Wind Energy Coursework

Your firm of technical experts is asked to produce an initial assessment of a given location for development of a wind farm, and to produce preliminary design choices for type, number and layout of wind turbines within the farm. Your assessment should include technical and economic assessments of the site.

Part A: Resource assessment

For the purpose of this exercise, the locations are coincident with Met Office weather stations and you will be provided with one year's worth of wind data. The data will comprise hourly average wind speed (in knots) and direction based which was derived from continuous sampling at a sampling rate of once per minute. You should expect some missing or outlier data within the set. You should choose a suitable site within 15 km of the specified weather station location. The resource assessment should include at least:

- A Weibull distribution fit to the wind speed data
- A wind rose
- The choice of suitable site
- The load factor of the turbines/farm
- The choice of type of turbine (chosen from commercially available turbines)
- The choice of number and layout of turbines
- The expected average annual energy output

Part B: Economic assessment

The economic assessment should produce an estimate of the levelised cost of energy (LCOE) for your wind farm, expressed in p/kWh. You may add other economic indicators such as payback period or net present value if you find that useful. To calculate the LCOE, in addition to the technical data, you will also need to:

- Estimate the capital cost of the wind farm. This should be a complete breakdown and at the very least comprise the cost of the wind turbines, the support structure, the foundations and internal cable connections, and electrical connections.
- Estimate the operation and maintenance costs.
- Assume a discount rate of 8% and an economic lifetime of 20 years.

Finally consider how the economic performance of your wind farm can be optimised with respect to your choice of turbine and hub height, and number of turbines. What might prevent you from building a farm with these optimised parameters? What happens at the end of 20 year life time?

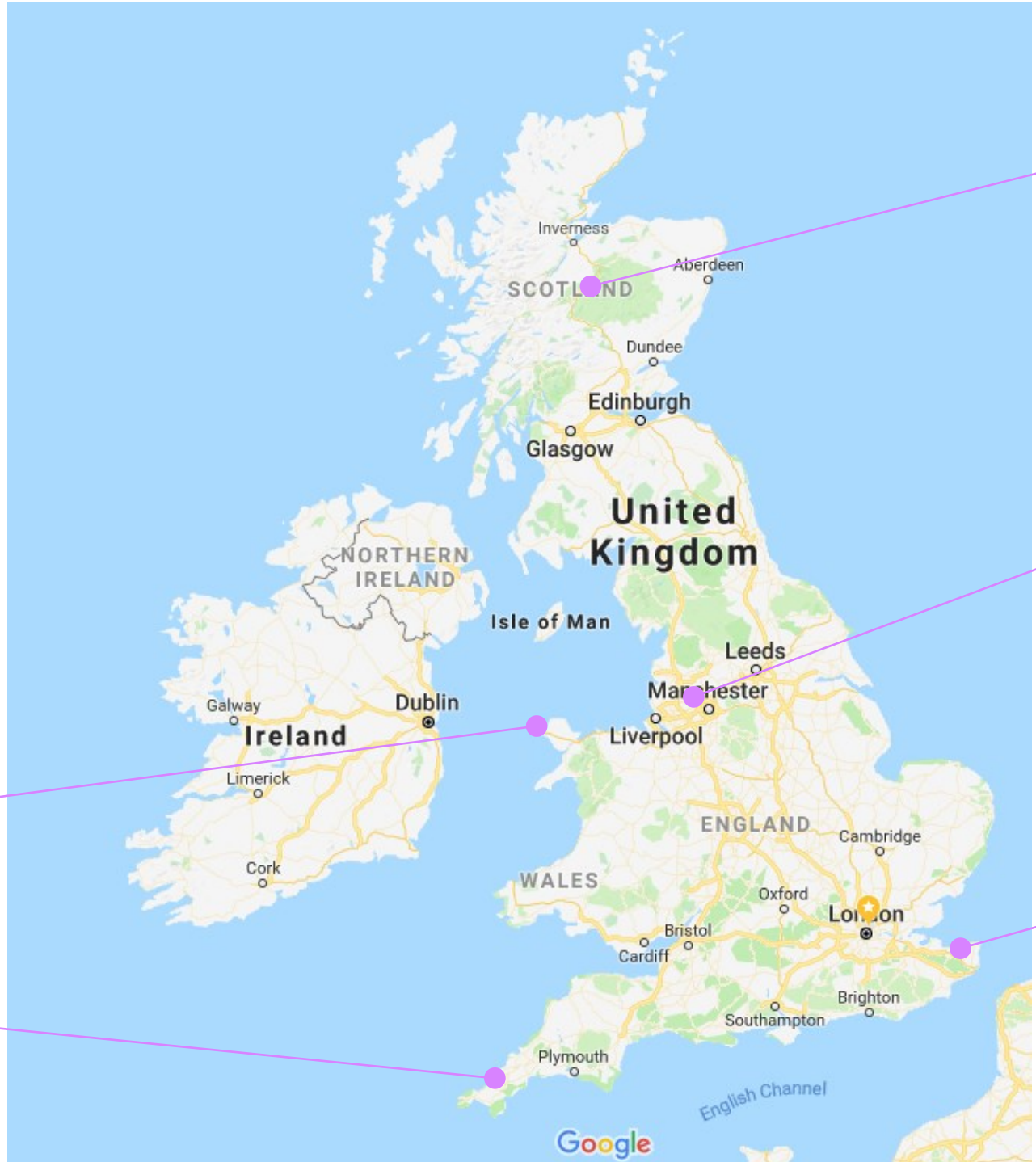
Submission

The exercise will be completed in groups and each group will submit a single report. The deadline is **Friday 8th December 2023**.

The report should comprise two separate sections for Part A and Part B and an overall conclusion. Make sure you include clear and concise comparisons of various options considered in terms of site selections, turbines, layout etc. and the impact of these choices on LCOE.

The word limit for the report is 5,000 (excluding references and appendices). You can use appendices for any additional relevant information to support the main sections A & B (use separate appendices for these).

Mark allocation is 60% for technical assessment, 30% for economic assessment and 10% for presentation and referencing.


Aviemore
Winter Hill
Valley
Manston
Camborne
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Aberdeen
SCOTLAND
Dundee
Edinburgh
Glasgow
United Kingdom
NORTHERN IRELAND
Isle of Man
Leeds
Manchester
Liverpool
Galway
Dublin
Ireland
Limerick
Cork
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Oxford
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Bristol
Cardiff
Brighton
Southampton
Plymouth
English Channel
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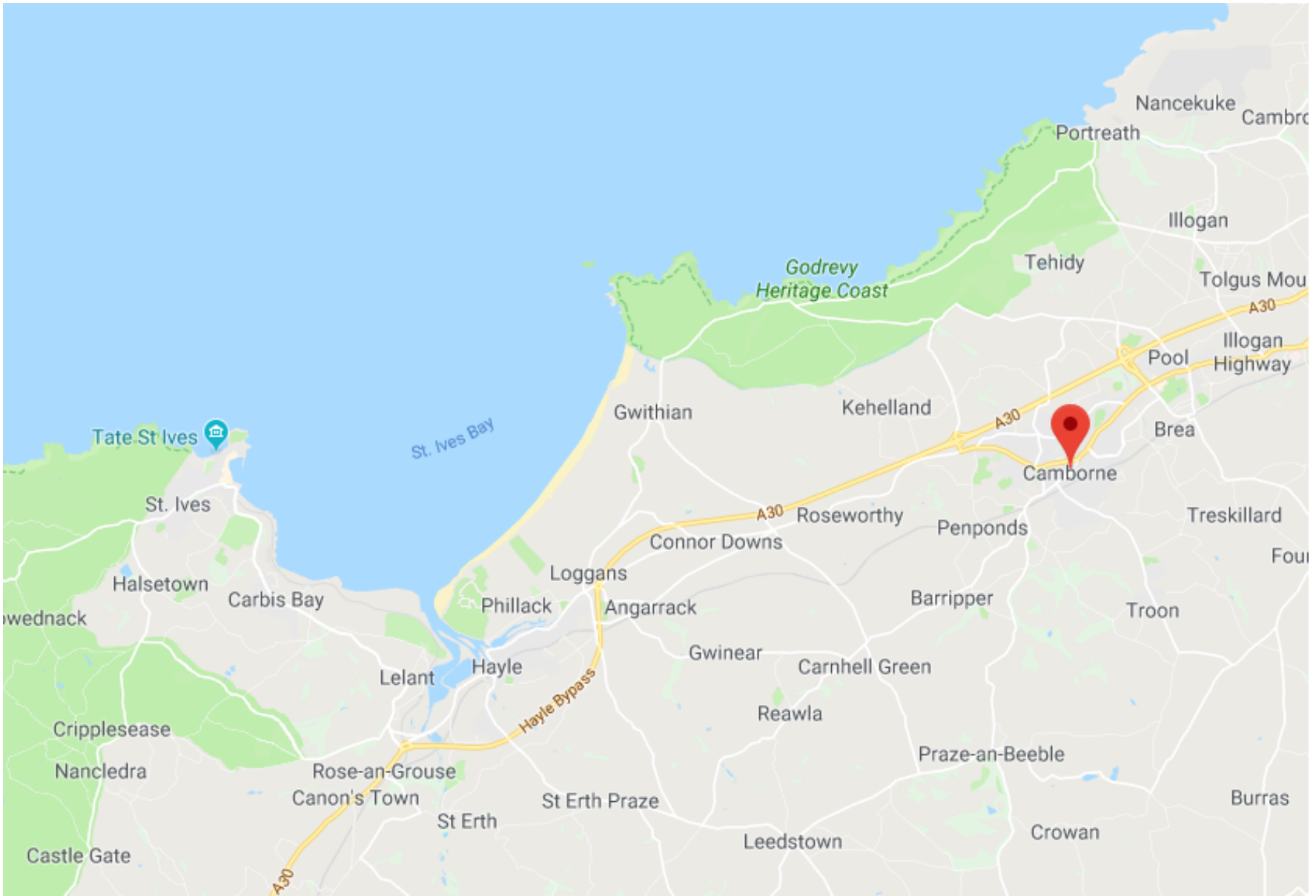
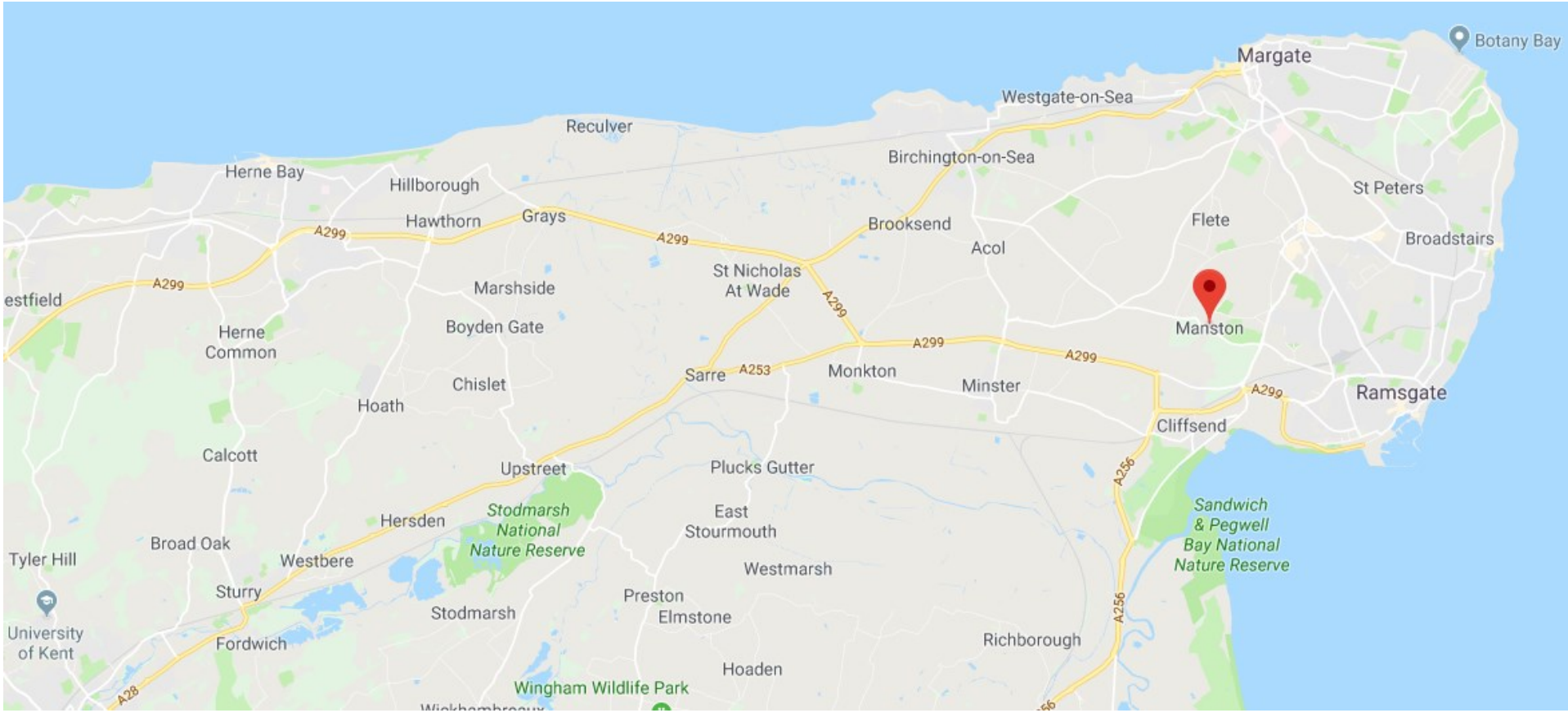
Camborne (Cornwall)



Manston (Kent)



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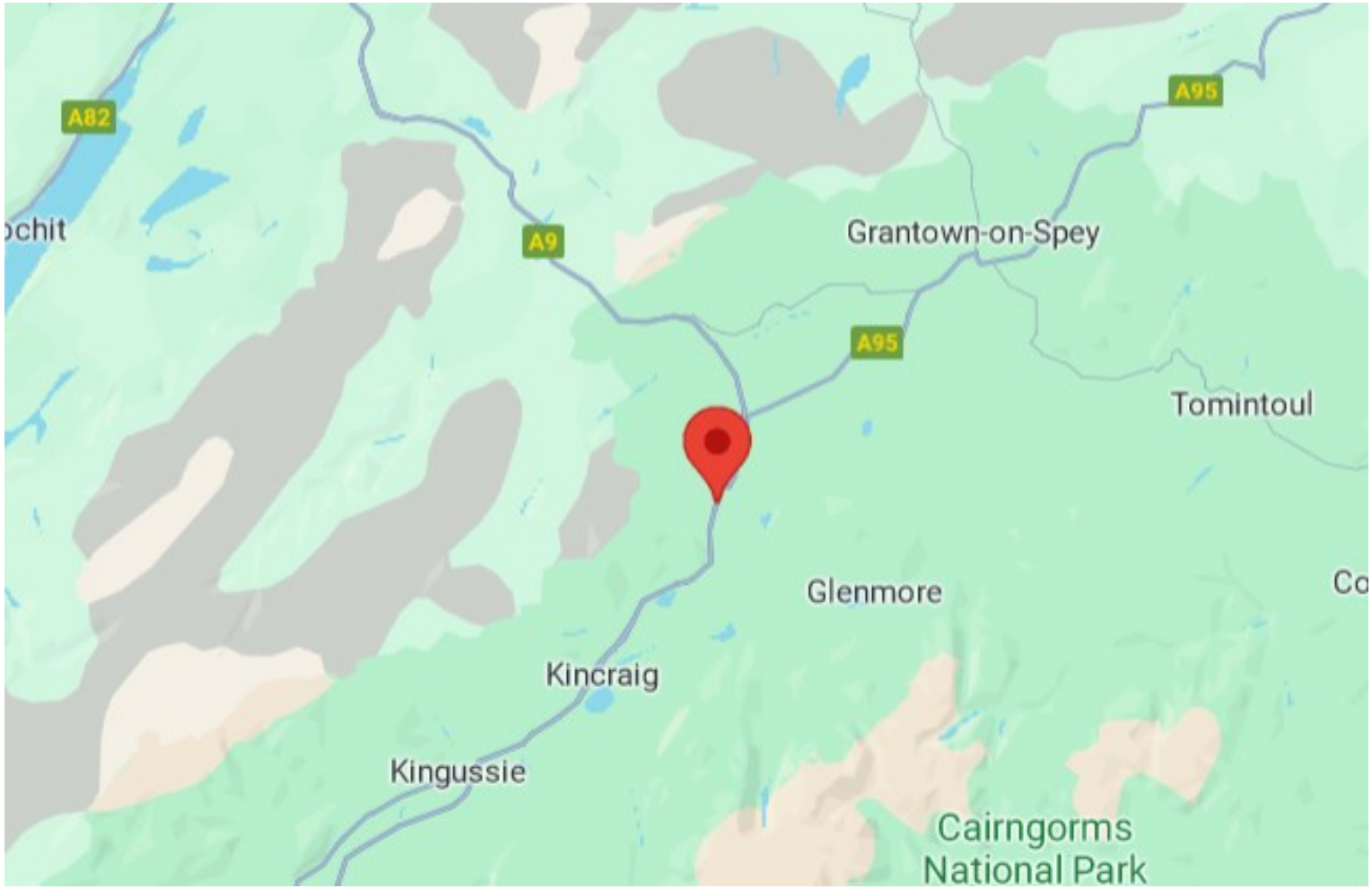
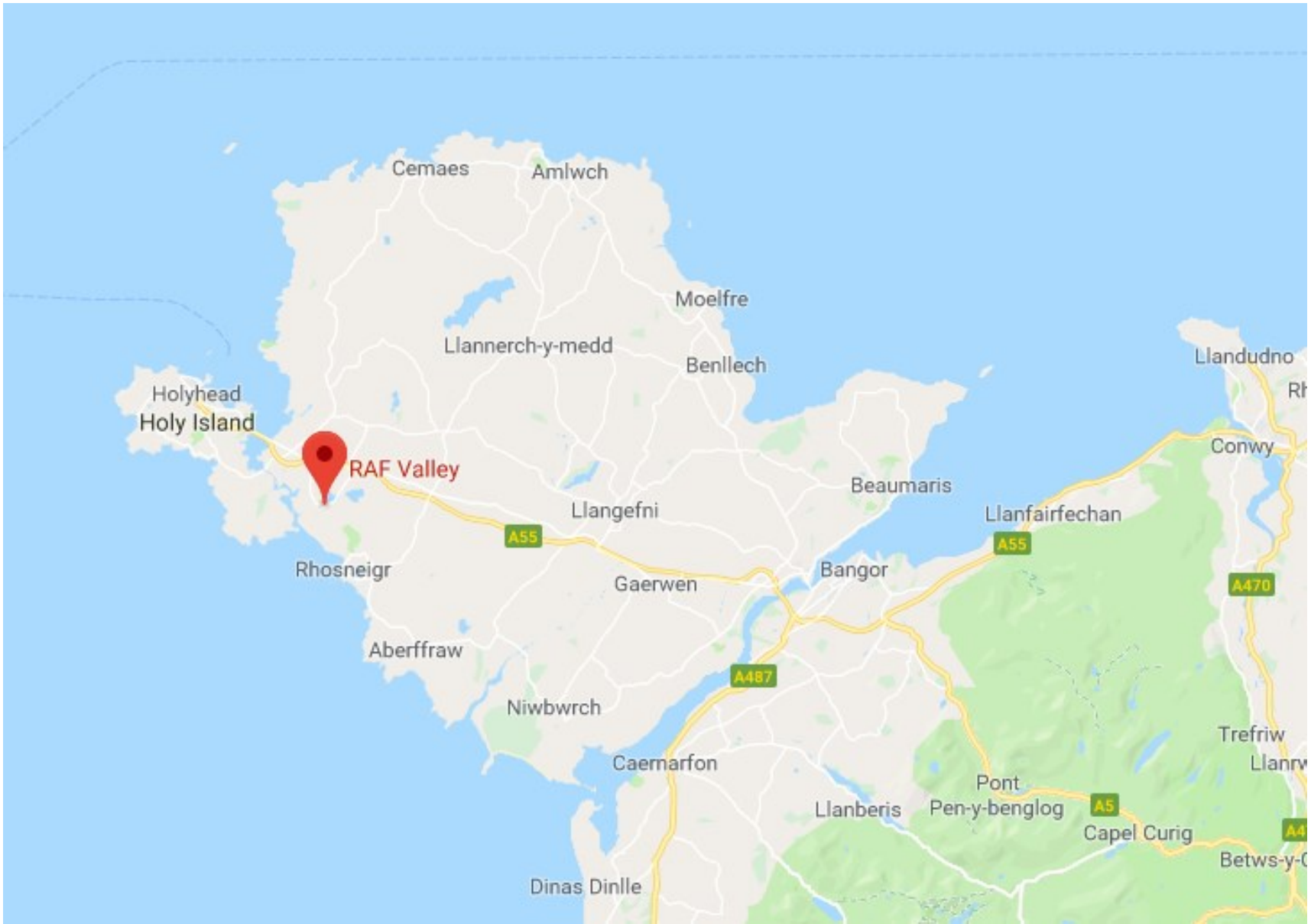


Valley (Anglesey / Ynys Môns)



Winter Hill (Lancashire)