

# Advancing the Reliability of ANZG Water Quality Guidelines Through Updated Methodology and Modernised Tools

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# WHY GUIDELINE RELIABILITY MATTERS FOR CONSULTANTS, CLIENTS, AND REGULATORS

## Role of Water Quality Guidelines

- Guidelines support critical decisions in contaminated land, discharge permits, and environmental monitoring for clients and regulators.

## Importance of Guideline Reliability

- Reliability affects costs, feasibility, and outcomes; overly cautious or lenient values impact remediation and ecosystem safety.

## Managing Uncertainty in Guidelines

- ANZG classifies guidelines by reliability and promotes weight-of-evidence approaches when uncertainty is high.



# LEGACY GUIDELINE VALUES AND RELIABILITY CLASSIFICATIONS

## Comprehensive ANZG Guidelines

- ANZG Guidelines cover over 300 toxicants in freshwater and marine environments, providing broad water-quality standards.

## Legacy Data Challenges

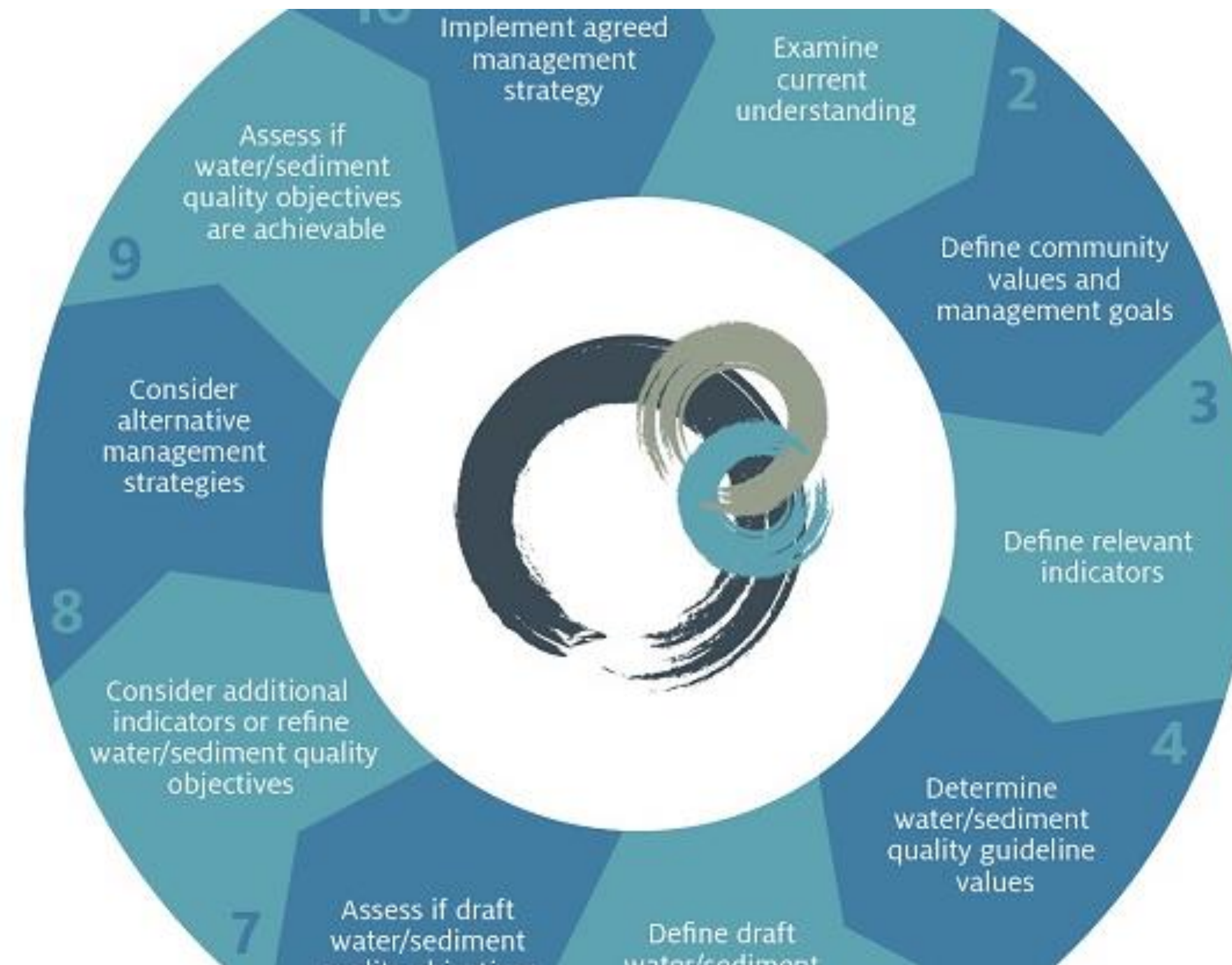
- Many guideline values stem from older frameworks and haven't been updated to reflect modern ecotoxicology or statistics.

## Reliability Classifications Importance

- Reliability ratings reflect data quality and derivation methods, guiding appropriate use of guideline values in decisions.

## Use of Low-Reliability Values

- Low reliability values should be used cautiously as interim measures and in combination with other evidence, yet are often misapplied as fixed thresholds.
- ANZG guidelines recommend supplementing the old guidelines' ecotoxicity database with newer ecotoxicity data to improve reliability.



# WHY ARE MANY EXISTING GUIDELINES OF LOW RELIABILITY?



# LIMITATIONS OF ASSESSMENT FACTOR APPROACHES

## **Single Species Focus**

Assessment factor methods rely on a single species endpoint, which may not reflect overall ecosystem sensitivity.

## **Subjectivity in Factors**

The choice of assessment factor depends on many variables and can obscure true uncertainty and protection levels.

## **Lack of Confidence Measures**

Assessment factor approaches do not provide confidence intervals or clear estimates of species protection.

## **Can Not Easily Integrate Site Specific Factors**

Usually don't have Toxicity Modifying Factors (TMFs) such as hardness, pH or dissolved organic carbon.

## **Shift to SSD Methods**

Modern practices prefer species-sensitivity distribution approaches that use data from multiple species.



# KEY UPDATES IN WARNE ET AL. (2025)

## Structured Data Quality Assessment

The update introduces a transparent approach to evaluating the quality of ecotoxicity data to improve guideline reliability.

## Chronic vs Acute Toxicity Rules

Clear criteria separate chronic from acute toxicity data, ensuring more accurate water quality guidelines.

## Model-averaged Sensitivity Distributions

Use of model-averaged species sensitivity distributions improves statistical robustness over single models.

## Uncertainty Documentation

Greater emphasis on documenting uncertainty supports transparent and defensible.



# SHINY SSD TOOLS AND SUPPORTING QA WORKFLOWS

## User-Friendly Interactive Tools

Shiny SSD tools provide an accessible interface for fitting species sensitivity distributions without advanced programming.

## Robust Model Averaging Approach

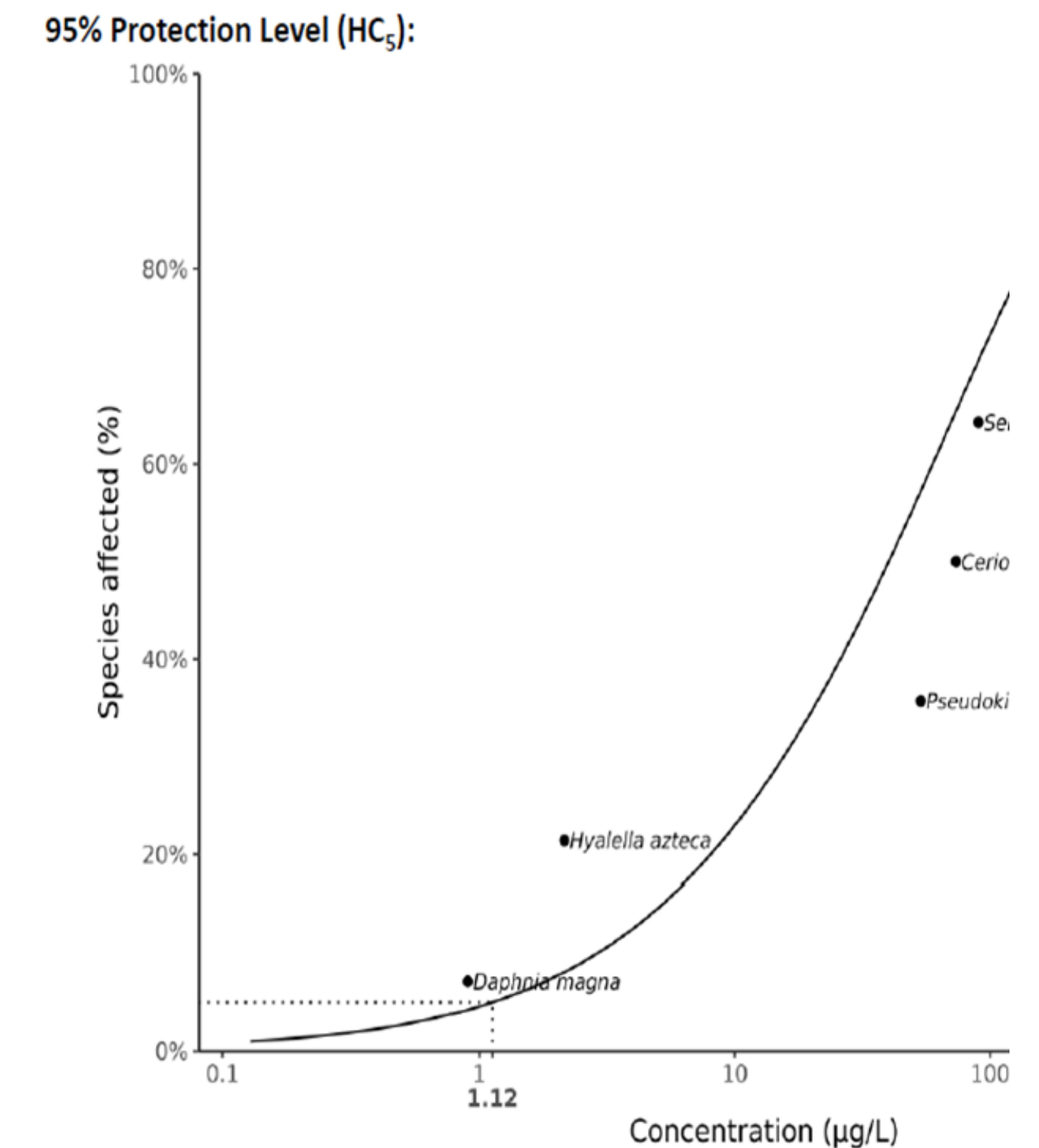
Model averaging across multiple statistical distributions improves robustness and confidence in protection levels.

## Quality Assessment Workflow

Structured ecotoxicity data quality assessment spreadsheet operationalises key criteria for transparent guideline derivation.

## Transparency and Professional Judgement

Tools enhance transparency and make professional judgment explicit and defensible in regulatory contexts.



# CASE STUDY 1: THALLIUM IN FRESHWATER



## FROM LOW-RELIABILITY LEGACY VALUE TO SSD -BASED GUIDELINE

- Current ANZG DGV – 0.03 µg/L - reliability unknown.
- Uses assessment factor approach - one data point (amphipod *H. Azteca*).
- Safety factor of 20.
- WQ monitoring shows periodic thallium exceedance at the site.
- Biological monitoring at the site did not show any adverse effects.
- Thallium possibly from natural sources (Waikato Coal Measures).

Level of Protection (%)	Updated DGV for Thallium in Freshwater (µg/L)
99%	0.2
95%	2
90%	4
80%	10



## CASE STUDY 2: PFOS IN FRESHWATER



# DATASET SELECTION AND SSD SENSITIVITY

Species Protection Level	2015 Interim DGV (µg/L)	2023 Draft DGV (µg/L)	2023 Draft + SERDP Dataset (µg/L)	2025 Final PFOS DGV (µg/L)
99%	0.00023	0.0091	0.038	0.02
95%	0.13	0.48	1.2	0.9
90%	2.0	2.7	5.5	4
80%	31	17	27	20



# PFOS IN MARINE WATERS

## Challenges in PFOS Guidelines

ANZG has not yet published default PFOS marine water guidelines, complicating contamination management in coastal areas.

## Interim Scientific Approaches

Best available science and stringent criteria guide interim PFOS management using compiled marine ecotoxicity data.

## Draft Marine Guideline Values

Draft marine guideline values derived using SSD methods provide insight despite low reliability and data variability.

## Framework Flexibility and Decision Support

ANZG framework's flexibility enables risk-based assessments even without finalised guideline values, supporting sound decisions.



# OTHER CANDIDATES FOR UPDATED OR SITE-SPECIFIC GUIDELINE VALUES

## Toxicant-Specific Considerations

The toxicity of aluminium, lead, selenium, and cobalt varies with environmental factors and bioaccumulation.

## Modern Methodologies

Updated ecotoxicity data and SSD approaches enable more site-relevant guideline values for contaminants.

## Proportional Approach

Effort in guideline derivation should match the risk scale and decision significance for efficient resource.



# WHAT THIS MEANS FOR TECHNICAL PRACTITIONERS

## Legacy Versus Updated Guidelines

Many water quality guidelines are legacy values needing updates with modern best practices and tools for accuracy.

## Use Guidelines with Caution

Low-reliability guideline values require cautious use, combined with other evidence and awareness of uncertainty.

## Case Studies Demonstrating Improvement

Case studies on thallium and PFOS show science-driven improvements lead to more reliable environmental guidelines.

## Engagement for Better Outcomes

Practitioners must engage with guideline derivation to improve environmental decisions and ecosystem outcomes.

