# PRINCIPLE 6: SEQWATER'S CATCHMENT INFORMATION DECISION SUPPORT SYSTEM (CIDSS)

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**Appropriate investment and risk-based decision-making should be followed.**

KEYWORDS

Source water catchments, source water quality, treatment challenge, drinking water safety, Health-Based Targets, decision support system; risk assessment; optimisation; total suspended sediments; pathogens; intervention.

CASE STUDY DETAILS:

**Year:**

Conceptualisation: 2015

Development: 2016 – 2018

Operationalisation: 2019

**Location:**

South East Queensland (Queensland Bulk Water Supply Authority, T/A Seqwater)

**Team:**

Seqwater

Truii (Pty Ltd)

**Citation:**

This Case Study has been based on the following Ozwater20 paper:

Greene, G., Smolders, A., Stewart, M., Thompson, C., March, N. (2020) Planning for Optimised Investment in South East Queensland's Drinking Water Supply Catchments. Ozwater20 (online).

CASE STUDY OUTLINE:

**Key drivers:**

Why did the project occur, and what issues were the project trying to address?

- The Australian Drinking Water Guidelines Framework for the Management of Drinking Water Quality (ADWG) asserts that the most effective and efficient means of assuring drinking water safety is through the adoption of a preventive management approach across the water supply system – from catchment to tap (Principles 1, Principle 2 and Principle 5). Under the ADWG catchment to tap approach, investing in source water protection to minimise loads of pathogenic microorganisms and suspended sediments delivered to water treatment plants (WTP) reduces the likelihood that subsequent treatment steps will be overburdened and drinking water safety compromised (Principle 3). This also reduces water treatment costs. There is a lack of assurance that water treatment systems will work 100% of the time and when those barriers are breached, the potential consequences for communities can be severe, both financially and socially (Principle 4).
- Source water catchments in south east Queensland, which Seqwater relies on to supply drinking water to 3.2 million people, are largely open and support a wide variety of land uses.
- Historically, Seqwater made decisions regarding the location, type and scale of investment to address contaminants arising in source water catchments based primarily on in-house knowledge and experience (that varied from officer to officer) combined with adhoc/unlinked data.
- Financial budgets are finite, and there is an increasing focus on the identification of project outcomes, quantifying return on investment, and determining the most optimal and cost-effective suite of projects to protect source water quality.
- Three overarching needs were identified. Firstly, a structured and systematic method to identify and prioritise locations for investment based on the loads of contaminants they generate (Principle 7) and on

whether concentrations received in raw water pose a risk to drinking water safety in terms of the capability of a WTP to meet the treatment challenge and achieve Health Based Targets. Secondly, a method to identify an optimum portfolio of intervention activities that, if implemented, would provide maximum reduction in source water quality risk at a WTP for a given budget. Thirdly, a system and modelling approach that achieves the first two requirements and can produce outputs that feed into multiple levels of source protection planning.

**Approach taken:**

- The approach taken to develop and ultimately operationalise the Catchment Information Decision Support System (CIDSS) followed a process of: identification of need, conceptualisation of the solution, a formalised needs and options analysis, model/system build, operationalisation of the system and incorporation into business as usual, identification of improvements and developing a formal Investment and Improvement Strategy document.
- Important activities undertaken during conceptualisation and the needs and options analysis stage included meetings with interstate water supply counterparts to learn about their approaches/solutions, literature review/search on relevant modelling approaches, and meetings with the University sector for advice. Key activities undertaken during the build and operationalisation of the system included external peer review of components of the modelling approach, working with a UX designer, engaging with industry colleagues at conferences and workshops, undertaking user testing, and publishing papers on the CIDSS in international peer reviewed Journals.

**Outcomes:**

Summary of outcomes

- Seqwater has a fit-for-purpose decision support system which operates within a geographic information system environment and combines spatial and nonspatial data to assess where contaminants arise, their mobilisation and their relative contribution to changes in water quality within a source water catchment. This information is then compared to treatment capability criteria for individual WTPs to assess the water quality risk posed at each specific plant. A simulated annealing routine is then used to optimise the type and quantity of interventions to be implemented based on the most efficient reduction in risk to drinking water quality from sediment and microbial pollution for the least cost. Seqwater then uses the outputs of the CIDSS to inform its source protection project planning across different time horizons.

Measurable impacts of the activities

- The CIDSS provides the cornerstone for Seqwater’s catchment planning and investment framework, ensuring funding and interventions are allocated effectively. Outputs are used to assist in long-term and portfolio level source protection planning and project definition planning. Importantly, the CIDSS is used as a communications tool internally in Seqwater and with community-based natural resource management groups that deliver source water protection projects on behalf of Seqwater (Principle 8 and Principle 9).

The extent to which the outcomes are sustainable and were achieved in a cost-efficient manner

- The CIDSS itself is a sustainable product because it produces outputs that informs multiples levels of source protection planning across different time scales, and particularly because exhaustive input data sets, specialised modelling expertise, large processing power are not required, the system will remain relevant and useful over the long term. Further, the CIDSS by design applies a cost function to consider the relative risk reduction per dollar performance for various options for on-ground works. This ensures that limited budgets can be applied most efficiently to achieve optimal source protection outcomes. By enabling optimal investment in catchments to address contaminants and improve land condition and water quality to protect drinking water, the CIDSS makes a significant contribution to helping Seqwater achieve a prosperous and sustainable water future.
- The investment decisions informed by the CIDSS outputs result in catchment interventions being delivered largely through multi-year partnership agreements with community-based natural resource management groups and local councils that target lands not owned by Seqwater. In addition to the source water benefits there are multiple co-benefits associated with investing through partnerships. These include supporting

local employment and businesses, improving the health of local waterways, improving the ecological health of catchment land, aligning with Indigenous values (Principle 11), raising community awareness and building trust with the community.

**Lessons learnt and critical success factors.**

Numerous important lessons were learnt during the development and operationalisation of the CIDSS. These include applying a critical appraisal of the modelling products and approaches on the market, providing ample time for user testing and feedback, expecting technical setbacks, and understanding the planning process that the outputs will inform.

Critical success factors have been engagement with subject matter experts to ensure authentic linkages from catchment to tap for drinking water safety, strong alignment with the ADWG Framework and particularly the risk management approach (Principle 1 and Principle 2), as well as user testing and external peer review. The number one critical success factor was a clearly defined and well-articulated need to anchor the project.

**Supporting Figures:**

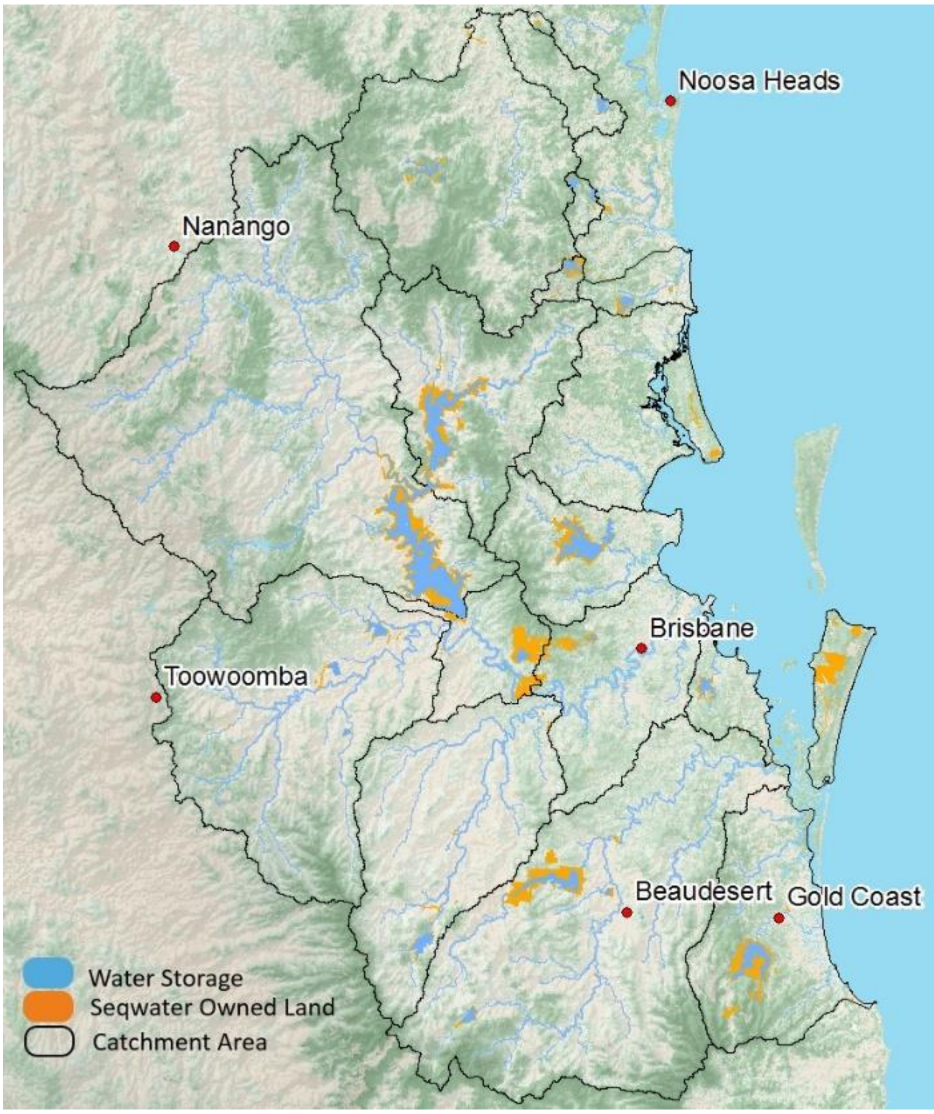


**Figure 1. Seqwater catchment area**

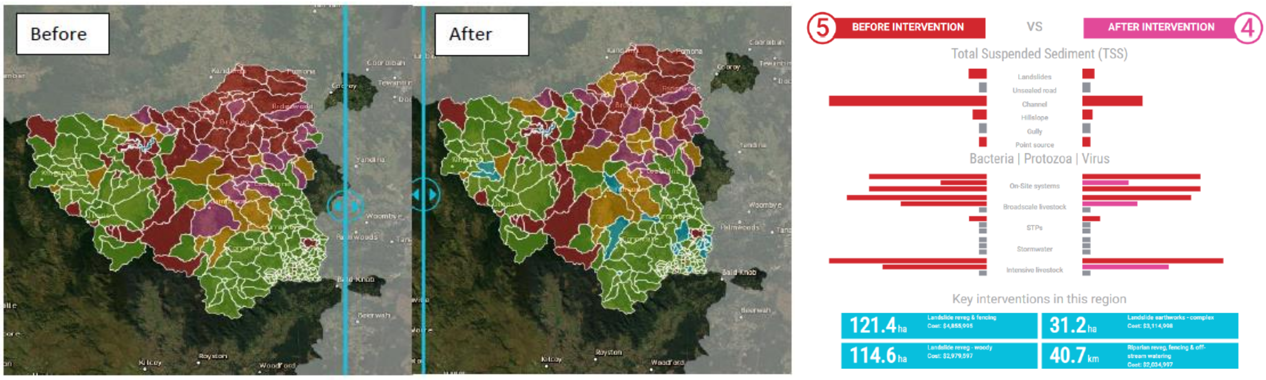


**Figure 2:**
**(Left) Example CIDSS Scenario showing the water quality risk received at a water treatment plant, before and after the proposed investment strategy. Colours relate to the planning unit risk category relative to the water treatment plant.**
**(Right) Example CIDSS Feature Scenario summary showing the overall before and after total suspended solids or pathogen load generated from each hazardous process in the drinking water catchment. The loads are transformed to a risk level relative to the water treatment plant. The quantity and cost of the top four key interventions are also shown.**

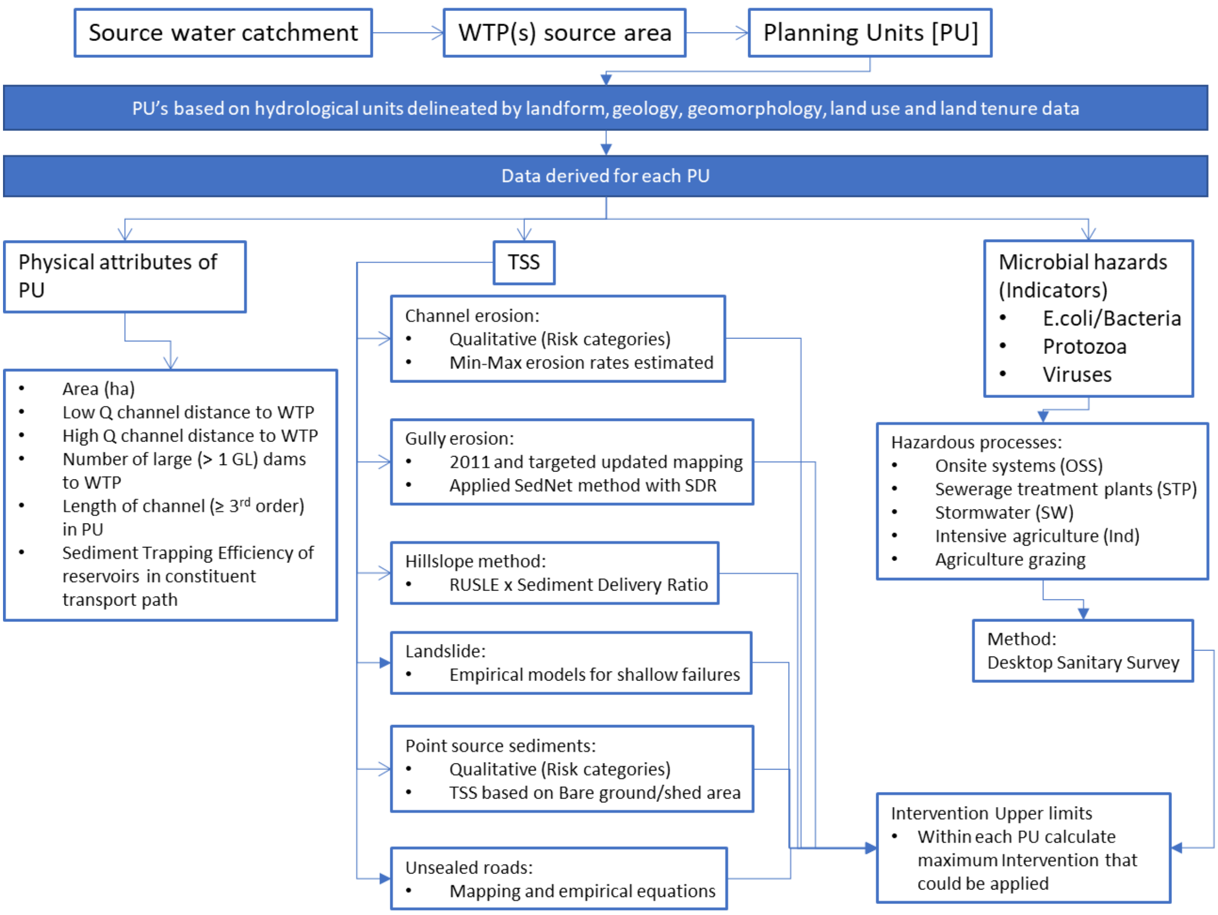


**Figure 3: Overview of CIDSS data inputs and derivation methods**