

About the HHERA



As part of our work to respond to legacy use of PFAS at Callide Power Station we engaged Environmental Risk Sciences (enRiskS), an independent toxicology risk assessment consultancy, to do a Human Health and Ecological Risk Assessment (HHERA).

The HHERA was prepared prior to the NHMRC proposed revision of the Australian Drinking Water Guidelines and refers to the current guidelines of PFOS and PFHxS combined value of 0.07 µg/L. PFOS, PFHxS and PFOA are the different chemicals that are collectively known as PFAS. CS Energy will continue to comply with government guidelines as they evolve.

At a glance



On the basis of available data, and the current national health guidelines, the risks from PFAS concentrations in groundwater or surface water are low for all investigation zones, noting that a slightly elevated risk was reported for certain areas in Zone 1 where multiple exposure pathways are combined.



Zone 1 of our investigation area (closest to the power station) has the highest concentration of PFAS. In this zone if some or all exposure pathways for home grown produce are combined (i.e. eggs + fruit and vegetables + meat) with groundwater as the sole source of drinking water (at the maximum concentration reported), the risk to some locations would be slightly elevated when compared to current national guidelines. Based on data available it is understood no individual household is exposed to these combined pathways.



No effect on aquatic, bird or mammal species is expected.



While the site is likely to contribute to the levels of PFAS in Callide Creek, the site investigation shows that Callide Power Station is not the sole source of these chemicals to this waterway.



What is a HHERA?

A HHERA assesses specific risks to human health and the environment by looking at exposure pathways – such as drinking water, and water use around the home such as during cooking, showering, cleaning, and backyard garden irrigation. It takes a holistic approach to understand the total exposure to PFAS.

It was undertaken by qualified risk assessors enRiskS who are registrants of The Australasian College of Toxicology & Risk Assessment. The HHERA examined the presence of PFAS in the environment in CS Energy's investigation area, which runs from the Callide Power Station downstream to Jambin Dakenba Road.

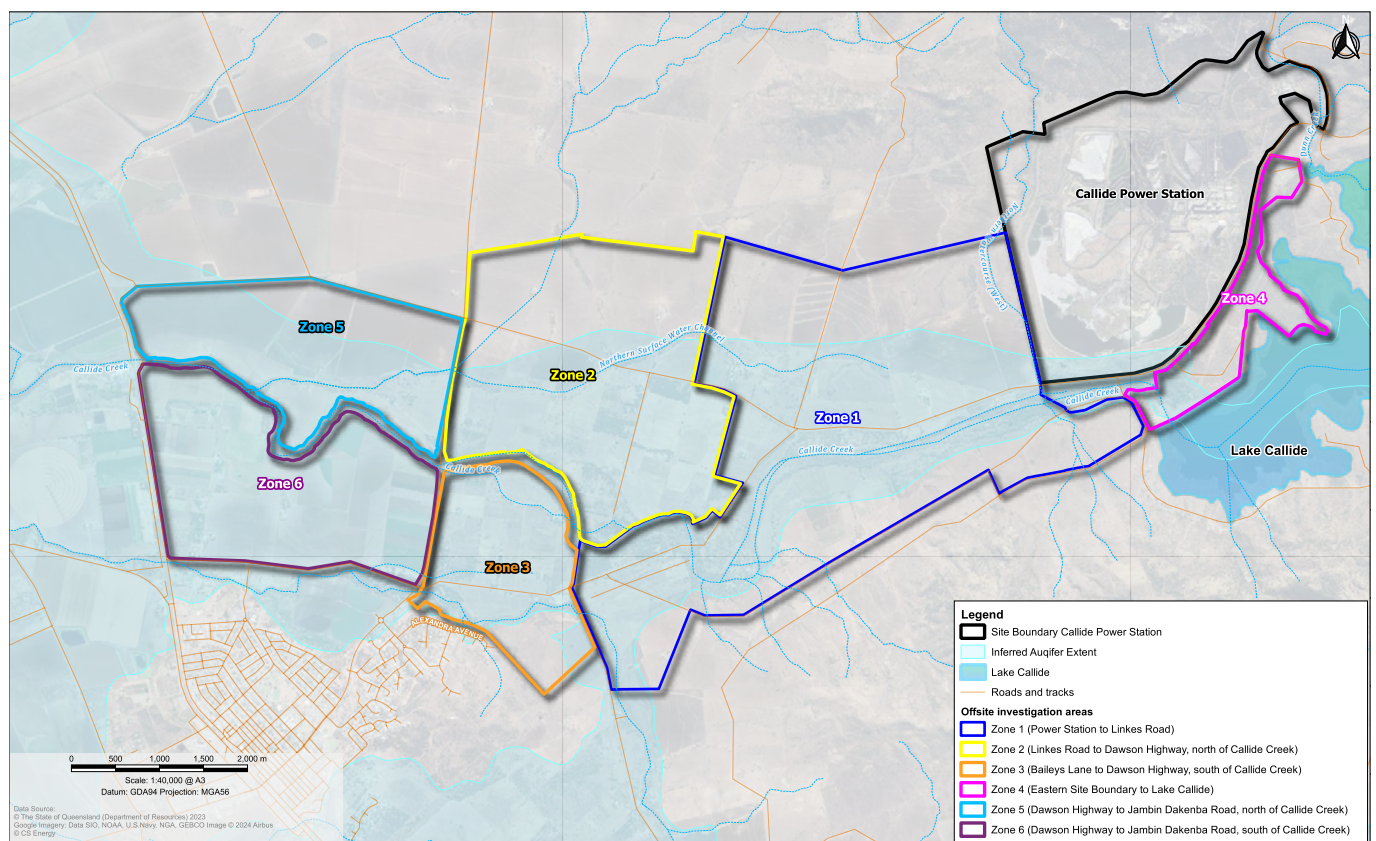
Approach to creating the HHERA

CS Energy has been working with the Department of Environment Science and Innovation (DESI) to manage our historical PFAS use under an Environmental Evaluation framework.

This has included monitoring PFAS levels in the area using an independent, suitably qualified person from consultancy firm Epic Environmental.

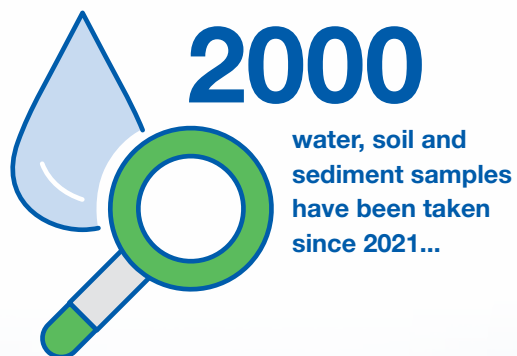
Since 2021 CS Energy and Epic Environmental have:

- Sampled for PFAS at 158 monitoring wells and ground water supply bores and 50 surface water monitoring locations. This includes bores on 82 private properties, where testing has been offered at least annually between 2021 and 2024.
- Collected results from more than 2,000 water, soil and sediment samples.
- Completed hydrological studies showing how PFAS has travelled through the environment.
- Finalised aquatic biota sampling of the local dam and creek.
- Conducted bore use surveys with individual landholders to help understand the ways that water is being used in the area.
- Completed soil and concrete remediation at PFAS source areas on site at Callide Power Station.



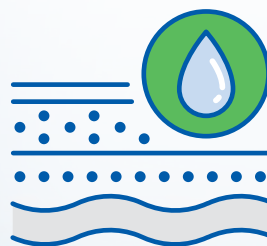
This information and data from this program of work was provided to enRiskS and they used this, along with references to national guidelines to review:

- PFAS levels in CS Energy's investigation area.
- The common individual exposure pathways.
- Where there might be combined exposure pathways that might elevate risk to people or the environment.



2000

water, soil and
sediment samples
have been taken
since 2021...



including,

**OVER
500**

samples from private
properties surrounding the
Callide Power Station.



Common exposure pathways in the investigation area

The HHERA found people are most likely to be exposed to PFAS when they drink the water or eat the foods grown in that soil or water.

The most common exposure pathways in CS Energy's investigation area include:



Using groundwater

for drinking and household activities such as cooking, bathing, cleaning and watering the garden.



Incidentally ingesting groundwater

or surface water through farming (filling troughs, washing hands etc) or domestic use (sprinkler play, using swimming pools). This includes swallowing small amounts from splashes or wet hands touching the mouth.



Consuming home-grown fruit and vegetables

irrigated by groundwater.

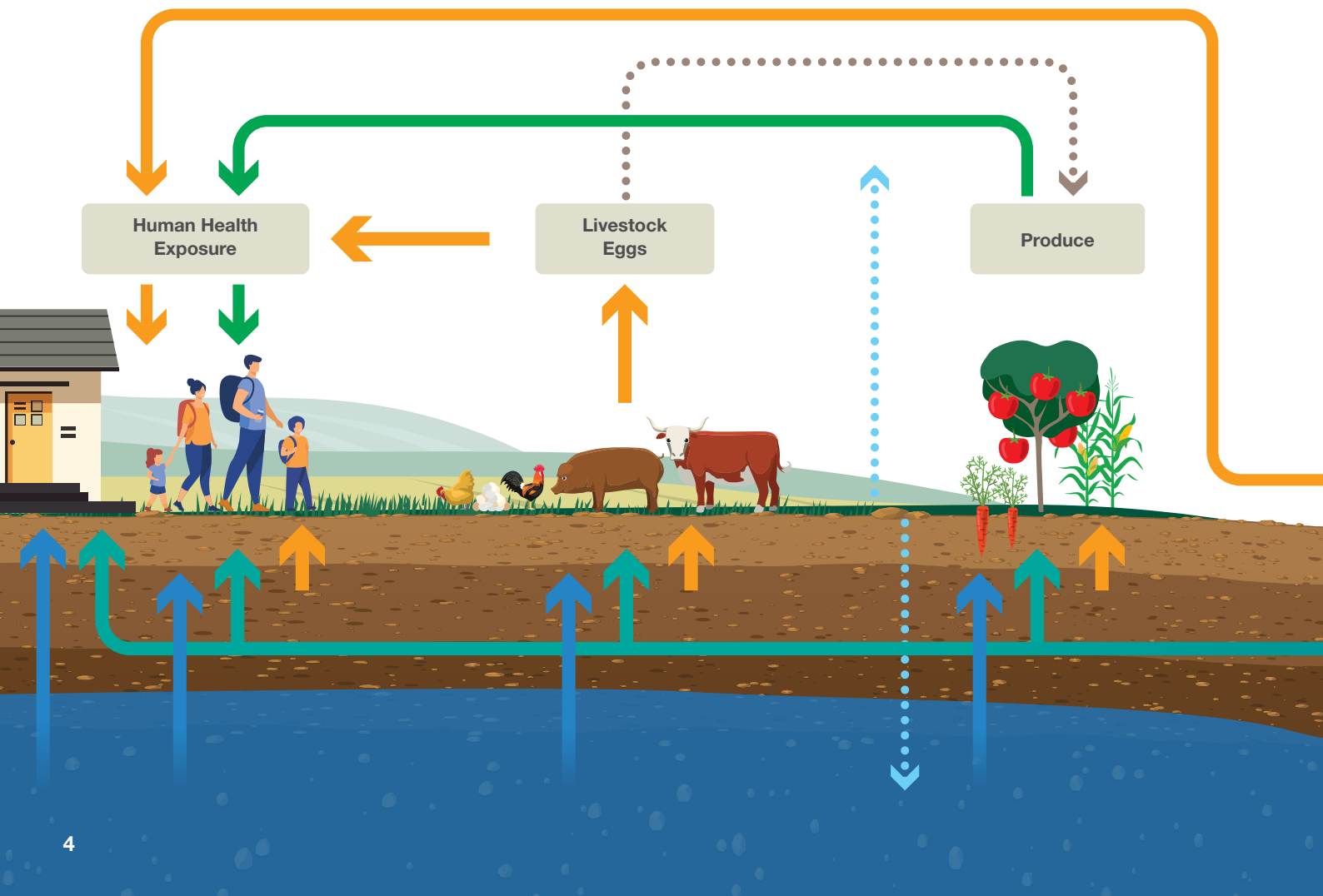


Consuming home-grown eggs

laid by chickens that drink groundwater.

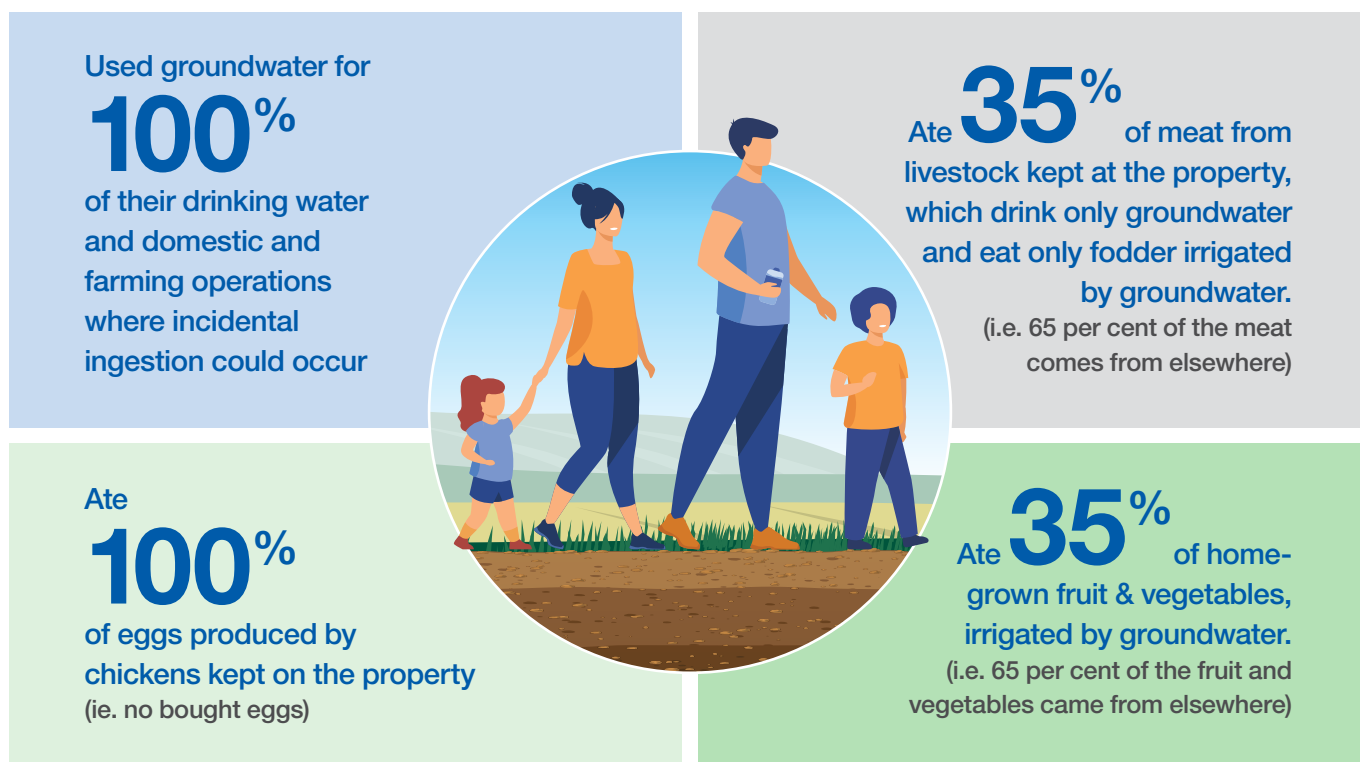


Consuming **home-grown meat** from stock that drinks groundwater and eats fodder irrigated with groundwater.

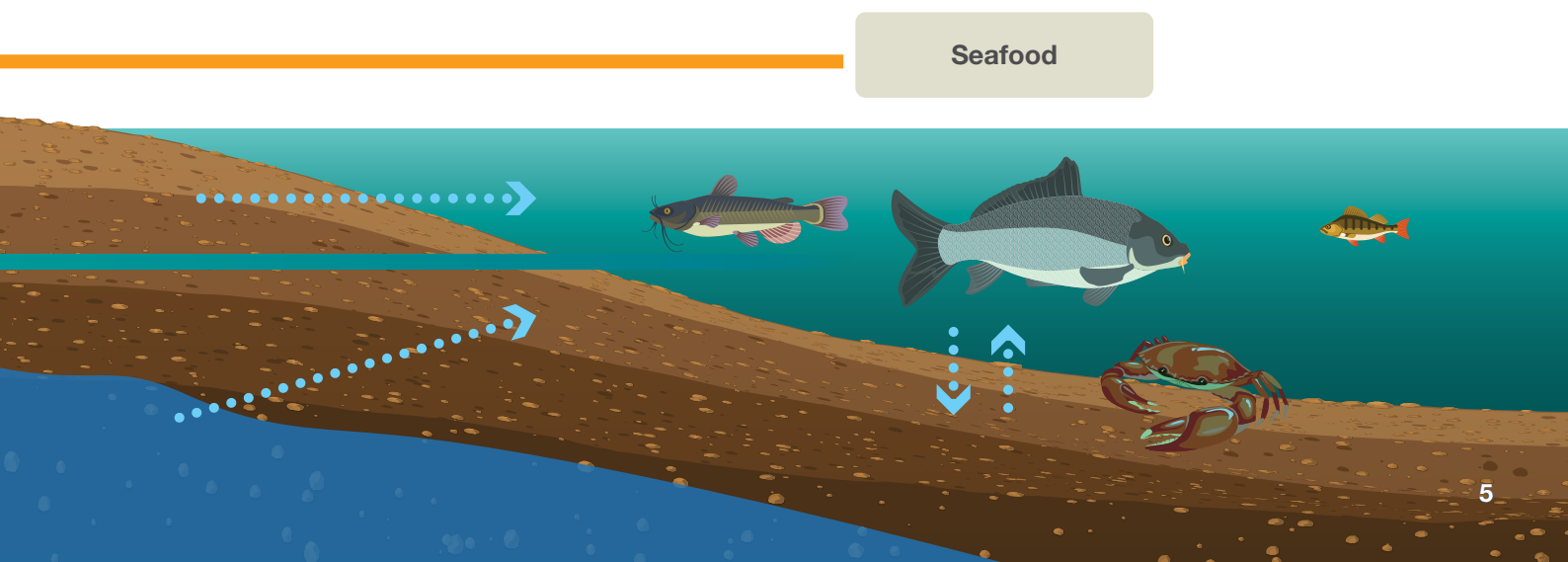


The HHERA considered all the ways people could be exposed to PFAS and added up all the exposures to consider the total exposure at that site.

The risk assessment assumed people living and/or working in the zones:



Based on what we know about water use in the area, and that CS Energy has provided alternative water to properties with PFAS over the Australian Drinking Water Guidelines (ADWGs), it's understood the combination of all pathways is unlikely to have occurred at any properties.



Key findings of risk from combined pathways

- ✓ Based on the above assumptions, the risk assessment found risks for individual pathways in all zones were low (on current guidelines).
- ✓ Risks resulting from combining drinking groundwater with all or some of the pathways involving consumption of home grown produce are low based on current Australian health guidance for all zones **except for the most impacted areas within Zone 1, which reported a slightly elevated risk when some or all pathways were combined.**

About Zone 1

Zone 1 has properties with the highest concentration of PFAS, however half of the properties were under the current ADWG.

Based on our understanding of how water is used in this zone, we don't expect anyone within Zone 1 is currently drinking groundwater and eating homegrown produce across all pathways.

Eating fish from Lake Callide and Callide Creek

In 2023 CS Energy engaged a specialist to do an aquatic biota sampling report. This found that Callide Creek is unlikely to be a place where people fish for inclusion in a routine diet. Lake Callide, on the other hand, is stocked with fishable species and fishing occurs there regularly. All samples collected from Lake Callide did not contain any measurable levels of PFAS.

Based on the levels of PFAS found in the fish sampled in Callide Creek, Queensland Health advised in 2023 that infrequent consumption (every few months) of these fish would not make a significant contribution to an individual's overall exposure to PFAS. Following the HHERA there are no material changes to this advice.

It found:

- Risks due to exposure to PFAS via eating fish caught in Lake Callide are acceptable based on the current national Food Standards Australia and New Zealand (FSANZ) trigger point.
- Risks due to exposure to PFAS via eating fish caught in Callide Creek are acceptable provided that consumption of these fish is infrequent (every few months).



Scan QR code to read the full aquatic biota sampling report

Table 1: Exposure pathways

Exposure Scenario	Zone 1 Callide Power Station to Muirs Road	Zone 2 Muirs Road to Dawson Highway	Zone 3 Baileys Lane to Dawson Highway	Zone 4 Eastern boundary of power station to Lake Callide	Zone 5 Dawson Highway to Jambin Dakenba Road north of Callide Creek	Zone 6 Dawson Highway to Jambin Dakenba Road south of Callide Creek
Individual Exposure Pathways						
Drinking Water	✓	✓	✓	✓	✓	✓
Incidental Ingestion (farming)	✓	✓	✓	✓	✓	✓
Incidental Ingestion (domestic)	✓	✓	✓	✓	✓	✓
Home produced fruit & vegetables	✓	✓	✓	✓	✓	✓
Home produced eggs	✓	✓	✓	✓	✓	✓
Home produced meat (drinking groundwater)	✓	✓	✓	✓	✓	✓
Home produced meat (drinking groundwater and irrigated crops)	✓	✓	✓	✓	✓	✓
Combined Exposure Pathways						
Groundwater + fruit & vegetables	✓	✓	✓	✓	✓	✓
Groundwater + eggs	✓	✓	✓	✓	✓	✓
Groundwater + meat	✗	✓	✓	✓	✓	✓
Groundwater + meat and eggs	✗	✓	✓	✓	✓	✓
Groundwater + fruit & vegetables, meat and eggs	✗	✓	✓	✓	✓	✓

Notes: ✓ Acceptable Risk ✗ Elevated Risk ✗ Unacceptable Risk

In addition, it found exposure risk to people using Callide Creek for swimming/recreation are low based on current guidelines. Our quarterly technical monitoring program shows PFAS is under level of detection in Lake Callide.

How human health effects were measured

The HHERA has referred to a range of Australian standards when assessing risk to human health and the environment. These include:

Food Standards Australia and New Zealand (FSANZ)

FSANZ, the agency responsible for food standards in Australia, does not have any regulatory measures in place at this stage.

However, they have developed a guideline for tolerable daily intake, based on a toxicity reference value (TRV). The TRV is a dose, or concentration at which a chemical is not expected to impact on the human body.

The tolerable daily intake for food in Australia is:

The Australian Drinking Water Guidelines (ADWG)

The ADWG are set by the National Health and Medical Research Council (NHMRC). Where health-based guideline values exist, they tend to be conservative in nature, ensuring that public health is protected.

The drinking water guidelines are 0.07 μg per litre for the sum of PFOS and PFHxS, and 0.56 μg per litre for PFOA. These values (**which are currently under review**) are set to levels at which the chemicals may be consumed in the long term without significant health risk to humans.

The drinking water guidelines measure in **μg = micrograms**. That is a unit of mass equal to one millionth of a gram.

Recreational water guidelines

The recreational guidelines for water use for activities like swimming and sprinkler play are set by the NHMRC. They are set at a level that is higher than the ADWG. They are based around the method of exposure being by accidentally swallowing water – not by water having contact with skin.

These are: the total concentration of PFOS plus PFHxS should not exceed 2 μg per litre and 10 μg per litre for PFOA. This is calculated on an estimated accidental ingestion of 30 litres per year.

No areas in the investigation zone (e.g. off the power station site) have returned levels above the recreational guidelines since CS Energy began sampling.

Table 2: FSANZ Toxicity Reference Values for PFAS

PFAS Compound	TRV	Background intake	Reference
PFOS + PFHxS	0.02 $\mu\text{g}/\text{kg}/\text{day}$	0.0014 $\mu\text{g}/\text{kg}/\text{day}$ (7% of the TDI)	(FSANZ 2017c)
PFOA	0.16 $\mu\text{g}/\text{kg}/\text{day}$	0.00078 $\mu\text{g}/\text{kg}/\text{day}$ (negligible)	(FSANZ 2017c)



Key ecological findings

The levels of PFAS in groundwater or surface water also do not pose an unacceptable risk to ecosystems in and around Callide Creek based on national guidance for ecological risk assessment.

This includes:



No effect on aquatic species in Callide Creek or Lake Callide



No effects on birds consuming species from these waterways



No effects on mammals consuming species from these waterways.

Next steps

CS Energy will continue to monitor and test for PFAS in our investigation area.

For more information visit

www.csenergy.com.au

