



**Broads Authority
Dark Sky Surveys
October 2015 to March 2016**

1. Introduction

The Broads Authority has surveyed the dark skies of the Broads Authority Executive Area; the aim being to understand the quality of the dark skies in the Broads. This note sets out the reasons for undertaking the study as well as details the methodology used and resulted collected.

2. Why do this study?

The National Planning Policy Framework (NPPF) at paragraph 125 says '*by encouraging good design, planning policies and decisions should limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation*'. The data collected for this study will indicate if the Broads Authority Executive Area has any intrinsically dark skies that should be protected through the new Local Plan.

The other reason for undertaking this study is to consider applying for Dark Sky Status. This award is administered by the International Dark Skies Association (IDA). The International Dark Sky Places conservation program recognizes and promotes excellent stewardship of the night sky. Councils, landowners, businesses, individuals and communities work together to reduce light pollution. There are three types of dark sky places:

- Reserves – large areas
- Park – small with large population
- Community – smallest

3. Why tackle light pollution?

There are many reasons to tackle light pollution.

With regards to people, exposure to light at night can disrupt the body's production of melatonin, a brain hormone and there are also links to cancer.

Turning to wildlife, lights attract and disorientate animals and lighting increases the mortality rate of wild birds, via fatal collisions with illuminated buildings. Insects can be killed instantly with the heat of the bulb, or circle until they are too exhausted either to feed or procreate.

In relation to the economy, light pollution could be seen as inefficient and a waste of energy and money. There are also tourism benefits to dark skies such as tourism related to astronomy.

Tackling light pollution is not necessarily about turning lights off. It is about using better lighting in a better way. It is about understanding the lighting task (why the light is needed in the first place) and ensuring the quantity, intensity and direction of light is well designed and appropriate.

4. Dark Skies Survey Pilot – March 2015

It was intended to survey the entire area of the Broads using the Dark Sky Metre application for I Phones. Because we did not have enough volunteers with I phones and night navigation qualifications available to cover the 6 dates that were selected in March (when there was little moon), it was decided that a pilot survey would be completed to check the methodology.

The pilot survey was completed in two areas:

- Coiltishall to Horning (land and water)
- Whitlingham to Brundall

There were some queries with regards to the data collected using the application.

- Whitlingham is nearer to Norwich yet the readings show very dark skies. Further along the River Yare, further from Norwich, the readings on the water were much lower. One would have expected higher readings further from Norwich.
- Similarly, there is a very high reading outside Hoveton train station when compared to other more remote areas in that pilot area.



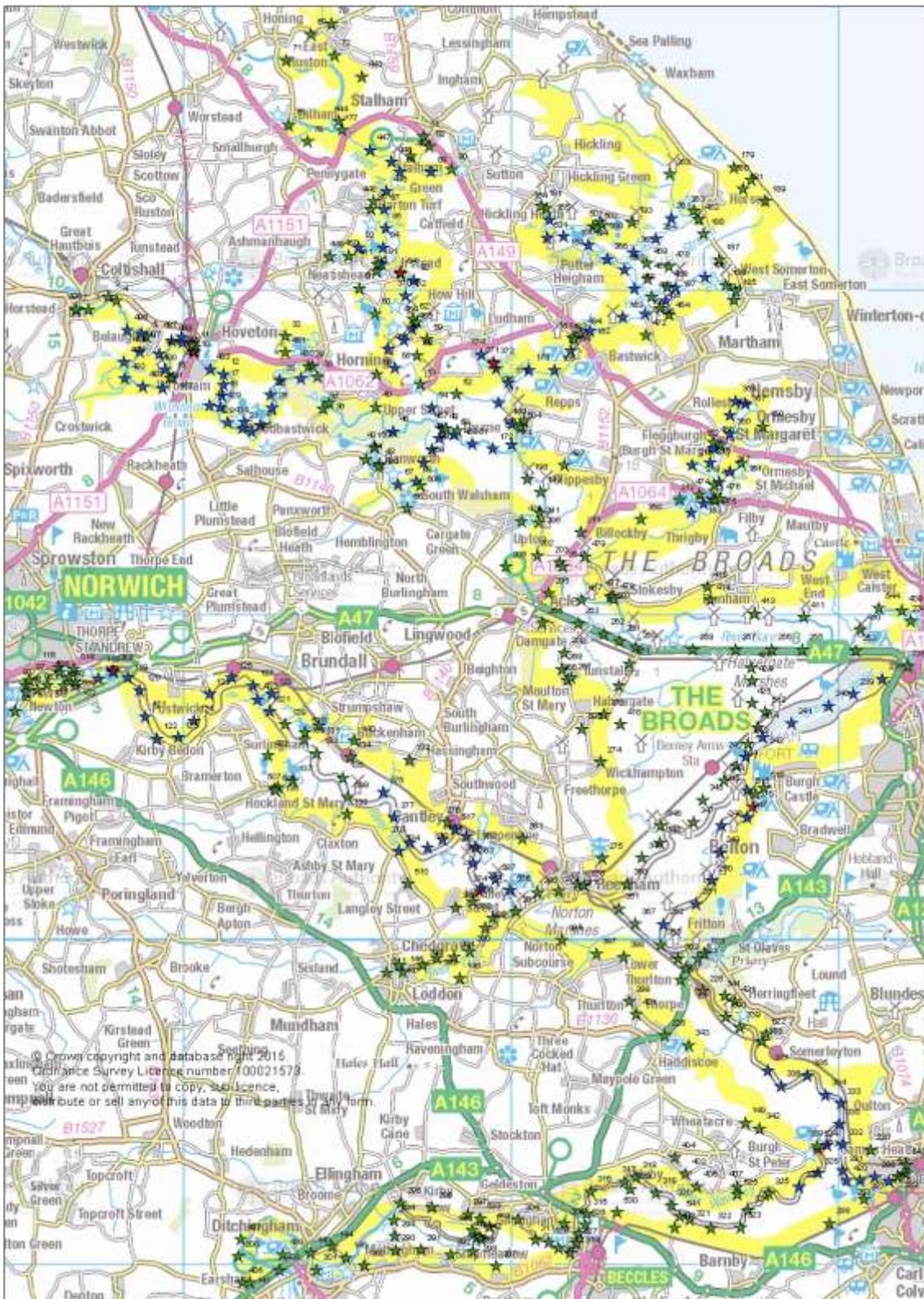
As a result of the Pilot scheme, Sky Quality Meters were purchased or borrowed from Snowdonia National Park.

5. October 2015 to March 2016 survey

The dates and times of the completed surveys are shown below.

New Moon	Sunset	Dates of survey	End of Astronomical Twilight (first survey time)
13 October 2015	18:05	11 to 15 October 2015	19:59
11 November 2015	16:08	9 to 14 November 2015	18:07
11 December 2015	15:40	9 to 14 December 2015	17:47
10 January 2016	16:02	6 to 12 January 2016	18:07
8 February 2016	16:53	4 to 11 February 2016	18:50
9 March 2016	17:49	1 to 11 March 2016	19:44

The entire area of the Broads was surveyed from October 2015 to March 2016. The following map shows the locations of the survey points. Green stars indicate land based surveys and blue stars indicate water based surveys. Red stars show the location of the launches.



6. Final Methodology

a. Dark Sky Surveyors

Volunteers and Broads Authority Staff were contacted to see if they wanted to take part in the surveys. With five Sky Quality Meters available, there were five teams assembled each month. The teams consisted of two volunteers for land-based surveys and three volunteers for water-based surveys. For the water-based surveys, two volunteers who

were qualified to helm at night formed the basis of the team, with a third meter reader. Volunteers were fully briefed and made aware of the risks and precautions prior to the surveys.

b. Cloud cover

Volunteers or staff living in the vicinity of a particular survey area were contacted to see if there were stars or if the sky was cloudy. The BBC Weather and Weather Underground websites were also checked to see what the weather forecast was for the rest of the night. Teams were subsequently stood down or given the go ahead to undertake the surveys, depending on the local observations and forecast.

During the survey, if cloud cover was estimated to be over 3 oktas, the survey was abandoned due to the effect cloud cover has on the readings (tending to make them lower in value).

c. What to do at each survey point

If in a car, teams parked up in a safe location and turned off lights. If on a launch, the boat was stopped and navigation lights turned off (if safe to do so)

The GPS on the launch/hand held Garmin or a grid reference app on smart phones was used to ensure the teams were in the right location. If in the vicinity of the grid reference but not the exact position, the grid reference of the reading was noted down.

The following form was filled out. Eight readings were taken in the same place and noted, taken one after the other. The name of the surveyor, the date, time, weather, cloud cover level (in oktas) were also noted.

★ Survey Point 363
 Pull up to gate of car park (gate closed) and walk along path for 2 minutes, passed the toilets. Grass path.

Name of surveyor:
 Phone used:
 Date:
 Time:
 Cloud observations:

Readings	
1	5
2	6
3	7
4	8
Lat	
Lon	
GridRef	

Notes and observations:

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 You are permitted to use this map solely for the purpose of assisting with the Dark Sky Survey.

Any observations such as sources of light and the presence of milky way, zodiacal light, meteors or aurora were noted. The following crib sheet was used.



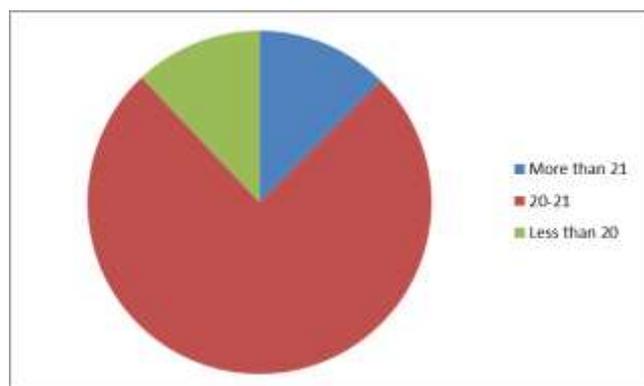
d. Safety and Wellbeing

Safety and wellbeing of the surveyors was of utmost importance. Volunteers were fully briefed and made aware of the risks and precautions prior to the surveys. If on a launch, lifejackets with lifejacket lights were worn. If walking near to water, land –based survey teams also wore life jackets. Teams had to check in the the coordinator regularly and at the end of the survey. The risk of exposure to the cold was also emphasised and teams were advised to dress warm as well as make use of the hand warmers that were provided.

7. Results

Maps are included in Appendix A. To summarise, the following table and pie chart show how many readings were of a certain value of magnitudes per square arcsecond:

More than 21	55
20-21	332
Less than 20	53



The darkest areas were around the Hickling Broad and Heigham Holmes area as well as between Beccles and Bungay on the river Waveney.

Around 20 survey points were not completed either because there were missed on the night, or it was deemed to dangerous to walk to the readings at night.

8. Conclusion

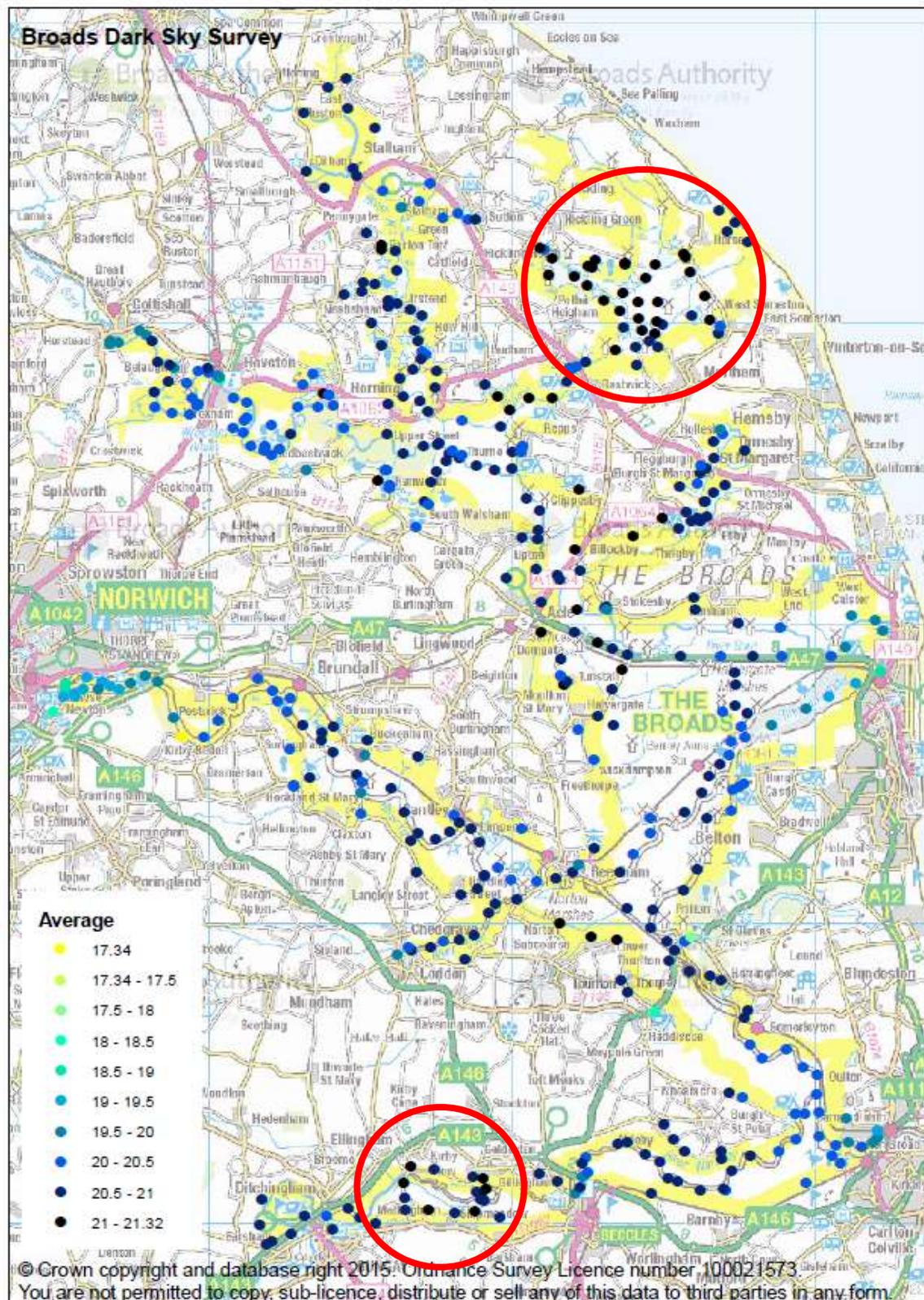
To be considered a dark sky of sufficient quality by the International Dark Sky Association, values of 20 magnitudes per arc second must be achieved. The Broads therefore has areas of intrinsically dark skies. There is justification for tackling light pollution in the Local Plan.

The readings imply that the Authority could seek to be awarded Dark Sky Status. The actual category (Park or Reserve) and level (gold, silver, bronze) would be understood through detailed conversations with the International Dark Skies Association¹.

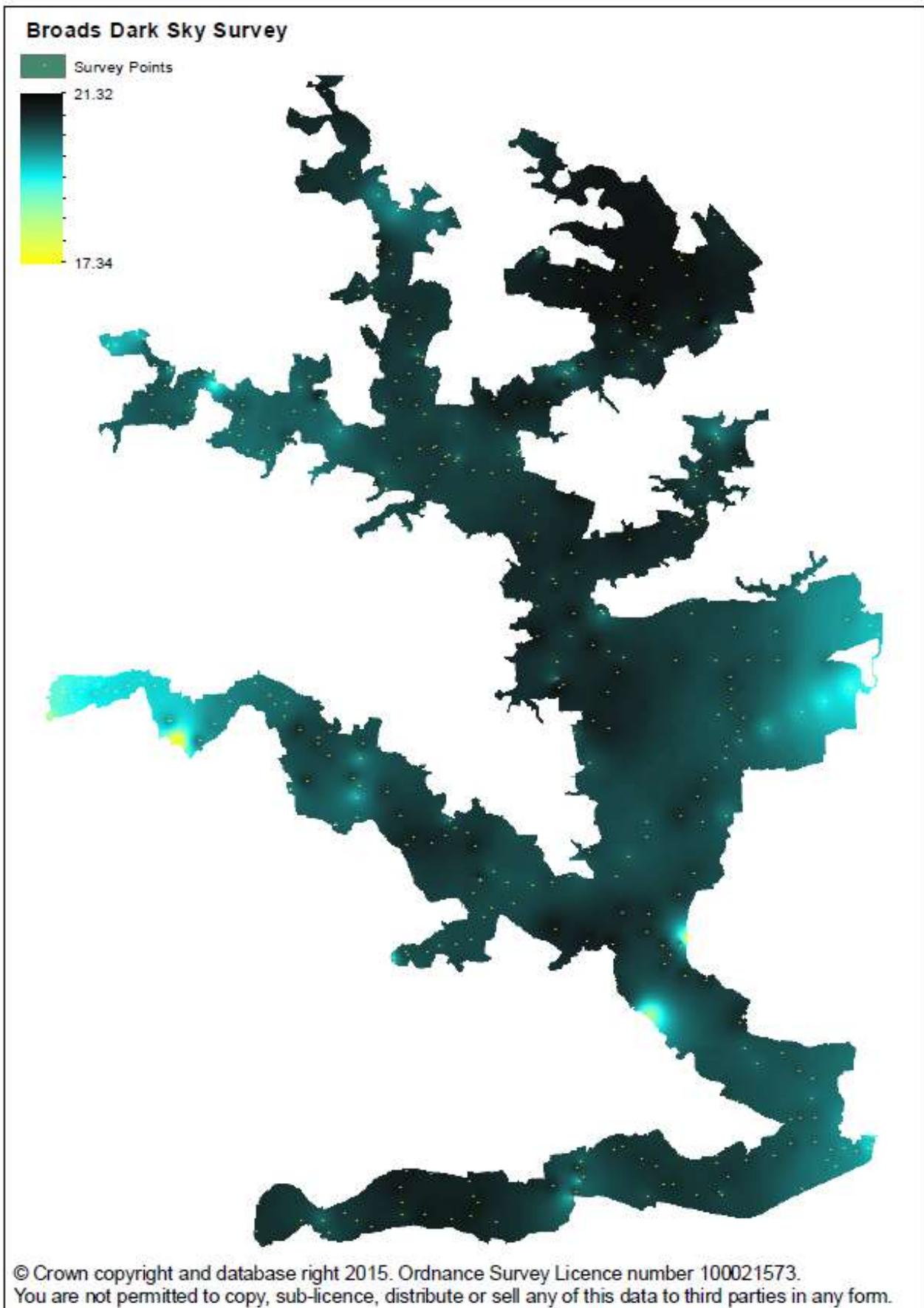
¹ <http://darksky.org/idsp/become-a-dark-sky-place/>

Appendix A: Maps displaying results of Dark Skies Survey

Map 1: This map shows the survey result for each of the survey points. The darker the colour, the greater the value and the darker the sky. The red circles show the darkets areas around Hickling and Heigham Holmes and between Beccles and Bungay.



Map 2: This map uses GIS software to predict the values of the areas between the survey points. The darker the colour, the greater the value and the darker the sky.



Map 3: This map shows the points with a value of 21 Magnitudes per Arc Second.

