .44 ppm. Consider applying a boron supplement per manufacture's direction to correct deficiency. boron is an essential micro-nutrient that is thought to play a part in the plant's ability to translocate carbohydrates. Note that boron can become increasingly toxic to the plant when exceeding 1.4 ppm.

As described in the pH section, foliar applications of iron may have a good effect if you see iron chlorosis.

Soil Testing | Tees



Fairways

This is a summary and recommendations for fairway samples 1, 2, 17, 4, 6, 8, 10, 12, and 16. Recommendations are based on the **average results for samples** unless otherwise noted and an annual nitrogen input of 2.75 lbs. per 1000 sq. ft.

pH (H_2O 1:1) The average pH is 7.19. This is within the optimum range for soil microbial activity and soil nutrient availability. The 2020 pH average was 7.30. With the pH in this range, there is a chance of seeing some iron chlorosis. If this does occur, you can fix it by making foliar applications of ferrous sulfate.[3]

Organic matter The average organic matter percentage is 4.38%. This is normal for fairways. This also represents a substantial amount of potential for mineralized nitrogen. During the warmest months of the growing season, the mineralized N may be enough to provide for the desired growth rate. Consider reducing N applied during the warmest months and monitor. The 2020 organic matter average was 4.42%.

Available Nitrogen (NO_3-N) The average total available nitrogen is 2.46 ppm. This is ideal.

Potassium The average potassium is 156 ppm. This is above the minimum MLSN guideline of 82 ppm. None is required. The 2020 average was 195 ppm.

Phosphorous The average Mehlich III phosphorus is 78 ppm. This is above the minimum MLSN guideline of 32 ppm. None is required. The 2020 average was 89 ppm.

Calcium The average calcium is 1939 ppm. This is above the minimum MLSN guideline of 341.46 ppm. None is required. The 2020 average was 2285 ppm.

Magnesium The average magnesium is 116 ppm. This is above the minimum MLSN guideline of 53 ppm. None is required. The 2020 average was 144 ppm.

Sodium The average sodium is 19 ppm. This is well below 110 ppm and will not have a negative effect on turfgrass performance. The 2020 average was 26 ppm.

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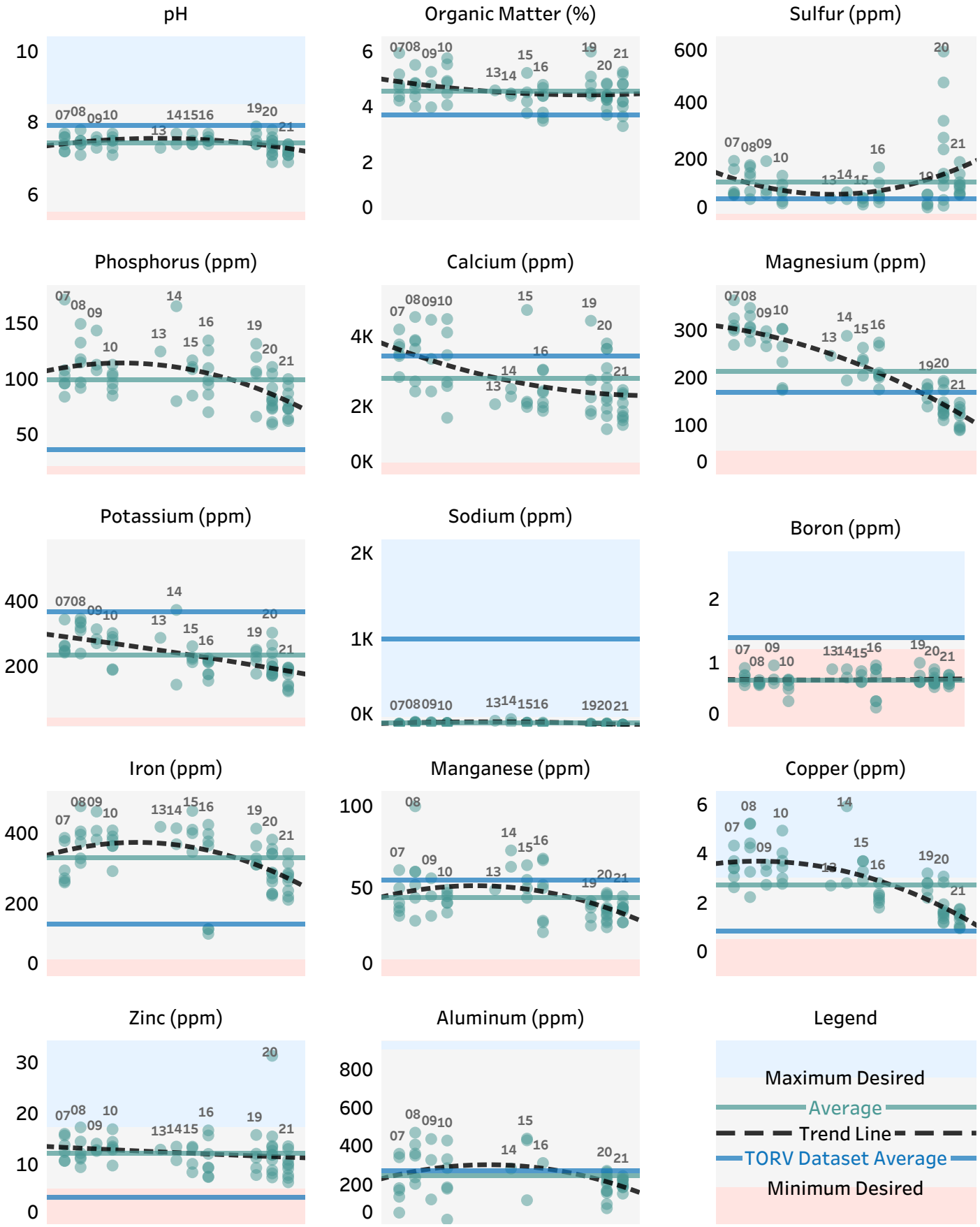
[3] See this article from the University of Nebraska for more about this: https://turf.unl.edu/turfinfo/6-7-Iron-Chelates.pdf

Sulfur The average sulfur is 88 ppm. This above the minimum MLSN guideline of 13 ppm. None is required. The 2020 average was 75 ppm.

Micronutrients Boron consistently falls below the recommended 1.2 -1.4 ppm. The average boron is .72 ppm. Consider applying a boron supplement per manufacture's direction to correct deficiency. Boron is an essential micro-nutrient that is thought to play a part in the plant's ability to translocate carbohydrates. Note that boron can become increasingly toxic to the plant when exceeding 1.4 ppm.

As described in the pH section, foliar applications of iron may have a good effect if you see iron chlorosis.

Soil Testing | Fairways



Roughs

This is a summary and recommendations for fairway samples 2, 8, and 12. Recommendations are based on the **average results for samples** unless otherwise noted and an annual nitrogen input of 2.12 lbs. per 1000 sq. ft.

pH (H_2O 1:1) The average pH is 7.07. This is within the optimum range for soil microbial activity and soil nutrient availability. With the pH in this range, there is a slight chance of seeing some iron chlorosis. If this does occur, you can fix it by making foliar applications of ferrous sulfate.[4] However, this may or may not be practical because it is the rough. Fertigation with an iron source may benefit.

Organic matter The average organic matter percentage is 6.43%. This is OK. This also represents a substantial amount of potential for mineralized nitrogen. During the warmest months of the growing season, the mineralized N may increase the growth rate. Unlike other playing surfaces, this may be desirable as it could help in filling in weaker areas where the rough is at its weakest.

Available Nitrogen (NO_3-N) The average total available nitrogen is 2.3 ppm. This is ideal.

Potassium The average potassium is 141 ppm. This is above the minimum MLSN guideline of 72 ppm. None is required.

Phosphorous The average Mehlich III phosphorus is 67 ppm. This is above the minimum MLSN guideline of 30 ppm. None is required.

Calcium The average calcium is 2483 ppm. This is above the minimum MLSN guideline of 338 ppm. None is required.

Magnesium The average magnesium is 111 ppm. This is above the minimum MLSN guideline of 51 ppm. None is required.

Sodium The average sodium is 20 ppm. This is well below 110 ppm and will not have a negative effect on turfgrass performance.

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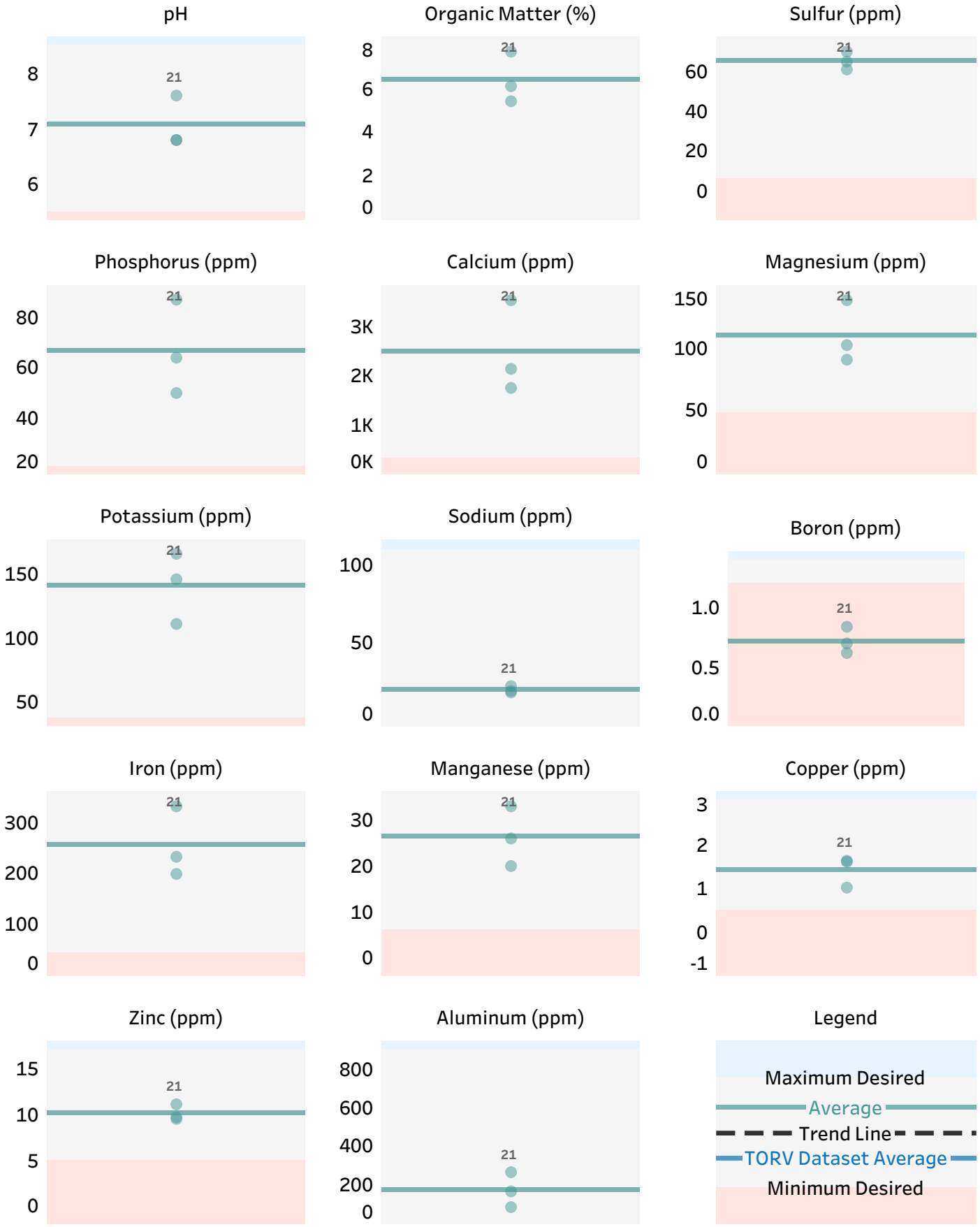
[4] See this article from the University of Nebraska for more about this: https://turf.unl.edu/turfinfo/6-7-Iron-Chelates.pdf

Sulfur The average sulfur is 65 ppm. This above the minimum MLSN guideline of 11 ppm. None is required.

Micronutrients While boron continues to be low like the other areas of the course, all micronutrients are present, and none are required as fertilizer.

As described in the pH section, foliar applications of iron may have a good effect if you see iron chlorosis.

Soil Testing | Roughs



Water

FAO Handbook 29 is the Food and Agricultural Organization of the United Nations and widely is recognized as the leading source for irrigation water quality guidelines. Below are your water sample results as shown in comparison to the FAO guidelines.

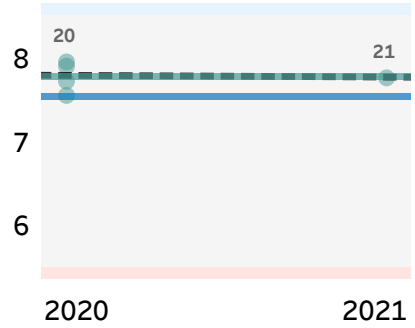
15 Pond

		Likelihood of Soil Problems		
	Lab Value	**Low**	**Medium**	**High**
ECw (Conductivity) (mmhos/cm)	.18	< 0.7	0.7 - 3.0	> 3.0
TDS (mg/l, ppm)	115.52	< 450	450 - 2000	> 2000
SAR 0 -3	.12	ECw > 0.7	ECw 0.7 - 0.2	ECw < 0.2
SAR 3 - 6		ECw > 1.2	ECw 1.2 - 0.3	ECw < 0.3
SAR 6 - 12		ECw > 1.9	ECw 1.9 - 0.5	ECw < 0.5
SAR 12 - 20		ECw > 2.9	ECw 2.9 - 1.3	ECw < 1.3
Sodium Na (mg/l, ppm)	2.54	< 70	70 - 200	> 200
RSC (me/l)*	-.22	< 1.25	> 1.25	
Nitrate NO3 - N (mg/l, ppm)		< 5	5 - 20	> 30
Ammonium NH4 - N (mg/l, ppm)		< 5	5 - 20	> 20
Boron B (mg/l, ppm)	.05	< 0.5	0.5 - 3.0	> 3.0
Bicarbonate HCO3 (mg/l, ppm)	88.51	< 92	92 - 520	> 520
Chloride Cl (mg/l, ppm)	<2.00	< 105	> 105	

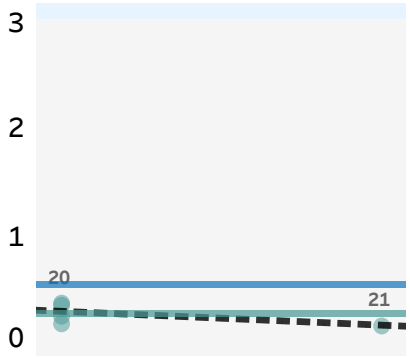
- Because of the low EC_W and low SAR, this water is classified as Ultra-pure and can pose a significant risk for soil deflocculation. Gypsum applications are being made to counter act the low EC_w.

Water Testing | Pond 15

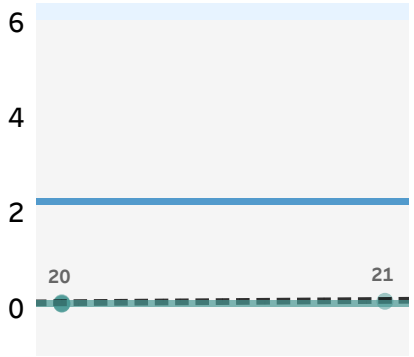
pH



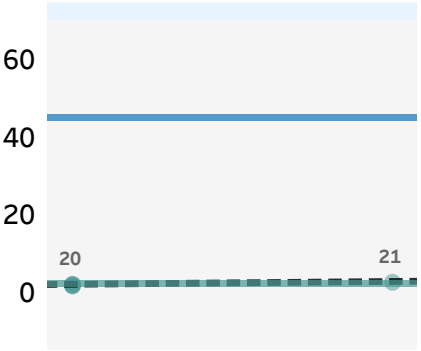
Conductivity



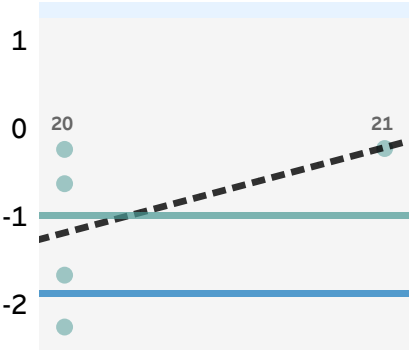
Adjusted SAR



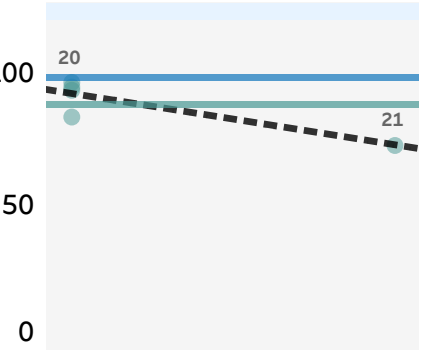
Sodium (ppm)



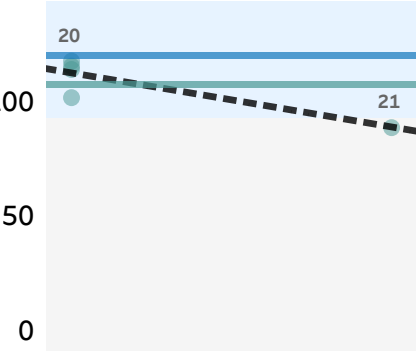
RSC



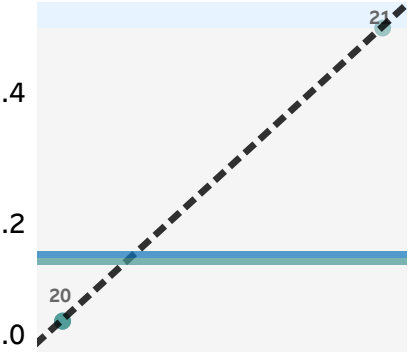
Total Alkalinity (ppm)



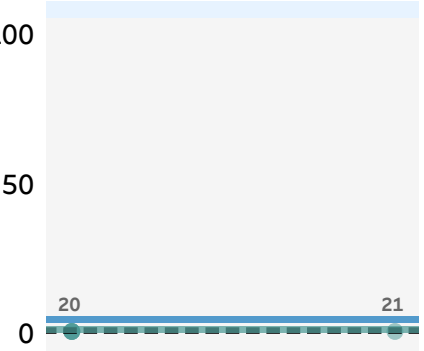
Bicarbonate (ppm)



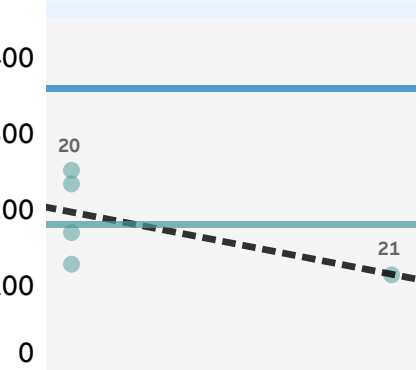
Boron (ppm)



Chloride (ppm)

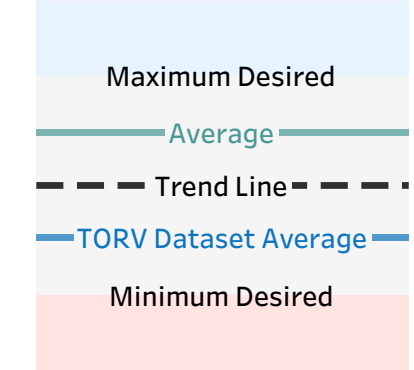


TDS (ppm)



TORV
Sustainable Agronomics

Legend

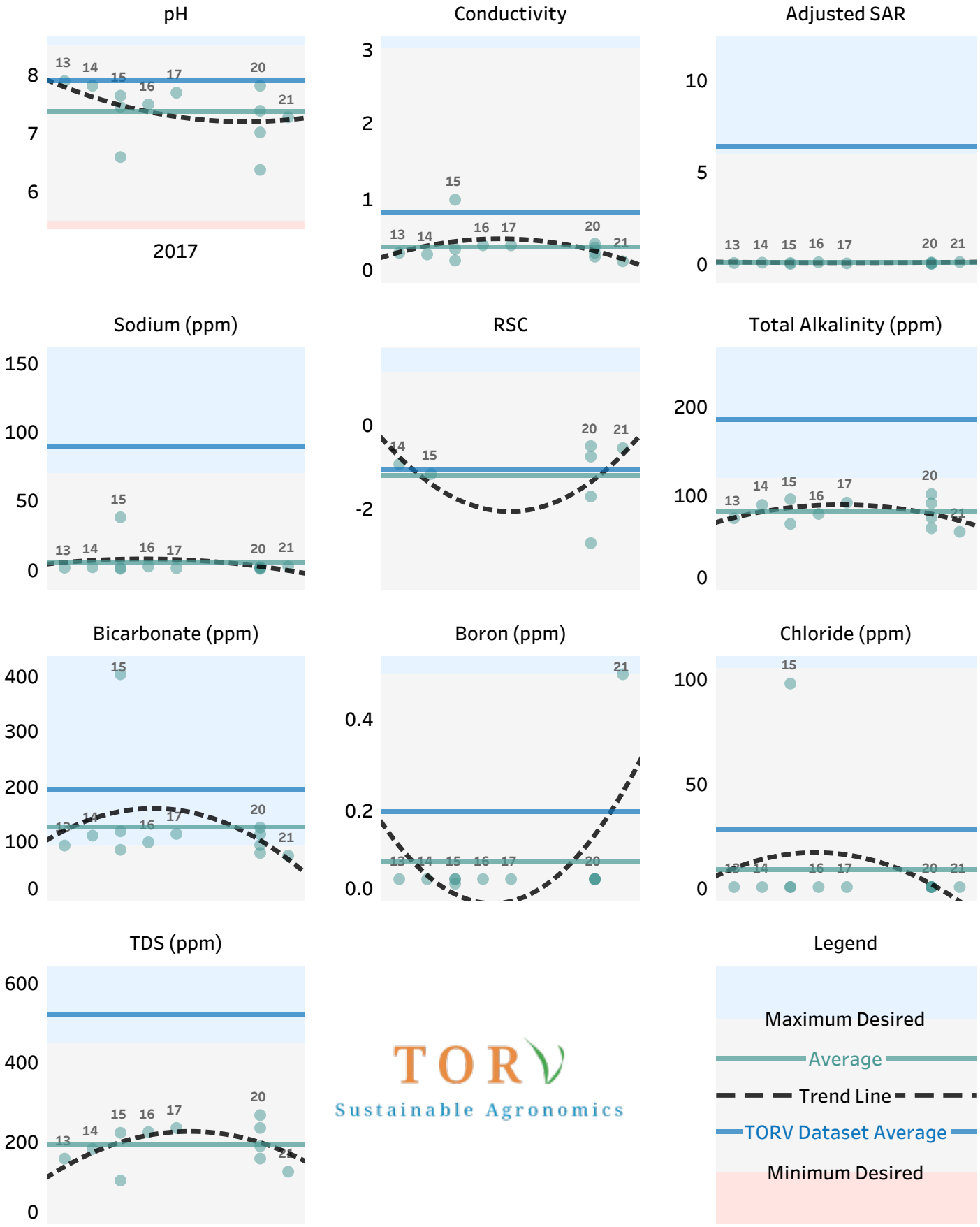


Irrigation 18 QC

		Likelihood of Soil Problems		
	Lab Value	**Low**	**Medium**	**High**
ECw (Conductivity) (mmhos/cm)	.19	< 0.7	0.7 - 3.0	> 3.0
TDS (mg/l, ppm)	124.22	< 450	450 - 2000	> 2000
SAR 0 -3	.12	ECw > 0.7	ECw 0.7 - 0.2	ECw < 0.2
SAR 3 - 6		ECw > 1.2	ECw 1.2 - 0.3	ECw < 0.3
SAR 6 - 12		ECw > 1.9	ECw 1.9 - 0.5	ECw < 0.5
SAR 12 - 20		ECw > 2.9	ECw 2.9 - 1.3	ECw < 1.3
Sodium Na (mg/l, ppm)	2.70	< 70	70 - 200	> 200
RSC (me/l)*	-.55	< 1.25	> 1.25	
Nitrate NO3 - N (mg/l, ppm)		< 5	5 - 20	> 30
Ammonium NH4 - N (mg/l, ppm)		< 5	5 - 20	> 20
Boron B (mg/l, ppm)	.05	< 0.5	0.5 - 3.0	> 3.0
Bicarbonate HCO3 (mg/l, ppm)	74.24	92	92 - 520	> 520
Chloride Cl (mg/l, ppm)	< 200	< 105	> 105	

- The irrigation water is very similar to the pond 15 (storage). Because of the low EC_W and low SAR, this water is classified as Ultra-pure and can pose a significant risk for soil deflocculation. Gypsum applications are being made to counter act the low EC_w.

Water Testing | Irrigation



OM%

These measurements are neither good nor bad. They are a baseline. Now that a baseline has been established, this fall we can do the same test and measure any differences. We can then use the information such as fertilizer applied, cultural practices, sand applied, verti-cutting, aerification, etc. to see how these practices have changed the OM% by depth. Ideally, once a desired OM% has been identified based on playability and turf performance, fertility and cultural practices can be adjusted to maintain the desired OM%.

The S196 test package includes the entire sample submitted. This includes leaves, stems, and roots. This differs from the standard soil test which filters out most of the components. This is the reason why the percentages appear higher than that on the standard soil test.

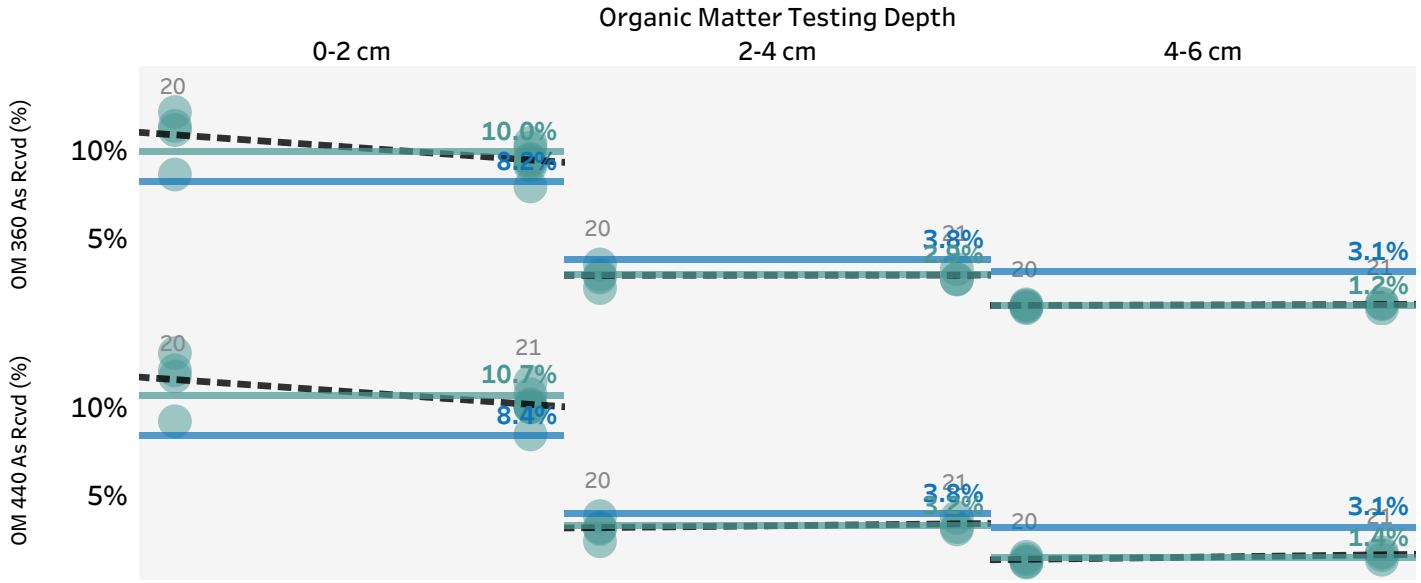
Green 0-2 cm is trending down with an average of 10.7%. 2-4 cm and 4-6 cm trendlines remain stable with little to no change. Note with the additional sampling, the average will stabilize closer to the norm.

Tee 0-2 cm is trending down with an average of 7.7%. 2-4 cm and 4-6 cm trendlines are also decreasing. It was noted that during the sampling, rooting in general was “delicate” especially at the deeper depths. This may be the reason for the lesser OM% that one would expect. Note with the additional sampling, the average will stabilize closer to the norm.

Rough OM% baseline has been established.

OM Testing Summary | Greens

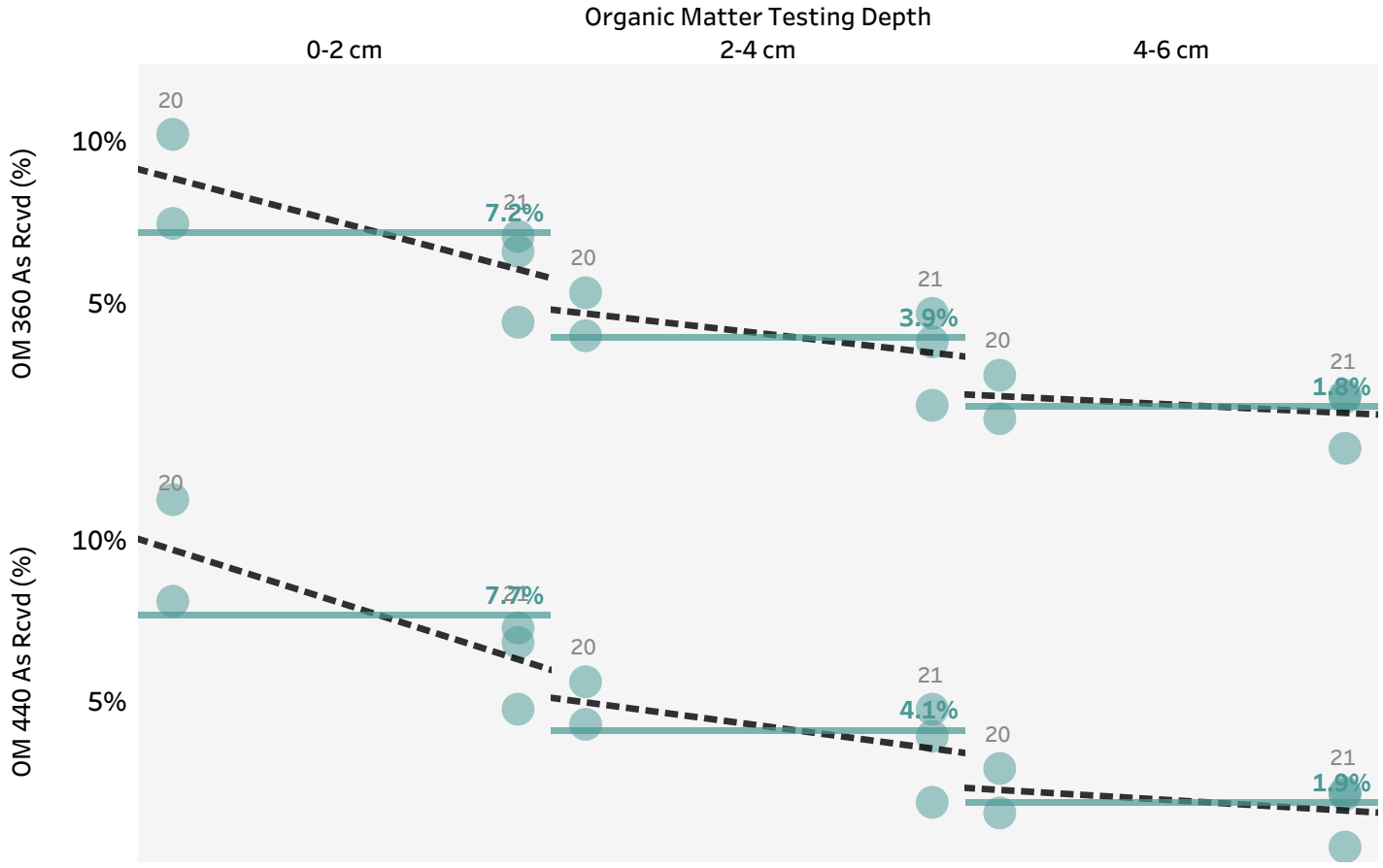
-----Average----- | -----TORV-Dataset-Average----- | -----Trendline-----



				Organic Matter Testing Depth		
				0-2 cm	2-4 cm	4-6 cm
OM 360 As Rcvd (%)	3	2021	May 21, 2021	9.6%	2.7%	1.0%
			WT AVG YEAR	9.6%	2.7%	1.0%
			WT AVG HOLE	9.6%	2.7%	1.0%
	5	2021	May 21, 2021	9.5%		
			WT AVG YEAR	9.5%		
			WT AVG HOLE	9.5%		
	7	2021	May 21, 2021	8.0%		
			WT AVG YEAR	8.0%		
			WT AVG HOLE	8.0%		
	12	2021	May 21, 2021	10.2%		
			WT AVG YEAR	10.2%		
			WT AVG HOLE	10.2%		
	16	2020	May 29, 2020	11.5%	2.8%	1.3%
			October 22, 2020	12.2%	3.6%	1.1%
			WT AVG YEAR	11.8%	3.2%	1.2%
		2021	May 21, 2021	10.5%	3.3%	1.3%
			WT AVG YEAR	10.5%	3.3%	1.3%
			WT AVG HOLE	11.4%	3.2%	1.2%
	17	2020	May 29, 2020	11.2%	3.0%	1.2%
			October 22, 2020	8.7%	2.2%	1.1%
			WT AVG YEAR	9.9%	2.6%	1.2%
		2021	May 21, 2021	9.2%	2.7%	1.3%
			WT AVG YEAR	9.2%	2.7%	1.3%
			WT AVG HOLE	9.7%	2.6%	1.2%
	18	2021	May 21, 2021	9.4%		
			WT AVG YEAR	9.4%		
			WT AVG HOLE	9.4%		
	WT AVG TOTAL			10.0%	2.9%	1.2%
OM 440 As Rcvd (%)	3	2021	May 21, 2021	10.1%	3.0%	1.3%
			WT AVG YEAR	10.1%	3.0%	1.3%
			WT AVG HOLE	10.1%	3.0%	1.3%
	5	2021	May 21, 2021	10.2%		
			WT AVG YEAR	10.2%		
			WT AVG HOLE	10.2%		
	7	2021	May 21, 2021	8.5%		
			WT AVG YEAR	8.5%		
			WT AVG HOLE	8.5%		
	12	2021	May 21, 2021	10.8%		
			WT AVG YEAR	10.8%		
			WT AVG HOLE	10.8%		
	16	2020	May 29, 2020	12.2%	3.1%	1.5%
			October 22, 2020	13.2%	3.8%	1.1%
			WT AVG YEAR	12.7%	3.4%	1.3%
		2021	May 21, 2021	11.5%	3.7%	1.7%
			WT AVG YEAR	11.5%	3.7%	1.7%
			WT AVG HOLE	12.3%	3.5%	1.4%
	17	2020	May 29, 2020	11.8%	3.2%	1.3%
			October 22, 2020	9.2%	2.4%	1.2%
			WT AVG YEAR	10.5%	2.8%	1.2%
		2021	May 21, 2021	10.1%	3.2%	1.6%
			WT AVG YEAR	10.1%	3.2%	1.6%
			WT AVG HOLE	10.4%	2.9%	1.4%
	18	2021	May 21, 2021	10.0%		
			WT AVG YEAR	10.0%		
			WT AVG HOLE	10.0%		
	WT AVG TOTAL			10.7%	3.2%	1.4%

OM Testing Summary | Tees

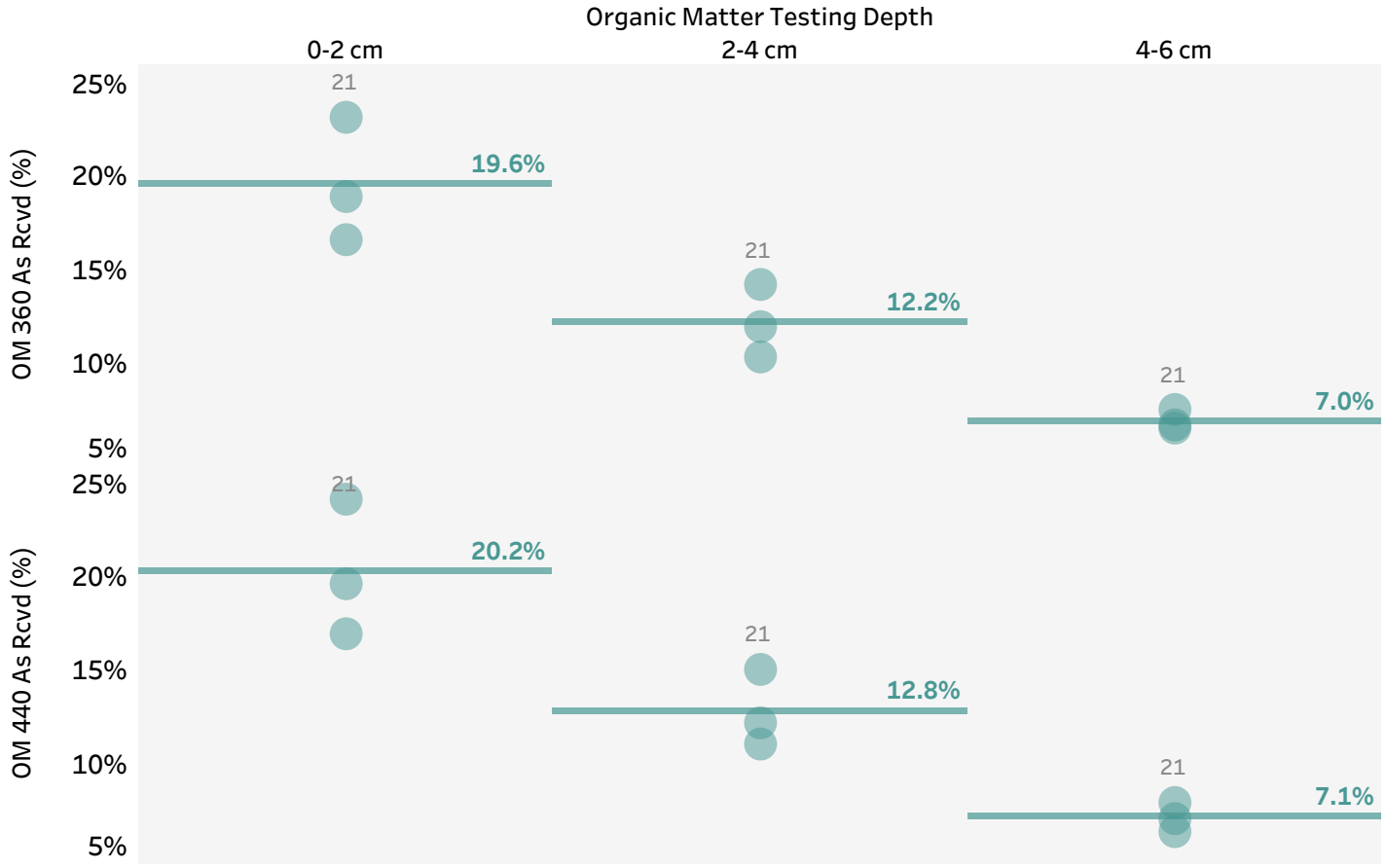
-----Average----- | -----TORV-Dataset-Average----- | -----Trendline-----



				Organic Matter Testing Depth		
				0-2 cm	2-4 cm	4-6 cm
OM 360 As Rcvd (%)	1	2020	June 26, 2020	10.2%	4.0%	1.4%
			October 22, 2020	7.5%	5.3%	2.8%
			WT AVG YEAR	8.8%	4.7%	2.1%
		2021	May 21, 2021	7.1%	4.7%	2.2%
			WT AVG YEAR	7.1%	4.7%	2.2%
		WT AVG HOLE		8.3%	4.7%	2.1%
	3	2021	May 21, 2021	6.6%	3.8%	2.1%
			WT AVG YEAR	6.6%	3.8%	2.1%
		WT AVG HOLE		6.6%	3.8%	2.1%
	12	2021	May 21, 2021	4.4%	1.9%	0.5%
			WT AVG YEAR	4.4%	1.9%	0.5%
		WT AVG HOLE		4.4%	1.9%	0.5%
	WT AVG TOTAL			7.2%	3.9%	1.8%
OM 440 As Rcvd (%)	1	2020	June 26, 2020	11.3%	4.3%	1.6%
			October 22, 2020	8.1%	5.6%	2.9%
			WT AVG YEAR	9.7%	5.0%	2.2%
		2021	May 21, 2021	7.3%	4.8%	2.2%
			WT AVG YEAR	7.3%	4.8%	2.2%
		WT AVG HOLE		8.9%	4.9%	2.2%
	3	2021	May 21, 2021	6.8%	3.9%	2.1%
			WT AVG YEAR	6.8%	3.9%	2.1%
		WT AVG HOLE		6.8%	3.9%	2.1%
	12	2021	May 21, 2021	4.8%	1.9%	0.5%
			WT AVG YEAR	4.8%	1.9%	0.5%
		WT AVG HOLE		4.8%	1.9%	0.5%
	WT AVG TOTAL			7.7%	4.1%	1.9%

OM Testing Summary | Roughs

-----Average----- | -----TORV-Dataset-Average----- | -----Trendline-----



				Organic Matter Testing Depth		
				0-2 cm	2-4 cm	4-6 cm
OM 360 As Rcvd (%)	2	2021	May 21, 2021	18.9%	12.0%	6.8%
			WT AVG YEAR	18.9%	12.0%	6.8%
		WT AVG HOLE		18.9%	12.0%	6.8%
	8	2021	May 21, 2021	23.1%	14.3%	7.6%
			WT AVG YEAR	23.1%	14.3%	7.6%
		WT AVG HOLE		23.1%	14.3%	7.6%
	12	2021	May 21, 2021	16.6%	10.4%	6.6%
			WT AVG YEAR	16.6%	10.4%	6.6%
		WT AVG HOLE		16.6%	10.4%	6.6%
	WT AVG TOTAL			19.6%	12.2%	7.0%
OM 440 As Rcvd (%)	2	2021	May 21, 2021	19.6%	12.2%	6.4%
			WT AVG YEAR	19.6%	12.2%	6.4%
		WT AVG HOLE		19.6%	12.2%	6.4%
	8	2021	May 21, 2021	24.1%	15.0%	7.9%
			WT AVG YEAR	24.1%	15.0%	7.9%
		WT AVG HOLE		24.1%	15.0%	7.9%
	12	2021	May 21, 2021	16.9%	11.1%	7.1%
			WT AVG YEAR	16.9%	11.1%	7.1%
		WT AVG HOLE		16.9%	11.1%	7.1%
	WT AVG TOTAL			20.2%	12.8%	7.1%

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BROOKSIDE LABORATORIES, INC.

35873-70

SOIL AUDIT AND INVENTORY REPORT

Name Maroon Creek Golf Club City Aspen State CO

Independent Consultant TORV, LLC Date 05/26/2021

Sample Location FAIRWAY			1		2		17
Sample Identification			4 in		4 in		4 in
Lab Number			0244-1		0245-1		0246-1
Total Exchange Capacity (ME/100 g)			11.37		9.87		12.75
pH (H_2O 1:1)			7.1		7.1		7.2
Organic Matter (360°C LOI) %			4.83		4.01		5.27
Estimated Nitrogen Release		#/1000	2		1		2
SOLUBLE SULFUR*		ppm	77		106		119
MEHLICH III	#/1000	P as P_2O_5	7		6		6
		ppm of P	94		87		80
BRAY II	#/1000	P as P_2O_5	12		10		11
		ppm of P	174		137		162
OLSEN	#/1000	P as P_2O_5					
		ppm of P					
CALCIUM*		#/1000	56		48		64
		ppm	1838		1577		2076
MAGNESIUM*		#/1000	4		4		5
		ppm	139		121		148
POTASSIUM*		#/1000	5		6		6
		ppm	174		185		195
SODIUM*		#/1000	1		1		1
		ppm	20		18		23
BASE SATURATION PERCENT							
Calcium	%		80.83		79.89		81.41
Magnesium	%		10.19		10.22		9.67
Potassium	%		3.92		4.81		3.92
Sodium	%		0.76		0.79		0.78
Other Bases	%		4.30		4.30		4.20
Hydrogen	%		0.00		0.00		0.00
EXTRACTABLE MINORS							
Boron* (ppm)			0.75		0.67		0.81
Iron* (ppm)			265		287		315
Manganese* (ppm)			41		38		38
Copper* (ppm)			1.50		1.32		1.75
Zinc* (ppm)			13.48		9.06		12.92
Aluminum* (ppm)			187		230		197
Soluble Salts (mmhos/cm)							
Chlorides (ppm)							
NO_3-N (ppm)			2.5		3.2		1.4
NH_4-N (ppm)			1.9		3.0		1.6

d - specific

* Mehlich III Extractable

#/1000

BROOKSIDE LABORATORIES, INC.

35873-69

SOIL AUDIT AND INVENTORY REPORT

Name Maroon Creek Golf Club City Aspen State CO

Independent Consultant TORV, LLC Date 05/26/2021

Sample Location FAIRWAY			4		6		8
Sample Identification			4 in		4 in		4 in
Lab Number			0217-1		0218-1		0219-1
Total Exchange Capacity (ME/100 g)			14.57		10.10		10.18
pH (H_2O 1:1)			7.4		6.9		7.2
Organic Matter (360°C LOI) %			4.19		4.83		4.21
Estimated Nitrogen Release		#/1000	1		2		1
SOLUBLE SULFUR*		ppm	109		82		75
MEHLICH III	#/1000	P as P_2O_5	5		5		4
		ppm of P	73		73		64
BRAY II	#/1000	P as P_2O_5	11		8		7
		ppm of P	154		117		103
OLSEN	#/1000	P as P_2O_5					
		ppm of P					
CALCIUM*		#/1000	75		51		52
		ppm	2457		1659		1701
MAGNESIUM*		#/1000	4		3		3
		ppm	134		92		99
POTASSIUM*		#/1000	6		4		4
		ppm	191		142		137
SODIUM*		#/1000	1		0		1
		ppm	21		16		17
BASE SATURATION PERCENT							
Calcium	%		84.32		82.13		83.55
Magnesium	%		7.66		7.59		8.10
Potassium	%		3.36		3.60		3.45
Sodium	%		0.63		0.69		0.73
Other Bases	%		4.00		4.50		4.20
Hydrogen	%		0.00		1.50		0.00
EXTRACTABLE MINORS							
Boron* (ppm)			0.63		0.76		0.73
Iron* (ppm)			283		212		221
Manganese* (ppm)			38		29		36
Copper* (ppm)			1.72		0.96		1.07
Zinc* (ppm)			10.01		7.23		7.81
Aluminum* (ppm)			221		226		204
Soluble Salts (mmhos/cm)							
Chlorides (ppm)							
NO_3-N (ppm)			3.4		3.2		3.8
NH_4-N (ppm)			1.9		2.1		2.0

d - specific a - alkaline

* Mehlich III Extractable

#/1000

BROOKSIDE LABORATORIES, INC.

35873-69

SOIL AUDIT AND INVENTORY REPORT

Name Maroon Creek Golf Club City Aspen State CO

Independent Consultant TORV, LLC Date 05/26/2021

Sample Location FAIRWAY			10		12		16
Sample Identification			4 in		4 in		4 in
Lab Number			0220-1		0221-1		0222-1
Total Exchange Capacity (ME/100 g)			8.77		13.27		14.09
pH (H_2O 1:1)			7.3		7.4		7.1
Organic Matter (360°C LOI) %			3.31		3.66		5.18
Estimated Nitrogen Release		#/1000	1		1		2
SOLUBLE SULFUR*		ppm	148		98		190
MEHLICH III	#/1000	P as P_2O_5	4		5		7
		ppm of P	62		74		100
BRAY II	#/1000	P as P_2O_5	8		11		12
		ppm of P	120		163		170
OLSEN	#/1000	P as P_2O_5					
		ppm of P					
CALCIUM*		#/1000	44		71		73
		ppm	1441		2320		2368
MAGNESIUM*		#/1000	3		3		4
		ppm	96		90		126
POTASSIUM*		#/1000	4		4		6
		ppm	121		125		195
SODIUM*		#/1000	1		0		1
		ppm	21		15		21
BASE SATURATION PERCENT							
Calcium	%		82.16		87.42		84.03
Magnesium	%		9.12		5.65		7.45
Potassium	%		3.54		2.42		3.55
Sodium	%		1.04		0.49		0.65
Other Bases	%		4.10		4.00		4.30
Hydrogen	%		0.00		0.00		0.00
EXTRACTABLE MINORS							
Boron* (ppm)			0.71		0.81		0.67
Iron* (ppm)			238		275		343
Manganese* (ppm)			45		29		37
Copper* (ppm)			0.99		1.45		1.55
Zinc* (ppm)			6.37		9.73		10.78
Aluminum* (ppm)			185		152		244
Soluble Salts (mmhos/cm)							
Chlorides (ppm)							
NO_3-N (ppm)			1.1		2.2		1.4
NH_4-N (ppm)			1.8		1.9		1.4

d - specific a - alkaline

* Mehlich III Extractable

#/1000

BROOKSIDE LABORATORIES, INC.

35873-69

SOIL AUDIT AND INVENTORY REPORT

Name Maroon Creek Golf Club City Aspen State CO

Independent Consultant TORV, LLC Date 05/26/2021

Sample Location ROUGH			2		8		12
Sample Identification			4 in		4 in		4 in
Lab Number			0223-1		0224-1		0225-1
Total Exchange Capacity (ME/100 g)			13.44		10.74		19.78
pH (H_2O 1:1)			6.8		6.8		7.6
Organic Matter (360°C LOI) %			7.72		5.42		6.12
Estimated Nitrogen Release		#/1000	2		2		2
SOLUBLE SULFUR*		ppm	70		65		61
MEHLICH III	#/1000	P as P_2O_5	6		4		4
		ppm of P	87		64		50
BRAY II	#/1000	P as P_2O_5	12		7		9
		ppm of P	173		101		132
OLSEN	#/1000	P as P_2O_5					
		ppm of P					
CALCIUM*		#/1000	66		54		109
		ppm	2147		1759		3543
MAGNESIUM*		#/1000	4		3		3
		ppm	140		91		103
POTASSIUM*		#/1000	5		3		4
		ppm	166		111		146
SODIUM*		#/1000	1		1		1
		ppm	22		19		18
BASE SATURATION PERCENT							
Calcium		%	79.87		81.89		89.56
Magnesium		%	8.68		7.06		4.34
Potassium		%	3.17		2.65		1.89
Sodium		%	0.71		0.77		0.40
Other Bases		%	4.60		4.60		3.80
Hydrogen		%	3.00		3.00		0.00
EXTRACTABLE MINORS							
Boron* (ppm)			0.62		0.70		0.84
Iron* (ppm)			333		199		233
Manganese* (ppm)			33		26		20
Copper* (ppm)			1.61		1.02		1.63
Zinc* (ppm)			11.11		9.71		9.52
Aluminum* (ppm)			264		164		82
Soluble Salts (mmhos/cm)							
Chlorides (ppm)							
NO_3-N (ppm)			2.2		2.1		2.6
NH_4-N (ppm)			1.9		5.1		2.8

d - specific a - alkaline

* Mehlich III Extractable

#/1000

BROOKSIDE LABORATORIES, INC.

35873-70

SOIL AUDIT AND INVENTORY REPORT

Name Maroon Creek Golf Club City Aspen State CO

Independent Consultant TORV, LLC Date 05/26/2021

Sample Location GREEN			1		2		17
Sample Identification			4 in		4 in		4 in
Lab Number			0226-1		0227-1		0228-1
Total Exchange Capacity (ME/100 g)			3.47		2.82		3.43
pH (H_2O 1:1)			7.2		7.2		7.1
Organic Matter (360°C LOI) %			1.15		1.15		1.11
Estimated Nitrogen Release		#/1000	1		1		1
SOLUBLE SULFUR*		ppm	8		8		12
MEHLICH III	#/1000	P as P_2O_5	3		2		3
		ppm of P	38		31		44
BRAY II	#/1000	P as P_2O_5	3		4		6
		ppm of P	43		62		85
OLSEN	#/1000	P as P_2O_5					
		ppm of P					
CALCIUM*		#/1000	16		13		16
		ppm	533		435		525
MAGNESIUM*		#/1000	2		1		2
		ppm	54		44		55
POTASSIUM*		#/1000	2		1		2
		ppm	58		40		54
SODIUM*		#/1000	0		0		0
		ppm	13		13		14
BASE SATURATION PERCENT							
Calcium	%		76.80		77.13		76.53
Magnesium	%		12.97		13.00		13.36
Potassium	%		4.29		3.64		4.04
Sodium	%		1.63		2.00		1.77
Other Bases	%		4.20		4.20		4.30
Hydrogen	%		0.00		0.00		0.00
EXTRACTABLE MINORS							
Boron* (ppm)			0.29		< 0.20		0.25
Iron* (ppm)			79		78		76
Manganese* (ppm)			31		25		25
Copper* (ppm)			1.68		1.39		1.48
Zinc* (ppm)			9.21		7.29		8.05
Aluminum* (ppm)			80		70		86
Soluble Salts (mmhos/cm)							
Chlorides (ppm)							
NO_3-N (ppm)			< 0.5		< 0.5		< 0.5
NH_4-N (ppm)			1.6		1.4		1.2

d - specific

* Mehlich III Extractable

#/1000

BROOKSIDE LABORATORIES, INC.

35873-70

SOIL AUDIT AND INVENTORY REPORT

Name Maroon Creek Golf Club City Aspen State CO

Independent Consultant TORV, LLC Date 05/26/2021

Sample Location GREEN			4		6		8
Sample Identification			4 in		4 in		4 in
Lab Number			0229-1		0230-1		0231-1
Total Exchange Capacity (ME/100 g)			3.65		3.27		2.73
pH (H_2O 1:1)			7.0		7.1		7.4
Organic Matter (360°C LOI) %			1.24		1.14		1.19
Estimated Nitrogen Release		#/1000	1		1		1
SOLUBLE SULFUR*		ppm	9		9		9
MEHLICH III	#/1000	P as P_2O_5	2		3		2
		ppm of P	33		39		26
BRAY II	#/1000	P as P_2O_5	4		4		4
		ppm of P	62		64		55
OLSEN	#/1000	P as P_2O_5					
		ppm of P					
CALCIUM*		#/1000	17		16		13
		ppm	562		506		416
MAGNESIUM*		#/1000	2		2		1
		ppm	57		49		45
POTASSIUM*		#/1000	2		2		1
		ppm	56		49		42
SODIUM*		#/1000	0		0		0
		ppm	13		14		14
BASE SATURATION PERCENT							
Calcium		%	76.99		77.37		76.19
Magnesium		%	13.01		12.49		13.74
Potassium		%	3.93		3.84		3.94
Sodium		%	1.55		1.86		2.23
Other Bases		%	4.40		4.30		4.00
Hydrogen		%	0.00		0.00		0.00
EXTRACTABLE MINORS							
Boron* (ppm)			0.29		0.21		0.28
Iron* (ppm)			91		79		73
Manganese* (ppm)			38		25		26
Copper* (ppm)			2.19		1.83		1.82
Zinc* (ppm)			16.99		8.95		11.54
Aluminum* (ppm)			91		75		73
Soluble Salts (mmhos/cm)							
Chlorides (ppm)							
NO_3-N (ppm)			0.6		0.5		< 0.5
NH_4-N (ppm)			1.1		0.9		0.6

d - specific a - alkaline

* Mehlich III Extractable

#/1000

BROOKSIDE LABORATORIES, INC.

35873-70

SOIL AUDIT AND INVENTORY REPORT

Name Maroon Creek Golf Club City Aspen State CO

Independent Consultant TORV, LLC Date 05/26/2021

Sample Location GREEN			10		12		16
Sample Identification			4 in		4 in		4 in
Lab Number			0232-1		0233-1		0234-1
Total Exchange Capacity (ME/100 g)			3.15		2.80		2.71
pH (H_2O 1:1)			7.2		7.5		7.2
Organic Matter (360°C LOI) %			1.05		1.19		1.16
Estimated Nitrogen Release		#/1000	1		1		1
SOLUBLE SULFUR*		ppm	10		6		10
MEHLICH III	#/1000	P as P_2O_5	2		2		2
		ppm of P	31		29		24
BRAY II	#/1000	P as P_2O_5	3		3		4
		ppm of P	47		49		52
OLSEN	#/1000	P as P_2O_5					
		ppm of P					
CALCIUM*		#/1000	15		13		13
		ppm	485		426		413
MAGNESIUM*		#/1000	2		1		1
		ppm	49		46		44
POTASSIUM*		#/1000	1		1		1
		ppm	47		45		41
SODIUM*		#/1000	0		0		0
		ppm	14		15		13
BASE SATURATION PERCENT							
Calcium		%	76.98		76.07		76.20
Magnesium		%	12.96		13.69		13.53
Potassium		%	3.83		4.12		3.88
Sodium		%	1.93		2.33		2.09
Other Bases		%	4.20		3.90		4.20
Hydrogen		%	0.00		0.00		0.00
EXTRACTABLE MINORS							
Boron* (ppm)			0.22		0.23		0.21
Iron* (ppm)			79		76		61
Manganese* (ppm)			27		30		21
Copper* (ppm)			1.96		1.58		1.20
Zinc* (ppm)			8.33		8.40		5.99
Aluminum* (ppm)			85		76		71
Soluble Salts (mmhos/cm)							
Chlorides (ppm)							
NO_3-N (ppm)			0.5		0.5		0.6
NH_4-N (ppm)			0.8		0.8		0.9

d - specific a - alkaline

* Mehlich III Extractable

#/1000

BROOKSIDE LABORATORIES, INC.

35873-70

SOIL AUDIT AND INVENTORY REPORT

Name Maroon Creek Golf Club City Aspen State CO

Independent Consultant TORV, LLC Date 05/26/2021

Sample Location TEE			1		2		17
Sample Identification			4 in		4 in		4 in
Lab Number			0235-1		0236-1		0237-1
Total Exchange Capacity (ME/100 g)			3.62		3.32		3.95
pH (H_2O 1:1)			7.4		7.4		7.3
Organic Matter (360°C LOI) %			1.85		1.59		1.25
Estimated Nitrogen Release		#/1000	1		1		1
SOLUBLE SULFUR*		ppm	9		8		9
MEHLICH III	#/1000	P as P_2O_5	6		4		5
		ppm of P	88		61		78
BRAY II	#/1000	P as P_2O_5	9		9		8
		ppm of P	122		125		114
OLSEN	#/1000	P as P_2O_5					
		ppm of P					
CALCIUM*		#/1000	16		15		18
		ppm	521		489		571
MAGNESIUM*		#/1000	2		2		2
		ppm	74		65		78
POTASSIUM*		#/1000	2		1		2
		ppm	70		47		78
SODIUM*		#/1000	1		1		1
		ppm	18		18		18
BASE SATURATION PERCENT							
Calcium		%	71.96		73.64		72.28
Magnesium		%	17.03		16.32		16.46
Potassium		%	4.96		3.63		5.06
Sodium		%	2.16		2.36		1.98
Other Bases		%	4.00		4.00		4.10
Hydrogen		%	0.00		0.00		0.00
EXTRACTABLE MINORS							
Boron* (ppm)			0.52		0.36		0.49
Iron* (ppm)			189		138		181
Manganese* (ppm)			21		21		21
Copper* (ppm)			1.42		1.34		1.42
Zinc* (ppm)			6.25		5.24		4.82
Aluminum* (ppm)			96		87		100
Soluble Salts (mmhos/cm)							
Chlorides (ppm)							
NO_3-N (ppm)			< 0.5		0.6		< 0.5
NH_4-N (ppm)			1.2		1.1		1.3

d - specific a - alkaline

* Mehlich III Extractable

#/1000

BROOKSIDE LABORATORIES, INC.

35873-70

SOIL AUDIT AND INVENTORY REPORT

Name Maroon Creek Golf Club City Aspen State CO

Independent Consultant TORV, LLC Date 05/26/2021

Sample Location TEE			4		6		8
Sample Identification			4 in		4 in		4 in
Lab Number			0238-1		0239-1		0240-1
Total Exchange Capacity (ME/100 g)			4.26		3.82		3.28
pH (H_2O 1:1)			7.5		7.3		7.3
Organic Matter (360°C LOI) %			2.00		1.88		1.17
Estimated Nitrogen Release		#/1000	1		1		1
SOLUBLE SULFUR*		ppm	16		9		6
MEHLICH III	#/1000	P as P_2O_5	6		5		3
		ppm of P	79		72		40
BRAY II	#/1000	P as P_2O_5	9		7		5
		ppm of P	133		104		72
OLSEN	#/1000	P as P_2O_5					
		ppm of P					
CALCIUM*		#/1000	20		17		15
		ppm	646		570		489
MAGNESIUM*		#/1000	2		2		2
		ppm	75		70		59
POTASSIUM*		#/1000	2		2		2
		ppm	65		58		56
SODIUM*		#/1000	0		1		0
		ppm	16		18		14
BASE SATURATION PERCENT							
Calcium		%	75.82		74.61		74.54
Magnesium		%	14.67		15.27		14.99
Potassium		%	3.91		3.89		4.38
Sodium		%	1.63		2.05		1.86
Other Bases		%	3.90		4.10		4.10
Hydrogen		%	0.00		0.00		0.00
EXTRACTABLE MINORS							
Boron* (ppm)			0.58		0.52		0.26
Iron* (ppm)			242		254		104
Manganese* (ppm)			22		22		16
Copper* (ppm)			1.56		1.45		0.89
Zinc* (ppm)			6.51		6.19		3.46
Aluminum* (ppm)			106		107		77
Soluble Salts (mmhos/cm)							
Chlorides (ppm)							
NO_3-N (ppm)			0.6		0.6		< 0.5
NH_4-N (ppm)			0.9		0.8		0.7

d - specific a - alkaline

* Mehlich III Extractable

#/1000

BROOKSIDE LABORATORIES, INC.

35873-70

SOIL AUDIT AND INVENTORY REPORT

Name Maroon Creek Golf Club City Aspen State CO

Independent Consultant TORV, LLC Date 05/26/2021

Sample Location TEE			10		12		16
Sample Identification			4 in		4 in		4 in
Lab Number			0241-1		0242-1		0243-1
Total Exchange Capacity (ME/100 g)			3.91		2.91		3.21
pH (H_2O 1:1)			7.2		7.5		7.2
Organic Matter (360°C LOI) %			1.50		0.90		1.36
Estimated Nitrogen Release		#/1000	1		1		1
SOLUBLE SULFUR*		ppm	12		5		15
MEHLICH III	#/1000	P as P_2O_5	5		2		4
		ppm of P	68		35		53
BRAY II	#/1000	P as P_2O_5	8		4		5
		ppm of P	110		58		75
OLSEN	#/1000	P as P_2O_5					
		ppm of P					
CALCIUM*		#/1000	18		13		15
		ppm	575		429		476
MAGNESIUM*		#/1000	2		2		2
		ppm	74		52		58
POTASSIUM*		#/1000	2		2		2
		ppm	69		55		52
SODIUM*		#/1000	1		1		1
		ppm	18		18		18
BASE SATURATION PERCENT							
Calcium		%	73.53		73.71		74.14
Magnesium		%	15.77		14.89		15.06
Potassium		%	4.52		4.85		4.15
Sodium		%	2.00		2.69		2.44
Other Bases		%	4.20		3.90		4.20
Hydrogen		%	0.00		0.00		0.00
EXTRACTABLE MINORS							
Boron* (ppm)			0.51		0.33		0.39
Iron* (ppm)			186		100		181
Manganese* (ppm)			22		15		22
Copper* (ppm)			1.64		0.65		1.11
Zinc* (ppm)			6.05		2.15		4.33
Aluminum* (ppm)			100		94		86
Soluble Salts (mmhos/cm)							
Chlorides (ppm)							
NO_3-N (ppm)			< 0.5		< 0.5		0.6
NH_4-N (ppm)			1.1		< 0.5		1.3

d - specific a - alkaline

* Mehlich III Extractable

BROOKSIDE LABORATORIES, INC.

** WATER ANALYSIS

Maroon Creek Golf Club
10 Club Circle
Aspen, CO 81611

File Number: 35873
Date Received:05/24/2021
Date Reported:05/25/2021

Submitted By:TORV, LLC

Lab Number	1160
Sample Location	MAROON CREEK CLUB
Sample Description	SOURCE 15

pH		7.77
Hardness	(ppm)	84.34
Hardness	(grains/gal)	4.93
Conductivity	(mmhos/cm)	0.18
Sodium Adsorp. Ratio		0.12
Adjusted SAR		0.15
Adjusted RNa		0.11
pHc		8.16
Residual Sodium Carbonate (RSC)		-0.22

		(ppm)	meq/l	lbs/ac in
Calcium	(Ca)	26.91	1.34	6.10
Magnesium	(Mg)	4.03	0.33	0.91
Potassium	(K)	1.28	0.03	0.29
Sodium	(Na)	2.54	0.11	0.57
Iron	(Fe)	0.31		0.07
Total Alkalinity	(CaCO3)	72.54		16.45
Carbonate	(CO3)	0.00		
Bicarbonate	(HCO3)	88.51	1.45	20.07
Hydroxide	(OH)	0.00		
Chloride	(Cl)	< 2.00		
Sulfur as	(S04)	26.79	0.56	6.08
Salt Concentration	(TDS)	115.52		26.20
Boron	(B)	< 0.05		

Cation/Anion Ratio	0.90

Reviewed by: Jackie Brackman

BROOKSIDE LABORATORIES, INC.

** WATER ANALYSIS

Maroon Creek Golf Club
10 Club Circle
Aspen, CO 81611

File Number: 35873
Date Received:05/24/2021
Date Reported:05/25/2021

Submitted By:TORV, LLC

Lab Number	1161
Sample Location	MAROON CREEK CLUB
Sample Description	IRRGATION

pH		7.28
Hardness	(ppm)	88.89
Hardness	(grains/gal)	5.20
Conductivity	(mmhos/cm)	0.19
Sodium Adsorp. Ratio		0.12
Adjusted SAR		0.15
Adjusted RNa		0.11
pHc		8.23
Residual Sodium Carbonate	(RSC)	-0.55

		(ppm)	meq/l	lbs/ac in
Calcium	(Ca)	27.85	1.39	6.32
Magnesium	(Mg)	4.57	0.38	1.04
Potassium	(K)	1.49	0.04	0.34
Sodium	(Na)	2.70	0.12	0.61
Iron	(Fe)	0.30		0.07
Total Alkalinity	(CaCO3)	60.84		13.80
Carbonate	(CO3)	0.00		
Bicarbonate	(HCO3)	74.24	1.22	16.84
Hydroxide	(OH)	0.00		
Chloride	(Cl)	< 2.00		
Sulfur as	(S04)	37.47	0.78	8.50
Salt Concentration	(TDS)	124.22		28.17
Boron	(B)	< 0.05		

Cation/Anion Ratio	0.96

Reviewed by: Jackie Brackman

BROOKSIDE LABORATORIES, INC.

** PHYSICAL ANALYSIS REPORT **

Maroon Creek Golf Club
10 Club Circle
Aspen, CO 81611

File Number: 35873
Date Received: 05/24/2021
Date Reported: 06/01/2021

Submitted By: TORV, LLC

SAMPLE LOCATION: TEE-OM

NBR	FIELD	DESCRIPTION	OM 360 As Rcvd (%)	OM 440 As Rcvd (%)
094	1 MAR	0-2	7.07	7.29
095	1 MAR	2-4	4.69	4.77
096	1 MAR	4-6	2.16	2.19
097	3 MAR	0-2	6.61	6.84
098	3 MAR	2-4	3.81	3.93
099	3 MAR	4-6	2.09	2.12
100	12 BLK	0-2	4.42	4.77
101	12 BLK	2-4	1.85	1.88
102	12 BLK	4-6	0.52	0.49

BROOKSIDE LABORATORIES, INC.

** PHYSICAL ANALYSIS REPORT **

Maroon Creek Golf Club
10 Club Circle
Aspen, CO 81611

File Number: 35873
Date Received: 05/24/2021
Date Reported: 06/01/2021

Submitted By: TORV, LLC

SAMPLE LOCATION: ROUGH-OM

NBR	FIELD	DESCRIPTION	OM 360 As Rcvd (%)	OM 440 As Rcvd (%)
103	2	0-2	18.93	19.60
104	2	2-4	12.02	12.18
105	2	4-6	6.80	6.38
106	8	0-2	23.14	24.11
107	8	2-4	14.26	15.03
108	8	4-6	7.62	7.93
109	12	0-2	16.64	16.93
110	12	2-4	10.41	11.05
111	12	4-6	6.63	7.07

BROOKSIDE LABORATORIES, INC.

** PHYSICAL ANALYSIS REPORT **

Maroon Creek Golf Club
10 Club Circle
Aspen, CO 81611

File Number: 35873
Date Received: 05/24/2021
Date Reported: 06/01/2021

Submitted By: TORV, LLC

SAMPLE LOCATION: GREEN OM

NBR	FIELD	DESCRIPTION	OM 360 As Rcvd (%)	OM 440 As Rcvd (%)
116	17	0-2	9.18	10.06
117	17	2-4	2.72	3.17
118	17	4-6	1.29	1.57
119	3	0-2	9.57	10.09
120	3	2-4	2.69	3.04
121	3	4-6	1.03	1.30
122	16	0-2	10.48	11.48
123	16	2-4	3.28	3.71
124	16	4-6	1.34	1.72
125	18	0-2	9.35	10.04
126	7	0-2	8.00	8.49
127	12	0-2	10.20	10.79
128	5	0-2	9.49	10.22

Brookside Laboratories, Inc.
Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 35873
Client Name: Maroon Creek Golf Club
Consultant Name: TORV, LLC
Date Collected: 05/21/2021
Date Received: 05/24/2021

Lab Number: WE0524020
Location: ENTRY
Description:
Sub Description:

Code	Procedure Name	Prep Method	Analysis Method	Completed Prep	Completed Anal	Analyst	Result	LOQ
IA260	DISSOLVED OXYGEN		360.1		May-24	ALP	8.56 mg/l	0.01
IA270	CONDUCTIVITY		120.1		May-25	ALP	147.8 umhos/cm	0.02
IA490	NITROGEN-NITRATE		300.0		May-25	GMY	0.158 mg/l	0.1
IA492	NITROGEN-NITRITE		300.0		May-25	GMY	ND mg/l	0.1
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2		Jun-01	NLS	0.4 mg/l	0.1
IA590	pH		4500H-B		May-24	ALP	7.49 SU	0.01
IA647	PHOSPHORUS-TOTAL (SM 4500 P-E)		SM 4500 P-		Jun-01	ALP	ND mg/l	0.05
IA791	FIELD TEMPERATURE				May-24	EF	42 degrees C	0.1

Approval

Erica Huber
Environmental Laboratory Manager

Abbreviations/Definitions

ND = Non Detect (Values only known to be somewhere between zero and the reporting limit.)

LOQ = Limit of Quantitation (The lowest concentration of analyte in a sample that can be determined with acceptable precision and accuracy under the stated experimental conditions.)

Detected = Compound was detected between zero and the Limit of Quantitation. Limits detected below the LOQ can not be quantitated.

Brookside Laboratories, Inc.
Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 35873
Client Name: Maroon Creek Golf Club
Consultant Name: TORV, LLC
Date Collected: 05/20/2021
Date Received: 05/24/2021

Lab Number: WE0524021
Location: EXIT
Description:
Sub Description:

Code	Procedure Name	Prep Method	Analysis Method	Completed Prep	Completed Anal	Analyst	Result	LOQ
IA260	DISSOLVED OXYGEN		360.1		May-24	ALP	8.44 mg/l	0.01
IA270	CONDUCTIVITY		120.1		May-25	ALP	266.3 umhos/cm	0.02
IA490	NITROGEN-NITRATE		300.0		May-25	GMY	ND mg/l	0.1
IA492	NITROGEN-NITRITE		300.0		May-25	GMY	ND mg/l	0.1
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2		Jun-01	NLS	0.63 mg/l	0.1
IA590	pH		4500H-B		May-24	ALP	7.87 SU	0.01
IA647	PHOSPHORUS-TOTAL (SM 4500 P-E)		SM 4500 P-		Jun-01	ALP	ND mg/l	0.05
IA791	FIELD TEMPERATURE				May-24	EF	58 degrees C	0.1

Approval

Erica Huber
Environmental Laboratory Manager

Abbreviations/Definitions

ND = Non Detect (Values only known to be somewhere between zero and the reporting limit.)

LOQ = Limit of Quantitation (The lowest concentration of analyte in a sample that can be determined with acceptable precision and accuracy under the stated experimental conditions.)

Detected = Compound was detected between zero and the Limit of Quantitation. Limits detected below the LOQ can not be quantitated.

-25

35873 TorV

CHAIN OF CUSTODY

Instructions: In order for analysis to be completed correctly, please fill out this form completely. Test Method Codes are located on the back of this form.

White = Original - send to lab w/samples
Yellow = Copy - send to lab w/samples
Pink = Client Copy - Keep for your records

BROOKSIDE LABORATORIES, INC.
Environmental Services Department
200 White Mountain Drive
New Bremen, OH 45869
Tel: (419) 977-2766
Fax: (419) 977-2767

6/4/21

Client **Maroon Creek Club**	Account No: **35873**	
Report Address: **10 Club Circle Aspen, CO 81611**	Invoice Address: **#760 TORV, LLC**	
	ATTN:	
	Sampled By: **Eric Foerster**	
ATTN:	P.O. No:	
Phone No:	Quote No:	
Fax No:	State Samples Collected: **CO**	

TURNAROUND TIME (additional fees)
☑ Standard (none) ☐ 3 Day (+ 50%)
☐ 5 Day (+25%) ☐ 24 Hour Rush (+ 100%)
Date Needed: Standard

Test Methods Must Be Specified

Sample ID	Date	Time	Comp (C) Grab (G)	Matrix	Field pH	TESTS REQUESTED: TEST METHODS	EE549	# and type of containers: HCl/NaOH	HNO_3	H_2SO_4	Other	None	LAB USE ONLY
Entry	5/20	9:45am					X			1			WE0524090
Exit	5/20	1:24pm					X			1			WE0524021

QC Deliverables:
☐ Level 1 ☐ Level 2 ☐ Level 3
☐ Level 4 ☐ Other

COMMENTS: EXIT FIELD = 58° EMAIL TO eric@torv.me
ENTRY FIELD = 42°
Please run the Audubon Core test package on both of these samples. I have included 1 250ml w/preservative for each sample to do the nitrogen and phosphorus tests.

Chain of Custody Protocol is:
☐ Mandatory ☒ Optional

Relinquished By: F. Foerster	Date/Time	Rec'd By: [illegible]	Date/Time 5-24-21	Field Temp:
Relinquished By:	Date/Time	Rec'd By:	Date/Time	Rec Lab Temp:
Relinquished By:	Date/Time	Rec'd By:	Date/Time	

Matrix Codes: DW - Drinking Water S - Soil O - Oil IS - Industrial Solid WW - Wastewater SD - Sludge M - Manure