



APPLICATION FOR COMPONENT ADDITION TO NRCS

# NRCS Practice Standard 632

Technical Documentation and Review  
of Solid-Liquid Separation Technologies  
In Support of NRCS Practice Standard  
632 Implementation

## STUDY PREPARED BY:

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## **Informational White Paper on Solid-Liquid Separation Technology:**

### **Supporting Implementation under NRCS Practice Standard 632**

#### ***Purpose and Scope***

Solid-liquid separation (SLS) technologies are presently recognized as components under NRCS Conservation Practice Standard (CPS) 632 – Waste Separation Facility. However, continued interest from NRCS, producers, and technical service providers highlights the need for more comprehensive, field-based performance data to support informed decision-making, particularly across varying system configurations, farm sizes, and operational parameters.

This report provides a comparative technical review and on-farm evaluation of multiple SLS technologies, including:

- **One vibratory screen separator,**
- **Two sloped screen separators, and**
- **Two screw press systems.**

While some of these technologies may be manufactured by the same vendor, they differ significantly in scale, bedding type, operational context, and configuration. This variation offers a valuable opportunity to evaluate how system design and site-specific factors influence performance outcomes, particularly regarding solids capture efficiency, nutrient partitioning, effluent quality, and system suitability under Practice Standard 632.

#### ***Context and Rationale***

As regulatory and environmental pressures increase around manure and nutrient management, dairy producers face growing complexity in selecting effective treatment technologies. Although SLS systems are widely adopted, producers must often rely on anecdotal reports or vendor-supplied information. To help close this gap, Newtrient, in collaboration with field partners and producers, has compiled real-world performance data and operational insights from a representative set of SLS installations.

This evaluation builds upon Newtrient’s standardized technology assessment framework, originally developed in partnership with Washington State University for NRCS Practice Standard 629. It has been adapted here to support deeper technical understanding of SLS systems as implemented under CPS 632.

## Objective

The objective of this white paper is to provide NRCS with:

- An independent, third-party review of SLS systems' performance across multiple use cases.
- Comparative data on solids and nutrient separation efficiency.
- Key operational considerations that influence system effectiveness.
- Recommendations to enhance the use and guidance of SLS components within CPS 632.

This work is not a request for new component acceptance, but rather an effort to inform and support broader adoption and optimization of existing SLS technologies under current NRCS standards.

### ***BRIEF DESCRIPTION OF COMPONENT CLASS***

SLS systems separate solids from the liquid fractions of livestock manure. These systems play a critical role in manure management by reducing the volume of solids handled in liquid storage or land application, improving nutrient distribution, and producing more manageable effluent streams. SLS technologies are commonly incorporated into manure handling systems to enhance the efficiency of storage, transport, treatment, application, and reuse.

This component class includes a range of technologies that use mechanical screening, compression, or a combination of both to achieve separation. The primary mechanism is typically based on physical filtration or pressure-induced dewatering.

This review includes three common categories of SLS technologies:

- Vibratory Screen Separators
- Sloped Screen Separators
- Screw Press Separators

Within each technology type, multiple system configurations and installations are evaluated in this report. While the core separation mechanisms remain consistent within each category, individual systems vary by:

- Screen size and design,
- Flow rate capacity,

- Manure source (e.g., flush vs. scrape),
- Bedding material (e.g., sand, manure solids, sawdust),
- Installation scale, and
- Integration with downstream treatment or storage systems.

### ***DETAILED DESCRIPTION***

SLS systems are used to partition livestock manure into solid and liquid fractions. These systems are commonly applied under NRCS CPS 632 – Waste Separation Facility. Their primary function is to remove suspended and settleable solids from manure, thereby reducing the volume of material requiring further handling, improving nutrient management flexibility, and enhancing the performance of downstream storage or treatment components.

Mechanical SLS technologies rely on physical screening or pressure-based mechanisms to separate solids based on size, moisture content, and other characteristics. The choice of technology depends on factors such as manure consistency, bedding type, system throughput requirements, and operational goals. Common types of SLS systems include (Figure 1):

#### **1. Vibratory Screen Separators**

These systems utilize a motor-driven vibration mechanism to move manure across a fine screen. Vibration reduces screen clogging and helps improve the separation of finer solids. They are generally used in systems handling more dilute manure, such as those employing flush collection.

Typical design features include:

- High-frequency vibration to promote flow and separation
- Flat or slightly inclined screen beds
- Fine mesh sizes for capturing small particles
- Moderate energy input and regular maintenance needs

#### **2. Sloped Screen Separators**

Sloped screen separators use gravity to move manure over an inclined, stationary screen. Liquid drains through the screen while coarse solids are retained on the surface. These systems are favored for their simplicity and low energy requirements. Some systems incorporate self-cleaning or vibration devices to reduce downtime, removing build-up or clogging of the screens. Roller and/or screw presses at the bottom of the inclined screen may be used to reduce the moisture content of the removed solids.

Key features typically include:

- Screen incline angles ranging from 5° to 25°
- Stainless steel or plastic screen materials
- Minimal mechanical components
- Performance that depends on screen size, slope, and manure properties

### **3. Screw Press Separators**

Screw presses separate solids by compressing manure through a cylindrical screen using a rotating auger. The buildup of pressure dewateres the solids, producing relatively dry material for handling or reuse. The screw augers may be supported by bearings on one or both ends of the unit.

Typical system characteristics:

- Variable auger pitch and backpressure mechanisms
- Ability to handle a wide range of manure consistencies
- Higher solids dryness compared to passive separators
- Greater mechanical complexity and energy demand

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### **Design and Integration Considerations**

SLS systems can function as stand-alone components or be integrated into multi-stage manure management systems. Their effectiveness depends on:

- Manure source and characteristics (e.g., total solids, fiber content, bedding material)
- Desired solids capture and nutrient partitioning goals

- Integration with upstream (e.g., collection) and downstream (e.g., storage, treatment) components
- Operational and maintenance capacity at the site



Vibratory Screen Separators



Slope Screen



Screw Presses

Figure 1. Representative Solid-Liquid Separation Technologies.

### ***HOW PROPOSED SYSTEM ACCOMPLISHES PURPOSES OF THE STANDARD***

SLS systems support the purpose of NRCS CPS 632 by improving the physical separation of solids from manure and agricultural wastewater. This reduces solids and partitions nutrient loading in downstream systems, enhances water quality protection, and supports the performance and longevity of storage and treatment components. By partitioning nutrients between solid and liquid fractions, SLS technologies also enable more precise nutrient management and better alignment with land application plans, supporting soil and crop health. In addition, they contribute to improved material handling, reduced environmental risk, and create opportunities for energy generation or nutrient recovery. By partitioning the organic load in storage systems, SLS can also contribute to a reduction in greenhouse gas (GHG) emissions, particularly methane,

from manure storage. These combined functions align with and help fulfill the intended outcomes of CPS 632.

Newtrient (<https://www.newtrient.com/>), a company sponsored by the dairy industry and committed to enhancing value and sustainability in manure management, has conducted a thorough assessment of technology systems and practices within the field, focusing on their impact on critical environmental metrics, specifically water quality. The information in this report is based on a white paper evaluation of several SLS units that were assessed as part of Newtrient's 2020 Conservation Innovation Grant (CIG) project titled "*Evaluating Environmental and Economic Benefits of Dairy Manure Treatment Technologies and Practices for Improving Water Quality.*" While the broader CIG project examined a range of manure treatment technologies, this white paper provides a deeper, focused analysis of the SLS systems included in that study. It is intended to offer NRCS a more detailed technical review of SLS performance, system variability, and alignment with the objectives of CPS 632.

In support of this discussion, Appendix A offers a brief discussion on the significant impact of SLS technology on key environmental indicators related to water quality, air emissions, and other relevant factors aligned with the objectives of Standard 632. Appendix B includes a technology evaluation of screw press, slope screen, and vibratory screen technologies at commercial dairies in New York, Colorado, Wisconsin, and Maryland, highlighting key benefits and challenges. Also, Appendix C contains the white paper developed by Dr. Jaclyn Schnurr, professor emerita, Wells College, Aurora, NY, providing further insights into the effectiveness and benefits of SLS technology.

#### Reducing nutrient content, organic strength

SLS technologies can partition the nutrient content and organic strength of the liquid fraction of manure by removing a portion of the solids that contain bound nutrients and organic material. However, the degree of concentration varies depending on the type of separator, system configuration, and characteristics of the incoming manure. SLS is more effective at removing particulate-bound phosphorus (P) than dissolved nutrients such as ammonium-nitrogen ( $\text{NH}_4^+\text{-N}$ ) and potassium, which largely remain in the liquid effluent. Similarly, removal of volatile solids (VS) and chemical oxygen demand (COD)—key indicators of organic strength—is partial and influenced by the efficiency of solids capture. While SLS does not achieve complete nutrient or organic load reduction, it plays an important role in lowering the concentration of solids-associated nutrients and organic material in the liquid stream, thereby improving the efficiency and performance of downstream storage, treatment, and land application systems.

#### Reducing odor and gaseous emissions

SLS can contribute to the reduction of odors and gaseous emissions from manure management systems by removing VS and other organic materials from the liquid waste stream that are precursors to gas generation. By separating a portion of the solids before manure enters storage, SLS may reduce the potential for anaerobic decomposition within storage structures, which is a key source of odors and gases such as methane (CH<sub>4</sub>), ammonia (NH<sub>3</sub>), and hydrogen sulfide (H<sub>2</sub>S). The extent of emission reduction depends on the efficiency of solids removal, manure characteristics, and how both the separated solids and liquid effluent are managed post-separation. While SLS alone is not a complete odor or emissions control strategy, it can play a valuable role when integrated into a broader manure management system.

#### Facilitating desirable waste handling and storage

SLS improves the physical characteristics of manure, making both the solid and liquid fractions easier to handle, transport, and store. By reducing the volume of solids entering liquid storage systems, SLS can help minimize settling, decrease agitation requirements, and extend the operational life of lagoons, holding ponds or tanks. Separated solids, often with higher dry matter content, can be optimally stacked, stored, or transported off-site, offering greater flexibility in nutrient management. Additionally, the clarified liquid fraction flows more easily through pumps and pipelines, supporting more consistent irrigation or land application. Overall, SLS enhances the efficiency and manageability of manure handling systems, particularly on farms with high manure volumes or limited storage capacity.

#### Producing value added byproducts that facilitate manure and waste utilization

SLS enables the recovery of concentrated solid fractions from manure that can be used as value-added byproducts. These solids may be repurposed as bedding, composted for use as a soil amendment, or further processed into products with commercial or agronomic value. By concentrating nutrients and reducing moisture content, SLS improves the transportability and marketability of manure-derived materials. This can expand utilization options beyond the farm, support nutrient redistribution, and reduce dependency on land application alone. The potential value of these byproducts depends on their quality, local demand, and how the solids are managed post-separation.

### ***RANGE OF VOLUMETRIC AND MASS FLOW CAPACITIES AS WELL AS HYDRAULIC RETENTION TIME***

The flow capacities and hydraulic retention times of solid-liquid separation systems vary

widely based on system design, technology type, manure characteristics, and site-specific operational conditions.

### ***DESIRED FEEDSTOCK CHARACTERISTICS***

The effectiveness of SLS systems is closely tied to the characteristics of the manure or wastewater being processed. Feedstock properties influence separator performance, solids capture efficiency, equipment wear, and overall system reliability. While SLS technologies can accommodate a range of manure types and bedding materials, certain feedstock characteristics are generally more favorable and can enhance separation outcomes. Identifying these characteristics helps inform system selection, sizing, and operational expectations.

#### **Key desired feedstock characteristics include:**

1. **Total Solids Concentration:** Ideally within 2–8%, depending on the separation technology, to ensure effective separation without excessive dilution or clogging. By utilizing coagulants and/or flocculants effective solid liquid separation can also be performed at lower solids concentrations.
2. **Low Contaminant Load:** Free of large debris, hoof blocks, rocks, plastics, or other non-organic materials that may cause equipment damage or operational issues.
3. **Stable Flow Rate:** Consistent volumetric flow matching system design capacity for optimal efficiency and reduced wear.
4. **Uniform Composition:** Well-mixed or agitated material to prevent settling and promote consistent performance across system cycles.
5. **Compatible Bedding Material:** Use of bedding types that do not interfere with separation performance (e.g., organic vs. inorganic materials like sand, which may reduce equipment lifespan in some systems).
6. **Controlled Dilution Water:** Avoidance of excessive flush water or runoff that may reduce solids capture or overwhelm hydraulic capacity.
7. **Pre-Processed or Screened Input:** Where necessary, coarse screening or agitation may improve feedstock consistency and protect mechanical components from wear and tear.

### ***EXPECTED SYSTEM PERFORMANCE***

SLS systems generally provide consistent removal of suspended solids and associated nutrients, particularly P bound to organic matter. Performance benchmarks often

include metrics such as total solids (TS) reduction, nutrient partitioning efficiency, flow rate capacity, and solids dryness. These systems are not intended to remove dissolved nutrients but can significantly enhance downstream treatment efficiency and nutrient management flexibility. Performance also depends on proper maintenance, alignment with feedstock characteristics, and system sizing.

- *Changes in form or handling characteristics*
  - SLS systems significantly alter the physical form of manure, dividing it into distinct solid and liquid fractions with improved handling characteristics. The collected separated solids typically have reduced moisture content, making them easier to stack, store, and transport compared to raw manure. This change supports the use of solids for applications such as composting, bedding reuse, or off-site nutrient redistribution. The liquid fraction, with fewer suspended solids, flows more consistently through pumps and pipelines, reducing clogging and improving the efficiency of irrigation or land application systems. These changes enhance operational flexibility and can reduce the labor, equipment wear, and energy demands associated with manure management. One of the evaluated screw presses experienced an inflow moisture content of 91% and decreased moisture content in the solids to 60%.
  
- *Nutrient fate or end use projections*
  - SLS systems influence the distribution and potential end uses of nutrients in manure by partitioning them between the solid and liquid fractions. Phosphorus tends to concentrate in the separated solids due to its association with particulate matter, making the solid fraction more suitable for off-site transport or targeted land application where P is needed. In contrast, most N—particularly in the form of ammonium ( $\text{NH}_4^+$ )—remains in the liquid fraction, supporting its use as an N-rich fertilizer for nearby fields. This separation of nutrient forms can enhance nutrient management planning by offering greater flexibility in timing, placement, and transport of manure-derived fertilizers. However, the effectiveness of nutrient redistribution depends on system efficiency, storage practices, and land application strategies. Screw presses, for example, perform well for farms wanting to utilize separated solids in another process such as bedding, composting, pyrolysis, or economically transporting solids long distances. Similarly, vibratory screens enhance the

removal of coarse solids for anaerobic digestion and hair and other particles that could interfere with downstream fine solid separation technologies like ultrafiltration membranes. End-use options for each fraction vary based on local agronomic needs, environmental regulations, and market conditions.

- Coarse solids separation removes the largest material and only a small portion of the phosphorus. If the goal is to partition a larger percentage of the phosphorus, fine solid-liquid separation technologies should be implemented to remove finer suspended solids. Coagulants and/or flocculants can also be used to remove more suspended solids and higher amounts of phosphorus from the liquid waste stream.
- *Macro-nutrient reductions or transformations*
  - Nutrient composition is maintained within the collected separated solids and effluent. SLS primarily redistributes key macro-nutrients—N, P, and K—between manure fractions without significantly altering their chemical forms or total quantities. P tends to concentrate with solids, inorganic N remains mostly dissolved in the liquid while a portion of the organic N is concentrated with solids, and K stays largely soluble in the liquid phase. Screw presses enhance levels of P in solids, particularly optimal for use as a soil amendment for crop growth. While SLS does not chemically transform or reduce nutrient mass, its partitioning function supports more precise nutrient management and can contribute indirectly to nutrient load reductions when combined with subsequent treatment steps or optimized land application.
- *Pathogen reductions or eliminations*
  - SLS primarily functions as a physical process to separate solids from liquids and does not directly inactivate or eliminate pathogens present in manure. Some pathogens may be removed to the solid fraction due to their association with particulate matter, but viable pathogens can remain in both the solid and liquid streams. Effective pathogen reduction typically requires additional treatment steps such as composting, anaerobic digestion, or chemical/thermal disinfection following separation. Therefore, while SLS can contribute to improved pathogen management by isolating solids for targeted treatment, it should be considered as one component within a comprehensive manure treatment and biosecurity strategy.

- *Air quality*
  - SLS can influence air emissions by altering the characteristics and handling of manure fractions. By removing solids, SLS often reduces volatile solids in the liquid fraction, which can lower emissions of gases such as  $\text{NH}_3$ ,  $\text{CH}_4$ , and  $\text{H}_2\text{S}$  during anaerobic storage and land application. Sloped screens, optimal for farms who want a quick separation of liquids and solids for example, are capable of adequately decreasing the amount of solids stored in waste facilities. However, emissions from the separated solids depend on how they are managed post-separation, with composting or drying typically reducing odor and GHG release. While SLS alone does not eliminate air emissions, it plays an important role in integrated manure management systems aimed at minimizing gaseous emissions and improving air quality.
- *Water quality*
  - SLS reduces the concentration of suspended solids and particulate-bound nutrients in the liquid fraction, helping to minimize nutrient leaching and/or runoff into surface and groundwater. By capturing solids and associated P, SLS supports improved nutrient management and water quality protection. However, dissolved nutrients such as  $\text{NH}_4^+$  and nitrate ( $\text{NO}_3^-$ ) largely remain in the liquid fraction and require appropriate management through further treatment or adequate land application to prevent runoff and leaching into water bodies. While SLS alone does not fully address water quality, it is a valuable component of comprehensive conservation practices aimed at maintaining and improving water resource quality.

### ***PROCESS MONITORING AND CONTROL SYSTEM REQUIREMENTS***

SLS technologies vary in design and operational complexity, but effective process monitoring and control are critical to ensure consistent performance, equipment longevity, and optimal nutrient separation. This section outlines general requirements across the different technologies evaluated (vibratory screens, slope screens, and screw presses), with recognition that specific equipment and controls may differ by system size, manufacturer, and application.

Table 1. Comparative Monitoring and Control Requirements Across Solid-Liquid Separation Technologies

Requirement	Vibratory Screen	Slope Screen	Screw Press	Notes / Common Elements
<b>Required Monitoring</b>	Flow rate, screen vibration frequency, motor load, screen fouling or scale formation	Flow rate, screen fouling or scale formation	Flow rate, hydraulic pressure, temperature, motor load, screen fouling or scale formation	Flow meters and motor sensors are common to all systems. Certain areas experience more scale formation than others.
<b>Required Control</b>	Feed rate, vibration frequency adjustment	Feed rate	Feed rate, hydraulic pressure control, screw speed control	Variable speed drives and Programmable Logic Controllers (PLC) used across all systems
<b>Monitoring Equipment</b>	Flow meter, vibration sensors, motor load sensors	Flow meter, motor sensors	Flow meter, pressure transducer, temperature sensors, motor load sensors	Data logging and alarms typically integrated
<b>Control Equipment</b>	Variable Frequency Drive (VFD), PLC, automated shutdown	VFD, PLC, automated shutdown	VFD, hydraulic regulators, PLC, automated shutdown	Emergency shutdown standard across all systems

### ***TYPICAL OPERATIONS/MAINTENANCE PLAN WITH MONITORING REQUIREMENTS AND REPLACEMENT SCHEDULE***

SLS systems require regular operation and maintenance to ensure long-term performance and consistent nutrient separation. While basic operational goals are similar across systems, the maintenance activities, monitoring requirements, and component lifespans vary by technology. The table below summarizes key expectations for vibratory screens, slope screens, and screw presses.

Table 2. Comparative Operations, Maintenance, and Replacement Overview for SLS Technologies

O&M Category	Vibratory Screen	Slope Screen	Screw Press	Notes / Common Elements
<b>System Monitoring</b>	Monitor vibration frequency, motor load, influent flow, and screen fouling or scale formation.	Monitor influent flow, screen loading, and screen fouling or scale formation.	Monitor screw speed, hydraulic pressure, temperature, and screen fouling or scale formation.	Visual inspection and flow monitoring common to all systems.
<b>Typical Maintenance</b>	Clean screens daily or as needed, check for debris, inspect vibration mounts.	Rinse screen surface regularly, remove buildup, inspect	Grease bearings, check screw and screen wear, flush system, clean dewatering zone,	Cleaning frequency varies with manure solids content.

O&M Category	Vibratory Screen	Slope Screen	Screw Press	Notes / Common Elements
		slope angle and flow consistency.	inspect seals and gearbox.	
<b>Replacement Schedule</b>	Replace screens every 6–18 months depending on use; vibration components every 3–5 years.	Replace screens every 6–24 months; minimal mechanical parts to replace.	Replace screens every 6–24 months; replace screw every 2–5 years; seals and bearings as needed.	Vendor-specific intervals; heavy solids content may accelerate wear.

### **CHEMICAL INFORMATION**

- Mechanical SLS does not rely on chemical additives to achieve separation; instead, it is a process that leverages physical differences in particle size, density, and moisture content. As such, SLS does not normally chemically alter the manure but redistributes nutrients and solids between the liquid and solid fractions. The chemical characteristics of the separated outputs vary depending on the influent manure composition, system design, and operational parameters.

### **ESTIMATED INSTALLATION AND OPERATION COST**

Industry averages provide a general estimate of the expenses involved in acquiring and installing SLS technology. It is important to note that these costs are subject to variation based on scale, specific project requirements, customizations, and market conditions.

#### Equipment and Installation Capital Costs

Table 3. Estimated Equipment and Installation Capital Costs as of 2025

Technology	Capital Cost	Notes
<b>Vibratory Screen</b>	\$18,000-\$200,000	Total capital costs for a dairy when all components, installation, and ancillary costs are considered. Larger more complex operations will see costs at the higher end of this range. Smaller less complex projects will see costs at the lower end of this range.
<b>Slope Screen</b>	\$28,000-\$75,000	Cost depends on the farm’s size and dry matter/water quality requirements. Typically, a Midwest/Eastern farm will use one screen per 1,200 cows, a western farm may get by with one per 2,000 cows or more.

Technology	Capital Cost	Notes
Screw Press	\$21,000-\$110,000	Cost varies based on model and farm size; the lower end of the cost range is estimated for a capacity of 400 cows while the higher end is estimated for a capacity of 400 to 1,200 cows.

### Operation and Maintenance Costs (O&M)

While O&M costs vary by SLS system type, scale, and manure characteristics, general categories of ongoing expenses include:

- **Electrical**—Energy is primarily used to power pumps, screens, motors, or vibration depending on the system type. Screw presses and vibratory screens generally require more electrical input than passive systems like slope screens. Estimated energy use varies with throughput rate, solids content, and operating hours.
- **Labor**—Regular labor is needed for system monitoring, cleaning, and routine adjustments. Labor requirements increase with system complexity and frequency of maintenance. Passive systems require less attention, while mechanically intensive systems may require daily inspection and cleaning. All systems require labor to manage the separated solids generated by the system.
- **Maintenance Replacement**—Maintenance includes tasks such as greasing bearings, replacing wear components (screens, seals, drive units), and flushing or rinsing equipment. Component lifespan depends on solids loading, bedding material, and system use. Spare parts inventory and planned service intervals are recommended to reduce downtime.

Table 4. Estimated Operation and Maintenance Costs as of 2025

Technology	Operation and Maintenance Costs	Notes
Vibratory Screen	\$3,000/year	Electrical costs can range from \$2,000-\$5,000/year. On average, a vibratory system may require 3-7 hours per week of labor. Maintenance and replacement costs can average \$3,000-\$10,000 plus a potential motor replacement on a 5-year-cycle, costing an estimated additional \$3,300.
Slope Screen	< \$2,800/year	A typical two stage screen (with an integrated roll) would run on a 1.5 horsepower motor on a 24/7 run time. Minimal

Technology	Operation and Maintenance Costs	Notes
		maintenance is required, anticipating 0.5 hours per day to clean with no added water for operation.
Screw Press	\$13,000/year	This estimated cost reflects the operation of a screw press for 10 hours/day on a 1,000-cow dairy.

### **EXAMPLE WARRANTY**

The manufacturer warrants that the SLS system shall be free from defects in materials and workmanship under normal use and service for a period of **[12–24 months]** from the date of installation or **[18–36 months]** from the date of shipment, whichever occurs first.

### **Covered Components**

This warranty applies to the following components:

- Structural frames and housings
- Screens and press elements
- Motors and gearboxes
- Sensors and control panels
- Electrical wiring and enclosures

### **Exclusions**

This warranty does not cover:

- Damage caused by improper installation not performed by an authorized technician
- Damage resulting from misuse, negligence, accidents, or exposure to corrosive or abrasive materials beyond system design parameters
- Consumable parts such as seals, gaskets, and lubrication materials
- Normal wear and tear

## Remedy

During the warranty period, the manufacturer will, at its discretion, repair or replace defective components upon verification of failure. Labor, shipping, and travel expenses related to warranty service may be the responsibility of the equipment owner unless otherwise specified in the purchase agreement.

## Limitations

This warranty is the sole and exclusive remedy for the purchaser. No other warranties, express or implied, including warranties of merchantability or fitness for a particular purpose, shall apply. The manufacturer's liability shall not exceed the original purchase price of the equipment.

### ***RECOMMENDED RECORD-KEEPING FOR SOLID-LIQUID SEPARATION SYSTEMS***

Effective record-keeping is essential to ensure optimal operation, maintenance, and regulatory compliance of SLS systems. Maintaining detailed and consistent records supports performance evaluation, troubleshooting, and long-term planning, while also helping to document environmental benefits and operational costs.

Key recommended records include:

- **System Operation Logs:**  
Record daily operational parameters such as run times, flow rates, screen or press settings, and any deviations or downtime events.
- **Maintenance and Inspection Records:**  
Document routine inspections, cleaning activities, lubrication, part replacements, and repairs. Include dates, performed tasks, and responsible personnel.
- **Monitoring Data:**  
Track influent and effluent characteristics, including solids content, nutrient concentrations (e.g., N, P, K), pH, and other relevant chemical or physical parameters.
- **Energy and Labor Usage:**  
Record electricity consumption, fuel usage (if applicable), and labor hours dedicated to system operation and maintenance.
- **Replacement and Parts Inventory:**  
Maintain logs of replaced components, spare parts on hand, and expected replacement schedules to facilitate timely upkeep.

- **Environmental Compliance Records:**  
Include data required for permits or regulatory reporting related to nutrient management, water, and air quality.

Consistent and accurate record-keeping not only enhances system reliability but also supports data-driven decisions that maximize environmental and economic benefits of SLS technology.

### ***ALTERNATIVES FOR THE USE OF BYPRODUCTS***

SLS systems generate two primary byproducts: a solid fraction and a liquid fraction, each of which can be managed in a variety of ways depending on local conditions, nutrient content, and operational goals. Proper use or land application of these byproducts is essential to achieving environmental and economic benefits.

#### **Solid Fraction – Common Utilization Pathways:**

- **Nutrient-Rich Soil Amendment:**  
The separated solids, often higher in P, can be precisely applied to cropland where additional P is needed, either on-site or transported off-farm.
- **Composting Feedstock:**  
Solids can be blended with other organic materials and composted to create a stabilized product suitable for land application, landscaping, or retail.
- **Animal Bedding:**  
In some dairy operations, separated solids are reused as bedding material after appropriate drying or treatment.
- **Pelletizing or Drying for Export:**  
Solids may be dried and processed into pellets or granules for easier transport and broader marketability.
- **Bioenergy Feedstock:**  
Separated solids may serve as feedstock for anaerobic digestion, combustion, gasification, or pyrolysis, depending on moisture content and system compatibility.

#### **Liquid Fraction – Common Utilization Pathways:**

- **Fertilizer Application:**  
The liquid effluent, typically high in  $\text{NH}_4^+$  and K, is often reused as a nutrient source for nearby fields via irrigation or direct land application.

- **Further Treatment:**  
The liquid may be directed to downstream systems such as lagoons, holding ponds, anaerobic digestion, or advanced nutrient recovery technologies.
- **Storage for Seasonal Application:**  
In regions with seasonal restrictions, the liquid may be stored in lined lagoons, holding ponds, or tanks until field conditions allow for appropriate application.

### ***INDEPENDENT VERIFIABLE DATA DEMONSTRATING RESULTS/CREDENTIALS***

Appendix A is a summary of the expert opinion and technical data available for this class of technology and how it relates to key performance indicators within NRCS Standard 632. This information is available through Newtrient.

Appendix B provides a summary of data from a Newtrient-managed third-party review of screw press, slope screen, and vibratory screen coarse solids separation technologies. The data comes from a system performance analysis conducted by a former Wells College professor but has not been peer-reviewed.

Appendix C contains the full White Paper detailing the third-party review of solid-liquid separation systems by Dr. Jaclyn Schnurr.

### ***CONTACT INFORMATION—VENDORS***

While not an absolute conclusive list, the list below identifies vendors that are active in the application of this class of technology on manure projects within the U.S.:

1. **SWECO – HX Series Round Separator – Vibratory Separation Screen**

**Address:** 8029 Dixie Highway, Florence, KY 41042

**Phone:** 859-283-8400

**Website:** <https://sweco.com/>

**Contact:** [info@sweco.com](mailto:info@sweco.com)

**Company Information:** SWECO, a business unit of M-I L.L.C., is a manufacturer of customized industrial separation equipment. They manufacture round, rectangular, and pharmaceutical separators plus several lines of complementary separation products; centrifuges, grinding mills, finishing mills, and a wide variety of aftermarket screens and parts.

2. **FAN Separator – Screw Press**

**Address:** 107 Eastwood Rd./PO Box 8943, Michigan City, IN

**Phone:** 630-750-3482

**Website:** <https://www.fan-separator.de/en/products/separator-pss>

**Contact:** [info@fan-separator.de](mailto:info@fan-separator.de)

**Company Information:** FAN Separator is a traditional, European company

carrying out business worldwide. FAN designs and manufactures according to strict European standards, thus ensuring the highest quality down to the smallest detail. Our aim is leadership in quality in the areas of separation and slurry technology as well as wastewater management in the non-agricultural sector. For this reason, FAN works to produce sustainable and economic solutions. FAN is dedicated to a modern conservation of values and FAN's mission is at the same time FAN's highest requirement: FAN wants satisfied customers. Worldwide.

3. **DODA USA – Screw Press**

**Address:** 255 16<sup>th</sup> St. S, St. James, MN 56081

**Phone:** 507-375-5577

**Website:** <https://www.dodausa.com/>

**Contact:** [info@dodausa.com](mailto:info@dodausa.com)

**Company Information:** Doda USA is a manufacturing company based in St. James, MN with a primary focus on the agricultural waste solutions and industrial waste solutions. Our products are built strong and last long for a variety of clientele for efficient waste solutions. Our agricultural side produces top quality equipment for all size operations such as hog and dairy farms as well as large equipment such as tanker trucks for handling livestock waste. Doda USA's parent company, Doda®—located in Italy—is a leader in the wastewater treatment sector and has been present on the international market for over half a century.

4. **AL-INS Enterprise, LLC – Screw Press**

**Address:** 695 Sullivan Dr. Fond du Lac, WI 54935

**Phone:** 920-238-5460

**Website:** <https://al-ins.com/>

**Contact:** [aaron.kuhls@al-ins.com](mailto:aaron.kuhls@al-ins.com)

**Company Information:** AL-INS Enterprises' goal since day one has been to exceed our customers' expectations through the persistent pursuit of perfection. AL-INS Enterprises, LLC takes immense pride in driving the industry standards forward and consistently adapting, year after year. That means changing the materials they use, the design of their equipment and their processes to make sure that only completely optimized products are available for their clients.

5. **Trident TNZ, LLC – Screw Press**

**Address:** 446 Harrison St. #81D Sumas, WA 98295

**Phone:** 1-800-799-3740

**Website:** <https://tridenttnz.com/>

**Contact:** [info@tridenttnz.com](mailto:info@tridenttnz.com)

**Company Information:** Trident TNZ provides circular resource recovery solutions for livestock producers, creating pathways to net-zero agriculture, as well as regenerative wastewater and sludge treatment solutions for a variety of sectors including agri-food or municipal applications.

6. **Bauer Group – Screw Press**

**Address:** 107 Eastwood Rd. Michigan City, IN 46360

**Phone:** 630-750-3482

**Website:** <https://www.bauer-at.com/en/>

**Contact:** [bauer@bauer-at.com](mailto:bauer@bauer-at.com)

**Company Information:** Bauer is a traditional, European company carrying out business worldwide. They design and manufacture according to strict European standards, thus ensuring the highest quality down to the smallest detail. Bauer's aim is leadership in quality in the areas of irrigation, separation and slurry technology as well as wastewater management in the non-agricultural sector. For this reason, Bauer works to produce sustainable and economic solutions. Bauer is dedicated to a modern conservation of values, and their mission is at the same time their highest requirement: They want satisfied customers. Worldwide.

7. **Nutrient Control Systems, Inc. – Screw Press**

**Address:** 130 Industrial Dr. Chambersburg, PA 17201

**Phone:** 717-261-5711

**Website:** <https://www.ncsysinc.com/>

**Contact:** [information@ncsysinc.com](mailto:information@ncsysinc.com)

**Company Information:** Nutrient Control Systems (NCS), Inc. was founded in 2001 with the vision of improving manure handling practices and water quality within the highly sensitive Chesapeake Bay Watershed. As the business has evolved, NCS has become an industry leader in technological development of residuals processing systems for both agricultural and industrial customers. Our current geographic reach stretches from our home base in Pennsylvania, south to Florida and west to California, Washington, and Oregon.

8. **Börger, LLC – Screw Press**

**Address:** 2860 Water Tower Pl. Chanhassen, MN 55317

**Phone:** 612-435-7300

**Website:** <https://www.boerger.com/us/>

**Contact:** [Contact Form](#)

**Company Information:** Börger's aim is to keep on improving their products as well as to launch new products and solutions for their customers. Constantly making things better. The one thing that they value above everything else is

building an honest and reliable partnership with their customers, suppliers, and staff. Flat hierarchies, short communication paths and working independently and responsibly characterize the work at Börger. Qualified, highly-motivated and satisfied employees are just as crucial as having a constant dialog with the customer.

9. **Daritech, Inc. – Screw Press**

**Address:** 8540 Benson Rd. Lynden, WA 98264

**Phone:** 360-354-6900

**Website:** <https://www.daritech.com/>

**Contact:** [info@daritech.com](mailto:info@daritech.com)

**Company Information:** DariTech was founded in 1990 and has grown to be a top to bottom dairy service and supply company worldwide. DariTech’s design team has developed a diversified product line that meets the needs of today’s modern dairies. DariTech’s ability to design and manufacture DariTech’s own components lets them personally ensure the quality of each product. DariTech’s equipment is built to be durable and functional not only today, but also for years to come. DariTech’s goal is to provide every customer with a long-term value for their investment.

10. **Schwing Bioset – Screw Press**

**Address:** 350 SMC Dr. Somerset, WI 54025

**Phone:** 715-247-3433

**Website:** <https://www.schwingbioset.com/>

**Contact:** [Contact Form](#)

**Company Information:** For more than 30 years, Schwing Bioset Inc. has been helping wastewater treatment plants, mines and power generation customers by engineering material handling solutions. Schwing Bioset’s custom-engineered solutions can be found in hundreds of wastewater treatments plants in North America, as well as mines and tunnels around the world. Schwing Bioset, Inc. was founded in 2006 by separating the Material Handling Division of Schwing America into its own company. This company was created to pioneer and develop high performance, remarkable material handling solutions.

11. **Press Technology & Mfg. Inc. – Screw Press**

**Address:** 1940 S. Yellow Springs St. Springfield, OH 45506

**Phone:** 937-324-0352

**Website:** <https://presstechnology.com/>

**Contact:** [info@fluidquip.com](mailto:info@fluidquip.com)

**Company Information:** Press Technology & Mfg., Inc. (PT&M) is an industry leader in manufacturing durable, cost-effective dewatering equipment. They feel confident that in a thorough comparison of alternatives, the quality and value of their equipment will be apparent. PT&M's goal is to maintain 100% customer satisfaction resulting in unequaled service and support.

#### 12. Bellmer – Screw Press

**Address:** 4840 Roswell Rd. Suite 201 Atlanta, GA 30342

**Phone:** 219-712-3511

**Website:** <https://www.bellmer.com/>

**Contact:** [info@bellmer.com](mailto:info@bellmer.com)

**Company Information:** Bellmer Separation Technology focuses on perfect separation of liquids and solids. Their products clean water, filter almost any liquid, press sludges to highest dryness, or produce quality food juices. The family-owned company, founded 1842 in Germany, is worldwide installing high-class equipment in more than 60 industries.

#### 13. Ag Pro, Inc. – Screw Press

**Address:** 859 Airport Rd. Paris, TX 75462

**Phone:** 800-527-1030

**Website:** <https://agprousa.com/>

**Contact:** [info@agprousa.com](mailto:info@agprousa.com)

**Company Information:** Agpro, Inc. is an established company with over 50 years experience in design, engineering, and equipment for collection and processing of animal wastes and organic food processing wastes. They manufacture and design equipment and systems for conveying, cleaning, pumping, agitating, dewatering and general processing of animal and organic food waste. Agpro, Inc. considers every order custom because each of their clients has different needs.

#### 14. Valmetal US Farm Systems – Slope Screen

**Address:** 240 Industriel Blvd. Saint-de-Germin-de-Grantham, QC J0C 1K0

**Phone:** 819-395-4282

**Website:** <https://valmetal.com/>

**Contact:** [Contact Form](#)

**Company Information:** Valmetal's mission is to facilitate the work of farmers

from all over the world by providing them with innovative and efficient equipment to mechanize and automate the different tasks of feeding animals and manure handling. Through the years, Valmetal has managed to position itself sustainably on the international market through the quality of its equipment combined with the flexibility and efficiency of its customer service. Valmetal specializes in the designing and the manufacturing of equipment to mechanize and automate most processes for the preparation and distribution of food to farm animals.

**15. Ag Pro, Inc. – Slope Screen**

**Address:** 859 Airport Rd. Paris, TX 75462

**Phone:** 800-527-1030

**Website:** <https://agprousa.com/>

**Contact:** [info@agprousa.com](mailto:info@agprousa.com)

**Company Information:** Agpro, Inc. is an established company with over 50 years experience in design, engineering, and equipment for collection and processing of animal wastes and organic food processing wastes. They manufacture and design equipment and systems for conveying, cleaning, pumping, agitating, de-watering and general processing of animal and organic food waste. Agpro, Inc. considers every order custom because each of their clients has different needs.

**16. GEA Houle – Slope Screen**

**Address:** 1385 N Weber Rd., Romeoville, IL 60446

**Phone:** 630-303-4703

**Website:** <https://www.gea.com/en/>

**Contact:** [Contact Form](#)

**Company Information:** GEA is proud to serve customers around the world in the food, beverage, chemical, pharma, dairy processing, dairy farming and marine industries. Many of these sectors are experiencing tremendous growth given global trends and other socio-economic drivers – contributing to GEA’s solid performance. Our strategy for the coming years, Mission 30, is based on strengthening our position in these key industries by accelerating sustainable, profitable growth and making a positive impact.

***OTHER CONSIDERATIONS***

While the preceding sections address the 15 core items required in a third-party technical evaluation per the 629 methodology, adapted under CPS 632, additional

insights gathered during the evaluation process may inform broader adoption and implementation decisions for SLS systems. The following considerations are provided to help NRCS and other stakeholders better understand practical, operational, and strategic factors associated with the technology:

- **Site-Specific Conditions:**  
Soil type, climate, topography, and proximity to water bodies can influence system design and byproduct storage and utilization strategies.
- **Manure Characteristics:**  
Variability in solids content, bedding materials, and storage practices can affect separation efficiency and equipment performance. Pre-screening or agitation may be needed in some cases.
- **Regulatory Compliance:**  
Local, state, and federal nutrient management or water quality regulations may dictate how and where byproducts are stored, applied, or discharged.
- **Integration with Other Systems:**  
SLS is often part of a larger manure management strategy and may need to integrate with storage facilities, lagoons, digesters, composters, or nutrient recovery systems.
- **Scalability and Flexibility:**  
System selection should consider future herd size changes, evolving operational goals, or technology upgrades. Modular designs may offer more flexibility.
- **Economic Considerations:**  
Upfront capital costs, ongoing O&M expenses, potential revenue from byproduct sales or reuse, use in downstream technologies, and cost avoidance (e.g., reduced hauling or land application needs) all contribute to the economic viability of SLS systems.
- **Training and Technical Support:**  
Consistent performance requires trained staff, a clear operations plan, and reliable vendor support for troubleshooting and maintenance.

## **Conclusion**

SLS technologies play a foundational role in modern manure management by improving the handling, transportation, distribution, and utilization of dairy waste. These systems physically divide manure into solid and liquid fractions and, in doing so, also partition nutrients in ways that support more targeted and precise nutrient management. Phosphorus, which tends to bind to particulate matter, is primarily concentrated in the separated solid fraction. This makes it more feasible to transport P-rich material off-site or apply it to fields where P is agronomically needed. N, particularly in the form of  $\text{NH}_4^+$ , is largely retained in the liquid fraction due to its solubility. In some cases, a portion of TN may also be lost to the atmosphere through volatilization, particularly during agitation, pumping, or surface application. A portion of the organic nitrogen is retained in the separated solids. Potassium, being highly soluble, almost entirely remains in the liquid fraction and can be utilized through irrigation or liquid land application systems. This physical redistribution of nutrients enables better alignment with crop nutrient demands, reduces risk of nutrient overloading in sensitive areas such as waterways and vulnerable soils, and enhances the utility of both byproduct streams.

The data and observations presented in the following white paper—based on multiple SLS technologies evaluated under the 2020 NRCS Conservation Innovation Grant titled: *Evaluating Environmental and Economic Benefits of Dairy Manure Treatment Technologies and Practices for Improving Water Quality (Appendix C)*—demonstrate that vibratory screens, sloped screens, and screw presses each offer distinct advantages depending on site-specific conditions, feedstock characteristics, and operational goals. By reducing organic strength, managing nutrient distribution, facilitating value-added byproducts, and supporting reductions in odor and GHG emissions, SLS systems align with the core purposes of NRCS Conservation Practice Standard 632, Waste Separation Facility.

Coarse solids separation techniques are an important consideration for the sustainable treatment of manure at dairy farms. This study compared the moisture and nutrient composition of manure from 5 different farms using 3 different coarse solids separation techniques: screw press, sloped screen, and SWECO vibratory screen. All techniques were able to decrease the moisture content of the collected solids, and all maintained the nutrient composition of the leftover solids and effluent (Figure 2). The best coarse solids separation technique is the one that would be most utilized and best enhance the needs for a given livestock operation. Following is a brief description of the results for each of the separation technologies evaluated.

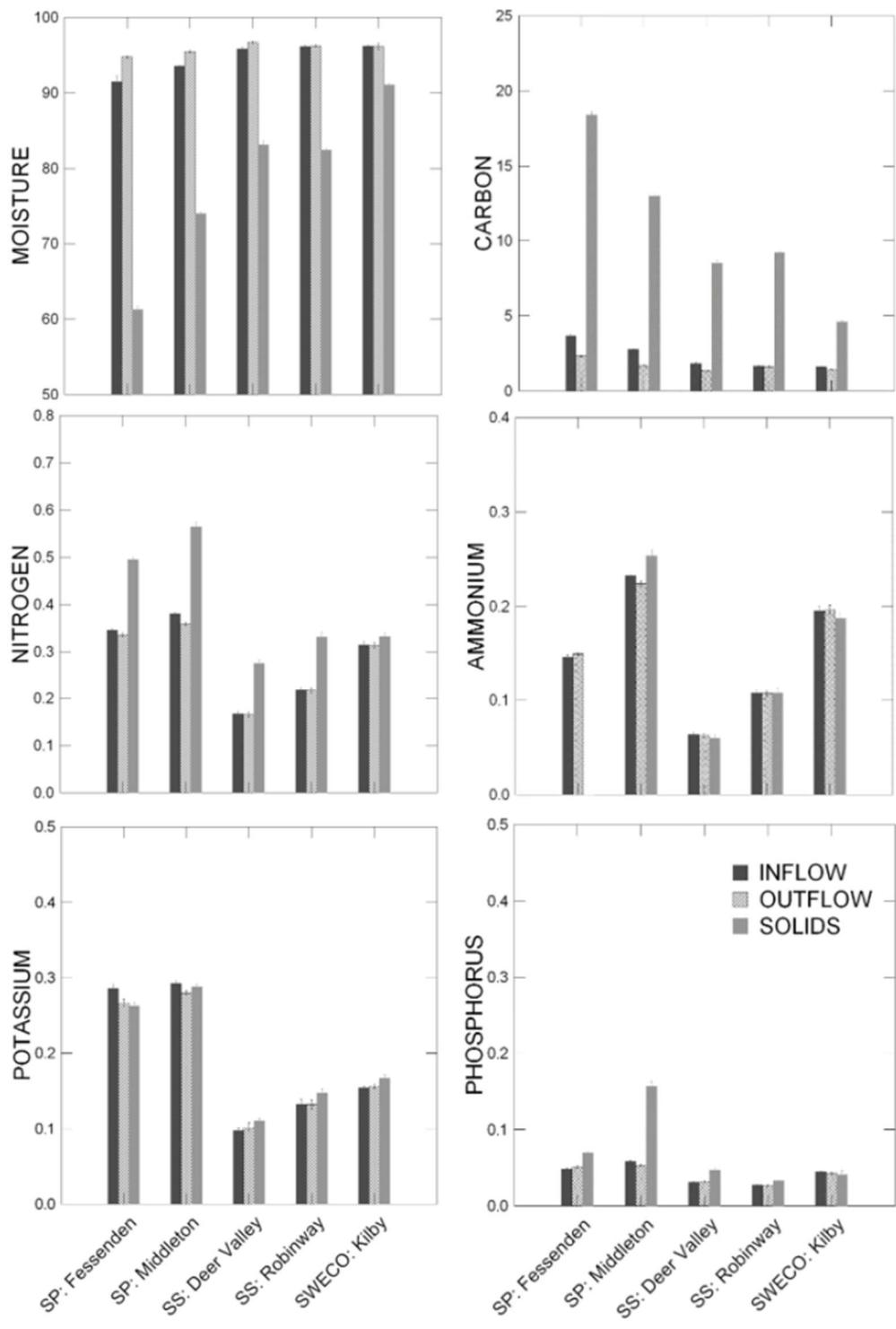


Figure 2. Average performance data for the evaluated separation technologies.

For screw presses it appears that this technology works best for farms that want to utilize the separated solids in another process, such as bedding material, biogas or natural gas production, or transporting solids a longer distance more economically for land application. The screw press is best able to decrease the moisture content of the solids (Figure 2), which allows it to be used in anaerobic digesters and potentially in new technologies like such as thermochemical processes in the creation of biochar. In this study the screw pressed solids also had enhanced levels of phosphorus, which may make it a good choice for soil amendments for crop growth. Anaerobic digestion seems to improve this partitioning of phosphorus in the solids fraction. Additional work should be conducted to determine the validity of this impact and what factors affect this increase in phosphorus partitioning.

Sloped screens are best for farms that want to do a quick separation of solids and liquids. Because of the low initial costs of operation, it may be the best choice for dairies that want to have the most flexibility in the uses of the solids. In this study the slope screen farms didn't excel in either moisture reduction or nutrient retention (Figure 2) but were in the middle of the screw press and the vibratory screen farms in most categories. For farms that want to decrease the amount of solids stored in their waste storage facilities at a minimal cost, slope screens may be the optimal choice.

The SWECO vibratory screen removed the least amount of moisture from the solids (Figure 2) and was on the lower end of the scale compared to the other technologies for nutrient retention. This technology is the most space efficient (Figure 1) so for farms where space may be limited it may be the right choice. However, the SWECO system allows for increased categories of solid separation by changing the size of the screen so it may be the best choice for farms that require more variability in their coarse solids separation. This technology has been used to remove coarse solids for anaerobic digestion and removal of hair and other particles that could interfere with advanced fine separation technologies like ultra-filtration membranes.

Although the coarse solids separation techniques did show some differences, the farm-to-farm comparisons were equally important. Each farm differed in the moisture reduction and nutrient retention independent of separation technique (Figure 2). One of the screw presses generated the lowest moisture content of the inflow (91%) and were able to decrease solids moisture content to 60%. In contrast, the enhanced nitrogen

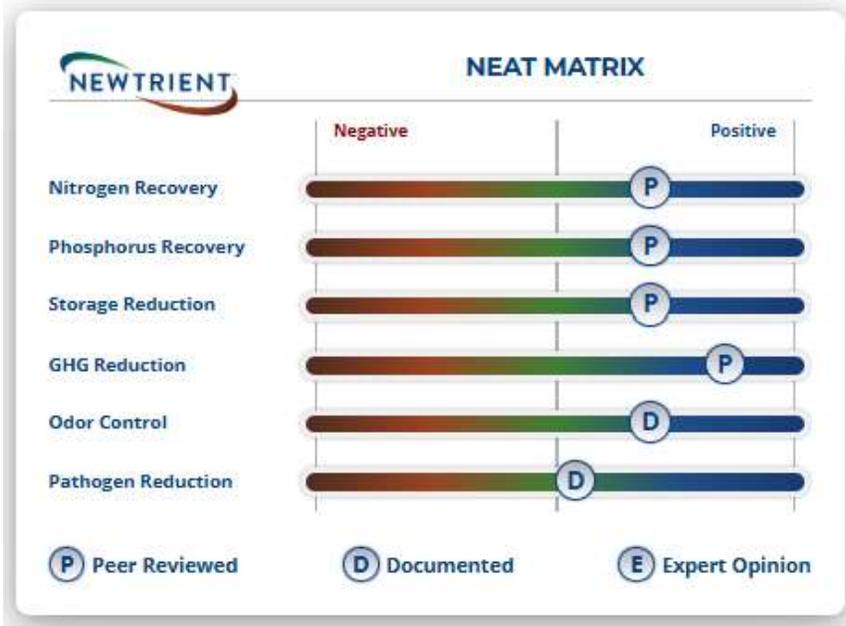
concentration in for one of the inclined screens produced the highest N:P ratio of any farm, allowing those solids to be in the range that is considered neither N nor P limited in terrestrial ecosystems (Gusewel 2004).

All coarse solid separation manure techniques can help decrease the environmental impacts of dairy farms by allowing for more efficient and focused applications of waste products. Aguirre-Villegas et al. (2019) performed a similar analysis to this and found that separating solids and liquids from manure were able to decrease greenhouse gas emission by 38%; this aspect of manure management is an important consideration for sustainability of dairy farms. Any technique that allows farmers to utilize manure in a positive manner that fits in with the overall functioning of the farm will be beneficial for the future. Each solid separation technology has its benefits and limitations. Technology selection should be based on the goals and objectives of the livestock operation.

Continued refinement of monitoring practices, performance evaluation, and integration with other treatment strategies will further improve the environmental and economic outcomes of these technologies. As pressure grows for more sustainable manure management solutions, SLS remains a critical component in the toolbox for producers and conservation planners alike.

## Appendix A

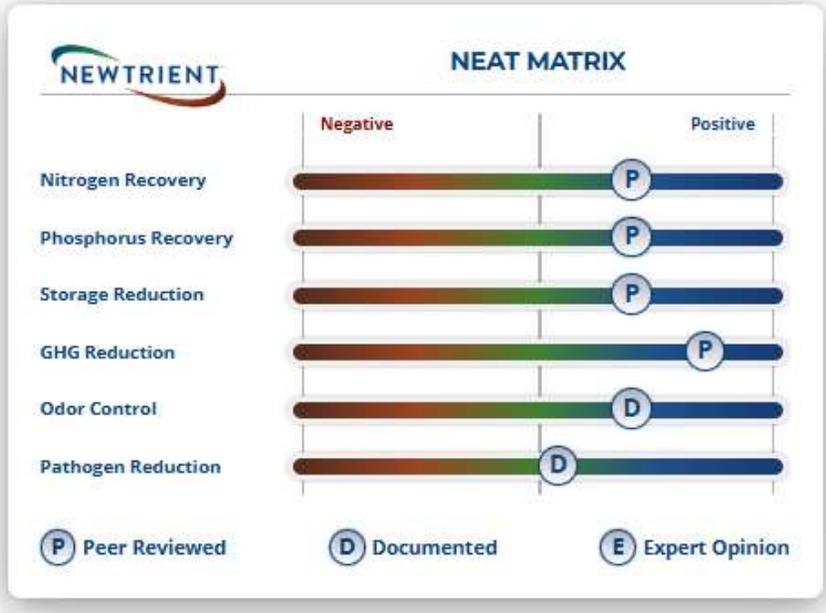
### NEWTRIENT CRITICAL ANALYSIS – SCREW PRESS TECHNOLOGY



#### Overall Summary

Screw press technologies are widely used on dairy farms across the U.S. for their ability to effectively remove coarse solids from manure, producing a fibrous byproduct suitable for use as animal bedding, compost, or soil amendment. These systems are often deployed as a preliminary separation method and are compatible with a variety of other technologies, such as sloped screens and rotary drums. Their operation typically requires minimal maintenance and limited operator oversight, making them attractive for routine use. While screw presses contribute to reductions in storage volume, odor, and GHG emissions, as well as improvements in N and P recovery, their impact in each of these areas is generally limited. Importantly, they do not significantly reduce total nutrient loads in the manure stream but rather help redistribute nutrients to support downstream treatment and management.

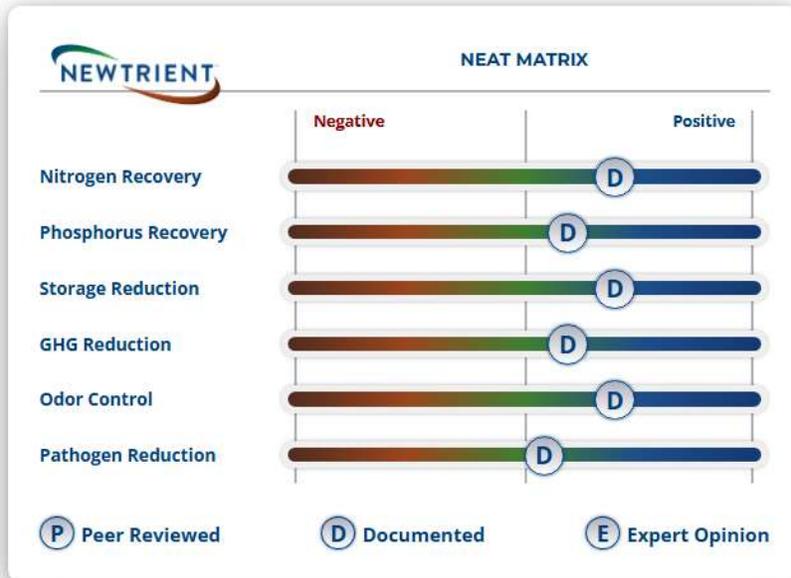
## NEWTRIENT CRITICAL ANALYSIS – SLOPE SCREEN TECHNOLOGY



### Overall Summary

Slope screen technologies are commonly used on dairies as a preliminary separation method to remove coarse solids from manure, producing a fiber-rich byproduct that can be used for bedding, composting, or land application. These passive systems operate without moving parts, making them low-maintenance and requiring minimal operator oversight. Their widespread adoption across the dairy industry is driven by their simplicity, durability, and ability to reduce the volume of material entering storage or downstream treatment processes. While slope screens are effective at capturing larger particulate matter, they do not significantly reduce total nutrient loads—particularly N, P, or K—in the manure stream. However, they can contribute to nutrient partitioning, particularly concentrating P in the solid fraction, and offer incremental benefits related to odor reduction, GHG mitigation, and improved handling. Their performance, while generally limited in magnitude, supports their value as part of an integrated manure management system.

## NEWTRIENT CRITICAL ANALYSIS – VIBRATORY SCREEN TECHNOLOGY



### Overall Summary

Vibratory screen technologies are used on dairy farms across the U.S. for their reduced footprint, flexible screen size and ability to effectively remove coarse solids from manure, producing a fibrous byproduct suitable for composting, or soil amendment. These systems are often deployed as a preliminary separation method ahead of other technologies, such as centrifuges and ultrafiltration membranes. Their operation typically requires a modest amount of maintenance and operator oversight, making them attractive for routine use. While vibratory screens contribute to reductions in storage volume, odor, and GHG emissions, as well as improvements in N and P recovery, their impact in each of these areas is generally limited. Importantly, they do not significantly reduce total nutrient loads in the manure stream but rather help redistribute nutrients to support downstream treatment and management.

## **Appendix B**

### ***Third-Party Review of Coarse Solids Separation Technologies – King Ferry, NY; Kiel, WI; Fort Morgan, CO; Rising Sun, MD***

#### **University Partner**

Dr. Jaclyn Schnurr  
Professor Emerita  
Wells College  
Aurora, NY 13026

**OCTOBER 2025**

#### **BACKGROUND**

As dairy farms have expanded in size and herd density, manure management has become increasingly complex, particularly for operations that rely on liquid manure systems. Traditional approaches such as settling basins or lagoons are limited by the large volumes produced and the need to maintain appropriate nutrient balances. Coarse solids separation (CSS) has emerged as a practical strategy to divide manure into distinct liquid and solid fractions that can each be managed more efficiently. Separating manure into liquid and solid waste streams helps address these pressures by improving manure transport efficiency, reducing lagoon loading rates, applying precise nutrients, and allowing targeted reuse of solids and liquids.

Mechanical separators—such as screw presses, slope screens, and vibratory screens—provide farms with ways to quickly remove coarse solids before storage or further downstream treatment. Solid fractions can be used as bedding, compost ingredients, digester feedstock, or soil amendments. Liquid fractions typically maintain a nutrient profile well-suited for agronomic land application. As farms pursue more sustainable manure strategies, CSS technologies offer important benefits across nutrient management, environmental protection, and on-farm resource circularity.

This evaluation summarizes performance outcomes from a multi-site review of three CSS technologies and examines how each performs under real-world dairy conditions.

#### **INTRODUCTION**

This assessment reviewed the performance of screw press, slope screen, and vibratory screen technologies (Figure 1) as documented across five commercial dairy operations in a multi-site white paper. Unlike controlled field trials that follow a consistent treatment protocol, this evaluation synthesizes existing operational data from farms already using these systems under normal working conditions. The goal of the assessment is to understand how coarse solids separation technologies influence the distribution of moisture, organic material, and nutrients between the liquid and solid fractions of manure. By examining general patterns in solids dryness, carbon content, nitrogen and phosphorus behavior, and overall separation consistency, the evaluation provides insight into the practical advantages and limitations of each technology. This broader perspective helps clarify how CSS

fits into a farm's manure management strategy and how technology differences may affect downstream use options and nutrient planning.



Figure 1: Coarse solids separation techniques examined in this study. A. Slope screen in use at Robinway Farm. B. Screw press in use at the Middleton project. C SWECO vibratory screen in use at Kilby Dairy.

## METHODOLOGY

The evaluation is based on a 15-week dataset in which independent researchers collected manure samples from three points in the separation process—inflow, solids, and outflow—at farms operating three different coarse separation systems (slope screen, screw press, and vibratory screen). Samples were collected three times per week and analyzed at A&L Great Lakes Laboratories using standard M7 procedures for moisture, organic carbon, total Kjeldahl nitrogen (TKN), ammonium nitrogen ( $\text{NH}_4^+\text{-N}$ ), potassium (K), P, and calculated N:P ratios. Data were drawn from screw press systems at Fessenden Farms (NY) and the Middleton regional digester project (WI); slope screen systems at Deer Valley Dairy (CO) and Robinway Dairy (WI); and a vibratory screen system at Kilby Dairy (MD). Analysis of variance (ANOVA) models (SYSTAT v13) were used to assess differences among farms and technologies. Results were interpreted by comparing averaged values for each farm and separation point to identify general trends in moisture removal, nutrient partitioning, and solids characteristics.

## DISCUSSION OF RESULTS

The evaluation of CSS technologies across five commercial dairy operations demonstrates clear trends in moisture reduction, nutrient distribution, and solids quality. While the study was not a controlled field trial, the consistent patterns observed across Table 1 and Figure 2 illustrate how screw presses, slope screens, and vibratory screens influence the characteristics of separated solids and liquids under real farm conditions. The results show that all systems effectively reduce moisture in the solids, concentrate carbon and nutrients to varying degrees, and create liquid fractions that retain a relatively stable nutrient profile, suitable for land application. These outcomes form the basis for understanding the operational strengths and limitations of each CSS technology.

## KEY BENEFITS OF COARSE SOLIDS SEPARATION

### Reliable Moisture Reduction Across All CSS Technologies

Across all participating farms, each CSS system reduced moisture in the solids relative to the inflow, creating a more manageable and transportable material. As shown in Table 1, solids moisture decreased from inflow values above 91%-96% to post-separation values ranging from 61%-91%. Screw presses demonstrated the greatest effectiveness in moisture reduction, with Fessenden Farms producing solids at 61.30% moisture and Middleton producing solids at 73.98%. Slope screens achieved reductions to 82.43% (Robinway) and 83.08% (Deer Valley), while the vibratory system exhibited the smallest reduction, generating solids at 91.06% (Kilby). Both inclined screens also incorporated roller presses at the bottom of the screen to remove additional moisture from the separated solids. Inclined screens without the roller presses would result in higher moisture content in the solids which could lead to potential leaching issues from the solids and reduced ability to stack. These patterns for the three systems, visually reinforced in Figure 2, confirm that all technologies provide measurable moisture reduction, with screw presses offering the most pronounced improvement.

Table 1. Percent of each type of analysis for each farm and sample type. Most comparisons were significant at the P<0.001 level using Analysis of Variance; exceptions are explained in the text.

<i>Middleton</i>	Moisture	Carbon	Nitrogen	Ammonium	Potassium	Phosphorus	N:P
Inflow	93.56	2.77	0.38	0.23	0.29	0.06	6:1
Solids	73.98	12.99	0.56	0.25	0.29	0.16	3.5:1
Outflow	95.46	1.72	0.36	0.22	0.28	0.05	7:1

<i>Fessenden</i>	Moisture	Carbon	Nitrogen	Ammonium	Potassium	Phosphorus	N:P
Inflow	91.45	3.68	0.35	0.15	0.29	0.05	7:1
Solids	61.30	18.38	0.49	.	0.26	0.07	7:1
Outflow	94.73	2.32	0.34	0.15	0.27	0.05	7:1

<i>Deer Valley</i>	Moisture	Carbon	Nitrogen	Ammonium	Potassium	Phosphorus	N:P
Inflow	95.82	1.83	0.17	0.06	0.10	0.03	5:1
Solids	83.08	8.53	0.28	0.06	0.11	0.05	5:1
Outflow	96.81	1.30	0.16	0.06	0.10	0.03	5:1

<i>Robinway</i>	Moisture	Carbon	Nitrogen	Ammonium	Potassium	Phosphorus	N:P
Inflow	96.13	1.66	0.22	0.11	0.13	0.03	7:1

Solids	82.43	9.21	0.33	0.11	0.15	0.03	11:1
Outflow	96.20	1.62	0.22	0.11	0.13	0.03	7:1

<i>Kilby</i>	Moisture	Carbon	Nitrogen	Ammonium	Potassium	Phosphorus	N:P
Inflow	96.20	1.62	0.31	0.20	0.15	0.04	8:1
Solids	91.06	4.60	0.33	0.19	0.17	0.04	8:1
Outflow	96.15	1.43	0.31	0.20	0.16	0.04	8:1

### Improved Carbon and Organic Matter Concentration in Solids

All CSS technologies concentrated organic carbon in the solids fraction, enhancing their composting potential, bedding dryness, and soil amendment value. Table 1 illustrates substantial increases in carbon across all farms, particularly in the screw press systems: Fessenden’s solids increased to 18.38% carbon compared to 3.68% inflow, and Middleton’s solids rose to 12.99% from 2.77% inflow. Slope screen systems also increased carbon to 8.53% (Deer Valley) and 9.21% (Robinway), while vibratory screen solids increased more modestly to 4.60% (Kilby). Figure 2 displays these increases clearly, with solids consistently showing higher carbon levels than both inflow and outflow streams. This data confirms that CSS reliably captures organic matter in the solids fraction, creating a concentrated material suitable for multiple farm uses.

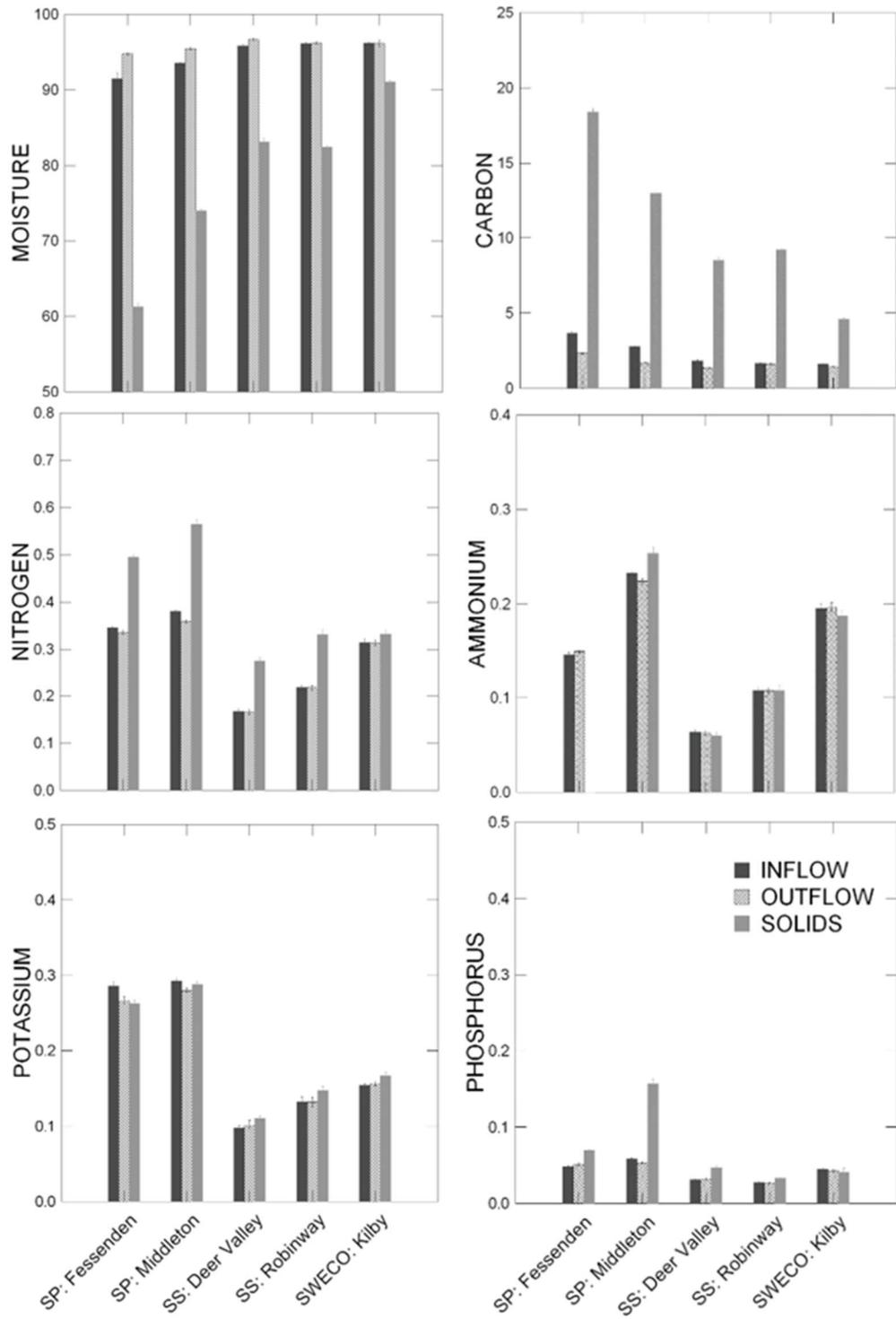


Figure 2. Percentages of moisture and nutrients for each farm, arranged by coarse separation technique. SP = Screw Press; SS = Slope Screen; SWECO = vibratory screen. Error bars are + standard error.

## **Flexible Technology Options to Meet Farm-Specific Goals**

The performance profiles shown in Table 1 and Figure 2 demonstrate that each CSS technology offers distinct advantages, enabling farms to select the system best aligned with their operational objectives. Screw presses provide the driest and most nutrient-dense solids, making them ideal for bedding recovery, composting, or long-distance nutrient export. Slope screens offer moderate nutrient retention with lower capital costs, making them practical for farms prioritizing basic solids removal and a lower infrastructure investment. Vibratory screens, while producing wetter solids (91.06% moisture at Kilby), offer compact system footprints and interchangeable screens, enabling targeted separation and compatibility with pretreatment for anaerobic digestion and other practices. The diversity of performance outcomes across technologies gives farms the flexibility to match CSS capabilities with manure characteristics, climate, available space, and downstream nutrient management strategies.

### **EVALUATION KEY CHALLENGES AND ISSUES**

#### **High Variability in Performance Across Farms**

Table 1 shows substantial variation in moisture, carbon, N, and P values across farms using the same technology, highlighting one of the most significant challenges in CSS implementation. For example, screw press moisture levels ranged from 61.30% at Fessenden to 73.98% at Middleton, despite similar mechanical separation methods. Likewise, N levels in solids for slope screens differed between Deer Valley (0.28%) and Robinway (0.33%). These disparities reflect differences in manure dilution, anaerobic digestion status, bedding composition, screen size, and other farm-specific factors. Figure 2 reinforces this variability, demonstrating wide nutrient and moisture distributions across farms. This underscores the need for site-specific evaluations when selecting or optimizing CSS technologies.

#### **Differences in Moisture Removal Affect Downstream Use Options**

While all CSS systems reduce moisture, the extent of reduction varies dramatically, impacting how solids can be used on the farm. Screw press solids at Fessenden reached 61.30% moisture—appropriate for bedding or compost feedstock—while solids at Kilby remained at 91.06%, which may require further drying before use. Slope screens produced intermediate values in the 82%-83% range. As reflected in Table 1 and illustrated in Figure 2, this variability directly influences bedding suitability, composting efficiency, storage space, hauling costs, and potential equipment or infrastructure needs for further drying or processing. Farms relying on CSS for bedding production or solids export must account for these differences during equipment selection.

#### **P Enrichment in Solids Can Limit Land Application Options**

Several separation systems showed considerable P concentration in the solids relative to the inflow. Table 1 highlights dramatic increases from the screw presses at Middleton (0.06% to 0.16%) and smaller but meaningful rises at Fessenden (screw press) and Deer Valley (slope screen). For systems with anaerobic digesters, some operations add iron-based additives to reduce hydrogen sulfide generation. When utilized, the iron also allows more of the phosphorus to be captured in the solids. While nutrient-rich solids can be beneficial as soil amendments, P accumulation can also restrict flexibility for land application in regions with P-limited fields or regulatory constraints. Figure 2 demonstrates these

differences visually, showing pronounced P elevation in some solid streams. Farms aiming to manage P surpluses must consider whether CSS will concentrate P beyond workable thresholds or require alternative nutrient export pathways.

### **Operational Limitations of Certain Separation Technologies**

The study analysis showed that slope screens require highly dilute manure and continuous flow to prevent solids build up or drying on the screen surface, limiting their use in intermittent-flow or cold-weather environments. Vibratory screens, while compact and adjustable, produced the wettest solids, as shown by Kilby's 91.06% moisture in Table 1, which may hinder downstream handling. Figure 2 further illustrates this moisture challenge. These technological limitations mean that CSS systems cannot be selected based solely on nutrient performance; they must be evaluated in the context of climate, manure dilution level, manure consistency, and integration with farm infrastructure such as digesters, storage tanks, or bedding management systems.

### **IMPLICATIONS**

The evaluation of CSS technologies shows they can serve as an effective foundation for improving manure handling, storage efficiency, and nutrient distribution on dairy operations. By producing more manageable solid and liquid fractions, these systems support flexibility in how farms apply nutrients, reuse solids, and plan long-term manure strategies. CSS also enhances the ability of farms to match nutrient forms with agronomic needs, enabling producers to direct solid and liquid streams where they can be used most effectively. This separation helps reduce pressure on storage systems, improves opportunities for transport or export of nutrients, and contributes to more controlled land application practices.

At the same time, the evaluation highlights the importance of selecting technologies that align with a farm's specific operational goals, manure characteristics, and downstream uses. Differences among systems in the dryness, consistency, and characteristics of the separated solids mean that equipment choice influences how easily solids can be incorporated into bedding recovery, composting, anaerobic digestion, or off-site hauling management. Because performance can also vary under different farm conditions, CSS is most effective when integrated into a broader manure management approach that accounts for the farm's storage capacity, field base, climate, and nutrient management plan.

Overall, CSS technologies can play an important role in advancing the sustainability of dairy operations by enhancing nutrient stewardship, improving manure flow efficiencies, and supporting more resilient long-term management strategies. Continued evaluation across diverse farm types and operational conditions will help refine technology selection, identify best-fit systems, and guide producers in adopting approaches that meet both agronomic and environmental objectives.

Information on these and other solid-liquid separation technologies can be found in the Newtrient's Solutions Catalog on the [Newtrient website](#).

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## **Appendix C**

### ***Third-Party Review of Solid-Liquid Separation Systems by Dr. Jaclyn Schnurr (White Paper)***

A comparison of coarse solid separation techniques  
White Paper  
By Dr. Jaclyn Schnurr, formerly with Wells College, Aurora, NY

#### **INTRODUCTION**

Manure management is an important consideration in the dairy industry, especially as farms grow larger (MacDonald et al. 2007). To help mitigate issues caused by storing liquid manure, dairy farms have been turning to ways to sustainably manage manure production. Although the simplest strategy is to allow settling of solids in a waste storage facility or lagoon, the increased size of dairy farms makes this a difficult process. This report will examine 3 different mechanical technologies used by farms to separate manure into liquid and solid fractions.

Coarse solid separation (CSS) is important to the dairy industry because separating the wet from the dry components of manure allows for more sustainable uses of each of the components. Effluent can be applied to crops to allow farmers to save money by using a waste-stream product and not having to purchase fertilizer for enhanced crop growth, while the solids that are left can be used as bedding, compost or a stable soil amendment and allows the solids to be transported longer distances more economically. This study analyzed screw press, sloped screen, and SWECO vibratory screen technologies (Figure 1).

#### **BACKGROUND**

Screw presses work by inputting manure directly from the waste storage facility or reception tank into a chamber that contains a rotating auger (Fig 1B). As the manure moves down the chamber, it becomes squeezed along the sides, concentrating the solids and removing the liquid. The liquid can be collected for use as a fertilizer while the solids can be used in an anaerobic digester, composter, or land applied and can be used in different farm applications such as low-pathogen bedding. In this study, we examined data from two locations that utilized screw presses to separate their manure: Fessenden Farms in King Ferry, New York, and the Middleton project, which is a regional anaerobic digester system collecting manure from 5 dairies in Middleton, Wisconsin. The Middleton project was the only site the manure passed through an anaerobic digester prior to waste separation.

Sloped screen methods are the simplest for dairy farms to use. The manure is pumped to an elevated screen where gravity causes the liquid to fall through a screen and the solids to fall to the ground, where they are moved using farm machinery (Fig 1A). Some systems utilize roller presses at the bottom of the screen to help obtain a drier solids product. This method is the most cost effective but also has the most limitations: the manure must be extremely dilute; it must be in continual use so that manure solids don't dry on the screen; and it is not for use in cold climates unless it is in a climate-controlled area. In this study we reviewed data from Deer Valley Dairy in Fort Morgan, Colorado and Robinway Dairy in Kiel, Wisconsin.

Finally, SWECO vibratory screen separators were evaluated (Fig 1C). They work similar to the slope screen set-ups, but instead of using gravity to separate the manure they use a series of weights that cause the separator screen to vibrate, mechanically separating the liquid (which passes through the screen) from the solids to be collected. Liquids from this technology at the study site were sent to a covered in-ground anaerobic digester. Coarse solids removal was done to minimize the accumulation of solids within the digester. The separated solids went to a screw press to be prepared for making compost. In this study, data from Kilby Dairy in Rising Sun, Maryland was used.

#### Methods:

Each of these farms were investigated to determine the efficacy of these technologies to separate manure. Studies were conducted for 15-weeks, with samples collected 3 times a week by independent researchers. Manure was collected pre-separation ("inflow"), as well as the liquid effluent ("outflow") and remaining solids ("solids") after separation. Samples were shipped to A&L Great Lakes laboratories in Fort Wayne, Indiana. Samples were analyzed using standard laboratory techniques, M7, which included Moisture Content (%), Organic Carbon (%), LOI @550oC, Total Nitrogen (% TKN, Kjeldahl), Ammonium Nitrogen (% NH<sub>4</sub>-N), Potassium (%), Phosphorus (%), and other nutrients were reported. Samples were averaged for each collection point for each farm and Analysis of Variance Models were used in SYSTAT ver. 13 to determine differences among farms and coarse solid separation techniques.

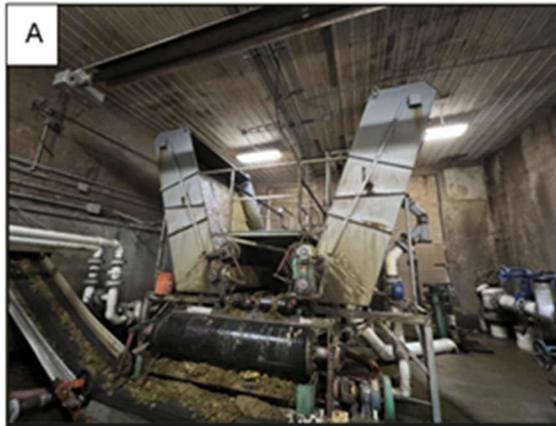


Figure 1. Coarse solid separation techniques examined in this study. A. A slope screen in use at Robinway Farm. B. A screw press in use at the Middleton project. C. A SWECO vibratory screen in use at Kilby Dairy.

## Results:

### Differences among farms

All of the farms and coarse separation techniques showed similar patterns, and for the most part, were significantly different among farms and sample types. Solids always had less moisture content than the inflow, and outflow had more moisture after the solids were removed (Table 1; Figure 2). Similarly, solids had more carbon than either inflow or outflow across all farms. There were some differences in the percent nitrogen; most farms had higher TKN in the solids except for the SWECO separator at Kilby Farm ( $F=2.367$ ,  $P=0.098$ ), where the solids had a similar percentage of nitrogen as the inflow and the outflow. Ammonium remained consistent throughout the separation process; it was only significantly different at the Middleton Farms ( $F=10.64$ ,  $P<0.001$ ). Potassium also was consistent across farms and sample types; only Fessenden ( $F=6.86$ ,  $P=0.002$ ) and Kilby Farms ( $F=3.32$ ,  $P=0.03$ ) had significant differences among sample types. Phosphorus percentage increased in the solids for the Middleton Farms and to a lesser extent at Fessenden and Deer Valley. Phosphorus did not significantly vary among sample types at Kilby Dairy ( $F=0.334$ ,  $P=0.7$ ).

N:P ratio is a way of determining how much nitrogen is contained in the manure compared to the amount of phosphorus. For most agricultural crops this value should be greater than 1:1. Some crops may require a ratio of 5:1 or greater to balance the crop production needs. This is a primary consideration in manure application for agricultural plant growth where more manure has to be added to increase the amount of nitrogen needed by plants, leading to an increase in phosphorus in the soil profile which could lead to runoff of phosphorus and decreased water quality. Soil tests can also control the amount of nutrients (predominately phosphorus) that can be applied. Each of these farms had significantly different N:P ratios, with the Middleton, WI farms having the lowest ratio and the solids at Robinway farm having the highest ratio (Table 1). Several factors could have contributed to these differences ranging from feed rations, anaerobic digestion, separation screen sizes, and separated solids moisture content. Mass flow data was only available for the Middleton project.

Table 1. Percent of each type of analysis for each farm and sample type. Most comparisons were significant at the  $P<0.001$  level using Analysis of Variance; exceptions are explained in the text.

<i>Middleton</i>	Moisture	Carbon	Nitrogen	Ammonium	Potassium	Phosphorus	N:P
Inflow	93.56	2.77	0.38	0.23	0.29	0.06	6:1

Solids	73.98	12.99	0.56	0.25	0.29	0.16	3.5:1
Outflow	95.46	1.72	0.36	0.22	0.28	0.05	7:1

<i>Fessenden</i>	Moisture	Carbon	Nitrogen	Ammonium	Potassium	Phosphorus	N:P
Inflow	91.45	3.68	0.35	0.15	0.29	0.05	7:1
Solids	61.30	18.38	0.49	- <sup>1</sup>	0.26	0.07	7:1
Outflow	94.73	2.32	0.34	0.15	0.27	0.05	7:1

<i>Deer Valley</i>	Moisture	Carbon	Nitrogen	Ammonium	Potassium	Phosphorus	N:P
Inflow	95.82	1.83	0.17	0.06	0.10	0.03	5:1
Solids	83.08	8.53	0.28	0.06	0.11	0.05	5:1
Outflow	96.81	1.30	0.16	0.06	0.10	0.03	5:1

<i>Robinway</i>	Moisture	Carbon	Nitrogen	Ammonium	Potassium	Phosphorus	N:P
Inflow	96.13	1.66	0.22	0.11	0.13	0.03	7:1
Solids	82.43	9.21	0.33	0.11	0.15	0.03	11:1
Outflow	96.20	1.62	0.22	0.11	0.13	0.03	7:1

<i>Kilby</i>	Moisture	Carbon	Nitrogen	Ammonium	Potassium	Phosphorus	N:P
Inflow	96.20	1.62	0.31	0.20	0.15	0.04	8:1
Solids	91.06	4.60	0.33	0.19	0.17	0.04	8:1
Outflow	96.15	1.43	0.31	0.20	0.16	0.04	8:1

1 – Ammonium nitrogen was not determined for this evaluation.

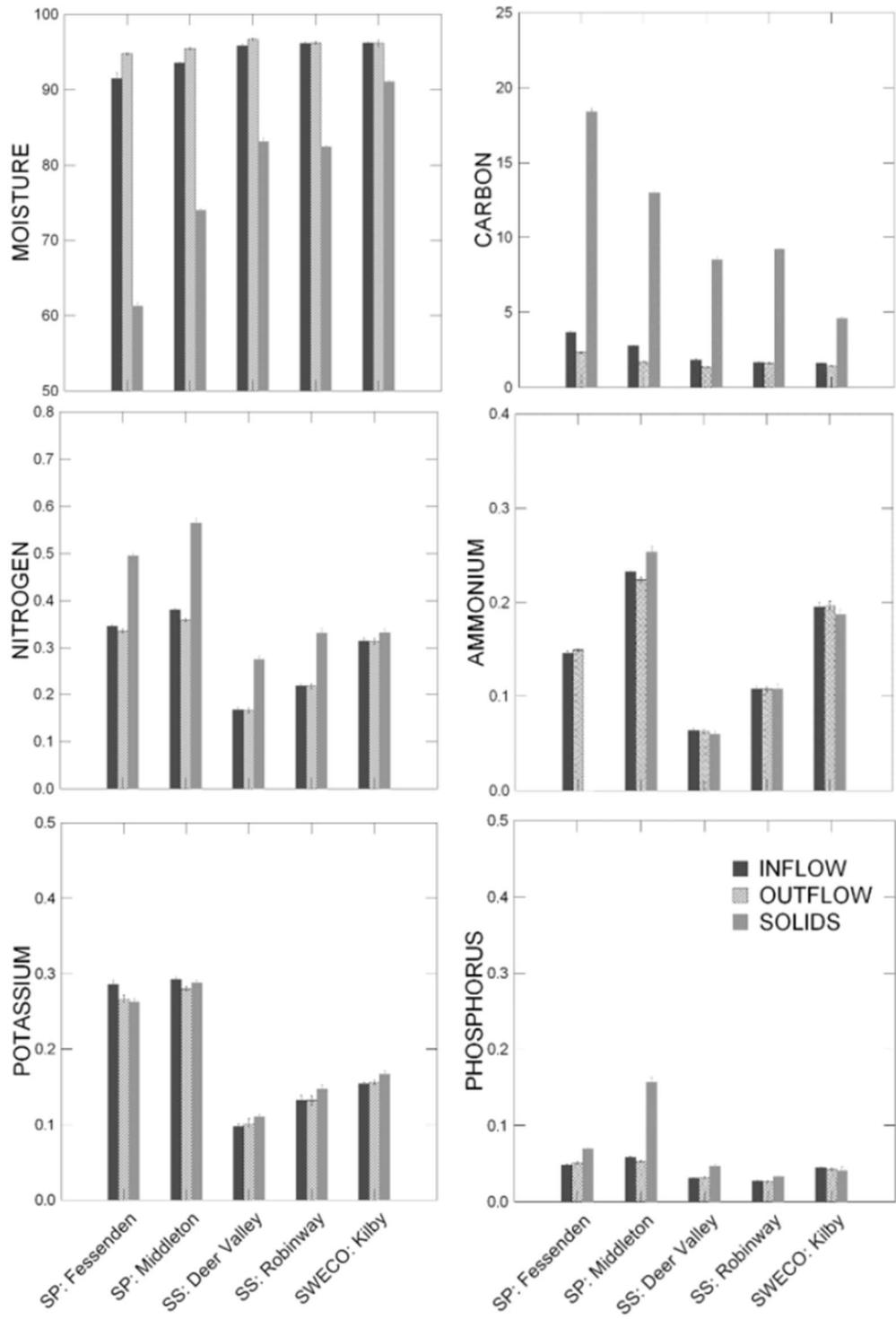


Figure 2: Percentages of moisture and nutrients for each farm, arranged by coarse separation technique. SP = Screw Press; SS = Slope Screen; SWECO = SWECO vibratory screen. Error bars are + standard error.

### Differences among coarse separation techniques

Each of the coarse separation techniques had significant effects on each of the analyses - there were no non-significant ANOVA results when comparing chemical properties for each of the separation and sample types (Figure 2). Among the techniques the screw press performed best overall, with the lowest amount of moisture and the highest amounts of other nutrients preserved in the solids. The screw press also had the lowest N:P ratio in solids, indicating that solids from the screw press may be able to be transported longer distances to fields with low phosphorus compared to fields close to the dairy which may be high in phosphorus.

### Overall:

Coarse solid separation techniques are an important consideration for the sustainable treatment of manure at dairy farms. In this study we compared the moisture and nutrient composition of manure from 5 different farms using 3 different coarse solid separation techniques: screw press, sloped screen, and SWECO vibratory screen. All techniques were able to decrease the moisture content of the collected solids and all maintained the nutrient composition of the leftover solids and effluent (Figure 2). Each farm and technique will be discussed below, but overall it seems that the best coarse solid separation technique is the one that would be most utilized and best enhance the needs of each farm.

Screw presses are best for farms that want to utilize the separated solids in another process, such as bedding material like Fessenden Farms, biogas or natural gas production, or transporting solids a longer distance more economically for land application. The screw press is best able to decrease the moisture content of the solids (Figure 2), which allows it to be used in anaerobic digesters and potentially in new technologies like the creation of biochar. In this study the screw pressed solids also had enhanced levels of phosphorus, which may make it a good choice for soil amendments for crop growth.

Sloped screens are best for farms that want to do a quick separation of solids and liquids. Because of the low initial costs of operation, it may be the best choice for dairies that want to have the most flexibility in the uses of the solids. In this study the slope screen farms didn't excel in either moisture reduction or nutrient retention (Figure 2),

but were in the middle of the screw press and the vibratory screen farms in most categories. For farms that want to decrease the amount of solids stored in their waste storage facilities at a minimal cost, slope screens may be the optimal choice.

The SWECO vibratory screen removed the least amount of moisture from the solids (Figure 2) and was on the lower end of the scale compared to the other techniques for nutrient retention. The technology is the most space efficient (Figure 1) so for small farms where space may be limited it may be the right choice. However, the SWECO system allows for increased categories of solid separation by changing the size of the screen so it may be the best choice for farms that require more variability in their coarse solid separation. This technology has been used to remove coarse solids for anaerobic digestion and removal of hair and other particles that could interfere with advanced fine separation technologies.

Although the coarse solid separation techniques did show some differences, the farm-to-farm comparisons were equally important. Each farm differed in the moisture reduction and nutrient retention independent of separation technique (Table 1; Figure 2). Fessenden Farm had the lowest moisture content of the inflow (91%), so the screw press was able to decrease moisture content to 60%. In contrast, the enhanced nitrogen concentration in Robinway Dairy's solids allowed it to have the highest N:P ratio of any farm, allowing those solids to be in the range that is considered neither N or P limited in terrestrial ecosystems (Gusewel 2004).

All coarse solid separation manure techniques can help decrease the environmental impacts of dairy farms by allowing for more efficient and focused applications of waste products. Aguirre-Villegas et al. (2019) performed a similar analysis to this and found that separating solids and liquids from manure were able to decrease greenhouse gas emission by 38%; this aspect of manure management is an important consideration for sustainability of dairy farms. Any technique that allows farmers to utilize manure in a positive manner that fits in with the overall functioning of the farm will be beneficial for the future. Each solid separation technology has its benefits and limitations. Technology selection should be based on the goals and objectives of the livestock operation. Information on these and other solid liquid separation technologies can be found in the Newtrient's Solutions Catalog at [www.newtrient.com](http://www.newtrient.com).

## Literature Cited

Aguirre-Villegas, H.A., R. A. Larson, and M. A. Sharara. 2019. Anaerobic digestion, solid-liquid separation, and drying of dairy manure: Measuring constituents and modeling emission. *Science of the Total Environment* 696 134059

Gusewell, S. 2004. N:P ratios in terrestrial plants: variation and functional significance. *New Phytologist* 164: 243–266 <https://doi.org/10.1111/j.1469-8137.2004.01192.x>

MacDonald, J.M., E. J. O'Donoghue, W. D. McBride, R. F. Nehring, C. L. Sandretto, and R. Mosheim 2007. Profits, Costs, and the Changing Structure of Dairy Farming / ERR-47 Economic Research Service/USDA

## Appendix

### Screw Press – Middleton, WI

SAMPLE ID	DATE RECEIVED	DATE REPORTED	PARAMETER	DRY RESULT	WET RESULT	UNIT	LIMIT	METHOD
DIGESTATE 18	1/24/2024	2/1/2024	Moisture		93.22	%	0.1	UW A3769 III.2
DIGESTATE 18	1/24/2024	2/1/2024	Ash @ 550 C	25.345	1.718391	%	0.01	TMECC 03.02-B
DIGESTATE 18	1/24/2024	2/1/2024	Organic Matter (LOI @ 550 C)	74.655	5.061609	%	0.01	TMECC 05.07-A
DIGESTATE 18	1/24/2024	2/1/2024	Organic Carbon (LOI @ 550 C)	43.3	2.93574	%	0.01	Calculation (OM x 0.58)
DIGESTATE 18	1/24/2024	2/1/2024	Carbon to Nitrogen Ratio (C:N)			-	0.1	Calculation
DIGESTATE 18	1/24/2024	2/1/2024	Nitrogen (TKN)	5.840708	0.396	%	0.001	UW A3769 III.3.2
DIGESTATE 18	1/24/2024	2/1/2024	Ammonium Nitrogen (NH4-N)	3.377581	0.229	%	0.001	UW A3769 III.4.1
DIGESTATE 18	1/24/2024	2/1/2024	Phosphorus, Total (P)	0.9062	0.06144	%	0.001	UW A3769 III.6.3
DIGESTATE 18	1/24/2024	2/1/2024	Potassium (K)	4.1151	0.279004	%	0.01	UW A3769 III.6.3
DIGESTATE 18	1/24/2024	2/1/2024	Sulfur (S)	0.5173	0.035073	%	0.01	UW A3769 III.6.3
DIGESTATE 18	1/24/2024	2/1/2024	Magnesium (Mg)	1.645	0.111531	%	0.01	UW A3769 III.6.3
DIGESTATE 18	1/24/2024	2/1/2024	Calcium (Ca)	2.678	0.181568	%	0.01	UW A3769 III.6.3
DIGESTATE 18	1/24/2024	2/1/2024	Sodium (Na)	2.26	0.153228	%	0.01	UW A3769 III.6.3
DIGESTATE 18	1/24/2024	2/1/2024	Aluminum (Al)	985.6	66.82368	ppm	1	UW A3769 III.6.3
DIGESTATE 18	1/24/2024	2/1/2024	Copper (Cu)	993.9	67.38642	ppm	1	UW A3769 III.6.3
DIGESTATE 18	1/24/2024	2/1/2024	Iron (Fe)	1116	75.6648	ppm	1	UW A3769 III.6.3
DIGESTATE 18	1/24/2024	2/1/2024	Manganese (Mn)	398.4	27.01152	ppm	1	UW A3769 III.6.3
DIGESTATE 18	1/24/2024	2/1/2024	Zinc (Zn)	486.8	33.00504	ppm	1	UW A3769 III.6.3
DIGESTATE 18	1/24/2024	2/1/2024	pH		7.9	Std. Unit	0.1	UW A3769 III.7
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Moisture		93.44	%	0.1	UW A3769 III.2
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Ash @ 550 C	35.157	2.306299	%	0.01	TMECC 03.02-B
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Organic Matter (LOI @ 550 C)	64.843	4.253701	%	0.01	TMECC 05.07-A
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Organic Carbon (LOI @ 550 C)	37.609	2.46715	%	0.01	Calculation (OM x 0.58)

SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Carbon to Nitrogen Ratio (C:N)			-	0.1	Calculation
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Nitrogen (TKN)	5.777439	0.379	%	0.001	UW A3769 III.3.2
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Ammonium Nitrogen (NH4-N)	3.429878	0.225	%	0.001	UW A3769 III.4.1
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Phosphorus, Total (P)	1.1573	0.075919	%	0.001	UW A3769 III.6.3
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Potassium (K)	3.9489	0.259048	%	0.01	UW A3769 III.6.3
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Sulfur (S)	0.7748	0.050827	%	0.01	UW A3769 III.6.3
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Magnesium (Mg)	2.431	0.159474	%	0.01	UW A3769 III.6.3
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Calcium (Ca)	4.226	0.277226	%	0.01	UW A3769 III.6.3
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Sodium (Na)	1.84	0.120704	%	0.01	UW A3769 III.6.3
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Aluminum (Al)	923.7	60.59472	ppm	1	UW A3769 III.6.3
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Copper (Cu)	442.2	29.00832	ppm	1	UW A3769 III.6.3
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Iron (Fe)	1351	88.6256	ppm	1	UW A3769 III.6.3
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Manganese (Mn)	484.4	31.77664	ppm	1	UW A3769 III.6.3
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	Zinc (Zn)	444.4	29.15264	ppm	1	UW A3769 III.6.3
SCREW PRESS EFFLUENT 18	1/24/2024	2/1/2024	pH		8.2	Std. Unit	0.1	UW A3769 III.7
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Moisture		73.05	%	0.1	UW A3769 III.2
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Ash @ 550 C	13.305	3.585698	%	0.01	TMECC 03.02-B
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Organic Matter (LOI @ 550 C)	86.695	23.364303	%	0.01	TMECC 05.07-A
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Organic Carbon (LOI @ 550 C)	50.283	13.551269	%	0.01	Calculation (OM x 0.58)
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Carbon to Nitrogen Ratio (C:N)			-	0.1	Calculation

SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Nitrogen (TKN)	2.074212	0.559	%	0.001	UW A3769 III.3.2
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Ammonium Nitrogen (NH4-N)	0.927644	0.25	%	0.001	UW A3769 III.4.1
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Phosphorus, Total (P)	0.5831	0.157145	%	0.001	UW A3769 III.6.3
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Potassium (K)	1.1715	0.315719	%	0.01	UW A3769 III.6.3
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Sulfur (S)	0.3411	0.091926	%	0.01	UW A3769 III.6.3
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Magnesium (Mg)	0.91	0.245245	%	0.01	UW A3769 III.6.3
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Calcium (Ca)	2.129	0.573766	%	0.01	UW A3769 III.6.3
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Sodium (Na)	0.488	0.131516	%	0.01	UW A3769 III.6.3
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Aluminum (Al)	377.7	101.79015	ppm	1	UW A3769 III.6.3
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Copper (Cu)	223.9	60.34105	ppm	1	UW A3769 III.6.3
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Iron (Fe)	574.3	154.77385	ppm	1	UW A3769 III.6.3
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Manganese (Mn)	283.6	76.4302	ppm	1	UW A3769 III.6.3
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	Zinc (Zn)	216.9	58.45455	ppm	1	UW A3769 III.6.3
SCREW PRESS SOLIDS 18	1/24/2024	1/30/2024	pH		8.5	Std. Unit	0.1	UW A3769 III.7

## Screw Press – Fessenden Dairy, King Ferry, NY

SAMPLE ID	DATE RECEIVED	DATE REPORTED	PARAMETER	DRY RESULT	WET RESULT	UNIT	LIMIT	METHOD
INFLOW	3/14/2022	3/16/2022	Moisture		92.06	%	0.1	UW A3769 III.2
INFLOW	3/14/2022	3/16/2022	Ash @ 550 C	16.68	1.324392	%	0.01	TMECC 03.02-B
INFLOW	3/14/2022	3/16/2022	Organic Matter (LOI @ 550 C)	83.32	6.615608	%	0.01	TMECC 05.07-A
INFLOW	3/14/2022	3/16/2022	Organic Carbon (LOI @ 550 C)	48.33	3.837402	%	0.01	Calculation (OM x 0.58)
INFLOW	3/14/2022	3/16/2022	Carbon to Nitrogen Ratio (C:N)			-	0.1	Calculation
INFLOW	3/14/2022	3/16/2022	Nitrogen (TKN)	4.609572	0.366	%	0.001	UW A3769 III.3.2
INFLOW	3/14/2022	3/16/2022	Ammonium Nitrogen (NH4-N)	1.763224	0.14	%	0.001	UW A3769 III.4.1
INFLOW	3/14/2022	3/16/2022	Phosphorus, Total (P)	0.5101	0.040502	%	0.001	UW A3769 III.6.3
INFLOW	3/14/2022	3/16/2022	Potassium (K)	3.3572	0.266562	%	0.01	UW A3769 III.6.3
INFLOW	3/14/2022	3/16/2022	Sulfur (S)	0.4384	0.034809	%	0.01	UW A3769 III.6.3
INFLOW	3/14/2022	3/16/2022	Magnesium (Mg)	0.7094	0.056326	%	0.01	UW A3769 III.6.3
INFLOW	3/14/2022	3/16/2022	Calcium (Ca)	1.717	0.13633	%	0.01	UW A3769 III.6.3
INFLOW	3/14/2022	3/16/2022	Sodium (Na)	1.013	0.080432	%	0.01	UW A3769 III.6.3
INFLOW	3/14/2022	3/16/2022	Aluminum (Al)	258.6	20.53284	ppm	1	UW A3769 III.6.3
INFLOW	3/14/2022	3/16/2022	Copper (Cu)	580.5	46.0917	ppm	1	UW A3769 III.6.3
INFLOW	3/14/2022	3/16/2022	Iron (Fe)	479.8	38.09612	ppm	1	UW A3769 III.6.3
INFLOW	3/14/2022	3/16/2022	Manganese (Mn)	143.1	11.36214	ppm	1	UW A3769 III.6.3
INFLOW	3/14/2022	3/16/2022	Zinc (Zn)	200.7	15.93558	ppm	1	UW A3769 III.6.3
OUTFLOW	3/14/2022	3/16/2022	Moisture		94.98	%	0.1	UW A3769 III.2
OUTFLOW	3/14/2022	3/16/2022	Ash @ 550 C	24.91	1.250482	%	0.01	TMECC 03.02-B
OUTFLOW	3/14/2022	3/16/2022	Organic Matter (LOI @ 550 C)	75.09	3.769518	%	0.01	TMECC 05.07-A
OUTFLOW	3/14/2022	3/16/2022	Organic Carbon (LOI @ 550 C)	43.55	2.18621	%	0.01	Calculation (OM x 0.58)
OUTFLOW	3/14/2022	3/16/2022	Carbon to Nitrogen Ratio (C:N)			-	0.1	Calculation
OUTFLOW	3/14/2022	3/16/2022	Nitrogen (TKN)	6.673307	0.335	%	0.001	UW A3769 III.3.2

OUTFLOW	3/14/2022	3/16/2022	Ammonium Nitrogen (NH4-N)	2.988048	0.15	%	0.001	UW A3769 III.4.1
OUTFLOW	3/14/2022	3/16/2022	Phosphorus, Total (P)	0.8967	0.045014	%	0.001	UW A3769 III.6.3
OUTFLOW	3/14/2022	3/16/2022	Potassium (K)	4.9678	0.249384	%	0.01	UW A3769 III.6.3
OUTFLOW	3/14/2022	3/16/2022	Sulfur (S)	0.7076	0.035522	%	0.01	UW A3769 III.6.3
OUTFLOW	3/14/2022	3/16/2022	Magnesium (Mg)	1.06	0.053212	%	0.01	UW A3769 III.6.3
OUTFLOW	3/14/2022	3/16/2022	Calcium (Ca)	2.672	0.134134	%	0.01	UW A3769 III.6.3
OUTFLOW	3/14/2022	3/16/2022	Sodium (Na)	1.63	0.081826	%	0.01	UW A3769 III.6.3
OUTFLOW	3/14/2022	3/16/2022	Aluminum (Al)	318.2	15.97364	ppm	1	UW A3769 III.6.3
OUTFLOW	3/14/2022	3/16/2022	Copper (Cu)	1017	51.0534	ppm	1	UW A3769 III.6.3
OUTFLOW	3/14/2022	3/16/2022	Iron (Fe)	775.6	38.93512	ppm	1	UW A3769 III.6.3
OUTFLOW	3/14/2022	3/16/2022	Manganese (Mn)	233.1	11.70162	ppm	1	UW A3769 III.6.3
OUTFLOW	3/14/2022	3/16/2022	Zinc (Zn)	363.8	18.26276	ppm	1	UW A3769 III.6.3
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	Moisture @ 70 C		63.51	%	0.01	TMECC 03.09-A
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	Total Nitrogen (N)	1.37	0.499913	%	0.01	TMECC 04.02-D
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	Phosphorus (P)	0.18	0.065682	%	0.01	TMECC 04.03-A
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	Potassium (K)	0.74	0.270026	%	0.01	TMECC 04.04-A
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	Sulfur (S)	0.25	0.091225	%	0.01	TMECC 04.05-S
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	Magnesium (Mg)	0.51	0.186099	%	0.01	TMECC 04.05-MG
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	Calcium (Ca)	1.5	0.54735	%	0.01	TMECC 04.05-CA
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	Sodium (Na)	0.19	0.069331	%	0.01	TMECC 04.05-NA
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	Iron (Fe)	0.06	0.021894	%	0.01	TMECC 04.05-FE
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	Aluminum (Al)	0.03	0.010947	%	0.01	TMECC 04.07-AL
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	Copper (Cu)	246	89.7654	mg/kg	1	TMECC 04.05-CU
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	Manganese (Mn)	71	25.9079	mg/kg	1	TMECC 04.05-MN

PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	Zinc (Zn)	113	41.2337	mg/kg	1	TMECC 04.05-ZN
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	pH		8.5	Std. Unit	0.1	TMECC 04.11-A
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	Soluble Salts		3.65	dS/m	0.01	TMECC 04.10-A
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	Estimated Ash	0.04	0.014596	%	0.01	TMECC 03.02-B (modified)
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	Organic Matter (LOI @ 550 C)	99.96	36.475404	%	0.01	TMECC 05.07-A
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	Total Organic Carbon (C)	49.98	18.237702	%	0.01	TMECC 04.01-A
PRE-COMPOST (SOLID)	3/14/2022	3/18/2022	C:N Ratio			-	0.1	TMECC 05.02-A

## Slope Screen – Deer Valley Dairy, Fort Morgan, CO

SAMPLE ID	DATE RECIEVED	DATE REPORTED	PARAMETER	DRY RESULT	WET RESULT	UNIT	LIMIT	METHOD
COARSE SOLID	11/8/2022	11/11/2022	Moisture		85.05	%	0.1	UW A3769 III.2
COARSE SOLID	11/8/2022	11/11/2022	Ash @ 550 C	10.38	1.55181	%	0.01	TMECC 03.02-B
COARSE SOLID	11/8/2022	11/11/2022	Organic Matter (LOI @ 550 C)	89.62	13.39819	%	0.01	TMECC 05.07-A
COARSE SOLID	11/8/2022	11/11/2022	Organic Carbon (LOI @ 550 C)	51.98	7.77101	%	0.01	Calculation (OM x 0.58)
COARSE SOLID	11/8/2022	11/11/2022	Carbon to Nitrogen Ratio (C:N)			-	0.1	Calculation
COARSE SOLID	11/8/2022	11/11/2022	Nitrogen (TKN)	1.411371	0.211	%	0.001	UW A3769 III.3.2
COARSE SOLID	11/8/2022	11/11/2022	Ammonium Nitrogen (NH4-N)	0.468227	0.07	%	0.001	UW A3769 III.4.1
COARSE SOLID	11/8/2022	11/11/2022	Phosphorus, Total (P)	0.2398	0.03585	%	0.001	UW A3769 III.6.3
COARSE SOLID	11/8/2022	11/11/2022	Potassium (K)	0.634	0.094783	%	0.01	UW A3769 III.6.3
COARSE SOLID	11/8/2022	11/11/2022	Sulfur (S)	0.3362	0.050262	%	0.01	UW A3769 III.6.3
COARSE SOLID	11/8/2022	11/11/2022	Magnesium (Mg)	0.3456	0.051667	%	0.01	UW A3769 III.6.3
COARSE SOLID	11/8/2022	11/11/2022	Calcium (Ca)	1.281	0.19151	%	0.01	UW A3769 III.6.3
COARSE SOLID	11/8/2022	11/11/2022	Sodium (Na)	0.433	0.064734	%	0.01	UW A3769 III.6.3
COARSE SOLID	11/8/2022	11/11/2022	Aluminum (Al)	651.8	97.4441	ppm	1	UW A3769 III.6.3
COARSE SOLID	11/8/2022	11/11/2022	Copper (Cu)	37.1	5.54645	ppm	1	UW A3769 III.6.3
COARSE SOLID	11/8/2022	11/11/2022	Iron (Fe)	747.2	111.7064	ppm	1	UW A3769 III.6.3
COARSE SOLID	11/8/2022	11/11/2022	Manganese (Mn)	54.31	8.119345	ppm	1	UW A3769 III.6.3
COARSE SOLID	11/8/2022	11/11/2022	Zinc (Zn)	96.89	14.485055	ppm	1	UW A3769 III.6.3
Inflow	11/8/2022	11/11/2022	Moisture		95.74	%	0.1	UW A3769 III.2
Inflow	11/8/2022	11/11/2022	Ash @ 550 C	18.31	0.780006	%	0.01	TMECC 03.02-B
Inflow	11/8/2022	11/11/2022	Organic Matter (LOI @ 550 C)	81.69	3.479994	%	0.01	TMECC 05.07-A
Inflow	11/8/2022	11/11/2022	Organic Carbon (LOI @ 550 C)	47.38	2.018388	%	0.01	Calculation (OM x 0.58)
Inflow	11/8/2022	11/11/2022	Carbon to Nitrogen Ratio (C:N)			-	0.1	Calculation
Inflow	11/8/2022	11/11/2022	Nitrogen (TKN)	3.920188	0.167	%	0.001	UW A3769 III.3.2
Inflow	11/8/2022	11/11/2022	Ammonium Nitrogen (NH4-N)	1.408451	0.06	%	0.001	UW A3769 III.4.1
Inflow	11/8/2022	11/11/2022	Phosphorus, Total (P)	0.6604	0.028133	%	0.001	UW A3769 III.6.3
Inflow	11/8/2022	11/11/2022	Potassium (K)	1.5106	0.064352	%	0.01	UW A3769 III.6.3

Inflow	11/8/2022	11/11/2022	Sulfur (S)	0.6263	0.02668	%	0.01	UW A3769 III.6.3
Inflow	11/8/2022	11/11/2022	Magnesium (Mg)	0.8375	0.035678	%	0.01	UW A3769 III.6.3
Inflow	11/8/2022	11/11/2022	Calcium (Ca)	2.355	0.100323	%	0.01	UW A3769 III.6.3
Inflow	11/8/2022	11/11/2022	Sodium (Na)	1.036	0.044134	%	0.01	UW A3769 III.6.3
Inflow	11/8/2022	11/11/2022	Aluminum (Al)	1407	59.9382	ppm	1	UW A3769 III.6.3
Inflow	11/8/2022	11/11/2022	Copper (Cu)	101.6	4.32816	ppm	1	UW A3769 III.6.3
Inflow	11/8/2022	11/11/2022	Iron (Fe)	1187	50.5662	ppm	1	UW A3769 III.6.3
Inflow	11/8/2022	11/11/2022	Manganese (Mn)	113.7	4.84362	ppm	1	UW A3769 III.6.3
Inflow	11/8/2022	11/11/2022	Zinc (Zn)	233	9.9258	ppm	1	UW A3769 III.6.3
Effluent	11/8/2022	11/11/2022	Moisture		96.74	%	0.1	UW A3769 III.2
Effluent	11/8/2022	11/11/2022	Ash @ 550 C	27.78	0.905628	%	0.01	TMECC 03.02-B
Effluent	11/8/2022	11/11/2022	Organic Matter (LOI @ 550 C)	72.22	2.354372	%	0.01	TMECC 05.07-A
Effluent	11/8/2022	11/11/2022	Organic Carbon (LOI @ 550 C)	41.89	1.365614	%	0.01	Calculation (OM x 0.58)
Effluent	11/8/2022	11/11/2022	Carbon to Nitrogen Ratio (C:N)			-	0.1	Calculation
Effluent	11/8/2022	11/11/2022	Nitrogen (TKN)	4.846626	0.158	%	0.001	UW A3769 III.3.2
Effluent	11/8/2022	11/11/2022	Ammonium Nitrogen (NH4-N)	1.840491	0.06	%	0.001	UW A3769 III.4.1
Effluent	11/8/2022	11/11/2022	Phosphorus, Total (P)	0.9205	0.030008	%	0.001	UW A3769 III.6.3
Effluent	11/8/2022	11/11/2022	Potassium (K)	2.1708	0.070768	%	0.01	UW A3769 III.6.3
Effluent	11/8/2022	11/11/2022	Sulfur (S)	0.7948	0.02591	%	0.01	UW A3769 III.6.3
Effluent	11/8/2022	11/11/2022	Magnesium (Mg)	1.15	0.03749	%	0.01	UW A3769 III.6.3
Effluent	11/8/2022	11/11/2022	Calcium (Ca)	3.2	0.10432	%	0.01	UW A3769 III.6.3
Effluent	11/8/2022	11/11/2022	Sodium (Na)	0.74	0.024124	%	0.01	UW A3769 III.6.3
Effluent	11/8/2022	11/11/2022	Aluminum (Al)	1825	59.495	ppm	1	UW A3769 III.6.3
Effluent	11/8/2022	11/11/2022	Copper (Cu)	129.9	4.23474	ppm	1	UW A3769 III.6.3
Effluent	11/8/2022	11/11/2022	Iron (Fe)	1518	49.4868	ppm	1	UW A3769 III.6.3
Effluent	11/8/2022	11/11/2022	Manganese (Mn)	155.5	5.0693	ppm	1	UW A3769 III.6.3
Effluent	11/8/2022	11/11/2022	Zinc (Zn)	329.7	10.74822	ppm	1	UW A3769 III.6.3

## Slope Screen – Robinway Dairy, Kiel, WI

1 – Inflow to Inclined Screen

2 – Outflow from Inclined Screen

3 – Solids from Inclined Screen

SAMPLE ID	DATE RECEIVED	DATE REPORTED	PARAMETER	DRY RESULT	WET RESULT	UNIT	LIMIT	METHOD
1	1/15/2025	1/20/2025	Moisture		96.8	%	0.1	UW A3769 III.2
1	1/15/2025	1/20/2025	Ash @ 550 C	28.503	0.912096	%	0.01	TMECC 03.02-B
1	1/15/2025	1/20/2025	Organic Matter (LOI @ 550 C)	71.497	2.287904	%	0.01	TMECC 05.07-A
1	1/15/2025	1/20/2025	Organic Carbon (LOI @ 550 C)	41.468	1.326976	%	0.01	Calculation (OM x 0.58)
1	1/15/2025	1/20/2025	Carbon to Nitrogen Ratio (C:N)			-	0.1	Calculation
1	1/15/2025	1/20/2025	Nitrogen (TKN)	6.65625	0.213	%	0.001	UW A3769 III.3.2
1	1/15/2025	1/20/2025	Ammonium Nitrogen (NH4-N)	2.8125	0.09	%	0.001	UW A3769 III.4.1
1	1/15/2025	1/20/2025	Phosphorus, Total (P)	0.6993	0.022378	%	0.001	UW A3769 III.6.3
1	1/15/2025	1/20/2025	Potassium (K)	5.1151	0.163683	%	0.01	UW A3769 III.6.3
1	1/15/2025	1/20/2025	Sulfur (S)	0.6059	0.019389	%	0.01	UW A3769 III.6.3
1	1/15/2025	1/20/2025	Magnesium (Mg)	2.236	0.071552	%	0.01	UW A3769 III.6.3
1	1/15/2025	1/20/2025	Calcium (Ca)	3.47	0.11104	%	0.01	UW A3769 III.6.3
1	1/15/2025	1/20/2025	Sodium (Na)	1.93	0.06176	%	0.01	UW A3769 III.6.3
1	1/15/2025	1/20/2025	Aluminum (Al)	401.3	12.8416	ppm	1	UW A3769 III.6.3
1	1/15/2025	1/20/2025	Copper (Cu)	68.26	2.18432	ppm	1	UW A3769 III.6.3
1	1/15/2025	1/20/2025	Iron (Fe)	877.3	28.0736	ppm	1	UW A3769 III.6.3
1	1/15/2025	1/20/2025	Manganese (Mn)	123.7	3.9584	ppm	1	UW A3769 III.6.3
1	1/15/2025	1/20/2025	Zinc (Zn)	156.7	5.0144	ppm	1	UW A3769 III.6.3
1	1/15/2025	1/20/2025	pH		7.1	Std. Unit	0.1	UW A3769 III.7
3	1/15/2025	1/20/2025	Moisture		80.99	%	0.1	UW A3769 III.2
3	1/15/2025	1/20/2025	Ash @ 550 C	15.59	2.963659	%	0.01	TMECC 03.02-B
3	1/15/2025	1/20/2025	Organic Matter (LOI @ 550 C)	84.41	16.046341	%	0.01	TMECC 05.07-A
3	1/15/2025	1/20/2025	Organic Carbon (LOI @ 550 C)	48.958	9.306916	%	0.01	Calculation (OM x 0.58)
3	1/15/2025	1/20/2025	Carbon to Nitrogen Ratio (C:N)			-	0.1	Calculation

3	1/15/2025	1/20/2025	Nitrogen (TKN)	2.062073	0.392	%	0.001	UW A3769 III.3.2
3	1/15/2025	1/20/2025	Ammonium Nitrogen (NH4-N)	0.368227	0.07	%	0.001	UW A3769 III.4.1
3	1/15/2025	1/20/2025	Phosphorus, Total (P)	0.1854	0.035245	%	0.001	UW A3769 III.6.3
3	1/15/2025	1/20/2025	Potassium (K)	0.8689	0.165178	%	0.01	UW A3769 III.6.3
3	1/15/2025	1/20/2025	Sulfur (S)	0.1797	0.034161	%	0.01	UW A3769 III.6.3
3	1/15/2025	1/20/2025	Magnesium (Mg)	0.695	0.13212	%	0.01	UW A3769 III.6.3
3	1/15/2025	1/20/2025	Calcium (Ca)	1.406	0.267281	%	0.01	UW A3769 III.6.3
3	1/15/2025	1/20/2025	Sodium (Na)	0.307	0.058361	%	0.01	UW A3769 III.6.3
3	1/15/2025	1/20/2025	Aluminum (Al)	204.7	38.91347	ppm	1	UW A3769 III.6.3
3	1/15/2025	1/20/2025	Copper (Cu)	22.77	4.328577	ppm	1	UW A3769 III.6.3
3	1/15/2025	1/20/2025	Iron (Fe)	545.7	103.73757	ppm	1	UW A3769 III.6.3
3	1/15/2025	1/20/2025	Manganese (Mn)	38.19	7.259919	ppm	1	UW A3769 III.6.3
3	1/15/2025	1/20/2025	Zinc (Zn)	61.44	11.679744	ppm	1	UW A3769 III.6.3
3	1/15/2025	1/20/2025	pH		8.7	Std. Unit	0.1	UW A3769 III.7
2	1/15/2025	1/20/2025	Moisture		96.23	%	0.1	UW A3769 III.2
2	1/15/2025	1/20/2025	Ash @ 550 C	27.407	1.033244	%	0.01	TMECC 03.02-B
2	1/15/2025	1/20/2025	Organic Matter (LOI @ 550 C)	72.593	2.736756	%	0.01	TMECC 05.07-A
2	1/15/2025	1/20/2025	Organic Carbon (LOI @ 550 C)	42.104	1.587321	%	0.01	Calculation (OM x 0.58)
2	1/15/2025	1/20/2025	Carbon to Nitrogen Ratio (C:N)			-	0.1	Calculation
2	1/15/2025	1/20/2025	Nitrogen (TKN)	6.047745	0.228	%	0.001	UW A3769 III.3.2
2	1/15/2025	1/20/2025	Ammonium Nitrogen (NH4-N)	2.387268	0.09	%	0.001	UW A3769 III.4.1
2	1/15/2025	1/20/2025	Phosphorus, Total (P)	0.7552	0.028471	%	0.001	UW A3769 III.6.3
2	1/15/2025	1/20/2025	Potassium (K)	3.9298	0.148153	%	0.01	UW A3769 III.6.3
2	1/15/2025	1/20/2025	Sulfur (S)	0.5338	0.020124	%	0.01	UW A3769 III.6.3
2	1/15/2025	1/20/2025	Magnesium (Mg)	2.563	0.096625	%	0.01	UW A3769 III.6.3
2	1/15/2025	1/20/2025	Calcium (Ca)	4.058	0.152987	%	0.01	UW A3769 III.6.3
2	1/15/2025	1/20/2025	Sodium (Na)	1.57	0.059189	%	0.01	UW A3769 III.6.3
2	1/15/2025	1/20/2025	Aluminum (Al)	475.4	17.92258	ppm	1	UW A3769 III.6.3
2	1/15/2025	1/20/2025	Copper (Cu)	78.45	2.957565	ppm	1	UW A3769 III.6.3
2	1/15/2025	1/20/2025	Iron (Fe)	1085	40.9045	ppm	1	UW A3769 III.6.3

2	1/15/2025	1/20/2025	Manganese (Mn)	132.6	4.99902	ppm	1	UW A3769 III.6.3
2	1/15/2025	1/20/2025	Zinc (Zn)	172.9	6.51833	ppm	1	UW A3769 III.6.3
2	1/15/2025	1/20/2025	pH		7.2	Std. Unit	0.1	UW A3769 III.7

## Vibratory Separation Screen – Kilby Dairy, Rising Sun, MD

SAMPLE ID	DATE RECEIVED	DATE REPORTED	PARAMETER	DRY RESULT	WET RESULT	UNIT	LIMIT	METHOD
INFLOW	2/17/2023	2/23/2023	Moisture		94.4	%	0.1	UW A3769 III.2
INFLOW	2/17/2023	2/23/2023	Ash @ 550 C	37.5	2.1	%	0.01	TMECC 03.02-B
INFLOW	2/17/2023	2/23/2023	Organic Matter (LOI @ 550 C)	62.5	3.5	%	0.01	TMECC 05.07-A
INFLOW	2/17/2023	2/23/2023	Organic Carbon (LOI @ 550 C)	36.25	2.03	%	0.01	Calculation (OM x 0.58)
INFLOW	2/17/2023	2/23/2023	Carbon to Nitrogen Ratio (C:N)			-	0.1	Calculation
INFLOW	2/17/2023	2/23/2023	Nitrogen (TKN)	5.714286	0.32	%	0.001	UW A3769 III.3.2
INFLOW	2/17/2023	2/23/2023	Ammonium Nitrogen (NH4-N)	3.392857	0.19	%	0.001	UW A3769 III.4.1
INFLOW	2/17/2023	2/23/2023	Phosphorus, Total (P)	0.6811	0.038142	%	0.001	UW A3769 III.6.3
INFLOW	2/17/2023	2/23/2023	Potassium (K)	2.0981	0.117494	%	0.01	UW A3769 III.6.3
INFLOW	2/17/2023	2/23/2023	Sulfur (S)	0.3819	0.021386	%	0.01	UW A3769 III.6.3
INFLOW	2/17/2023	2/23/2023	Magnesium (Mg)	0.7823	0.043809	%	0.01	UW A3769 III.6.3
INFLOW	2/17/2023	2/23/2023	Calcium (Ca)	1.599	0.089544	%	0.01	UW A3769 III.6.3
INFLOW	2/17/2023	2/23/2023	Sodium (Na)	0.77	0.04312	%	0.01	UW A3769 III.6.3
INFLOW	2/17/2023	2/23/2023	Aluminum (Al)	3701	207.256	ppm	1	UW A3769 III.6.3
INFLOW	2/17/2023	2/23/2023	Copper (Cu)	111.4	6.2384	ppm	1	UW A3769 III.6.3
INFLOW	2/17/2023	2/23/2023	Iron (Fe)	4119	230.664	ppm	1	UW A3769 III.6.3
INFLOW	2/17/2023	2/23/2023	Manganese (Mn)	116.2	6.5072	ppm	1	UW A3769 III.6.3
INFLOW	2/17/2023	2/23/2023	Zinc (Zn)	134.4	7.5264	ppm	1	UW A3769 III.6.3
SWECO SOLIDS	2/17/2023	2/23/2023	Moisture		92.93	%	0.1	UW A3769 III.2
SWECO SOLIDS	2/17/2023	2/23/2023	Ash @ 550 C	13.529	0.9565	%	0.01	TMECC 03.02-B
SWECO SOLIDS	2/17/2023	2/23/2023	Organic Matter (LOI @ 550 C)	86.471	6.1135	%	0.01	TMECC 05.07-A
SWECO SOLIDS	2/17/2023	2/23/2023	Organic Carbon (LOI @ 550 C)	50.153	3.545817	%	0.01	Calculation (OM x 0.58)
SWECO SOLIDS	2/17/2023	2/23/2023	Carbon to Nitrogen Ratio (C:N)			-	0.1	Calculation
SWECO SOLIDS	2/17/2023	2/23/2023	Nitrogen (TKN)	4.031117	0.285	%	0.001	UW A3769 III.3.2
SWECO SOLIDS	2/17/2023	2/23/2023	Ammonium Nitrogen (NH4-N)	2.545969	0.18	%	0.001	UW A3769 III.4.1

SWECO SOLIDS	2/17/2023	2/23/2023	Phosphorus, Total (P)	0.4606	0.032564	%	0.001	UW A3769 III.6.3
SWECO SOLIDS	2/17/2023	2/23/2023	Potassium (K)	2.1275	0.150414	%	0.01	UW A3769 III.6.3
SWECO SOLIDS	2/17/2023	2/23/2023	Sulfur (S)	0.375	0.026513	%	0.01	UW A3769 III.6.3
SWECO SOLIDS	2/17/2023	2/23/2023	Magnesium (Mg)	0.5068	0.035831	%	0.01	UW A3769 III.6.3
SWECO SOLIDS	2/17/2023	2/23/2023	Calcium (Ca)	0.9996	0.070672	%	0.01	UW A3769 III.6.3
SWECO SOLIDS	2/17/2023	2/23/2023	Sodium (Na)	0.779	0.055075	%	0.01	UW A3769 III.6.3
SWECO SOLIDS	2/17/2023	2/23/2023	Aluminum (Al)	1702	120.3314	ppm	1	UW A3769 III.6.3
SWECO SOLIDS	2/17/2023	2/23/2023	Copper (Cu)	80.64	5.701248	ppm	1	UW A3769 III.6.3
SWECO SOLIDS	2/17/2023	2/23/2023	Iron (Fe)	1449	102.4443	ppm	1	UW A3769 III.6.3
SWECO SOLIDS	2/17/2023	2/23/2023	Manganese (Mn)	74.84	5.291188	ppm	1	UW A3769 III.6.3
SWECO SOLIDS	2/17/2023	2/23/2023	Zinc (Zn)	102.4	7.23968	ppm	1	UW A3769 III.6.3
SWECO LIQUIDS	2/17/2023	2/23/2023	Moisture		96.77	%	0.1	UW A3769 III.2
SWECO LIQUIDS	2/17/2023	2/23/2023	Ash @ 550 C	27.19	0.878237	%	0.01	TMECC 03.02-B
SWECO LIQUIDS	2/17/2023	2/23/2023	Organic Matter (LOI @ 550 C)	72.81	2.351763	%	0.01	TMECC 05.07-A
SWECO LIQUIDS	2/17/2023	2/23/2023	Organic Carbon (LOI @ 550 C)	42.23	1.364029	%	0.01	Calculation (OM x 0.58)
SWECO LIQUIDS	2/17/2023	2/23/2023	Carbon to Nitrogen Ratio (C:N)			-	0.1	Calculation
SWECO LIQUIDS	2/17/2023	2/23/2023	Nitrogen (TKN)	10.03096	0.324	%	0.001	UW A3769 III.3.2
SWECO LIQUIDS	2/17/2023	2/23/2023	Ammonium Nitrogen (NH4-N)	5.263158	0.17	%	0.001	UW A3769 III.4.1
SWECO LIQUIDS	2/17/2023	2/23/2023	Phosphorus, Total (P)	1.338	0.043217	%	0.001	UW A3769 III.6.3
SWECO LIQUIDS	2/17/2023	2/23/2023	Potassium (K)	4.6335	0.149662	%	0.01	UW A3769 III.6.3
SWECO LIQUIDS	2/17/2023	2/23/2023	Sulfur (S)	0.79	0.025517	%	0.01	UW A3769 III.6.3
SWECO LIQUIDS	2/17/2023	2/23/2023	Magnesium (Mg)	1.378	0.044509	%	0.01	UW A3769 III.6.3
SWECO LIQUIDS	2/17/2023	2/23/2023	Calcium (Ca)	2.53	0.081719	%	0.01	UW A3769 III.6.3
SWECO LIQUIDS	2/17/2023	2/23/2023	Sodium (Na)	1.69	0.054587	%	0.01	UW A3769 III.6.3
SWECO LIQUIDS	2/17/2023	2/23/2023	Aluminum (Al)	5026	162.3398	ppm	1	UW A3769 III.6.3
SWECO LIQUIDS	2/17/2023	2/23/2023	Copper (Cu)	227.6	7.35148	ppm	1	UW A3769 III.6.3
SWECO LIQUIDS	2/17/2023	2/23/2023	Iron (Fe)	3492	112.7916	ppm	1	UW A3769 III.6.3
SWECO LIQUIDS	2/17/2023	2/23/2023	Manganese (Mn)	197.2	6.36956	ppm	1	UW A3769 III.6.3
SWECO LIQUIDS	2/17/2023	2/23/2023	Zinc (Zn)	280.8	9.06984	ppm	1	UW A3769 III.6.3

