

Wastewater

Lagoon Systems Frequently Asked Questions (FAQ)

The Michigan Department of Environmental Quality (DEQ), Water Resources Division (WRD) has developed this FAQ sheet for compliance assistance purposes. The answers to these questions are based on the requirements of the National Pollutant Discharge Elimination System (NPDES) Lagoon General Permit; Part 41, Sewerage Systems, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA); and the recommendations of Ten States Standards. Lagoon Facilities authorized by an Individual Permit or Groundwater Permit may be different. Permittees should refer to their permit for specific requirements.

Please contact your local DEQ district office with any compliance questions, and Surface Water Permit Section or [Groundwater Permits Section](#) for permitting questions.

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Sampling

1. *How should I collect grab samples during pre-discharge events?*

The pre-discharge sample should be drawn from a point about five feet from the edge of the cell and one foot below the water surface.

2. *When do I have to take my pre-discharge dissolved oxygen (DO) sample?*

The DO must be sampled within the last 24 hours prior to notification. We recommend that a DO sample be taken just before the discharge begins to assure the DO concentration has not dropped below an acceptable level. Due to diurnal fluctuations, a DO sample collected during daylight hours will produce the highest DO concentration. The DO sample should be taken at a time that is representative of the discharge. If the discharge will be continuous over a 24-hour period, a sample collected during the period around sunrise will represent the worst case, but would be most appropriate since the DO limit is a daily minimum.

3. *How should I collect grab and composite samples during discharge events?*

Effluent samples should be collected before the effluent mixes with the receiving stream or any other water source. Sampling methods are defined as:

- Grab sample is a single sample taken at neither a set time nor flow.
- 3-Portion Composite sample is a sample consisting of three equal volume grab samples collected at equal intervals over an 8-hour period.
- 24-Hour composite sample is a flow proportioned composite sample consisting of hourly or more frequent portions that are taken over a 24-hour period.

4. *What sort of bottles can I collect samples in? Are old, used milk jugs/cartons okay?*

Required containers, preservation techniques, and holding times for samples are outlined in Title 40 Code of Federal Regulations (40 CFR), Part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants, Table II. The type of bottle used for sample collection and sample holding varies based on the parameter. Parameters required by the general permit for wastewater storage lagoons (WWSL) must be sampled with either a polyethylene bottle or glass bottle. Milk jugs are generally made of polyethylene, which is an acceptable bottle type, although all sampling equipment must be clean to ensure you obtain a representative sample. We encourage you to use bottles that have not been formerly used for food storage.

Your facility permit may require sampling for parameters that require specialized sampling equipment. You should review the 40 CFR, Part 136, Table II requirements if you do not know what type of bottle to use for sampling. [Access the most current U.S. Environmental Protection Agency approved sampling, preservation, and analytical requirements in 40 CFR, Part 136.](#)

Reporting

5. *How do I calculate a geometric mean?*

A [monthly operating report spreadsheet](#) that will make this calculation for you is available online. Commonly available spreadsheets and online resources may also calculate geometric means, such as the [Horton geometric mean calculator \(www.graftacs.com/geomean.php3\)](#). Please make sure the calculator that you are using is correct; the DEQ WRD does not endorse any specific online resource. District staff can provide more assistance if needed.

Geometric Means for two or more numbers: Fecal coliform numbers need to be summarized as geometric means, not as simple averages. As an example, assume 7 days of discharge, with the following data:

<1, 150, 34, 4, 533, 8, and 2

First of all, the "<1" becomes a "1". Then take the logarithms of all numbers and sum them up:

$$= \log 1 + \log 150 + \log 34 + \log 4 + \log 533 + \log 8 + \log 2$$

$$= 0.0000 + 2.1761 + 1.5315 + 0.6021 + 2.7267 + 0.9031 + 0.3010 = 8.2405$$

The average of this sum is $8.2405 / 7 = 1.1772$.

Use the 10^x key to calculate Geometric Mean = $10^{1.1772} = 15$

Note: This example is only used to demonstrate how to calculate geometric mean. Please refer to Question 6 for guidance on calculating 7-day averages.

6. *How do I calculate 7-day averages?*

The 7-day average is derived by taking the average of the samples collected in any 7-day period during discharge. Days with no discharge shall not be used to determine the value. During discharge, a rolling 7-day period is used to calculate 7-day averages.

With the exception of geometric mean, calculate the 7-day averages by adding the available data within each 7-day period and dividing it by the number of data points. For example, a facility discharges every day, but monitors five days each week. For one 7-day period, their total suspended solids (TSS) would be calculated as follows (before rounding):

$$\frac{(37.5\text{mg/l} + 46\text{mg/l} + 48.5\text{mg/l} + 76\text{mg/l} + 40\text{mg/l})}{5 \text{ data points}} = 49.6 \text{ mg/l 7-day average}$$

In another example, a facility discharges for 11 days and has six data points. Since the days before the first day of discharge and days following the last day of discharge are not to be included, there are five 7-day periods to consider (days 7 through 11). With the exception of geometric mean, calculate the 7-day averages by adding the available data within each 7-day period and dividing it by the number of data points.

For 7-day average geometric mean, calculate the geometric mean for the data points included in each of the 7-day periods (see instructions above for calculating a geometric mean).

DEQ district staff can provide more assistance if needed.

7. *How do I complete DMRs for a discharge event that occurs partially in each of two months?*

A Summary and Daily DMR should be submitted for both months that include part of the discharge event. As required by the permit, the monthly average and any 7-day average shall be reported on the Summary DMR form for the month in which the last day of the discharge occurred. On the Summary DMR, for the initial part of the discharge, the non-numeric code *E (“This effluent limit not applicable in this reporting period”) should be entered for monthly averages and 7-day averages. Daily effluent data should be reported on the Daily DMR forms for both months that included part of the discharge event..

8. *Do DMRs need to be submitted during non-discharge periods?*

A DMR must be submitted for each month when discharges are authorized. If no discharge occurred during the month, the Daily and Summary DMR can be marked “No Discharge.” A DMR is not required for months when discharges are not authorized. If you have a discharge during these periods, it is not authorized and special reporting requirements will apply. Contact DEQ district staff for further instructions.

NOTE: DMR QUESTIONS NOT ANSWERED HERE MAY BE ANSWERED BY CONSULTING THE [DMR FAQ DOCUMENT](#).

9. *What is the Treatment Facility Monitoring Program (aka Monthly Operating Reports)?*

Part 41 requires facilities that serve the public to provide a monthly summary of operational data to the DEQ. This summary of data has historically been called monthly operational reports (MORs). The Treatment Facility Monitoring Program is an evaluation of the adequacy of the operational data being collected. An acceptable program should include a description of facility operations (*i.e.* weather, influent flow, maintenance checks, dissolved oxygen (DO) concentrations in each cell, etc.), an outline of sampling frequencies at each stage of the treatment process, and examples of inspection and analytical data forms.

After receiving approval of your Treatment Facility Monitoring Program, it is acceptable to maintain copies of your monitoring records on-site, instead of submitting them (retained self-monitoring) unless you have been notified by the district office to submit them. If retained self-monitoring is not authorized, the facility will be provided an explanation.

10. Who is required to submit a Treatment Facility Monitoring Program?

Because this is a Part 41 requirement, it will apply to all systems that serve the public such as publicly owned wastewater treatment systems and wastewater treatment plants that serve condominiums and subdivisions.

11. Where can I find examples of acceptable operational forms required by the Treatment Facility Monitoring Program?

Examples of treatment facility monitoring forms/requirements for publicly owned lagoons can be found on the DEQ wastewater construction Web site at <https://www.michigan.gov/Part41>.

Operation and Maintenance

12. Can lagoon discharges occur when ice covers the ponds or when ice is present on the receiving water body?

Discharges can occur when ice covers the ponds as long as dissolved oxygen (DO) concentrations are above 5.0 mg/L. Discharges are prohibited when significant ice cover is on the receiving water unless authorized by the WRD. When there is significant ice-coverage on the receiving waters, DO levels could be depressed due to minimal treatment occurring in the ponds, minimal oxygen production by aquatic plants, and almost no atmospheric re-aeration in the receiving water.

13. Is it acceptable to use livestock to maintain the vegetation around the lagoons?

While this practice is not encouraged; there is currently no prohibition to using livestock to maintain the vegetation around the lagoons. The facility must be aware of, and protect against, potential problems. Hooves can cause slumping, break-down berms, or cause erosion that may impair the structural integrity of the cell liners, which the facility will be required to repair. In addition, animal wastes may create a pathogen issue if the animals are allowed around an isolated cell preparing for discharge.

14. What are acceptable means of controlling vegetation on the inner dikes of the lagoons?

To preserve the integrity of the lagoon liner, the General Permit specifies that vegetation shall be maintained at a height not more than six inches above the ground on lagoon dikes. There are several means of controlling vegetation, including mowing, burning or chemical treatment. Options available depend on whether the inner banks consist of rip rap or are strictly grass and/or other vegetation. Ideally, lagoon staff are able to maintain a grassy inner bank through regular mowing without allowing the vegetation to exceed the 6-inch maximum allowed by the permit. More difficult is maintaining vegetation growth in rip rap material. Ideally a chemical treatment can be applied during first growth in early spring. Chemical treatment can take place without DEQ approval if the chemical does not come in contact with lagoon wastewater. However, it should be noted that if growth cannot be controlled chemically, physical removal or burning is an option. It is recommended that burning take place in late fall, winter, or early spring when the plants have died and are dry. Check with your local government regarding burning ordinances.

15. What should be included during permittee Operation and Maintenance (O&M) checks (i.e. transfer piping, looking for corrosion, etc.)?

Facility staff should have an adequate understanding of both the condition and performance of the infrastructure throughout the lagoon and collection system. Periodic evaluations and O&M activities should be performed by facility staff to keep infrastructure in good working condition. The following are examples of basic information that should be collected to ensure adequate O&M of the facility:

- Does the staff have access to accurate and up-to-date drawings of the lagoon and collection system infrastructure?
- What material are the lagoon's underground pipes made of?
- What is the current condition of the lagoon's pipes and/or when was the last time they were inspected?

- What condition are the lagoon's transfer valves? Are they periodically "exercised" to make sure they can function?
- Is there any evidence of valve leakage?
- If the facility is not discharging, is there any flow at the outfall?
- Is the lagoon equipped with emergency overflow pipes to prevent failure of the lagoon dikes?
- Are emergency overflow pipes blocked or inoperable? If so, why? Are they periodically checked in case they are needed?
- Does the facility utilize emergency overflow pipes to transfer water from one cell to the other? If so, why?
- Is the facility able to operate as originally designed (for example, parallel vs. series operation)?

16. What is the concern about muskrat holes?

An impermeable liner (clay, HDPE, etc.) prevents wastewater from leaking out of the lagoon and contaminating the groundwater. A layer of clay that is about two feet thick is used to line many wastewater lagoons. A muskrat hole can create a leak in the liner that could result in groundwater contamination or unauthorized and uncontrolled discharges to surface waters. The permit requires berm damage to be repaired immediately.

17. How do you check for lagoon leakage?

Lagoon leakage can be detected by simple visual observations (e.g. flowing or ponding water coming from the side of a cell) or an Exfiltration Test. Exfiltration Tests involve measuring lagoon levels compared to evaporation and precipitation rates over a period of time. It is not very accurate and detects only gross leakage. A more thorough investigation may be needed and would be conducted by groundwater monitoring. The DEQ believes that installing monitor wells down gradient of the lagoon and sampling for representative wastewater constituents (groundwater monitoring) is a more accurate method for detecting leakage.

Upon receipt of an NPDES permit application for lagoon discharge, DEQ will conduct a lagoon exfiltration/leakage evaluation to determine the need for groundwater monitoring at a lagoon facility. As part of the application, the facility provides additional information about lagoon construction, repairs and potential leakage observations. Based on this information as well as local hydrogeologic conditions, site location and water usage, DEQ will determine whether groundwater monitoring is necessary.

18. How much algae is too much?

While algae creates oxygen during daylight hours (through photosynthesis), it uses dissolved oxygen (DO) at night for respiration. Excessive algae could result in low DO conditions that could affect the treatment efficiency of oxygen demanding pollutants such as ammonia and biochemical oxygen demand. Because algae is accounted for in the total suspended solids (TSS) concentration, excessive algae could increase levels of TSS above the NPDES permit levels. Excessive algae could also clog irrigation lines resulting in uneven application. As long as you comply with all other requirements in your permit, this may not be an issue for you.

19. How do you control algae growth?

Algae can be chemically treated, but authorization for any treatment additives must be obtained prior to use. Excessive algae could be the result of high nutrient loadings so if an algae bloom occurs and if it is unusual for your system, it may be a good idea to monitor the influent to help identify potential sources/causes of the bloom. Find more information about water treatment additives at Michigan.gov/EGLEnpdes.

20. Does the DEQ have a position about the use of barley to control algae/total suspended solids (TSS)?

The use of barley straw without DEQ authorization is prohibited. There are potential toxicity issues with barley straw. DEQ urges the use of other algaecides which contain the appropriate aquatic toxicity data for us to review. To apply to use barley straw, you will be required to submit a non-select water treatment additive (WTA) request in MiWaters. Information about submitting a non-select WTA request is at Michigan.gov/EGLEnpdes.

21. Duckweed seems uncontrollable; how am I supposed to deal with it?

The general permit prohibits more than 40 percent of the water surface area be covered by floating vegetation. An area estimate for duckweed is difficult to assess because it can go from a small percent to over 80 percent coverage in a single day of growth and depending on wind conditions. Excessive duckweed can cause interference with the treatment process through blockage of sunlight and reduction in water movement resulting in a decrease of dissolved oxygen (DO). Excessive duckweed can also trap grease and scum, create odors, and provide areas for insect breeding.

Duckweed can be removed manually by using rakes or skimmers, or removed chemically by using an herbicide. Requests to use herbicides and other water treatment additives must be made to the DEQ prior to use. The DEQ prefers physical removal because dead vegetation left in the lagoon can result in a biochemical oxygen demand and solids loading problem.

22. What is turnover?

Turnover is the mixing of aerated surface waters with bottom waters. During the summer, surface waters are warmed by the sun and become less dense than the colder water beneath. The waters become stratified into two layers which do not mix. In fall, colder temperatures cool the top layer down to the same temperature as the bottom layer. At this time, they have the same densities so they can easily mix. Strong fall winds blow surface water to the leeward shore. Bottom water wells up in its place, causing the displaced surface water to sink.

During warm weather, algae grow in the top layer and when they die, they sink and carry nutrients with them. The dead algae decompose in the bottom layer, and in the process use up all the oxygen. At summer's end, the warm top layer is well oxygenated, but poor in nutrients, while the cold bottom layer is poor in oxygen, but rich in nutrients. Turnover causes re-oxygenation of bottom water, and a return of nutrients to the surface water. Some of the anaerobic constituents in the bottom waters can cause odors. A similar, but less extreme, stratification can occur in winter, with turnover in spring.

23. How do you control/abate odors during turnover?

As noted above, odors during turnover are not unexpected. Some facilities begin aeration early in the spring in order to shorten turnover time. Deodorizing sprays can be used in the vicinity of the lagoons as a temporary measure to mask the odors. These sprays may not be applied directly into the lagoons. The use of chemicals to increase the dissolved oxygen (DO) concentration in the lagoon (to offset the anaerobic conditions) has also been used, but it requires DEQ approval prior to use.

24. Is it okay to use my lagoon water or effluent to irrigate my lawn, to use it for dust control on the roads, or for a neighboring farmer to use it to irrigate his crops?

The NPDES discharge permit only authorizes a discharge of treated wastewater to a designated receiving surface water. You may not discharge treated wastewater from the WWSL to any other receiving water or to ground without appropriate authorization.

A discharge to a lawn, roads, or crop irrigation may require authorization through a Michigan Groundwater Discharge Permit. Information on how to apply for a groundwater discharge permit is available at <https://www.michigan.gov/som/government/state-license-search>.

25. Can I accept hauled wastes, septage, or port-a-john wastes? Can I accept contaminated groundwater or any other wastewaters not specified in my permit application?

A facility should carefully review all requests to accept hauled wastes including septage, port-a-john waste, and contaminated groundwater. If identified in your NPDES or groundwater discharge permit application, all of the above may be accepted if the material will not bring the lagoon out of compliance with permit limits, if the discharge will not exceed the groundwater concentrations identified in Part 22 Groundwater Quality, promulgated under Part 31, if it is not toxic to treatment microorganisms, and if it will not create nuisance conditions. If these wastes have not been identified in your wastewater discharge application, then that will need to be done first (you may need to submit a permit modification request with an updated application, so check with the local

district office). Waste acceptance should be regulated through a municipal ordinance that includes a procedure for review of the material.

Since these wastes may be high-strength or include unusual chemicals, careful consideration is required. At a minimum, the permittee should demonstrate to the DEQ that it can accept these additional wastes without adverse impacts on the wastewater treatment system or its ability to comply with permit effluent limits. Wastewater characteristics (which may be estimated) should be investigated and the additional loadings estimated and compared to the facility's design loadings and/or maximum allowable headworks loadings, if available. Contact your District Industrial Pretreatment staff for guidance on how to conduct this evaluation.

Septage receiving stations require a construction permit (under Part 41 for systems that serve the public and are connected to the Part 41 collection or treatment system or through Part 117, Septage Waste Servicers, of the NREPA). Prior to accepting septage waste, all septage receiving stations must develop and submit an operating plan for review and approval by the DEQ Septage Waste Program. Details concerning this requirement can be requested from the program by calling the program coordinator at 517-780-7874. [Additional information can be found on the program website at www.michigan.gov/EGLSeptage.](http://www.michigan.gov/EGLSeptage)

26. What sort of security fencing is considered adequate?

The NPDES permit requires that the lagoons be enclosed by security fencing with gates wide enough to accommodate mowing machinery. All gates shall be locked to prevent unauthorized access. Metal warning signs shall be posted on the fencing.

Facilities that serve the public must also consider Section 93.51 of the Ten States Standards which states that, "The pond area shall be enclosed with an adequate fence to prevent entering of livestock and discourage trespassing. Fencing should not obstruct maintenance vehicle traffic on top of dikes. A vehicle access gate of sufficient width to accommodate mowing equipment shall be provided. All access gates shall be provided with locks."

Lagoon systems that utilize sophisticated mechanical equipment should consider more secure fencing and access control.

27. What authorizations/notifications/permits are required if you add aerators, mixers, or diffusers to the lagoons?

A Part 41 Wastewater Construction Permit is required for the addition of aeration devices and mixers prior to implementation for systems that serve the public. Addition of this equipment for systems that do not serve the public does not require a permit, but a notification to the DEQ is appreciated since it will likely improve treatment performance.

If aeration or other mechanical devices are added, it could result in a change to the facility classification and require a certified operator with the appropriate certification. A stabilization lagoon with no mechanical treatment is classified as an L1 system, but a lagoon system with aeration or other mechanical devices would be classified as an L2, or greater. Please contact your local district office regarding facility classification questions.

Solids Handling

28. How do I check my sludge levels?

If sludge levels are checked in the winter, it should be after a safe layer of ice has formed. A grid can be marked off on the ice and holes bored along the grid. The sludge can then be measured through these holes with a conventional sludge judge. The grid is necessary to be able to average the sludge depth.

If there is no ice cover, a boat should be used so interior locations can be checked. Several locations in a cell should be checked including the end of the inflow pipe, the center, and at the corners.

29. How often should I measure sludge depth?

Accruing sludge is a function of the organic loading a lagoon system receives. Some lagoon systems are preceded by septic tanks that capture the majority of solids so it will take many, many years to accrue to a level that requires action. The sludge levels will also vary depending on the cell and its function. Primary influent cells will accrue sludge much more quickly than polishing cells.

We recommend that you check sludge levels once after the first ten years of operation and then annually after year 15 of operation in lagoon cells that receive loadings they were designed to handle.

30. When do I need to start planning for sludge removal?

The true answer is when you first build the lagoon. Too many times, communities ignore collecting enough in sewer use fees to cover the sludge removal project when it is necessary. When average sludge depth (measured from the bottom of the cell) reaches 1.6 feet, the lagoon has reached 80 percent of what is considered capacity (two feet). This would be the time to start planning for sludge removal since it is a costly proposition. Sludge removal should be initiated before the accumulation begins to affect your ability to meet permit limits.

Non-Compliance

31. Do I need to send the DEQ a letter when I have a really minor exceedance? What if I have already called it in?

Non-compliance notification requirements are outlined in the NPDES permit. 24-hour verbal reporting and a five-day written report are required for exceedances that may endanger health or the environment, which include daily minimum and maximum concentration limitations. Any other excursions from effluent limitations can be addressed through a written explanation in the comment section of the monthly DMR form.

32. If it is discovered that the lagoons are overflowing/discharging during an unauthorized period, what follow-up response is required?

There are really three issues here:

The first issue is the structural integrity of the lagoon system. If the discharge is over the top of the dike, the increased pressure to the top of the dikes could cause a failure of the structural integrity of the system. Immediate action should be taken to reduce the volume in the WWSL, in consultation with DEQ district staff. Hauling excess wastewater should be considered in addition to an out of season discharge. After the discharge has ceased, needed repairs must be completed where any damage has occurred. Any time the minimum freeboard is not maintained, contact the DEQ staff to discuss strategies for dealing with the situation.

The second issue is the reporting requirements associated with an unpermitted discharge of sanitary sewerage. Discharges out of season are considered partially treated discharges and must be reported to the DEQ and others in accordance with Section 324.3112(a) of the Michigan Act. The reporting requirements should be followed which includes notification to the DEQ, health department, local newspaper (as well as any other affected municipality that has requested notification), no more than 24-hours after the discharge begins, followed by completion of the DEQ's Report of Discharge Form. You can find more information about the discharge of untreated or partially treated sewage at <https://www.michigan.gov/Part41>.

The third issue is the capacity of the lagoon system. These conditions suggest that an expansion may be needed/overdue or that there is excessive inflow and infiltration (I&I) into the system. Smoke testing, lining the sewers, checking for open manholes, etc., are all tools to investigate and resolve I&I issues. Having to discharge outside the authorized period because the lagoon was not able to achieve effluent limits during the authorized discharge period may suggest issues such as organic overloading of the treatment system, the need for system upgrades, excessive sludge blanket levels, or failure to properly operate the lagoons. Each of these potential deficiencies should be evaluated through appropriate follow-up actions such as influent sampling, sludge blanket analysis, and detailed review of operational logs

A facility can apply for a continuous discharge if an extended discharge authorization period is needed. It is likely that effluents limitations will be more restrictive and active disinfection would be required because the discharge could occur during total body contact recreation seasons. These issues should be discussed with DEQ district staff so an acceptable resolution can be found.

33. If my sampling shows that I am exceeding the NPDES limits, do I have to stop discharging?

When effluent limits are exceeded, we recommend, whenever possible, that the discharge be stopped. There may be occasions where the permittee may decide to continue the discharge because they no longer have capacity and must discharge to protect the structural integrity of the berms. If this occurs, the permittee should discuss the situation with the DEQ district office so they are aware of the situation.

Miscellaneous

34. Why is there a difference between the spring and fall total suspended solids (TSS) discharge limitations?

The alternate effluent limitations were established because the DEQ determined that wastewater storage lagoons could meet this level of treatment at a frequency satisfactory to the DEQ. In addition, as algae dies in the fall and is discharged, we need to be protective of the dissolved oxygen (DO) impact the algae could have on the receiving stream.

35. Has the DEQ considered adjusting the authorized discharge periods for facilities located in the Upper Peninsula that have extended ice coverage on their lagoons?

The Upper Peninsula District Supervisor may extend the spring discharge period from April 1 through June 21 for lagoon systems located in Baraga, Dickinson, Gogebic, Houghton, Iron, Keweenaw, Marquette and Ontonagon counties. Please contact for Upper Peninsula District Supervisor for approval to extend the discharge period.

All other WWSL discharges have been limited to periods other than the total body contact recreation period in accordance with the designated uses identified in Michigan's Water Quality Standards:

“R 323.1100 Designated uses.

Rule 100. (1) At a minimum, all surface waters of the state are designated and protected for all of the following uses:

- (a) Agriculture.
- (b) Navigation.
- (c) Industrial water supply.
- (d) Warmwater fishery.
- (e) Other indigenous aquatic life and wildlife.
- (f) Partial body contact recreation.
- (g) Fish consumption.

(2) All surface waters of the state are designated and protected for total body contact recreation from May 1 to October 31 in accordance with the provisions of R 323.1062. Total body contact recreation immediately downstream of wastewater discharges, areas of significant urban runoff, combined sewer overflows, and areas influenced by certain agricultural practices is contrary to prudent public health and safety practices, even though water quality standards may be met.”

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