Northern Territory Government

TECHNICAL FACT SHEET

Iron Fouling of Groundwater
Getting to the Bottom of the Problem

Many problems arise in the operation of groundwater extraction systems – one of the most common is the occurrence of iron fouling or “red water”. This particular problem is not unique to the Territory but is widespread nationally and internationally and has been since people first started sinking wells. The extent of the problem in the Darwin region remains poorly defined, although anecdotal reports of “iron bacteria” fouling abound.

The department took up the issue in 1993 by distributing questionnaires to pump and bore suppliers, and bore owners. A number of bores were selected from the Darwin rural area to undertake a survey.

The results of the survey indicated that the main cause of the red water problem was due to high concentrations of dissolved iron in some of the aquifer waters. However, only low concentrations of iron bacteria were found in the bores surveyed. This finding is at odds with the perception that iron bacteria caused the problem.

How does the iron get into the water and how do you remove it once it is there?

Iron is a common constituent in soils and groundwater. It readily participates in subsurface chemical reactions and only under certain conditions can cause problems with groundwater extraction systems.

As rainwater soaks into the ground and recharges the aquifer it also carries with it some dissolved oxygen. As this water percolates down through the soil, microbial activity consumes this store of dissolved oxygen as organic material is broken down. These processes can result in the groundwater having little or no dissolved oxygen remaining and sometimes elevated concentrations of carbon dioxide, making the water slightly acidic.

Under these conditions, iron in the soil (and there is usually plenty of it) can dissolve in the water where it will remain dissolved until the water is re-oxygenated. This usually occurs when the groundwater comes back into contact with the atmosphere (eg. small springs often have iron staining/deposits around them) or can happen when oxygenated water mixes with the groundwater (eg. down your bore when water siphons back from above ground reticulation through a leaking non-return valve). The dissolution and precipitation of the iron are chemical reactions that can be catalysed by iron bacteria.

When groundwater with high concentrations of dissolved iron has contact with air a red/brown/ochre floc is produced – thus sparkling clear water freshly pumped to the surface will slowly become “muddied”. Iron Bacteria causes rusty slime to form on bore screens and in submersed pumps. It reduces the inflow of water to the bore by blocking the impellers. The slime also coats the submersible motor which overheats as a result. In many cases the pump blocks completely and the electric motor fails. Most of the rusty slime seen inside the discharge and distribution pipes have been deposited there during pumping.

So what can be done about it?

If you do have high concentrations of dissolved iron in your groundwater it is important to ensure that precipitation only occurs where there is ready access for cleaning. Sixty metres down a 150mm diameter hole in the ground is a particularly awkward spot for this to occur! Unsealed shallow aquifers cascading water down the bore during drawdown, leaking or non-existent non-return valves and over pumping/forking of the bore all lead to oxygenation and iron precipitation down the hole. Tipping chlorine down the bore under these conditions is to be avoided as chlorine is a strong oxidising agent and causes iron to precipitate even faster than oxygen does.

If you already have a problem with reduced yield from your bore, cleaning may be the first step in getting your system back into good operational condition. An experienced and trained operator should be engaged to carry out this process as it will usually involve the use of a special acid cleaning solution together with surging and recirculation of the solution to remove any iron build-up from the bore casing pump. After this acid solution has been pumped to waste and the system thoroughly flushed of residual acid, chlorine can be added to ensure disinfection of the downhole area.

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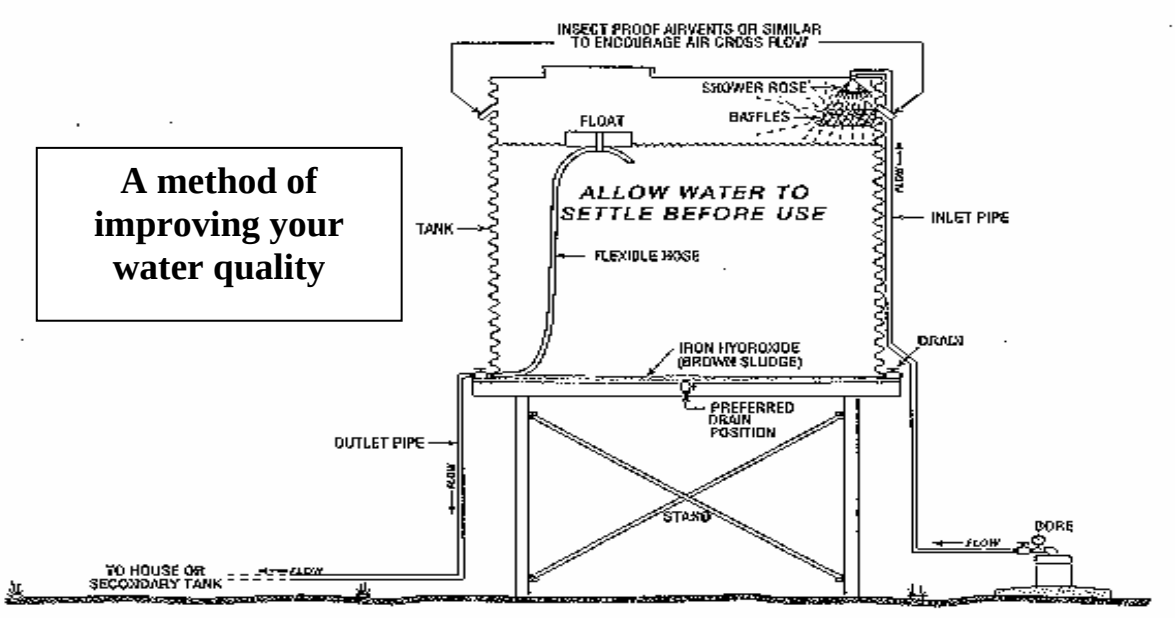
Given that all is satisfactory downhole, what about all that "red water" sitting in your tank?



The bad news is that there is not much you can do. Over time, most of the dissolved iron will oxidise, precipitate and settle at the bottom of your storage tank. The process of iron precipitation can be speeded up by spraying the water drawn from the bore onto splash screens, facilitating aeration of the water. Water should then be drawn from either a floating or raised off-take so as to avoid the iron sludge accumulating at the base of the storage. Periodic cleaning of the tank will be required because it is effectively being used as a sedimentation tank.

If you are going to carry out this process, fill the tank, let it settle and use approximately 80 per cent of the whole tank before refilling. For situations where this is not feasible, a second tank could be used as an alternative option; the first tank is then used as an aeration/settling/sedimentation tank and only clarified water is drawn from just below the water level in the first tank (refer to above diagram) into the second or service tank. In either situation, periodic cleaning of the tanks will be necessary for the ongoing delivery of good clean water.

For assistance, contact the Water Management Branch:

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  4th Floor Goyder Building, PO Box 496 Palmerston NT 0831 Ph: 89 993678
- **Katherine**
  Randazzo Arcade, 16 Katherine Terrace, Katherine NT 0850, Ph: 89 738100
- **Alice Springs**
  1st Floor Alice Plaza, Todd Mall, PO Box 1120 Alice Springs NT 0871, Ph: 89 519215

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