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ACT 1990
14 OCT 1998

W.A. P... ..

The Lowca Windcluster

ENVIRONMENTAL STATEMENT

JUNE 1998

VOLUME 3: FIGURES



RENEWABLES

Westwood Way Westwood Business Park Coventry CV4 8LG

The Lowca Windcluster

ENVIRONMENTAL STATEMENT

VOLUME 3

FIGURES

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KEY



Application Site



Existing / approved windfarm sites



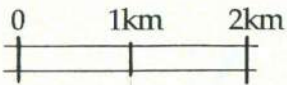
Landscapes designated as National Park and Heritage Coast



Landscapes of County Importance



Scale:



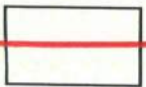

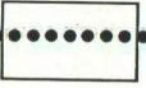

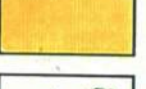

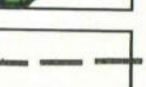
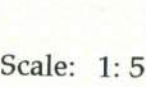
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Figure 1

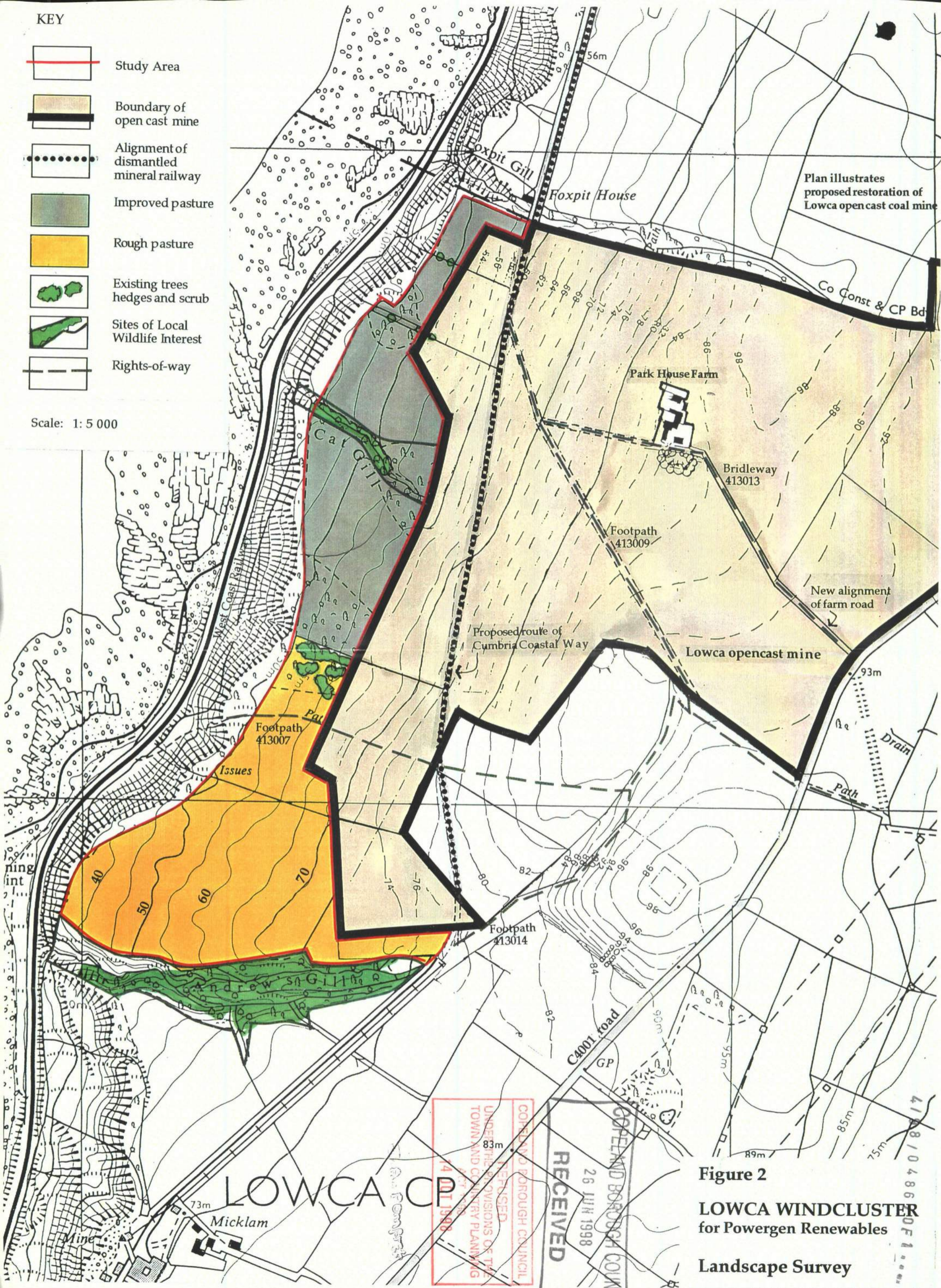
LOWCA WINDCLUSTER
for Powergen Renewables

Site Location & Regional Context

KEY

-  Study Area
-  Boundary of open cast mine
-  Alignment of dismantled mineral railway
-  Improved pasture
-  Rough pasture
-  Existing trees hedges and scrub
-  Sites of Local Wildlife Interest
-  Rights-of-way

Scale: 1: 5 000



Plan illustrates proposed restoration of Lowca open cast coal mine

Co Const & CP Bd

Park House Farm

Bridleway 413013

Footpath 413009

New alignment of farm road

Proposed route of Cumbria Coastal Way

Lowca opencast mine

Footpath 413007

Issues

Footpath 413014

C4001 road

GP

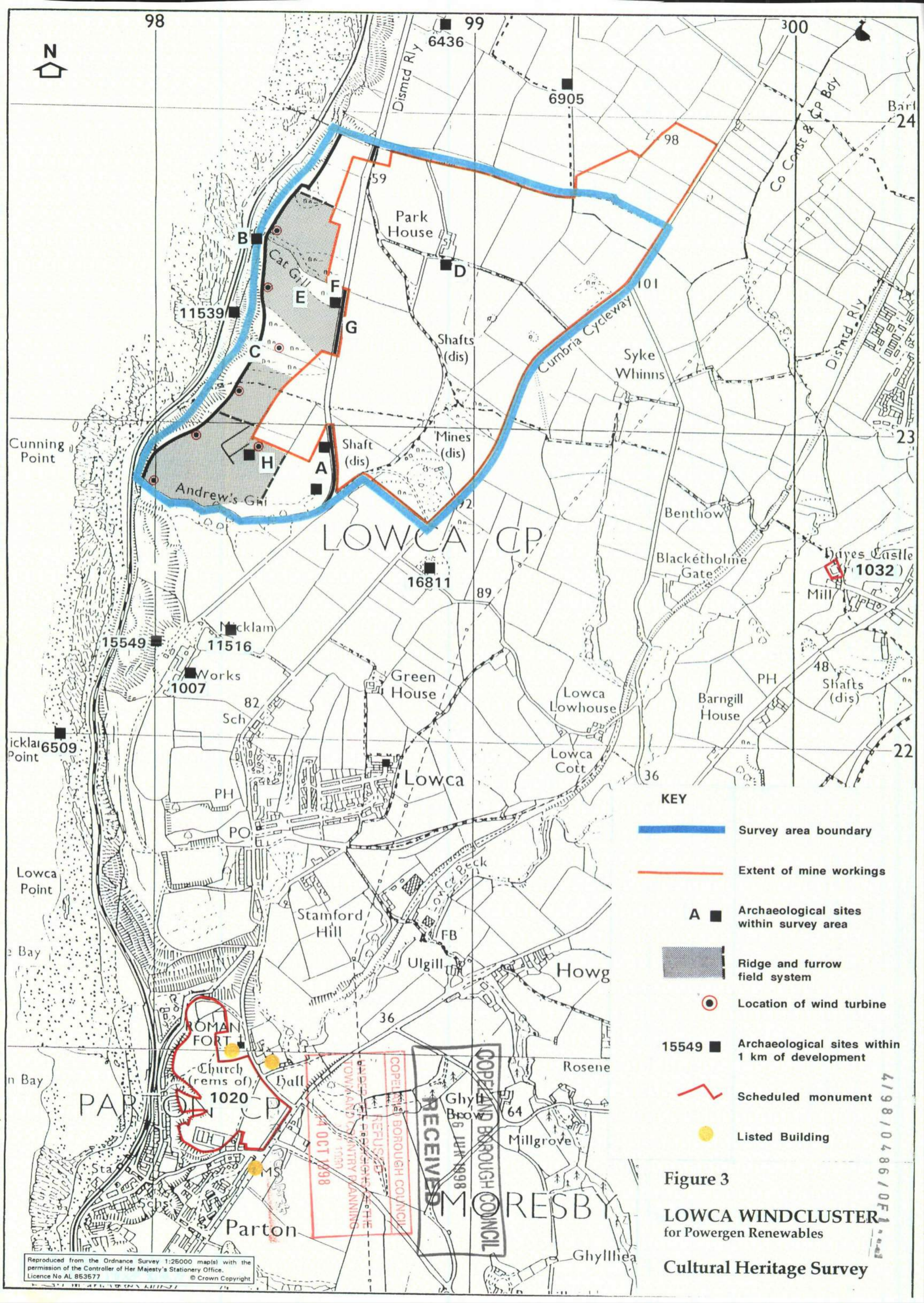
LOWCA CD

Micklams

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Figure 2
LOWCA WINDCLUSTER
 for Powergen Renewables
Landscape Survey

41810486 OF 1



KEY









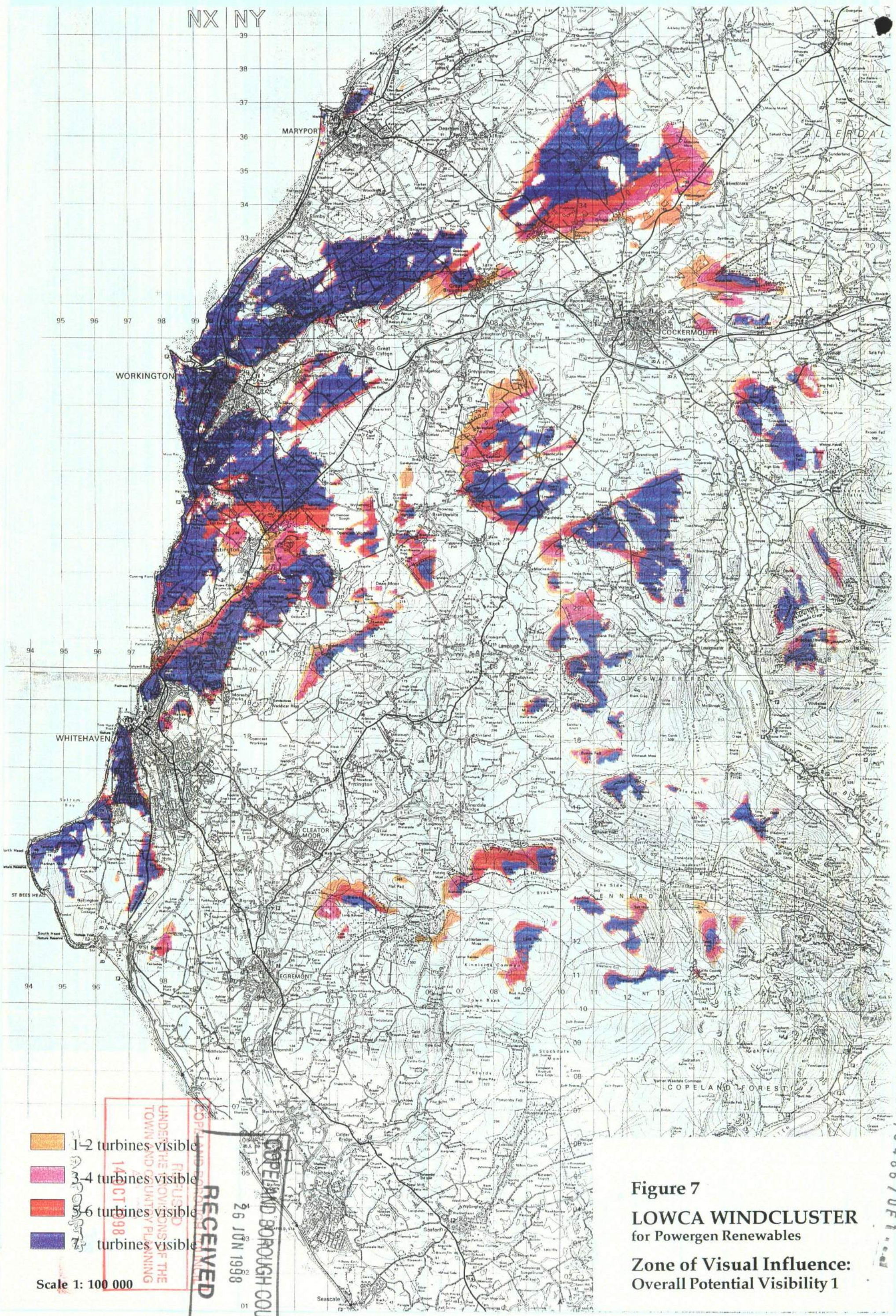
-  Survey area boundary
-  Extent of mine workings
- A**  Archaeological sites within survey area
-  Ridge and furrow field system
-  Location of wind turbine
- 15549**  Archaeological sites within 1 km of development
-  Scheduled monument
-  Listed Building

Figure 3
LOWCA WINDCLUSTER
 for Powergen Renewables
Cultural Heritage Survey

Reproduced from the Ordnance Survey 1:25000 map(s) with the permission of the Controller of Her Majesty's Stationery Office.
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NX NY



- 1-2 turbines visible
- 3-4 turbines visible
- 5-6 turbines visible
- 7 turbines visible

Scale 1: 100 000

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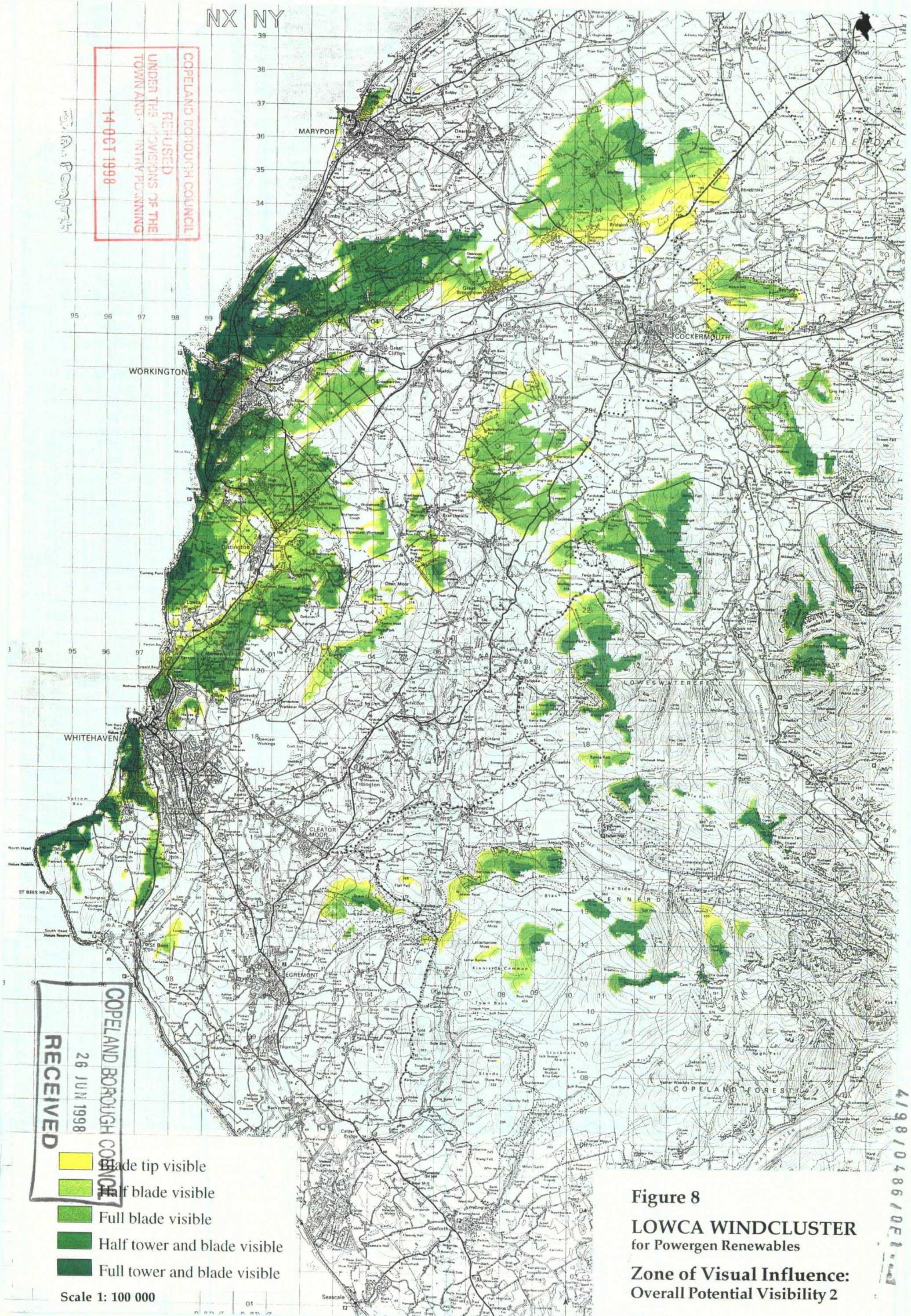
Figure 7
LOWCA WINDCLUSTER
 for Powergen Renewables
Zone of Visual Influence:
Overall Potential Visibility 1

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NX NY

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- blade tip visible
- half blade visible
- full blade visible
- half tower and blade visible
- full tower and blade visible

Scale 1: 100 000

Figure 8
LOWCA WINDCLUSTER
 for Powergen Renewables
Zone of Visual Influence:
Overall Potential Visibility 2

41981048610F1

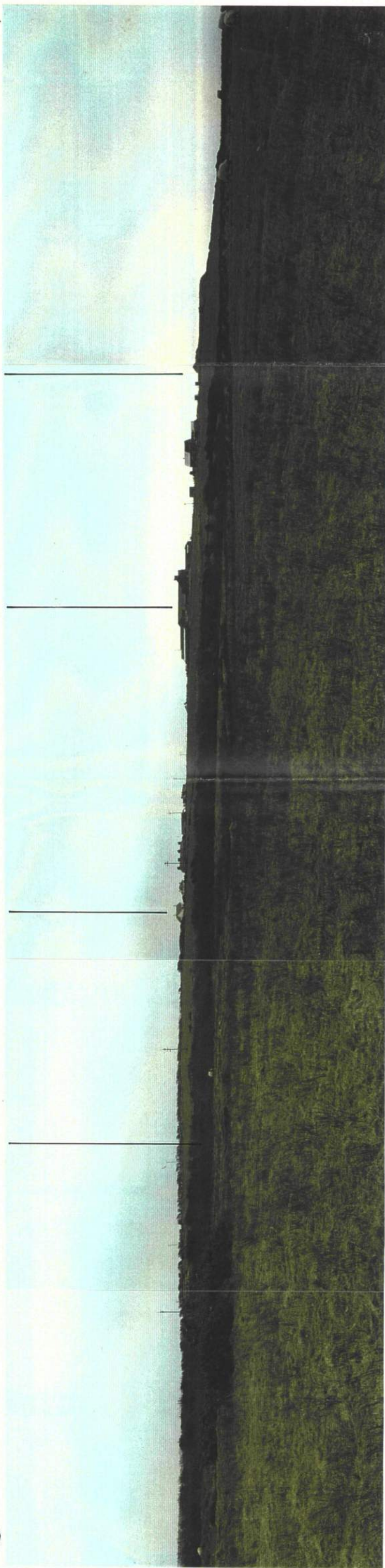
4198/0486/0F1...

Former Micklam brickworks

Micklam Farm

Micklam House and other properties adjacent to C4001 road

Andrew's Gill



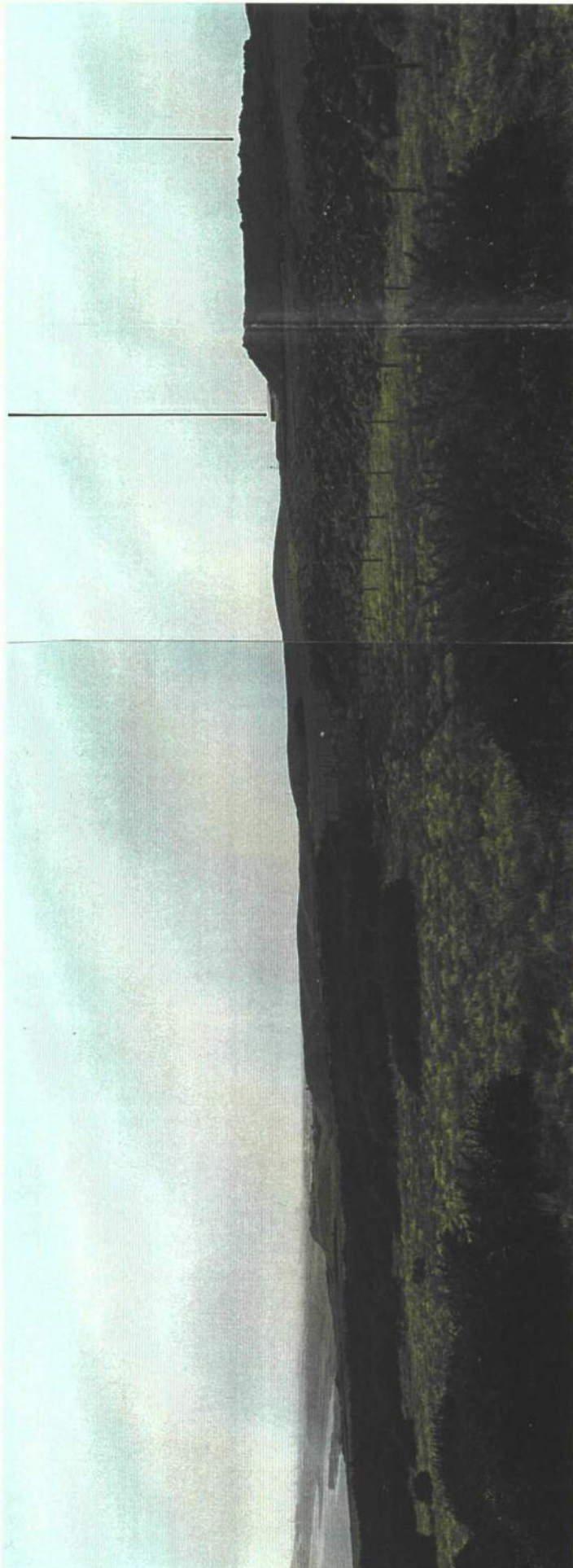
Viewpoint A

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Lowca open-cast mine

Park House Farm



Viewpoint B

Viewpoint C

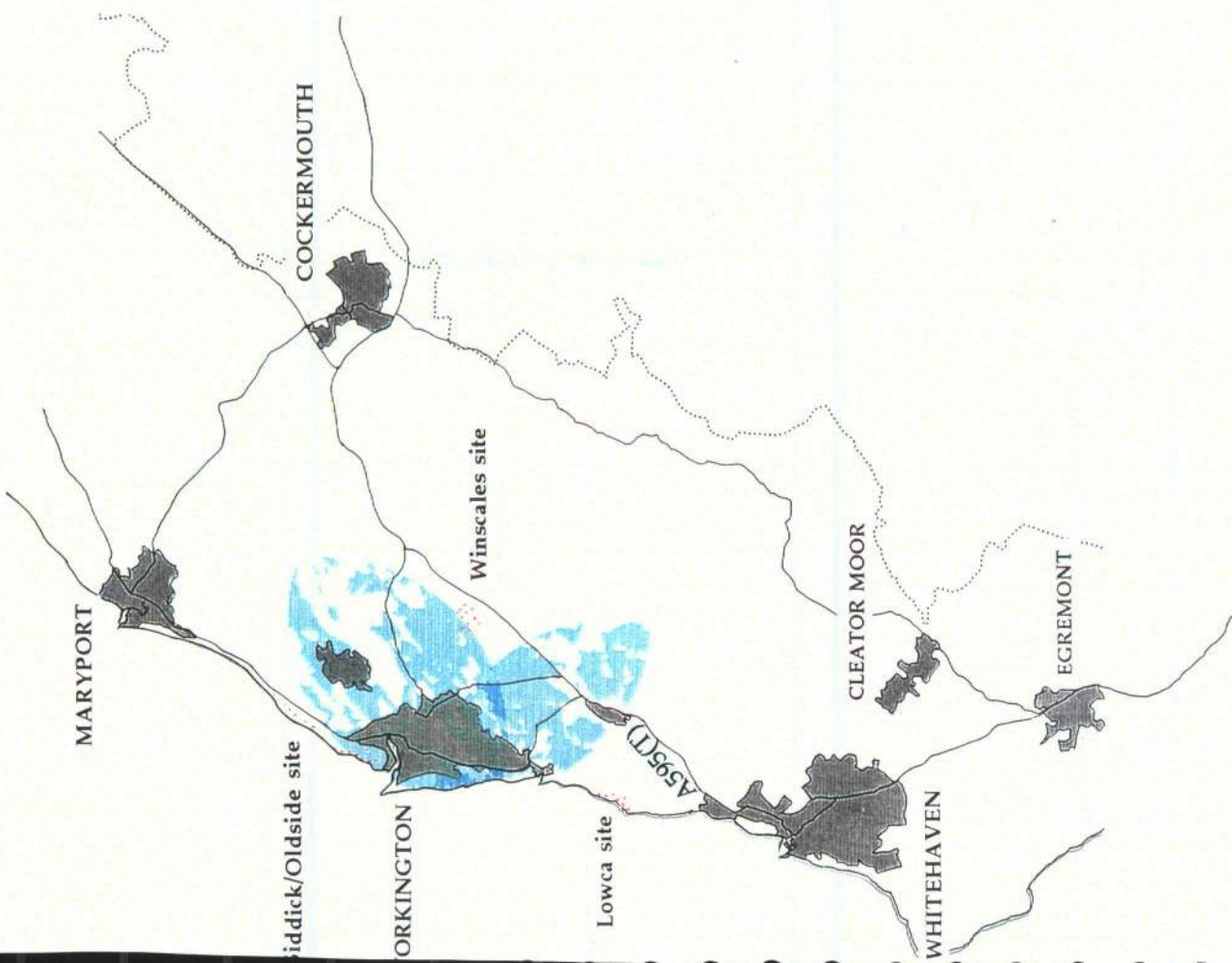
Figure 4

LOWCA WINDCLUSTEI
for Powergen Renewables

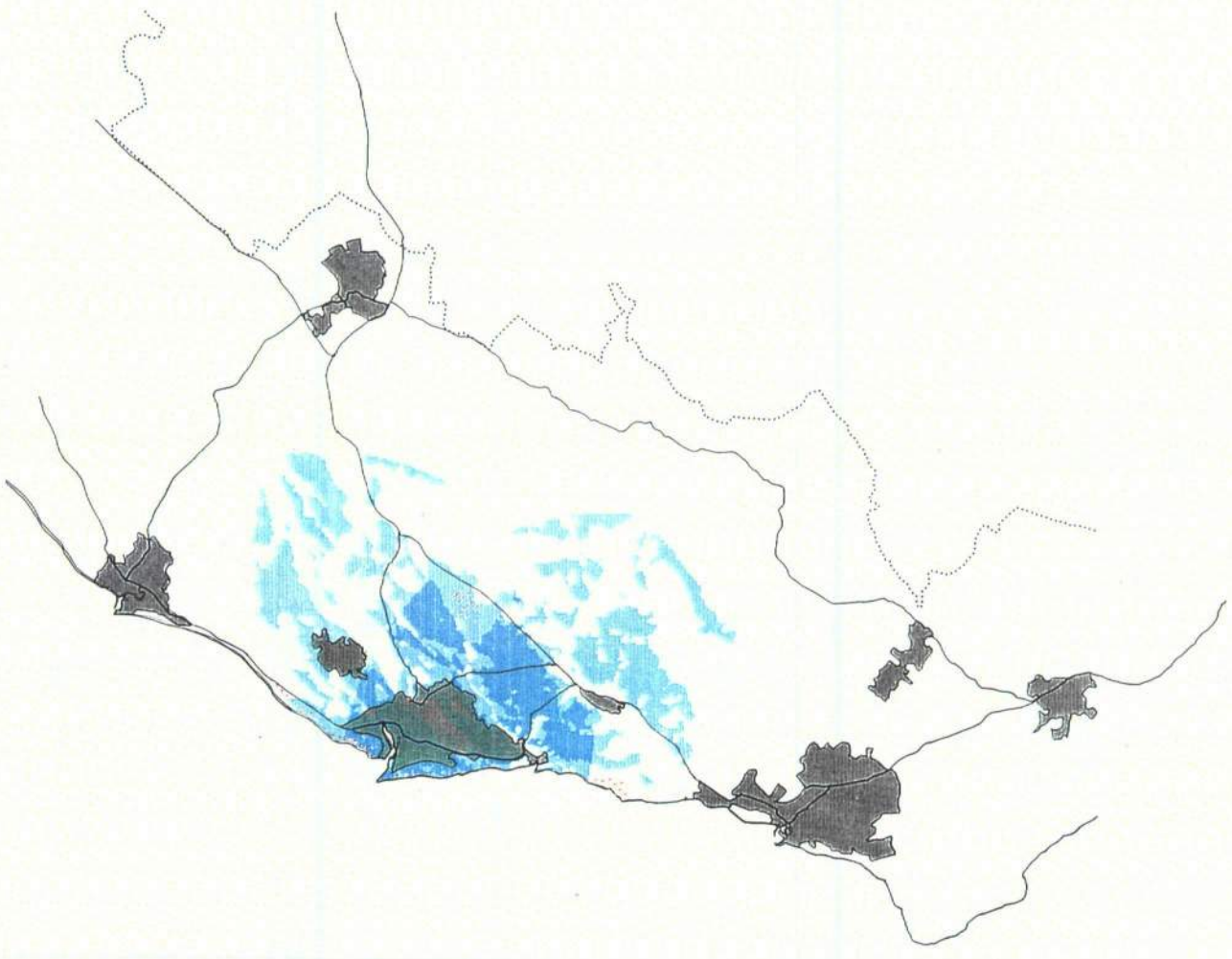
For location of viewpoints, refer to Figure 12

Photographic Record

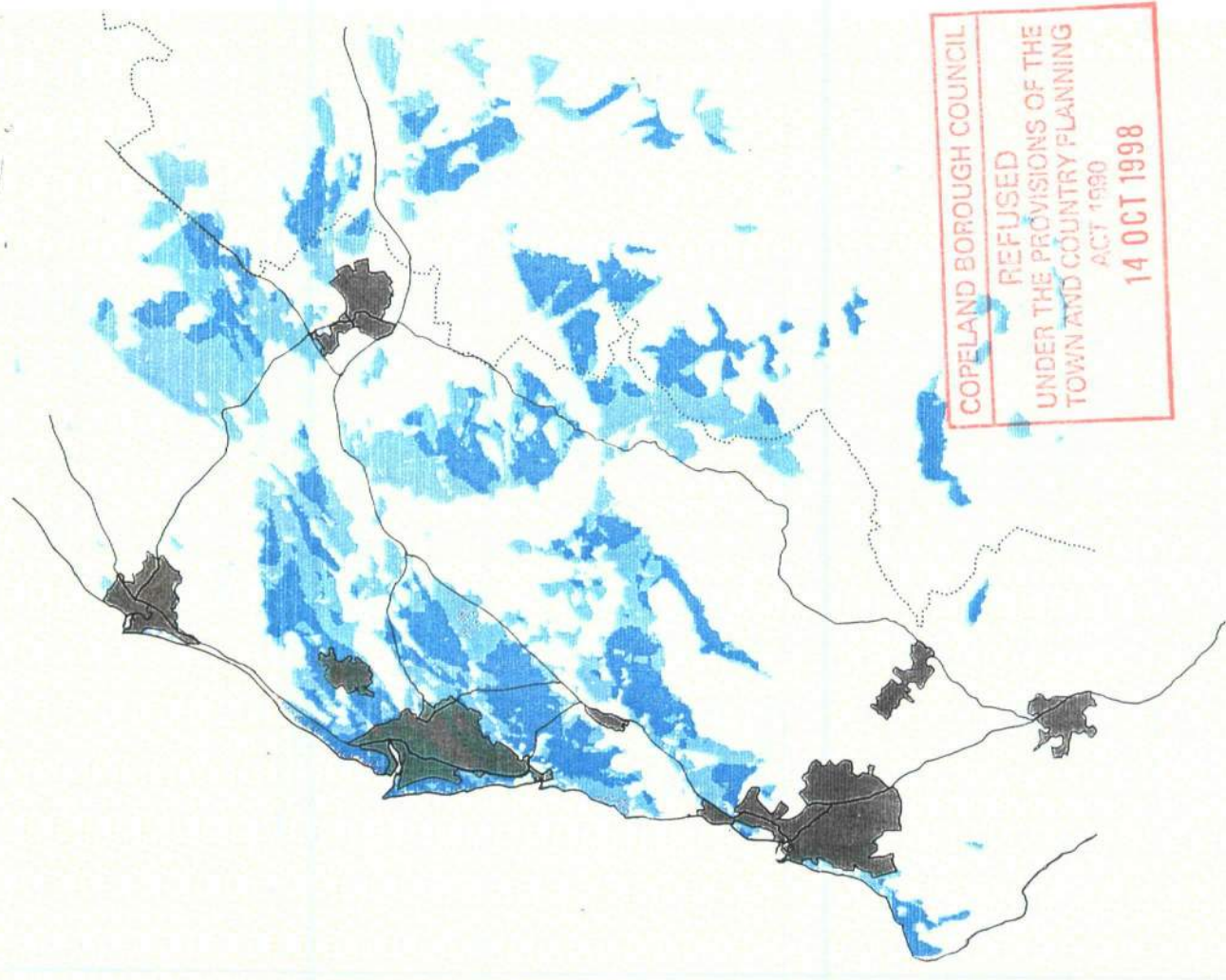
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Potential Intervisibility within 5 km
(NB No intervisibility within 2 km)



Potential Intervisibility within 7.5 km



Potential Intervisibility within 20 km

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Figure 11

LOWCA WINDCLUSTER
for Powergen Renewables

Potential intervisibility of
existing windfarm sites
plus Lowca Windcluster

- 2 Windfarms visible
- 3 Windfarms visible

Scale 1: 200 000

WORKINGTON

0 1km 2km


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Location of
Wind Turbines

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Key

• Wind Turbine

 Photographic Viewpoint
for Photomontage

 Photographic Survey
viewpoint

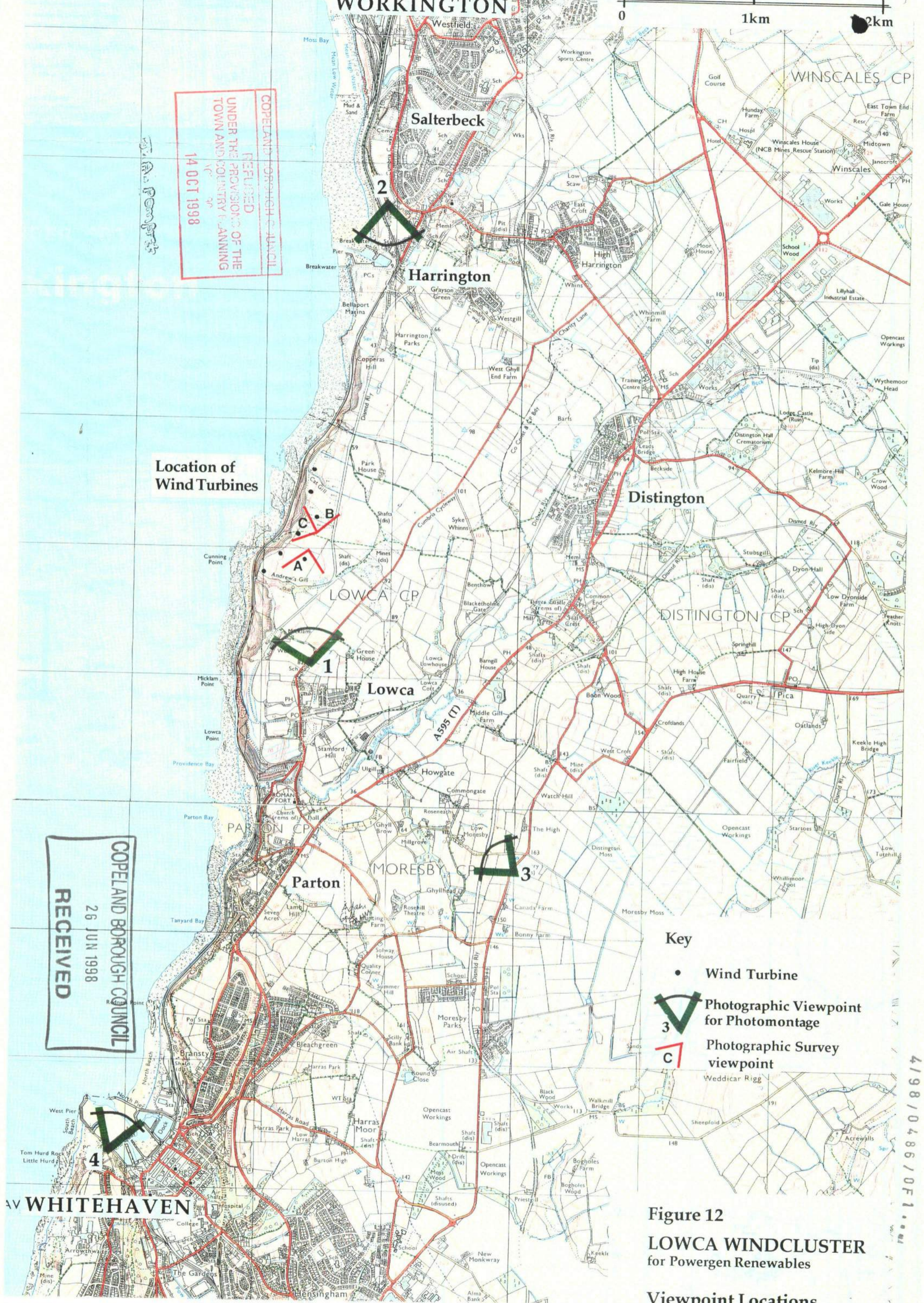
Weddicar Rigg

Figure 12

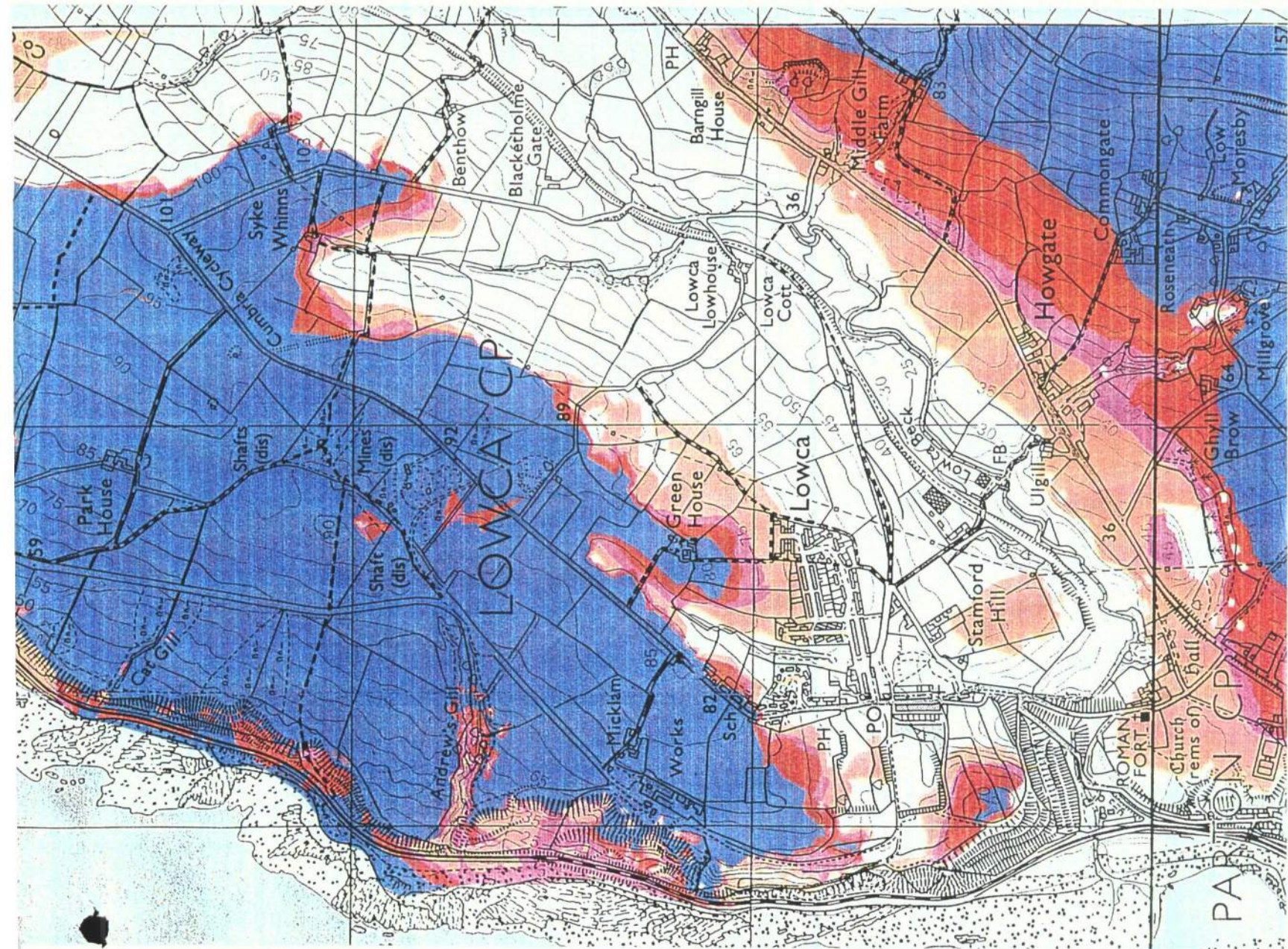
LOWCA WINDCLUSTER
for Powergen Renewables

Viewpoint Locations

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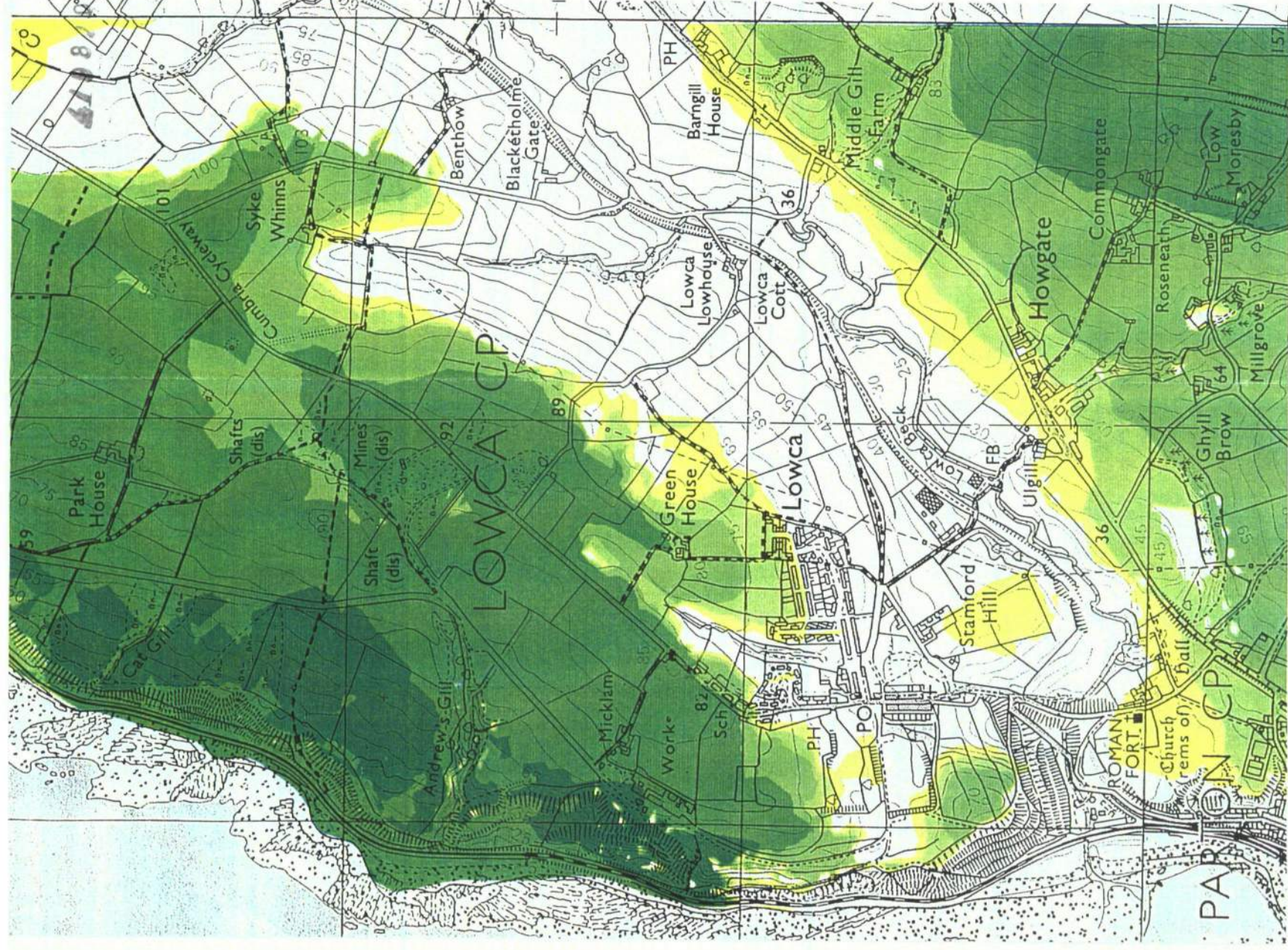
4.85 / D.F. 1



Analysis of Numbers of Turbines Potentially Visible

- 1-2 turbines visible
- 3-4 turbines visible
- 5-6 turbines visible
- 7 turbines visible

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Analysis of Elements of Turbines Potentially Visible

- Blade tip visible
- Half blade visible
- Full blade visible
- Half tower and blade visible
- Full tower and blade visible

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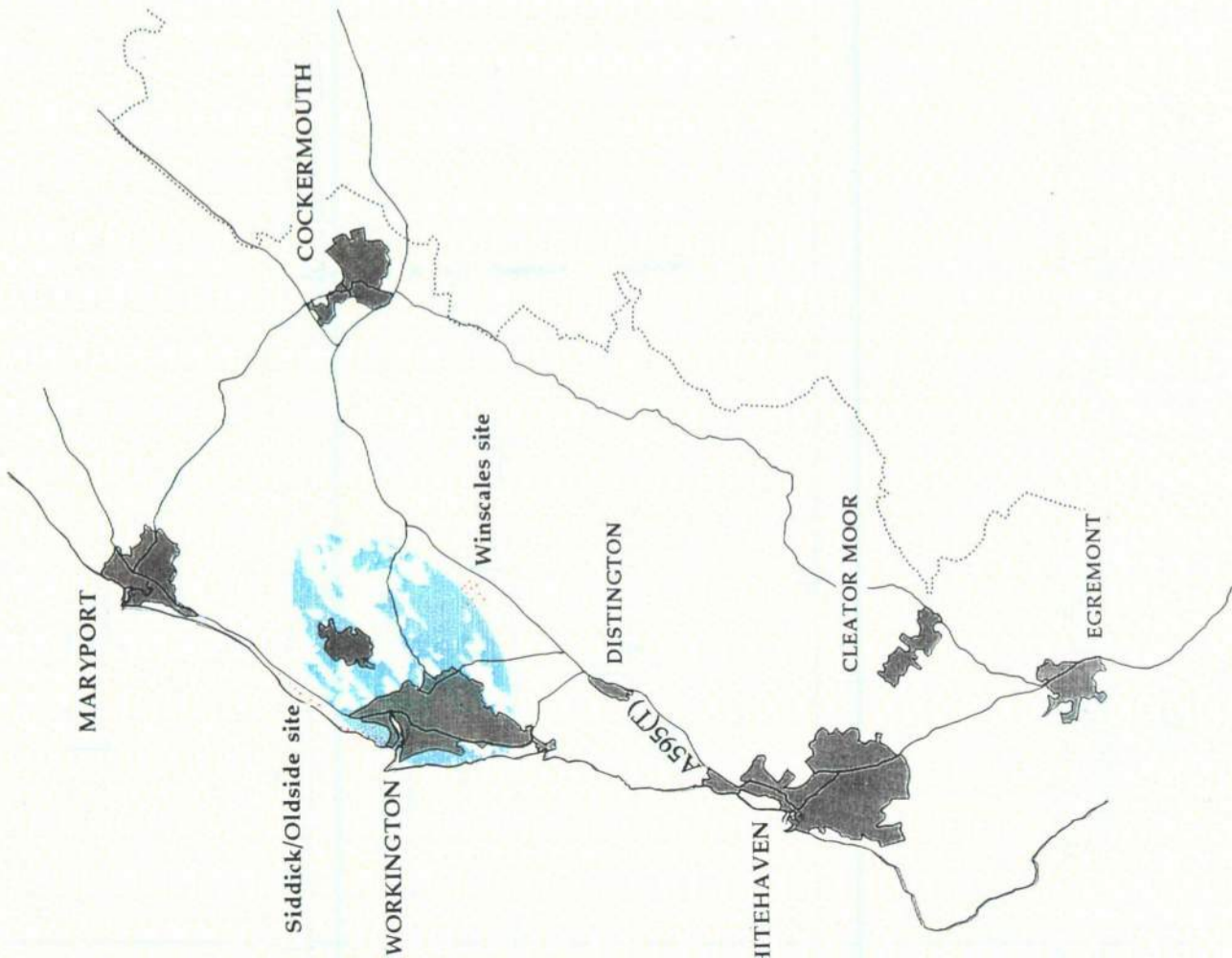
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Figure 9 RECEIVED

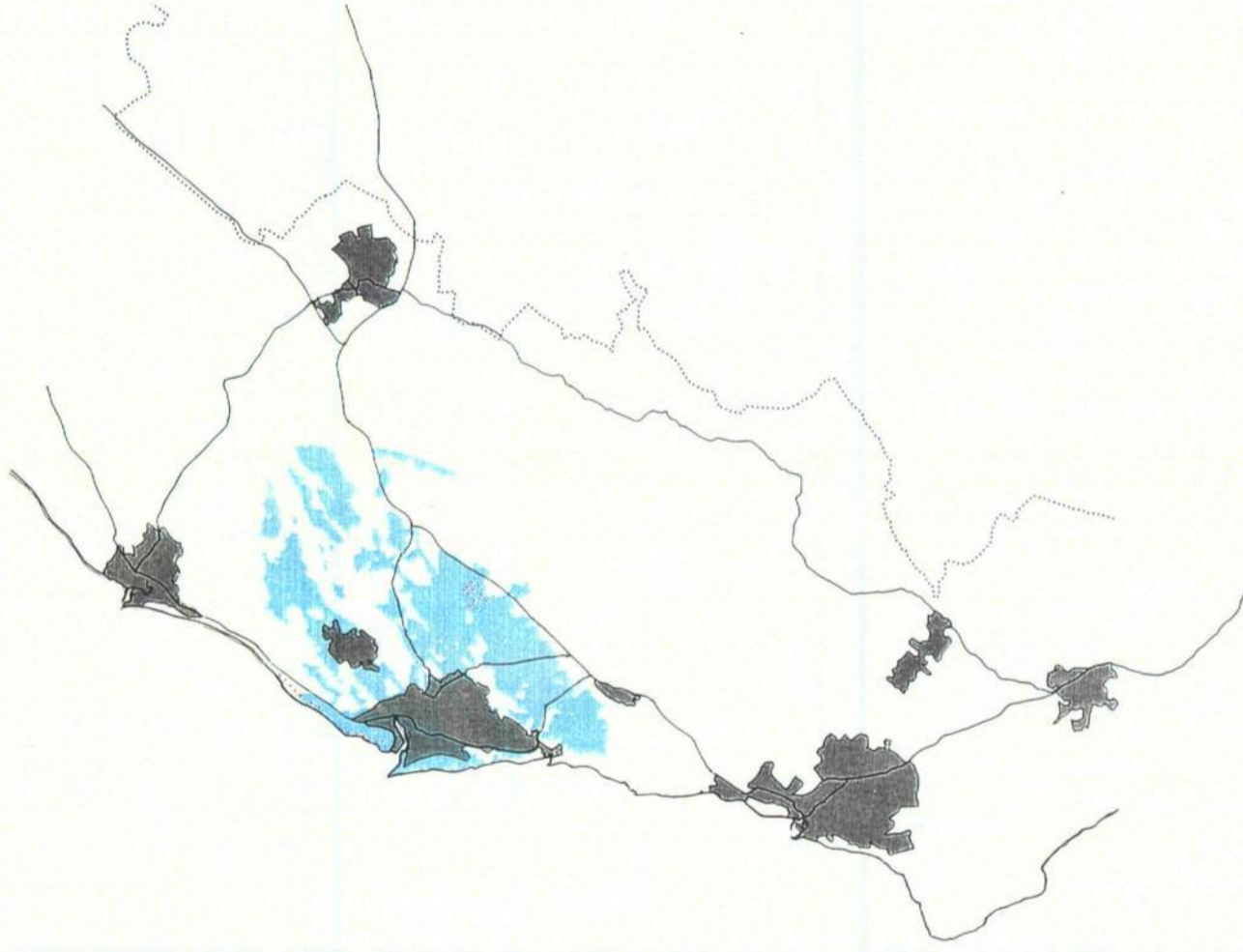
LOWCA WINDCLUSTER
 for Powergen Renewables

Zone of Visual Influence:
 Detailed Visibility Analyses

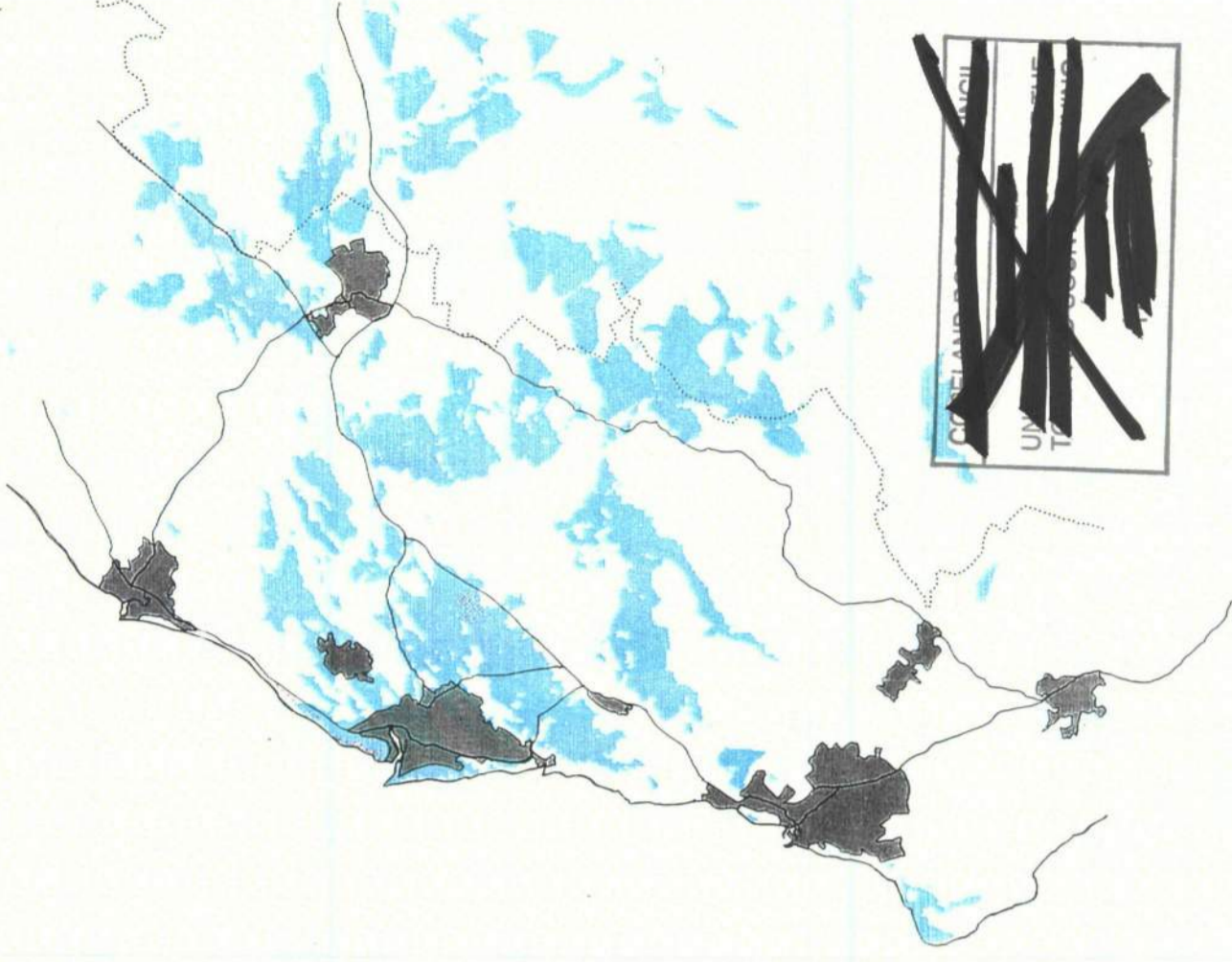
4198/0486/0F1.c.d.



Potential Intervisibility within 5 km
(NB No intervisibility within 2 km)



Potential Intervisibility within 7.5 km



Potential Intervisibility within 20 km

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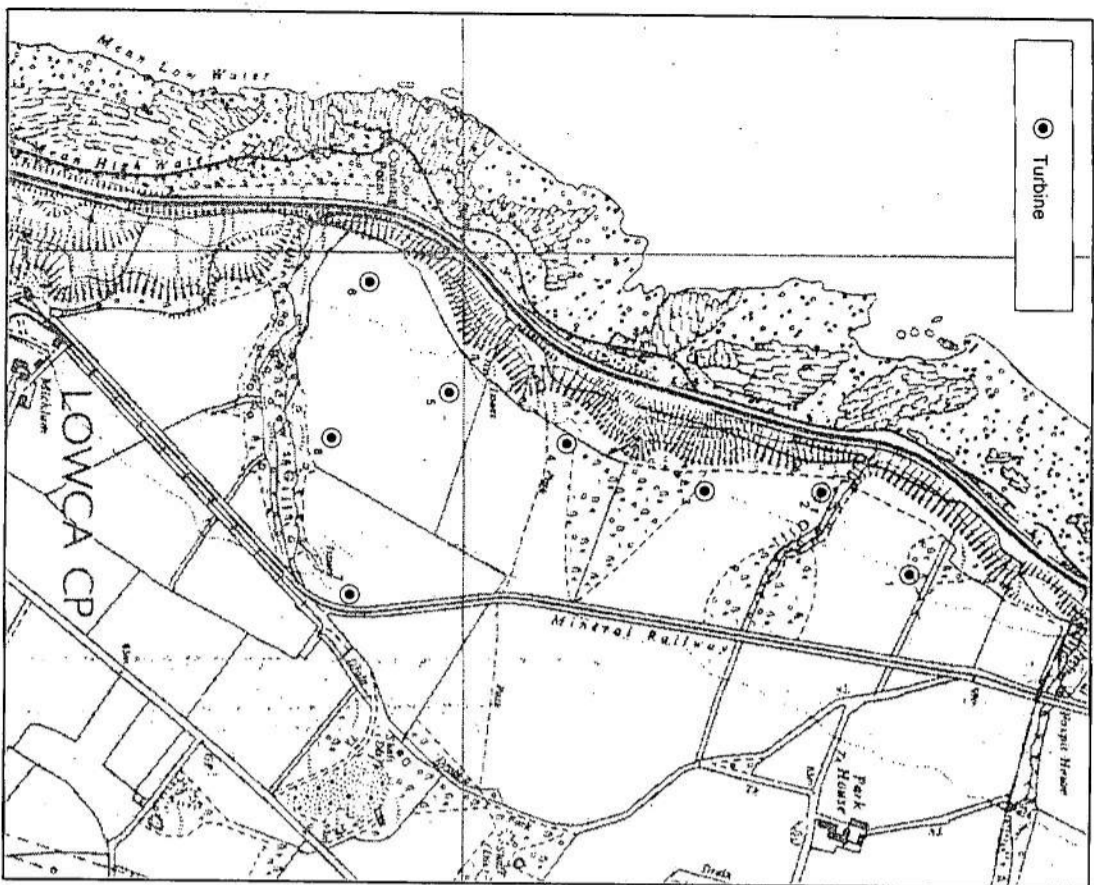
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Figure 10
 LOWCA WINDCLUSTER
 for Powergen Renewables
 Potential intervisibility of
 existing windfarm sites

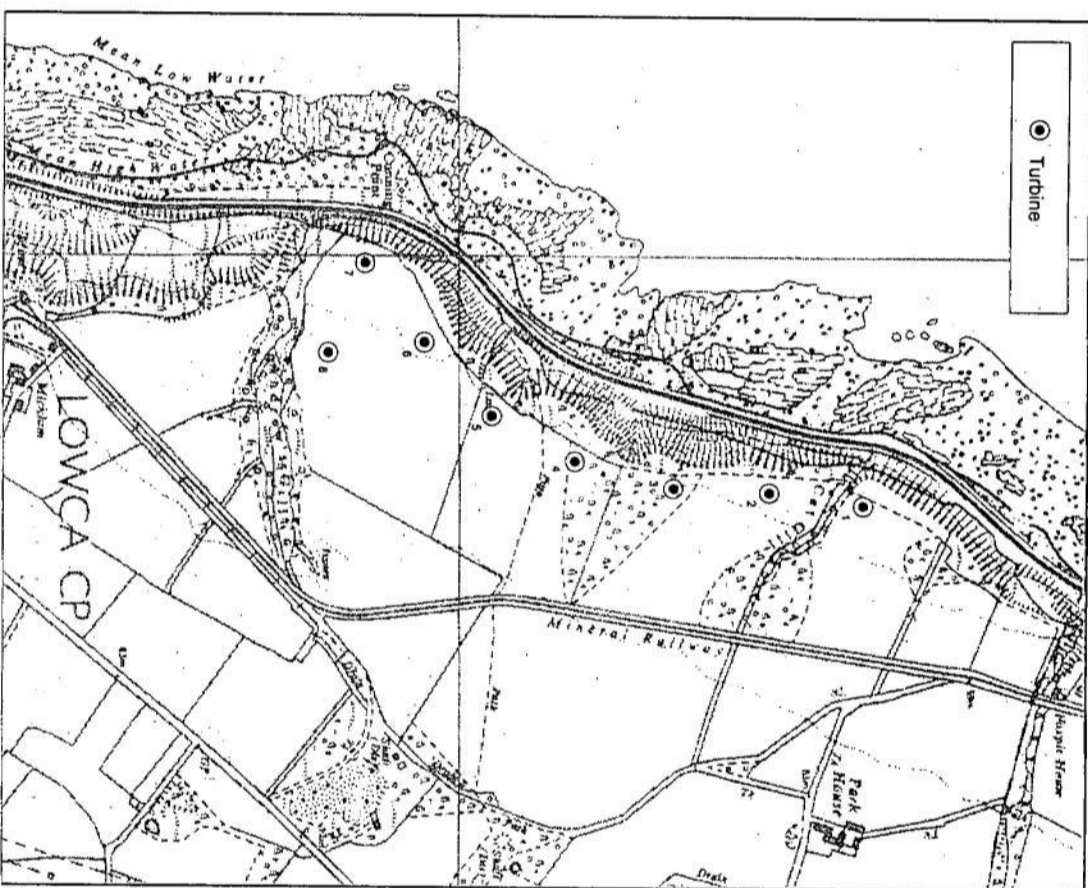
2 Windfarms visible

Scale 1: 200 000

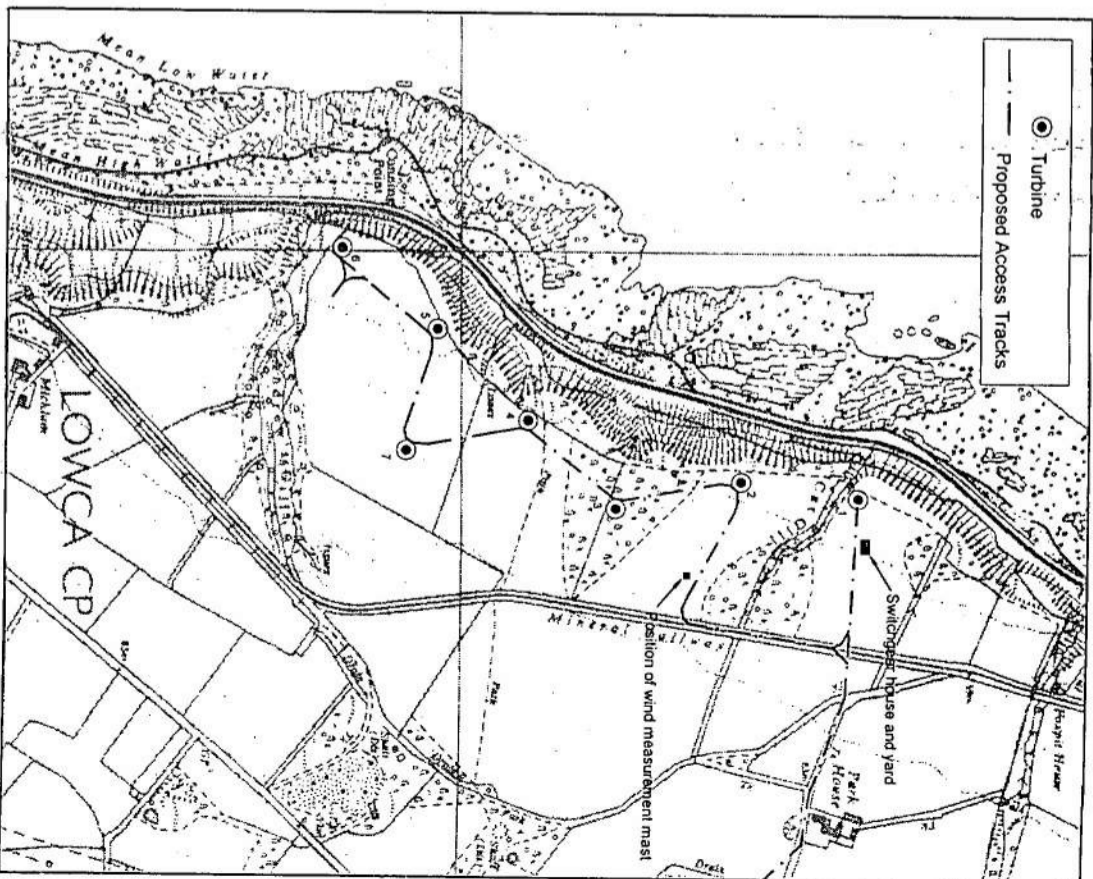
Initial Design - 1994



Intermediate Design - December 1997



Final Design for Application - April 1998



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Figure 5P

LOWCA WINDCLUSTER
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Alternative Site Designs

The Lowca Windcluster

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VOLUME 2A: APPENDICES

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B.A. Pomphrey



RENEWABLES

Westwood Way Westwood Business Park Coventry CV4 8LG



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660 kW

VESTAS V47-660 kW PITCHREGULATED WIND TURBINE WITH OPTISLIP® AND OPTITIP®

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B. A. Pomfret

BORN TO BE WILD ...



"Born to be wild ...", our choice of slogan for the V47-660, refers to an extremely efficient newly-developed turbine from Vestas. Intensive and meticulous R&D work has led to the conclusion that the obvious successor to the long-running 600 kW is not necessarily a 700 or 800 kW turbine. Instead research led to the development of Vestas' new flagship – the V47-660 kW wind turbine which generates 660 kW: neither more nor less! Vestas has come up with something very new in its efforts to improve blade design and reduce structural strain, the goal being to make a turbine that is as profitable as at all possible for the customer. It is actually a whole 19%* more productive than its predecessor! Part of the secret is, as already mentioned, the blade design. The rotor diame-

ter has been increased by 3 metres to 47, and the blades are now so flexible that they actually bend under the force of the wind. The OptiSlip® generator system is the second important part of the secret – not that this is the best kept secret anymore, as this tried and tested system has been installed on more than 750 (per September 97) turbines at sites all over the world!

Together, these improvements have significantly reduced wear and tear on vital turbine components and resulted in a higher cut-out wind speed – and so improved production.

* at average wind speed 7 m/s single-generator version measured at the hub height

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The standard V47-660 kW is a single generator version, and highly efficient under most wind conditions. However, Vestas can also supply a dual generator version. Up to wind speeds of 7 m/s this uses the smaller of the two generators, which means not only operating with a reduced noise level in conditions where this is important, but also an efficient exploitation of winds of low speeds.

OPTITIP®

As with all turbines from Vestas, the 660 kW is equipped with the microprocessor-controlled OptiTip® pitch-regulation system, which constantly regulates the blades so that they are always tilted to the optimal angle for current wind conditions. OptiTip® makes it possible to find the right balance between maximum production and minimum noise level.

OPTISLIP®

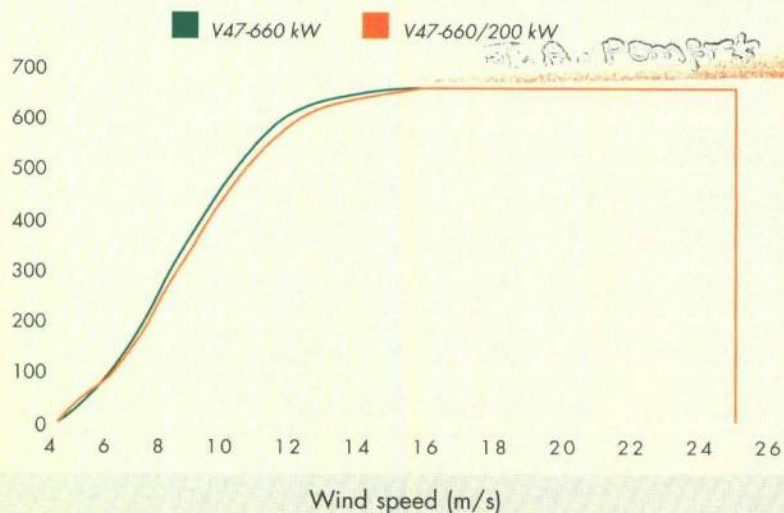
As mentioned above, the V47-660 kW turbine is fitted with the unique OptiSlip® generator system. The system allows both the rotor and the generator to vary their rpm by up to 10% during violent gusts of wind. OptiSlip® therefore not only minimises wear and tear on the turbine, but also improves the quality of the supply of electricity produced.



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CALCULATED POWER CURVE
AIR DENSITY 1.225 KG/M³

Effect (kW)



LIGHTNING PROTECTION

The V47-660 kW turbine is protected, from the tips of its blades to the base of the tower, by the Vestas Total Lightning Protection. For more details, ask for our special brochure on Vestas Total Lightning Protection.



FLEXIBLE BLADES

Vestas always measures and runs tests on all of its products right down to the smallest detail before anything is released for general sale. The same approach has been adopted for the flexible blades, which have been through a six-month dynamic vibration test under extreme strain. These test conditions reproduced a greater level of stress on the prototype turbine than would be exerted in a 20-year active life. After this, the blades were tested in a static test in their position of maximum curvature and under maximum strain. The prototype blades passed the various tests, allowing Vestas to start production of a new blade type that will go on to make a significant contribution to improved productivity on the V47-660 kW turbine.

V47-660 kW V47-660/200 kW

ROTOR

Diameter:	47 m	47 m
Swept area:	1.735 m ²	1.735 m ²
RPM:	28.5	26/20
Number of blades:	3	3
Power regulation:	Pitch/OptiSlip®	Pitch/OptiSlip®
Air brake:	Full-feathering	Full-feathering

TUBULAR TOWER

Hub height (approx.):	40-45-50-55 m	40-45-50-55-60-65 m
-----------------------	---------------	---------------------

OPERATING DATA

Start-up wind speed:	4 m/s	3,5 m/s
Optimal operating wind speed (660 kW):	15 m/s	16 m/s
Cut-out wind speed:	25 m/s	25 m/s

GENERATOR

Large generator:	Asynchronous with OptiSlip®	Asynchronous with OptiSlip®
Nominal power output:	660 kW	660 kW
Operating data:	50/60 Hz	50 Hz
	690 V	690 V
	1.515-	1.515-
	1.650 RPM	1.650 RPM
	(50 Hz)	
	1.818-	
	1.980 RPM	
	(60 Hz)	

Small generator:	Asynchronous
Nominal power output:	200 kW
Operating data:	50 Hz
	690 V
	1.500-
	1.516 RPM

TRANSMISSION

Type:	Planet/parallel shafts	Planet/parallel shafts
-------	------------------------	------------------------

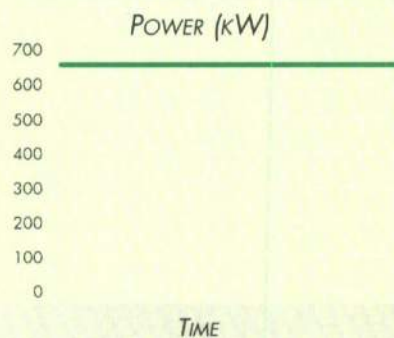
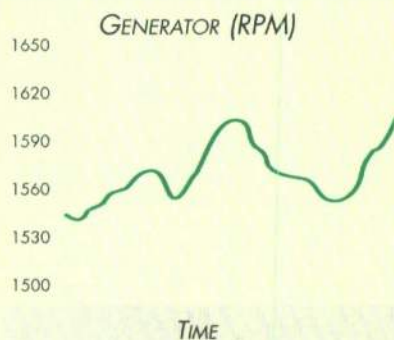
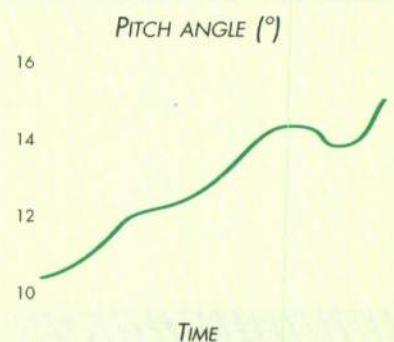
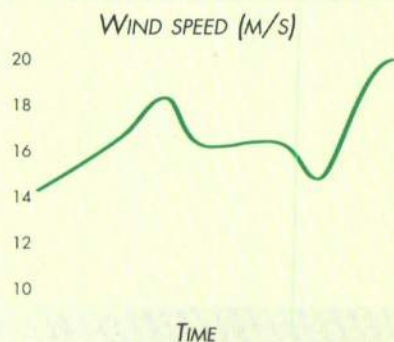
CONTROL

Type:	Microprocessor-based monitoring of all turbine functions, plus OptiSlip® regulation of output and OptiTip® pitch regulation of the blades.
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ACTUAL MEASUREMENTS
ON A VESTAS 660 kW
WIND TURBINE WITH
OPTISLIP®



WITH QUALITY AND CARE
WE USE THE WIND
TO CREATE COMPETITIVE,
ENVIRONMENTALLY FRIENDLY
ENERGY.



Vestas Wind Systems A/S
Smed Hansens Vej 27 · DK-6940 Lem
Denmark
Tel. +45 97 34 11 88 · Fax +45 97 34 14 84
e-mail: vestas@vestas.dk

ASSOCIATED COMPANIES

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Vestas - Scandinavian Wind Technology A/S
Smed Hansens Vej 27 · DK-6940 Lem
Denmark
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Vestas - American Wind Technology Inc.
19020 N. Indian Avenue, Suite 4-C
P.O. Box 278
North Palm Springs · Ca 92258
USA
Tel. 760 329 5400 · Fax 760 329 5558

Vestas Deutschland GmbH
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Germany
Tel. 04841 971 0 · Fax 04841 971 41

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Åkarevägen 17 · S-31132 Falkenberg
Sweden
Tel. 0346 59050 · Fax 0346 59055

Vestas - Nederland Windtechnologie B.V.
Dr. Langemeijerweg 1 a
Postbus 63 · NL-6990 AB Rheden
The Netherlands
Tel. 0264971500 · Fax 0264971555

Wind Power Invest A/S
Smed Hansens Vej 27 · DK-6940 Lem
Denmark
Tel. +45 97 34 11 88 · Fax +45 97 34 14 84

JOINT VENTURE COMPANIES

Vestas RRB India Ltd.
161 Sukhdev Vihar · New Delhi 110 025
India
Tel. 011 6848228 · Fax 011 6835160

Gamesa Eólica S.A.
Poligono Comarca 1 (Agustinos)
31013 Pamplona
Spain
Tel. 48 30 90 10 · Fax 48 30 90 09

The new generator design allows a variation in the rotational speed of up to 10%. This flexibility significantly reduces mechanical strain and prevents undesirable fluctuation on the grid.

APPENDIX ON PLANNING POLICY

Government Strategy and Policy

Sustainable Development Strategy, Environmental and Energy Policy

"Sustainable Development - The UK Strategy" (CM2426) January 1994

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1. The widely quoted definition of the concept of sustainable development is **"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"**.

2. The Strategy notes that emissions of carbon dioxide and other greenhouse gases may result in warming of the earth's surface and consequent changes in climate and rises in sea levels. It is indicated that this will be one of the major problems for the whole world over the next 20 years and beyond if improved scientific understanding of climate changes confirms present estimates. The UK has committed itself under the Framework Convention on Climate Change to take measures aimed at restoring emissions of carbon dioxide and other greenhouse gases to 1990 levels by the year 2000. Current Convention measures will need to be reviewed in the light of further scientific evidence, and it may be necessary to identify targets and measures for the years beyond 2000. With regard to energy supply, it is indicated that modern societies are critically dependant upon the supply of energy, and the way in which energy is produced, supplied and consumed is one of the major ways in which human activity affects the environment.

3. The Government's policy is that the debate about the proportions of energy being produced from different fuel sources will be resolved through the operation of the market, guided by price signals which take proper account of the different costs and benefits. It is concluded that **"new and renewable energy technologies have the potential to make a significant contribution to UK energy supply in the next century"**. The planning system is a key instrument in delivery land use and development compatible with the aims of sustainable development.

4. The strategy refers to the application of special restraints in statutorily designated areas and that sustainable development objectives demand an approach which integrates rural development and conservation.

"This Common Inheritance: Britain's Environmental Strategy" (CM1200) September 1990

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14 OCT 1998

5. The Government's environmental strategy notes that an important contribution towards the reduction of carbon dioxide emissions can come from renewable energy. The Government's policy **"..is to introduce the development and application of all renewable energy sources, such as biofuels, wind and tide where they show promise of commercial viability in Britain"**. *Pomfrith*

6. Annex C to CM1200 deals with "Action on Global Warming" and notes **"..as a result of the strong prevailing winds in Britain, wind energy on land has the potential to supply up to 10% of current electricity needs. However,**

APPENDIX 2

4/98/0486/0F1

there are planning constraints because technically favourable sites are often in areas of natural beauty or importance to wildlife".

Energy Policy

7. The Department of Energy has, since the mid 1970s pursued a programme of research, development and demonstration of renewable energy which resulted in a strategy, published in June 1988, as Energy Paper No. 55 "Renewable Energy in the United Kingdom: The Way Forward". This paper concluded that renewable energy sources could make a useful and economic contribution to the UK's economy from the late 1990's onward, thereby assisting diversity of supply. Wind energy was identified as one of the most promising of the renewable sources.

8. Confirmation of the Government's commitment to renewable energy is set out in the DTI's Energy Paper No. 62 "New and Renewable Energy: Future Prospects for the UK" which was published by the Energy Minister on 31 March 1994. This document represents the Government's response to the 1992 report of the Renewable Energy Advisory Group (REAG). It sets out a strategy for the implementation of its policies to help key renewable technologies, including wind power, to become fully competitive energy options.

9. The Government's policy for new and renewable energy is as follows:

**"..to stimulate the development of new and renewable energy sources wherever they have prospects of being economically attractive and environmentally acceptable in order to contribute to:
diverse, secure and sustainable energy supplies;
reduction in the emission of pollutants;
encouragement of internationally competitive industries".**

Planning Policy

10. PPG1 ("General Policy and Principles" - 1997) confirms that the planning system regulates the development and use of land in the public interest. The basic question is not whether owners and occupiers of neighbouring properties would experience financial or other loss from a particular development, *but whether the proposal would unacceptably affect amenities and the existing use of land and buildings which ought to be protected in the public interest.* Those deciding planning applications should always take into account whether the proposed development would *cause demonstrable harm to interests of acknowledged importance.*

11. PPG1 indicates that the Government is committed to a plan-led system of development control given statutory force by Section 54A of the Town and Country Planning Act 1990 as amended. Where an adopted or approved development plan contains relevant policies, Section 54A requires that an application for planning permission or an appeal shall be determined in accordance with the plan unless material considerations indicate otherwise. If the development plan contains material policies or proposals and there are no other material considerations, the application should be determined in accordance with the development plan. Where there are other material considerations, it is indicated that the development plan should be the starting point, and the other

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26 JUN 1998

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