Structured internal project application 2025-2026

Project Overview

Project name:	Development of QMRA Workflow Engine
Staff:	Reza Moghaddam (Lead Developer - 150 hrs), David Wood (Model Review & Support - 40 hrs)
Project Manager:	Andrew Hughes
Region:	Hamilton
Centre:	FRESHWATER
Type:	Science (Applied Research & Development)
Project objective:	Develop a Python-based QMRA workflow engine to reduce project delivery time by 60-70% and capture greater market share in the expanding regulatory compliance sector.

Project Outline

Quantitative microbial risk assessment (QMRA) represents the gold standard for evidence-based decision-making in water and food safety. With national wastewater performance standards becoming mandatory in August 2025 and approximately 60% of treatment plants requiring consent renewals, there is urgent market demand for efficient QMRA delivery capabilities.

This project will develop a comprehensive Python-based QMRA workflow engine from the ground up. Current QMRA projects require 80-100 hours of manual work: 20 hours building dose-response models, 25 hours on treatment calculations, 15 hours for simulation setup, and 40 hours for reporting. Our workflow engine will reduce this to 20-30 hours through standardised components, automated processes, and reusable modules.

The technical approach leverages Python's full ecosystem including NumPy/SciPy for numerical computations, pandas for data management, and specialized libraries for statistical modelling. This native Python implementation ensures optimal performance, maintainability, and integration with modern data science workflows. The system will incorporate advanced methodologies including Bayesian approaches for parameter uncertainty quantification, validated through recent applications in dairy product safety, respiratory pathogen policy, and wastewater treatment risk assessment.

Recent New Zealand-specific research validates the critical need for localized QMRA approaches, particularly for recreational and drinking water contamination assessment and emerging pathogens. Our workflow engine will position NIWA as the premier provider of regulatory-grade QMRA services in this expanding market.

Expected outcomes: 60-70% reduction in project delivery time, improved competitive win rate from 60% to 80-85%, and strategic positioning for the $25-50M regulatory compliance market opportunity. Investment recovery is projected through 2-3 projects, with $100-200K additional annual revenue from enhanced competitive positioning.

System Architecture

- The QMRA Workflow Engine will be built as a comprehensive Python application featuring automated processing modules and standardized outputs for regulatory compliance. The modular architecture enables:

  • Pathogen Database Module: Standardized dose-response relationships using Python statistical libraries
  • Treatment Assessment Module: Automated log-reduction calculations with NumPy/SciPy
  • Risk Simulation Engine: Monte Carlo analysis with uncertainty quantification using native Python implementations
  • Regulatory Reporting Module: Automated compliance documentation and visualization
  • Data Management Layer: Robust data handling using pandas and modern Python data structures

Commented [AH1]: Is this really the case? Most of the QMRA work seems to be very small projects. How many have been in the vicinity of 80-100 hours?

Commented [AH2]: This is not a big issue here, but one you need to consider when writing ESI reports, proposals etc in the future,, you should use NZ English, not US English.

Commented [AH3]: I think you should avoid hyperbole and sell this proposal on facts

Commented [AH4]: Where did these number come from? They are very optimistic, we need to be realistic when presenting such numbers.

I think you need to:
1) indicate how much QMRA work we are currently obtaining (David you might know this?). ($ value, number of projects).
2) indicate how the proposed tool will bring in more work or improve value?

If our client base or demand for our service does not increase, and we can do QMRA quicker in the future because of this tool, then there is a risk of less $ for ESI.

Commented [AH5]: Avoid tying to explain things in bullet points. A narrative would be more useful.

I'm not sure how this stuff is useful for selling the proposal.

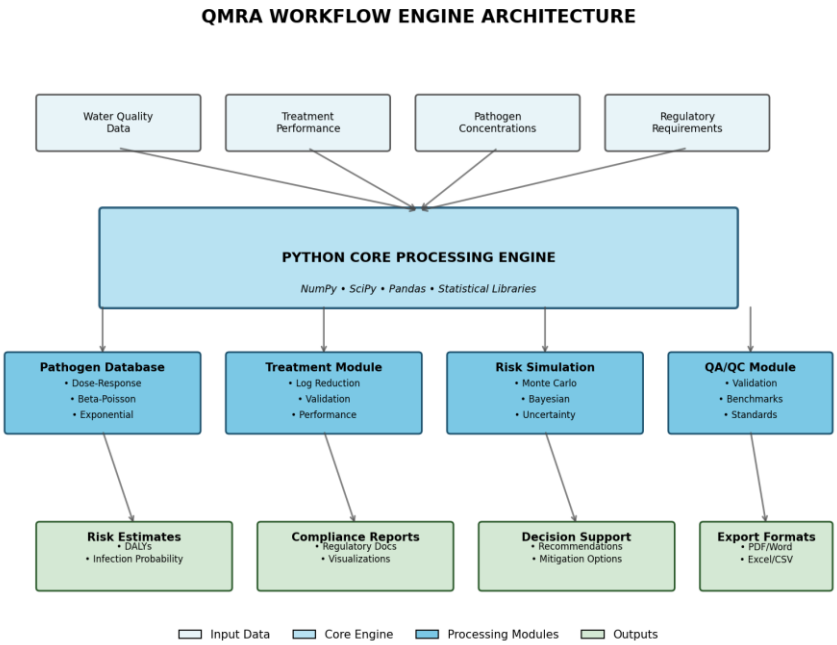

Figure 1: QMRA Workflow Engine Architecture - Non-overlapping modular design ensures efficient data flow and processing

WORK PROGRAMME

Task	Specific Activity	Responsible	Hours
Requirements & Design	System architecture definition, QMRA methodology analysis, stakeholder consultation	Reza	30
Core Development	Pathogen database creation, dose-response model implementation, Python framework development	Reza	60
Advanced Features	Monte Carlo simulation engine, Bayesian uncertainty quantification, statistical modeling	Reza	35
Testing & Validation	Performance testing, regulatory benchmark validation, quality assurance protocols	Reza	25
Model Review & Validation	Technical review of QMRA models, validation of dose-response relationships	David	25
Documentation Review	Review of technical documentation, user guides, and training materials	David	15
Deployment & Transfer	System deployment, staff training, knowledge transfer protocols	Reza/David	10

Total Project Duration: 2 months

Effort Breakdown: Reza Moghaddam - 150 hours (Development Lead), David Wood - 40 hours (Model Review & Support)

Commented [AH6]: These hours look reasonable as far as a SIP goes

EMERGING COLLABORATION OPPORTUNITIES

Recent developments have strengthened the business case for this QMRA workflow engine. PHF has approached NIWA to develop QMRA guidance specifically for shellfish safety assessment. PHF has confirmed their interest through direct communication with Taumata Arowai about collaborating with NIWA on this initiative.

Commented [AH7]: Who is PHF?

This emerging opportunity demonstrates:

- Immediate market validation for our QMRA capabilities
- Direct application potential for the workflow engine in shellfish safety assessment
- Strategic partnership opportunities with regulatory bodies (PHF and Taumata Arowai)
- Enhanced revenue potential beyond initial projections

Commented [AH8]: Narrative rather than bullet points

The shellfish QMRA guidance project would serve as an ideal pilot application for our workflow engine, providing real-world validation while generating immediate revenue. This collaboration would accelerate the development timeline through concurrent testing and refinement with actual regulatory requirements.

Commented [AH9]: Can we charge time to this shellfish project to recover the development costs

Technical Foundation & Risk Assessment

Technical Strengths:

- Pure Python implementation ensures optimal performance and maintainability
- Comprehensive use of mature Python scientific libraries (NumPy, SciPy, pandas)
- Modern software architecture enabling easy extension and customization
- No dependency on external statistical software reducing licensing costs and complexity

Risk Mitigation:

- Technical Risk: LOW - leveraging mature, well-supported Python ecosystem
- Implementation Risk: MINIMAL - single developer approach ensures consistent architecture and design
- Deployment Risk: LOW - modular Python design allows phased rollout and validation

Commented [AH10]: Narrative not bullet points

Research Foundation: Advanced QMRA methodologies including Bayesian hierarchical modeling for parameter uncertainty reduction provide proven approaches for systematic risk assessment. New Zealand-specific pathogen research validates the critical need for localized analytical tools.

Strategic Alignment

This project directly supports NIWA's Impact Strategy through:

- Competitive Positioning: Establishing NIWA as the market leader in regulatory compliance QMRA services
- Regulatory Engagement: Enhanced capability to support national wastewater performance standards
- Technical Innovation: Modern Python-based solution providing superior performance and maintainability
- Revenue Growth: Capturing disproportionate market share in the expanding regulatory compliance sector

Commented [AH11]: My concern here is that we are developing a tool but that does not mean we will become a market leader. Some effort is required to sell it so clients know about it

The workflow engine represents a strategic investment in NIWA's long-term competitive position, transforming current operational inefficiencies into market-leading capabilities that directly support regulatory compliance objectives across New Zealand.

CHIEF SCIENTIST SUPPORT

Chief Scientist comment: (For example - If agreement that project required, indicate why SIP mechanism versus Centre Funds; What is/are the key output(s) and how will NIWA/National Centre/programme/individual benefit from that; note that there must be an output at the end of the project)

Signature