Minnesota Pollution Control Agency

Stabilization Pond Discharge Guidance

The acceptable discharge periods included in this guidance document were revised in July 2009 and may not reflect those acceptable discharge periods listed in your permit. Stabilization pond permits are being modified as they expire to reflect the dates included in this guidance. Facilities must continue to follow the dates listed in their individual permit until such time that it is updated to reflect the change. If acceptable discharge period dates in your permit are not the same as the dates in this guidance and you want to utilize the acceptable discharge periods listed in this guidance, please contact the Minnesota Pollution Control Agency (MPCA) compliance staff assigned to your facility. If your facility is covered by the Minnesota River Basin General Phosphorus Permit you must use the dates listed in that permit.

MPCA Offices

Brainerd	218-828-2494	Marshall	507-537-7146
Detroit Lakes	218-847-1519	Rochester	507-285-7343
Duluth	218-302-6656	St. Paul	651-296-6300
Mankato	507-344-5249	Willmar	320-441-6965

I. Introduction

Minnesota has more than 300 controlled discharge non-aerated stabilization pond systems. Design criteria require a minimum of 180-210 days hydraulic storage capacity, dependant on location, for controlled discharge systems. This capacity has been required to avoid discharge(s) during winter months and/or during periods of low flow rate in the receiving stream (referred to as "Problem Discharge Periods"). The standard controlled discharge National Pollutant Discharge Elimination System (NPDES) permits limitations of 25 milligrams per liter (mg/L) five day carbonaceous biochemical oxygen demand ($CBOD_5$) and 45 mg/L total suspended solids (TSS) are based upon the premise that discharges occur during periods of adequate receiving water flow rate and favorable aerobic conditions (referred to as "Acceptable Discharge Periods").

This guidance defines the "Acceptable and Problem Discharge Periods" and presents a decision-making process to assist stabilization pond operators in evaluating their discharge options. **It is emphasized that discharges to receiving waters that are under a 100 percent ice cover should occur only in emergency situations.** Discharges to 100 percent ice-covered receiving waters could results in depressed dissolved oxygen (DO) levels due to minimal treatment occurring in the ponds, minimal oxygen production by aquatic plants, and almost no atmospheric re-aeration in the receiving water. Winter field studies have documented that some receiving waters may take up to 20 to 30 river miles to recover the DO concentrations found upstream of the discharge.

Violations of effluent limitations and NPDES permit conditions can be subject to MPCA enforcement action. The intent of this guidance is to assist stabilization pond operators to manage the operation of their facilities to minimize the environmental impacts of their discharges.

II. Acceptable and Problem Discharge Periods

Stabilization ponds should be discharged during periods when receiving waters are free of ice, and water temperatures are adequate to minimize oxygen depletion in the receiving water. In Minnesota, such favorable conditions generally occur during the spring and fall of the year, although each of the state's nine major drainage basins exhibit individual hydrologic characteristics.

"Acceptable Discharge Periods" and "Problem Discharge Periods" have been identified in order to provide guidance for the management of stabilization pond systems (see Table 1 and Table 2). The spring and fall "Acceptable Discharge Periods" for the northern regions of the state are longer than those for the southern regions in order to allow for the completion of all necessary discharges while the receiving waters are free of ice cover.

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Table 1. Acceptable Discharge Periods

MPCA Brainerd, Detroit Lakes, and Duluth Offices		MPCA Rochester, Marshall/Willmar, and St. Paul Offices	
Spring	March 1 – June 30	**Spring**	March 1 – June 15
Fall	September 1 – December 31	**Fall**	September 15 – December 31

Table 2. Problem Discharge Periods

MPCA Brainerd, Detroit Lakes, and Duluth Offices		MPCA Rochester, Marshall/Willmar, and St. Paul Offices	
Summer	July 1 – August 31	**Summer**	June 16 – September 14
Winter	January 1 – February 28 (29 when applicable)	**Winter**	January 1 – February 28 (29 when applicable)

Discharging to ice-covered receiving waters maximizes the environmental impact of the discharge. Such discharges must be avoided to the maximum practicable extent possible. Receiving water that is sufficiently ice-covered to impede re-aeration of the water column is defined as 100 percent ice coverage from bank to bank, regardless of ice thickness. Although a stretch of open water may be available at or near the discharge point, the condition of the receiving water up to 25 miles downstream of the discharge must be taken into account due to the long decay rates of oxygen demanding compounds in ice-covered receiving waters.

If it becomes necessary to discharge a stabilization pond during the summer "Problem Discharge Period," there must be an adequate volume of receiving water flow to assimilate the oxygen-demanding characteristics of the discharge. Table 3 and Table 4 are guides to determine the required amount of dilution necessary.

Table 3. Dilution ratio determination

During "Problem Discharge Periods" and whenever the receiving water is 100 percent ice covered sufficient dilution must be available to protect the receiving water from excessive oxygen depletion.

The necessary amount of dilution is calculated in relation to the $CBOD_5$ concentration of the discharge according to the following table.

$CBOD_5$ Concentration (mg/L)	**Dilution Ratio (receiving water flow rate divided by discharge flow rate)**
$CBOD_5$ less than 5 mg/L	No minimum dilution ratio necessary
$CBOD_5$ 5 to 10 mg/L	3 : 1
$CBOD_5$ 10 to 15 mg/L	5 : 1
$CBOD_5$ 15 to 20 mg/L	7 : 1
$CBOD_5$ 20 to 25 mg/L	10 : 1
Greater than 25 mg/L	Call MPCA Regional Office

Note: In order to calculate a dilution ration both receiving water flow rates and discharge flow rates must be expressed in terms of cubic feet per second (cfs). The conversion factor from million gallons per day (MGD) to cubic feet per second (cfs) is: MGD x 1.5473 = cfs.

Table 4. Dilution ratio

Step 1. Calculate discharge rate from stabilization pond:

A. Size of secondary _____ acres

B. Average depth discharged each day _____ feet/day

C. _____ (step 1.A answer) X _____ (step 1.B answer) = _____ acre-feet/day

D. _____ (step 1.C answer) X 43,560 cubic feet / acre-feet = _____ cubic feet/day

E. Discharge rate

_____ (step 1.D answer) X day / 86,400 seconds = _____ cubic feet/second

Step 2. Calculate flow rate in receiving waters

A. Average stream width _____ feet

B. Average stream depth _____ feet

C. Distance float travel _____ feet

D. Time needed to travel _____ seconds

E. Average velocity (surface velocity is multiplied by 0.7 to determine the average receiving water velocity)

_____ (step 2.C answer) divided by _____ (step 2.D answer) X 0.7 = _____ feet/second

F. Flow rate

_____ (step 2.A answer) X _____ (step 2.B answer) X _____ (step 2.E answer) = _____ cubic feet/second

Step 3. Calculate dilution ratio

_____ (step 2.F answer) divided by _____ (step 1.E answer) = _____

Method for determining the dilution rate

As indicated by step 3 of the above table, the formula for calculating the dilution ratio for stabilization pond discharge to the receiving water is as follows:

$$\textbf{Dilution ratio} = \frac{\textbf{Flow rate in the receiving water}}{\textbf{Discharge rate from the pond}}$$

To determine the flow rate in the receiving water, you need an estimate of the average depth, average width, and average velocity. The average width of the receiving water should be measured directly across at a convenient point or at a bridge or crossing close to the discharge location. To estimate the average depth, several measurements should be taken and averaged. The receiving water velocity can be estimated by dividing the travel distance of an object by the travel time. To determine the discharge rate from the pond, you need to know the size of the pond and the average depth discharged each day.

Example

Step 1. Calculate discharge rate from the pond

You are discharging 0.5 feet (6 inches) per day from a 20 acre pond. Your discharge rate would be 20 acres time 0.5 feet per day time 43,560 cubic feet per one acre - foot or 435,600 cubic feet per day. You have to convert that answer to cubic feet per second by dividing by the number of second in one day (86,400 seconds in one day). The discharge rate in cubic feet per second would be 43,560 cubic feet per day divided by 86,400 second in one day or 5.04 cubic feet per second.

Step 2. Calculate flow rate in the receiving waters

The receiving water measures 8 feet across and has an average depth of 3 feet. The time for an object to travel 20 feet is 5 seconds. Or 4 feet per second. Because the surface velocity is typically 70 percent faster than the actual receiving water velocity, you must multiply the surface velocity by 0.7. Therefore, the average receiving water velocity of 4 feet per second times 0.7 or 2.8 feet per second. The receiving water flow rate (in cubic feet per second) would be 8 feet (width) time 3 feet (depth) times 2.8 feet per second (average receiving water velocity) or 67.2 cubic feet per second.

Step 3. Calculate dilution ratio

You can then determine the dilution ratio by dividing receiving water velocity (67.2 cubic feet per second) by the discharge rate from the pond system (5.04 cubic feet per second) or 13.3 to 1.

III. Pre-discharge sampling

The maximum allowable time period between pre-discharge sampling and a discharge is two weeks. If more then two weeks elapse, another set of samples must be taken. You must keep the results of pre-discharge samples with their other monitoring records, but you **should not report pre-discharge sampling results on the monthly discharge monitoring report (DMR).**

Pre-discharge samples need to be analyzed for carbonaceous biochemical oxygen demand (CBOD), total suspended solids (TSS), fecal coliform, total phosphorus, pH, and dissolved oxygen (DO). $CBOD_5$, TSS, and total phosphorus should be collected as four-sided composite samples (equal volumes from the four sides and composite into one sample). **A fecal coliform bacteria sample must be collected in a sterilized container as an individual grab sample. Total phosphorus sample(s) must be in a separate special container supplied by your laboratory**. DO and pH are individual grab samples analyzed immediately after collection and **within 24 hours prior to the discharge**. All samples delivered to an analytical laboratory (certified by the Minnesota Department of Health) must be adequately preserved and within the minimum holding times established by the laboratory.

IV. Discharge notification

Prior to a discharge, operators are required to call their MPCA Regional Office (see page one for locations) **only under one or more of the following conditions**.

1. If any of the pre-discharge sample results do not meet permitted effluent limitations.
2. If any of the discharge occurs during a “Problem Discharge Period”.
3. If a discharge is anticipate to occur to an ice-covered receiving water (regardless of whether the discharge occurs during and “acceptable or a Problem Discharge Period”).

You will need to have all relevant information available (pre-discharge sample results, dilution ratio calculation, if necessary, etc.).

V. Sampling during a discharge

During a discharge, **two samples (taken three to four days apart) are required to be taken from the final control structure every seven days of discharging.** Samples must be analyzed by a certified laboratory for $CBOD_5$, TSS, total phosphorus, and fecal coliform. Samples for pH and DO must also be taken and analyzed immediately.

VI. Acceptable discharge periods

"Acceptable discharge periods" are shown in Table 1. Other than the condition noted below in section VI.B, you do not need to call the MPCA Regional Offices prior to discharge during this time period.

VI.A. If pre-discharge sample results meet NPDES permit effluent limits

When all of the pre-discharge sample results are in compliance with the NPDES/State Disposal System (SDS) permit limits, and receiving waters are not ice-covered, the discharge can be completed without notifying the MPCA.

VI.B. If any of the pre-discharge sample results do not meet NPDES permit effluent limits

If any of the pre-discharge sample results are not in compliance with the NPDES permit limits, you must call your MPCA Regional Office.

Options include:

1. Resample for only those samples not in compliance with permit limitations.
2. Take corrective measures to reduce/eliminate NPDES permit violation(s).
3. Discharge (see note*).
4. As a last resort, operating the ponds in a continuous discharge mode (flow through, with all ponds remaining at maximum design operating depth) may be an option.

*Note: If a decision is made to discharge and the pre-discharge sample results are not in compliance with the NPDES permit limits, you are subject to MPCA enforcement action if the samples collected during the discharge indicate a NPDES permit effluent violation.

VII. Problem Discharge Periods

"Problem Discharge Periods" are shown in Table 2. Call your MPCA Regional Office for discharges being considered during these periods.

VII.A. If all pre-discharge sample results meet NPDES permit limits

1. **Summer:** A discharge may occur if adequate receiving water dilution is available.

   (See Table 3 and Table 4 for dilution ratio instructions.)

   Winter: A discharge may occur if the receiving waters are not ice-covered.
2. The discharge rate may be reduced to less than the customary six inches per day in order to obtain an adequate dilution ratio.
3. As a last resort, operating the ponds in a continuous discharge mode (flow through, with all ponds remaining at maximum design operating depth) may be an option.
4. If a discharge occurs during a "Problem Discharge Period", submittal of a Discharge Evaluation Report is required. (See the "Discharge Evaluation Report" form at www.pca.state.mn.us/water/wastewater.html#operation.)

VII.B. If any of the pre-discharge sample results do not meet NPDES permit limits

1. Resample for those values not in compliance with the NPDES permit.
2. If still in violation, take corrective measures to reduce/eliminate NPDES permit violation(s).

3. **Summer:** Discharge if an adequate dilution ratio is available.

   (See Table 3 and Table 4 for dilution ratio instructions).

   Winter: Discharge if the receiving water is free of ice-cover and an adequate dilution ratio is available.

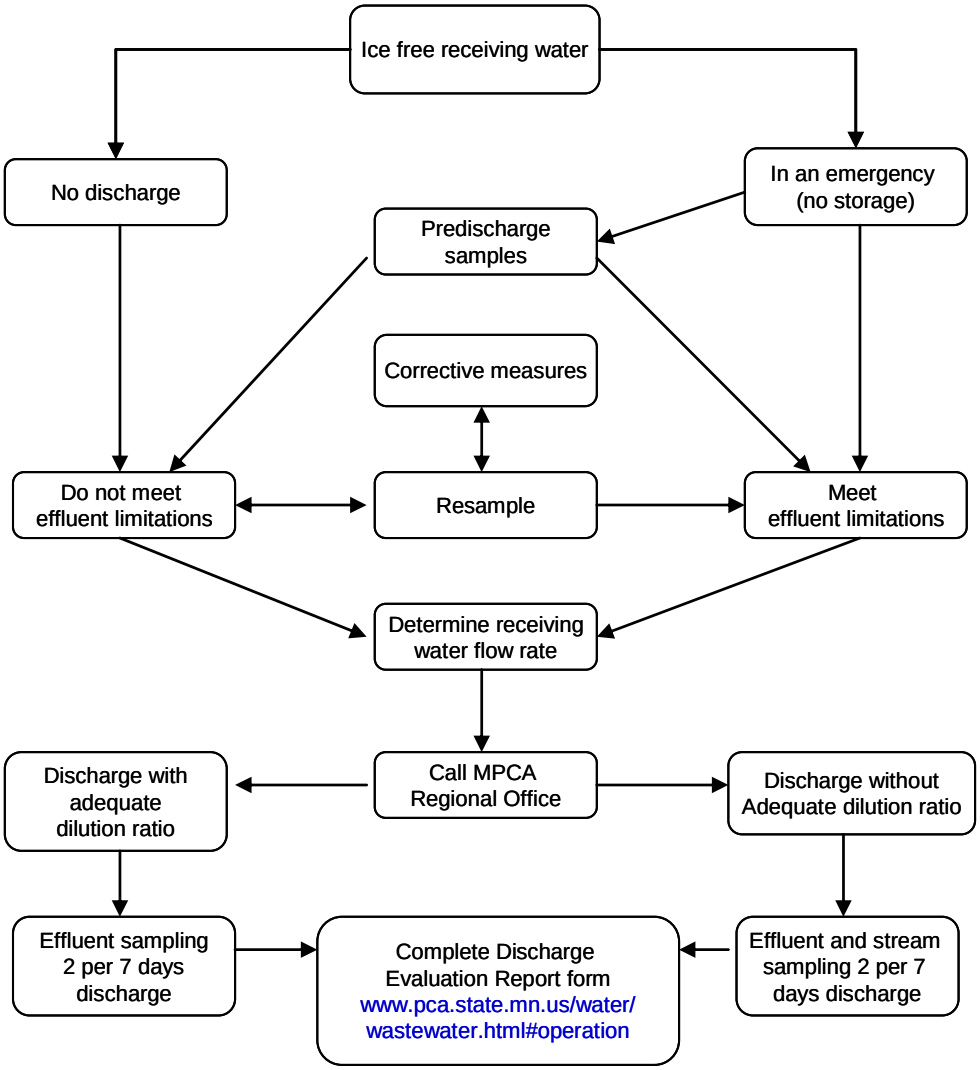
4. The discharge rate may have to be reduced to less than the customary six inches per day in order to obtain an adequate dilution ratio.
5. As a last resort, operating the ponds in a continuous discharge mode (flow through, with all ponds remaining at maximum design operating depth) may be an option.
6. If a discharge occurs during a "Problem Discharge Period", submittal of a Discharge Evaluation Report is required (see the "Discharge Evaluation Report" form at www.pca.state.mn.us/water/wastewater.html#operation).

If any of the sets of two-per-seven days of sample results meet all of the NPDES permit limits, refer to section VII.A.

If a decision is made to discharge, even though the pre-discharge sample results are not in compliance with NPDES permit limits, you will be subject to enforcement action if the samples collected during the discharge indicate a NPDES permit effluent violation.

See Figure 1 for discharges during a Problem Discharge Period.

Figure 1. Problem Discharge Period (ice free receiving waters only)



VIII. Ice covered receiving waters

Discharges to ice-covered receiving waters are in violation of NPDES permit conditions, and must be avoided regardless of whether they occur during an "Acceptable Discharge Period" or a "Problem Discharge Period". Receiving water that is sufficiently ice-covered to impede re-aeration of the water column is defined as 100 percent ice coverage from bank to bank, regardless of ice thickness. If receiving waters are ice covered and a discharge cannot be avoided, an adequate dilution ratio must be available in accordance with Table 3 and Table 4. If an adequate dilution ratio is not available, two samples per-seven-days of discharging of the receiving water monitoring are required.

Because discharges to ice-covered receiving waters maximize their adverse impacts on the environment, they are to be avoided regardless of whether permitted effluent limits are met. *In an emergency situation, when a discharge is planned to ice-covered receiving water, call your MPCA Regional Office. For late winter (February 1-29) discharges, when the initial receiving water is ice-free, but there is downstream water within 15 miles which may still be ice-covered, the discharge should not begin until two weeks after the ice-cover has left the initial receiving water. For example, the initial receiving water might be an ice-free drainage ditch which feeds an ice-covered river within 15 miles downstream.*

The exact dates associated with the onset of ice-covered conditions and ice out in receiving waters are unpredictable. If it is anticipated that a discharge may be necessary late in the fall or early in the spring, when the receiving waters may be ice-covered, you will need to determine the rate of receiving water flow in order to be able to determine the dilution ratio available for the discharge. Because of safety concerns, it would be impractical to determine the rate of flow of an ice-covered receiving water. You will need to measure the flow rate during the late fall (November/December) while the receiving water is still free of ice-cover. The late fall receiving water flow rate can be used to approximate the rate of flow during ice-covered conditions in the winter and early spring.

Receiving water flow rates from November 16 to December 15 can be assumed to be equal to flow rates on November 15.

Receiving water flow rates from December 16 to March 31 can be assumed to be half of flow rates on November 15.

VIII.A. If all pre-discharge sample results meet NPDES permit limits

1. A discharge may occur if adequate receiving water dilution is available. The discharge rate may be reduced to less than the customary six inches per day in order to obtain an adequate dilution ratio.
2. If a decision is made to discharge even though an adequate dilution ratio is not available, two samples per-seven-days of discharging of the receiving water monitoring are required.
3. As a last resort, operating the ponds in a continuous discharge mode (flow through, with all ponds remaining at maximum design operating depth) may be an option.
4. If a discharge to ice-covered receiving water occurs, discharge notification is required along with the submittal of a Discharge Evaluation Report (see the "Discharge Evaluation Report" form at www.pca.state.mn.us/water/wastewater.html#operation).

VIII.B. If any of the pre-discharge sample results do not meet NPDES permit limits

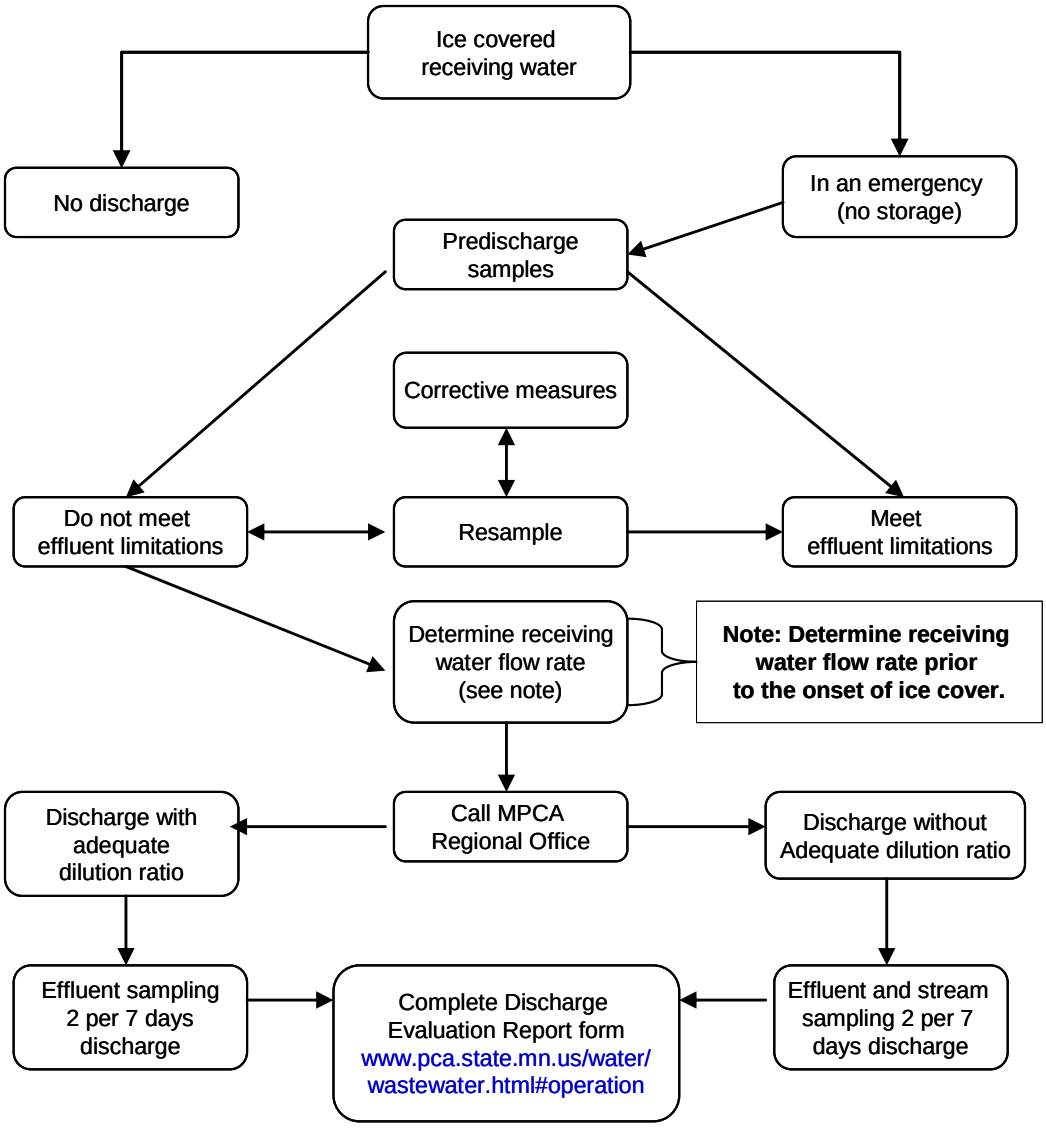
1. Resample for those values not in compliance with the NPDES permit.
2. If still in violation, take corrective measures to reduce/eliminate NPDES permit violation(s).
3. Discharge if an adequate dilution ratio is available. The discharge rate may be reduced to less than the customary six inches per day in order to obtain an adequate dilution ratio.
4. If a decision is made to discharge even though an adequate dilution ratio is not available, two samples per-seven-days of discharging of the receiving water monitoring are required.
5. As a last resort, operating the ponds in a continuous discharge mode (flow through, with all ponds remaining at maximum design operating depth) may be an option.
6. If a discharge to an ice-covered receiving water occurs, discharge notification is required along with the submittal of a Discharge Evaluation Report (see the "Discharge Evaluation Report" form at www.pca.state.mn.us/water/wastewater.html#operation).

If any of the sets of two per-seven-days of sample results meet all of the NPDES permit limits, refer to Section VIII.A.

If a decision is made to discharge even though the pre- discharge sample results are not in compliance with the NPDES permit limits, you will be subject to enforcement action if the samples collected during the discharge indicate an effluent violation.

See Figure 2 for discharges to ice-covered receiving waters.

Figure 2. Acceptable and Problem Discharge Periods (ice covered receiving stream)



XI. Operations

IX.A. Accurate influent flow measurement

Accurate influent flow measurement is necessary in order to evaluate the facility's available capacity, and to determine whether the pond system leaks excessively. An influent flow measurement device must be calibrated at least twice per year in accordance with the manufacturer's recommendations. If running time meters are used to calculate influent flows based on lift station pumping rates, pumps must be calibrated at least twice per year. In addition, a sufficient number of running time meters must be used to determine influent flows during periods when multiple pumps are operating simultaneously. As an example, the running time for each pump in a lift station is recorded by an individual running time meter. A third running time meter is needed to record the periods of time when both pumps are running at the same time. A pump calibration when both pumps run together is also required.

IX.B. Calculation of the discharge volume

The discharge volume of stabilization pond systems is typically calculated based on the area of the pond(s) at mean operating depth and the fraction of a foot of water discharged per day. In order to calculate this volume, accurate information on pond area must be available, and accurate measurements of the drop in pond level must be taken during the discharge. If the area of the ponds at mean operating depth is not known, this should be determined through a survey. The formula for calculating the discharge volume in million gallons per day (MGD) is: *Volume Discharge (MGD) = depth discharged (fraction of foot per day) times pond area (acres) times 0.326 million gallons per acre-foot.*

For example, the volume of water discharged from a four-acre pond in which the water level drops six inches in one day is calculated as follows:

Drop in water level (in feet): six inches per day divided by 12 inches per foot = 0.5 feet per day.

Volume discharged: 0.5 feet per day time four acres times 0.326 million gallons per acre-foot = 0.652 MGD.

IX.C. Controlled discharge

A controlled discharge is a normal discharge of a stabilization pond performed during an "Acceptable Discharge Period" when pre-discharge samples indicate that all effluent limitations will be met and the receiving water is free of ice-cover. Multiple ponds may be discharged simultaneously if all ponds meet applicable effluent limitations (both concentration and mass loading NPDES permit limitations).

If it becomes necessary to discharge a pond during the summer "Problem Discharge Period," there must be a sufficient receiving water flow rate (dilution ratio) to assimilate the oxygen-demanding characteristics of the discharge. The effluent flow rate may be reduced to less than the customary six inches per day in order to achieve the minimum necessary dilution ratio. This is most easily achieved if the discharge structures are equipped with valves that will allow for adjustment of effluent flow rates. If a discharge occurs during a "Problem Discharge Period" or to an ice-covered receiving water, and an adequate dilution ratio is not available, two samples, taken three to four days apart, per seven days of discharging of the receiving water monitoring is required, and a "Discharge Evaluation Report" form (see www.pca.state.mn.us/water/wastewater.html#operation) must be completed and submitted to the MPCA with the DMR. See Table 3 and Table 4 for dilution ratio determination.

IX.D. Accelerated discharge (exceeding six inches/day)

If it will not be possible to complete a series of discharges prior to the end of an "Acceptable Discharge Period," and the quality of the discharge is such that all effluent concentration limitations will be met, it may be preferable to exceed the customary 6 inch per day discharge rate, rather than discharging to an ice-covered or low dilution receiving water later in the season. Concerns with accelerated discharges include excessive scouring of the receiving water channel, re-suspension (and discharge) of solids within the stabilization pond, and the potential to damage the integrity of the pond's liner. Also, accelerating the discharge rate may cause flooding of downstream properties. Any discharge exceeding the six inches per day rate must be able to meet the mass loading limits in the NPDES permit. For help with this call your assigned compliance staff.

Many systems will be unable to increase the discharge rate due to restrictions caused by the existing pipe sizes and elevation differences between the discharge intake pipes and the outfalls. Call your MPCA Regional Office (see page one) to discuss the possibility of an accelerated discharge.

IX.E. Continuous (flow-through) discharge

Flow-through discharges should be undertaken only as a last resort, when other options have been exhausted.

A continuous (flow-through) discharge is performed by allowing the pond system to overflow at maximum design operating depths. The volume of influent wastewater forces an equal volume of water to overflow between ponds, and causes a discharge to the receiving water. A flow-through discharge is allowed in certain situations, but is not encouraged because it maximizes the probability of water quality problems.

Typically a flow-through discharge would take place if a facility is forced to release water during a "Problem Discharge Period," effluent limitations cannot be met, an adequate dilution ratio is not available, or a combination of the above-listed problems exist. Because the ponds are being operated at maximum operating depths, a discharge in the flow-through mode is likely to continue for the duration of a "Problem Discharge Period" and the quality of the discharge is likely to degrade over time, as relatively untreated (primary) wastewater mixes with better treated (secondary) wastewater.

During a flow-through discharge, effluent sampling is required two times (taken three to four days apart)

per-seven-days of discharging as specified by the NPDES permit. If a flow-through discharge occurs during a Problem Discharge Period or to an ice-covered receiving water, and an adequate dilution ratio is not available, two samples, taken three to four days apart, per-seven-days of discharging of the receiving water monitoring are also required. A "Discharge Evaluation Report" form (see www.pca.state.mn.us/water/wastewater.html#operation) must be completed and submitted to the MPCA with the DMR.

IX.F. TSS and pH problems

Stabilization ponds that are properly operated and loaded within design parameters have experienced problems with elevated pH concentrations and algal blooms that cause TSS effluent limitations to be exceeded. Nutrients such as nitrogen and phosphorus in wastewater and favorable growth conditions cause algal blooms in pond systems, which cause effluent TSS concentrations to rise. During daylight hours, photosynthetic activity by algae consumes carbon dioxide, depleting concentrations of carbonic acid in the water column and causing pH concentrations to rise. During night time hours, algal respiration produces carbon dioxide which dissolves in the water column as carbonic acid, causing pH concentrations to drop. If TSS concentrations are in excess of 45 mg/L, but less than 65 mg/L**,** it may be preferable to discharge in violation of permitted effluent limitations rather than wait for the ponds to "clear up" and risk having to discharge in a limited dilution condition or to an ice-covered receiving stream. Although either situation would result in NPDES permit violation and is subject to MPCA enforcement action, a discharge with adequate receiving water flow and favorable re-aeration conditions will usually result in a lesser environmental impact. Call your MPCA Regional Office (see page one) to discuss discharge options and receiving water sampling requirements.

IX.G. Chemical addition

Chemicals such as alum (aluminum sulfate), ferric chloride, potassium permanganate, Hydrothol 191, or sodium percarbonate may be used to enhance the reduction of suspended solids. Due to toxicity concerns to sensitive receiving waters, the use of copper sulfate as an algaecide is discouraged. If copper sulfate is used, effluent and receiving waters copper limits must be complied with. Dosages of all chemical additives should be in accordance with the manufacturer's recommendations, along with proper holding time prior to discharging. Call your MPCA Area Regional Office (see page one) for advice on using any chemical.

IX.H. Receiving water sampling

Discharges to ice-covered or low flow rate receiving waters may deplete dissolved oxygen levels and disrupt the aquatic habitat. In order to protect receiving waters from harmful discharges during periods when these conditions may occur, an adequate dilution ratio (proportion of receiving water flow rate to effluent flow rate) must be available in proportion to the effluent's oxygen demanding characteristics. Table 3 and Table 4 present a minimum necessary dilution ratio scale based on effluent $CBOD_5$ concentrations. Two samples per every seven days of discharging of the receiving waters for DO is required if the wastewater treatment facility is discharged during a "Problem Discharge Period" or to an ice-covered receiving water, and an adequate dilution ratio is not available.

Two samples (taken three to four days apart) per seven days of discharging of the receiving waters for pH, fecal coliform bacteria, and total phosphorus are required if pre-discharge or effluent samples indicate that effluent limitations for these parameters will be exceeded during a "Problem Discharge Period" and an adequate dilution ratio is not available. For minimum necessary dilution ratios (see Table 3 and Table 4).

If a discharge occurs during a "Problem Discharge Period" or to an ice-covered receiving water and adequate dilution ratio is not available, receiving water sampling is required two times per week, taken three to four days apart.

- **Dissolved Oxygen (DO)**

  Receiving water samples for DO must be collected upstream of the discharge point (to establish the background conditions of the receiving water), and in the downstream river reach that is likely to be impacted by discharges that occur during "Problem Discharge Periods."

  During warm weather months, the DO impact zone is likely to be within one to three river miles downstream of the discharge point. The DO impact zone for a discharge to ice-covered receiving water is likely to be 15 to 25 river miles downstream of the discharge point. Open water DO samples must be collected during the early morning hours (within 2 1/2 hours after sunrise). DO samples taken from ice-covered receiving waters can be collected at any time during the day. **All DO samples must be analyzed immediately.**

- **pH**

  If pre-discharge or effluent sample results indicate that pH effluent limitations will be exceeded, pH samples shall be collected upstream of the discharge point, and one to three river miles downstream of the discharge point. All pH samples must be analyzed immediately.

- **Fecal coliform**

  If pre-discharge or effluent sample results indicate that fecal coliform bacteria effluent limitations will be exceeded, fecal coliform bacteria samples shall be collected upstream of the discharge point, and one to three river miles downstream of the discharge point. Fecal coliform bacteria samples must be collected as individual grab samples collected in sterilized containers, adequately preserved, and delivered to the laboratory for analysis within the minimum specified holding time.

- **Total Phosphorus (TP)**

  If pre-discharge samples indicate that TP effluent limitations will be exceeded after chemical treatment has taken place, TP samples shall be collected upstream of the discharge point, and one to three river miles downstream of the discharge point. TP samples must be taken as individual grab samples in their own special container, adequately preserved and delivered to the laboratory for analysis within the minimum specified holding time.

Report all receiving water monitoring results to the MPCA on the Discharge Monitoring Report (DMR) for the month during which the discharge occurred. If receiving water samples were not, or could not be obtained, specify why samples were not collected.

IX.I Adequate Elevation Difference

In order to completely fill up a secondary cell either before or after a discharge, an elevation difference of at least four feet is necessary. Without this difference, the discharge time will be drastically increased; sometimes up to double the total discharge time. If this elevation difference is not present, a pump must be purchased. In order to transfer at least six inches per day, a pump of 100 gallons per minute per acre is needed. Pumping is done from the control structure.