Technical Position Paper

On the Performance, Risk Profile, and Appropriate Application of Onsite Wastewater Treatment Systems in Water Sensitive Environments

ABSTRACT

Onsite wastewater decisions made today will shape groundwater, waterways, and public health outcomes for decades, especially in water sensitive environments where nutrients and pathogens have clear pathways to harm. Recent industry debate has renewed enthusiasm for soil based and passive treatment approaches, often supported by historical failure rate claims about Aerated Wastewater Treatment Systems.

This paper examines those claims and finds that the commonly cited legacy datasets are not fit for purpose. Key inputs needed to attribute poor performance are typically missing, including influent characterisation, system generation and configuration, maintenance history, mechanical fault data, alarm response, and valid sampling methodology. In some jurisdictions, historic sampling was taken from incorrect chambers, producing results that do not represent treated effluent and undermining the credibility of compliance records used to generalise modern performance.

Using current science and the only robust Australasian evaluation framework, AS NZS 1546.3 2017, this paper argues for risk-based system selection grounded in verified long duration performance, not snapshot studies. It also highlights an established reality that soil based disposal fields are a proven nutrient export pathway, particularly for nitrogen, and that passive systems can fail silently without monitoring, alarms, or controlled discharge. With domestic sewage strength increasing as water use declines, standards and approvals must anticipate future loading, not historical dilution.

The paper concludes with practical principles for regulators and practitioners: prioritise containment, verification, and engineered nutrient reduction where environmental connectivity exists, and apply equivalent scrutiny at the dispersal interface for all system types.

PREPARED FOR: Councils, Consulting Engineers, Environmental Health Officers, Water Authorities, and Regulatory Bodies, and anyone who is interested in waste water and our environment.

PREPARED BY: Scott Humberstone

AUTHOR BACKGROUND AND PERSPECTIVE

Before I get into the technical arguments, I want to be clear about who I am and the perspective I bring to this.

I started my wastewater career as what is bluntly referred to as a “turd wrangler.” I began in drainage and servicing, working directly with onsite systems in the field. That hands on exposure gave me an early understanding of how systems behave once they are installed, lived with, misused, neglected, or pushed beyond what they were designed for.

Over time, and perhaps more accurately through persistence and curiosity, I was fortunate enough to grow within the industry into roles involving system design, testing, compliance, and performance assessment. Some might jokingly say I have gone from turd wrangler to something closer to a “poo professor,” although I am very conscious that I am still learning and always will be.

I have been lucky to work alongside highly experienced engineers, technicians, and operators who tolerated my questions early on, and many who still do. That culture of shared knowledge has been fundamental. I work within a company where understanding wastewater treatment is not siloed, it is embedded across the organisation. Even office staff undertake comprehensive training on how our systems work, to the same technical level expected of service technicians. That depth of shared understanding matters.

I have had meaningful involvement across commercial and remote applications, and I work in an environment where we have more than a decade of NATA accredited laboratory testing on effluent across a wide range of systems. Influent analysis has also been undertaken, but far less consistently and generally only at selected sites and periods, so long term influent datasets are limited compared with our effluent performance datasets. Through unique mobile and remote installations, many of which are effectively domestic scale systems operating in demanding conditions, I have been exposed to an extraordinary depth of long term performance data. This includes systems subject to frequent laboratory analysis, sometimes monthly or even weekly, over many years.

That environment has allowed me to learn not just from individual systems, but from patterns, trends, and long term outcomes. It is this combination of field exposure, internal knowledge sharing, and extensive verified data that fundamentally shapes my views on onsite wastewater treatment. Wastewater treatment, alongside clean drinking water, is widely recognised as one of the most important public health advances in human history. Together, these interventions are credited with dramatically increasing average human life expectancy, on a scale comparable to the discovery of antibiotics such as penicillin. Wastewater treatment underpins modern civilisation quietly and invisibly. When it works well, nobody notices. When it does not, the consequences are cumulative, environmental, and long lasting.

This paper has been prepared in my personal capacity. I work in the onsite wastewater treatment industry and have experience across field servicing, compliance, and performance assessment. The views expressed are my own and are not made on behalf of any employer, brand, or organisation..

PURPOSE AND CONTEXT

Recent industry discussions and conference presentations have promoted an increased interest on soil based and passive onsite wastewater treatment systems, including trench based disposal, sand and media filtration systems, and other proprietary soil dependent secondary treatment approaches, often supported by historical “failure rate” studies of Aerated Wastewater Treatment Systems (AWTS).

This paper addresses onsite wastewater management generally across residential and small scale non trade applications and deliberately excludes trade wastewater. This document has been prepared to clarify the engineering, scientific, and environmental realities of onsite wastewater treatment, particularly in waterway connected, groundwater dependent, and nutrient sensitive environments.

The intent is not to advocate for one technology ideology over another, but to ensure that system selection, policy direction, and regulatory decisions are grounded in current science, modern standards, and long term environmental risk management, rather than outdated datasets or incomplete interpretations.

Many of the historic studies and examples relied upon in current discussions relate to older generation approaches that were later replaced or materially changed because they did not perform consistently when deployed at scale, or when applied in higher density settings. Where these systems underperformed, the drivers were often a combination of design limitations, operational constraints, and maintenance realities, not treatment theory alone. This is an important distinction when legacy data is used to justify broad technology preferences in modern approvals.

FUNDAMENTAL LIMITATION OF COMMONLY CITED AWTS “FAILURE” STUDIES

A recurring issue in the industry is reliance on legacy studies to characterise AWTS as inherently unreliable or prone to failure. When examined with engineering rigour, these studies do not contain the minimum information required to support such conclusions.

Across the commonly referenced datasets, the following critical inputs are almost universally absent, influent characterisation (BOD, COD, TN, TP, FOG, chemical shock loads), system age, design generation, and configuration, servicing, desludging, and maintenance history, mechanical fault records (blowers, pumps, floats, irrigation components), alarm activation or response data, differentiation between process failure and mechanical or user driven faults.

Without these inputs, it is not scientifically possible to attribute poor outcomes to treatment process, operation and maintenance, rather than misuse, neglect, age, or incorrect sampling.

In many cases, these studies rely on single grab samples, visual inspections, administrative compliance records, mixed system types (septic, sand filters, trenches, legacy ATUs), and undefined or inconsistent “failure” criteria.

As such, they cannot be used to generalise the performance or reliability of modern onsite treatment systems.

INCORRECT HISTORICAL SAMPLING PRACTICES FURTHER UNDERMINE LEGACY DATASETS

It is also important to recognise that historic compliance sampling practices were often technically invalid.

There is direct first hand experience, including within Victoria under legacy approval pathways, where regulatory compliance samples were taken from sludge digestion chambers incorrectly assumed to be final effluent chambers. Sampling from these locations will inevitably produce extremely elevated BOD, high suspended solids, elevated nitrogen species, and results that do not represent treated effluent.

This also highlights that compliance outcomes can be materially influenced by the competence and consistency of field sampling and inspection practices, reinforcing the need for standardised methods, clear sampling points, and appropriately trained auditors and inspectors

These results were initially recorded as “effluent non compliance” and, in our case, were sufficient to temporarily halt sales and approvals of our systems. It was only because this commercial impact forced a detailed review that the sampling location error was identified. Once corrected sampling was undertaken from the appropriate effluent chamber, the system was retested and subsequently passed. Without the direct consequence of sales being halted, this error would likely have remained undetected. This experience demonstrates that legacy compliance datasets, where sampling location and methodology were not rigorously controlled, cannot be relied upon as accurate indicators of AWTS treatment performance and demonstrate very low levels of understanding by the auditors and inspectors.

Several studies frequently cited today were produced during the same period, under the same non standardised sampling regimes.

Failure magnitude is rarely quantified or contextualised

Another critical flaw in many “failure rate” studies is the absence of information about how much systems failed by, how often, and why.

Typically, these studies do not quantify the magnitude of exceedances, differentiate minor exceedances from severe failures, distinguish one off events from sustained poor performance, separate mechanical faults from treatment process issues, identify whether failures were due to neglect, blockages, overload, or misuse, or provide statistical distributions of effluent quality.

Equating a marginal exceedance or irrigation malfunction with “treatment failure” is technically incorrect and fundamentally incompatible with modern wastewater performance assessment.

None of the cited legacy studies reflect modern AWTS evaluated under AS/NZS 1546.3:2017 [1]

AS/NZS 1546.3:2017 remains the only scientifically robust framework for evaluating onsite wastewater treatment systems in Australia and New Zealand. [1]

The standard assesses sustained performance over a 26 week test period, influent variability representative of domestic use, shock loading, nitrogen and phosphorus reduction, sludge age and solids management, mechanical reliability, correct effluent sampling protocols, and statistically valid effluent performance outcomes. [1]

None of the commonly cited legacy studies approximate this level of assessment, and none can be reasonably used to evaluate modern AWTS designed, tested, and certified under the current standard.

Sewage strength is increasing, not decreasing

There has been discussion suggesting that sewage strength assumed in current standards may be “too high.” Contemporary evidence indicates the opposite.

Domestic sewage strength is increasing over time, driven by widespread adoption of low flow fixtures and appliances, reduced per capita water use, drought driven behavioural changes, and increased chemical concentration per litre of wastewater. [10]

Onsite systems are typically expected to operate for 15 to 30 years or more, however there are legacy passive systems still operating today that are 40 to 50 years old, meaning standards must be written for future loading conditions, not historical averages.

A robust standard must accommodate rising BOD, COD, TN, TP, and chemical variability, rather than assume ongoing dilution. Weakening design assumptions now would create systemic under performance over the life of installed systems.

It is also important to recognise that sewage strength assumptions within a standard must be deliberately wide, because domestic use is inherently variable. Onsite systems must perform across everything from intermittently used holiday homes with very low daily loads, through to full time residences with high strength influent events that occur as part of normal household behaviour. Simple actions, such as the disposal of food waste or liquids with high organic content, can introduce instantaneous loads far in excess of average daily assumptions. This variability is not misuse, it is the reality of domestic wastewater. A robust standard must therefore accommodate a wide range of influent strengths and loading patterns, rather than be optimised for a narrow or idealised operating condition.

I say this not from theory, but from direct experience. I spent a decade servicing onsite wastewater systems in the field, and I now provide technical support to over 100 agents Australia wide, many of whom have more than 30 years of hands on experience. Through this role, I directly help support more than 30,000 installed systems.

Any experienced service technician will tell you they have seen everything imaginable entering domestic systems, excessive fats, oils and grease, food waste, detergents, chemicals, and high strength organic inputs that occur as part of normal household life. Liquids such as milk and other emulsified organic loads are not intercepted by grease traps and are not meaningfully attenuated by primary settling chambers, they pass straight through into downstream treatment processes.

These are not edge cases or misuse, they are routine realities of domestic wastewater. A standard that assumes narrow influent conditions is disconnected from the real world. A standard that recognises this variability, and requires systems to cope with it, is one that genuinely protects the environment.

SOIL BASED DISPOSAL FIELDS ARE A PROVEN NUTRIENT EXPORT PATHWAY [6, 7, 8, 14]

Extensive Australian and international research demonstrates that systems relying on soil, sand, trenches, absorption beds, sand and media filtration beds, or proprietary soil dependent secondary treatment approaches do not remove nitrogen to any meaningful degree. Instead, these systems convert nitrogen predominantly to nitrate and export it down gradient via groundwater. [6, 7, 8, 14]

A further distinction that warrants consideration is whether treatment occurs within a closed, engineered vessel or within an open soil, sand, or media bed. Where treatment is not in a closed vessel and instead relies on a bed, soil, sand, or media layer, the level of containment is inherently reduced.

In these configurations treatment performance is influenced by soil heterogeneity, hydraulic short circuiting, seasonal groundwater movement, and physical disturbance, and occurs without full physical containment or lining. Where treatment is not fully contained, the margin for error is reduced and unintended subsurface discharge pathways are more difficult to control or detect. [7, 8]

7.1 AUSTRALIAN CASE STUDY, MOUNT GAMBIER, SOUTH AUSTRALIA

CSIRO's work over the Mount Gambier karst aquifer, which supplies Blue Lake, the city's drinking water, provides one of the clearest Australian examples. [2]

At realistic peri urban densities of approximately 10 lots per hectare, septic tank dispersal fields were modelled to leach around 111 kg N per hectare per year, comparable to intensively irrigated legume agriculture, with one third of bores on the Mount Gambier Plain exceeding 10 mg/L nitrate due to onsite effluent entering the unconfined aquifer, contributing to a measurable rise in total nitrogen within Blue Lake itself. [2, 4]

This demonstrates that the disposal field is the primary risk interface, nitrogen export increases rapidly with density, and groundwater connectivity results in direct drinking water impacts. [2, 4] MEDLI was originally developed by CSIRO to help assess and quantify this exact type of nutrient export and environmental loading risk, reinforcing that the disposal field interface is the critical point for evaluating real world impact. [5]

It is important to state clearly that soil, sand, and media based systems do have valid applications when correctly matched to site conditions, loading rates, hydrogeology, and environmental sensitivity. The concern arises when these systems are promoted or approved as broadly applicable solutions in groundwater connected, nutrient sensitive, or high risk catchments where their inherent limitations are well established. Correct application of any onsite wastewater system is imperative. Any areas where waterways are a factor, including streams fed by underground reservoirs or connected groundwater systems, must consider total nitrogen and total phosphorus outcomes, not just assumed soil attenuation.

AUSTRALIAN REGULATORY GUIDANCE ALREADY RECOGNISES THIS RISK

Australian regulators across multiple jurisdictions explicitly acknowledge nutrient export from onsite disposal fields. [6, 7, 8, 13]

The QBCC On site Sewage Treatment Panel Report (2022) quantifies higher nitrogen and phosphorus export from unsewered catchments compared with sewered catchments and identifies onsite effluent disposal fields as a material nutrient source. [6]

EPA Victoria guidelines recognise that failing onsite systems can pollute surface water, groundwater, and drinking water supplies. [7]

NSW On site Sewage Management Guidelines identify onsite systems as contributors to nutrient loading and water quality degradation. [8, 9]

Queensland Government literature reviews identify unsewered areas relying on soil based disposal as elevated risk sources of nitrogen and phosphorus to coastal waters. [13]

These are not theoretical risks, they are acknowledged regulatory realities. [6, 7, 8, 13]

CRITICAL ENGINEERING DISTINCTION, FAIL SAFE ENVIRONMENTAL PROTECTION [1, 7, 8]

A fundamental difference between modern AWTS and passive soil based systems is the presence of active fail safe mechanisms. [1, 7, 8]

Modern AWTS typically incorporate final effluent filtration, shallow subsurface pressure compensating irrigation, hydraulic restriction through filters, alarm systems linked to hydraulic or quality faults, and automatic restriction or shutdown of discharge when performance degrades. [1, 7, 8]

When effluent quality deteriorates or filters begin to block, discharge is restricted or stopped, alarms are triggered, and servicing is initiated. This prevents uncontrolled discharge to the environment. [1, 7, 8]

Passive systems relying on trenches, sand beds, media beds, or soil absorption have no alarms, no monitoring, no quality based shut down, and no mechanism to prevent continued discharge during failure. When they fail, they fail silently, often for extended periods, with direct discharge to soil horizons above groundwater or surface waters. [7, 8]

From a risk management perspective, this distinction is critical. It is also critical to recognise an inconsistency in how different onsite wastewater system types are assessed and discussed.

Aerated Wastewater Treatment Systems are tested for compliance at the outlet of the treatment process, specifically at the effluent chamber, prior to discharge to land application. This is deliberate and appropriate, as it evaluates the treatment plant itself against defined performance criteria under AS/NZS 1546.3:2017. [1]

By contrast, soil, sand, trench, and media based passive systems are rarely, if ever, tested in situ under real operating conditions. Where assessment occurs, it is typically limited to design assumptions, modelling, or visual inspection, rather than measured effluent quality at the point of environmental interaction. [6, 7, 8]

A true like for like comparison would require both system types to be evaluated at the same interface, the point that actually matters, which is the dispersal field and its interaction with the surrounding environment.

This distinction is important because even when an AWTS experiences a mechanical or operational issue, the treated effluent still passes through soil based dispersal systems that are functionally equivalent to those relied upon by passive systems. In effect, a “failed” AWTS still retains the same final environmental barrier that passive systems depend on entirely.

Conversely, when a passive system underperforms, there is no upstream engineered treatment step, no alarms, no containment, and no automatic restriction of discharge. Failure occurs directly at the soil interface, often undetected and unmanaged. [7, 8]

If environmental protection is the true objective, then assessment frameworks should focus less on isolated treatment plant metrics and more on actual environmental loading at the dispersal interface. Evaluating AWTS solely at the effluent chamber while assuming soil based systems perform adequately without equivalent field verification creates an uneven and misleading comparison. [6, 7, 8]

Ultimately, what matters is not theoretical treatment performance, but what is released into our soils, groundwater, and waterways. Any assessment or policy discussion that does not apply this principle consistently across system types risks drawing conclusions that are technically incomplete and environmentally unsafe.

ADDITIONAL TECHNICAL CLARIFICATION, CONTAINMENT, VERIFICATION, AND PASSIVE SYSTEM RISK CONTROLS

A further technical issue that warrants explicit recognition is the concept of containment and how it relates to environmental risk. [7, 8]

If the industry is to place increasing reliance on soil, sand, trench, and media based passive systems, then the types and configurations of systems considered acceptable must be clearly defined, including whether they remain appropriate under current environmental and development conditions. [7, 8]

In addition, passive and soil dependent systems should be required to demonstrate performance rather than rely primarily on assumed attenuation. This evidence could be established through mandated verification approaches, including service based testing, structured inspection protocols, or where practical, measured field performance indicators. [7, 8]

It is also necessary to define the level of containment achieved by each passive system configuration, because containment can vary materially across different designs and site conditions. Once containment is defined, it becomes possible to quantify risk more transparently and to identify specific system design improvements that reduce that risk. [7, 8]

Containment and effluent concentration assumptions are also directly relevant to modelling frameworks used in approval pathways, including MEDLI based approaches used to assess loading and installation approvals. If modelling outcomes are materially influenced by assumed containment and attenuation, then those assumptions should be explicit, justified, and where possible supported by field verification. [5]

Finally, if passive systems are to be treated as acceptable long term infrastructure in sensitive catchments, then they should be expected to adopt at least some of the monitoring principles that have proven valuable in engineered systems. Even basic indicators such as level monitoring, turbidity proxies, or odour and vent condition indicators can be used to support fault detection and trigger investigation, rather than allowing underperformance to remain silent and unmanaged.

THE ROLE OF ENGINEERED NUTRIENT REDUCTION

Where waterways, aquifers, subsurface flow paths, reservoirs, estuaries, or coastal systems are present, total nitrogen and total phosphorus reduction is not optional. [6, 7, 8, 14]

Reliance on soil alone to manage nutrients is not defensible in groundwater connected catchments, karst or fractured rock environments, shallow water tables, high density developments, or environmentally sensitive receiving environments. [6, 7, 8, 14]

Engineered treatment, monitoring, alarms, and controlled discharge are essential to protect downstream environments. [1, 6, 7, 8]

AUSTRALIAN INNOVATION AND LONG TERM OPERATIONAL DATA

Australia and New Zealand are global leaders in onsite wastewater treatment innovation. Systems tested under AS/NZS 1546.3:2017 have achieved total nitrogen reduction of up to 82 percent, which to the best of my knowledge represents the highest denitrification performance achieved anywhere in the world for a domestic scale onsite wastewater treatment system tested under a recognised national standard, and this is one of the strongest standards globally. [1]

It is also worth noting that Australian manufacturing innovation is not only about treatment performance, it is about sustainability and material science. To date, Ozzi Kleen is the only wastewater company in the world that is using up to 80 percent recycled plastic in its tank manufacture, a process created and refined over the last 17 years. The broader point is that we should be supporting Australian and New Zealand companies that invest in science, testing, manufacturing, and environmental outcomes locally, rather than dragging the industry backwards on the back of incomplete data.

Supporting Australian and New Zealand companies that invest locally in science, testing, manufacturing, and verified environmental outcomes is also a practical risk management position for regulators and communities, because it helps retain capability, accountability, and technical support within our region rather than shifting reliance toward overseas suppliers who may not carry the same long term service and performance responsibilities in Australian and New Zealand conditions.

Long term operational datasets from our own mining sector installations, many supported by monthly or even weekly NATA certified laboratory sampling over the life of the systems provide a depth of empirical performance data that most domestic manufacturers simply do not have access to.

These datasets consistently demonstrate that modern, well designed, and properly serviced AWTS deliver reliable, measurable treatment outcomes when applied appropriately, and that real world performance can be validated with long-duration data rather than inferred from legacy “snapshot” studies.

MARKET REALITY AND THE CHALLENGE OF ADVANCING DOMESTIC ONSITE WASTEWATER SYSTEMS

There is an uncomfortable reality in the domestic wastewater sector that is rarely acknowledged openly.

For most homeowners, an onsite wastewater system is viewed as a grudge purchase. It is not something they aspire to own or upgrade. In many cases, people are required to replace or upgrade a system because council mandates it, their legacy passive system has failed, or a property transaction forces the issue. The expenditure is therefore reluctant, unplanned and often resented.

Unlike vehicles, appliances or home improvements, wastewater systems do not benefit from consumer driven innovation. People do not shop for them based on features, aesthetics or technology. Most simply want to flush the toilet and not think about what happens next, and understandably gravitate toward the lowest cost option that meets the approval requirement.

I genuinely wish this dynamic were different. In an ideal world, wastewater infrastructure would be valued in the same way as other household systems, where people seek out modern technology, reliability, performance and long term environmental benefit. However, that is not the reality we operate in today.

This market reality has direct consequences for system design and industry advancement. In the domestic space, profit margins are extremely tight. Manufacturers are required to invest heavily in compliance testing, certification, servicing infrastructure and regulatory engagement, yet are simultaneously constrained by a market that overwhelmingly demands the minimum cost solution.

From a manufacturer and designer perspective, this creates a difficult balance. It is entirely possible to design and build a domestic treatment system with significantly higher levels of automation, advanced sensors, real time monitoring, app based interfaces and even higher effluent quality than current systems deliver. However, the number of consumers willing or able to purchase a system costing several times more than today's approved solutions is very small. At that scale, such products are not commercially viable in the domestic market.

This reality should not be used as justification to weaken standards or reduce environmental protection. Instead, it highlights why robust minimum performance standards are essential. When the market does not naturally reward higher performance, regulation becomes the primary mechanism to ensure environmental outcomes are protected across the full population of installed systems.

Advancing the industry therefore cannot rely on consumer choice alone. It requires collaboration between regulators, engineers, designers and manufacturers to ensure that minimum standards continue to reflect environmental risk, future loading conditions and long term performance, even when market forces push toward the lowest acceptable cost.

If we accept weaker standards simply because systems are a reluctant purchase, we embed under performance into the landscape for decades. Conversely, if we set strong, science based minimum requirements, innovation occurs within those boundaries and environmental protection is maintained, even in a cost sensitive market.

This is not an easy problem to solve, but it is one the industry must confront honestly if we are serious about protecting waterways, groundwater and public health over the long term.

CONCLUSION

Onsite wastewater systems are expected to operate for decades. Decisions made today will shape water quality outcomes across Australia and New Zealand for a generation.

Policy and design decisions must therefore be based on current science, robust standards, empirical data, and long term environmental risk.

Legacy datasets, incomplete studies, and assumptions about soil "treatment" cannot meet this obligation.

CLOSING STATEMENT

I want to be clear about where I am coming from.

Yes, I work for a manufacturer, but far more importantly than that, I am an Australian who genuinely cares about the environment we live in. We are custodians of some of the most remarkable and fragile natural systems in the world, our rivers, aquifers, estuaries, reefs and coastal environments are not abstract concepts, they are places we live, work, swim, fish and raise our families around. I have also been to New Zealand and seen the amazing landscape there, and while I am from Australia, it is just as important that the biospheres and aquascapes across both countries are protected.

What we decide today in onsite wastewater treatment has consequences that extend far beyond current policy cycles or commercial interests. These systems are installed in the ground for decades. Once approved, they do not disappear when opinions change, they become legacy infrastructure. If we lower standards, simplify assumptions or accept inadequate protection now, those decisions will echo for a generation or more.

A standard is not about what works today under ideal conditions. It is about what must continue to protect the environment twenty or thirty years from now, under higher loads, changing climate, evolving household chemistry and increasing development pressure. Future custodians do not get to redesign what we approve today, they inherit it.

Those of us who influence standards, approvals, system selection, manufacturing and design therefore carry a responsibility that goes beyond individual technologies or short term cost considerations. Our obligation is to be driven by science, evidence, and a genuine understanding of environmental risk, not by agenda, convenience or financial pressure.

If we get this right, we protect the places we love and pass on systems that perform as intended long after we are gone. If we get it wrong, the impacts will not be theoretical, they will be measurable in our waterways, aquifers and coastal ecosystems.

What we do now matters, and it matters for a very long time.

Scott Humberstone
Senior wastewater treatment professional, Australia
Licensed Drainer (Qld) PD27902
Certificate III in Water Industry Operations (NWP30219)

REFERENCES AND SUPPORTING EVIDENCE

[1] Standards Australia and Standards New Zealand. AS NZS 1546.3 2017, On site domestic wastewater treatment units, Part 3, Secondary treatment systems. Standards Australia catalogue.
https://store.standards.org.au/product/as-nzs-1546-3-2017

[2] Levett, K J, Vanderzalm, J L, Alexander, K S, Dillon, P J, et al. CSIRO Water for a Healthy Country National Research Flagship. Holistic solutions to management of on site wastewater treatment systems over a karstic aquifer used for drinking water supplies, Mount Gambier.
Key support for Section 7.1: Table 24, page 41.
https://www.researchgate.net/publication/264805111_Holistic_solutions_to_management_of_on-site_wastewater_treatment_systems_over_a_karstic_aquifer_used_for_drinking_water_supplies_CSIRO_Water_for_a_Healthy_Country_National_Research_Flagship

[3] CSIRO Publications Repository. Search portal for CSIRO publications and reports.
https://publications.csiro.au

[4] Smith, D, et al. (1999). Contamination of Australian groundwater systems with nitrate. Land and Water Resources Research and Development Corporation.
Key support for Section 7.1: page 15.
https://library.dbca.wa.gov.au/Journals/082185/082185-1999.03.pdf

[5] Queensland Government, Department of Environment and Science, Science Division. MEDLI software for effluent reuse schemes.
Key support for Section 7.1: MEDLI development context and purpose.
https://science.qld.gov.au/government/science-division/water-and-coastal/medli

[6] Queensland Building and Construction Commission (QBCC). (2022). On site Sewage Treatment Panel Report.
Key support for Section 8: page 41, Table 2, and paragraph immediately below Table 2.
https://www.qbcc.qld.gov.au/sites/default/files/documents/publication-on-site-sewage-treatment-panel-report.pdf

[7] Environment Protection Authority Victoria. (2024, 22 May). Guideline for onsite wastewater management, Publication 5001.
Key support for Section 8: page 24 (Containment onsite) and page 59 (sand and gravels, low nutrient retention and groundwater risk).
https://www.epa.vic.gov.au/sites/default/files/epa/publications/onsite-wastewater-management-pdf.pdf

[8] NSW Office of Local Government. Environment and health protection guidelines, On site sewage management for single households.
Key support for Section 8: page 4 (cumulative impacts) and page 17 (groundwater protection).
https://www.olg.nsw.gov.au/wp-content/uploads/Onsite-sewage-management-guide.pdf

[9] NSW Health. Domestic wastewater, AWTS, and on site sewage management resources.
https://www.health.nsw.gov.au/environment/domesticwastewater/Pages/default.aspx

[10] The Water Research Foundation. (2019). Water use and efficiency, research brief.
Key support for Section 6: page 3.
https://www.waterrf.org/sites/default/files/file/2020-07/4949-WaterUse-Efficiency.pdf

[11] Australian Government, Department of Health. Guidelines for managing risks in recreational water.
https://www.health.gov.au/resources/publications/guidelines-for-managing-risks-in-recreational-water

[12] ABC News. (2019, 24 October). High E. coli levels recorded at two popular swimming spots along Queensland’s Mary River.

https://www.abc.net.au/news/2019-10-24/water-concerns-at-mary-river-with-high-e-coli-levels/11630432

[13] Queensland Government Publications portal. On site wastewater treatment and nutrient risk publications.
https://www.publications.qld.gov.au

[14] United States Environmental Protection Agency. Septic systems guidance.
https://www.epa.gov/septic

[15] World Health Organization. Guidelines on sanitation and health.
https://www.who.int/publications/i/item/9789241514705

[16] Queensland Government, Department of Environment, Tourism, Science and Innovation. Temporary Emissions Licence TEL100821189, Howard sewage treatment plant to Maria Creek, Notice of decision.
Key support for Howard: page 3 (authorised release point) and page 9 (monitoring table including E. coli, total nitrogen, total phosphorus).
https://storagesolutiondocsprod.blob.core.windows.net/register-documents-tel/TEL100821189.pdf

[17] Queensland Government, Environmental Authority Register. Environmental authority EPPR00815913 issued to Fraser Coast Regional Council, Howard sewage treatment plant.
Key support for Howard: page 9 (authorised release point and monitoring location identification).
https://storagesolutiondocsprod.blob.core.windows.net/register-documents-ea/EPPR00815913.pdf

[18] Fraser Coast Regional Council. Howard sewage treatment plant project page.
Key support for Howard: project scope and what is and is not included.
https://www.frasercoast.qld.gov.au/about-council/projects/major-regional-projects/howard-sewage-treatment-plant