2025 Soil Health Program Report

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rpbcwd.org/soil-health-study

Introduction

The District and Barr Engineering staff have been developing the Soil Health Program as part of the Ecosystem Health Action Plan (EHAP). The purpose of this program is to assess various functions of urban soils to better understand the relationship between plant communities, soil functions and characteristics, and hydrology. Through on-site assessment and soil sampling, staff have collected data on various soil function metrics and plant communities. This study also acts as a way for staff to catalogue and identify the makeup of soils within the District.

These findings will provide further framework for improving soil functions pertaining to water quality and stormwater storage by informing changes to existing programs, including:

- Bolstering our cost-share program to include soil restoration
- Providing soil health resources for stakeholders
- Updating our regulatory rules pertaining to soil impacts
- Identifying long-term impacts of site restoration on soil
- Optimizing project site selection by accounting for soil benefits

What is Soil Health?

Soil health can be seen as "the continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals and humans" (NRCS 2023). Soil health and soil quality are considered synonymous. However, many soil professionals will make one distinction between the two: soil quality includes both inherent and dynamic quality (Moebieus-Clune 2017). Inherent quality is the makeup and properties of soil, shaped by long-term geological processes; dynamic qualities, more of the "soil health" qualities, are the properties of the soil which are

Soil sample collection

influenced by use and changes on a human time scale (Cornell University 2017). Soil is its own ecosystem, working as a vital part of boarder ecosystems. Therefore, it is important to manage and strive for good soil health and function. Properly functioning soil provides benefits such as:

- Nutrient cycling and retention
- Healthy vegetation communities
- Carbon sequestration
- Greater water infiltration and storage

For more information on soil health, refer to Cornell University's "What is Soil Health?" Soil Health Manual Series, Fact sheet found in Appendix A, or the Cornell University Comprehensive Assessment of Soil Health Training Manual.

Extensive research exists on soil health and its effectiveness on improving water quality and conservation. Staff continue to review literature on the subject, compile research findings, and identify best practices for soil improvement and policies. The following is a summary of the soil assessment efforts staff undertook during the 2025 field season. This includes methods of assessment, infiltration data (specifically hydraulic conductivity), and soil physical, biological, and chemical characteristics. Further analysis of apparent trends in the data across the different land use types and soil types is also discussed.

Assessment Metrics

Table 1 contains the current list of sampling metrics collected during a site assessment. These metrics may change upon further literature review and data reassessment. One example of this is the addition of bulk density to the metrics list for the 2025 field season. The metrics analyzed by Cornell University's Soils Lab as a part of their standard soil health analysis package are noted in the following table.

Assessment Sites

Since Fall of 2023, site and point selection has been based on representative land use types. These land use types fall into two general categories: minimally disturbed soils with minimally altered hydrology, and disturbed soils with moderate-highly altered hydrology (Table 2).

Altered hydrology is the change in how water moves in the watershed, often due to human influence. This can lead to negative impacts on our ecosystems, including increased runoff into our waterbodies and decreased water storage capacity. A residential lawn is an example of a land use with altered hydrology. On lawns, this usually occurs through grading, soil compaction and maintenance of turfgrass. In other land use types, the introduction of invasive species, such as common buckthorn (Rhamnus cathartica) or earthworms, can also lead to altered hydrology. These invasive species can also drastically alter the soil and surrounding vegetation. This can lead to perceived natural land use types, such as forested areas, having altered hydrology. Areas with minimally altered hydrology, or hydrology that has been restored to a more natural state, will have less soil disturbance that would lead to these negative impacts. In theory, these land use types will have increased infiltration and water storage capacity. An example of a land use type with minimally altered hydrology is an undisturbed prairie with diverse native plant communities.

Table 1. List of current RPBCWD Soil Health Program sampling metrics.

Metric	Assessment
Infiltration rates (MPD infiltrometer)	On-site
Compaction (field penetrometer)	On-site
Soil respiration	Cornell University Soils Lab
pH	Cornell University Soils Lab
Modified Morgan Extractable P	Cornell University Soils Lab
K, Mg, Fe, Mn, Zn, Al, Ca, Cu, S, B	Cornell University Soils Lab
Soil texture	On-site *and* Cornell University Soils Lab
Active carbon	Cornell University Soils Lab
Wet aggregate stability	Cornell University Soils Lab
Soil organic carbon	Cornell University Soils Lab
Predicted Autoclave-citrate Extractable (ACE) protein*	Cornell University Soils Lab
Available water capacity	Cornell University Soils Lab
Surface/sub-surface hardness interpretation (based on field penetrometer readings)	Cornell University Soils Lab
Soil profile/horizon assessment (texture, color, thickness, matrix makeup, redoximorphic features, presence of wetland soils and/or hydrology, etc.)	On-site
Soil moisture	On-site
Vegetation	On-site
Presence of earthworms	On-site
Bulk density	On-site

*Autoclave-citrate extractable (ACE) protein and available water capacity are predicted based on other indicators measured.

Specific site selection focuses on observing and comparing soil conditions at sites with altered hydrology, and minimally altered or restored hydrology. 2025 sample sites can be seen in

Figure 1. Initial points are mapped using Web Soil Survey. This application provides mapped soil textures and types created by the Natural Resource Conservation Service (NRCS). Once on site, adjustments to point placements are made if needed. They are made to accommodate observation of land use type boundaries, add additional assessment points to the sample size, or if other factors called for staff to do so (ex: to avoid sprinkler systems). One infiltration test is conducted at each mapped point. At least one composite sample, consisting of six subsamples, is taken at each point as well. Subsamples are taken within the general area of the corresponding infiltration measurement.

Figure 1. Map of 2024-2025 soil assessment sites

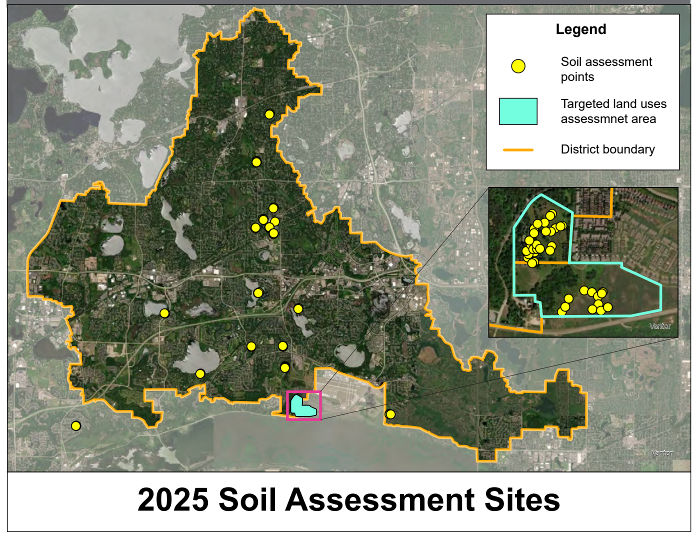


Table 2. List of representative land use types assessed within RPBCWD.

Minimally Altered and Restored Hydrology	Altered Hydrology
Restored praiirie (>30 years old)	Residential lawn
Fallow field (>30 years old)	Mowed parkland and multi-activity field
Forests with good (>50%) herbaceous cover	Forest with poor (<50%) herbaceous cover
	Rain garden

After reviewing sample and test data from 2023-2024, staff identified three issues with site selection and sample point placement that they wanted to correct in 2025. First, it was determined that more assessments on residential, maintained lawns were needed. Residential lawns cover about 40 percent of the District. Staff did not sample any lawns until 2024, and the number of sites assessed was still too low to get a good baseline on how residential lawn soils were functioning within the District. Staff planned for analyzing data from residential lawn sites with the goal of identifying what the soil in these residential areas looked like. The 2025 residential sample sites had been developed across multiple decades and had varying levels of topsoil. Some sites had heavily mixed soils containing fill originating from off-site, and other sites had soil closer to what was present before development. Assessing residential lawns, which have such a varying level of disturbance depending on where and when they were developed, is key to staff having a clearer picture of what the District's soils look like. Sampling a large portion of residential lawns also gives staff an idea of how they function across the District. This can better inform future programs and rules pertaining to residential development and existing development management.

Second, staff found they needed more information on how soil function in land use types differs when they all share similar soil textures and makeup. In 2023 and 2024, staff collected quite a bit of data from each land use type. However, the soil makeup across these land use types varied quite a bit. A question was posed: How do soil texture and makeup affect these soil functions being measured? When looking at all the sample points containing a specific soil make-up and texture (ex: all sites with predominantly sandy soil), there were not enough points sampled within each land use type containing that specific soil make-up and texture(s) to carry out any accurate statistical analyses. this, a large part of the 2025 schedule focused on assessing a few different land use types with consistent soil texture and makeup located adjacent to each other.

Staff focused this part of assessments on one specific area in the southern part of the District, near Riley Creek immediately north of Flying Cloud Drive. This area contains Prairie Bluff Conservation Area and the Spring Road property. This area contains adequate sample area within a fallow tree farm dominated by smooth brome (Bromus inermis), forest with poor herbaceous cover dominated by common buckthorn, and a restored prairie. The addition of the fallow tree farm (which was given its own category of land use as seen in Table 2) was an opportunity for the District to sample such a contained area that had multiple land use types, all with very similar sandy soils. Figure 1 shows sites assessed in these adjacent land use types during the 2025 field season.

Lastly, staff wanted to increase the density of sample and test points across each site. Increasing the density of testing at a site gives a better representation of what the soil looks like at the site. It also avoids skewing results due to undersampling the site.

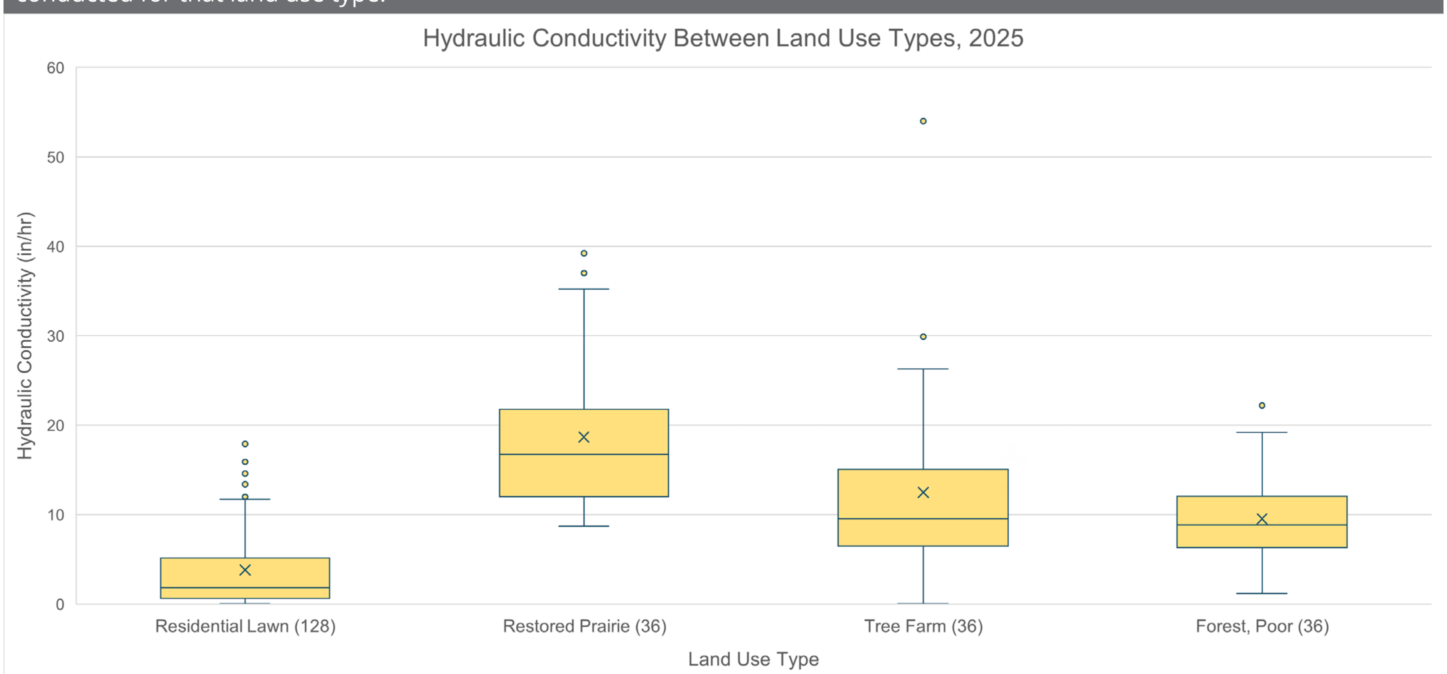
Infiltration testing using the MPD Infiltrometer

Infiltration

Infiltration testing was conducted to measure the hydraulic conductivity (Ksat) of the soil at each site using a Modified Philip Dunne infiltrometer (MPD). Hydraulic conductivity is the water infiltration rate once the soil has reached 100% saturation and the infiltration rate has become constant. Infiltration testing was conducted on days when there was no precipitation 24 hours prior. At each assessment point, three four-inch diameter graduated cylinders were pounded into the soil at a three-foot radius around a center point. At this point, the cylinders were each filled with 30 centimeters of water. Once filled, the MPD sensor heads were placed onto the cylinders, and the test was started immediately. Each individual cylinder constituted one test. Once the sensor head was in place and turned on, the MPD automatically recorded data for each test. Each test ran until all the water had drained from the tube. If no water drainage was observed after one hour, the test was concluded.

Previously, this was done at the surface by only removing surface debris and sod. In 2025, staff conducted infiltration testing 12 inches below the surface. This was done because staff wanted to test hydraulic conductivity in residential lawn soils at a point below the lawn's topsoil. The topsoil is the 6 to 12 inches of soil that is usually placed on top of graded soils at the end of development. To be able to compare results across all four

Figure 2. Hydraulic conductivity of successful infiltration tests. "X" indicates the mean hydraulic conductivity (Ksat) value across all the tests within that particular land use type. The lines intersecting each box plot indicate the median Ksat value of the tests conducted for that land use type.



land use types tested in 2025, the three non-residential land use types were tested as 12” below the surface as well. Beyond this, seeing how hydraulic conductivity performs further down the soil column can give staff a better understanding of the depth of potential stormwater storage space at a site. This would also consider any change in compaction or other functions deeper below the surface.

Samples and Soil Profiles

Clear, sunny days were needed to properly evaluate the soil profile. When it was too overcast to properly assess soil horizon colors, soil profiles were conducted later during sunny conditions.

Each composite sample consisted of at least six subsamples taken in pairs. Each set of subsamples were taken 15 feet apart, with one pair taken adjacent to the infiltration test point. Previously for each subsample, surface debris was removed and an 8-inch-deep hole was dug using a tile spade. From the side of the hole, the top two inches of surface soil was removed to clear vegetation. Digging where the top two inches of surface soil were removed, and a six-by-two-inch sample, the width of the shovel blade, was removed along with any extra soil. In

Example of a soil profile extracted at a residential lawn

Stiff sunflower (Helianthus pauciflorus)

2025, the starting hole was dug to a depth of about 18 inches. From here, the sample was removed from the side of the hole starting 12 inches below the surface. At each subsample point, a penetrometer was used to measure surface and subsurface compaction (0”-6” and 6”-18” from the surface, respectively). Penetrometer readings were recorded with soil samples and analyzed by the soils lab. Subsamples were placed and mixed in a clean, five-gallon bucket. Five cups of the composite sample were measured and double bagged in gallon freezer bags. Sample was labeled with site information, refrigerated, and mailed via USPS to the Cornell University Soils Lab for analysis. All samples were sent by end of day or the following day to prevent decomposition of samples.

Infiltration Data Results

Given the change in analysis depth in 2025, this analysis will focus on data collection in 2025. We will discuss how this field season’s data compares to previously collected data, but with the caveat that different assessment depths could change the level of function or compaction.

During the 2025 field season, 83 sites were assessed for hydraulic conductivity (Ksat), equating to 249 individual infiltration tests. At least one set of three tests was conducted at each site; some sites had repeat or extra tests conducted. Some of these extra tests were due to errors in the infiltration test that produced “NULL” results. Other tests were stopped

Figure 3. Sample assessment report for a sample taken at the Prairie Bluff Conservation Area.

Comprehensive Assessment of Soil Health

From the Cornell Soil Health Laboratory, Department of Soil and Crop Sciences
School of Integrative Plant Science, Cornell University, Ithaca, NY 14853
https://soilhealthlab.cals.cornell.edu

Grower: Zach Dickhausen
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Sample ID: CC544
Field ID: PB17
Date Sampled: 08/11/2025
Coordinates: Latitude: 44.81971
Longitude: -93.474761

Measured Soil Textural Class: **sand**

Sand: **91%** - Silt: **5%** - Clay: **3%**

Group	Indicator	Value	Rating	Constraints
physical	Available Water Capacity	**0.05**	**13**	Water Retention and Availability
physical	Surface Hardness	**196**	**35**	
physical	Subsurface Hardness	**300**	**50**	
physical	Aggregate Stability	**37.1**	**63**	
biological	Organic Matter Soil Organic Carbon: 0.01 / Total Carbon: 1.49 / Total Nitrogen: 0.04	**0.7**	**5**	Nutrient and Energy Storage, Ion Exchange, C Sequestration, Water Retention
biological	Predicted Soil Protein	**4.85**	**23**	
biological	Soil Respiration	**0.1**	**6**	Soil Microbial Abundance and Activity
biological	Active Carbon	**125**	**5**	Energy Source for Soil Biota
chemical	Soil pH	**7.6**	**81**	
chemical	Extractable Phosphorus	**1.4**	**41**	
chemical	Extractable Potassium	**39.3**	**58**	
chemical	Additional Nutrients Ca: 9480.9 / Mg: 205.4 / S: 3.3 Al: 3.8 / B: 0.17 / Cu: 0.06 Fe: 1.4 / Mn: 5.3 / **Zn: 0.2**		**88**	

Overall Quality Score: **39** / Low

Table 3. List of land use types with respective number of MPD tests over the 2025 field season.

Land Use Type	Number of MPD tests
Residential Lawn	128
Forest, Poor	36
Tree Farm	36
Fallow Field	36

early by staff due to slow or no drainage and produced a "NULL" result. In total, 27 tests produced a "NULL" result. Each of these NULL tests had their hydrographs analyzed. If the hydrograph showed that the infiltration rate over the last five minutes was close to 0.1 inches of movement per hour, then the hydraulic conductivity was estimated to be 0.1 inches per hour. If there was little to no movement during the entire test and the water level dropped at rate much less than 0.1 inch per hour, then hydraulic conductivity was estimated to be 0 inches per hour. Of those 27 NULL tests, 13 were determined unusable and left out of the data analysis. In total, 236 usable tests were collected. Table 3 gives the breakdown of how many successful tests occurred within each land use type in 2025.

Hydraulic conductivity varied across the four sampled land use types. The restored prairie had the highest average hydraulic conductivity across 36 tests at 18.67 in/hr. The prairie plant community was dominated by prairie grasses such as prairie dropseed (Sporobolus hererolepsis) and big blue stem (Andropogon gerardii). Residential lawns, dominated by Kentucky bluegrass (Poa pratensis) or other low-mowed turf grasses, had the lowest average hydraulic conductivity at 3.80 in/hr across 128 tests. The average hydraulic conductivity of the 36 tests at the tree farm and the 36 tests in the buckthorn dominated forested area were 12.49 in/hr and 9.52 in/hr, respectively. The old tree farm was dominated by smooth brome (Bromus inermis), kentucky bluegrass (Poa pratensis), and thick areas of white spruce (Picea glauca). The forested area was dominated by thick buckthorn (Rhamnus cathartica) across all strata, and basswood (Tilia americana). Site-specific hydraulic conductivity graphs for each land use type can be found in Appendix B.

Staff did plan out non-residential sample points to be taken from within a relatively small portion of the District. The idea behind this was to reduce variability when comparing hydraulic conductivity and other functions across different land use types by ensuring sites sampled were either on the same parcel or parcels adjacent to each other. This way they would all contain mostly similar soil types, textures, and topography. This would avoid widely varying soil textures which would have a significant effect on infiltration rates. In previous years, assessment sites were spread across and just outside of the District. This helped staff identify what soils looked like across more areas of the District, but there was more variability with soil makeup and texture. In the previous years' data, there was a similar trend in hydraulic conductivity between altered and minimally altered and restored hydrology land use types, not including the mowed parkland and multi-use field categories. These categories were removed for assessment consideration because there was too much variability in traffic and use across this category. They would have to be split up into sub-categories to be considered for future sampling. Staff did start to see larger and more consistent differences in hydraulic conductivity between land use types when they shared similar soil texture and makeup.

Although 2025 residential lawn samples were taken from areas spread out across the District, most of the soil types assessed were majority sand or a sand-loam mixture. 33 of the 47 residential lawn sites sampled had a soil texture of sandy loam to sand, the remaining 14 sites having a texture of loam. This brings a bit more confidence when comparing hydraulic

Prairie at the Praire Bluff Conservation Area

Table 4. Soil Health Indicators - Cornell Framework.

PHYSICAL	**Predicted Available Water Capacity:** reflects the quantity of water that a disturbed sample of soil can store for plant use. It is the difference between water stored at field capacity and at the wilting point, and is measured using pressure chambers.
	Surface Hardness: is a measure of the maximum soil surface (0 to 6 inch depth) penetration resistance (psi), or compaction, determined using a field penetrometer.
	Subsurface Hardness: is a measure of the maximum resistance (psi) encountered in the soil between 6 to 18 inch depths using a field penetrometer.
	Aggregate Stability: is a measure of how well soil aggregates resist disintegration when hit by rain drops. It is measured using a standardized simulated rainfall event on a sieve containing soil aggregates between 0.25 and 2.0 mm. The fraction of soil that remains on the sieve determines the percent aggregate stability.
BIOLOGICAL	**Organic Matter:** is a measure of all carbonaceous material that is derived from living organisms. The percent organic matter is determined by the mass of oven dried soil lost on combustion in a 500º C furnace.
	Predicted Soil Protein: is a measure of the fraction of the soil organic matter which contains much of the organically bound N. Microbial activity can mineralize this N and make it available for plant uptake. This is measured by extraction with a citrate buffer under high temperature and pressure.
	Soil Respiration: is a measure of the metabolic activity of the soil microbial community. It is measured by re-wetting air dried soil, and capturing and quantifying carbon dioxide (CO_2) produced.
	Active Carbon: is a measure of the small portion of the organic matter that can serve as an easily available food source for soil microbes, thus helping fuel and maintain a healthy soil food web. It is measured by quantifying potassium permanganate oxidation with a spectrophotometer.
CHEMICAL	**Soil Chemical Composition:** is a standard soil test analysis package measures levels of pH and plant nutrients. Measured levels are interpreted in this assessment's framework of sufficiency and excess but no crop specific recommendations are provided. Nutrients measured include extractable phosphorus, extractable potassium, calcium, magnesium, iron, zinc, aluminum, boron, copper, manganese, and sulfur.

conductivity of residential lawns in the District to other land use types assessed in 2025. There was a much lower average Ksat average for residential lawns in 2025 of 3.80 in/hr than the Ksat across 2022-2024 residential lawn tests of 7.63 in/hr. Both datasets were collected from areas across the District, but there are a couple things that could account for the difference in average Ksat. First, there were considerably more tests done in 2025 than in 2022-2024 (128 tests vs. 53 tests, respectively). With almost 2.5 times more tests, the 2025 data set is more reliable. Staff also made a point to collect more samples at each property to get a better representation of them. Secondly, staff wanted to test lower in the soil profile in 2025, specifically in residential areas. This was to find out how the soil beneath topsoil in our residential areas' functions. Decompaction practices often do not decompact soil very deep, if at all. The layer of topsoil put down after grading and decomposition may not be very thick, if any was added at all. The age of the residential areas assessed varied. Some were developed within the last decade, some 30-40 years ago, and some homes were just built on land with minimal-to-no-large-scale residential development and alteration of the soil. By assessing the soil deeper in the profile, we can get a better idea of how the soil will function and infiltrate, especially in areas where the topsoil might be masking a heavily compacted soil beneath it.

Sample Data Results

Over the 2025 field season, 83 composite soil samples were collected from across the four different land use types (12 from each of the three land use types at the Spring Road and Prairie Bluff Conservation Area and 47 residential lawn samples). Samples were mailed to the Cornell University Soils Lab for analysis. Lab results and assessment of the samples included a comprehensive analysis of soil health for each sample, including measurements and functional scores of physical, biological, and chemical metrics. These scores rated each functional metric of a given sample out of 100, 0 being a very low functional score, and 100 being a very high functional score (Figure 3 is a sample assessment report for one of three samples taken at Prairie Bluff Conservation Area. This site is labeled as "PB17".) The assessment report for each sample also includes soil texture composition, as well as management suggestions to correct indicators which scored poorly. It is important to note that the CASH framework for assessment and soil health focus around soils within agricultural settings. Chemical functions' ratings listed in these reports are very specific to how the chemical makeup of the soil will influence crop growth. Chemical properties in soil will continue to be a part of the analysis of soil samples collected, but at this time, it will not be a part of sample analysis of this report. The overall quality score provided on the Cornell CASH report will also not be included seeing that chemical analysis has been removed.

Last year's soil report analyzed 114 samples taken from seven different land use types (including forest with poor cover, residential lawns and restored prairie) across the District since 2022. Staff had also expected to see better biological and physical functional scores in the unaltered/restored hydrological land use types when looking at the sample data collected during this period. However, as was the case with the samples taken in 2025, this did not necessarily happen. Including the 102 samples taken during the 2023-2024 season, the following analysis includes a total of 114 samples taken from representative ecosystems since the study began in the fall of 2022. Graphs of average functional ratings by land use type for 2025 can be found in Appendix C. The fallow field land use type, where the field had been left to revert to a more natural state for 30 plus years, had some of the lowest average scores across most of the functions. This is a land use type that, when assessing older sites, one might expect the functional scores to be higher given the diversity and density of the plant community, and the reduced usage of the site. Like 2024, degraded forests' rates varied across the different functions, scoring higher than other land use types in some categories. Given the lack of herbaceous cover, and in the case of the forest site at the Spring Road property, the dominance of buckthorn, there was an assumption that degraded forests would score poorly across all functions.


New England Aster (Symphyotrichum novae-angliae)

After several years of data collection and review, staff are concluding that many of the representative sites being sampled range in functional quality and health. Some of the spaces with greater amounts of altered hydrology and disturbance are potentially in a healthier condition than they could be, given their land use type. On the flip side, minimally altered or restored hydrology land use types can be minimally disturbed and have a somewhat healthy plant community, but still have poorer soil function, while still having good hydraulic conductivity. Given this and the hydraulic conductivity results we have recorded over this study, there are likely other factors such as the makeup of plant community and usage that are influencing hydraulic conductivity. Even when we are seeing lower soil physical and biological functions across the minimally altered/restored hydrology land uses, we are still typically seeing much higher average hydraulic conductivity rates. We know based on the literature on soil health and function, and infiltration, that good biological soil function leads to good soil physical function which ultimately leads to improved infiltration and water storage capacity. When looking at soil function within these different land uses, the level of function may not necessarily be an indicator of the plant community and land use. Perhaps the land use and plant communities are the indicator of how well stormwater might infiltrate and the amount of potential storage capacity despite what the level of biological and physical soil function. In cases where minimally altered hydrology land use types had decreased soil function, the goal of implementing any future BMP or restoration would be to improve those specific low-scoring functional categories and increase infiltration rates and storage capacity.

Next Steps

With several years of focused soil assessments, staff want to start using this data to inform and guide other District programs. In 2026, staff are exploring ways to improve residential lawn soil health in the District. One avenue being evaluated is soil quality restoration. This method improves lawn soil health through deep aeration and compost application This process increases infiltration of water into the soil and organic matter content. Staff will also be looking into developing soil functional standards for the District using soil function assessment data collected since 2022. This will include looking to incorporate such standards into future rule updates and capital improvement projects.

Staff will continue sampling and testing soil in 2026. Assessment efforts will focus on remnant and restored prairies of differing ages in Minnetonka and Bloomington, as well as before and after District permitted projects.

References

Moebius-Clune, B.N., D.J. Moebius-Clune, B.K. Gugino, O.J. Idowu, Et al. 2017. Comprehensive Assessment of Soil Health, The Cornell Framework. Cornell University. Ithaca, New York. Available at: soilhealth.ca ls.cornell.edu/manual

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Appendices

Appendix A

Cornell University Soils Fact Sheet

Cornell University
School of Integrative Plant Sciences

Soil Health Manual Series — Fact Sheet Number 16-00

Cornell Soil Health Laboratory: Comprehensive Assessment of Soil Health (CASH)

The Comprehensive Assessment of Soil Health (CASH), commonly known as the Cornell Soil Health Test, is designed for farmers, gardeners, agricultural service providers, landscape managers and researchers who want to go beyond simply testing the nutrient levels of their soils. The Cornell Soil Health Lab was the first to offer a comprehensive soil health package analysis that provides standardized information on a suite of important soil biological and physical parameters in addition to standard nutrient analyses. The CASH assessment is regarded as a key tool for soil health measurement by a diverse clientele of growers, research projects, and national initiatives.

The Cornell Soil Health Lab conducts many thousands of soil health package analyses each year. The Soil Health Report lists the laboratory results from each analysis. Each lab value is scored against the large database with color-coding for clarity. The Cornell Soil Health Lab also offers a Soil Health Management Planning framework to focus soil management options on the identified parameters.

The Cornell Soil Health Lab offers cutting edge soil assessments, many of which were developed in house, and which serve as the standard for soil health lab analytics around the world. The analyses are offered as individual assessments and as parts of soil health assessment packages. The suite of lab analyses include:

- pH and Nutrient Testing
- Loss on Ignition/Organic Matter
- Active Carbon
- Total Carbon, Total Nitrogen
- Soil Organic Carbon
- Surface and Sub-Surface Hardness
- Rapid Texture
- Wet Aggregate Stability
- Soil Respiration
- Autoclave-Citrate Extractable (ACE) Protein
- Available Water Capacity
- Predicted Available Water Capacity
- Predicted Autoclave-Citrate Extractable (ACE) Protein
- Bulk Density and Stone Content
- Soluble Salts

Our website offers a collection of one-page, two-sided Fact Sheets designed to explain each the soil indicators listed above. The Fact Sheets provide information regarding each soil analysis in a ready format for researchers, growers, Extension personnel and Ag Service Providers.
More comprehensive details regarding the CASH soil assessment indicators and soil health management strategies for improving soil health are available in the Comprehensive Assessment of Soil Health Training Manual, available free online.
Also available online are the Cornell Soil Health Lab Standard Operating Procedures for each of the soil lab analyses.

Acknowledgments

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This information is based on The Cornell Soil Health Manual and includes contributions from all authors of that document.
This fact sheet represents the best professional judgment of the authors and does not necessarily reflect the views of the funders or reviewers.

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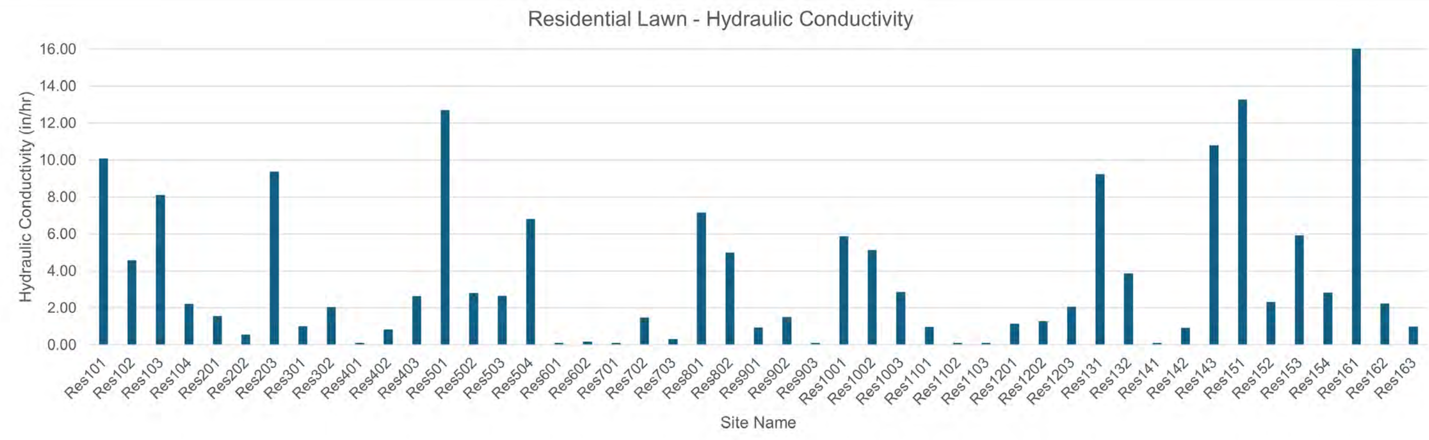
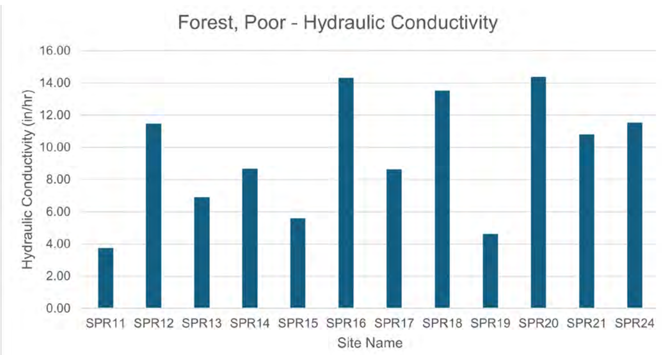
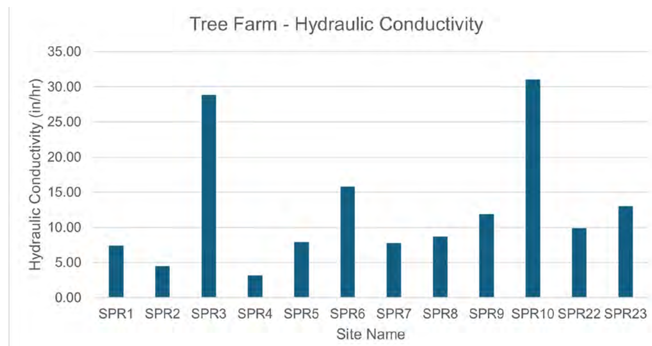
Soil and Crop Sciences Section — Comprehensive Assessment of Soil Health - soilhealthlab.cals.cornell.edu

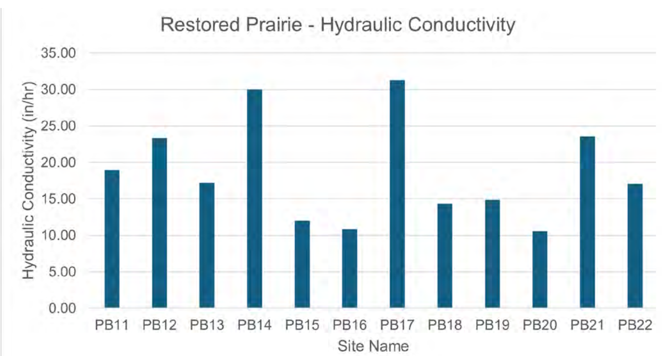
Appendix B

Site-specific hydraulic conductivity measurements across all land use types.









Appendix C

Comprehensive assessment of soil health indicator function/health ratings across all sites sampled.