### Resource assessment using GIS modelling of orogenic gold mineralisation and wind energy potential in Wellington, New Zealand.

#### Introduction

We have used GIS spatial modelling over the Wellington area to find ideal locations for orogenic gold exploration and wind farm development. This was done to find potential exploration targets, assess the most suitable use for the land and to illustrate how predictive modelling in a GIS can be used to assist with land management.

#### Wellington Goldfields & Orogenic Gold

The southwest region of Wellington encompassing the Terawhiti, Makara and Karori mineral fields has undergone mining for gold since the 1850s. This included an initial phase of alluvial mining followed by mining of quartz reefs in the 1880s with some renewed exploration in the 1980s. There is currently no exploration for gold in this region and there are only a few small historic adits visible in the hillsides along with remnants of historic tramways and battery equipment from 100 years ago.

An orogenic deposit model is proposed for the concentration of gold in the Wellington region. The metamorphism and deformation of the basement terrane to greenschist facies produced fluid which transported and concentrated gold from within the sedimentary pile into structural traps. Wellington is similar to other Mesozoic orogenic gold terranes such as Marlborough and Otago. Schistose rocks in these terranes are one of the key lithological targets for gold exploration in New Zealand and host deposits such as Macias Flat in Otago.

The mineral systems concept was used to define the parts of the deposit model which are critical for ore-forming processes. We have generated predictive maps of the most potential places in the region, structures that could be used for fluid migration and ideally suited to host a mineral deposit, and outflow zones which may indicate a subsurface deposit.

#### Wellington Wind Energy

Wellington has a world class wind resource making it an important region for wind energy. With the recent opening of Meridians Project West Wind the area is already contributing to New Zealand's goal of 16% renewable energy by 2020.

Our three stage wind prospecting approach:
- determines the wind resource available at a site,
- analyses the terrain to find the best turbine positions, and
- assesses site suitability based on infrastructure and environment.

We use wind speed and direction data from mesoscale wind modelling developed by Aurecon using three-dimensional models simulating airflow over complex terrain. In our model we classify the wind speed into ranges suitable for modern wind turbines and use the wind direction data in our terrain analysis.

#### Model Results & Land Management

We have found targets for orogenic gold and wind energy throughout Wellington. The models have located historic mines and current mines validating our modelling technique. The highest potential for orogenic gold is the Terawhiti Hill area west of the Terawhiti Fault. This area contains archaeological heritage sites, several native coastal plant species and seabird nesting sites, and is visible from the coastline considered to hold high scenic value in Wellington. These considerations, along with the small target size and limited prospectivity west of Terawhiti, significantly reduce the potential for economic gold deposits in the region.

The wind energy model has found several ridgelines and open hilltop regions suitable for turbine placement. Although the region has one operating wind farm and others in planning stages, there is excellent potential for further development over areas identified by the model. Only a few model targets fall within the environmentally sensitive area over Terawhiti Hill leaving many suitable targets remaining throughout the region. Most of these are over farmland; are away from metropolitan areas where noise and visual pollution is minimised; are in proximity to major transmission lines; and are near tracks and roadways for easy access.

Our modelling clearly shows that wind energy is currently the most suitable land based resource for the Wellington region. Modelling studies such as these could be applied in other regions for wind, gold, or other resources, to evaluate economic potential. The modelling could help regional planners and explorers assess future developments and manage their assets more effectively.