Factsheet

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Nutrient Management Act, 2002

Handling Milking Centre Washwater

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INTRODUCTION

Washwater that has been used to clean and sanitize milking equipment and milk tanks must be properly managed on the farm. The two most common acceptable methods of managing this washwater are:

- store it with liquid manure in a properly engineered and constructed liquid manure storage facility for eventual land application on the farm
- treat it, after the first rinse is diverted away from the drains, with a sediment tank and treatment trench system, also known as a septic system, approved under the Ontario Building Code

This factsheet outlines the volumes and characteristics of the washwaters for various milking systems such as tie-stall, parlour and robot, along with different options for treatment or managing washwater on the farm.

MILKING CENTRE WASHWATER

The introduction of the pipeline milking system in the late 1960s was a welcome improvement for dairy farmers everywhere. At the same time, a new problem was created — what to do with the quantity of water required to clean and sanitize the milking equipment and pipeline.

Equipment used during the milking of livestock must be rinsed, washed, acid rinsed and sanitized. Through this process, milking centre washwater is exposed to high concentrations of chlorinated alkaline solutions, acidified waters and heavy detergents that can harm the environment if they are not handled properly (Figure 1).

Figure 1. Washwater from milking centres contains pollutants that must be disposed of properly.

THE NEED FOR PROPER DISPOSAL

Washwater contains phosphates from detergents and concentrated phosphoric acid that is used to remove oils and greases and sanitize milk lines and equipment. Phosphorus is a main contaminant in surface water that leads to eutrophication — a process that increases aquatic plant growth, decreases oxygen levels and reduces light penetration, all of which harm aquatic life.

Proper storage and handling of the milking centre washwater containing phosphorus protects surface waters from eutrophication. Phosphate-free soaps are not an acceptable alternative to proper storage and treatment since the phosphates are usually replaced with nitrates. Nitrates from soap and manure can lead to contamination of surface water and groundwater.

Milk in the washwater is also a contaminant. Decomposing milk uses oxygen, while bacteria in the milk can transmit disease.

QUANTITY OF WASHWATER PRODUCED

Milking centre washwater comes from dairy cow, goat and sheep operations. To select and design the best system for the farm, determine the daily washwater production. Washwater production varies depending on the type of animal milked, the number of animals milked, the type of milking system and individual management practices. It is important to account for all of these factors when calculating daily washwater production.

Dairy Cow Operations

A survey of 300 Ontario dairy farms in the early 1990s found the average washwater produced was approximately 14 L/cow/day. This amount varied from a low of 6 L/cow/day to more than 28 L/cow/day. For dairy operations with a pipeline milking system, the average daily washwater production is 14 L/cow/day, and for operations with a milking parlour, it is only slightly higher at 17 L/cow/day.

Milking systems have made many advances over time, resulting in the introduction of milking parlours of various designs and the use of robotic milkers. The type of milking system used directly influences the amount of washwater produced.

Table 1. Average Milking Centre Washwater Production for Different Milking System Types

Milking System Type	Washwater Production (L/cow/day)
Tie stall (no pipeline/bucket milking)	7
Tie stall (pipeline)	14
Free stall (parlour)	17
Robotic (brush teat cleaning)	11
Robotic (water teat cleaning)	20

Table 1 shows the average amount of milking centre washwater produced by dairy milking cows for these different types of milking systems. Robotic milking systems typically clean the cow's teats with rotating brushes or with a water bath inside a special teat cup.

Other Dairy Operations

Table 2 shows the amount of washwater produced by goat and sheep milking herds.

Table 2. Goat and Sheep Washwater Quantities

Number of Milking Goats or Sheep	Typical Daily Washwater Production*
<100	450 L/day
100–300	570 L/day
301–500	680 L/day

* Based on: dry parlour (parlour floor scraped instead of washed), bulk tank cleaned out once a week, and no preparation on does.

Calculating Washwater Production

The numbers in Tables 1 and 2 should only be used as a rough estimate of water use. It is important to accurately measure the specific amount of water used to properly select and size the system that is best suited for the operation.

To measure the actual water used, either install a water flow meter or estimate use using a calibrated pail or the sink (if its capacity is known) and a stopwatch to time the water flow.

If the operation uses an excessive amount of water, reduce this amount to improve the performance of the disposal system and to reduce the amount of storage and handling required. To reduce water usage:

- Use proper calibration and adjust the pipeline and bulk tank wash cycles.
- Use recaptured washwater for cleaning floors.
- Direct clean water, such as the overflow from heat reclaimers, away from the floor drains.
- Make sure that any steps taken to reduce washwater do not adversely affect the cleaning of the milking system.

MANAGEMENT PRACTICES AND WATER REDUCTION OPTIONS

In 2013, a study determined the actual volume of washwater produced on different types of milking systems within Ontario. It concluded that, in addition to the number of cows and milking type, the management practices used on the farm can have a significant impact on the total volume of washwater produced. These management practices include recirculating plate cooler water, recycling washwater, choosing appropriate floor cleaning methods, preparing cows before milking and many other factors. The study found that there are four major practices contributing to the amount of washwater generated:

- sending the plate cooler water to storage instead of recirculating it
- sending the washwater to storage instead of recycling it
- including bulk tank water in the washwater
- including wastewater from other sources (washing machines, bathrooms, etc.) in the washwater

Re-circulating plate cooler water and recycling washwater can significantly reduce the total volume of washwater that needs to be stored or treated. Not including bulk tank water or other wastewater will reduce the volume of washwater even further. However, most operations include the bulk tank water in the total washwater and other washwater-producing activities.

Use the following calculations to get a better idea of the washwater volume produced on the farm:

- If the plate cooler does not re-circulate water, **add 45 L for every cow**. (A plate cooler that re-circulates water will have no impact on the amount of washwater produced.)
- If the washwater is sent straight to storage instead of being recycled, **add the volume of the average washwater production from Table 1**.
- If the bulk tank water is included in the washwater, **add 1.5 L for every cow.**
- If wastewater from other sources such as washing machines, bathrooms, etc., is included in the washwater, **add 4 L for every cow.**

To get the total washwater volume, add up all the practices that apply to the farm and **combine the total with the average daily washwater volume**.

See Table 3 for an example of a dairy operation with 80 cows. Using these figures, a milking parlour operation that incorporates all of the management practices listed would produce a total of 6,760 L of washwater per day.

This information can be used to develop more accurate washwater estimates for specific dairy operations.

Table 3. Milking Systems and Approximate Washwater Production for an 80-Cow Operation

Type of Milking System	Amount of Washwater Produced (L/day)				
		Management Practices That Increase Washwater Production			
	Minimum Daily Washwater Production[1]	Plate Cooler Water Sent to Storage Instead of Being Recirculated	Washwater Sent Straight to Storage Instead of Being Recycled	Bulk Tank Water Included in Washwater	Miscellaneous Volumes (Washing Machine, Bathroom, etc.) Included in Washwater
Tie stall (pipeline)	1,120	+3,600	NA[2]	+120	+320
Parlour	1,360	+3,600	+1,360	+120	+320
Robotic — brush teat clean	880	+3,600	+880	+120	+320
Robotic — water teat clean	1,600	+3,600	+1,600	+120	+320

[1] Based on the figures listed in Table 1.
[2] Washwater cannot be used to clean parlour floors in tie stall operations.

STORAGE AND TREATMENT SYSTEMS

Storage and treatment systems must be properly designed, installed and operated to be economical, compatible with current washwater and manure handling systems on the farm and effective in preventing pollution of surface or groundwater.

The storage systems can be either a separate storage unit designed for the quantity of washwater produced or a combined storage for both the manure and the washwater. The stored washwater is disposed of through land application or as a liquid ingredient for anaerobic digesters. The storage of milking centre washwater is regulated under the *Nutrient Management Act (NMA), 2002*, Ontario Regulation 267/03 as amended.

Applicable Regulations

Farm operations are now required to comply with requirements under Part VII.I of the Regulation for managing milking centre washwater when:

- building or replacing a milking parlour or milkroom
- expanding an existing milking parlour or milkroom if the storage capacity of the bulk tank is increased
- undertaking any construction relating to a new, replacement or existing sediment tank, treatment trench system or milking centre washwater storage facility, or
- when a farm is required to have a nutrient management strategy

An existing dairy producer who is not required to prepare an NMS under the Regulation and does not apply for a building permit for the three scenarios listed is not affected by the new regulation, assuming there is no negative effect to the environment. However, operators should always follow best management practices and dispose of milking centre washwater in an environmentally safe manner.

The Regulation includes the following options for managing milking centre washwater:

- **storing it** in a properly designed storage facility (which may also store manure), that meets the capacity requirements of the Regulation
- **treating it and disposing of it** through a sediment tank and treatment trench (i.e., septic system) that meets the requirements of either Ontario Regulation 350/06 (Building Code) made under the *Building Code Act, 1992,* or the *Ontario Water Resources Act, 1990*, or treating it and disposing of it through a regulated mixed anaerobic digestion facility
- **applying it to land** along with the sludge pump-out from the sediment tank, providing it meets the criteria set out in s.61.10 of the Regulation

Adding Milking Centre Washwater to Liquid Manure or Manure Runoff

A proven means of handling milking centre washwater is to add it to liquid manure or manure runoff storage (Figure 2). The milking centre washwater can be applied to the land along with the liquid manure or runoff material. Consider this alternative if:

- there is a properly sited liquid manure storage or runoff storage facility with enough additional capacity for the milking centre washwater or there are plans to add one in the future
- there is a large herd (>80 cows), or the operation produces a large amount of washwater (>1,120 L/day)
- there are excessive solids in the washwater
- the manure storage requires additional liquid for agitation and pumping

Liquid manure storage systems must have 240 days of storage capacity (with exceptions as defined in the regulations). Concrete, earthen and steel storage facilities are commonly used for containing liquid manure or runoff. Any concrete or steel storage that is adequate for liquid manure is also adequate for storing milking centre washwater. Further information on the siting, sizing and design of manure, runoff and washwater storage is available in *NMA, 2002*, O.Reg. 267/03, as amended.

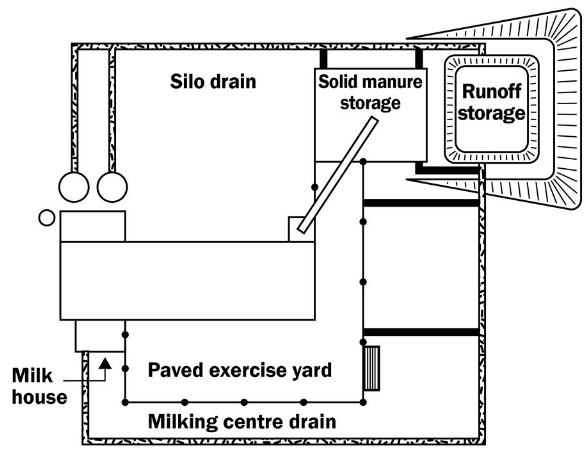

Figure 2. Washwater added to a manure runoff storage system.

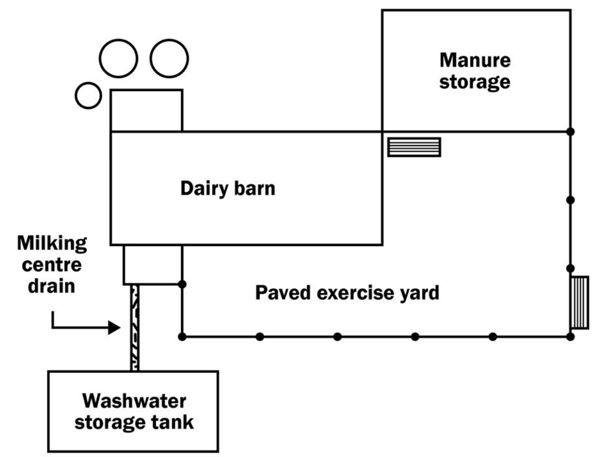

Figure 3. Store washwater separately.

Adding Milking Centre Washwater to Solid Manure Storage

Adding milking centre washwater to a solid manure storage facility adds very little fertility value to the manure. However, it may eliminate the need for liquid storage and handling. To store washwater in a solid manure storage facility:

- the storage facility must be equipped with a runoff management system
- adding washwater to the storage must not create a liquid mixture
- the amount of washwater added to the facility cannot exceed 250 L per day
- the storage must meet siting and setback requirements

When applying the manure and washwater to land, follow procedures and practices that prevent surface and groundwater pollution. For requirements on land application of manure and washwater, see *NMA, 2002*, O.Reg. 267/03, as amended.

Separate Liquid Storage

Milking centre washwater can be collected and stored in a separate storage facility (Figure 3). The facility should have the capacity to store at least 240 days of washwater production and ideally, it would have capacity for at least 365 days to reduce the frequency of required pump-outs. Consider this alternative if:

- the liquid manure storage cannot hold additional liquid
- a treatment trench system is not feasible due to heavy clay soil, a high water table or shallow soil
- a separate storage is available, and odours will not be a problem

Milking centre washwater can produce offensive odours during warm summer weather. It is wise to locate open storages far away from neighbours' dwellings and from the farm family's living area. Follow the setback distances for manure storages outlined in *NMA, 2002*, O.Reg. 267/03, as amended. An approved NMS is required before constructing any concrete, steel or earthen storage facility. Also, make sure the siting of the storage facility meets the municipal Minimum Distance Separation Formula II and any other municipal requirements.

Sediment Tank and Treatment Trench System

A sediment tank and treatment trench system is an approved method for handling milking centre washwater (Figure 4). This system requires a building permit and is regulated under the Building Code, Part VIII. The design, construction, operation and maintenance of these systems must meet the minimum requirements set out by this code.

Installing a sediment tank and treatment trench system is only allowed if:

- each individual system has a design capacity of 10,000 L per day or less
- the first rinse from the wash cycle of milking operations is not allowed to enter the system unless it is treated to an equivalent of domestic sanitary sewage before entering the treatment trench system (removing the first rinse before it enters the sediment tank and treatment trench system is the most common way of meeting this requirement, as described later)

These required setbacks from landscape features are different for the distribution pipes in the treatment trenches and the sediment tanks. The setback distances specified in the *Building Code* must be followed.

Consider the sediment tank and treatment trench system only if:

- there is no existing liquid manure or runoff storage, nor are there plans to build one
- the soil around the farm is deep and has good drainage characteristics
- the washwater is relatively free from solids
- the water that enters the system can be restricted to a minimum
- milk cannot enter the system

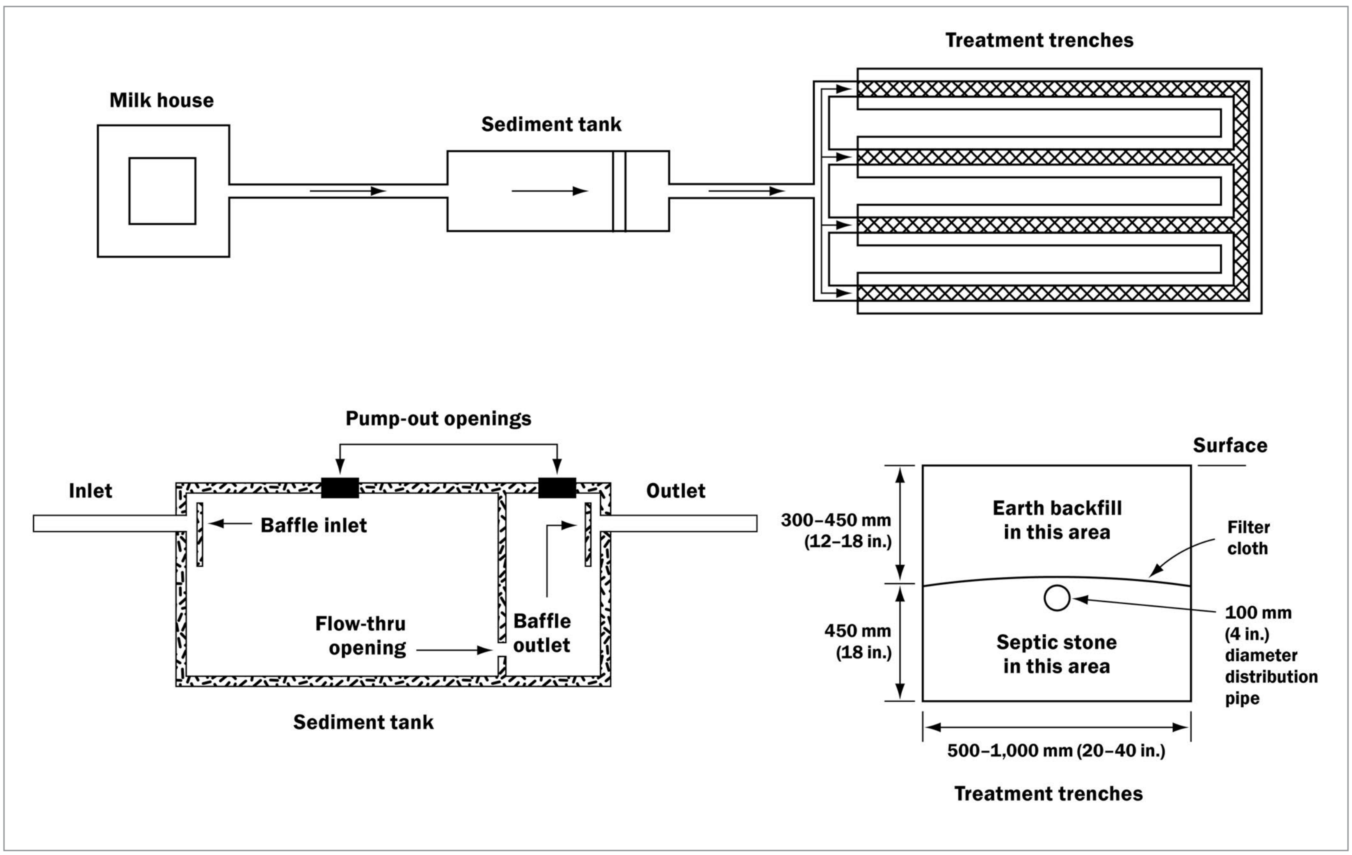

Figure 4. The sediment tank and treatment trench system is an alternative for handling milking centre washwater.

A sediment tank and treatment trench system consists of a sediment tank and several treatment trenches. The purpose of the sediment tank is to collect solids that are washed down drains and to prevent floating material from blocking the treatment trench lines. The treatment trenches distribute the liquid from the sediment tank over a large area to allow it to percolate into the soil. Bacteria attached to the stone in the treatment trench help remove contaminants in the milking centre washwater. Other contaminants, such as phosphates, are trapped and degraded by the soil.

The success of the sediment tank and treatment trench system depends on the principle of treated water draining away from the distribution pipes. Therefore, this system works best in well-drained soil types. Where finer soils exist, consider another option.

Seed the treatment trench area with grass, and fence it to prevent heavy traffic and livestock from damaging the system. Remove all water-loving trees, such as willow, soft maple, elm and poplar within 30 m of the treatment trench area. Remove other trees and shrubs within 15 m of the treatment trench.

The sediment tank must be large enough to retain the wastes until the solid particles separate out. A minimum retention time of 4 days is recommended, but 6 days is preferable. The retention time is equal to the capacity of the sediment tank divided by the daily volume of washwater produced. The tank must provide space for 6 months or more of accumulated solids. An approved two-compartment septic tank with a minimum capacity of 3,600 L is satisfactory for operations producing up to 680 L of washwater per day.

The disposal field includes distribution piping and treatment trenches. Use connecting pipe between the sediment tank and the distribution pipes in the treatment trenches. If the connecting pipe must go under a roadway, replace it with galvanized steel pipe to prevent damage due to heavy vehicles or frost.

Make the sediment tank and treatment bed large enough to accommodate any future herd expansion. Have the treatment system installed by a licensed engineer/contractor who understands milking centre washwater disposal systems.

Never dispose of waste milk, milk from treated cows or waste colostrum through the sediment tank and treatment trench system. This system is not designed to “treat” milk. In the event of a milk spill, pump out the sediment tank and properly dispose of the material immediately.

Collect the first 10–15 L of the first rinse cycle before it enters the sediment tank and treatment trench system. This washwater contains a high percentage of milk. Even a small amount of milk going down the drain every day will eventually plug the system. One method of disposing of this first rinse is to feed it to calves. There is not enough milk in this rinse water to contribute significantly to the nutritional requirements of young calves, but it can be fed to older calves that are already weaned, or it can be used as the liquid to reconstitute milk replacers. For calves 1 month of age, add the first rinse to milk to provide additional liquids.

If this system is used to treat water from a milking parlour, **do not wash manure from the parlour into the sediment tank**, as this could completely fill the system with solids in a week or less. Shovel all manure solids into manure alleys or gutters of adjoining barns before washing walls and floors into the washwater system. To wash solids from the milking parlour through the floor drain system, connect the system to a liquid manure storage tank and not to the sediment tank and treatment trench system.

Regular (once-per-year) pump-out of the sediment tank is required to ensure the solids do not clog the system.

With proper design, management and soil conditions, these systems work quite well. Failures are often due to the disposal of excess milk and water through the system. It is illegal to dispose of human wastes through any of these washwater systems. If installing a toilet, it must be connected to a separate septic tank system approved by the local regulatory agency.

OTHER SYSTEMS

Vegetated Filter Strip System (VFSS)

Vegetated filter strip systems are strips or areas of vegetation designed to remove sediment, organic matter, nutrients and other pollutants from washwater (Figure 5). VFSSs remove pollutants from washwater via a number of treatment processes, thereby protecting the environment.

As the washwater flows overland through vigorous dense vegetation, settling and some infiltration occurs. The strip is not intended to treat concentrated flows. It is an excellent method for reducing the total solids, sediment, biochemical oxygen demand and total phosphorus in the washwater.

Figure 5. Distribution pipe for a vegetated filter strip system.

The VFSS must be sited correctly to ensure the treatment system works effectively. Solids must be removed before the washwater enters the VFSS to ensure that the VFSS does not get clogged. This is accomplished through a sediment tank, as previously described. It must meet all appropriate setbacks and soil conditions. A VFSS should be designed by a professional engineer and approved under the *Ontario Water Resources Act, 1990,* through the Ontario Ministry of the Environment, Conservation and Parks prior to construction.

Engineered Wetlands

Pollutants in milking centre washwater can be removed through the use of natural processes and systems such as sedimentation and engineered wetlands (Figure 6). Wetlands have always been valued as nature's natural filter. Using engineered wetlands to remove phosphorous, nitrogen, pathogens and soluble organic material is becoming more common and is considered an acceptable way of treating and recycling milking centre washwater.

Given that temperatures in Ontario drop below freezing in the winter yet milkhouse washwater is produced year-round, it is recommended that subsurface engineered wetlands be used to treat milkhouse washwater. Subsurface engineered wetlands are constructed so that water flows below ground and is contained within an impermeable membrane or liner, ensuring that the system does not freeze in the winter months.

Figure 6. This three-celled engineered wetland treats milking centre washwater from a dairy goat operation as well as runoff from the adjacent 280-m^2 solid manure storage facility.

Subsurface engineered wetlands use gravel, water depth and aquatic plant life to reduce the presence of pollutants in the washwater. Forcing the milking centre washwater to flow through subsurface gravel allows bacteria growing on the gravel to feed on the nutrients and compete with pathogenic bacteria in the milking centre washwater as it passes through the wetland. The longer the residence time, the greater the reduction or conversion of pathogens and nutrients. Forcing the washwater to flow through a subsurface gravel medium encourages additional bacteria to thrive, increasing the rate at which soluble nutrients are degraded. The intent of an engineered wetland is to improve water quality so the discharge does not impair surface and groundwater sources.

An engineered wetland should be designed by a professional engineer and approved under the *Ontario Water Resources Act, 1990*, through the Ontario Ministry of the Environment, Conservation and Parks prior to construction.

SUMMARY

Several alternatives for disposing of milking centre washwater are described in this factsheet. Any of these options will work well if installed correctly and managed properly. The choice of the best system depends on the current operation and its future plans. Further instructions for constructing an environmentally safe and secure storage facility are available in *NMA, 2002*, O.Reg. 267/03, as amended and associated protocols.

This factsheet was updated by Peter Doris, Environmental Specialist, OMAFRA.

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