Farm Water Quality Considerations

The quality of water on farm can have economic impacts for farmers through its effects on livestock, crop production, and the effectiveness of pesticides and other agricultural chemicals. In spite of this, only 30% of New Brunswick farmers test their well water regularly (every two years or less) according to Statistics Canada (2001). The New Brunswick Department of Health recommends testing of domestic water supplies for inorganic substances (minerals) and microorganisms. Both the recommended testing frequencies and analyses included in a standard water test (potability test) are listed in Table 1.

Table 1. Well water quality testing information.

	Inorganic	Bacteriological
Analysis	Hardness, alkalinity, calcium, chloride, copper, fluoride, iron, potassium, magnesium, manganese, sodium, nitrite, lead, sulphate, antimony, arsenic, boron and zinc	Total coliform & fecal coliform
Frequency	Every 2-3 years	Twice annually (after spring thaw & during fall rainy season)
Re-testing	Periodically if water contains high levels of a particular substance	After any event that could have affected the microbial safety of the water (flood, sewage backup)

When drinking water test results are provided in New Brunswick, they are compared to the Canada Drinking Water Guidelines and the New Brunswick Health Advisory Levels. Depending on the water source but more specifically the end usage, agricultural guidelines may differ from these drinking water guidelines. For example, water from a dugout or pond that is used to irrigate crops or water livestock may not have to meet human drinking water standards. Water quality guidelines may also vary between types of crop or livestock and stage of growth or production. Documents that provide a broad range of water quality guideline values for both crop production (e.g. irrigation water) and livestock are included in the section "**Additional Information**".

Livestock

Water quality plays an important role in both animal health and nutrition. Livestock require access to large volumes of clean water daily (see Table 2). If water consumption drops below desired levels, the following may result:

- Reduced urine production;
- Loss of body weight;
- Animals seeking shade; and
- Reduced feed consumption.

Table 2. Typical Livestock Water Consumption Levels

Dairy	(L/day)	Beef	(L/day)
Dry cows	40	Dry cows	35
Lactating	100	Lactating cows	55
Yearling heifers	30	Yearling heifers	30
		Feedlot animals	50
Swine	(L/day)	Poultry	(L/1000 birds/day)
Sows	25	Broilers	140
Weaners	2.5	Layers	190
Growing–finishing	7	Turkeys	700

Notes

1. *All intake levels are subject to large variation related to environmental temperature, humidity, water quality and availability, diet composition and animal performance level.*
2. *Animals consuming wet feeds such as by-products, pastures or silages will drink considerably less water than indicated above.*

Drinking water quality guidelines for livestock generally view acceptable levels as being those required to maintain performance and animal health. Toxicity is regarded not as a level to cause death, but as the level that reduces such performance measures as milk production or weight gain. For some elements or minerals, there are specific recommendations, while for others there are no guidelines (Table 3).

It is important to consider the quality of the livestock drinking water source when balancing livestock rations. Substances in drinking water can interact with other essential nutrients in the diet to either decrease availability or contribute to overall dietary excess. An example of this is that both nitrates and nitrites can decrease the utilization of Vitamin A. Similarly, hard water caused by high calcium levels can influence the incidence of milk fever in a dairy herd.

Farmers also need to consider microorganisms in relation to livestock water quality. Viruses, bacteria, cyanobacteria (blue-green algae), protozoa, and algae are all of concern in livestock drinking water. Multiple types of bacteria and viruses, including those that cause scours, may be transmitted by contaminated livestock drinking water. It is extremely important to provide livestock access to a clean water source, uncontaminated by sewage, manure, or runoff.

Finally, water quality can affect the water delivery system. Mineral deposits may build on the inside of metal piping, reducing water flow. Also, low flow nozzles for poultry may clog due to microbial growth, chemical precipitation, or particles becoming trapped inside the nozzle.

Table 3. Maximum Acceptable Drinking Water Parameters in ppm (mg/L)

Major Ions & Nutrients	Livestock	Humans
Calcium	1000	—
Nitrate plus nitrite	100	11
Nitrite	10.0	1.0
Sulphate	1000	500
Total dissolved solids (TDS)	3000	500
Heavy Metals & Trace Ions		
Aluminum	5.0	—
Arsenic	0.025	0.025
Beryllium	0.1	—
Boron	5.0	5.0
Cadmium	0.08	0.005
Chromium	0.05	0.05
Cobalt	1.0	—
Copper	1.0 *(cattle)* 5.0 *(swine & poultry)* 0.5 *(sheep)*	1.0
Fluoride	2.0	1.5
Iron	—	0.3
Lead	0.1	0.01
Manganese	—	0.05
Mercury	0.003	0.001
Molybdenum	0.5	—
Nickel	1.0	—
Selenium	0.05	0.01
Uranium	0.2	0.02
Vanadium	0.1	—
Zinc	50	5.0

NOTE : — indicates no guideline for this parameter

Crop Production (Irrigation)

Water quality may have an impact upon plants and soil characteristics and is thus of importance in conventional irrigation systems. Water quality effects on plants include those related to:

- total soluble salt content (salinity hazard);
- relative proportions of sodium cations and other cations (sodium hazard / soil permeability effects);
- alkalinity effects (carbonate, bicarbonate, calcium and magnesium concentrations);

- concentrations of elements that may be toxic to some plants (especially sodium, chlorine, and boron);
- excessive nutrients (yield and quality problems);
- unsightly deposits (reduced marketability);
- excessive corrosion of equipment; and
- potential microbial problems.

When using micro-irrigation systems (trickle, drip, or small spray nozzles) care must also be taken to remove substances that may clog the nozzles. Both organic (biological fouling) and inorganic (calcium or iron precipitation) can affect water delivery.

Crops vary in their tolerance to various water quality parameters (especially salinity and boron). Common problems with irrigation water quality can be identified by testing for the parameters listed in Table 4. Due to the crop specific nature of problem levels, the interpretation of test results should be discussed with an agrologist.

Table 4. Common testing parameters for irrigation water.

Salt Content	Cations and Anions	Nutrients	Miscellaneous
electrical conductivity (EC_w)	calcium	nitrate-nitrogen	**total coliform**
OR	magnesium	ammonium-nitrogen	**fecal coliform**
total dissolved solids (TDS)	sodium	phosphate-phosphorous	boron
	carbonate	potassium	pH
	bicarbonate		sodium absorption ratio (SAR)
	chloride		
	sulphate		

Pesticides and Other Agricultural Chemicals

Pesticides and other agricultural chemicals may also be influenced by water quality. Their efficacy may increase or decrease depending upon the quality of the mix water. For pesticides, suspended solids, hardness, dissolved solids, bicarbonate, and pH are of most concern. Certain products used with “clean-in-place” dairy farm washing systems require water that meets potability standards to be effective.

Where to Get Your Water Tested

Water sampling kits are available from local offices of the New Brunswick Departments of Environment, Health, and Service NB. Accredited private laboratories can also be utilized to test water. In addition to testing for potable water, laboratories may perform water quality tests for agricultural purposes (basic suitability for irrigation, livestock, and/or spray water).

Selected Factsheets Available

The following factsheets by the Prairie Farm Rehabilitation Administration (PFRA) of Agriculture and Agri-Food Canada are available for distribution through the New Brunswick Department of Agriculture, Aquaculture and Fisheries.

GENERAL
Water Quality Testing
Domestic Water Quality

LIVESTOCK
Water Quality and Cattle

HOUSEHOLD OR AGRICULTURAL WATER TREATMENT
Approaches to Water Treatment
Evaluation of Treatment Systems
Chlorine Disinfection of Private Water Supplies for Household or Agricultural Use
Biological Treatment of Surface Water
Biological Treatment of Ground Water
Slow Sand Filter
On-Farm Coagulation
Chemicals for On-Farm Coagulation
How to Coagulate Your Dugout or Cell
Algae, Cyanobacteria and Water Quality

Additional Information

1. Agriculture and Agri-Food Canada. **Water Supply and Quality**.

2. Andrew A. Olkowski. 2009. **Livestock Water Quality – A Field Guide for Cattle, Horses, Pouletry & Swine.** p 180 http://www.agriculture.gov.sk.ca/Livestock_Water_Quality_Guide

3. New Brunswick Department of Environment and Local Government. **Well Construction and Well Water Testing**. http://www2.gnb.ca/content/gnb/en/departments/elg/environment/content/land_waste/content/reference_manual/well_construction_well_water_testing.html

4. Canadian Council of Ministers of the Environment (CCME) - Environment Canada. 2005. **Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses - Summary Table**.