



# APF Project Web Summary

**Project Title:** Marine Management Model

**Grantee:** Waikato Regional Council

**Grant Number:** 12-03

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## Summary

To assist with the integrated management of the east coast of its region, Waikato Regional Council is developing a Marine Management Model for the Hauraki Gulf. The basis of the model is a three dimensional numerical hydrodynamic model. The first application of the Marine Management Model is an aquaculture effects model, which, in conjunction with the deployment of permanent monitoring instrumentation, will be able to predict the fate of farm waste and nitrogen discharge from fish farms. It will pave the way for environmentally sustainable economic development of aquaculture and other activities in the Hauraki Gulf, as well as supporting cost-effective consent monitoring and future plan development. The data and model will be made freely available to the public, for example the aquaculture industry and environmental interest groups. The project is due to be completed in mid 2014.

## The Opportunity

Waikato Regional Council is developing a Marine Management Model for the Hauraki Gulf as a resource management tool to achieve environmentally sustainable economic development of aquaculture and other activities. The model will be able to predict the fate of farm waste (farm footprints), nitrogen discharge from fish farms and disease risks. It will be able to identify areas where marine farming and other coastal activities may be in conflict and thus support marine spatial planning, including the selection of new sites for marine farms. The quality of model predictions is highly dependent on the amount and quality of data used for model validation. For this reason, the deployment of permanent instrumentation to record relevant water quality data is a key component of this project. The model will assist with the Hauraki Gulf Marine Spatial Plan by aiding identification of new areas for aquaculture. Being able to simulate environmental effects of marine farms will also support cost-effective consent monitoring by providing information on the level of effects and support logistical decision-making, e.g. the selection of effectual sampling sites.



## Intended Outcomes

### **Contribution to the Government's strategic goals and objectives for aquaculture**

This project contributes to and supports the Government's Aquaculture Strategy and goal of \$1 billion annual sales by providing relevant information and a decision-support tool to ensure environmental sustainability of aquaculture growth and diversification.

By making the model freely available to the public, this project also supports the partnership between industry and government, communities, iwi, regions, and research / education / training providers emphasised in the guiding principles of the Aquaculture Strategy. If all stakeholders use the same tool to support their decision-making, the risk of conflicting information, often leading to conflict and expensive planning and consenting processes, is minimised.

### **Economic benefits**

The project has a number of economic benefits, including:

1. An improved understanding of the Firth of Thames and Hauraki Gulf ecosystem allows council to make bolder decisions regarding the use and development of the marine area as it is council's policy to take a precautionary approach in the absence of good information.
2. By supporting the selection of new marine farming space and improving the assessment (and thus optimal utilisation) of the assimilative capacity of existing and proposed space, this project provides economic benefits to marine farmers (through increased production) and council (through efficient selection and allocation of space).
3. By improving our understanding of environmental effects from marine farms, this project leads to more effective consent conditions and environmental monitoring requirements, resulting in cost-effectiveness of monitoring for marine farmers.
4. As the Marine Management Model will be freely available it creates economic benefits for stakeholders who require or benefit from modelling environmental effects of aquaculture (e.g. marine farmers applying for resource consents) as they would otherwise have to pay for models.

### **Achieving good environmental outcomes**

Having access to a well verified Marine Management Model based on robust science and high quality data provides valuable information on the interactions of marine farming activities and the environment. This information is particularly important in relation to finfish farming in the Waikato region due to the lack of experience in the management of this activity. In the absence of a reliable predictive tool (like the Marine Management Model) such information would not be available until after finfish farms were established.

Being able to make predictions on environmental effects of finfish farms using the Marine Management Model will promote aquaculture in the Waikato region by improving our understanding of environmental effects, leading to:

- more confidence in the establishment of environmental monitoring conditions, thus improving sustainability of marine farming and cost-effectiveness of environmental monitoring by consent holders; and
- easier identification of additional areas suitable for aquaculture.

This model does not reproduce existing models. The Marine Management Model is a freely available management model, simulating aquaculture environmental effects from a resource management perspective. Existing models are scientific models. They can be applied to



resource management situations but are not designed to be used by regional councils or other stakeholders to support their decision making.

## Methods

Most decision making and management issues in the coastal marine area are underpinned by reliable information on water flow speed and direction, mixing zones and general circulation pattern. For this reason, the basis of the Marine Management Model is a three-dimensional (3D) numerical hydrodynamic model.

Cawthron Institute and MetOcean Solutions Ltd have been contracted to carry out the development and validation of the Marine Management Model. The model code that is being used for the hydrodynamic model is the 3D baroclinic model SELFE (<http://www.stccmop.org/CORIE/modeling/selfe/>). SELFE is an open-source community-supported modelling system, based on unstructured grids, designed for the effective simulation of 3D baroclinic circulation across river-to-ocean scales. The unstructured grid allows water properties (e.g. currents) to be resolved at high resolution (down to ~20 metres) in shallow water and at specific sites of interest. The model domain includes the whole Hauraki Gulf Marine Park area but validation within this project will focus on the Waikato region from the southern Firth of Thames to the top of the Coromandel Peninsula. Future model development will extend this area. The model has been calibrated and validated using data collected through a carefully designed data collection programme in the early stages of this project.

The Marine Management Model will be supported by permanent instrumentation to record relevant water quality data. Waikato Regional Council will deploy a coastal water quality monitoring buoy in the northern Firth of Thames in summer 2013/14. The buoy will collect continuous time-series data (current speed and direction, water temperature, salinity, turbidity, dissolved oxygen, chlorophyll-a and weather data) and transmit data into the council's data network in real time. Data will be made available to the public via the council website.

The aquaculture effects model is integrated into the hydrodynamic model. It simulates the deposition of mussel and finfish farm waste on the seafloor (farm footprints), the dispersal of parasites, diseases, dissolved nitrogen and therapeutants released at the farm sites. The dispersal of nutrients, therapeutants, parasites and diseases from marine farms will be simulated through a combination of tracers released during SELFE model runs and post processed particle tracking techniques where appropriate. The deposition of farm waste will be modelled by using the particle tracking software DEPOMOD (<http://www.ecasatoolbox.org.uk/>).

Waikato Regional Council will make the Marine Management Model and data collected as part of this project freely available to the public.