KAIMAI WIND FARM

Kaimai Wind Farm

Zone Of Visual Influence Methodology

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1. Zone of Visual Influence Software and Major Inputs

The Zone of Visual Influence (ZVI) for the proposed Kaimai Wind Farm was formulated using the software package “WindFarm” (Release 4.1.2.2). WindFarm is written by ReSoft, a specialist wind farm software development company (http://www.resoft.co.uk/English/).

WindFarm is an integrated software package, which combines the ability to produce turbine site layouts, assess turbine energy yields, and also has the ability to analyse various turbine layouts for both noise emissions and visual impacts.

To accurately position turbine layouts and locations, topographical contour information is required.

This data has been obtained through a variety of sources. The LINZ Data Service was used to provide background raster maps. Data for the wider area was obtained from raster files produced by the Shuttle Radar Topographical Mission (SRTM), this information is downloaded from the US Geological Services web site. The processed files are 1 arc-second in resolution. In addition high resolution data was provided of the proposed wind farm site by synergy position systems, the supplied raster data was sampled at a 1m resolution for use in WindFarm. In conjunction a surveyed layout of the proposed turbine location was also entered as a major input parameter.

WindFarm uses the contour and layout information for a number of turbine energy yield calculations, and of particular importance, to perform the ZVI calculations and create the wireframe image for Photomontage formation if required.

2. ZVI Calculation

The ZVI module of WindFarm creates maps of the zone-of-visual-influence of a wind farm, and the cumulative visual impacts of a number of wind farms should there be more than one wind farm in the immediate area under study.

There are a number of different ways of counting visibility. The most common way is to count the number of turbines visible from certain points within a specified radius of the wind farm, with the point of visibility being the blade tip, nacelle, or a point on the tower. The blade points were counted in the case of the Kaimai Wind Farm analysis, being the most conservative option.

In addition a visibility count can be made which sums each blade tip, nacelle, and a point on the tower that can be seen. Therefore if a whole turbine can be seen, the count for that turbine would be 3. The maximum count for a wind farm using this method is 3 times the number of turbines if no weighting is used for any particular component. This method does however have the disadvantage that a count of 6 could be either 6 blade tips or 2 whole turbines, which are visually very different.

The ZVI calculations use the input contour files, and the selected turbine dimensions to calculate where, and how many turbines can be seen from any particular vantage point. The accuracy of the ZVI calculation is dependent on the resolution of the contour data. With only 10m contour data available for the wider area, the results will not be as accurate as using 2m contour data for the entire ZVI calculation area for example.

Various options are available to the software operator when conducting the ZVI analysis. Important operator variables are:

- Topographical data
- Centre point of calculation area (usually notional wind farm centre)
- Calculation area
- Calculation shape (circular or square)
- Counting methodology (nacelle, blade, tower, or all components)
- Observer height relative to ground level
- Resolution of each visibility point
- Atmospheric refraction
- Earths curvature

- Inclusion of features which obscure visibility

It should be recognised that only the topography is normally used in a ZVI calculation (sometimes called a “bald earth” ZVI), ignoring the effects of trees, buildings or other structures, and therefore representing the theoretical maximum visibility of turbines that may be seen from a given point. However; WindFarm permits the specification of exclusion zones where features other than the landscape obscure the wind farm. For example, a forest area may be defined and given a nominal height of 20m. The turbines' visibility is automatically set to zero inside the exclusion zone and in addition the wind farm visibility will be modified at the edges of the forest because of its height. No exclusion zones have currently been entered into the ZVI analysis, however; shelter belts, exotic forests, bush, and other structures in the immediate vicinity of the proposed wind farm could be defined as exclusion zones, thus reducing overall visibility.

The graphical output of the ZVI analysis is a shaded circular or square region (depending on the calculation shape selection), with various colours identifying the number of visible turbine points from a particular vantage point. The output then has a topographical map of the area overlaid to give spatial context to the viewer.

The following screenshots illustrate the graphical ZVI output:

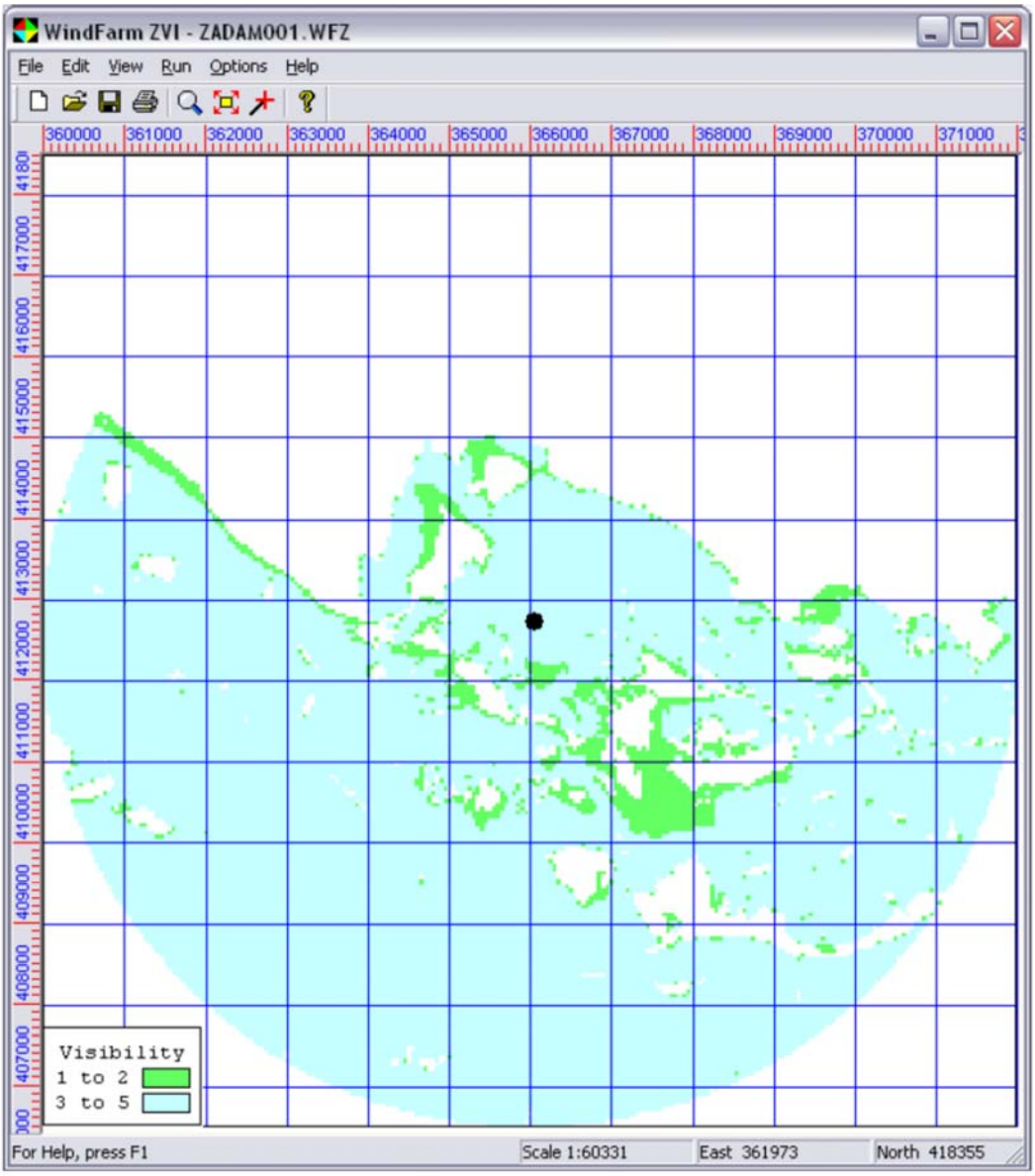

Figure 1 - ZVI Output

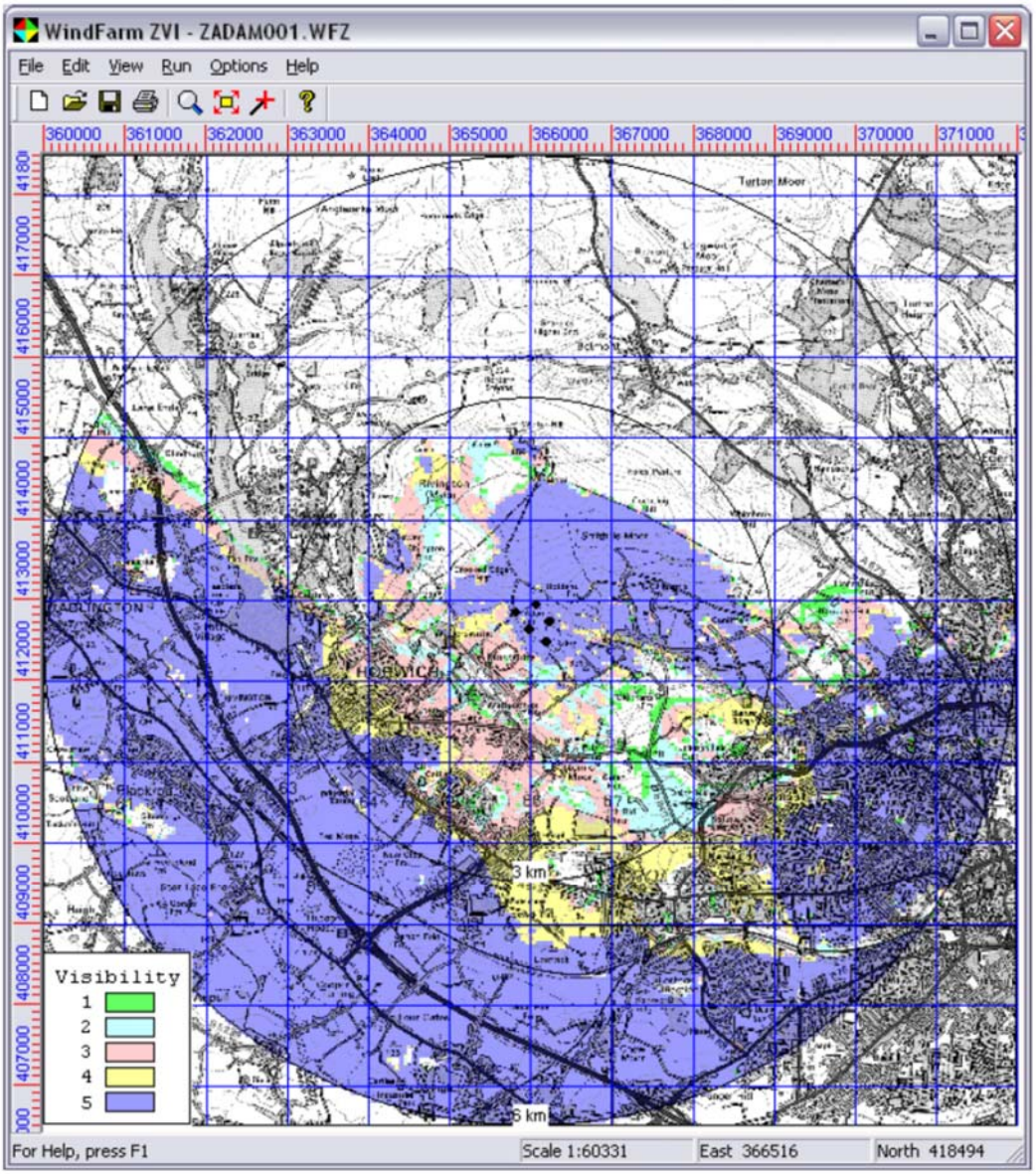

Figure 2 - ZVI output overlaying topographical map

Run Data and Statistics are available from each calculation run, and describe critical parameters of the run data, and also a list of visibility statistics. The number of visibility points, percentage of total points, and area is given for each of the groups. The information can be printed or exported as required.

3. Variances in Methodology to NZILA BPG 10.2

In August 2008 the New Zealand Institute of Landscape Architects hosted a Landscape Planning Initiative, from which arose a directive that a series of Best Practice Guide (BPG) documents be prepared. The Technical Guide for Photomontage Simulations was the first of such documents to be published, and as such, has relevance to the formation of the ZVI analysis and the photomontages for the proposed Kaimai Wind Farm.

The analysis does accurately follow the general principals set out in the NZILA BPG, namely:

- The analysis is as accurate as possible with the provided data, in order to assist in making well informed judgments.
- The analysis by WindFarm is based on a structured and replicable procedure so that others may test and confirm the accuracy, and credibility of the simulations.
- The analysis is carried out by specialist wind farm software, and therefore uses techniques that represent the project in its true environmental context, and in a fair and reasonable manner.
- The presentation provides a clear representation, and conveys important information in regards to the analysis for each ZVI analysis.