STATE OF MINNESOTA

MINNESOTA POLLUTION CONTROL AGENCY

IN THE MATTER OF PROPOSED RULES
GOVERNING REQUIREMENTS FOR
AQUACULTURE FACILITIES, MINNESOTA
RULES PART 7050.0216

STATEMENT OF NEED
AND REASONABLENESS

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AQUACULTURE RULE

STATEMENT OF NEED AND REASONABLENESS

I. INTRODUCTION

The 1991 Minnesota Legislature directed the Minnesota Pollution Control Agency (Agency) to develop rules for the aquaculture industry (Minn. Stat. Sections 17.494 and 17.498). The rule described herein is in response to this legislative directive. This rule relates to existing Minn. Rules ch. 7001 and 7050, which are briefly discussed below. The new rule will be codified as Minn. Rules pt. 7050.0216.

A. Minnesota Rules Chapter 7001

Minn. Rules ch. 7001 are the rules of the Agency that set forth the procedures for the issuance, reissuance and revocation of Agency permits. For the aquaculture industry, the requirement to obtain a permit is addressed in chapter 7001 and in this rule. Chapter 7001 also contains the requirements which enable the Agency to issue National Pollutant Discharge Elimination System (NPDES) permits in compliance with the Clean Water Act, 33 U.S.C. 1251 et seq., and the regulations adopted by the U.S. Environmental Protection Agency (EPA).

B. Minnesota Rules Chapter 7050

Minn. Rules ch. 7050 are the rules of the Agency that establish water quality standards and the beneficial use classifications for waters of

the state. These rules define the water quality standards for all water bodies consistent with the goal of the federal Clean Water Act to provide fishable and swimmable waters wherever attainable. The standards, in general, include narrative requirements and general provisions applicable to all dischargers and to all waters of the state. Specific numerical water quality standards are established to protect fisheries and recreation and other beneficial uses such as drinking water. The numerical standards provide a measure against which the Agency can assess the quality of the state's waters, determine the need for treatment or clean-up programs, measure the success of ongoing pollution abatement programs, and help establish priorities when planning for pollution control needs. Also, effluent limitations in permits must protect the standards.

Chapter 7050 also defines the levels of wastewater treatment that apply to industrial, municipal and animal feedlot point source dischargers. Secondary treatment and federal technology-based minimum treatment requirements are generally required, although more advanced water quality based effluent limitations may be required if the technology-based effluent limitations are not adequate to maintain water quality standards.

C. Scope of Proposed Part 7050.0216

Part 7050.0216 addresses the water quality requirements for concentrated aquatic animal production facilities. The need for this

part is explained in Section III. The reasonableness for each subpart is explained in Section IV. The major subparts of part 7050.0216 are as follows:

1. An explanation of the terms applicable to this rule.

2. A statement indicating that no person may construct, operate or maintain a concentrated aquatic animal production facility until a NPDES/State Disposal System (SDS) permit is obtained from the Agency.

3. The treatment technology discharge requirements for concentrated aquatic animal production facilities after collection and treatment of the wastewater.

4. A statement indicating that all other applicable requirements of parts 7050.0110 to 7050.0220 apply to concentrated aquatic animal production facilities.

5. Procedures under which a variance for temporary reversible impacts to water quality may be granted to concentrated aquatic animal production facilities.

6. Conditions for monitoring, testing, reporting, record-keeping, the disposal of mortalities and blood, and the discharge of water treatment and chemical additives.

II. STATEMENT OF STATUTORY AUTHORITY

The Agency's statutory authority to adopt rules to regulate aquatic animal production facilities is generally set forth in Minn. Stat. Section 115.03, Subd. 1(c) and 1(e), and more specifically set forth in Minn. Stat. Sections 17.494 and 17.498. Minn. Stat. Section 17.494 provides:

> "State agencies shall adopt rules or issue commissioner's orders that establish permit and license requirements, approval timelines and compliance standards."

Minn. Stat. Section 17.498 provides:

> "The commissioner of the pollution control agency, after consultation and cooperation with the commissioners of agriculture and natural resources, shall present proposed rules to the pollution control agency board prescribing water quality permit requirements for aquaculture facilities by May 1, 1992. The rules must consider:
>
> (1) best available proven technology, best management practices, and water treatment practices that prevent and minimize degradation of waters of the state considering economic factors, availability, technical feasibility, effectiveness, and environmental impacts;
>
> (2) classes, types, sizes, and categories of aquaculture facilities;

(3) temporary reversible impacts versus long-term impacts on water quality;

(4) effects on drinking water supplies that cause adverse human health concerns; and

(5) aquaculture therapeutics, which shall be regulated by the pollution control agency."

Under these statutory provisions, the Agency has the necessary statutory authority to adopt the proposed rule.

III. NEED FOR THE RULE

Minn. Stat. ch. 14 requires the Agency to make an affirmative presentation of facts establishing the need and reasonableness of the rule as proposed. In general terms, this means that the Agency must set forth the reasons for its proposal, and the reasons must not be arbitrary or capricious. However, to the extent that need and reasonableness are separate, need has come to mean that a problem exists which requires administrative attention, and reasonableness means that the solution proposed by the Agency is appropriate. The need for the rule is discussed below.

As previously discussed, Minn. Stat. Section 17.498 requires the Agency to adopt rules prescribing water quality permit requirements for aquaculture facilities. In addition, Minn. Stat. Section 17.494 requires state agencies to adopt rules "that establish permit and license requirements,

approval of timelines, and compliance standards." These provisions attempt to clarify and standardize the requirements applicable to the aquaculture industry. Thus these rules are primarily needed to respond to this explicit legislative directive and to address the unique nature of concentrated aquatic animal production facilities.

Concentrated aquatic animal production facilities can be considered analagous to large feedlots except the facilities are used to rear aquatic livestock. Cultivating large quantities of fish requires the addition of large quantities of nutrients (feed) and occasionally the addition of various chemicals. The feed and chemicals are usually added directly to the water.

Until recently, the aquaculture industry in Minnesota consisted primarily of the production of bait fish and game fish. Currently there are approximately five commercial firms that rear fish in Minnesota to be processed as a food source. With the growth of the aquaculture industry in the state, and the water quality questions associated with in situ facilities in particular, there is a need for the Agency to regulate aquaculture with the principal goals of protecting human health and the environment while maintaining consistency with the regulation of other wastewater discharges.

IV. REASONABLENESS OF THE RULE

This section describes the Agency's reasons for the new rule language. The different subparts of the new rule are each discussed under major headings below.

A. Subpart 1. Definitions.

It is reasonable when promulgating a complex and technical rule to define the technical terms or the terms that may have special meaning in the context of this rule.

Item A. This item defines "aquaculture therapeutic" consistent with the definition of "therapeutic" by Webster's (exhibit 35), "of or relating to the treatment of disease or disorders by remedial agents or methods." Minn. Stat. Section 17.498 requires that this rule consider aquaculture therapeutics. The definition included in the rule is reasonable because drugs, medications and disease control chemicals are all remedial agents or methods that may be used to treat disease or disorders of aquatic animals. The definition is limited to those approved by the U.S. Food and Drug Administration (FDA) and the EPA because the former approves the use of drugs under the Federal Food, Drug and Cosmetic Act (FFDCA) and the latter approves the use of materials under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). Although the FFDCA and FIFRA have different scopes and purposes than the Clean Water Act and its water quality permit program, which is administered by the Agency in Minnesota, the definition of "aquaculture therapeutic" mentions the FDA and the EPA in order to help ensure that the requirements of the FFDCA and FIFRA are met, which is reasonable in order to help protect human health and the environment.

Item B. This item defines "aquatic animal production" to include both harvest and mortalities. It is reasonable to group both harvest and mortalities together because the "production" term is used in the rule

in relation to the size of facilities and their capability to generate wastes. The rates of waste fish food and excrements generated from a facility will generally not vary depending on the pounds of live versus dead animals that come out of a particular rearing facility.

Item C. This item defines "chemical additive" and is reasonable to encompass all those additives which may be used at a facility. This definition also is reasonable because each of these materials has been used in the past at aquatic animal production facilities and may cause pollution.

Item D. This item defines "cold water aquatic animals" in the same way as defined by the EPA regulations (40 CFR 122, Appendix C). The Agency is not aware at the time of preparation of this rule of any specific cold water species which are not members of the Salmonidae family of fish; however, it is reasonable to retain the EPA definition in order to avoid language that would be less strict than federal requirements, which is not allowed. This definition is intended to be mutually exclusive with the definition "warm and cool water aquatic animals."

Item E. This item defines "concentrated aquatic animal production facility" in a form similar to the EPA definition in 40 Code of Federal Regulations (CFR) Part 122. This is reasonable in order to be generally consistent with federal regulations. The federal definition establishes the feed and production thresholds for cold and warm water facilities that are reflected in the Agency definition. The EPA definition also exempts facilities that discharge less than 30 days per year, as well as closed pond facilities that discharge only during

periods of excess runoff. The Agency has modified the federal definition in the following manner:

a. The Agency has included intermittently discharging facilities, as well as continuously discharging facilities, as concentrated aquatic animal production facilities. This is reasonable because facilities which discharge less than 30 days per year may have high pollutant concentrations and loadings. Such high pollutant levels in turn can have significant impacts on Minnesota lakes and streams. Discharges with high pollutant levels that occur in a short timespan may in fact have a greater impact on waters than long-term discharges with lower pollutant levels.

   If the concentration of a discharge is high, even in an intermittent discharge or during periods of excess runoff, it can cause the downstream concentration to increase significantly. Also, a facility that discharges, for example, only 29 days per year at a very high concentration can release more pollutants per year than a facility that discharges all year at a very low concentration; the total mass load of pollutants for the former, intermittently discharging, facility would be higher. It is thus reasonable to consider intermittently discharging operations, like continuously discharging operations, as concentrated aquatic animal production facilities.

b. The EPA term "warm water" has been modified to "warm and cool water." This change is explained below under item K, the definition for "warm and cool water aquatic animals."

c. The EPA terms "Director" and "United States" have been changed to "commissioner" and "state" in order to identify that the rule applies to the Agency and to Minnesota. This is reasonable because the EPA has delegated the NPDES program to the Agency to administer in Minnesota.

In the context of this definition, "harvest weight" refers to the total weight of aquatic animals that are produced from the facility for release, transfer or sale. In reference to the harvest of commercial food aquatic animals in particular, this is the weight of the animals removed from the rearing facility, not the weight removed from the subsequent food processing facility; food processing facilities are not within the scope of this rule.

Feeding rate plays a role in the definition thresholds because it is the feed that is the basic source of pollutants at aquatic animal production facilities. In the words of Persson (exhibit 39), "Emissions from intensive fish cultures derive basically from added feed." Most of the fish in lakes and streams feed on materials that already are in the water; this food is not artificially added from outside the waterbody. In contrast, intensive aquaculture deliberately adds feed from outside the lake or stream. Most of this feed added to the water in intensive aquaculture is eaten by the fish and passed out of their bodies as waste (exhibit 31). This is similar to what happens with the food that cattle, hogs, or poultry eat in a land feedlot situation. Intensive fish farms are, therefore, a lot like other animal feedlot farms in terms of how the livestock are fed

and how the manure is generated. The density, or fish-per-acre-feet, of aquatic animals at a production facility is not nearly as important as the feeding rate in determining the amount of pollutants discharged.

By use of the production and feed rate thresholds in this definition, it is the intent of the Agency that aquatic animal production units that are located in the same geographic area and are operated by the same business(es) are considered as one aquatic animal production facility under this rule. This is reasonable because it is consistent with Agency requirements for other industries and it is protective of adjacent and nearby waters that may be subject to cumulative pollution impacts. Three examples, illustrated in figures 1, 2 and 3, help to demonstrate this.

Figure 1 shows an on-land facility that consists of indoor tanks, concrete raceways, constructed diversion rearing ponds and associated wastewater treatment systems. The discharges from the facility occur in separate locations, and enter two streams which flow together a short distance downstream of the rearing operations. In this hypothetical example, the indoor tanks produce 8000 pounds of trout per year, the concrete raceways produce 15,000 pounds of trout per year, and the ponds produce 80,000 pounds of catfish per year. This involves a number of different types of rearing units, fish species, treatment systems and discharges, which are not located immediately next to one another; however, the operations are close enough

together, under the same business, and may have a cumulative impact on the receiving waters such that they need to be considered as a single concentrated aquatic animal production facility.

Figure 2 illustrates in situ, floating raceway operations that are controlled by the same business at four different sites along a ten-mile stretch of river. Each set of raceways produces 10,000 pounds per year of salmon. As in the hypothetical case above, these operations are close enough together, under the same business, and may have a cumulative impact on the river such that they need to be considered as a single concentrated aquatic animal production facility.

Figure 3 illustrates one in situ, cage culture, operation that is moved from one site to another in different bays of the same lake from year to year. This set of net pens produces 50,000 pounds of trout per year. As above, both sites in this example are considered as a single concentrated aquatic animal production facility.

The "case by case" designation language in subitem 3 is taken from the federal requirements under the Clean Water Act (40 CFR 122.24). It is expected that this language would be applied rarely, if ever, in Minnesota, but allowance must be made in the rule for special cases that may be significant contributors of pollution. Examples of cases in which the subitem 3 language may be applied might include discharges to sensitive waters such as: a designated trout stream;

a lake that would be sensitive to even low levels of nutrient discharges; or a drinking water supply. (This discussion is not at all meant to suggest that subitem 3 would be applied in each of these three example situations that occur in Minnesota.)

Item F. This item defines "continuous discharge." The definition is taken from the EPA NPDES permit program regulations (40 CFR 122.2), which apply to concentrated aquatic animal production facilities, and is reasonable in order to be consistent with federal regulations.

Item G. This item defines "existing beneficial uses" as a set of those uses "which have been made or may be reasonably anticipated to be made" of the waters of the state. It is reasonable to define beneficial uses in this way, so as to reflect the variety and the extent of acts and practices in which the public interest is served by waters of the state. The order of the various uses in the definition has no relation to their relative importance nor their relative sensitivity to pollution impacts. The use of waters to supply aquatic animal production facilities is not specifically listed in this definition since the term "existing beneficial uses" is found exclusively in subpart 5, which deals directly and specifically in its provisions with the use of waters for aquatic animal production.

Item H. This item defines "fish food," and is taken in part from the definition in Webster's (exhibit 35), which includes the language "to sustain growth, repair, and vital processes and to furnish energy."

The wording, "commercial feeds, grains and seeds, plants, forage fish, insects, crustaceans, worms, plant wastes, meat and dead fish parts" is reasonable because it includes most if not all materials which are or have been fed in aquatic animal rearing operations in Minnesota. Live organisms, such as forage fish, are included within this definition only to the extent that they are fed upon by the fish which are produced at a facility. Although forage fish may feed upon matter already present in the facility, when the forage fish themselves are added to the facility they represent an additional load of organic matter and nutrients. This additional load would be converted into waste matter by the larger harvested fish which feed on the forage fish. To the extent that forage fish and other live organisms are used in an aquatic animal production facility as a food source, it is reasonable to include them within the scope of this definition.

Item I. This item defines "in situ facility." This definition identifies that category of facilities which are not "on-land facilities." It is reasonable because it takes the inverse, or opposite, of the definition for "on-land facilities." An individual facility therefore either falls within the in situ category or the on-land category, which are mutually exclusive of one another. The wording "in situ" is used because as defined by Webster (exhibit 35), this term means "in the natural or original position," which reasonably describes waters of the state prior to construction of a concentrated aquatic animal production facility within them.

Figures 4, 5 and 6 illustrate three different types of in situ facilities. A net pen or net cage system typically consists of a

floating frame from which a synthetic mesh net is held to contain the fish being reared (figure 4). Net or cage culture in situ systems can also be supported by off-shore boat vessels or as submersible designs. Floating raceways are typically made of a floating frame which holds an impermeable fabric; water is pumped into one end of the raceway and exits at the opposite end (figure 5). In situ barge culture systems typically utilize large vessels where aquatic animals are reared in tanks on the vessels; water is pumped aboard and drained out of the on-board rearing units (figure 6). Most in situ rearing facilities share the characteristic of being relatively mobile, easily transported from one part of a water body to another, or to a completely different water body; this ease of mobility also is illustrated by figures 4, 5 and 6.

Item J. This item defines "on-land facility." This definition is similar to that adopted by the Washington Department of Ecology (WAC 173-221A-030) for "upland fin-fish facility." It is reasonable to use the Washington definition as a model because it is clear, straightforward and fairly represents land-based facilities. The wording has been modified from the Washington definition in the following ways:

a. The Washington term is restricted to "fin-fish" production facilities only. The Agency definition is expanded to include all aquatic animals, since other aquatic animals such as mollusks and crustaceans may be reared in a concentrated aquatic animal production facility. This language change is reasonable because the wastes produced when such other animals are reared are similar to those produced by fin-fish rearing facilities.

b. The definition from the Washington language of "hatched, fed, nurtured, held, maintained, or reared to reach the size of release or for market sale" has been shortened to "reared." This change is reasonable because it does not alter the substantive meaning of the definition, and it shortens the text.

Figures 7, 8 and 9 illustrate three different water flow designs for once-through (that is, non-recirculating) on-land facilities. Typical design and construction of diversion ponds for intensive on-land aquatic animal production in Minnesota is outlined by Mittelmark and Landkammer (exhibit 37).

Item K. This item defines "warm and cool water aquatic animals" similarly to the EPA definition of "warm water aquatic animals" (40 CFR 122, Appendix C). The definition has been changed from the EPA wording by adding the terms "cool", "Percidae", "Ictaluridae" and "walleye." The Minnesota Department of Natural Resources (DNR) considers cool water species to include walleye, sauger, muskie, northern pike, yellow perch, striped bass, sucker, Catostomidae, Percidae, and Esocidae families of fish which have temperature optima in the vicinity of 45 to 75 degrees F. This group of species is included within the term "warm water aquatic animals" by the EPA. Most aquatic animal producers in Minnesota subscribe to the DNR's distinction between cool water and warm water species. Therefore, it is reasonable to add the terms "cool" and "walleye" in this rule is only to clarify for the regulated community and others in Minnesota

that this particular defined type of aquatic animals includes those normally considered cool water species. In addition, the Percidae and Ictaluridae families of fish have been added to the EPA definition to help clarify that the "warm and cool water" definition covers these commonly reared types of fish (perch and catfish, for example). The EPA definition has also been modified to specifically exclude the Salmonidae family of fish, and thereby stress that the "cold water aquatic animals" and the "warm and cool water aquatic animals" terms are mutually exclusive.

B. Subpart 2. Permit Requirements.

This subpart clarifies that a NPDES/SDS permit is required for concentrated aquatic animal production facilities. Subpart 2 is reasonable in view of the requirements of Minn. Stat. Sections 17.494 and 17.498 which require that the Agency establish permit requirements and approval timelines, and consider classes, types, sizes and categories of facilities. EPA regulations (40 CFR 122.24), promulgated under the authority of the Clean Water Act, contain a similar provision. As a result, owners and operators of facilities in Minnesota must apply for a NPDES permit under the provisions of existing federal regulations. Because the Agency has been delegated authority to administer the NPDES program, permit applications are submitted to the Agency; thus, subpart 2 is reasonable to incorporate and consolidate federal and state requirements for obtaining a permit.

This subpart makes it clear that a person who is required to obtain a permit shall not construct or operate a concentrated aquatic animal

production facility until a permit has been issued by the Agency. Multiple projects and multiple stages of a single project that are connected actions or phased actions must be considered in total when considering the need for a permit. In other words, the owner/operator must obtain a permit before proceeding with the construction or expansion of an aquatic animal production facility which is eventually planned to exceed the feeding or production thresholds which define a concentrated aquatic animal production facility. This is critically important because wastewater treatment systems that are designed and constructed to treat wastes at full-scale production above the permitting thresholds need to be reviewed and approved by the Agency before construction begins. In this way, it can be determined whether the proposed treatment system is adequate and capable of meeting the permit requirements.

C. Subpart 3. Treatment Technology Discharge Requirements.

The limiting concentrations or ranges set forth in this portion of the proposed rule are in conformance with the definition of secondary treatment as contained in Minn. Rules pt. 7050.0211, subpart 1. Therefore, under the terms of this portion of the proposed rule, all concentrated aquatic animal production facilities must collect their wastewater and provide a minimum of secondary treatment for the wastewater. Collection of wastes followed by minimum secondary treatment is a basis of the federal Clean Water Act, and is reflected in the Agency's overall approach to water pollution control. This

approach, based in federal and state law, is also reasonable to prevent pollution from concentrated aquatic animal production facilities in Minnesota.

This portion of the rule is reasonable because it appropriately responds to the requirements in Minn. Stat. Sections 17.494 and 17.498, which require that the Agency establish compliance standards and consider "best available proven technology, best management practices, and water treatment practices that prevent and minimize degradation of waters of the state considering economic factors, availability, technical feasibility, effectiveness, and environmental impacts."

Item A requires that "all concentrated aquatic animal production facilities collect, remove, treat and properly dispose of unconsumed fish food and fish wastes." Collection and treatment to prevent pollution is a cornerstone of water pollution control law. Minn. Stat. ch. 115, for example, charges the Agency "to encourage waste treatment, including advanced waste treatment, instead of stream low-flow augmentation for dilution purposes to control and prevent pollution." Concentrated aquatic animal production facilities generate many of the same basic pollutants as do sewage treatment plants, such as biochemical oxygen demand (BOD), total suspended solids (TSS) and phosphorus (exhibits 13, 29, 32, 39, 40, 47). The amount of these pollutants generated can also be comparable to the amount generated by sewage plants (exhibit 43). It is thus reasonable to collect, treat and remove these large quantities of manure wastes before they are discharged. Removal and proper disposal of these

wastes, such as in their use for soil amendments on croplands, also encourages waste utilization and resource recovery of the aquatic animal manures. Croplands can benefit from the fertilizing properties of manures, whether they are cattle manure or fish manure, when they are incorporated into the soil at appropriate rates.

A number of means of collection and treatment are available for in situ and for on-land facilities. Collection alternatives for on-land facilities include any number of pipe, ditch and basin structures. Treatment alternatives for on-land facilities include the use of settling basins, vacuum cleaning, filtration and controlled drainage (exhibit 47). The EPA (exhibit 47) indicates that some of these treatment technologies are both technically and economically feasible for on-land systems to meet pollutant concentrations even lower than those included by the Agency in item B. It is, therefore, reasonable to require on-land facilities in Minnesota to meet secondary treatment limits because these limits are economically achievable. Lower concentration treatment technology discharge limits, such as those outlined by EPA (exhibit 47), were not included in item B of this rule because the Agency believes it is reasonable that the effluent limit discharge requirements for concentrated aquatic animal production facilities be consistent with those for other industries in Minnesota. These limits have already been established in Minn. Rules pt. 7050.0212, which require secondary treatment limits for industries for which no final EPA technology-based limits have been established.

For in situ facilities, collection alternatives include closed bags and unit funnels (exhibit 25). Unit funnels can function well in

receiving waters that are not exposed to waves and high currents; such sites, which have little flushing action, are being considered for in situ facility culture sites in Minnesota. Many of the treatment alternatives for in situ facilities have also been utilized for on-land facilities; these include the use of filtration systems and constructed wetlands (exhibit 25). Collection and treatment systems may be a significant added cost for some in situ facilities, however, this added cost is offset by the lower capital construction costs of in situ facilities. The initial capital costs for cage culture facilities with no collection and treatment are significantly lower than those for on-land facilities that rear comparable aquatic animal species (exhibit 53). The rule requirement that in situ facilities collect and treat their wastes is reasonable in that it is equitable with Agency requirements for municipalities, other industries (including poultry, cattle and hog feedlots), and in particular the on-land facilities of the same aquatic animal production industry. Although collection and treatment costs tend to be greater for in situ than for on-land facilities, it should be recognized that the initial capital costs to construct the in situ rearing units are substantially less than those of on-land facilities. Therefore, it is reasonable for the Agency to require in situ facilities to collect and treat their wastes because the total capital construction costs, including the collection and treatment system, should be similar to those for on-land facilities.

The coliform bacteria limits in items B and C are reasonable to handle situations where this pollutant may be present in discharges from concentrated aquatic animal production facilities. There is mixed and

somewhat conflicting information on the impacts of aquatic animal production facilities on bacteria populations, particularly coliform bacteria (exhibit 40). The EPA (exhibit 47) noted the following:

> It is common practice in water quality surveys to measure the fecal coliform density to evaluate the sanitary significance of certain wastewaters. These bacteria can be identified and enumerated by either of two reliable techniques, the MPN or the milipore filter method. Fecal coliform bacteria are present in the gut of all warm-blooded animals. The presence of these bacteria at densities significant (usually a density of 200 organisms/100 mL of more) is a good indication of the probable presence of pathogens. Although fecal coliform bacteria are not expected to be produced by fish, it has been shown that these bacteria are present in some fish culturing facilities because of contaminated source water or manure used to fertilize ponds. Evidence has also shown that if the culturing water is contaminated by either of these sources, the bacteria accumulate in the fish.

The above information indicates that it is reasonable to apply the fecal coliform limit only "where the presence of sewage, fecal coliform organisms, or viable pathogenic organisms in such wastes is known or reasonably certain," such as when contamination by the addition of animal manures is suspected.

When considering the 1 milligram per liter limit for total phosphorus in items B and C, a clear distinction must be drawn between effluent

limits and water quality standards. An effluent limit of 1 milligram per liter means that the concentration of phosphorus in the effluent may not exceed 1 milligram per liter. On the other hand, a water quality standard for phosphorus refers to the maximum concentration of phosphorus which is allowed in the receiving water while still protecting designated uses. For most bodies of water a 1 milligram per liter effluent limit has allowed water quality standards to be met and been protective of designated uses. In those cases where lake modeling indicates that an effluent level of 1 milligram per liter would result in waste loadings that adversely impact water quality, the rule allows a more stringent effluent phosphorus limit to be applied.

The language on alternate concentration limits for recirculating flow in item D is included to encourage these types of systems because of their environmental benefits. Recirculating flow not only helps water conservation by reducing the need to appropriate water, but if properly managed with internal treatment and removal of manure wastes it can also substantially reduce the mass load discharge of pollutants. This promotes waste minimization and waste utilization. It is therefore reasonable that the Agency require detailed information on these aspects of system design, operation and maintenance in order to ensure that recirculating flow system alternate limits remain compatible with pollution control objectives of waste minimization, resource recovery, and basic collection and treatment. Typical recirculating flow systems pump wastewater flow

back into aquatic animal rearing units after it has been treated (figure 10). These environmentally progressive recirculating flow systems may become more and more popular designs as the technology of such systems advances (exhibits 31, 49).

D. Subpart 4. Additional Requirements.

All additional requirements of Minn. Rules ch. 7050 which apply to other industrial dischargers also apply to concentrated aquatic animal production facilities unless the permittee applies for and receives a variance under subpart 5 of this part. Additional requirements which apply include, for example, the nondegradation provisions of part 7050.0180 and 7050.0185, the anti-backsliding provisions of part 7050.0212, the advanced wastewater treatment provisions of part 7050.0213, and the toxic pollutant provisions of parts 7050.0217 and 7050.0218. This subpart is reasonable in order to ensure that it is understood that part 7050.0216 does not exempt concentrated aquatic animal production facilities from other applicable requirements of chapter 7050.

E. Subpart 5. Interim Reversible Impacts.

1. **Variance.** Minn. Stat. Section 115.03 and Minn. Rules pt. 7000.0700 allows the Agency to grant a variance. In general, an applicant will seek a variance on grounds of economic burden or on grounds that compliance with a standard is not technologically

feasible. Subpart 5 is included in the rule in response to the legislative directive that the Agency must consider "temporary reversible impacts versus long-term impacts on water quality" (Minn. Stat. Section 17.498(a)(3)). Subpart 5 requires that in seeking a variance for either economic reasons or technological feasibility the applicant must show that:

(1) the construction, operation and maintenance of the facility will not impair the existing beneficial uses of the receiving water;

(2) the variance is necessary to accommodate important economic or social development in the area;

(3) economic or social development will not occur due to the restrictions imposed by subpart 3;

(4) the baseline quality of the receiving waters has been established;

(5) a closure plan for the facility has been approved;

(6) financial assurance for the facility has been established, approved and maintained; and

(7) the applicant has obtained a permit for the facility.

Subitems (2) and (3) respond to federal and state law on antidegradation which allows lowering of water quality only if it is necessary to accommodate important economic or social development in areas in which the waters are located. This determination of important economic or social development must be made on a case-by-case basis, because it depends on the specifics of the particular development and the specifics of the area affected, as discussed below.

The economic review would be performed using costs that would be incurred to prevent the lowering of water quality, annualized to include the annual portion of the capital costs plus the operating and maintenance costs.

The first part of this step requires a demonstration that the economic or social development will not occur. This can take one of two forms:

- Demonstrating that the development cannot afford the necessary pollution control alternatives/measures and thus will not occur unless the quality of the water can be lowered (affordability tests), or

- Demonstrating that even though the development can afford the pollution control alternatives/measures, the development will occur some place else unless the quality of the water can be lowered.

The affordability tests measure whether or not the entity can afford to pay the costs of construction and operation of the pollution control alternative/measure. For private entities, four tests are used to assess affordability:

- Liquidity -- a measure of how easily the entity can pay its short-term bills.

- Solvency -- a measure of how easily the entity can pay its fixed costs and long-term bills.

- Leverage -- a measure of how much money the entity can borrow.

- Earnings -- a measure of how much the entity's profitability will change with the additional pollution control.

When measuring affordability for a public entity, a test of Household Burden is always used, and two supplemental tests (that measure Local Government Debt Burden) are used if the project is financed with property tax revenues. For public entities, the affordability tests include:

- Household Burden -- a measure of the total water pollution control costs per household compared to median household income.

- Local Government Debt Burden -- two measures of the ability of the public entity to collect sufficient tax revenues to pay for the increased debt burden.

It is reasonable to apply these measures, both private and public, as a method for demonstrating affordability because this is the approach has stood the test of being used in many past situations.

Although the applicant may meet the affordability tests, the applicant might chose to place the development elsewhere to avoid the costs associated with maintaining high water quality. In such a case, the applicant must demonstrate that the development could occur someplace else. Since there are many factors that enter into the decision of where to locate an economic activity (e.g., availability and cost of labor and raw materials, transportation costs to markets, taxes and local services), it is not sufficient for the applicant to simply point out that pollution control costs are higher in one location than they are in another.

If the applicant has demonstrated that the development under consideration will not occur without a lowering of the water quality, then the applicant must also demonstrate that the

development is important to the community. This first requires defining the relevant community in terms of the geographic area in which the economic, social and environmental impacts will occur.

In order for the development to be considered important, it must have a substantial impact on at least one of the following:

- increase in the number of jobs,

- increase in personal income/wages,

- reduction in the unemployment rate or the impact on other factors that can affect the social service expenses in a community,

- increase in tax revenues.

In evaluating the changes in any of these four types of factors, three important considerations must be kept in mind: the baseline situation (e.g., increasing the number of jobs in locations where unemployment rates are low is less important than in places where unemployment rates are high), the net impact (e.g., lowering the quality of the water might result in reduced fishing and/or recreational employment), and other possible developments (e.g., will other developments occur if this

particular one does not). As with the affordability measures, further information on defining the relevant community and determining whether or not the impacts should be considered important is available in Subpart I of EPA (exhibit 45) and the EPA Water Quality Standards Workbook.

Granting a variance under subpart 5 could allow a temporary, but reversible, impact on the waterbody. Because the waters of the state belong to everyone, it is in the public interest to maintain the baseline water quality. To ensure restoration, it is reasonable to require that the applicant have an approved closure plan and show financial assurance which will provide for closure, postclosure monitoring and corrective actions. These items are discussed in more detail below.

2. **Variance Application.** The information required by subpart 5 supplements the information set forth in Minn. Rules pt. 7000.0700 to be submitted by the applicant. The Agency may grant a variance only if the applicant complies with the requirements of Minn. Rules pt. 7000.0700. It is reasonable to require the applicant to submit sufficient information so that the Agency can determine whether or not the concentrated aquatic animal production facility will comply with all applicable statutes and rules.

3. **Baseline Quality.** The baseline water quality is essential in order to determine compliance for future restoration measures. Minn. Rules pt. 7050.0185, subp. 2, item C, defines baseline

quality as the water quality consistently attained by January 1, 1988. Baseline quality is important for the nondegradation concept of maintaining waters at their present quality and not allowing the waters to be further degraded. It is reasonable to use baseline quality as the benchmark level because degradation beyond this level is not allowed. Improvement of this level is desirable.

On February 8, 1968, a national nondegradation policy was established by the U.S. Department of the Interior. It was included in EPA's first water quality standards regulation and subsequently adopted in state rules in 1973. Initially, the nondegradation policy applied to high quality waters only. In 1984, the Agency repealed its old nondegradation policy and replaced it with a nondegradation policy that applies to all waters of the state with an emphasis on the significance of the discharge into the waterbody. The rule was written to fully evaluate and potentially apply more protective measures of pollution control to those dischargers that pose a significant threat to background water quality, thus ensuring that the existing beneficial uses are maintained.

The purpose of baseline monitoring is to reasonably define the condition of the receiving waters prior to the construction of aquatic animal production facilities. The measured baseline quality defines the quality that shall be achieved after closure

of the concentrated aquatic animal production facility. Postclosure compliance shall be assessed by statistically comparing the pre-operational to the postclosure data as specified below. The following discussion focuses on lakes as an example for baseline quality monitoring since it is believed these receiving waters are most likely to be considered for a variance under the terms of this subpart. Baseline quality monitoring for rivers would of course need to be adapted to the characteristics of those receiving waters.

Measurements of total phosphorus, transparency and total organic carbon, for example, would be used as primary data. Secondary data are used for general background definition and for further, generally non-statistical, comparisons. Secondary data consist, for example, of measurements of chlorophyll-a, total organic nitrogen (TON), bacteria, color, pH, turbidity, chloride, nitrite-nitrogen and un-ionized ammonia. General lake data include temperature/dissolved oxygen profiles for summer, and for spring and fall overturn periods.

Two years of sampling, or their equivalent (as discussed below), are required to reasonably define the mean baseline quality epilimnetic total phosphorus, chlorophyll-a and Secchi disk transparency and total organic carbon for lakes. Secondary data for lakes should also be collected to reasonably define conditions at: (1) the end of winter stratification period; (2)

spring/fall overturn; and (3) summer conditions, particularly at the end of the summer growing season (e.g., late August). At a minimum, twelve to fourteen samples per year are required for the primary data. The pre-operational total phosphorus mean shall be compared to the postclosure mean total phosphorus by use of the T-test and using a 5 percent significance level. Approximately eight to ten samples would need to be collected during the summer growing season, mid-June through mid-September.

It is reasonable to require sampling for two years, or equivalent, because with this level of sampling, it is possible to statistically define whether or not there is a difference between the pre-operational and postclosure total phosphorus conditions, for example. There are risks involved in assessing these data, even with a good baseline monitoring program. For example, if there is monthly total phosphorus sampling for two years there can be two apparent "risks," which are:

(1) about a 5 percent probability that there is no difference while the statistical test says there is a difference (applicant's risk); and

(2) about a 40-plus percent probability that there is a difference and the test does not detect it (state's risk).

Sampling at a level more intensive than monthly sampling will reduce the uncertainties for the state, as long as the applicant's risk remains at five percent. A twice monthly

monitoring program over a two year time period (essentially the ice-free time period), would reduce the state's risk to about 30 percent whereby the test might not detect a difference in total phosphorus concentrations. In contrast, a monthly sampling program over one year would increase the state's risk to about 58 percent probability of not detecting a real degradation. Lastly, decreasing the monitoring program to six samples over a one year period will likely increase the state's risk to about 75 percent.

One of the basic reasons for sampling is to determine whether there has been a change in water quality after some event in the waterbody's history. For such purposes, the monitoring data is used to detect a change by comparing the before and after data. The minimum detectable change in the multi-year average values can be referred to as the Least Significant Difference (LSD), and is defined as the minimum difference between the before and after multi-year means that are statistically significant (exhibit 42). Generally, for total phosphorus, the LSD is about 40 percent, if baseline water quality has been established. Using the methodology of Smeltzer et al. (exhibit 41) it was determined that two years of lake sampling was necessary to reasonably determine the baseline water quality. In this manner, if monthly lake sampling was accomplished, with an emphasis upon the growing season, then the LSD would be approximately 40 percent. This LSD represents a general threshold. To improve the LSD to values less than 40 percent requires establishment of a baseline

monitoring program with either greater intensity of sampling effort (e.g., biweekly or weekly sampling) or more than two years of baseline monitoring.

"Equivalent" monitoring means that less than two years of monitoring is accomplished. Depending upon the intensity of the sampling effort, the data may have to be augmented with specific assumptions about within year and among year variabilities. The Commissioner shall supply the specific assumptions regarding intra-year and inter-year variabilities for each of the water quality variables.

Equivalent monitoring must be sufficient to define baseline conditions with at least the same degree of precision and accuracy as would two consecutive years of pre-operational monitoring. Any assumptions proposed by the applicant regarding between-year variation for equivalent monitoring must be clearly stated and approved by the Commissioner. Two examples of equivalent, less-than-two-year, monitoring that would be accepted by the Agency are the following:

a. The applicant conducts a one-year baseline study to supplement a previously conducted baseline study by the applicant or another party. Such a previously conducted study must have been completed within three years of the application, and must include testing for each of the

primary and secondary parameters. The Commissioner, in this example, must determine that these two studies combined adequately represent the within year-variation of each of the parameters, and together provide sufficient data for statistical comparisons of each of the primary parameters with those of the postclosure study.

b. The applicant demonstrates, to the satisfaction of the Commissioner, that the between-year variation of the primary and secondary parameters is statistically insignificant, and that a one-year baseline study is therefore sufficient. As stated below, a one-year study like this would require more intensive monitoring than would the typical two-year baseline study.

More intensive baseline monitoring than the two-year program may be initiated for a one-year time period. This may mean, for example, a biweekly sampling program for a one-year time period. Regardless of the conditions, an absolute minimum sampling program shall consist of data collected over a six-month growing season extending from early May through late October.

After closure of the facility and completion of the restoration measures, a monitoring program shall be initiated and completed for determination of postclosure water quality conditions. This postclosure data shall include the same number of measurements

conducted over a similar time period as those in the pre-operational or baseline data. The primary data shall be statistically compared to the corresponding pre-operational data by use of the T-test (one-tailed, with p less than or equal to 0.05). Dissolved oxygen in the hypolimnion shall be returned to the values that were measured in baseline conditions at the monitoring site.

It is reasonable to require two years or equivalent of pre-operational baseline monitoring to provide an accurate level to which the waterbody must be restored upon closure of the facility.

4. **Closure.** This item identifies the situations where closure will be required and the receiving waters must be restored, if a variance is granted. Closure and restoration according to this item shall proceed as outlined in the closure plan developed as part of the variance process specified in this subpart. Subitem (1) acknowledges that those in control of the facility may choose at any time to halt production, at which time it will be necessary to restore the receiving waters. Subitem (2) requires closure when any of the control pollutant limits are exceeded. As explained below for item 6, these limits are established in part to prevent irreversible impacts and serious immediate impacts on existing beneficial uses; violation of these limits indicates a serious situation that requires immediate action to

restore the receiving waters according to the closure plan. Subitem (3) requires closure when a facility permit is not reissued. Restoration must be started when a facility is no longer permitted because the permit is the controlling document for facility operation. If the permit is no longer in effect operations must cease and steps be taken to mitigate any potential problems. Subitems (4) and (5) refer to enforcement actions taken by the Agency. The facility must be closed when the Agency revokes a facility permit or issues an order to cease operations. These actions are taken by the Agency when continued operation of the facility would pose a threat to human health or the environment. Subitem (6) requires closure of the facility if the required financial assurance is not maintained. This closure provision is consistent with the financial assurance requirements of item 6. If closure was not required when financial assurance is not adequately maintained, the financial assurance mechanism would mean little and funds would not be available to ensure proper restoration. This could lead to impacts on human health and the environment. Financial assurance helps to ensure that restoration costs will be carried by the owner/operator and not the general taxpayers of Minnesota.

It is reasonable to require the applicant to restore the receiving waters to baseline water quality at closure because everyone in the state should be able to use the water and returning the water to its baseline quality is consistent with the anti-degradation policy.

5. **Closure Plan.** The primary reasons for the requirement to submit a closure plan are to ensure that the restoration of the receiving waters is technologically and environmentally sound and that the postclosure monitoring is conducted properly. The closure plan also is to ensure that the methods used for restoration cause no long term degradation of the receiving waters, and that the postclosure monitoring has sufficient review by the Commissioner to ensure its adequacy for the assessment and restoration of the receiving waters. It is reasonable to require the Commissioner's review and approval of the closure plan to ensure that the proposed procedures are in conformance with the requirements of the rule.

Postclosure monitoring is needed to verify that the restoration achieves baseline quality. Accordingly, it is reasonable that the closure plan include the postclosure parameters to be monitored, number of samples, statistical tests, sampling sites and depths and other necessary information. A detailed quality assurance plan shall be included with the monitoring portion of the plan to ensure that the data to be obtained is complete, representative, accurate, and precise.

The restoration of the receiving waters to the baseline quality should in most cases be completed within one calendar year after the date of closure of the aquatic animal production facility.

The restoration may include removal of organic wastes, and other procedures that do not include the addition of chemicals to the receiving waters to "mask" the effects of fish feed and wastes and other materials that were deposited during facility operations. Following restoration, there must be no need to manipulate the receiving waters with mechanical aeration and circulation, dyes, precipitants, or other physical or chemical alterations to maintain the baseline water quality during the post-operational monitoring and after. Restoration by its very nature implies no need for long-term operation and maintenance of the waters. It is reasonable that the closure plan include the methods that will be used to restore the receiving waters to the baseline levels in a manner that will not require long-term operation and maintenance of the waters.

It is reasonable that the closure plan include a demonstration of financial assurance for postclosure monitoring and restoration since the burden of monitoring and restoration will otherwise fall on the public and the taxpayers.

6. **Financial Assurance.** This portion of the rule is needed to ensure that water quality restoration activities are implemented by concentrated aquatic animal production facilities when a variance is granted.

The legislature's concern that restoration be assured is documented by the following provisions of Minn. Stat. Section 17.498.

> Sec. 10 (b). Net pen aquaculture and other aquaculture facilities with similar effects must submit an annual report to the Commissioner of the Pollution Control Agency analyzing...documentation of costs to restore the waters used for aquaculture to the trophic state existing before aquatic farming was initiated, and documentation of financial assurance in an amount adequate to pay for restoration costs....The financial assurance may be a trust fund, letter of credit, escrow account, surety bond, or other financial assurance payable to the commissioner for restoration of the waters if the permittee cannot or will not restore the waters after termination of aquatic farming operations or revocation of the permit.

It is reasonable to require this item of the rule to assure that the necessary cost estimates will be developed and reported to the Commissioner, to establish the financial responsibility of an owner or operator as it relates to restoration and postclosure monitoring, to assure that the necessary restoration and postclosure monitoring will be carried out, and to assure that the funding necessary to pay for such restoration and postclosure monitoring will be available regardless of circumstances.

Under this law, it is the intent that operators be responsible for (a) developing and reporting valid estimates of the costs which would be incurred in restoration of waters to the

pre-existing condition, as well as the cost of postclosure monitoring, (b) performing such restoration and postclosure monitoring, and (c) demonstrating that sufficient funds to pay the costs of restoration and postclosure monitoring will be available when needed regardless of circumstances. It is similarly clear that restoration must be performed when and where necessary, and that the costs must be borne by operators rather than by some other entity such as the general public.

The use of financial assurance mechanisms is a well-established technique to assure the availability of sufficient funding for proper closure and postclosure care of facilities. It was, for example, made a part of the federal Surface Mining Control and Reclamation Act, the federal Resource Conservation and Recovery Act, and is included in the environmental regulatory programs of numerous states, including Minnesota. It is especially useful in those industries which make use of a natural resource such as a land area, surface water or ground water, whose pre-development attributes are valued by the public, and which the public has a vested interest in maintaining. In this context, financial assurance makes it possible for the public to grant to profit-making enterprises the privilege of making use of natural resources in which it has a vested interest in return for a guarantee of restoration to the pre-existing condition.

It is reasonable to be assured that sufficient funds will be available to complete the closure and postclosure care activities which will provide restoration of receiving waters as required by

the legislature. In order to be meaningful, this assurance must go beyond a mere promise to make the funding available. Such assurance would, in the final analysis, be no assurance at all.

The rule requires that the evidence of financial assurance must be prepared in accordance with the provisions of Minn. Rules pts. 7035.2685-2805 (exhibit 54). These requirements deal with the financial assurance requirements for mixed municipal solid waste land disposal facilities. The intent is not to make aquatic animal production facilities subject to the solid waste rules, but to identify that the Agency's financial assurance requirements for mixed municipal solid waste land disposal facilities and certain aquatic animal production facilities are similar. This is reasonable since those parts deal only with the various financial assurance instruments which the agency finds acceptable for those facilities, and the procedural and administrative requirements attached to them. The requirements for financial assurance are summarized as follows:

a. Part 7035.2685 establishes the requirements for cost estimates for closure. All cost estimates must be made in current dollars, based on the closure plan, and updated yearly and whenever the plan is modified.

b. Part 7035.2695 requires that a facility owner or operator use one of the instruments included in the rules as the means to establish financial assurance.

c. Part 7035.2705 establishes the requirements to be met in developing a trust fund, including the schedule by which a trust fund must be established. This rule requires that a trust agreement be updated after any change in the cost estimates and that monthly payments be made into the trust fund. The amount of each payment is determined by procedures outlined in the rule. This rule also includes a method for a facility owner or operator to show that the monthly payments calculated in accordance with the rule exceed the financial ability of the facility owner or operator. Separate methods of determination are provided for public and private sector owners or operators. The Commissioner, in consultation with the owner or operator, will determine if sufficient funds can be generated to meet the cost estimates. Annual reviews of the cost estimates are required. A facility owner or operator may request the release of funds in excess of the cost estimates. This rule also outlines procedures by which the Commissioner will authorize reimbursement to a facility owner or operator for work completed in accordance with the closure plan.

d. Part 7035.2715 establishes how a trust fund may be established to receive payments by more than one owner or operator for financial assurance at different sites. The trustee must maintain a separate account for each site and

the Commissioner may only authorize withholding or reimbursements from the specific account designated for a site.

e. Part 7035.2720 establishes how a local government or authority may comply by setting up a special fund within its municipal treasury. The fund must be dedicated to facility closure. The funds may be used only after the Commissioner has given permission for disbursement.

f. Part 7035.2725 establishes the criteria by which a facility owner or operator may satisfy the requirements for financial assurance using a surety bond to guarantee payment into a trust fund. A facility owner or operator using a surety bond to guarantee payment must establish a standby trust fund in the same manner a trust fund would be established.

g. Part 7035.2735 addresses the requirements that apply when a facility owner or operator uses a surety bond to guarantee performance. The requirements for submittal of the surety bond and standby trust agreement are the same as those described for the trust fund. The surety company issuing the bond must be listed as an acceptable surety on federal bonds in Circular 570, issued by the United States Department of Treasury as published in the Federal Register on July 1 of each year. The bond must guarantee that the

owner or operator will perform closure in accordance with the appropriate plan, or provide alternate financial assurance. The surety becomes liable on the bond obligation if the owner or operator does not perform as guaranteed by the bond. The surety will not be liable for deficiencies in the performance of closure after the Agency releases the owner or operator from the financial assurance requirements.

h. Part 7035.2745 establishes the requirements to be met by a facility owner or operator who uses a letter of credit to comply with the financial assurance rules. The facility owner or operator must submit the letter of credit to the Commissioner under the same schedule as for a trust fund agreement. The facility owner or operator must also establish a standby trust fund into which payments are made if the Commissioner draws on the letter of credit. Whenever the facility owner or operator fails to perform the appropriate action, the Commissioner would draw on the letter of credit to obtain the necessary funds to complete the actions.

i. Part 7035.2750 contains criteria by which a facility owner or operator may show sufficient security to self-insure for closure. Under this part, corporate bonds, municipal bonds or warrants would be used to provide collateral for self-insured facility owners and operators. As with other instruments, the user of self-insurance must establish a standby trust fund.

j. Part 7035.2755 allows a facility owner or operator to use more than one mechanism to comply with the financial assurance requirements. The combination of mechanisms must provide financial assurance for an amount equal to the sum of the cost estimates determined in the closure.

k. Part 7035.2765 provides a facility owner or operator with the option to use a single mechanism to meet the financial assurance requirements for more than one facility. The amount of funds included in the mechanism must equal the amount of funds that would be available if a separate mechanism were used for each facility. The Commissioner would be able to direct expenditures for a facility only in the amount of funds set aside in the mechanism for that facility.

l. Part 7035.2775 prescribes the conditions under which the Agency will release a facility owner or operator from financial assurance requirements for closure at a facility.

m. Part 7035.2785 allows a facility owner or operator to use only one mechanism to establish financial assurance for closure.

n. Part 7035.2795 contains procedures to be followed if owners or operators, guarantors, or financial institutions fail to maintain financial assurance because of, for example, the

commencement of a voluntary or involuntary bankruptcy proceeding or suspension or revocation of the institution's authority to issue the acceptable financial instrument.

o. Part 7035.2805 contains specific language required to be used for: a trust agreement; a certification acknowledgment; a surety bond guaranteeing payment into a trust fund; a surety bond guaranteeing performance; a letter of credit; a self-insurance letter from the chief financial officer of a private firm; a self-insurance letter from the head of a public body; and a resolution that establishes a dedicated fund within a municipal treasury.

Because the waters of the state belong to the public at large, it is reasonable to require the applicant to demonstrate financial assurance for postclosure monitoring and restoration of the beneficial uses of the waterbody.

7. **Control Pollutant Limits.** Subitem G identifies control pollutant limits that must not be exceeded in the waterbody while a concentrated aquatic animal production facility is operating under a variance. If any of the control pollutant limits are exceeded, the possibility exists that drinking water supplies could be threatened, or severe eutrophication of the receiving waters could occur, or that restoration of the receiving waters to baseline quality may not be possible.

Therefore, it is reasonable that these limits have been established to prevent irreversible impacts and serious immediate impacts on existing beneficial uses. Violation of these limits constitutes a threat to human health and the environment. These limits are needed to comply with Minn. Stat. Section 17.494, which requires the establishment of compliance standards, and Minn. Stat. Section 17.498, which considers effects on drinking water supplies. Therefore, for the protection of the waterbody and its beneficial uses, it is reasonable to require the control pollutant limits described below. The following discussion focuses on lakes since it is believed these receiving waters are most likely to be considered for a variance under the terms of this subpart.

If the baseline quality of a pollutant is greater than the control pollutant limit, or less in the case of lack of dissolved oxygen, the baseline quality of the pollutant should be used as the control pollutant limit.

a. Total Organic Carbon.

It is reasonable to require total organic carbon as a control pollutant because of the ability of organic compounds to chemically react with chlorine and other halogens (i.e., fluorine, bromine, and iodine) to form trihalomethanes (THM's). Examples of trihalomethane compounds are trichloromethane or

chloroform (Cl_3CH), bromodichloromethane ($BrCl_2CH$), and dibromochloromethane (Br_2ClCH). Trihalomethanes are believed to have carcinogenic (cancer-causing) properties and to produce other adverse human health effects (exhibit 33). Chloroform has been shown to be carcinogenic in animal experiments. When previously used as an anesthetic during surgery, the use of chloroform resulted in irreversible liver and kidney injuries and it has been shown to cause liver enlargement, fat degeneration, and toxic hepatitis as a result of industrial exposure.

Chlorinated trihalomethanes, such as chloroform, may be formed when naturally occurring organic compounds or introduced organic compounds combine with chlorine during the disinfection of drinking water supplies (exhibit 33). Trihalomethanes are not the only halogenated compounds formed when chlorine comes into contact with total organic carbons. Chlorine reacts with aromatic compounds, such as benzene, particularly through "electrophilic aromatic substitution." Olefins also readily react with chlorine to form chlorohydrins (exhibit 15). There are several other reactions between chlorine and organic compounds to form chloroorganic compounds. Many of the resultant chloroorganic compounds are resistant to breakdown by microbial organisms. Thus, in addition to the formation of haloform compounds (i.e., trihalomethanes, such as chloroform) as the result of the interaction of chlorine and organic

compounds, there is the "possibility that other, unknown, highly toxic or carcinogenic compounds may also be produced simultaneously" (exhibit 48).

There are many potential sources of organic material that may contribute to the total organic carbon in a lake. Total organic carbon may be comprised of many soluble and insoluble forms that are constantly being modified by biological and chemical processes in the receiving waters (exhibit 52). These various forms may include fish feed and wastes, organic substances in the watershed, algae and algal by-products, bacterial metabolities, and sediments.

For lakes that receive discharge from an aquatic animal production facility, fish feed and fish wastes may be the most important sources of organic carbon. In addition to being important sources of allocthonous organic carbon, they also provide nutrients (e.g., phosphorus and nitrogen) for the autocthonous production of organic compounds by algae and macrophytes.

There is evidence that lakes receiving heavy organic loadings may take several years to become "saturated" with phosphorus. However, "once thoroughly polluted, they would take a similarly long period to be cleansed" (exhibit 17). Since the concentrations of total organic carbon in the water are

indicative of the rate of organic loading and since the loading may take place for several years, the limit on the concentration of total organic carbon serves to speed the rate of recovery of a lake with aquatic animal waste discharges after the waste discharges to the lake are terminated.

As discussed below, it is reasonable to require a limit of 5 milligrams per liter for total organic carbon as an annual mean because there is evidence that the Maximum Contaminant Level for trihalomethanes will be exceeded when water containing concentrations greater than 5 milligrams per liter of total organic carbon is chlorinated while serving as a drinking water supply. Further, an upper limit for total organic carbon provides protection against the formation of other cloro-organic compounds, reduces long-term oxygen depletion of the receiving waters, and may accelerate the recovery of the receiving waters following closure of the aquacultural facility.

When the concentration of total organic carbon in lake water, for example, exceeds 5 milligrams per liter, it is possible that unacceptably high concentrations of trihalomethanes will be formed if the water is chlorinated as part of the drinking water treatment process. Further increases in total organic carbon will increase the trihalomethane formation potential (THMFP), that is positively correlated with the amount of total organic carbon in the water (exhibit 11).

Other investigators have found trihalomethane precursors in drinking water reservoirs. Palmstrom et al. (exhibit 38) examined precursor generation in an Ohio water supply reservoir and found that trihalomethane precursors from the reservoir were entering the drinking water treatment facility.

The EPA (exhibit 24) has established a Maximum Contaminant Level (MCL) of 0.1 milligrams per liter for total trihalomethanes (TTHM's) that are introduced into drinking water by the reaction of naturally occurring substances with chlorine in the course of water treatment. This limit was established under the Safe Drinking Water Act as amended (42 U.S.C. 300g et seq., specifically sections 1401, 1412, 1445, and 1450). They constitute amendments to the National Interim Primary Drinking Water Regulations (NIPDWR), 40 CFR Part 141, as authorized by Section 1412(a)(1). Total trihalomethanes are the sum of chloroform, bromodichloromethane, dichloromethane, dibromocloromethane and chloroform (exhibits 24, 33). For chloroform alone, the World Health Organization has recommended a limit of 0.030 milligrams per liter (exhibit 33). The total trihalomethanes MCL allowed in public water supplies, and the RAL for private water supplies, is 0.10 milligrams per liter in Minnesota (Minn. Rules pt. 4720.0800).

Among states that have adopted the 0.1 milligrams per liter limit for TTHM's, the state of Kansas has conducted a study of the relationships among trihalomethane formation potential,

organic carbon, and lake trophic status (exhibit 11). The study found that "in lakes with total organic concentrations greater than 4-5 milligrams per liter, and trophic status greater than 45, the MCL for trihalomethanes would probably be exceeded if water treatment processes were not modified to minimize THM formation." The trophic status of the lakes in the study were obtained from Carlson's Trophic State Index (exhibit 14). A trophic status of 45 corresponds to mesotrophic waters with a total phosphorus concentration of 18 micrograms per liter, chlorophyll-a concentration of 4.5 micrograms per liter and a Secchi disk transparency of 2.8 meters. Because of the probability that these levels will be exceeded when allocthonous organic carbon and nutrients are added to a lake by discharge from a concentrated aquatic animal production facility, and that the trophic state index will exceed 45, it is important that the total organic carbon be maintained at a concentration of 5 milligrams per liter or less, particularly if there is any chance that the receiving waters will come into contact with a drinking water aquifer or serve as a drinking water supply. (Allocthonous organic matter is organic matter that does not originate in the lake and autocthonous organic matter is formed in the lake through the process of photosynthesis in algae and macrophytic aquatic plants.)

Another important reason for the 5 milligram per liter standard for total organic carbon is to help prevent depletion of oxygen

in the water during aerobic catabolism (breakdown) of the organic compounds by microbial activity, and other oxygen-consuming processes.

The limit on the amount of total organic material in the water column helps to protect a lake from oxygen depletion and indirectly helps to reduce the amount of organic material that settles in the sediment in such forms as fish feed and wastes, and algal cells. In addition to problems associated with sediment oxygen demand and anaerobic respiration, the sedimented organic material may produce adverse changes in the benthic communities. Tsutsumi et al. (exhibit 44) found substantial disturbances in the benthic communities as a result of the development of reducing conditions and deoxidation of the bottom water attributable to the deposition and decomposition of organic matter from net pen fish culture operations in the coastal waters of Japan.

Since the toxicity of chloroorganic compounds is often due to chronic exposure, and since the cumulative deposition of organic material to the sediment is more important than the sedimentation over a short time period, an annual average value for total organic carbon is reasonable. Since there is evidence that, if the average total organic carbon concentrations exceed 5 milligrams per liter, there is a chance that the 0.1 milligram per liter MCL for trihalomethanes will be exceeded, the total organic carbon standard of 5 milligrams per liter is reasonable.

Also, since relatively high quantities of total organic carbon in the water column may result in increased amounts of deposited organic material, sediment oxygen demand and reducing conditions in the sediment, the limit of 5 milligrams per liter is reasonable.

b. Nitrate-Nitrogen

It is reasonable to require a control limit for nitrate-nitrogen because of the ability of the nitrate anion (NO_3-) to produce an effect known as cyanosis (methemoglobinemia) in infants. This condition can be fatal, and is characterized by a bluish discoloration of the skin that is attributable to an excess of methemoglobin in the blood. Methemoglobin prevents adequate supplies of oxygen from reaching the lungs, resulting in the bluish color.

As discussed below, it is reasonable to require a limit of 10 milligrams per liter as an instantaneous value for nitrate nitrogen because water containing more than 10 milligrams per liter is not safe to drink because of the risk of methemoglobinemia to infants. Further, an upper limit for nitrate nitrogen may help to prevent excessive algal growth in the receiving waters. The safe level of nitrate anion in drinking water supplies is 45 milligrams per liter. This

concentration is equivalent 10 milligrams per liter of elemental nitrogen (N) or nitrate-nitrogen (exhibits 19, 27). Nitrates are converted to nitrites in the intestine which ultimately causes the oxidation of hemoglobin and the formation of methemoglobin (exhibit 19).

The EPA has established a MCL of 10 milligrams per liter for nitrate as nitrogen (exhibit 23) under 40 CFR 141.62. The Minnesota Health Department has adopted the EPA standard as the primary standard for nitrate-nitrogen. The MCL for public water supplies, as well as the RAL for private water supplies is 10 milligrams per liter.

In addition to the aforementioned role of nitrate-nitrogen in the production of methemoglobin in infants, investigators have found other adverse health effect in humans. For example, Dorsch et al. (exhibit 18) found a threefold risk of malformations in the offspring of women who drank water containing 5 to 15 milligrams per liter of nitrate, and a fourfold risk for women who drank water containing more than 15 milligrams per liter of nitrate. The malformations were primarily of the central nervous system and musculoskeletal system. The findings above suggest that a 10 milligram per liter standard for any receiving water that may potentially be in contact with, or used as a drinking water supply, is reasonable.

Although the role of nitrate for promoting or limiting algal growth may not be as important as that of phosphorus, the limit of 10 milligrams per liter of nitrate as nitrogen is reasonable as a nutrient standard because of the possibility that excessive nitrate, or increases in nitrate, when it is functioning as a limiting nutrient in concert with phosphorus, may stimulate algal growth.

Nitrogen is one of the major constituents of the cellular protoplasm of organisms (including algae), and along with phosphorus, carbon and hydrogen is a major nutrient that affects the productivity of fresh waters. Many chemical species in fresh water contain nitrogen. Of all of these species, nitrate is the most readily assimilated by algae as nutrient nitrogen. Nitrate is probably not as important as phosphorus as a nutrient that limits or increases the rate of algal growth. This is because gaseous nitrogen (N_2) in the air may serve as an alternative source of nutrient nitrogen for blue-green algae through nitrogen fixation, especially when nitrate is in short supply (exhibit 52). Nitrate is more important as the nitrogenous nutrient for blue-green algae when it is present in ample supply in the water. Thus nitrogen gas may be used as an alternative to nitrate when necessary. Additionally, nitrogen gas may be formed in the water through the process of denitrification and be utilized by blue-green algae, or it may diffuse to the ambient air.

Nitrogen fixation can only be accomplished by prokaryotic plants such such as the blue-green algae, but not in eukaryotic plants (unless they are in symbiotic relationships with prokaryotic bacteria). Nitrogen fixation has not been demonstrated for other algal groups, and nitrate is typically the most important nitrogenous nutrient for non-blue-green algal groups. However, because blue-green algae are almost ubiquitous in fresh water bodies and can use nitrogen gas as an alternative to nitrate as a source of nutrient nitrogen, the role of nitrate in controlling the rate of algal growth may not be as important as that of phosphorus. Phosphorus has no gaseous phase and can not enter or leave the water column as a gas. The algae must utilize the phosphorus available in the water as a nutrient.

The concentrations of nitrogen in concert with phosphorus may be an important factor in determining the amount of algal growth. Based on Walker's (exhibit 50) assessment of reservoirs, which is one of the most comprehensive limnological data assessments completed to date, more accurate predictions of whole reservoir chlorophyll-a concentrations were obtained when the composite of total nitrogen and phosphorus was analyzed. Additionally more of the variance among the chlorophyll-a data could be explained by analyzing the composite phosphorus and nitrogen data. Therefore, Walker (exhibit 50) developed a system to predict algal growth potential, based on the composite nitrogen and

phosphorus concentrations, that is independent of whether phosphorus or nitrogen is the limiting nutrient for algal growth. Accordingly, it is important to assess and control nitrate (as well as ammonia, nitrite and total organic nitrogen) whenever there is a loading of organic or inorganic nitrogen above background levels to a water body.

c. Chlorophyll-a

It is reasonable to include chlorophyll-a as a control pollutant because it is an indicator of the quantity of algae in the receiving waters, and because waters containing high chlorophyll-a concentrations generally contain high quantities of blue-green algae (also known as Cyanophyeae or Cyanobacteria) that can produce toxins and impart adverse taste and odor to the water. Blue-green algae produce potent toxins, impart adverse taste and odor to the water, promote bacterial growth and add color to the water (exhibit 30). Chlorophyll-a is positively correlated with the quantity of algae in the water and is generally used as an indicator of the amount of algae instead of counts of the number of algal cells or colonies.

It is reasonable to require a limit of 30 micrograms per liter for chlorophyll-a as a monthly mean since there is evidence that "severe nuisance" algal blooms with their associated toxic by-products occur frequently at chlorophyll-a levels of 30 micrograms per liter or higher.

Walmsley (exhibit 51) has developed a classification system for the severity of algal blooms in South African reservoirs. In his classification system, lakes with chlorophyll-a concentrations greater than 30 micrograms per liter had algal blooms that were characterized as "severe nuisance" algal blooms. During "severe nuisance" algal blooms, blue-green algae predominate, scums form, and toxic substances are produced.

The two classes of toxins produced by blue-green algae are alkaloid toxins and peptide hepatotoxins. The alkaloid toxins may be produced by Anabaena and Aphanizomenon blue-green algae and can function as neurotoxins by paralyzing peripheral skeletal muscles and then respiratory muscles. These toxins have been responsible for numerous poisonings in dogs and other domestic animals when the animals ingested the algae or drank water infested with high concentrations of blue-green algae and/or acute lethal concentrations of the alkaloid toxins (exhibit 16). The second type of toxins, hepatotoxins, are probably the most common form worldwide and are produced by various strains of Microcystis aeruginosa. The mode of action again involves ingestion of sufficient toxin to cause death or toxic effects in domestic and wild animals. Removal of the toxins and odor and flavor organics from the blue-green algal blooms can be accomplished by filtration of reservoir water through sand topped with granular activated carbon (exhibit 21).

In general, "eutrophication of water supplies and recreational water bodies has increased, and with increases in productivity have come increases in the number of poisoning episodes" (exhibit 28).

Falconer (exhibit 20) has found that heavy blooms of blue-green algae in public water supplies in the United States, East Africa, and Australia were followed by the release of toxins that resulted in outbreaks of gastrointestinal disorders. The causative organisms included Microcystis, Anabaena, Aphanizomenon and Oscillatoria. He found that there was a significant increase in liver enzymes, resulting from liver damage, in the blood as a result of the toxicity. As reported by Carmichael (exhibit 16):

> Falconer et al. (1983b[Exhibit 22]) examined the results of routine assays for hepatic enzymes in plasma of persons who obtained drinking water from a reservoir (Malpas Dam, Armidale, New England, Australia) containing containing a heavy bloom of toxic M. aeruginosa during periods before, during and after the algal bloom. These results were compared with corresponding assays from an adjacent population that did not use water from this source. The residents supplied with water from the bloom infested Malpas Dam Reservoir showed a significant rise in gamma-glutamyltransferase (GGT) during the bloom period,

while no such increase occurred among residents not receiving their water from the Malpas Dam. GGT is characteristically released after alcohol or toxic damage to the liver cell membranes and is a more sensitive indicator of liver damage than alkaline phosphates or aspartate amino transferase.

There are other problems associated with blue-green algae. Among these are adverse effects on the taste of fish. The taste is often described as an "earthy" flavor or an "earthy-musty" flavor (exhibits 26, 34).

d. Dissolved Oxygen

It is reasonable to include oxygen as a control pollutant to ensure sufficient oxygen for animal and plant aerobic respiration, avoid a competitive advantage for blue-green algae, and to prevent the release of phosphorus, heavy metals, and such gases as ammonia, hydrogen sulfide and methane from the sediments.

The EPA has developed criteria, based on the available data, of dissolved oxygen concentrations necessary to to protect aquatic life and its uses. The criteria were based on a critical review of the literature on the oxygen requirements of freshwater aquatic life (exhibit 46).

Much of the literature on dissolved oxygen has been biased toward fish, especially fish of the economically important family Salmonidae. However, the literature on invertebrates suggests that, in general, invertebrates would be protected if there is sufficient oxygen to protect the fish populations. The criteria developed by the EPA for the protection of freshwater aquatic life is presented in table 1 (exhibit 46). The lowest recommended concentration is 3 milligrams per liter as a 1-day minimum to be achieved at all times for biota in warmwater habitats that are not in their early life stages. For early life stages in warmwater habitats, the dissolved oxygen criterion is 5.0 milligrams per liter. Early life stages were defined as all embryonic and larval stages and all juvenile stages up to 30 days following hatching.

An oxygen standard of 3 milligrams per liter in the lower half of the hypolimnion and 5 milligrams in the upper half of the hypolimnion provides reasonable protection for the water body and its biota, at least for water bodies with warmwater fisheries. Since sediment oxygen demand due to the discharge from aquatic animal production facilities may be difficult to overcome, the required oxygen concentration in the lower half of the hypolimnion allows more oxygen depletion than allowed in the upper half while providing some protection against the adverse effects of anoxia. The higher concentration required for the upper half of the hypolimnion allows more protection for the biota that can migrate to the upper half and provides more of the benefits of increased oxygen concentrations.

Naturally occurring dissolved oxygen profiles for oligotrophic lakes with very low organic production may form an orthograde dissolved oxygen curve for which the dissolved oxygen concentration in the hypolimnetic bottom waters may be greater than in the epilimnetic surface waters (exhibit 52). An orthograde oxygen profile is a top to bottom curve of the oxygen concentrations for which the hypolimnetic oxygen concentrations are higher than the metalimnetic oxygen concentrations. Generally, the orthograde profile occurs in receiving waters in which the surface water (metalimnion) is warmed by during the summer and lose oxygen because oxygen is less soluble in warm water than in cold water, but in which the colder bottom water (hypolimnion) retains more oxygen because oxygen is more soluble in cold water.

Some Minnesota lakes may experience hypolimnetic oxygen depletion without waste discharges from aquatic animal production or other facilities (exhibits 12, 36). Although some water bodies may experience "naturally" occurring oxygen depletion without the influence of aquatic animal production facility discharges, it is important to maintain sufficient oxygen in the hypolimnion when additional organic and nutrient loading is added to the receiving waters. Important reasons for maintaining oxygen concentrations in the hypolimnion at reasonably high levels when the water body is receiving additional organic and nutrient loadings from an aquatic animal production facility discharge are the following:

1. To prevent the internal loading (release from the sediments) of phosphorus, other nutrients and heavy metals that is attributable to oxygen depletion.

2. To prevent the formation of gases such as hydrogen sulfide, ammonia, and methane that result from anaerobic respiration and reducing conditions.

3. To provide some oxygen for the respirational needs of fish, invertebrates, aerobic microorganisms and other biota that originally inhabited the water body.

4. To provide some oxygen buffer for the hypolimnion in the event of the failure of mechanical aeration systems or other temporary oxygen depleting events.

Oxygen concentrations may be increased by such processes as wind action, diffusion, photosynthetic activity, advection, increased solubility due to atmospheric pressure and low temperatures as well as mechanical aeration. In the event of mechanical aeration, the whole water body may be mixed and no thermocline or discernible hypolimnion may be present. If mechanical aeration is used to mix the whole water body, the hypolimnetic depths will be determined from the temperature profile data obtained during the required baseline quality study.

Oxygen may be consumed by animal and plant respiration (especially bacterial respiration resulting in the breakdown of organic compounds), purely chemical oxidation of organic compounds, diffusion to the atmosphere, photochemical oxidation (exhibit 52), and loss of oxygen solubility attributable to increased water temperature. It will be necessary to consider all sources of oxygen supply and consumption to maintain the required hypolimnetic oxygen concentrations during discharges from aquatic animal production facilities at all times to successfully maintain the oxygen concentrations at the required levels.

It is reasonable to require a limit of 3 milligrams per liter (minimum) in the lower half of the hypolimnion and 5 milligrams per liter (minimum) in the upper half of the hypolimnion to be maintained at all times because it not only meets lowest concentration criteria of the EPA, but provides for some protection against the adverse effects of oxygen depletion during discharges from aquatic animal production facilities.

Table 1. EPA Water Quality Criteria for Ambient Dissolved Oxygen Concentrations in Milligrams per Liter

	Coldwater Criteria		Warmwater Criteria	
	Early Life Stages	Other Life Stages	Early Life Stages	Other Life Stages
30-Day Mean	NA	6.5	NA	5.5
7-Day Mean	9.5	NA	6.0	NA
7-Day Mean Minimum	NA	5.0	NA	4.0
1-Day Minimum (Instantaneous Value)	8.0	4.0	5.0	3.0

NA=Not Available.

F. Subpart 6. Special Conditions.

Item A. This item outlines special monitoring, testing and reporting requirements for concentrated aquatic animal production facilities. It is structured to emphasize the distinctions between measuring the discharge (subitems 1 and 2) and the receiving waters (subitem 3). This is reasonable because requirements differ substantially in monitoring waste discharges, which must be limited in permits so as to protect receiving waters, and in monitoring the receiving waters themselves. The wording in subitem 1 for on-land facilities reflects the way in which pollutant loads are determined for almost all municipal and industrial dischargers in Minnesota. The wording in subitem 2 for in situ facilities reflects the different nature of the discharges from this class of facilities, since unlike most other

municipal and industrial dischargers in Minnesota, in situ concentrated aquatic animal production facilities are located in the waters of the state.

Item B. This item outlines certain requirements for the collection and disposal of aquatic animal mortalities and blood. These requirements are reasonable in order to protect the environment from the impacts of such wastes from concentrated aquatic animal production facilities. The DNR is presently developing requirements for the disposal of infected or exposed fish in order to eliminate transmission of disease to non-infected fish. It is reasonable to incorporate this rule language to address the following water quality protection concerns which the DNR does not regulate:

a. Dead animals, even if they are not diseased, can add an extra organic waste load to surface waters and can deplete oxygen in the waters due to decomposition. They can accumulate on lake and stream bottoms and adversely affect the aquatic life, or can float on the water surface to create visual and odor problems at a minimum. The DNR requirements cover only diseased fish, not all dead aquatic animals, and do not directly address these water pollution control issues.

b. Bleeding of harvested aquatic animals may occur at production facilities, as well as processing facilities (which are not covered by this rule). The discharge of blood is an organic waste

which can deplete oxygen and discolor waters. It is reasonable to require that blood generated at production facilities is disposed of by rendering, land disposal, treatment at a municipal sewage plant or through a permitted NPDES outfall.

Prohibition of mortality and blood disposal in waters of the state also is reasonable in that it encourages recovery of these materials as resources. Composting and rendering of these materials, for example, can represent an opportunity to create beneficial products and help economic diversification for the industry.

Item C. This item requires that permittees maintain records of certain aspects of their operations that relate to water quality protection. Much of this information is routinely recorded by permittees as part of good production practices. It is reasonable to require this record-keeping because all of this information can be important to verify water pollution control at facilities, as follows:

a. Addition of fish food: The amount of food used tends to be directly related to the amount of untreated wastes generated at a facility.

b. Composition of fish food: The composition of the food, such as the percent phosphorus, percent nitrogen, ratios of protein to fat to carbohydrates, presence of antibiotics, all can affect the types and amounts of various wastes generated and, thus, impact the amount and type of treatment needed. This type of composition information should be recorded, at a minimum.

c. Aquatic animal transfers, harvests, and mortalities: These are all related to production level at the facility, which correlates with the amounts of untreated wastes generated.

d. Cleaning, major weather events, power failures: Each of these controlled or uncontrolled events can result in higher pollutant loads, and inefficiencies in waste treatment systems.

Item D. This item requires that permittees submit an annual report that summarizes information in several areas related to water pollution control. It is important and reasonable for both the permittee and the agency to have this information on an annual basis in order to better assess long-term trends in operation of the facility as it may impact water quality. Most of the information required by this item can be summarized from the regular monitoring data and the operation record book data compiled by the permittee.

Item E. This item requires that discharges of water treatment and chemical additives not be toxic, cause adverse human health concerns, nor violate water quality standards. This language is reasonable to reiterate for the regulated community and others that such water quality protection issues must be addressed when water treatment or chemical additives, including aquaculture therapeutics as noted in Minn. Stat. Section 17.498(a)(4), are discharged. The requirement is reasonable based on language in the federal Clean Water Act (Sec. 302, 307, 402) and Minn. Stat. Section 17.498(a)(5).

V. ECONOMIC CONSIDERATIONS

A. Economic Impact of the Proposed Amendments.

The Agency is required by Minn. Stat. Section 116.07, subd. 6, to give due consideration to economic factors. The statute provides:

> In exercising all its powers the pollution control agency shall give due consideration to the establishment, maintenance, operation and expansion of business, commerce, trade, industry, traffic, and other material matters affecting the feasibility and practicability of any proposed action, including, but not limited to, the burden on a municipality of any tax which may result therefrom, and shall take or provide for such action as may be reasonable, feasible, and practical under the circumstances.

During the process of proposing this new rule, the Agency has considered a number of possible economic impacts on the existing facilities in the state. As a result of these deliberations, the decision was made to focus the primary discussion of possible economic impacts on the new rule requirements of wastewater collection and treatment. The reason for focusing primarily in these areas is that these possible costs would likely be the most significant expenses that existing facilities would incur to comply with the provisions of the new rule.

It is also important to note that the cost information presented is based only on the proposed new revisions to the rule. The actual effluent limits that may be established in a facility's NPDES/SDS reissued or modified permit may not reflect the values established in these new requirements. The reason for this is that the Agency must consider a number of other rules and requirements during the process of setting a facility's effluent limitations, including the specific, existing conditions of the receiving water. The statewide water quality standards are one of the additional sets of rules which may impact a facility's effluent limitations. Costs could change if more stringent effluent limitations were placed in a permit.

The new Minn. Rules ch. 7050.0216, subpart 3, item A, states, "Collection and Treatment. All concentrated aquatic animal production facilities shall collect, remove, treat and properly dispose of unconsumed fish food and wastes. Mass discharge shall be determined by monitoring, testing and reporting, in accordance with subpart 6.A."

The new Minn. Rules ch. 7050.0216 subpart 3, items B and C, also require that discharges from on-land and in situ facilities comply with effluent limits of 25 mg/L $CBOD_5$, 30 mg/L TSS and 1 mg/L phosphorus.

The Agency has considered the possible costs for on-land facilities to comply with the requirements of subpart 3 of the rule. According to Fishpro, Inc., and Woodward-Clyde (exhibit 25), "The advantages which

land-based facilities hold over in-water fish production facilities is that the waste stream is most often contained within a drainline. This eliminates any collection costs for the treatment system other than perhaps some pumping costs and nominal piping costs." This draft report estimated that treatment costs for on-land facilities would be from $0.73 to $0.07 per pound of production (annual production range of 20,000 to 500,000 pounds). At on-land facilities, much of the solid wastes should settle out and remain as manure waste for removal from the treatment units. In addition, based on the calculations performed for the in situ example (which follows) and assuming complete mixing of the pollutants which do not settle out, the effluent discharged from on-land facilities should be in compliance with the limitations in subpart 3. Therefore, there should be no additional cost for existing on-land facilities to comply with the rule.

For in situ facilities, the economic analysis for this proposed new rule will include cost information on a method of waste collection, and the treatment of the wastewater.

1) Collection

The document used to provide the cost information presented here is an August 5, 1991, draft report to the EPA (exhibit 25). From Table 5-1 of this draft report, the cost values given are for facilities using a closed bag collection system with continuous wastewater removal and fresh make-up water. For comparison purposes, annual productions of 100,000 lb and 500,000 lb respectively are given as follows:

	Annual Production(lb/year) 100,000	500,000
Equipment	Total Capital Cost($)	
Net pen replacement	40,000	210,000
Water Supply system	21,000	168,000
Waste Pumping system	15,700	142,000
Power supply, backup generator, pump controls	46,000	94,000
Surge tank	10,000	50,000
Modifications to pier	10,000	15,000
SUBTOTAL	142,700	679,000
Engineering(10%)	14,300	67,900
Contingency(20%)	28,500	135,800
Taxes,fees(10%)	14,300	67,900
Total Capital Costs(1990) (ENR Index = 4732)	199,800	950,600
Updated 1991 capital cost (ENR Index = 4891.83)	206,600	982,920

Basis	Interest Rate	Life (years)		Annualized Capital Cost ($)
1990 ENR=4732	11%	10	33,900	161,400
9/1991 ENR=4891.83	11%	10	35,060	166,800

Operation and Maintenance	Annual O&M Cost ($)	
Total O&M Costs ENR=4732	19,600	78,700
1991 Adjusted O&M Costs ENR=4891.83	20,270	81,380

1991 TOTAL ANNUAL COST (Capital plus O&M)	55,330	248,180
	Annual Cost ($)	
Cost per lb produced	0.55	0.50
Cost per pound of pollutant collected		
BOD+TSS	0.52	0.45
Total N	7.68	6.90
Total P	51.22	45.97

2) Treatment

In order to perform a cost estimate for a treatment facility, it is appropriate to first do a brief analysis of the expected wastewater flows and loadings. For the purposes of this analysis, assume that the treatment system will be designed to handle all daily flow on a continuous basis. Again using the FishPro/Woodward-Clyde, draft report (exhibit 25) as basis for estimating, from Table C-4:

	Annual Production(lb)	
	100,000	500,000
	Flow Values	
Daily Effluent Flow (gallons per day, gpd)	7,200,000	32,000,000

The daily loadings can be calculated from the annual loading and collections Table C-2 (exhibit 25):

	Annual Production (lb)	
	100,000	500,000
	Total Waste Collection (lb/day)	
Closed bag collection - continuous		
BOD	98.6	493.2
TSS	197.3	986.3
Total N	19.7	98.6
Total P	3.0	14.8

Next, to determine the level of treatment required, the daily loadings will be converted to concentration values, assuming that the pollutant concentrations in the make-up water are zero and the daily loading will be equally dispersed within the daily effluent flow. The following example formula was utilized:

$$\text{BOD Concentration (milligrams/liter, mg/l)} = \frac{\text{BOD Daily Load (lb/day)}}{\text{[Daily Effluent Flow (mgd)]X[8.345(lb/mgal/mg/l)]}}$$

*where mgd is million gallons per day and;
lb/mgal/mg/l is pounds per million gallons per milligram per liter

	Annual Production (lb/year) 100,000	500,000	New Rule Effluent Limits
	Daily Concentrations (mg/l)		
Closed bag collection - continuous			
BOD	1.64	1.85	25.0
TSS	3.28	3.69	30.0
Total N	0.33	0.37	No limit identified
Total P	0.05	0.06	1.0

A number of possible treatment options to be used with bag collection systems are identified by FishPro, Inc., and Woodward-Clyde (exhibit 25). Treatment alternatives such as filtration, constructed wetlands, land application of wastewater, and pumping to a municipal wastewater treatment facility were suggested. Other treatment alternatives to consider may include microscreens, centrifuges, clarifiers (including special types such as Lammela), and stabilization ponds. These types of alternatives are suggested by FishPro, Inc., and Woodward-Clyde (exhibit 25), which notes the settleable portions of total suspended solids and phosphorus pollutants to be as much as 86 percent of the waste fraction distribution (also BOD is given as approximately 25 percent and Total Nitrogen is given as approximately 17 percent). Treatment of the remaining portion of the pollutants could be enhanced by a on-land chemical addition process, such as by using alum.

For purposes of presenting a possible representative treatment cost, the continuous filtration type of treatment was chosen. It is identified by FishPro, Inc., and Woodward-Clyde (exhibit 25) as a type of treatment that is compatible with the closed bag collection system. Following are costs (and adjusted 1991 costs) from the FishPro/ Woodward-Clyde draft report:

	Annual Production(lb/year) 100,000	500,000
Equipment	Total Capital Cost($)	
Tilted screen filter unit	75,000	375,000
High pressure pump and controls	3,500	6,200
Pressure tank	2,000	3,000
Piping and valves	15,000	30,000
Discharge diffuser	1,400	2,200
SUBTOTAL	96,900	416,400
Engineering(10%)	9,700	41,600
Contingency(20%)	19,400	83,300
Taxes,fees(10%)	9,700	41,600
Total Capital Costs(1990) (ENR Index = 4732)	135,700	582,900
Updated 1991 capital cost (ENR Index = 4891.83)	140,315	602,720

Basis	Interest Rate	Life (years)	Annualized Capital Cost ($)	
1990 ENR=4732	11%	10	23,000	99,000
9/1991 ENR=4891.83	11%	10	23,835	102,380

Operation and Maintenance	Annual O&M Cost ($)	
Total O&M Costs ENR=4732	20,200	49,200
1991 Adjusted O&M Costs ENR=4891.83	20,890	50,875
1991 TOTAL ANNUAL COST (Capital plus O&M)	44,725	153,175
	Annual Cost ($)	
Cost per lb produced	0.45	0.31
Cost per pound of pollutant collected		
BOD+TSS	0.61	0.41
Total N	15.51	10.64
Total P	62.67	43.00

The information presented here is an estimate. Some costs could significantly increase (or decrease) depending on site specific conditions. A number of factors should be considered when choosing a

collection and treatment alternative (such as waste type, wastewater volume, waste loading and characteristics), and a variety of alternatives which produce acceptable effluent should also be considered.

Based on the above example, estimates of the total costs of collection and treatment for an existing in situ facility would be approximately from $1.00 to $0.81 per pound of fish produced (or $1.13 to $0.86 per pound of BOD plus TSS removed). These costs are approximately three times greater than estimated costs for waste collection and treatment at on-land facilities, and also tend to exceed costs of waste collection and treatment for land animal feedlots and municipal sewage treatment plants (exhibit 25). None of these other facilities are, however, in situ, (i.e., located within receiving waters as a net pen aquatic animal facility would be); if a hog feedlot, for example, were sited on floating rafts on a lake, collection and treatment costs comparable to those for a net pen fish rearing facility might be sustained. As discussed in section IV.C, the initial capital construction costs for in situ facilities are less than those for on-land facilities; with collection and treatment systems included in facility costs, the total capital costs for in situ and on-land facilities are similar and equitable.

B. Small Business Considerations In Rulemaking.

Minn. Stat. Section 14.115, subd. 2, requires the Agency, when proposing amendments to an existing rule which may affect small

business, to consider the following methods for reducing the impact of the rule on small business:

(a) the establishment of less stringent compliance or reporting requirements for small businesses;

(b) the establishment of less stringent schedules or deadlines for compliance or reporting requirements for small businesses;

(c) the consolidation or simplification of compliance or reporting requirements for small businesses;

(d) the establishment of performance standards for small businesses to replace design or operational standards required in the rule; and

(e) the exemption of small businesses from any or all requirements of the rule.

The statute requires the Agency to incorporate into the proposed rules any of these methods that it finds to be feasible, unless doing so would be contrary to the statutory objectives that are the basis of the proposed rulemaking.

In drafting part 7050.0216, the Agency did give consideration to small businesses. Subpart 1 defines a concentrated aquatic animal

production facility as a hatchery, fish farm or other facility which contains, grows or holds 9,090 harvest weight kilograms of cold water aquatic animals or 45,454 harvest weight kilograms of warm and cool water aquatic animals. A facility which meets these criteria is considered a large production facility. Small fish farms or hatcheries are generally excluded from the requirement to obtain an Agency water quality permit and, thus, excluded from the conditions and requirements of this rule.

C. Public Bodies.

Under Minn. Stat. Section 14.11, subd. 1, the Agency must provide an estimate of the public monies associated with implementing the proposed rule if it is estimated that the total cost to all local public bodies exceeds $100,000 in either of the first two years following adoption of the rules. Concentrated aquatic animal production facilities are generally privately owned industries, with the exception of DNR-operated fish hatcheries. Three hatcheries currently require Agency permits and are operated with public funds. It is not expected that the proposed rule will require the expenditure of any public monies by local units of government within the first two years.

D. Agricultural Lands.

Minn. Stat. Section 17.83 requires the Agency to notice and describe in the Statement of Need and Reasonableness any direct or substantial adverse effect the proposed rule might have on agricultural land. The

Agency does not believe the proposed rule will have such an impact on agricultural land. Proposed procedures recommend the disposal of aquatic animal mortalities at a land-based facility where the mortalities could be composted and/or incorporated as a nutrient into the soil. The rule also encourages the land disposal of waste manure that is collected and removed from the water at aquatic animal production facilities. These actions will aid agricultural land by providing nutrient-rich fertilizer for croplands. Appropriately applied there will be no adverse effect on agricultural land.

VI. AQUACULTURE RULE ADVISORY GROUP

Minn. Stat. Section 17.498 states that the Minnesota Department of Agriculture (MDA) and the DNR must consult with an advisory group in the establishment and promotion of aquaculture programs. Minn. Stat. 17.498 also requires the Agency to consult and cooperate with the MDA and the DNR in rule development. Although consultation with an advisory group was not a requirement for the Agency, in keeping with the spirit of the Act and prior to drafting the rule, the Agency organized an Aquaculture Rule Advisory Group. The advisory group was composed of 26 individuals representing the aquaculture industry, MDA, DNR, Minnesota Department of Health, University of Minnesota, Legislative Water Commission, St. Louis County Soil and Water Conservation District, concerned citizens from Chisholm and Virginia, Audubon Society, Sierra Club, Minnesota Lake Management Federation, Minnesota Sport Fishing Congress, and the Oppenheimer Wolff & Donnelly Law Firm.

The group met four times: June 20, July 11, August 1, and August 22, 1991. At these meetings, the group discussed the five issues which the statute indicated must be considered in the rule. In considering the issues, the group offered options for each issue, an analysis of the options, and provided documentation to support the options. A worksheet (exhibit 6) containing the ideas, opinions, statements, and objections generated during the meetings was compiled and distributed to the members and other interested people. A fifth meeting of the advisory group was held on October 17, 1991. At this meeting, the Agency staff explained each subpart of the draft rule and responded to questions and concerns.

VII. LIST OF WITNESSES, FIGURES AND EXHIBITS

A. Witnesses.

In support of the need for and reasonableness of the proposed amendments to the rule, the following Agency staff helped prepare this statement of need and reasonableness and will be available to explain the proposed amendments and answer questions at the rulemaking hearing:

1. Greg Gross: water quality standards, antidegradation.
2. Douglas Hall: permit requirements, variance procedures.
3. William Lynott: financial assurance.
4. Gene Soderbeck: treatment technology discharge requirements.

5. Jim Strudell: definitions, recirculating flow, special conditions.
6. Randy Thorson: economic impact.
7. Richard Wedlund and Bruce Wilson: baseline quality, closure plan, restoration, postclosure monitoring and control pollutant levels.

B. Figures.

In support of the statement of need and reasonableness of the proposed rule, the following figures have been used.

Figure 1. Example Concentrated Aquatic Animal Production Facility
Figure 2. Example Concentrated Aquatic Animal Production Facility
Figure 3. Example Concentrated Aquatic Animal Production Facility
Figure 4. Near-shore Net Pen System
Figure 5. Floating Raceway System
Figure 6. Barge System
Figure 7. Rearing Pond System
Figure 8. Raceway System with In-line Settling Basin
Figure 9. Raceway System with Off-line Settling Basin
Figure 10. Example Recirculating Flow

C. Exhibits.

In drafting the proposed rules, the Agency relied on technical documents prepared by a number of sources. The following documents were utilized by Agency staff in developing these rules and are relied

on by the Agency as further support for the reasonableness of the proposed rules. These documents are available for review at the Agency's Public Information Office at 520 Lafayette Road North, St. Paul, Minnesota 55155.

In support of the need for and reasonableness of the rule, the following exhibits will be entered into the hearing record by the Agency:

Exhibit Number	Document
1.	Statement of Need and Reasonableness.
2.	Order of Hearing.
3.	Certificate of Agency Board's Authorizing Resolution.
4.	Notice of Hearing.
5.	Notice of Hearing as published in State Register.
6.	Mailing list certificates.
7.	Affidavit of Mailing.
8.	Rules with Revisor's Certificate of Approval.
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VIII. CONCLUSIONS

Based on the information in this statement and the exhibits, the proposed part 7050.0216 of Minnesota Rules are both needed and reasonable.

Dated: _____

_____
Charles W. Williams
Commissioner

FIGURE 1. EXAMPLE CONCENTRATED AQUATIC ANIMAL PRODUCTION FACILITY

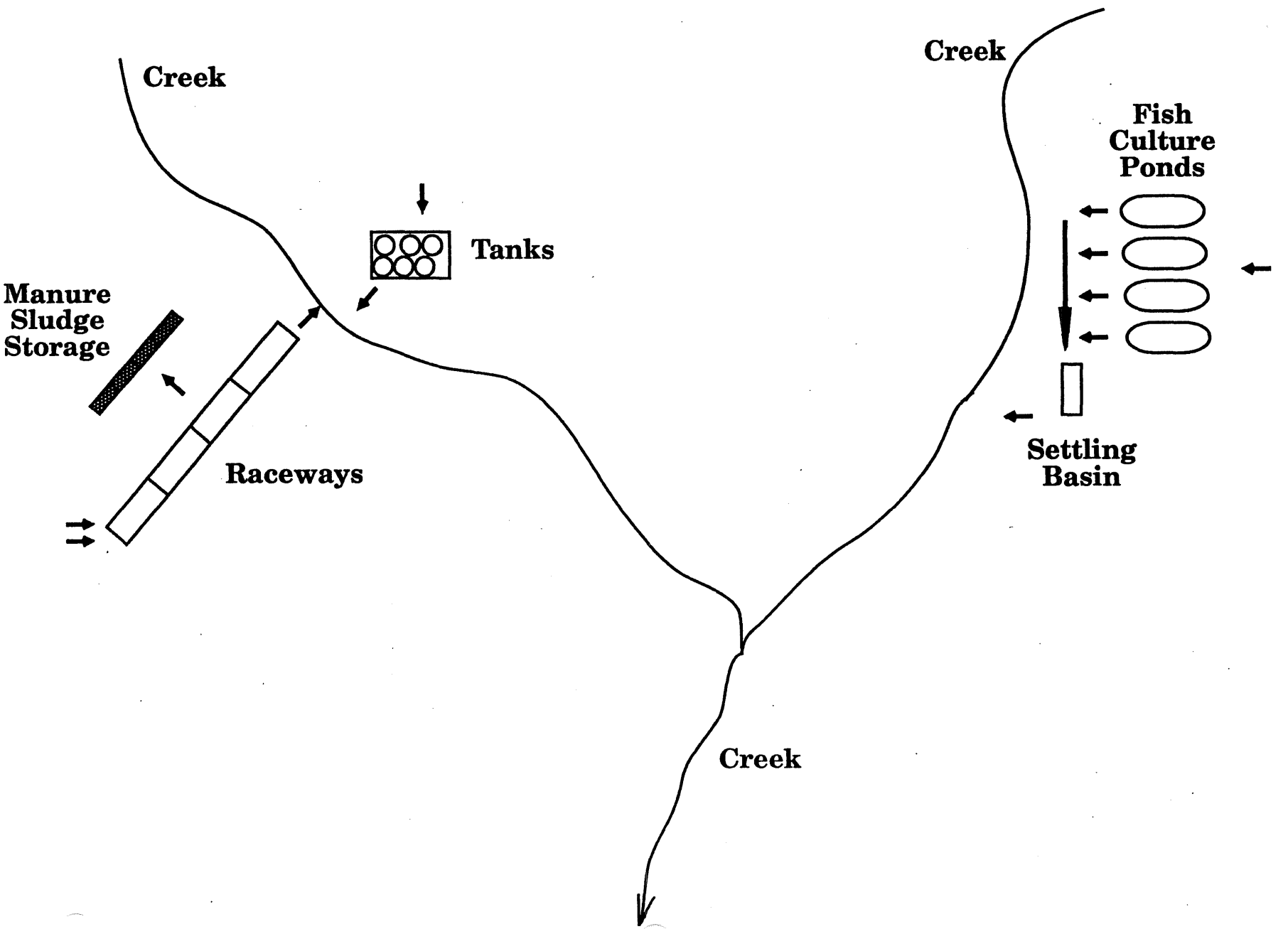


FIGURE 2. EXAMPLE CONCENTRATED AQUATIC ANIMAL PRODUCTION FACILITY

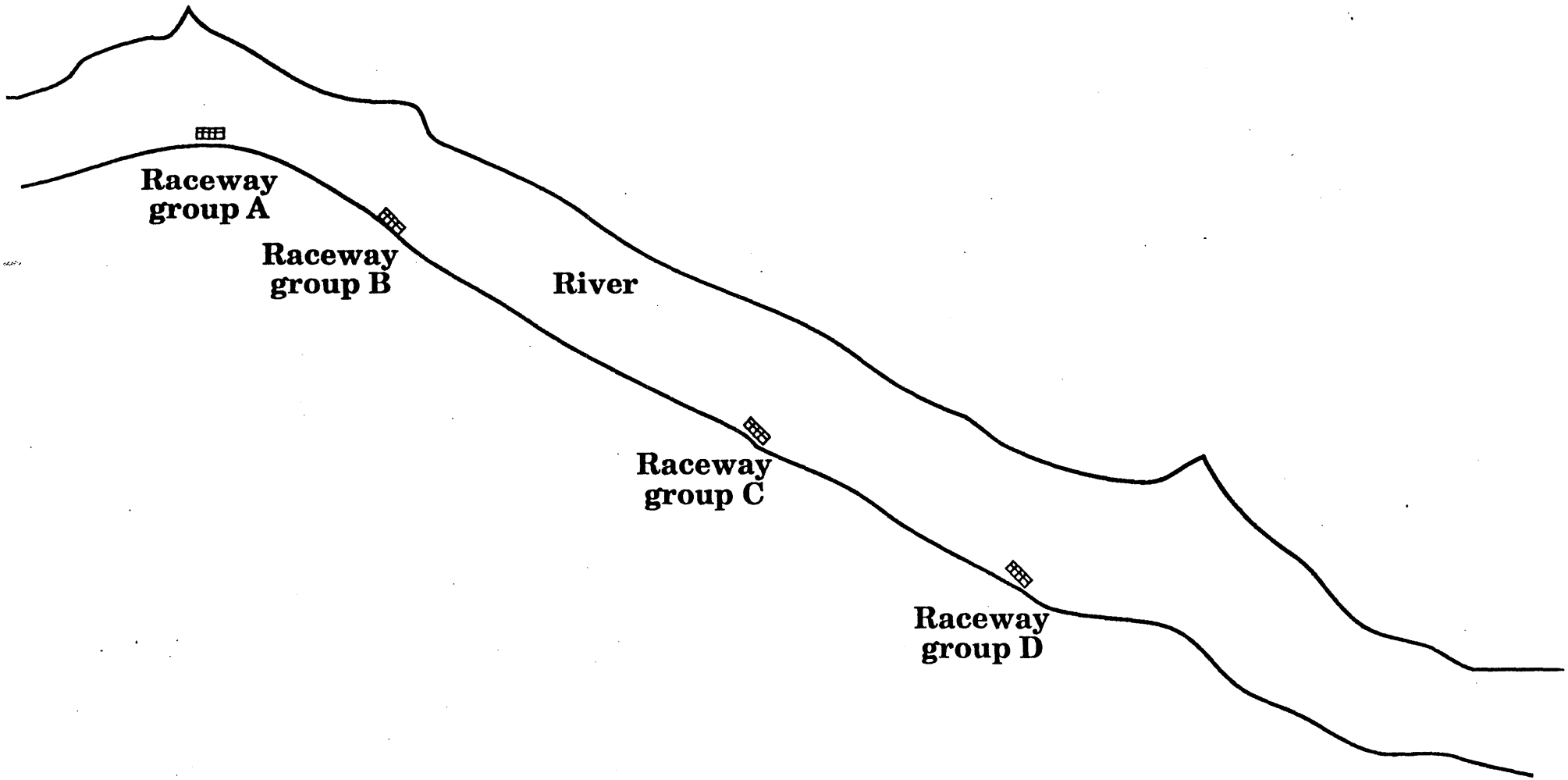
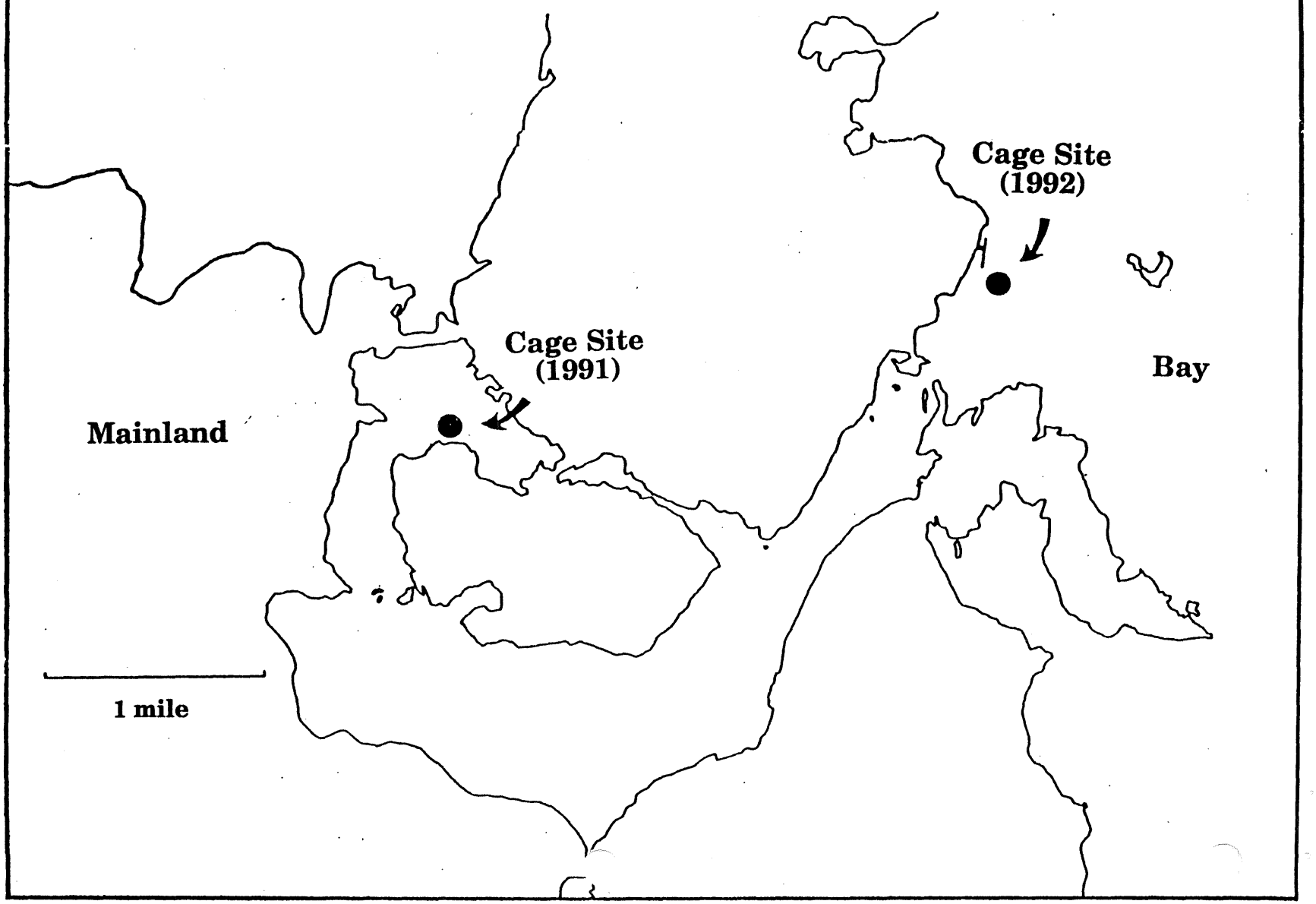


FIGURE 3. EXAMPLE CONCENTRATED AQUATIC ANIMAL PRODUCTION FACILITY



STATE OF MINNESOTA
MINNESOTA POLLUTION CONTROL AGENCY

IN THE MATTER OF PROPOSED RULES
GOVERNING REQUIREMENTS FOR
AQUACULTURE FACILITIES
MINN. RULES PT. 7050.0216

SUPPLEMENT TO THE
STATEMENT OF NEED
AND REASONABLENESS

This supplement is an addendum to Section V. ECONOMIC CONSIDERATIONS, part B. Small Business, in the Statement of Need and Reasonableness.

The proposed rules will affect small businesses which hold or require permits for aquaculture facilities. The proposed rules will affect management practices and impose requirements for aquaculture facilities if the facility produces more than 9,090 (approximately 20,000 pounds) harvest weight kilograms of cold water aquatic animals, or 45,454 (approximately 100,000 pounds) harvest weight kilograms of warm and cool water water aquatic animals per year.

A facility that meets these criteria is considered a large production facility and it will be governed by these rules. Small fish farms or hatcheries are generally excluded from the requirements to obtain a Minnesota Pollution Control Agency (MPCA) water quality permit. Compliance with criteria and requirements in the proposed rules could mandate additional costs and changes to aquaculture facilities.

The statutory definition of small businesses is in Minn. Stat. § 14.115, subd. 1. definition, which reads: For purposes of this section, "small business" means a business entity, including its affiliates, that (a) is independently owned and operated; (b) is not dominant in its field; and (c) employs fewer than 50 full-time employees or has gross annual sales of less than $4,000,000. For purposes of a specific rule, an agency may define small business to include more employees if necessary to adopt the rule to the needs and problems of small businesses.

Minn. Laws 1991, ch. 309, Sec. 10. authorizes the MPCA to propose rules governing requirements for aquaculture facilities; those requirements have been specified in the proposed rules. Minn. Stat. § 14.115, subd. 2. (1990) requires the MPCA to consider how the proposed rule amendments will affect small businesses. The MPCA considered the following methods for reducing the impact of the rule on small businesses. All of the following methods are from Minn. Stat. § 14.115, subd. 2. (1990).

(a) The establishment of less stringent compliance or reporting requirements for small businesses;

The MPCA defined large and small concentrated aquatic animal production facilities in proposed rule subpart 1. Small facilities are excluded from the conditions of and requirements of the rule amendments. Based on Minn. Stat. § 14.115, subd. 3. (1990) the MPCA feels that any other changes based on method (a) could be contrary to statutory objectives that are the basis of the proposed rulemaking.

(b) The establishment of less stringent schedules or deadlines for compliance or reporting requirements for small businesses.

Small production facilities, as defined in subpart 1 of the proposed rules, are not required to obtain a MPCA water quality permit, thus, small facilities are excluded from the conditions and requirements of the rule amendments. The rule does not specifically establish compliance deadlines or reporting frequencies. These items are established specifically in each individual permit.

Although the primary purpose of a compliance schedule is to limit as much as possible the length of time of a noncompliant discharge, the MPCA considers the size and capability of a company as one of the factors in negotiating

compliance schedules. As a result, a small business with limited resources would be considered for a longer compliance schedule than larger businesses with more resources.

Based on Minn. Stat. § 14.115, subd. 3. (1990), the MPCA staff feels that any other changes based on method (b) could be contrary to statutory objectives that are the basis of the proposed rulemaking.

(c) The consolidation or simplification of compliance or reporting requirements for small businesses.

Simplification of compliance and reporting requirements for small businesses were not included in the proposed rules for reasonable scientific reasons. MPCA staff does take time to explain reporting requirements to small businesses that may not have technical staff, and the MPCA will provide and explain reporting forms. Based on Minn. Stat. § 14.115, subd. 3. (1990), the MPCA staff feels that any other changes based on method (c) could be contrary to statutory objectives that are the basis of the proposed rulemaking.

(d) The establishment of performance standards for small businesses to replace design or operational standards required in the rule.

The authorizing statute of the proposed rules does not allow the MPCA to establish performance standards for small business which would replace design or operational standard requirements of the rule. Based on Minn. Stat. § 14.115, subd. 3. (1990) the MPCA feels that any other changes based on method (d) could be contrary to statutory objectives that are the basis of the proposed rulemaking.

(e) The exemption of small businesses from any or all requirements of the rule.

The authorizing statute of the proposed rule did not specify that the MPCA exempt small businesses from the requirements of the rule. The proposed rules exempt aquaculture operations under certain production levels.

MPCA staff estimates that only three or four non-governmental operations, out of approximately 80 Department of Natural Resource (DNR) licensed operations, will be required to obtain a permit. Although the rules exempt operations based on the level of production, rather than status as a small business, the effect will be an exemption for most small businesses from having to obtain a permit. Based on Minn. Stat. § 14.115, subd. 3., the MPCA feels that any other changes based on method (e) could be contrary to statutory objectives that are the basis of the proposed rulemaking.

Small Business Participation in Rulemaking

Under the requirements of Minn. Stat. subd. 4. "Small Business Participation in Rulemaking" the MPCA provided small businesses the opportunity to participate in the rulemaking process by: 1) allowing small businesses to participate in the Aquaculture advisory group (see attached list of members); 2) notification of the public hearing on the proposed rules to DNR license holders for private hatcheries and fish farms (see attached list); 3) rulemaking information published in Aqua Culture News, a Minnesota Department of Agriculture publication; and 4) an opportunity to participate with oral or written comments at the public rule making hearing in Grand Rapids, Minnesota and St. Paul, Minnesota.

1. The MPCA utilized the aquaculture advisory group by requesting input into the rulemaking process. Several meetings were held prior to the notice of public hearing at the MPCA, 520 Lafayette Road, St. Paul. The purpose of the

meetings was to provide information on the formulation of the proposed rules and to allow small businesses and other organizations an opportunity to contribute to the proposed rules.

2. The MPCA will mail a copy of the public hearing notice to aquaculture businesses that may be affected by the rule. The MPCA will use a DNR list of license holders for private hatcheries and fish farms for 1991, which includes small businesses. This mailing is a discretionary notice mailing in addition to the nondiscretionary notice mailing mandated by statute. The MPCA has attempted to mail a copy of the public notice to all businesses operating aquaculture facilities which may be affected by the proposed rules.

3. Issues concerning the proposed rules have been published in Aqua Culture News, a Minnesota Department of Agriculture publication covering topics and issues related to aquaculture. Aqua Culture News is a publication likely to be obtained by small businesses that would be affected by the proposed rules. The location and dates of the public hearing have also been published in this publication.

4. A public hearing concerning the proposed rules will be held January 29 in Grand Rapids, Minnesota, and January 31 in St. Paul, Minnesota. Small businesses will have an opportunity to submit oral or written comments and statements concerning the proposed rules at the public hearing.

Additional information concerning the need and reasonableness of the proposed rules can be found in the Statement of Need and Reasonableness.