
# Water quality for farm water supplies

*David Cummings, Melbourne*

August, 2004
LC0089
ISSN 1329-833X

Water is:

- an environment for biological growth
- a universal solvent
- a transporting agent.

Nearly all natural waters therefore contain a range of organisms, nutrients and other materials. Whether or not this is undesirable depends on:

- type of material or organisms;
- quantity of material or organism; and,
- use of the water

Farm water storages generally rely on the collection of water directly from the environment.

Rain collected off a clean roof will give one of the best water quality results. Runoff from a catchment collected in an earthern dam can be quite variable depending on the condition of the catchment area and activities occurring within it. It is a great advantage if the catchment is under the control of the dam manager. The quality of water flowing into the dam can be protected through careful management of catchment activities as outlined in Landcare Note LC0079: *Minimizing algal growth in farm dams.* River or creek off-takes can also be quite variable. Each site (and its attendant catchment) needs to be considered on individual merits.

All farm storages should be planned and designed to collect good quality water. Further, they should be managed to maintain that quality while it is retained in storage. It is much more efficient to collect good quality water rather than to treat it after collection.

## Water contents

Water may contain:

- materials which are physically suspended in the water;
- materials which are chemically dissolved in the water; or,
- living organisms or their remains (ie biological materials).

These are described in a little more detail in the following sections.

## Physical content

### *Sediment*

Soil particles can be picked up and transported by flows of water. The more vigorous the flow the greater the size and quantity of particles that can be retained within the water flow. However when water collects in a storage, it stops flowing and particles begin to settle. The finer sediments (which show as turbidity) may stay in suspension for long periods of time.

Materials suspended in water can cause:

- sedimentation in pipes, tanks and other equipment;
- staining of clothes, washed surfaces etc;
- clogging of fine tubes such as in air conditioners and micro-irrigation systems; and,
- aesthetic frustration.

Suspended sediment may be measured as weight per volume (mg/L) or in terms of the amount of light refracted by the sediment in suspension (nephelometer turbidity units (NTU)).

### *Colour*

Colour is usually due to organic materials dissolved in the water. The organic materials are generally leached from decomposing vegetation.

Users may object to the appearance of such water, but there are unlikely to be other problems.

## Chemical content

### *Salinity*

All natural waters contain some dissolved salts. High levels of salts can make water unsuitable for drinking and may make it unsuitable for irrigation.

High salinity levels makes it difficult for cells (plant and animal) to absorb the water (an osmotic effect) and dehydration can result.

The level of dissolved salts can be measured by evaporation to dryness and recording the result as weight of solids per unit of water evaporated (mg of solids /L of water). This is known as the total dissolved solids.

Electrolytic conductivity (abbreviated to EC) of water can be used as a measure of salinity level. It is a direct measure of the concentration of ions in solution. Values are given as µS/cm (microSiemen per centimeter). The higher the value the higher the salt content. Further



 

information is given in Landcare Note LC0064: *Measuring the salinity of water*.

### Hardness

Hardness is a useful description of the utility of water for washing and for the likelihood of it causing build-up of "scale" in pipes and on other surfaces.

It is mainly caused by the presence of calcium and magnesium salts.

It is usually measured as mg/L of calcium carbonate in water. Hard waters have values of over 100. Waters with values below this are regarded as soft.

### Acidity/alkalinity

This is measured as pH with a value of 7 being neutral, <6 being acid and >8 being alkaline. Acid waters and alkaline waters are corrosive to metal pipes and fittings

## Biological content

All surface waters contain biological activity. Generally it should be regarded as desirable. However for stock and domestic use, the presence of particular organisms, or the excessive growth of others, may be undesirable; for example:

### Algae

These are primitive plants found in most surface waters. If they build up in water this indicates high levels of nutrient chemicals contaminating the water. At high levels the algae can cause tastes, odours, blockages and stagnation of water. Some algae can produce toxins in certain circumstances (See Landcare Note LC0098*: Has your dam got a blue green algae problem?)*

### Other

Pathogenic bacteria in water supply indicate dangerous pollution to the water supply.

## Water quality needs

### Irrigation

Salinity and the balance of salts determine suitability of water for irrigation use.

Sodium, boron and chloride can cause plant toxicities.

High general salt levels can cause dehydration of intolerant plants. Very high levels will kill the lot.

The level and balance of salts in the water need to be matched to soil characteristics to ensure that salts in the water do not accumulate to undesirable levels in the soil.

### Livestock

Salinity is commonly used as a broad guide to water suitability for various classes of stock. There are a whole lot of factors affecting the upper limit of salinity which an animal might acceptably drink including:

- climate
- age and condition of animal
- activity of animal
- pasture composition
- use of supplementary feed and
- composition of salts in water

### Household

Household water standards need to meet the requirements for human consumption and also for various household washing and equipment needs.

Human consumption suitability is determined by absence of harmful chemicals and organisms as well as by the level of soluble salts present.

## Water quality criteria

***Table 1: Maximum desirable concentration of phosphorus and nitrogen in storages to minimise chances of algal blooms***

| Nutrient | Concentration in mg/L |
|---|---|
| Total phosphorus | 0.005-0.05 |
| Total nitrogen | 0.1 - 0.5 |

***Table 2: Effects of water salinity on plants***

| Conductivity µS/cm | Effect and suitability |
|---|---|
| <300 | Low salinity water suitable for most crops and most soils |
| 300-800 | Low to medium salinity water which can be used to irrigate all crops, however increased leaching may be required for sensitive crops |
| 800-2500 | Medium salinity water which requires adequate leaching and may be a problem if used on soils with restricted drainage or on stone fruit using an overhead sprinkler system; the salt tolerance of plants must be considered |
| 2500 - 5800 | Medium to high salinity water used with salt tolerant crops on permeable, well drained soils (to achieve adequate leaching); careful management required. |
| 5800 - 21500 | High salinity water only suitable for high salt tolerant crops on soil with excellent drainage and leaching potential: adequate winter rains required to leach salts from soil; careful management required. |
| >21500 | Generally considered to saline for irrigation. |

 

***Table 3: Stock water requirements***

| Conductivity µS/cm | Magnesium mg/L | Suitability for use |
|---|---|---|
| <5800 | <20 | Suitable for watering of all stock |
| <7500 | <200 | Unsuitable for poultry |
| <8500 | <400 | Unsuitable for poultry and pigs |
| 8500-16500 | <600 | Unsuitable for poultry or pigs, generally unsuitable for lambs, calves and weaner stock. Caution is required with lactating stock. Suitable for dry mature sheep and cattle. |
| 1650-25000 | <600 | Suitable only for dry mature sheep and cattle; caution is required for cattle unaccustomed to water of this salinity. |
| 25000 | <600 | Unsuitable for watering of stock. |

***Table 4: Drinking water guidelines***

| Characteristic | Unit | Guideline value |
|---|---|---|
| Turbidity | NTU | 5 at tap: preferably <1 for disinfection |
| Colour | Pt-Co | 15 |
| Salinity | µS/cm | 1000 |
| Hardness($CaCO_3$) | mg/L | 500 |
| pH | pH | 6.5 - 8.5 |
| Chloride | mg/L | 400 |
| Nitrate (as N)* | mg/L | 10* |

*Note that the guideline value is given in terms of nitrogen, not nitrate, but is equivalent to 50 mg/L of nitrate

## References

CNR (1995) Physical and chemical quality of drinking water: questions and answers. Department of Conservation and Natural Resources.