The wind resource in the Western Cape has been determined in three broad categories from the renewable energy resource database (DME, CSIR,Eskom 2004). The categories considered were

- high capacity factor sites with mean annual wind speeds at or in excess of 8m.s^{-1} at 70m (4% of the land area covered the renewable energy resource database);
- medium capacity factor at sites below this level but above 6.0 m.s^{-1} at 70m (23%)
- sites which would yield low capacity factor electricity generation with wind speeds below 6.0 m.s^{-1} at 70m (73%) as summarised in Table 10 below.

Table 10 Western Cape wind resource category areas

	Provincial land Area (km^2)	Provincial land coverage (%)
Low CF	62250	73
Medium CF	19452	23
High CF	3820	4

A second stage analysis looked within the above areas to find regions that were within 3km of existing secondary road network and within 15km of suitable existing distribution nodes (66kV – 400kv) were determined[4]. This yielded:

- approximately 1 000 km2 (a first order conservative installed capacity of 1 000 MW[5]) within 3km of the existing secondary road but beyond 1km of that road network and within 15km of suitable distribution infrastructure with a high capacity factor (in the 35% class) and
- approximately 2 200 km^2 in the medium capacity factor (24 – 31%) category[6] in the same infrastructure criteria set.

This is for the area covered by the renewable energy resource database representing 66% of the provincial area. Assuming that they are representative of the province this yields 1 480 km^2 and 3 320 km^2 in the above categories respectively.

In 2003 the Provincial Government of the Western Cape, Department of Environmental Affairs and Development Planning, embarked on a programme to pave the way for wind energy as a viable, clean, renewable energy development within the Province. A specialist assessment of regional wind energy site selection methodologies undertaken by DEA&DP

[4] The intuitive mismatch between windy rugged, elevated terrain and gently sloping, lower lying land used for transport and distribution infrastructure is apparent from the results.

[5] A note on turbine density. Turbine densities are a function of the terrain, individual turbine capacity and their spacing and tiling of the area in question. A general rule of thumb is that turbines should not be within 3 rotor diameters of one another to avoid downstream interference. For 100m rotor diameters this equates to 5 to 8 turbines per square Kilometers. With individual turbine capacities steadily increasing turbine densities could readily be in the 10 to 25 MW/Km^2 range. This implies a long run installed capacity of 10 to 25 times that outlined above. In the long run the trend witnessed elsewhere of replacing smaller turbines with higher capacity devices on limited available land as technologies improve would also be applicable in this regard.

[6] For comparative purposes, Denmark, with a total land area of only 16 000 km^2 already has approximately 7 000 turbines which account for 18 percent of its installed electricity generation capacity and currently generates 5.9 TWh of electricity annually. The average wind resource upon which that development was based is at the lower limit of the medium capacity factor category. Certain Danish provinces already produce as much as 40 percent of their regional supply from wind resources.

entitled *Strategic initiative to introduce commercial land-based wind energy developments to the Cape West Coast*. The study considered 2 methodologies for the selection of suitable onshore sites for wind development in a study area bounded by the Atlantic Ocean in the west, the N7 in the east, the urban edge of the Cape Metropole in the south, and to the North the Berg River. A composite of the land availability in positive, negotiable and negative areas for wind farms is shown in Figure 14 below.

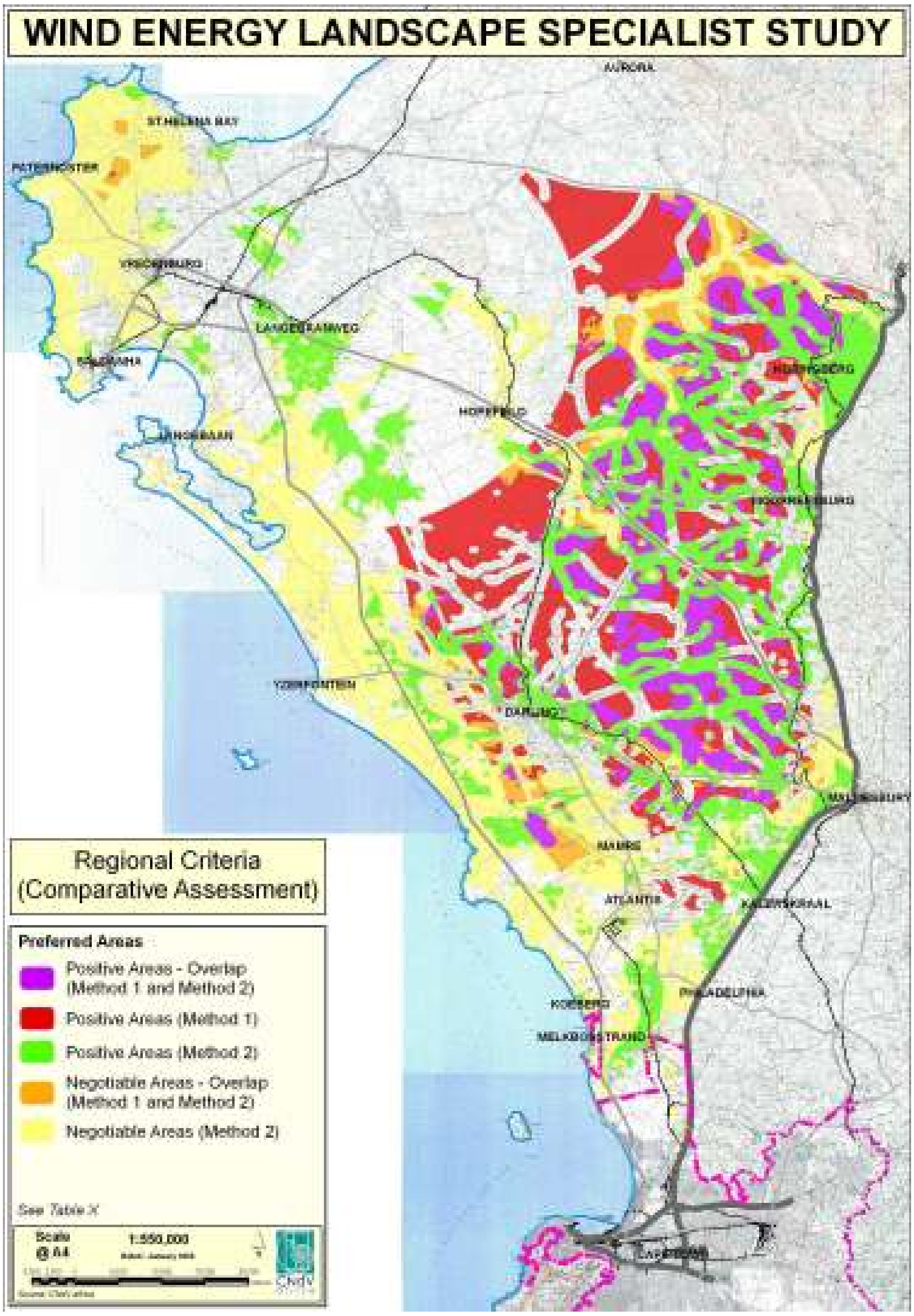

Figure 14 Land availability composite from draft wind site selection criteria (West coast)

Almost all (5 260 km^2) of the 5 340 km^2 in the study area is covered by the renewable energy resource database. 2 170 Km^2 are in high CF resource category and 1 630 km^2 are in the medium CF area. Applying the road and electrical infrastructure proximity criteria to this indicates that 1 070 km^2 are in the high CF infrastructure compatible area and 490 km^2 are in the medium CF infrastructure compatible area.

Overlay of the landscape assessment criteria in the study area, shown in Figure 15 below indicates 525 km^2 (49% of the infrastructure compatible area) of high CF, transport and electrical infrastructure compatible area to lie in positive and negotiable areas. 190km2 lies in positive areas for development of the 1070 km2 (18%) in the study area which would have sufficient wind resources and require limited additional investment in road and electrical distribution infrastructure. Similarly, of the 488 km2 in medium CF class areas within range of existing networks required, 356 km2 are in positive and negotiable areas (73% of the infrastructure compatible area). 177 km2 are in positive areas or 36% of the promising wind development areas in the timeframe of the target.

Of the 1 480 km^2 in the high capacity factor infrastructure compatible area 1070 km^2 is in the study area. Assuming for the present that similar criteria would be applicable in the rest of the province the total for the province in this category would be 726 km^2 (49% of 1 480 km^2). Similarly 2 420 km^2 (73% of 3 320 km^2) lies in the medium capacity factor infrastructure compatible area provincially. Based conservatively on a turbine capacity density of 1MW per km^2 this implies a maximum installed wind capacity onshore of 700 MW and 2 400 MW in the high and medium capacity factor resource categories respectively. As stated previously, the turbine capacities and therefore the total installed capacities could be increased to 10 to 25 times these numbers.

It is worth noting that the low wind capacity factor infrastructure compatible area has been excluded from the above considerations. This category represents slightly more than 80% or 18 900 km^2 of the land within reach of suitable infrastructure criteria suitable for grid-connected renewable energy transformation.

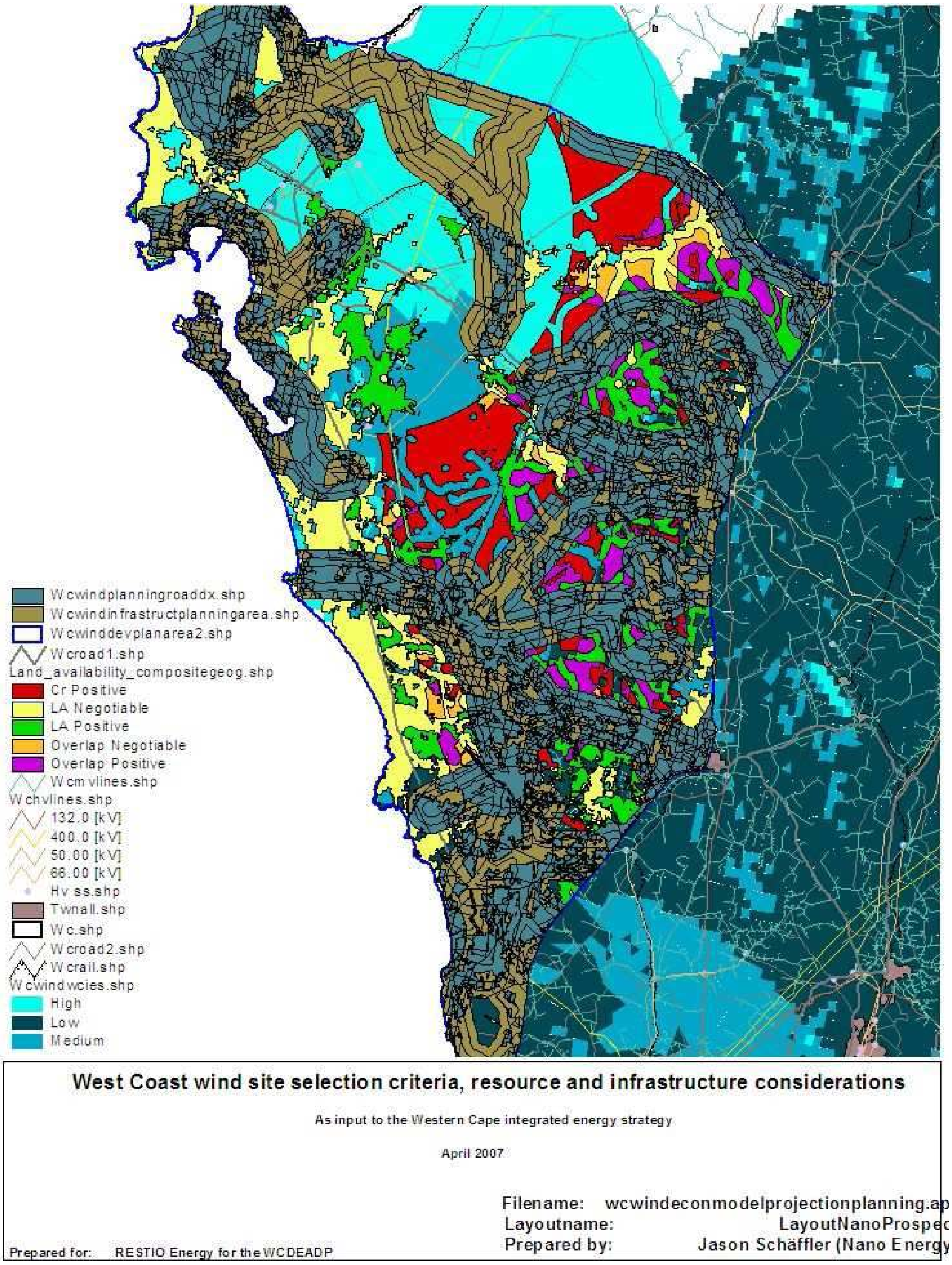

Figure 15 West coast wind site selection criteria, resource and infrastructure considerations.

3.7.2 Wind Offshore

Determining the realisable offshore potential requires information on:

- offshore areas covered by specific wind resources
- the locations and distance to distribution infrastructure and
- locations that are at suitable depths for wind farm installation.

The Council for Geosciences generously assisted with provision of an offshore depth coverage for the province as shown in Figure 16. Table 11 below is adapted from their analysis.

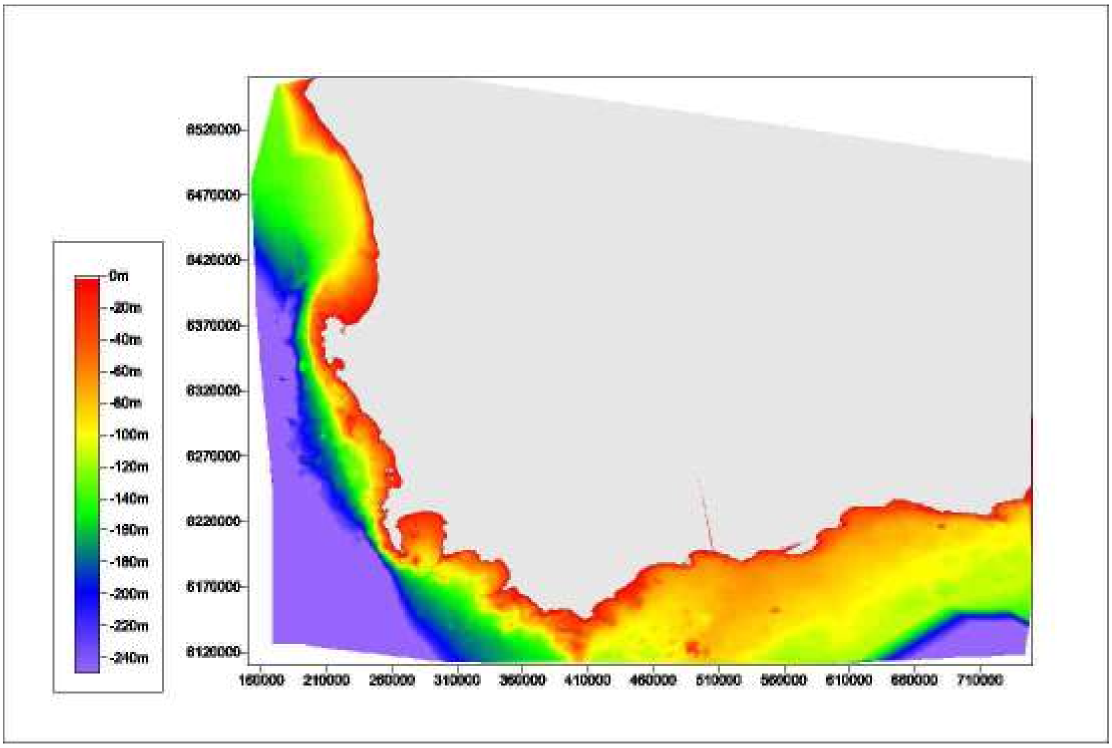

Figure 16 Water depth offshore of the Western Cape coastline (courtesy of Marine Geoscience Unit of the Council for Geoscience – April 2007)

Table 11 Lengths of near shore seabed at specified depths and distance from shore

Distance from shore (km)	<10m depth (Km)	<20m depth (Km)	<40m (Km)
<1	917	315	7
<2	1138	823	134
<5	1254	1195	777
<10	1264	1260	1132
>10	0	0	132

If it is assumed that water depths of less than 20 metres are suitable for power generation in the medium term, then the entire length of Western Cape coastline lies within 10km of water of suitable depth for offshore installations. However, note that the water close in to the shore is not suitable, as a result of wave action. An attempt was made to calculate existing land within workable distance of the distribution network and at a suitable depth for offshore installation using a low resolution digitisation of the data from Marine Geosciences and a buffer coverage of suitable distribution nodes for the province. This rudimentary analysis indicates that approximately 1500 km^2 of offshore area is within 15 km of suitable nodes on the transmission and distribution system, and at a suitable depth for offshore wind development. At a modest power density of 1 MW/km^2 this translates into an indicative capacity of 1.5 GW of wind offshore of the Western Cape coastline. Meso-scale modelling undertaken at the University of Cape Town indicates that the offshore resource is likely to be in the high capacity factor range used for resource categorisation in the onshore analysis above (Hagemann, 2006).