

MVP DAIRY – CELINA, OH

Sustainability Analysis

ON-FARM PRACTICES REPORT

2019

An Evaluation of Actual
Performance by



EcoPRACTICES®

Prepared for  **DANONE**
NORTH AMERICA



EcoPRACTICES®

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About EcoPractices

With a mission to promote planetary health for the future, Sustainable Environmental Consultants, SEC, is a leader in the sustainability movement with a true passion for agriculture. By promoting the use of measurable management practices, SEC engages and inspires agricultural, food and beverage companies to integrate the best sustainability tools into their business. The result is greater transparency, reduced risk, reduced environmental impacts and greater efficiency of natural resources while producing agricultural commodities.

SEC's Risk Management Platform, EcoPractices®, identifies, collects, verifies, documents and generates environmental impacts from conservation practices. Through this platform, agricultural producers are able to transform their operation to have verification and quantification of the efforts made each day on the farm and effectively deliver this science-based story to any audience.

For additional information please checkout Sustainableenviro.com.

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DANONE NORTH AMERICA - SOIL HEALTH PROGRAM

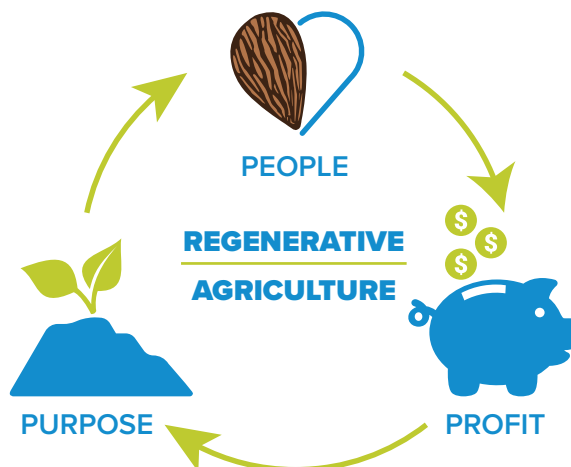
An Introductory Message from Danone North America

Danone North America believes that sustainable agriculture does not simply mean working for a better environment, but also to improve the life of farmers by delivering strong profitable returns. Danone North America aims to prove our Soil Health Program will be self-sustainable and profitable in the long run.

Thanks to our longstanding relationships with our farmer partners, Danone North America is able to achieve these goals. The outcomes learned from this report are a vital step for all of us as we join together in this journey!

EcoPractices will be alongside Danone North America to collect, verify, analyze and generate environmental impacts from practices taking place in the field and on the dairy. The EcoPractice process will help us establish a best in market sustainability baseline, and build a strong, meaningful, sustainable and continuous improvement plan for the next five years.

Thank you for making the planet better every day!



The Soil Health Program kicked off on January 1, 2018 with an official announcement from Danone North America on March 7, 2018: DanoneWave Puts a Stake in the Ground with Commitment to Regenerative Agriculture and Soil Health Research Collaboration with Renowned Research Partners.

5 Pillars of Regenerative Agriculture

Danone North America's 5 Pillars of Regenerative Agriculture are Soil Health, Water, Biodiversity, Carbon & Energy, and Economy & Productivity. Key Performance Indicators have been established in order to measure each of the 5 Pillars.

Key Performance Indicators



SOIL HEALTH

- › Monitor and decrease nitrogen, phosphorus and potassium
- › Increase organic matter through cover crops and no/reduced till
- › Use Comprehensive Assessment of Soil Health (CASH) Test to monitor and improve
- › Soil erosion and sediment control



WATER

- › Use of technology to reduce water consumption (water probes, milk condenser, etc.)
- › Soil becomes more resilient to drought and flooding because of water absorption ability
- › Reduce surface water degradation



BIODIVERSITY

- › Promote and increase cash and cover crop diversity
- › Monitor and decrease pesticides, chemical fertilizers and herbicides



CARBON & ENERGY

- › Increase carbon sequestration by having more organic matter in the soil



ECONOMY & PRODUCTIVITY

- › Increased return per acre
- › Better crop yields
- › Cost breakdown of each component
- › Efficiency of each input
- › Prove self-sustainability

LETTER FROM THE FAMILY

We are proud farmer partners with Danone North America and support their Sustainable Agriculture Pledge. Although we focus on Soil Health, Water, Biodiversity, Carbon & Energy, Economy & Productivity and Animal Welfare in this report, our family, along with Danone North America, has always had a commitment to care for cows, people and the land.

We are proud to provide dairy foods in a sustainable manner and are proud to release this report verifying our commitment and achievements at MVP Dairy. We are excited to develop sustainability goals and show our continuous improvement in areas that are and always have been important to our family.

Ken McCarty
MVP Dairy



The McCarty Family, Tom and Judy McCarty with their sons (left to right) Clay, Mike, Ken, and David.



The VanTilburg Family (front row) Jim and Brenda, with their grandson Jett, (middle row) Bailly, Paula, Sarah, Zane, (back row) Matt, Tate, Kyle, and Luke.



MVP Dairy broke ground in 2017.

FARM SNAPSHOT



McCarty-VanTilburg Partnership

MVP Dairy is the product of more than a century of proud agrarian history.

Boyd VanTilburg began farming on 1902. Over the generations, the Ohio farming operation expanded to include custom fertilizer and chemical application, poultry litter, soil sampling, a commercial grain elevator, a crop insurance business, a trucking division and an excavation company. VanTilburg Farms, Inc. was incorporated in 1977. Today, Boyd VanTilburg's great-grandsons, Matt, Luke and Kyle manage various components of the business.

MVP Dairy, LLC was created when the VanTilburg's joined forces with the McCarty family, a leader in sustainable milk production and direct supplier of milk to Danone North America. Like the McCarty's Kansas farm with its innovative evaporative cooling milk processor, the northwestern Ohio site utilizes the latest technologies and production methods including cover crops to protect against soil erosion and improve soil health, and an emphasis on wildlife habitat to maintain the farm's eco-friendliness.

Key Information

Mission Statement: As families and a dairy business partnership, MVP Dairy, LLC strives to create wholesome products in a sustainable manner. Using best management practices, our farm works to achieve the best in animal welfare, responsible environmental stewardship, sustainable community engagement, and the creation of a safe, rewarding work environment.

Type of Ownership: Family owned partnership

Location: Celina, OH

Year Started Dairy Farming:

McCarty Family: 1914
VanTilburg Family: 1902

Cows in Production: 3,200

Total Cows: 1,000

Total Acres: 4,166 acres included that form the conclusions of this report.

Employees: 41

MVP Goals:

- › Be a cost competitive direct supplier to Danone North America in a manner that is also conducive to public education as well as provide a place that can hold higher level meetings and gatherings.
- › Be good stewards of the environment.
- › Be community and employee oriented.
- › Provide the highest level of care to our cows to further reduce the stigma surrounding animal care in large dairies.
- › Provide the best quality milk possible to Danone North America.
- › Have a show place dairy that is CEO ready everyday.
- › Provide a farm that will mesh easily with fruit production and power generation.

Recognitions:

- › 2018 - Dairy featured in Celina, Ohio's The Daily Standard in [April](#), [June](#), and [November](#) editions
- › 2018 MVP & MFF showcased in a [Virtual Farm Tour](#) at the World Dairy Expo
- › 2019 Danone Dairy Forum [Social Award](#) recipient

VanTilburg Farms

- › 2018 Pheasants Forever Alex Andreoff Award for the state of Ohio for community service and conservation work
- › Awardee for the US EPA Great Lakes Restoration Initiative in collaboration with Pheasants Forever and Wright State University
- › 2019 Celina-Mercer County Business of the Year Award

McCarty Family Farms

- › 2018 Danone Nature Award
- › 2018 Featured on Market to Market, a show sponsored on Iowa Public Television, IPTV (Aug)
- › 2018 Danone Milk Cycle Days Excellence in Production Award, received at Danone conference in Barcelona, Spain



EcoCycle

START



The VanTilburgs and the McCartys are stewards of the land through regenerative agricultural practices that support healthy soil as the foundation to a sustainable dairy.



4,166 acres of **100% non-GMO crops** for the dairy

- › Corn Silage
- › Corn Grain
- › Soybeans



3,800 milk cows convert feed to **96 average lbs of milk per day.**



Whey, a byproduct of yogurt production, comes back to the dairy to feed cows.



MVP Dairy owners (left to right) Dave McCarty, Luke VanTilburg, Kyle VanTilburg, Matt VanTilburg, Ken McCarty, Clay McCarty, Mike McCarty, as well as general manager Brock Peters.



Raw milk is processed into Dannon yogurts and other dairy products.



Raw milk travels 21 miles from MVP Dairy to the Minster, Ohio, processing plant.



Manure is used as a natural source of nutrients and organic matter to build soil health.

CERTIFICATIONS

DairyCARE

The DairyCARE Standard is for producers who support good science-based agricultural practices. The Standard requires certification of three Validus programs: Animal Welfare, Environment and Worker Care Review.



FARM

The National Dairy FARM (Farmers Assuring Responsible Management) Program works with producers to communicate to consumers that the industry is committed to producing the highest quality of milk while also taking the best care of their operations and the environment.



Non-GMO Project

Non-GMO Project provides a third-party non-GMO verification program. This label gives consumers confidence and assurance in the products they are purchasing.



SUSTAINABILITY BENEFITS

Quantifying the Impact of Actual Farm Practices

While agricultural practices have progressed to better care for natural resources, the ability to quantify the influence these practices have on sustainability has not kept pace. MVP Dairy Farm seeks to put evidence-based measurements to its farm practices. Having such data brings more depth to decision making. Short- and long-term goals can be based upon more meaningful information.

The benefits included in this section were determined through EcoPractices' unique process that is able to pinpoint the influence of specific agricultural practices on such factors as carbon dioxide reductions. For more detailed information on this process, please see the Data Collection and Verification section.

67 Fields comprising **4,166** Acres

CROPLAND

Cultivated and non-cultivated crop production.**

4,166 acres
100%

FORAGE

Perennial pasture and hay production.**

ENVIRONMENTAL OUTCOMES

From the management practices at MVP Dairy, which was 80% no-till, 20% reduced tillage, and 97% cover crops during 2019, the following environmental impacts resulted.*

CO₂e Emissions (tons per acre)

Carbon Sequestered (tons per acre)

Soil Erosion (tons per acre)

CROPLAND

-1.0

0.5

0.4

Forage is expected to have lower CO₂e emissions, higher carbon sequestration, and lower soil erosion. CO₂e is comprised of greenhouse gas fluxes of carbon dioxide and nitrous oxide.

Ohio Cropland Average Erosion

2.8 T/ac

Ohio Forage Average Erosion

1.1 T/ac

National Average Erosion

4.6 T/ac

*** USDA, NRCS 2015 National Resource Inventory

MANAGEMENT PRACTICE IMPACTS

Significant environmental benefits resulted from cropland acres compared to a conventional tillage, no cover crop scenario.*



6,755 tons reduction of CO₂e, which is the same as



1,312 average passenger cars off the road for a year



or average yearly energy use by **662** American homes



1,842 tons of carbon sequestered



5,499 tons of soil saved instead of being lost to erosion, which is the same as

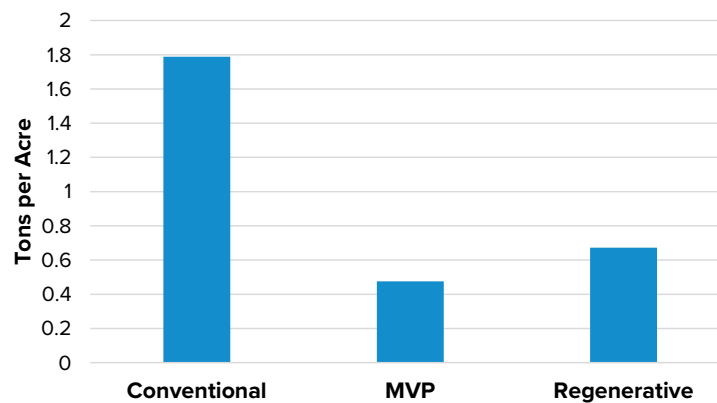
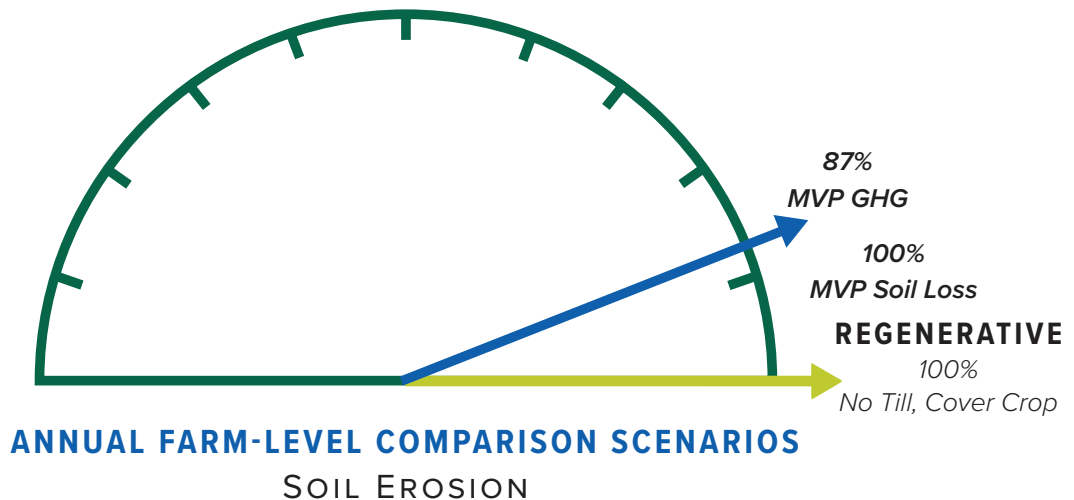


344 dump trucks of soil

CROPLAND CONTINUOUS IMPROVEMENT MOVING THE NEEDLE

■ Soil Loss
■ GHG

CONVENTIONAL
0%
Conventional Till,
No Cover Crop



Sustainable Continuous Improvement Plan™

MOVING THE NEEDLE ON REGENERATIVE AGRICULTURE



Soil Summary



PROGRESS

- › Participate in Danone Soil Health Program since 2018, with 4,166 acres included in 2019.
- › Utilizes a no-till system on 80% or about 3,340 acres.
- › Utilizes a mixture of cover crop species implemented on 97% or about 4,053 acres in the fall of 2018.
- › Maintains a diverse crop rotation and leaves corn stalk residue standing in the fields.
- › Conducts grid soil testing every other year in the spring, meeting or exceeding the recommended every 2 to 3 years by Ohio State University.
- › Maintains readily available soil tests with all KPI nutrients tested.
- › Utilized roller crimper for cover crop termination.
- › *Included Manure Management Plan.

SHORT TERM GOALS

- › Implement cover crops on all acres for MVP Dairy.
- › Convert 100% of the fields to a no-till system for most seasons when work is not required for tile lines and other drainage water maintenance.
- › Utilize manure produced by the dairy prior and during the cropping season as a soil organic matter amendment.
- › In conjunction with Danone, the dairy will update Nutrient Management Plan annually.

LONG TERM GOALS

- › Determine an optimum cover crop mixture for the area and continue to educate others on findings.
- › Standardize soil sampling protocols with Danone North America.

Water Summary



PROGRESS

- › Stores water runoff from the dairy and fields in a pond to be utilized as irrigation for crops.
- › Variety of conservation practices in place including wetlands, controlled drainage structures, saturated buffers and filter strips.
- › Utilizes 3 soil moisture probes on their 3 irrigation pivots.
- › Partners with NRCS on CRP, which offers compensation in exchange for growers removing environmentally sensitive land from agricultural production and planting species to improve environmental quality.
- › Utilizes nitrogen inhibitors to benefit water quality by limiting leaching.
- › Variety of conservation practices in place including wetlands, controlled drainage structures, saturated buffers and filter strips totaling 233 acres.

SHORT TERM GOALS

- › Establish method to track water use on the dairy.
- › Add electric flow meters in 2019 to assist in capturing total water used on the dairy.
- › Construct 2 new pivots for effluent application.
- › In conjunction with Danone, the dairy will complete a water risk assessment.
- › Improved irrigation water management practices.
- › Upgrade manure application equipment and infrastructure to apply solids to further fields.

LONG TERM GOALS

- › Maintain responsible water use on the dairy with periodic checks on total gallons utilized.
- › Explore adding additional buffer filter strips with new NRCS Conservation Contract.

Biodiversity Summary



PROGRESS

- › Utilizes manure as organic fertilizer to benefit the biodiversity of life below the soil.
- › Maintains a crop rotation of corn and soybeans that incorporates biodiverse cover crop.
- › Maintains 13 wildlife boxes.
- › Transitioned to 100% non-GMO for the 2018 cropping season.
- › The farm has 233 acres of forests, buffers, waterways, and wetlands.
- › Have an established Conservation Plan with NRCS.

SHORT TERM GOALS

- › Plant pollinator species in green spaces between barns.
- › In conjunction with Danone, MVP will install additional wildlife boxes such as bat and insect to add to the current wood duck boxes.

LONG TERM GOALS

- › Add prairie species/flowers to thinning filter strips if occurring over time.
- › Partner with local beekeeper to bring hives onto farm.

Carbon & Energy Summary



PROGRESS

- › The new dairy was constructed with 100% LED lighting.
- › Variable Speed Drive (VSD) fans and sprinklers were installed during 2018 construction process.
- › Utilizes chicken litter for fertilizer on fields farther from the dairy.
- › Utilizes dragline for manure application.

SHORT TERM GOALS

- › Evaluate equipment used at the dairy for efficiencies, especially aspects such as monitor idle time.
- › Include new dairies energy use records into efficiency evaluations.
- › Seek opportunities to utilize renewable energy on location.
- › Biodigester opportunities currently being evaluated

LONG TERM GOALS

- › Seek opportunities for efficiencies in product transportation supply chain to decrease emissions.

Economy & Productivity Summary



PROGRESS

- › Do own mastitis testing on location as well as own pregnancy testing which reduces the need to ship samples out savings costs and transportation emissions.
- › Dairy was fully functional with 4,200 dairy cows by December 1st, 2017.
- › Implemented a sand recycling program to clean and recapture 95% of sand bedding, minimizing need to purchase new bedding.
- › A corn grinder was installed at the dairy with the new construction to provide additional efficiency.
- › Included updated budget information for Economic Reports.

- › Utilizes precision farming technology, provided to EcoPractices for environmental evaluation.
- › 300,000 pounds of milk from 3,600 milking cows for 2019.

SHORT TERM GOALS

- › Continue to monitor yield comparisons over time.
- › Utilize the EcoPractices R3 ROI model to evaluate SCIP recommended sustainable practices.
- › In conjunction with Danone, the dairy will complete an energy audit.

LONG TERM GOALS

- › Monitor and increase the efficiency of inputs to outputs from the operation.

**New Progress or Goal*

ENVIRONMENT

Overview

The McCarty-VanTilburg Partnership (MVP) Dairy depends on thousands of acres in Ohio needed to support their 4,200-head dairy cow herd. In 2019, the VanTilburgs farmed and managed 67 fields on 4,166 acres that will encompass the basis for this report.

The fields associated with MVP Dairy have various crop rotations. The majority of acres in 2019 grew corn silage, soybeans, and corn grain. Previous years' crops contributed to a stockpile of several thousand bushels of shelled corn and several thousand tons of corn silage that will source feed to the dairy since it opened in the fall of 2018.

In mid-November of 2018, most of the MVP dairy had finished construction in all but two barns. The dairy was granted a partial permit to start bringing in dairy cows. Over the course of 18 days MVP was able to finish the last two barns, maintain a full permit, and fill the entire dairy with 4,200 adult dairy cows. McCarty family farms sourced all cows from their Rexford location in Kansas, which allowed for great genetic selection and herd control. By December

1st the dairy was, and still is, sending six truck loads per day to the Minster, OH plant for Danone North America.

The dairy has taken great steps to create and maintain a nutrient management plan (NMP). The program describes the fields based on how many nutrients it can legally handle. The goal of the NMP is to safely and accurately apply manure from the dairy to the fields while being environmentally responsible.

MVP has taken it upon themselves to have three waste storage ponds, consisting of one large and 2 smaller basins along with a solid separator system which safely stores the manure. In 2019, 901 acres received a total of 4.5 million gallons of effluent and/or over 14,437 tons of solids from the dairy, which is a reduction of over 36 tons of commercial nitrogen fertilizer, 16 tons of phosphorus fertilizer, and 31 tons of potassium fertilizer. The manure applied has a value of \$7.60 per acre. See the Nature's Best Fertilizer infographic on page 13.



Harvest from 2017 was stored for feed for the upcoming herd moving into the new barns in the fall of 2018.



MVP Dairy ground breaking ceremony August 21, 2017.

Performance

KEY INDICATOR: SOIL

Cover Crops

The benefits of cover crops include, but are not limited to, soil erosion control, improved water quality, increased soil health, reduced greenhouse gas emissions and wildlife restoration.

The roots of the plant may contribute to an increase of pore space within the soil allowing for increased aeration. The roots will also contribute to reducing nutrient loss due to it either holding onto the soil and nutrients or uptakes the nutrients to prevent it from leaching into waterways.

The above ground biomass will accumulate carbon dioxide (CO₂) and reduce the total amount of greenhouse gases being lost to the atmosphere. The cover crop in the field can also be utilized as nesting material by local wildlife during the cold winters.

A group of plant species known as cover crops are utilized during times cash crop cannot be grown. The cover crop is normally planted in the fall prior, during, or shortly after harvest to instill living biomass above and below ground. The cover may be a single plant species or a mixture of a few or several. The biomass will persist from its planting to the first killing frost. Depending on species, growth will continue after initial thawing of the soil.

Prior to the 2019 cropping season, a variety of species were planted on 97% of fields associated with the dairy. The previous year, 93% of acres were cover cropped. Matt VanTilburg, one of the MVP owners has chosen to plant a cocktail of species and varying rates which include grasses, legumes, and brassicas. See Cover Crop Species table on page 16.



Fall harvest drone image shots of corn grain near one of the wetland areas (Photo courtesy of Pheasants Forever)

The Natural Resources Conservation Service (NRCS) differentiates **soil quality** as the capacity of the **soil** to function within its ecosystem while **soil health** is the condition of that soil and its potential to sustain biological functions with maintaining environmental quality, both are essential to promote plant, animal, and human health.

Tillage Practices

Tillage is a tool for incorporating manure to reduce nitrogen volatilization, warming or drying the soil in a cold and wet spring, and weed management. A negative effect of excessive tillage is the loosening of the soil to the point of being susceptible to excessive erosion from wind or rain, loss of biological activity, and the deterioration of soil structure. The environmental benefits of reduced tillage include reductions in erosion and nutrient runoff, significant soil health improvement, reduced greenhouse gas emissions, increased wildlife habitat and improved air quality.

In 2019, 80% of fields associated with MVP Dairy were under no-till management. On the remaining 20% of acres, which were reduced till, they used a vertical till or field cultivator. In 2018, the VanTilburgs had a no-till system in place on 95% of their acres and implemented a reduced-till system of field cultivating on the remainder of the acres. Corn stalks are cut for harvest leaving over a foot of residue in fields to control erosion and add organic matter to fields.

Crop Rotation

Rotating crops has many benefits. In a corn-soybean rotation the total amount of commercial fertilizer being applied to the field is reduced compared to if corn was continuously monocropped for years. The soybean offers a legume nitrogen credit of 50 pounds, which means 50 less pounds of commercial fertilizer is needed to be applied for the succeeding corn to grow to its optimum point. A break



between high nitrogen-demanding crops, such as corn, decreases environmental impact. Soybeans do not require synthetic nitrogen to grow to its optimum due to the ability to fix nitrogen from the atmosphere.

Soil Organic Matter and Soil Organic Carbon

According to Cornell University, productive agricultural soils have between 3% and 6% organic matter (OM) content. OM improves soil structure, increases water holding capacity of sandy soils, improves drainage in clay soils, provides a source of slow-release nutrients, reduces wind and water erosion and promotes growth of earthworms and other beneficial soil organisms. Compost increases OM which in turn increases cation exchange capacity (CEC) of the soils. This all leads to better soil structure, porosity and density, thus creating a better plant root environment.

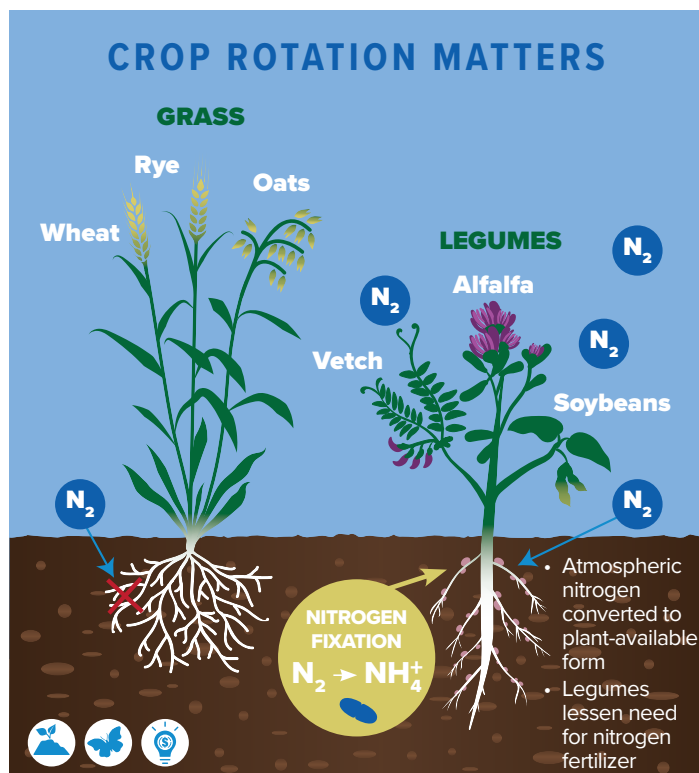
MVP's prominent soil type is an *Epiaqualf*, defined as a perched water table on a moderately-developed soil. The tested soils surrounding the dairy have a historic range of

0.5% to 1.9% OM according to the Web Soil Survey, a Natural Resources Conservation Service (NRCS) database, using an area around the new dairy of about 100,000 acres with the dairy as a central point. The fields of MVP tested at a range of 1.6% to 3.7% OM. Soil amendments such as manure are important for maintaining and increasing soil OM.

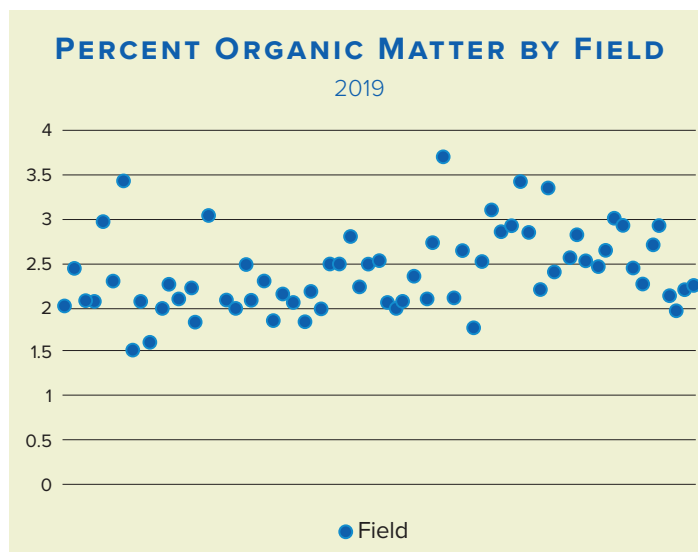
Soil Conditioning Index (SCI), a tool from the NRCS, predicts trends in soil OM in the top few inches of soil based on current management practices. If the calculated index is a negative value, the level of soil OM is predicted to decline under the production system. If the index is a positive value, the level is predicted to increase under the system. Values near zero (i.e., 0 ± 0.05) suggest that organic matter will be maintained near the current level. As of 2019, MVP Dairy has a positive SCI trajectory predicted from current management, soil type, and climate for future years.

Soil Sampling

Soil sampling is an important part of crop production to understand soil chemistry to properly apply nutrients. Soil sampling is typically done in the fall after harvest but as long as timing is uniform year-on-year, it can be done in the spring as well. At the dairy, soil sampling is important to know nutrient availability from manure because



A diverse crop rotation including legumes significantly contributes to soil health. There are two major reasons. The differences in root structures reduce soil compaction to increase mobility of nutrients and water in the soil. Also, legumes have a symbiotic relationship with a group of bacteria known as diazotrophs or nitrogen-fixing bacteria. The symbiosis allows for plants to uptake this nutrient, unable to do so by itself, in exchange for a nutrient-rich home in its special rooting structures, called nodules. This relationship creates a free fertilizer because nitrogen remains in the fields by residual organic matter to supplement the next crop. This reduces the total commercial fertilizer needed.



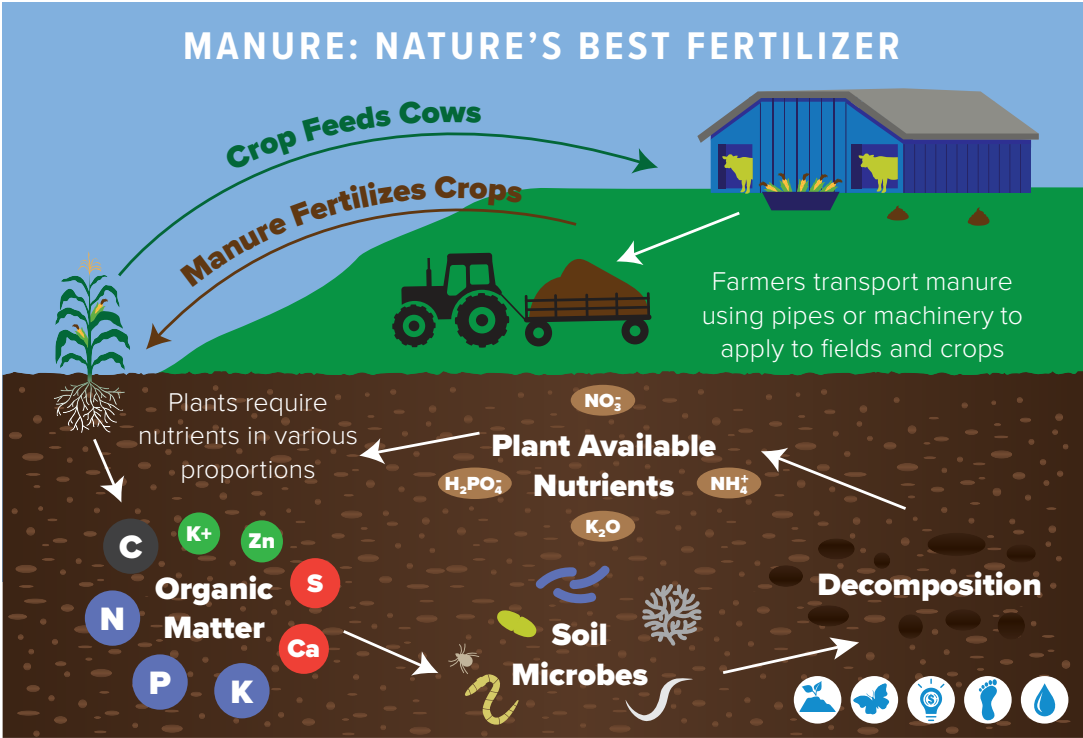
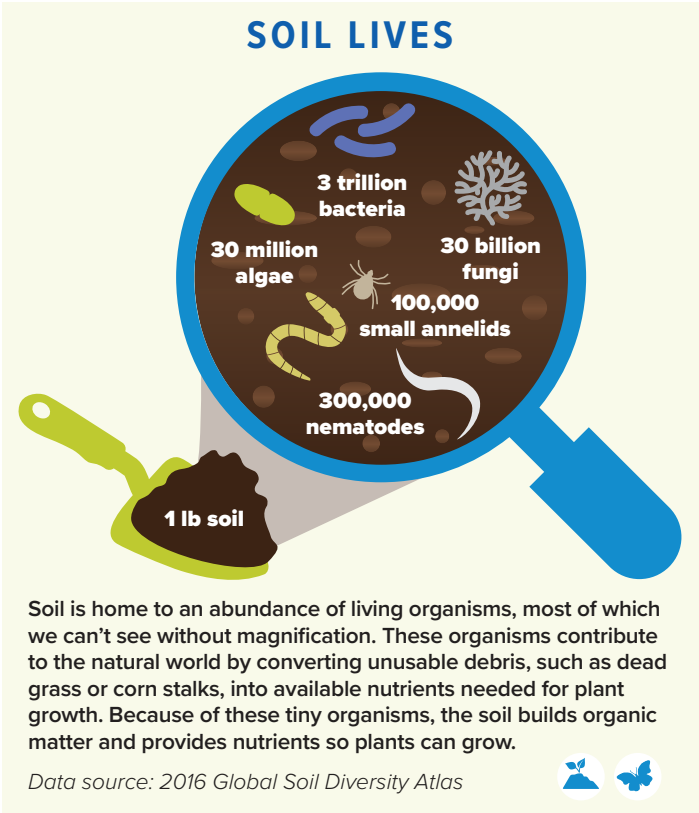
MVP Dairy fields organic matter results compared to shaded historic organic matter range.

SCI AT MVP DAIRY

At MVP Dairy, the overall **SCI** had a **+** trajectory toward **soil health**.

manure has a variable analysis. Soil sampling can reduce negative effects of overapplication or underapplication of nutrients. Overapplication of nutrients has adverse effects to water quality and return on investment for the dairy. Underapplication likely means a decrease in yield. At MVP Dairy, they complete soil testing every other year.

NRCS USDA PRACTICES AT MVP DAIRY	
Soil:	Cover Crop (CPS Code 340)
	Residue and Tillage Management, Reduced Till (CPS Code 345)
	Residue and Tillage Management, No-Till (CPS Code 329)
Water:	Field Border (CPS Code 386)
	Drainage Water Management (CPS Code 554)
	Grassed Waterway (CPS Code 412)
	Constructed Wetland (CPS Code 656)
	Filter Strip (CPS Code 393)
	Waste Storage Facility (CPS Code 313)
	Solids/Liquid Waste Separation Facility (CPS Code 632)
	Nutrient Management (CPS Code 590)
	Irrigation Water Management (CPS Code 449)
Biodiversity:	Conservation Crop Rotation (CPS Code 328)
	Structures for Wildlife (CPS Code 649)
	Upland Wildlife Habitat Management (CPS Code 645)
	Saturated Buffer (CPS Code 604)



- **Primary Macronutrients**
 - N (nitrogen)
 - P (potassium)
 - K (phosphorus)
- **Secondary Macronutrients**
 - S (sulfur)
 - Ca (calcium)
 - Mg (magnesium)
- **Micronutrients**
 - Si (silicon)
 - Cl (chlorine)
 - Fe (iron)
 - B (boron)
 - Mn (manganese)
 - Na (sodium)
 - Zn (zinc)
 - Cu (copper)
 - Co (cobalt)
 - Mo (molybdenum)
 - Ni (nickel)
- **Structural Nutrients**
 - C (carbon)
 - H (hydrogen)
 - O (oxygen)

Manure is a great source of nutrients for crops and a readily-available resource at dairy farms. Instead of treating it as a waste product, farmers know that manure is one of nature's best ways of improving soil and plants. Commercial fertilizers offer controlled application of nutrients in exact amounts and rations. While manure fertilizer contains those same nutrients, manure also has many advantages; such as close proximity to fields, adds organic matter to the soil and provides cost-savings.

KEY INDICATOR: WATER

Ohio Watersheds

The Ohio EPA defines a watershed as an area of land that drains into a lake or stream but they can be small, like the area that drains into the creek behind a house or large when considering all the land, streams and rivers that drain into the Ohio River or Lake Erie. MVP Dairy is located in the St. Mary's River watershed. The St. Mary's River watershed is one of 8 sub-watersheds within the Maumee River watershed and comprises 13% of that watershed. This river flows into the state of Indiana then continues northwest to join the St. Joseph River in Fort Wayne, Indiana where it forms the Maumee River which empties into Lake Erie. The St. Marys River watershed is defined as a total maximum daily load (TMDL) high priority watershed, meaning the total maximum daily loads of pollutants exceed standards set by the EPA. This watershed has a Watershed Management Plan (WMP) in collaboration with the Indiana Department of Environmental Management. According to a summary provided by the Indiana Department of Environmental Management, downstream from the dairy, this WMP focuses on issues with sedimentation, trash/debris, crop protection chemicals, *E. coli*, as well as total phosphorus and nitrate. According to the Ohio EPA some potential recommendations for improvement include public awareness, managing livestock manure to reduce nutrient runoff, improving erosion and sediment control in all areas both rural and urban with stormwater management, as well as eliminating the pervasive bacteria problems.

MVP Dairy utilizes many conservation practices in place. Filter strips are important for catching sediments and



Manure washed from the dairy runs over a separator screen that allows liquid to drain away. The liquid is treated for other uses on the dairy while solids are incorporated as crop fertilizers.



Manure solids resulting from the liquid separation process.

nutrients before they runoff the field into waterways. A saturated buffer is installed to filter tile water before it enters waterways and the few wetlands they have around the farm also serve to filter nutrients. Stop logs control drainage so that water doesn't immediately enter streams impairing them with excess nutrients. In addition to edge-of-field practices, 20% reduced tillage, 80% no-till, and 97% cover crops.

Filter Strips

Many filter strips are present on the farm including edge of field buffers and in-field grassed waterways. Riparian buffers are also along certain waterways and waterbodies that are comprised of shrubs and small trees. The field buffer strips encompass 137 acres.



"Miles of Algae Covering Lake Erie", New York Times October 3, 2017.



Field filter strip interseeded with pollinator species adjacent to the field that is receiving irrigation from the retention water pond.

Wetlands

From over 25 years ago to as recent as 10 years ago, restoration projects have been installed on four fields. The newer wetlands join three other wetland ponds and two retention ponds currently installed. The interest in water protection has attracted the attention of the Ohio EPA and Pheasants Forever. An ongoing collaboration between these two groups and the VanTilburgs has resulted in a wetland project that focuses on water recycling. The field associated with the project has a retention pond filled from subsurface drainage tiles. The water is then pumped back on the field by center pivot irrigation during times of insufficient rain. The wetlands encompass 67.8 acres on the farm.

Saturated Buffers

Currently, there is one field being farmed that sits between two streams. Prior to 2017, between the edge of the field and the streams was a 30-foot grass filter strip totaling two miles in length. The terrain was uneven near the streams and caused large areas within the filter strip to be useless for filtering water as the surface water flow was directed to only a select few locations. Funded by The Great Lakes Restoration Initiative, the VanTilburg operation converted the filter strips to a saturated buffer connected to the retention pond system. The construction occurred in 2016 and was fully functional in spring 2017. The filter strip was upgraded to make way for underground tiling and water control columns that create a saturated buffer. This system of tiling joins the field tiles together to release water under the grass buffer allowing the water to slowly move through the underground buffer of dense grass roots, which filters it before the water enters a water way.

Currently, the EPA and Pheasants Forever have partnered in a three-year study, Agricultural Runoff Retention and Reuse Project with the Ohio EPA Great Lakes Restoration Initiative, to observe nutrient runoff in the retention pond. The group responsible for testing is Wright State University. Along with a reduction in nutrient loading, the study also aims to reduce sedimentation and improve habitat for the unnamed tributaries that flow into Fourmile Creek, which flows into the St. Mary River and ultimately into the Maumee River. The study states that successful implementation of the project will reuse 3.5 million gallons of nutrient rich water and reduce sediment loadings by 14 tons per year, nitrogen loads by 1,462 pounds per year and phosphorus reductions of 113 pounds per year. The preliminary research finds a 0.2 mg/L phosphorus concentration in the retention pond. Water bodies on the south side of the county have been tested and show phosphorus levels at 20 mg/L.

Soil Moisture Probes

The enterprise currently manages five separate irrigation pivots. Of the five, one pivot is strictly well-fed and one is strictly pumped from a retention pond. The final of the three is partially supplied by well water and partially supplied by a retention pond. The runoff from the VTF Sunrise LLC retail location goes to a retention pond to protect surface waters from potential fertilizer spills from the business. The remainder of the water needed for the pivot is provided by a well that is pumped directly into the retention pond.

The pivots are run only when necessary. If the crops are experiencing stress from limited water, then a soil probe will determine total water needed. All five pivots utilize AgSense Soil Moisture Probes. The device drops down to 48 inches taking measurements at 8, 12, 36 and 48 inch marks. The information gathered is sent directly to a computer or smart phone every few hours. The soil moisture probe allows for proper irrigation decisions and helps increase yields on fields that have pivots from other fields that do not.

Stop Logs

The VanTilburgs monitor three stop logs on their land. Stop logs are part of a controlled drainage structure system to allow for increased water use efficiency for the crops. The management of the stop logs involves placing them in the fall to build the water table up in the field, removing them in the spring to drain the field for planting and replacing again in the fall.



Kyle VanTilburg at the controlled drainage structure. Stop logs are controlled within this control box to allow the rise and fall of the water table with the tile lines, allowing plants to absorb more water.

KEY INDICATOR: BIODIVERSITY

Danone North America's movement to non-GMO

The Danone North America Policy on Biodiversity and GMO Use of ingredients containing GMO crops depends on the agriculture, existing biodiversity risks and opportunities in the countries where they operate. In the US, Danone North America has decided to declare the presence of GMO ingredients with the movement of fewer ingredients in their products being more natural and non-GMO.

Breaking the Conventional Mold

All feed grown at the dairy is 100% non-GMO. All silage grown was stored for the dairy in a new state of the art feed storage facility that can hold up to 100,000 tons of corn silage for feed. The whole corn grown was ground on site to be stored for feed. Soybeans grown are sent to a local certified non-GMO crush plant and brought back to the dairy to be stored as soybean meal feed.

Cover Crop

The mixture of grasses, legumes and brassicaceae plant families helps mitigate nitrogen loss during times when a cash crop, such as corn silage, is not on the field.

Grass species are very useful as a cover crop because of their ability to scavenge nitrogen with their fibrous root structure. If the grass species can survive the winter, then it can uptake nitrogen in the fall and in the spring. The downside to a non-winter kill grass species is that chemical intervention is necessary before planting a cash crop. If the

grass species cannot survive winter, then it cannot capture spring leaching nitrogen.

Legumes are a great source for nitrogen fixation and add to the diversity of any system. A legume's rooting structure is considered a tap root which is compatible with the rooting structure of a grass species.

The use of brassicaceae (mustard family) as a cover crop is a newer idea. The plant family is an excellent nitrogen scavenger in the immediate growing area. The various species within the brassicaceae family establish rapidly. The negative to brassicaceae is that some species produce a pungent rotten egg-like smell during decomposition in the early spring. The following table shows the strengths and weaknesses of each species implemented.

Utilizing Manure Fertilizer

Manure, a by-product of an animal feeding operation, has a combination of carbon, nitrogen, phosphorus, potassium and other elements that plants need to survive. Exchanging manure for commercial fertilizers on the fields will reduce overall cropping costs on any field. Currently, the VanTilburgs utilize dairy manure as well as chicken litter from a local poultry facility.

Root Structures

Crop management in North America is prone to monocropping systems. The same species may be utilized in a field for years. If it occurs, then the soil within the field may degrade due to the same root system. The degraded soil can impact the crops growth and potential yield. To

Species	Nitrogen source	Nitrogen scavenger	Soil builder	Subsoil loosener	Topsoil loosener	Erosion preventer	Lasting residue	Weed fighter
Cereal Rye	P	E	E	VG	E	E	E	E
Annual Rye Grass	P	E	E	E	E	E	G	G
Oats	P	VG	VG	P	VG	E	G	E
Hairy Vetch	E	F	VG	G	VG	G	F	VG
Red Clover	E	F	E	G	VG	VG	G	VG
Crimson Clover	E	F	E	G	VG	VG	G	G
Radish	P	E	VG	E	VG	F	F	VG
Field Peas	VG	F	G	F	VG	G	F	G
Canola	P	VG	G	N/A	N/A	VG	G	VG
Key	Poor	Fair	Good	Very Good	Excellent			

Information found in Midwest Cover Crops Field Guide provided by Midwest Cover Crops Council and Purdue Crop Diagnostic Training and Research Center (2014).

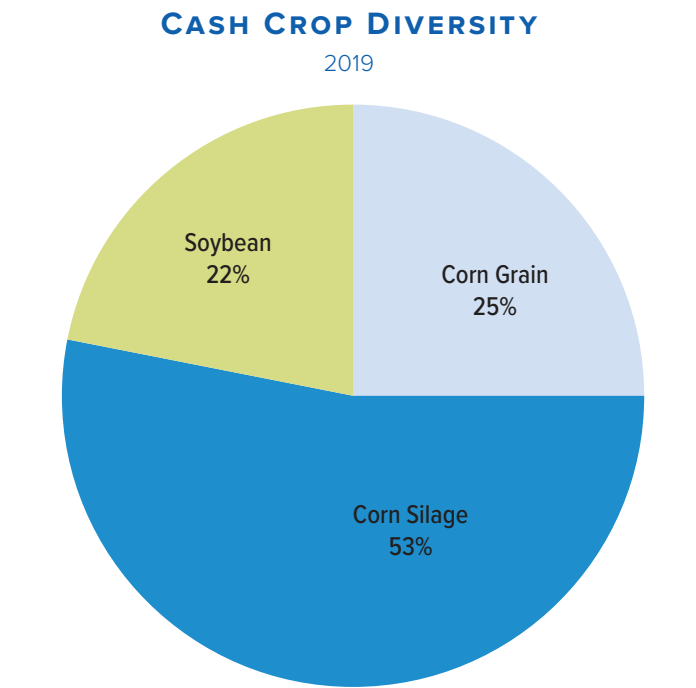
reduce the impacts on the soil and crop, growers are encouraged to place cover crops, increase crop rotation and reduce deep tillage practices.

Wildlife Conservation

The VanTilburgs have taken initiative for the wildlife on their acres and set up ten wood duck boxes on their wetlands. They partner with Pheasants Forever on various projects ranging from water quality, habitat restoration, and recreation. In 2019, they added two additional duck boxes



The VanTilburgs fashioned a cover crop seed planter from a highboy sprayer.



The crops in this pie chart represent “cash crops” as they were taken for feed or to sell. This chart shows the percentage of acres each crop was grown in 2019.

around the wetland and retention pond along with 1 bat box, 1 owl box, and 6 bird boxes. There are now a total of 13 wildlife boxes at MVP Dairy. The dairy also has 23 acres of woods around the farm and fields that provide native habitat.

Conservation Practice	Fields with Practice	Acres of Practice
Grassed Waterway	4	6
Forest	1	22.5
Buffer	33	136.6
Wetland	6	67.8
Additional environmental benefits from conservation practices**		
508 tons of soil saved instead of being lost to erosion , which is the same as		
32 dump trucks of soil		
11% of nitrogen saved from leaching for wetland and 33% of nitrogen saved from leaching for waterway/buffer		
58% estimated reduction of phosphorus saved from runoff into waterways from buffers		



Bat box out at MVP Dairy.

KEY INDICATOR: CARBON & ENERGY

Fleet

Many of the machines used by the VanTilburgs have real-time kinematic (RTK) positioning. RTK means it is equipped for satellite navigation purposes. RTK assists with auto steer to exact positions of rows and can pinpoint the exact spots year after year. Two RoGator 1300s spray applicators have nozzle by nozzle control to turn off unneeded rows or when turning corners to avoid over application. A Terra-Gator is the dry spreader applicator and has row control to reduce over application. A Case Steiger 370 and Case Steiger 420 are used to pull implements such as the 1250 corn planter and the Case 500T air drill for beans, both of which are RTK and have ability to turn off rows to not waste seed or over-plant. Those same tractors are used to pull implements for tillage such as a chisel and field cultivator when needed. A Case 9230 is used to harvest with a 12-row folding corn head and a 40-foot bean head which has RTK and a yield

monitor. Lately, the farm utilizes a Claas Jaguar 980 for silage chopping that is equipped with RTK and a yield monitor.

Reducing Carbon Footprint in Feed

The dairy has extensive feed storage with concrete floors and roofs to avoid feed loss. A skid loader enters to scoop up and add certain portions of each ingredient to be mixed up while a feed wagon follows to deliver to the cows.

The MVP dairy currently has an agreement with the Danone North America Minster Yogurt Plant. The process of creating Dannon Brand yogurt produces an excess of whey resulting in a waste by-product. The whey protein from the milk sourced by the dairy is then sent back from the Danone plant as a feed ingredient for the dairy. The dairy and facility benefit from this closed loop relationship which reduces overall outside sourced feed to the dairy while reducing a waste product from the plant. The 21 miles between the two



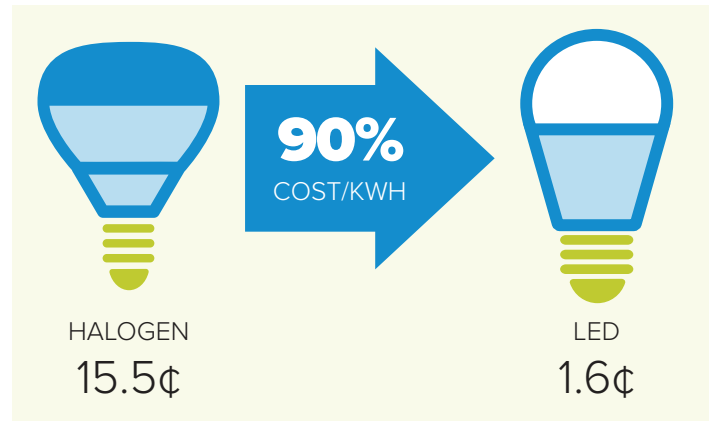
Case IH equipment in use for corn harvest.

enterprises benefits in reducing overall carbon footprints. The dairy receives a total of 7,873 tons of whey a year which reduces an estimated 4,686 tons of carbon dioxide equivalent from diverting that waste product from a landfill alone.

In addition to the whey, they strategically source types of feed from around the country aiming to buy it from sources as close to the dairy as possible when it's available. Cottonseed is brought in from South Carolina, wet corn gluten is from Indiana, dry corn and hay comes from the partnership in Kansas, and the straw all comes from within an hour of the dairy.

Energy Reduction

The dairy was built with 100% LED lighting in the freestall barns and holding areas. Most lights are automatic to conserve as much energy as possible without sacrificing safety for employees and cows. According to the University of Minnesota Dairy Extension, a dairy can see a savings of almost 90% per kWh used if bulbs are transitions to LED. Variable Speed Drive (VSD) fans and sprinklers installed with the new construction that reduce energy costs. The dairy is



also experimenting with placing sensors on the outside of the building that would sense heat and connect to the VSD fans.

The barns at MVP are structured as an inverted 6 row so feeding takes place on the outside of facility, rather than the inside. Feeding tractors will never leave the building but will move between the barns inside reducing fuel use. They also designed the freestall barns as head-to-head which provides efficient movement when taking the herds in and out for each feeding.

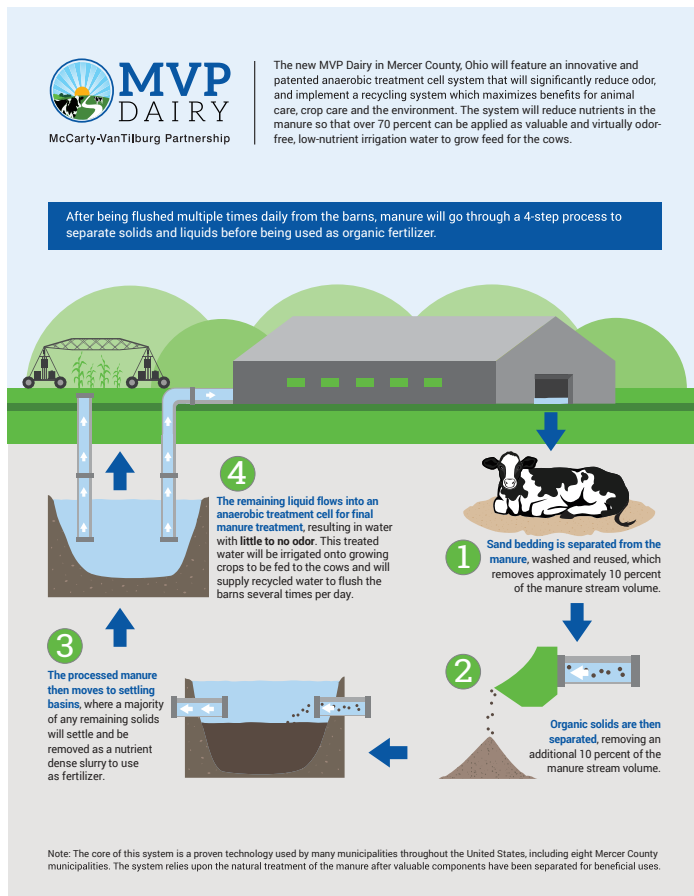


Image courtesy of MVP Dairy.



Feedstuff storage at MVP.




KEY INDICATOR: ECONOMY & PRODUCTIVITY

Strip Trial


The VanTilburg Farm performs strip trials on their land to gauge the effectiveness of fungicide and split nitrogen application. These strip trials help improve their agronomic decisions for whole field applications. The total product used is less than if they would subject an entire field to a trial.

Sand Separator

The dairy was constructed with the capability to recycle sand on the property. If the sand is removed from the barns it will be moved through the waste storage system. Once the sand hits the stage three lagoon it will settle to the bottom of the concrete basin. The sand is then scraped out and flushed with clean water in a separate basin. The now



2019 Total Milk Production:
13.4 Million Gallons



MVP Dairy cows produce approximately **20% more** milk than the national average.





The rotary milker is efficient for MVP Dairy.

CROP	YIELD
Corn Grain	161 bu/ac
Corn Silage	18.2 T/ac
Soybean	53 bu/ac

Yield from crops grown for MVP Dairy in 2019.

Efficient Transportation

MVP Dairy’s approximate **haul** to its processing plant is **21 miles**.



The national average distance to a processing plant is **275 miles**.

clean sand can be returned to the barns as bedding for the cows. The water used to clean the sand is routed to the final lagoon where it will be used for effluent irrigation.

Corn Grinder

The dairy was completed in the fall of 2018 with a fully operational corn grinder on location. The enterprise chose to incorporate one on-site to reduce total transport and emissions. The corn no longer needs to be moved off location to a grain mill to be transformed into palatable feed for the dairy cows.

Efficient Transportation

Milk from MVP Dairy travels about 21 miles from the farm to the processing facility compared to the national average of 275 miles (Innovation Center for US Dairy, 2012.)

Yield

Crop yields surrounding the dairy reflect the productivity on the fields, in turn impacting the quantity and quality of the feed. The growers optimize their efficiencies to produce quality feed for the dairy without having exorbitant costs. The graph shows the average yield by crop type for the 2019 growing season.

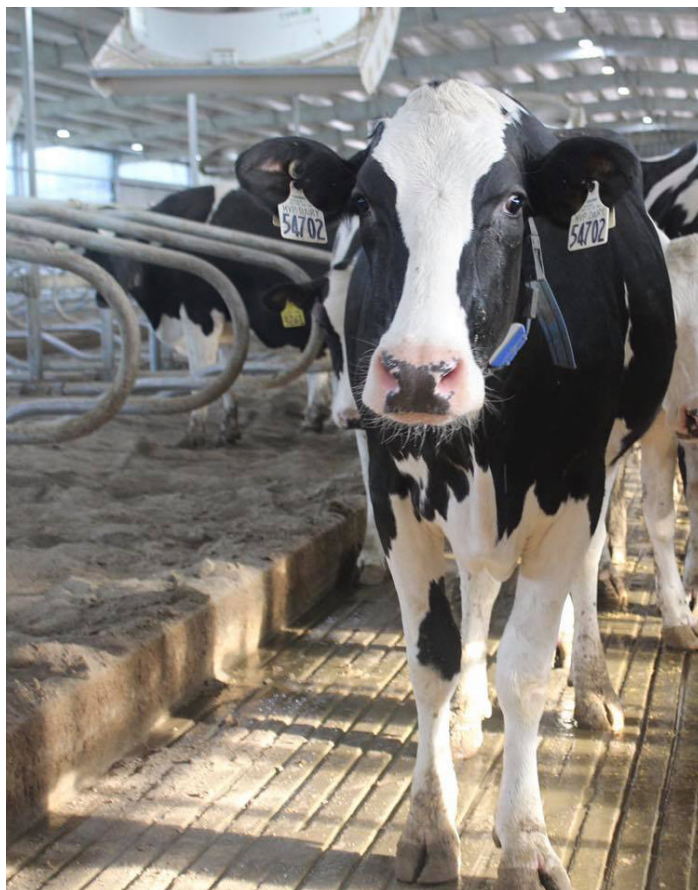
KEY INDICATOR: ANIMAL WELFARE

Danone North America's Animal Welfare Policy is recognized by Five Freedoms developed with the Farm Animal Welfare Council.

The dairy has taken steps to ensure five freedoms that must be provided to the cows by all workers:

- Freedom from hunger and thirst through ready access to fresh water and diet to maintain health and vigor.
- Freedom from discomfort by providing an appropriate environment, including shelter and a comfortable resting area.
- Freedom from pain, injury or disease by prevention or rapid diagnosis and treatment.
- Freedom to express normal behavior by providing sufficient space, proper facilities and company of the animal's own kind.
- Freedom from fear and distress by ensuring conditions and treatment which avoid mental suffering.

The combination of all five freedoms allows cows to be productive without limiting their physical, mental or social health.



MVP Dairy uses collars that track behavior to alert staff of any abnormality.

Brand New, State of the Art Facility

The dairy facility was built with odor control in mind. Kansas State University helps design a tunnel ventilation system in the barns with a concept successful in Australia. Over 400 fans are installed at the end of the barn that pulls the air out the back that directs any odor towards the lagoons, away from any home locations. The barns walls are fully covered with translucent polycarbonate siding and insulated roofing that keeps out UV rays and keeps the barns at least 8 degrees cooler than outside in the summer.

Completed in November 2018, all 4,200 Holsteins were moved over an 18-day period, a great feat. Milking started on the new 80 stall rotary as soon as the first few cows arrived on site in early November. All animals were brought safely over multiple states with minimum stress.

In addition to the fans that promote ambient temperatures there are also misters that will turn on based humidity levels which encourage less stress in the cows. The fans also eliminate any fly problems. The stalls have the recycled sand bedding groomed daily and the floors are flushed 5 to 6 times a day. The dairy also installed 23 cow brushes, with more to come. Their goal would be to have 4 per pen for the cows to interact with. The dairy also has 4 cow balls. A video monitoring program was added in 2019 with 96 cameras across the facility to increase animal welfare by monitoring the animals' behavior and employee interactions with the animals.

The McCarty Family Farming sister dairies in Kansas and Nebraska brought their HR employees, feeders, maternity ward, and other specialty staff to assist with the training and on-boarding of the new dairy to be successful.



MVP Dairy has a rotary stall milking parlor.

MVP DAIRY LEARNING CENTER

With its grand opening in July 2019, MVP Dairy opened its doors to the public with a 7,500 sq. ft learning center with interactive displays that share the story from soil to cup on how dairy products are made. Virtual reality experiences allow you to view the barns from a cow's view as well as care for the cows through an employee's view. It is complete with a viewing platform overlooking the cows being milked on the 80-cow carousel. Dannon dairy products are also available for taste-testing.

The facility has seen thousands of people since its opening and often has school groups tour. The facility was open by appointment only but as of November it is now open to the public during special hours. The learning center charges a small fee per person that goes back into the center as well as to help pay for scholarships for students pursuing an agricultural education. More information can be found at [MVP Dairy's Website](#).



A visit from the Wright State University Lake Campus Agriculture Program.



Celina Rotary Club Tour.



COMMUNITY ENRICHMENT

The McCarty and VanTilburg families came together as partners in this endeavor because of their shared vision of creating sustainable agriculture operations that have positive social, economic and environmental impacts on the communities in which they live and operate. Together, they're building an innovative, efficient and environmentally friendly operation the community will be proud to call their neighbor.

The dairy was able to provide more jobs for the community by hiring 41 instead of the intended 30. Every individual hired has been carefully trained to be successful at MVP Dairy.

Time and Donations

In 2018, at the Mercer County Fair MVP gave showman awards to all age groups totaling 44 livestock class and non-livestock as well as the 66 best in class awards which included special interest projects like welding, cooking, sewing, robotics, and 21 more. All received a \$100 award prize totaling an \$11,000 donation. A new rifle range for the Forester Club was built by the VanTilburg family's construction business where they took \$30,000 off of the bid as a donation to the club.

Giving Back



MVP Dairy **donated**
5,000 cups of
yogurt in 2019.



In 2019, Matt and Luke Vantilburg accept the Fields of 4-H Award.

Caring for Consumers

The McCartys and VanTilburgs strive to produce high quality and fresh milk. The farm is being built specifically to supply milk for growing consumer demand for Dannon's dairy products. A visitors' center is now open to the public where visitors can learn about the dairy and milk production.

Social Media

MVP Dairy has a social media presence with their Facebook page, MVP Dairy, where they interact with their followers and have provided updates on the construction process.

Celina-Mercer County Business of the Year Award

In 2019, the VanTilburg family won the county business of the year award for donating more than \$50,000 worth of time, equipment and labor to prepare a site for the new parks at the Mercer County District Library in Celina.



MVP and employees donate dairy products to their local food pantry.

Data Collection and Verification

The EcoPractices data collection and verification process provides assurance that the data reflected in this report is accurate and reliable. EcoPractices achieves the accuracy and reliability by employing data verification procedures with a multi-level verification process. All client data is collected and stored in EcoPractices' safe and secure database, which is accompanied by chain of custody records. EcoPractices enters into confidentiality and nondisclosure agreements with all clients in order to ensure that client data is protected. Additionally, EcoPractices enters into a Services Agreement with each client in order to define the release of any client information and acceptable reporting methods.

Statements of Accuracy

*EcoPractices estimates an environmental impact value for reducing greenhouse gas emissions, reducing soil erosion, and reducing nutrient loss due to reduced leaching. These estimates adhere to processes that are documented by the Natural Resources Conservation Service Technical Guides and publications from the Environmental Protection Agency. These environmental impact values are tailored to a specific location and participant's operation or project. Models used are supported by USDA, NRCS, other government agencies, and major universities. Greenhouse Gas emissions and carbon sequestration potential were predicted using the COMET-Farm Application Program Interface 2019. The COMET-Farm tool was developed for the USDA Natural Resource Conservation Service by the Paustian Research Group, Natural Resource Ecology Laboratory at Colorado State University, available at www.comet-farm.com.

**EcoPractices estimates an additional environmental impact for edge of field practices utilizing the data referenced from the Iowa State Nutrient Reduction Strategy by conservation practice based on whole field impact scale.

By signing below the parties agree *MVP Dairy Sustainability Analysis On-Farm Practices Report 2019*, and the data on which this EcoPractices report relies is accurate and has been presented correctly.

John Harsch
EcoPractices President

Brock Peters
Member, MVP Dairy, LLC

This summary must not be edited or altered in any way without the involvement and consent of EcoPractices.

Glossary and Abbreviations

4R Nutrient Stewardship – an approach that utilizes best management practices (BMP) addressing use of the right fertilizer source, at the right rate, at the right time, with the right placement <http://www.nutrientstewardship.com/4rs/>

American National Standards Institute (ANSI) – ANSI certifies the process that the appropriate mix of industry, academia, and public were consulted in developing the ANSI certification standard

Animal Unit (AU) – a basis to standardize and express stocking rates among different kinds and classes of livestock with similar dietary preferences. An AU is a measure of forage demand by a theoretical animal unit that can then be converted according to the relative demands of different animal classes (based primarily on metabolic bodyweight).
<https://globalrangelands.org/inventorymonitoring/animalunits>

Argiudoll – a soil great group classified as an Udoll with an argillic horizon, under the soil order of Mollisols

Agriaquoll – a soil great group classified as an Aquoll with an argillic horizon, under the soil order of Mollisols

Argiustolls – a soil great group classified as an Ustoll with an argillic horizon, under the soil order of Mollisols

Bioaccumulation – the accumulation of a substance in an organism that occurs when an organism absorbs the substance at a rate faster than that at which the substance is lost

CAFO – Confined Animal Feeding Operation

Carbon Dioxide – a naturally occurring substance composed of one atom of carbon (C) and two atoms of oxygen (O₂). Its chemical formula is CO₂.

Cation Exchange Capacity (CEC) – the capacity of the soil to hold onto cations. Cations are positively charged ions that are held by the negatively charged clay and organic matter particles in the soil through electrostatic forces (negative soil particles attract the positive cations). The cations on the CEC of the soil particles are easily exchangeable with other cations and as a result, they are plant available. Thus, the CEC of a soil represents the total amount of exchangeable cations that the soil can adsorb. <http://nmssp.cals.cornell.edu/publications/factsheets/factsheet22.pdf>

CFM – Cubic Feet per Minute

CO₂e, Carbon Dioxide Equivalent – a standard unit for measuring carbon footprints. The idea is to express the impact of each different greenhouse gas in terms of the amount of CO₂ that would create the same amount of warming.

Commercial Fertilizer – manufactured chemical mixture prepared for use as fertilizer meant to mimic natural substances such as animal manures

Compost – a mixture that consists largely of decayed organic matter and is used for fertilizing and conditioning land <https://www.merriam-webster.com/dictionary/compost>

Conservation Crop Rotation (CPS Code 328) –growing a planned sequence of various crops on the same piece of land for a variety of conservation purposes (USDA)
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1263479.pdf

Cover Crops (CPS Code 340) – growing a crop of grass, small grain, or legumes primarily for seasonal protection and soil improvement (USDA)
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1263481.pdf

Constructed Wetland (CPS Code 656) – an artificial wetland ecosystem with hydrophytic vegetation for biological treatment of water. Constructed wetlands are used to treat wastewater and contaminated runoff from agricultural processing, livestock, and aquaculture facilities or for improving the quality of storm water or other water flows (USDA)
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_025770.pdf

Comprehensive Nutrient Management Plan (CNMP) – a whole farm, progressive document. It contains records of the current activities on a livestock operation, an evaluation of the existing environmental risks, and proposals to reduce the negative impacts to the environment. A Nutrient/Manure Management Plan is part of a CNMP.
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1166381.pdf

Critical Area Planting (CPS Code 342) – is described as establishing permanent vegetation on sites that have, or are expected to have, high erosion rates, and on sites that have conditions that prevent the establishment of vegetation with normal practices. (USDA)
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1241316.pdf

CRP – Conservation Reserve Program

Deep Rip Tillage – performing tillage operations below normal tillage depth to modify the physical or chemical properties of a soil. It includes tillage operations commonly referred to as deep plowing, subsoiling, ripping, or tow-till, which are carried out on an as-needed basis

Denitrification – the nutrient Nitrogen (N) in a plant available form is converted by microbes to dinitrogen (N₂) and leave the soil

Diazotrophs – microbes that convert N₂ gas into crop accessible forms of nitrogen

Drag line – a pump that send manure to a tractor though a flexible hose for application

Drainage Water Management (CPS Code 554) – the process of managing water discharges from surface and/or subsurface agricultural drainage systems with water-control structures (USDA)
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_026409.pdf

Effluent – liquid portion of manure and waste water from a lagoon system that is used for irrigation

Endoaquolls – a soil great group classified as an Aquoll that does not fall under any other description, under the soil order of Mollisols

Endoaquepts – a soil great group classified as an Aquepts that does not fall under any other description, under the soil order of Inceptisols

EPA – Environmental Protection Agency

ERS – Energy Recovery System

Epiaqualf – a soil great group classified as an Aqualfs with that have episturation, under the soil order of Alfisols

FDA – Food and Drug Administration

Fertigation – Application of fertilizer materials via the irrigation system
https://ag.purdue.edu/hla/fruitveg/Presentations/Saha_Fertigation_6up.pdf

Field Border (CPS Code 386) – strips of permanent vegetation (grasses, legumes, forbs, and shrubs) established on one or more sides of a field (USDA)
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1241318.pdf

Filter Strip (CPS Code 393) – strip or area of herbaceous vegetation that removes contaminants from overland flow (USDA)
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1241319.pdf

Flume Pipe – water holding structures used to measure soil and other runoff from agricultural fields
<https://ascelibrary.org/doi/abs/10.1061/%28ASCE%29IR.1943-4774.0000672>

Grassed Waterway (CPS Code 412) – a shaped or graded channel that is established with suitable vegetation to convey surface water at a non-erosive velocity using a broad and shallow cross section to a stable outlet (USDA)
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1263483.pdf

Hapludalfs – a soil great group classified as an Udalfs that does not fall under any other description, under the soil order of Alfisols

Integrated Pest Management (IPM) (CPS Code 595) – a site-specific combination of pest prevention, pest avoidance, pest monitoring and pest suppression strategies (USDA)
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1255178.pdf

Irrigation Water Management (CPS Code 449) – the process of determining and controlling the volume, frequency, and application rate of irrigation water in a planned, efficient manner (USDA)
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1263485.pdf

KDHE – Kansas Department of Health and Environment

KPI – Key Performance Indicator

Kilowatt Hour (kWh) – a unit of energy used to describe the power in watts by the amount used over a period. 1 kWh is equal to 3.6 megajoules, which is the amount of energy converted if work is done at an average rate of one thousand watts for one hour.

Lagoon System – a system to collect liquid portions of livestock manure. Lagoons are earthen structures that are designed to provide biological treatment and storage of animal waste. Manure can be handled here with water flushing systems, waste water lines, pumps and irrigation equipment. <http://articles.extension.org/pages/13276/liquid-manure-treatment-lagoons>

LED – Light Emitting Diode

Legume – A group of plants that accumulate atmospheric nitrogen by having a symbiotic relationship with microorganism. <https://www.sciencedaily.com/terms/legume.htm>

Mastitis – inflammation of the mammary gland and udder tissue

Microbiome – a composition of microorganism interacting in and with the environment

Monocrop – Planting and harvesting the same species for several years consecutively

NPDES – National Pollutant Discharge Elimination System

NRCS – Natural Resources Conservation Service

Nutrient Management (CPS Code 590) – managing the amount, placement, and timing of plant nutrients to obtain optimum yields and minimize the risk of surface and ground water pollutions. (USDA) https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1255175.pdf

Nutrient Management Plan (NMP) / Manure Management Plan (MMP) – conservation plans unique to livestock operations. This plan describes how manure generated at a feedlot will be used in upcoming cropping years. An NMP documents all crop nutrient needs, soil test results, and application of all fertilizers, manure, soil amendments, and by-products to the fields. An MMP focuses on manure.

Ogallala Aquifer – shallow water table aquifer surrounded by sand, silt, clay and gravel located beneath the Great Plains in the U.S. One of the world's largest aquifers, it underlies an area of 174,000 square miles in portions of 8 states (South Dakota, Nebraska, Wyoming, Colorado, Kansas, Oklahoma, New Mexico and Texas).

OSHA – Occupational Safety and Health Administration

Paddock – An enclosed field

Phosphorus (P) – an essential element for plant and animal growth. Phosphorus does not occur as a gas or volatilize into the atmosphere.

Residue and Tillage Management, Reduced Till (CPS Code 345) – managing the amount, orientation, and distribution of crop and other plant residue on the soil surface year round while limiting the soil-disturbing activities used to grow and harvest crops in systems where the field surface is tilled prior to planting. (USDA) https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1251402.pdf

Residue and Tillage Management, No-Till (CPS Code 329) – addressing the amount, orientation, and distribution of crop and other plant residue on the soil surface year-round. Crops are planted and grown in narrow slots or tilled strips established in the untilled seedbed of the previous crop. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1249901.pdf

Restoration and Management of Rare or Declining Habitats (CPS Code 643) – reestablishing and/or renovating a unique or diminishing native terrestrial and aquatic ecosystems. (USDA) https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1255208.pdf

Riparian Forest Buffer (CPS Code 391) –area of predominantly trees and/or shrubs located adjacent to and up-gradient from watercourses or water bodies (USDA)

Roofs and Covers (CPS Code 367) – a system that consists of a rigid, semirigid, or flexible manufactured membrane, composite material, or a roof structure placed over a waste management facility or an agrichemical handling facility (USDA)

RTK – Real -Time Kinematic

Soil Health – the condition of the soil and its potential to sustain biological functions, maintain

environmental quality, and promote plant and animal health

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ks/newsroom/features/?cid=nrcs142p2_033494

Soil Organic Carbon (SOC) – one part in the much larger global carbon cycle that involves the cycling of carbon through the soil, vegetation, ocean and the atmosphere. It enters the soil through decomposition of plant and animal residues, root exudates, living and dead microorganism, and soil biota.

<http://www.fao.org/3/a-i6937e.pdf>

http://soilquality.org/indicators/total_organic_carbon.html.

Soil Organic Matter (SOM) – the fraction of the soil that consists of plant or animal tissue in various stages of breakdown (decomposition)

<http://franklin.cce.cornell.edu/resources/soil-organic-matter-fact-sheet/>

Soil Quality – the capacity of each soil to function, within its natural or managed ecosystems, to sustain productivity, enhance water and air quality, support human and animal health, and habitation. This is not limited to agriculture, but most work and evaluation has occurred on agricultural lands.

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ks/newsroom/features/?cid=nrcs142p2_033494

Solid/Liquid Waste Separation Facility (CPS Code 632) – a filtration or screening device, settling tank, settling basin or settling channel used to separate a portion of solids from a liquid waste stream (USDA)

https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1255200.pdf

Structures for Wildlife (CPS Code 649) – structures installed to replace or modify a missing or deficient wildlife habitat component (USDA)

https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1263418.pdf

Symbiotic – see symbiosis

Symbiosis – a long term interaction between two or more organism that will be mutually beneficial

Therm (CCF) – a unit of heat energy equal to 100,000 British thermal units (BTUs). It is approximately the energy equivalent of burning 100 cubic feet (CCF) of natural gas. The therm factor is usually expressed in units of therms per CCF. One therm is also equivalent to about 105.5 megajoules, 25,200 kilocalories, or 29.3 kilowatt-hours.

TMDL – Total Maximum Daily Load

Torripsamments – a soil great group classified as a Psamments that have aridic (or torric) soil moisture regime description, under soil order of Entisols

Upland Wildlife Habitat Management (CPS Code 645) – guidance on establishing and managing upland habitats and connectivity within the landscape for wildlife (USDA)

https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1255212.pdf

USDA – United States Department of Agriculture

Ustorthents – a soil great group classified as an Orthents that have an Ustic soil moisture regime, under soil order of Entisols

VFD – Variable Frequency Drive

Volatilize – Nutrients converted to gaseous form and leaving the soil to the atmosphere

Wind-Row Composting – consists of placing the mixture of raw materials in long narrow piles called wind-rows that are agitated or turned on a regular basis
<http://www.fao.org/docrep/007/y5104e/y5104e07.htm>

Waste Storage Facility (CPS Code 313) – an agricultural waste storage impoundment or containment made by constructing an embankment, excavating a pit or dugout, or by fabricating a structure (USDA)

Waste Treatment Lagoon (CPS Code 359) – an impoundment made by constructing an embankment and/or excavating a pit or dugout (USDA)
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_026002.pdf

Waste Utilization (CPS Code 633) – using agricultural wastes such as manure and wastewater or other organic residues (USDA)
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_022114.pdf