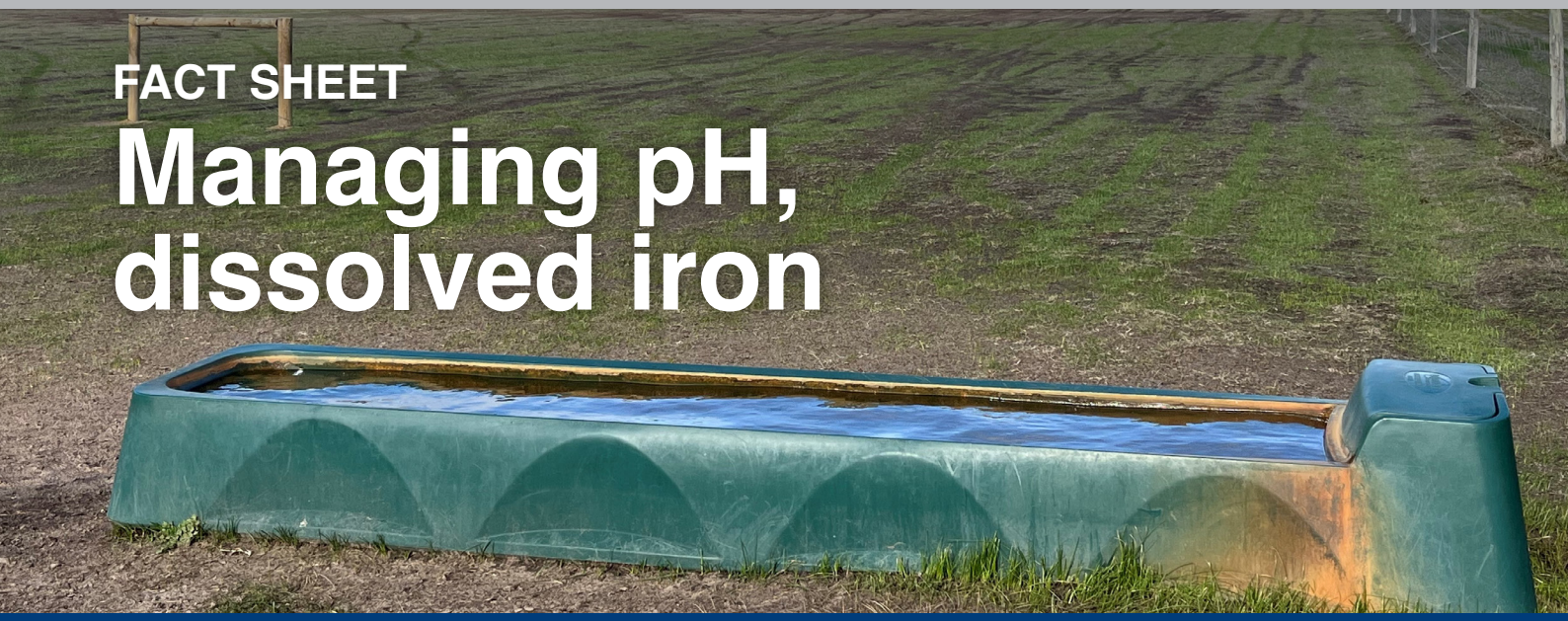


FACT SHEET

Managing pH, dissolved iron

Both pH (alkalinity/acidity) and dissolved iron can be significant factors in the overall quality of Eyre Peninsula groundwater.

Either can impact livestock water consumption and productivity, chemical spray effectiveness, as well as the performance, durability and integrity of water infrastructure – including pipes, fittings, pumps and sprayer nozzles.

It is important to note that pH and iron levels cannot be treated in isolation. pH, in particular, can interact with many other properties of water, including the level of dissolved metals and minerals. Benchmarking and monitoring all the key quality parameters for a water source should be an integral part of managing its pH and iron content.

pH

While the pH scale goes all the way from extremely acidic (0.0) to extremely alkaline (14), water that is even moderately acidic (below pH 6.0) or moderately alkaline (above pH 8.0) can affect its suitability for livestock or spraying. It is important to note that the pH scale is logarithmic, meaning that each 1.0 pH change equals a 10-times change of acidity.

Why pH should be tested

As water increases in acidity, it may contain higher concentrations of dissolved metals and minerals (such as aluminium, copper, zinc, manganese, etc) which may be harmful to animal health.

The bioavailability and toxicity of aluminium is generally greatest in more acidic solutions (Campbell & Stokes 1985, for example.)

In spray water, pH above 8.0 can cause some chemicals to break down through alkali hydrolysis. While this hydrolysis can improve the effectiveness of a limited number of herbicides, it reduces the effectiveness of most other spray chemicals – with the impact increasing the longer the mixed chemical is left in the tank.

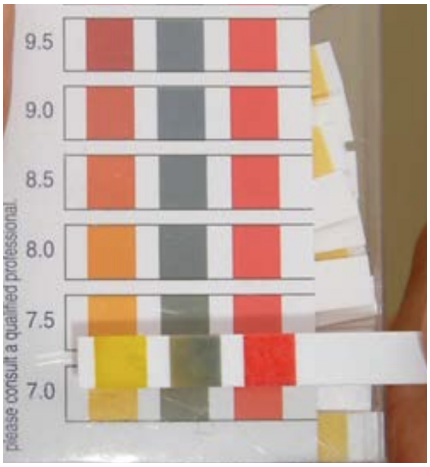
Conversely, acidic water can also affect the performance and stability of some chemicals.

Consult the product label of any chemical you intend to spray, to see how it may change and/or be affected by water pH.

How to correct pH

Generally, if the water in the sprays tank is pH 6.0 – 8.0 then it will be suitable for spraying.

Higher levels of acidity (lower pH) can be caused by agricultural runoff and decaying organic matter, with livestock, bird or fish manure and plant leaves being common sources. A healthy dam ecosystem, including aquatic plants, will help. Adding a probiotic or aeration system can also help nutrients be used more quickly.



pH test strips. Source: EP Landscape Board

Alternatively, adding finely-ground agricultural lime or potassium hydroxide will increase pH but the amount to add must be calculated carefully as lime may increase water hardness. Consult a water expert, rather than using trial and error. When spraying herbicides, an adjuvant pH adjuster can be added to

most herbicides (always check the label for details and mixing order) but adjusters are not compatible with fungicides or insecticides.

If water is too alkaline, almost any acid can be used to lower the pH, with phosphoric or sulphuric acid being common. Again, consult with an expert to add the precise amount and remember that glyphosate can lower the mixed pH by 1.0 or more.

Iron

High iron levels are very common in some groundwaters on the Eyre Peninsula. Iron is soluble in water that is very low in oxygen, such as in deep bores and hypoxic dams, which then encourages the growth of iron-loving bacteria. These bacteria can live in water with iron concentrations of 0.3 to 1.5 mg/L (ppm).

While not considered harmful to livestock, dissolved iron can have a significant taste effect which might reduce water palatability, uptake and, ultimately, livestock performance.

Why iron levels should be tested

Iron-eating bacteria can cause severe corrosion of mild steel components including pipes, taps, pumps and fittings. Iron and rust deposits can also form directly out of water with an iron concentration above 1.5 mg/L. These solid deposits result in build-ups that block, bind or corrode water infrastructure and spray equipment.

When used in spraying applications, dissolved iron can precipitate on contact with air, resulting in a build-up that impacts spray nozzle performance.

Iron (as Fe^{2+} or Fe^{3+}) can also affect the performance of many spray compounds. Refer to the manufacturer's guidelines for details of critical iron concentrations for a specific chemical.

How to reduce iron levels

High levels of dissolved iron are most easily treated by aerating the water, which causes the iron to oxidise and form solid particles that can be filtered or settled out of the water.

Aeration can be easily achieved by pumping the water through an aeration fountain, bubbling air into the dam or tank, bleeding air into the intake side of a pump, agitating the water with propellers or paddles, or cascading it over baffles into a settling tank.

Chlorination and adding potassium permanganate can also be used to correct high levels of iron. Consult an expert for help calculating the right amount to add and check the labels of any spray chemicals to ensure there will no chemical compatibility issues.

Source: SA Water

Water testing

As water quality is critical to agricultural performance and productivity, water sources should be tested regularly.

Water for livestock should be tested at least once each season to assess its qualities and any changes. Water for spraying and irrigation should ideally be checked for at least salinity, pH and hardness before mixing, particularly where quality is variable.

Simple, effective test strips are available for assessing both pH and dissolved iron in water. These strips can be purchased from most hardware or farm suppliers, or online.

Electronic water pH meters are also widely available, and these will give a more specific pH value than colour indication strips. If the pH of a critical water source is highly variable, a continuous pH metering unit can be used for ongoing monitoring.

However, the best results will be achieved by submitting water samples to a testing laboratory for more sophisticated tests across a range of parameters. The results of these tests can be used to benchmark water quality for each source and to calibrate the results of at-home test strips or kits for more frequent monitoring.

For more information on testing options, sampling methods and water quality parameters, refer to our 'Water testing' fact sheet via the Further resources section below.

Shandying water

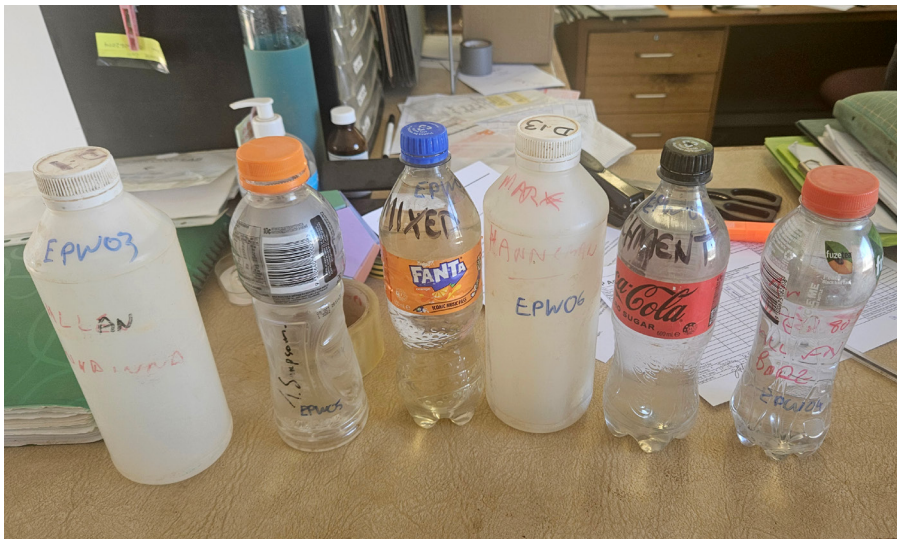
One of the simplest ways to manage water quality issues is by mixing the 'problem' water with fresh water captured from a clean source – such as rainwater runoff from infrastructure roofing or a lined catchment.

Often called 'shandying', this blending can help to moderate water quality issues including pH and iron levels. However, shandying will also combine the salinity, hardness and other properties of the two water sources.

Therefore, a detailed knowledge of both water sources, derived from laboratory testing, is essential to manage the shandying ratios and achieve a suitable result for the intended use.

The blended water sample should be re-tested to confirm that the pH and dissolved iron – along with salinity, hardness and other key parameters – are all within target levels. If necessary, conduct small scale tests to establish the optimum blending ratio for the available water sources.

Shandying is most commonly used to correct water salinity. For more detailed steps on shandying water, refer to our 'Salinity' fact sheet via the Further resources section below.



Source: J Telfer, PIRSA

Managing other water quality issues

The colour and smell of water can provide important clues to its quality. Additionally, reduced flow rates may indicate blockages in farm water infrastructure, potentially caused by poor water quality. The cause of these should be addressed along with the impact.

For more information on specific water quality issues and how to manage them, refer to the other fact sheets in our Water Quality fact sheet series:

- **Salinity**
- **Hardness**
- **Cloudiness, turbidity and algae**
- **Water testing**

Further resources

Additional EP Farm Water Security information and fact sheets
pir.sa.gov.au/sardi/projects/eyre-peninsula-farm-water-security-project

EP Landscape Board
landscape.sa.gov.au/ep/water

Water testing fact sheet, EP Landscape Board
cdn.environment.sa.gov.au/landscape/docs/ep/Water-Testing-fact-Feb2022.pdf

EP Water Security Response Plan, SA Water
sawater.com.au/__data/assets/pdf_file/0004/1017625/EP_Water-Security-Response-Plan.pdf

Water affecting activities resources and policy guide, EP Landscape Board
landscape.sa.gov.au/ep/water/water-affecting-activities

Handy links to local councils on the EP, Eyre Peninsula Local Government Association
eplga.com.au/about/councils

*Australian Water Quality Centre (AWQC)*Water testing available from independent business unit within SA Water
awqc.com.au

GRDC Spray Water Quality Fact Sheet (October 2019)
grdc.com.au/resources-and-publications/all-publications/publications/2019/spray-water-quality

Flocculants and water testing instructions, Water Quality Solutions
stage.waterqualitysolutions.com.au/how-to-clear-muddy-water/#:~:text=What%20is%20flocculation%3F,particles%20together%20and%20binds%20them

Measuring the turbitiy of water supplies
wedc-knowledge.lboro.ac.uk/resources/booklets/G031-Measuring-turbidity-in-water-supplies-online.pdf

A quick way of measuring the turbidity of water
wedc-knowledge.lboro.ac.uk/resources/posters/P023_A_quick_way_of_measuring_turbidity.pdf

Glyphosate and the Effect of Hard Water
eurekaag.com.au/glyphosate-effect-hard-water/

About EP Farm Water Security

EP Farm Water Security is a project to promote better capture, storage and management of water on EP farms. It is led by Primary Industries and Regions SA (PIRSA), with project partners SA Water, the Eyre Peninsula Landscape Board, AWI Extension SA, SA Department for Environment and Water and AgCommunicators.

Agriculture is the dominant force in Eyre Peninsula land use and economic activity. It is also the largest user of mains water, accounting for up to 40 percent of local SA Water supply. By acting now to enhance water capture, storage and infrastructure, farmers have the power to underwrite their own water security, save money and reduce their reliance on mains water.

References

1. ANZG (2023). Livestock drinking water guidelines (currently in draft form). https://www.waterquality.gov.au/sites/default/files/documents/livestock-drinking-water-guidelines-draft.pdf

   ANZECC & ARMCANZ (2000) Water quality guidelines.https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf

Acknowledgements

NSW DPIRD Water quality for chemical spraying, 2012 (https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0008/433691/Water-quality-for-chemical-spraying.pdf)

Sprayers 101 (https://sprayers101.com/ph-hardness/)

Decision checklist:

- [ ] Consult with experts to assess the water test parameters needed.
- [ ] Identify a suitable water testing laboratory and confirm the test package covers all required results.
- [ ] Prepare sampling supplies, including containers labels, courier arrangements, etc.
- [ ] Identify suitable sampling locations.
- [ ] Plan for any other requirements, such as running a new bore pump for three hours before sampling.
- [ ] Ensure samples will be dispatched for testing promptly after collection.
- [ ] Regularly check and monitor water quality to ensure it is safe and fit for purpose, especially prior to using for crop spraying or watering livestock.
- [ ] Make sure your water quality tests check for salt, chemical and bio-contaminants such as bacteria and algae.

Legal considerations

On-farm construction activities designed to access water resources are subject to State Government legal requirements in South Australia. These requirements are designed to protect the water resources, other water users and the natural environment.

The legal requirements are affected by factors such as the location, size and type of the works, for example:

- Large dams and large, highly visible water harvesting structures (e.g. sheeted catchments) may be subject to the need for development approval via your local Council, under the state's planning regulations.
- A permit is required from the Eyre Peninsula Landscape Board for a range of water affecting activities that may impact on watercourses, including the construction or modification of small to medium sized dams in watercourses in some catchments across southern Eyre Peninsula.
- A permit is required from the Department for Environment and Water (DEW) to construct or modify a groundwater well or to discharge water into a well. A licensed well driller must carry out or supervise the drilling or modifications.

Landholders should seek information from their local Council, Landscape Board and DEW when in the early planning stage of their proposal, so that the activity can be located and designed to meet legal requirements and to streamline any approvals process that applies.

For more information, see the Resources and further reading section.