OCCUPATIONAL AND ENVIRONMENTAL MEDICINE WING

NOISE AND VIBRATION DIVISION

Report: OEM/04/14 Dated January 2014

A REPORT ON AN ENVIRONMENTAL NOISE SURVEY
OF AIRCRAFT ACTIVITY AT RAF BRIZE NORTON

Approved for publication

[redacted]
Head of the
Noise and Vibration Division

Date

Copy Number:

CONDITIONS OF RELEASE

OCCUPATIONAL AND ENVIRONMENTAL MEDICINE WING
NOISE AND VIBRATION DIVISION

ROYAL AIR FORCE CENTRE OF AVIATION MEDICINE

Report No: OEM/04/14

A REPORT ON AN ENVIRONMENTAL NOISE SURVEY OF AIRCRAFT ACTIVITY AT RAF BRIZE NORTON

EXECUTIVE SUMMARY

1. The Noise and Vibration Division was tasked by [redacted], OC Airfield Wing, RAF Brize Norton to carry out a Noise Amelioration Scheme (Military) assessment of aircraft activity at RAF Brize Norton.

2. Brize Norton is the transport and air-to-air refuelling hub of the RAF. The C-17A, Tristar, Voyager and C130J propeller transport aircraft currently operate out of this base.

3. Aircraft Movement numbers were collected for the period 01 Jun 11 to 01 Jul 12 and 01 Oct 13 to 30 Oct 13. Engine ground runs information was also collected for the period 01 Jun 11 to 01 Jul 12 and 01 Sep 13 to 30 Oct 13.

4. Information was gathered from Air Traffic Control and Operations Wing regarding aircraft movements and aircraft ground running respectively. From this information Average Daily Movement figures for each aircraft type and average daily ground running durations for each aircraft type for each location were calculated.

5. Using the Federal Aviation Administration's Integrated Noise Model, 16-hour L_{Aeq} noise contours were produced. These contours were reviewed by the Defence Safety and Environment Authority and administrative adjustments made to extend the noise contour in specific areas.

6. It is recommended that the administrative adjusted 72, 66 and 63 dB $L_{Aeq,16hr}$ contours should be used as the basis for the Noise Amelioration Scheme (Military) at RAF Brize Norton.

7. The unadjusted noise contours and adjusted contours are presented alongside details of the adjustments made.

DISTRIBUTION LIST

[redacted]

*Electronic copy

CONTENTS

SECTION	PAGES
Introduction	1
Background	1
Relevant Legislation	1
Flight Data Collection	2
Movements Review	2
Engine Ground Runs	3
Analysis	5
Assumptions	6
Results	6
Recommendations	6
Acknowledgements	6
References	7

ANNEXES

A. Unadjusted $L_{Aeq,16hr}$ Contours	A-1
B. Adjusted $L_{Aeq,16hr}$ Contours	B-1
C. Details of Administrative Adjustments	C-1

OCCUPATIONAL AND ENVIRONMENTAL MEDICINE WING

NOISE AND VIBRATION DIVISION

ROYAL AIR FORCE CENTRE OF AVIATION MEDICINE

Report No: OEM/04/14

A REPORT ON AN ENVIRONMENTAL NOISE SURVEY OF AIRCRAFT ACTIVITY AT RAF BRIZE NORTON

Author: [redacted]

INTRODUCTION

1. The Noise and Vibration Division was tasked by [redacted], OC Airfield Wing, RAF Brize Norton to carry out a Noise Amelioration Scheme (Military) (NAS(M)) assessment, as detailed at Reference A, of aircraft activity at RAF Brize Norton.

BACKGROUND

2. RAF Brize Norton is situated in the district of West Oxfordshire. The nearest town is Carterton which is located adjacent to the station. The larger town of Witney is located to the North-East. RAF Brize Norton is also surrounded by a number of villages including Clanfield, Bampton, Black Bourton and Aston to the south, Minster Lovell to the north east and Kencot to the west.

3. RAF Brize Norton has one main runway designated 08/26 which is 3050m long and 60m wide. Due to prevailing meteorological conditions, the dominant aircraft movements take place on Runway 26 with an average 74% share of movements; Runway 08 has an average 26% share of movements.

4. The last environmental noise survey of RAF Brize Norton is detailed in Reference B.

RELEVANT LEGISLATION

5. The Secretary of State's policy statement on health, safety and environmental protection requires that adverse effects on the environment are minimised and where defence has exemptions derogations or disapplications from environmental protection legislation, departmental arrangements that produce outcomes that are so far as reasonably practicable, at least as good as those required by UK legislation. Defence is bound by the majority of environmental protection legislation applicable to environmental noise including those covering protected species and habitats. However, defence does have an exemption from elements of statutory nuisance in the Environmental Protection Act (1990); that exemption includes "noise emitted from premises so as to be prejudicial to health or nuisance". To meet Secretary of State's policy commitments to take all reasonable steps to minimise adverse effects from environmental noise and put in place arrangements that produce outcomes that are, so far as is reasonably practicable, at least as good as those required by legislation to manage the environmental noise produced by defence activities.

6. Reference B was written to satisfy Planning Policy Guidance 24 (Reference C). PPG24 uses similar but not identical noise levels to the NAS(M). PPG 24 has now been withdrawn and Reference D has partially replaced it.

7. Reference A details MOD Environmental Policy. With regards to Environmental Noise, in particular aircraft operations, the MOD has a Noise Amelioration Scheme (Military) (NAS(M)) which is introduced on an airfield by airfield basis. Its aim is to compensate those people living in the immediate vicinity of military airfields in the United Kingdom and who are affected by noise from the activity. NAS(M) is based on the following criteria:

a. Offer to purchase residential properties exposed to aircraft noise of 72 dB(A) $L_{Aeq,16hr}$ or more.
b. Offer to install an acoustic insulation package:
   i. For residential properties exposed to aircraft noise of 66 dB(A) $L_{Aeq,16hr}$
   ii. For noise sensitive areas such as schools/colleges, hospitals and care homes exposed to aircraft noise of 63 dB(A) $L_{Aeq,16hr}$

FLIGHT DATA COLLECTION

8. Information regarding aircraft performance, flight paths and flight variables were obtained from RAF Brize Norton Military Flight Information Publication document (MilFLIP) at Reference E and discussions with the relevant aircrew.

9. The airfields visual circuit direction is varied whenever possible and is flown 1500 ft above ground level.

MOVEMENTS REVIEW

10. RAF Brize Norton is operational for 365 days per year. Across all RAF flying stations the average number of flying days is 220 per annum. This average takes into account annual leave, weekends and public holidays. It does not take into account extended periods of poor weather, extended periods of aircraft unservicability or extended aircraft deployments away from the station. To be in line with other RAF stations, the total annual movement figures for each aircraft type are divided by 220 to produce the expected aircraft movements on an average flying day. This is known as the average daily movements (ADM) figure.

11. Modelled aircraft comprise 74% of total movements. Other aircraft comprise 26% of total movements. Of these other aircraft, 10% are rotary-wing, 1% are fast-jet and the remaining 15% are a mix of other fixed wing and light aircraft. Aircraft circuit manoeuvres require an ADM figure of 1.00 or above to allow input into the Federal Aviation Administration's Integrated Noise Model (INM), which was used to model noise contours. The 26% of visiting aircraft are not included because their individual manoeuvre frequencies are below this.

12. RAF Brize Norton Air Traffic Control (ATC) logs provided all station aircraft movement information. ATC logs also provided details of runway direction and usage. Table 1 shows the total calculated ADM numbers for the period 01 Jul 11 to 01 Jun 12. Table 2 shows the total calculated ADM numbers for the period 01 Oct 13 to 30 Oct 13. Table 3 shows the percentage change for each identifiable type.

Table 1 – Calculated Average Daily Movements for 01 Jul 11 to 01 Jun 12

Aircraft Type	Take-Off/ Landing	Roller / Overshoot
Boeing 757	1.29	<1.00
Boeing 767	1.81	<1.00
Airbus A300	2.49	<1.00
Airbus A330*	3.55	<1.00
Hercules C130J/K	17.41	14.84
C17A	5.27	4.19
Tristar	5.04	4.06
Piper PA-28	3.99	<1.00
VC10	3.03	2.28

*Includes both chartered A330 aircraft and RAF Voyager aircraft

Table 2 – Average Daily Movements for 01 Sep 13 to 30 Oct 13

Aircraft Type	Take-Off/ Landing	Roller / Overshoot
Boeing 757	No Change	No Change
Boeing 767	No Change	No Change
Airbus A300	No Change	No Change
Airbus A330*	8.6	1.36
C17A	No Change	No Change
Tristar	No Change	No Change
Piper PA-28	No Change	No Change
Hercules C130J	11.23	9.92
VC10	Retired	Retired

*Includes both chartered A330 aircraft and RAF Voyager aircraft

Table 3 – Percentage Change in Average Daily Movement Figures

Aircraft Type	Take-Off/ Landing Percentage change	Roller / Overshoot Percentage Change
Boeing 757	No Change	No Change
Boeing 767	No Change	No Change
Airbus A300	No Change	No Change
Airbus A330*	+145.71%	+100%
C17A	No Change	No Change
Tristar	No Change	No Change
Piper PA-28	No Change	No Change
Hercules C130J	-35.49%	-33.15%
VC10	Retired (-100.00%)	Retired (-100.00%)

*Includes both chartered A330 aircraft and RAF Voyager aircraft

13. When an aircraft is going to perform an overshoot or roller it approaches the airfield as if it is going to land. Overshoots are performed when an aircraft enters the landing pattern and continues straight down the line of the runway before climbing again into the circuit. A roller is similar however it involves the aircraft touching its wheels onto the ground and rolling down the runway before accelerating and climbing again into the circuit. Therefore all circuit manoeuvres are modelled as rollers as it is the worst case scenario for noise.

ENGINE GROUND RUNS

14. RAF Brize Norton Airfield Wing provided information regarding engine ground running for the period of 01 Jul 11 to 01 Jun 12 and 01 Sep 13 to 30 Oct 13. The annual total duration for different engine settings for each aircraft type was calculated for each ground running location. These durations were divided by 220 to calculate average daily engine ground run duration for each aircraft type at each power setting at each engine ground run location.

15. Table 4 shows a summary of the total duration of engine ground running per aircraft type across all ground running locations during the period of 01 Jul 11 to 01 Jun 12. Table 5 shows a summary of the total duration of engine ground running per aircraft type across all ground running locations for the period of 01 Sep 13 to 30 Oct 13. Table 6 shows the percentage change of annual daily ground running duration for each aircraft.

Table 4 – Average Daily Ground Running Durations for 01 Jul 11 to 01 Jun 12

Aircraft Type	Average Daily Duration (mm:ss)
Boeing 757	00:12
Boeing 767	00:08
Airbus A300	No Data Available
Airbus A330*	01:21
Hercules C130J	69:24
C17A	16:19
Tristar	10:37
Piper PA-28	No Data Available
VC10	19:06

*Includes both chartered A330 aircraft and RAF Voyager aircraft

Table 5 –Average Daily Ground Running Durations for 01 Sep 13 to 30 Oct 13

Aircraft Type	Average Daily Duration (mm:ss)
Boeing 757	No Change
Boeing 767	No Change
Airbus A300	No Data Available
Airbus A330*	03:48
Hercules C130J	112:13
C17A	60:53
Tristar	34:08
Piper PA-28	No Data Available
VC10	Retired

*Includes both chartered A330 aircraft and RAF Voyager aircraft

Table 6 – Percentage Change Average Daily Ground Running Durations for Each Aircraft Type

Aircraft Type	Average Daily Duration Percentage Change (mm:ss)
Boeing 757	No Change
Boeing 767	No Change
Airbus A300	No Data Available
Airbus A330*	+187.60%
Hercules C130J	+61.94%
C17A	+273.87%
Tristar	+228.64%
Piper PA-28	No Data Available
VC10	Retired (-100.00%)

*Includes both chartered A330 aircraft and RAF Voyager aircraft

ANALYSIS

16. INM is an internationally recognised noise prediction package and is used extensively within the UK for civil/commercial aircraft operations. INM 7 is the latest version which allows a 3 dimensional geometric model to be constructed including the runway, flight tracks, ground heights and receiver. Aircraft noise models work by taking a core data set of aircraft Noise-Power-Distance source noise levels and then predicting the noise impacts beneath the flight track using the flight profiles of the aircraft.

17. Information regarding aircraft performance, flight paths and flight variables of aircraft based at RAF Brize Norton were obtained from Reference F and Reference G, supported by discussions with the aircrew of each aircraft type. For modelled visiting aircraft the standard information regarding aircraft performance and flight variables built into INM were used.

18. Administrative adjustments are extensions of the noise contours intended to smooth regions of the contour where there are significant variations in noise levels in small areas. Where the noise contour passes through areas of housing or near to noise sensitive buildings (i.e. schools, nursing homes, hospitals etc.) then an administrative adjustment will be made to extend the noise contour to a natural break (such as a road, river or empty land etc.) An administrative adjustment always extends the area covered by the contour. Administrative adjustments are made by the Defence Safety and Environment Authority.

ASSUMPTIONS

19. All departing aircraft have been modelled as using standard instrument departures (SIDs) as published in Reference F. The percentage usage split of each SID is not recorded therefore it was assumed that each SID was used equally. All approaching aircraft are modelled as having taken either the published precision approach procedure or the category A/B Instrument Landing System approach with an equal split between the two.

RESULTS

20. Annex A presents the 72, 66 and 63 dB $L_{Aeq,16hr}$ unadjusted noise contours. This is the direct output from INM. The contours consider noise from aircraft only; it may be that in any particular area there may be other noise sources such as busy roads, railway lines etc that dominate the noise environment.

21. Annex B presents the 72, 66 and 63 dB $L_{Aeq,16hr}$ administrative adjusted noise contours. The contours consider noise from aircraft only; It may be that in any particular area there may be other noise sources such as busy roads, railway lines etc that dominate the noise environment.

22. Annex C contains enlargement of the areas covered by administrative adjustments. The contours were reviewed by the Defence Safety and Environment Authority.

RECOMMENDATIONS

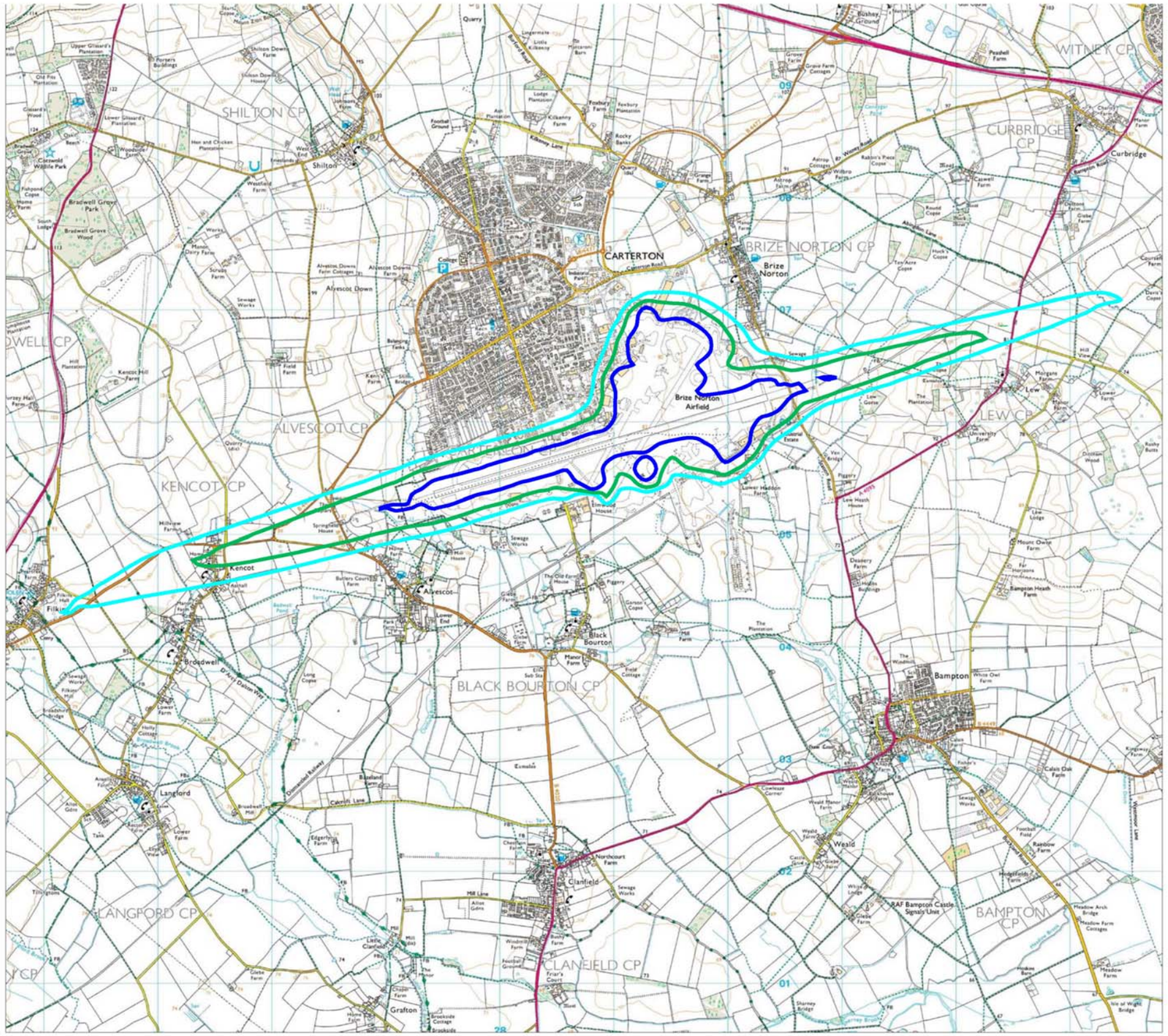
23. It is recommended that the 72, 66 and 63 dB $L_{Aeq,16hr}$ administrative adjusted noise contours detailed at Annex B, should be used as the basis for the NAS(M) at RAF Brize Norton.

ACKNOWLEDGEMENTS

24. The Noise and Vibration Division would like to thank the personnel of RAF Brize Norton who contributed information, in particular Brize Norton Airfield Wing, who assisted with data collection that enabled the production of the contours.

REFERENCES

A. JSP 418, Volume 2, Leaflet 04.1. Dated June 2010.
B. Predicted Environmental Noise Impact Resulting from RAF Brize Norton Aircraft Operations. RAF CAM Report No. OEM/117/06 dated 21 Nov 06.
C. Planning Policy Guidance: Planning and Noise. PPG 24. Department of the Environment, dated Sep 94.
D. Noise Policy Statement for England. Department of Environment, Food and Rural Affairs, dated 15 Mar 10.
E. MilFLIP No 1 AIDU Flight Information Publication issue 49, December 13.
F. RAF Brize Norton Air Orders, Edition 5.
G. Brize Norton Aerodrome Booklet. No. 1 AIDU Flight Information Publication, 18 Oct 12.



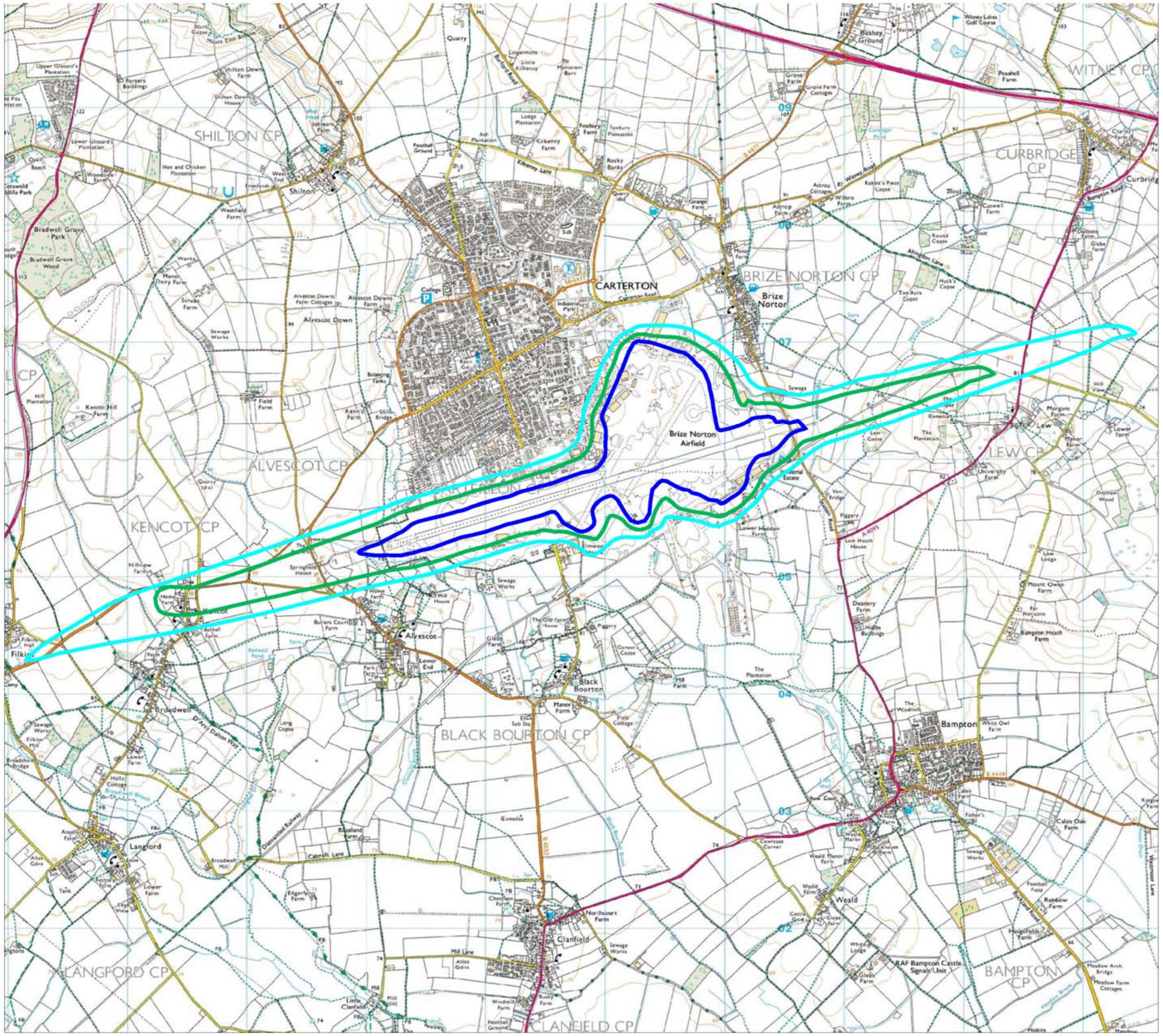
KEY

- BZN 72dB $L_{Aeq,\ 16h}$ Contour.
- BZN 66dB $L_{Aeq,\ 16h}$ Contour.
- BZN 63dB $L_{Aeq,\ 16h}$ Contour.

RAF CENTRE OF AVIATION MEDICINE
NOISE AND VIBRATION DIVISION

[redacted]

PROJECT	RAF Brize Norton
TITLE	LAeq,16 Hour Noise Contour without Administrative Adjustments
DRAWING NUMBER	1
DRAWN BY	[redacted]
DATE	29.01.2014
REVISION	1
CAD FILE	BZN Scaled Unadjusted.dwg
CAN FILE REFERNCE	0409100905
CLASSIFICATION	None



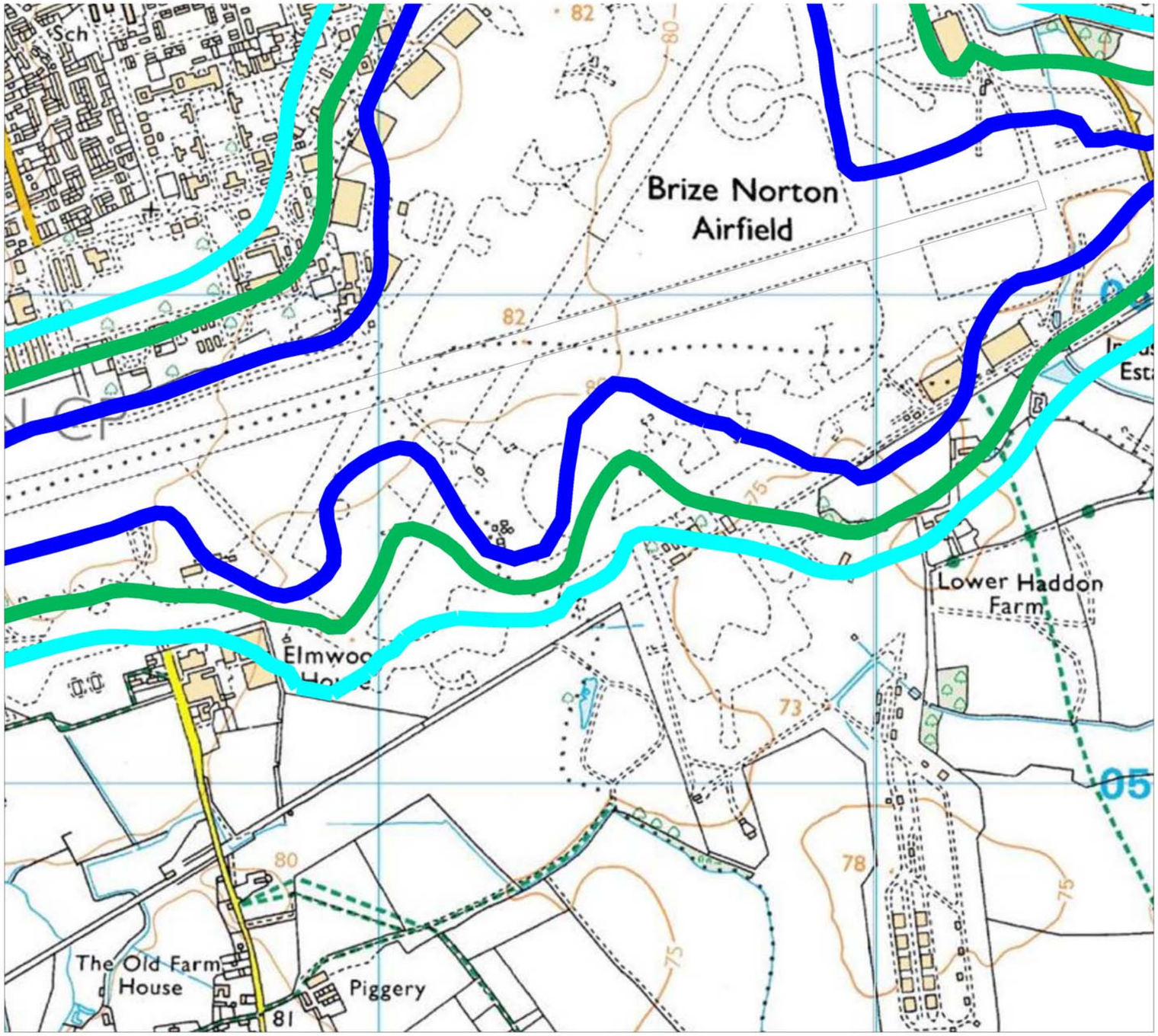
KEY

- BZN 72dB $L_{Aeq,16h}$ Contour.
- BZN 66dB $L_{Aeq,16h}$ Contour.
- BZN 63dB $L_{Aeq,16h}$ Contour.

RAF CENTRE OF AVIATION MEDICINE
NOISE AND VIBRATION DIVISION

[redacted]

PROJECT RAF Brize Norton	
TITLE LAeq,16 Hour Noise Contour with Administrative Adjustments	
DRAWING NUMBER 1	**DRAWN BY** [redacted]
DATE 29.01.2014	**REVISION** 1
CAD FILE BZN Scaled adjusted.dwg	
CAM FILE REFERENCE 0409100905	
CLASSIFICATION None	

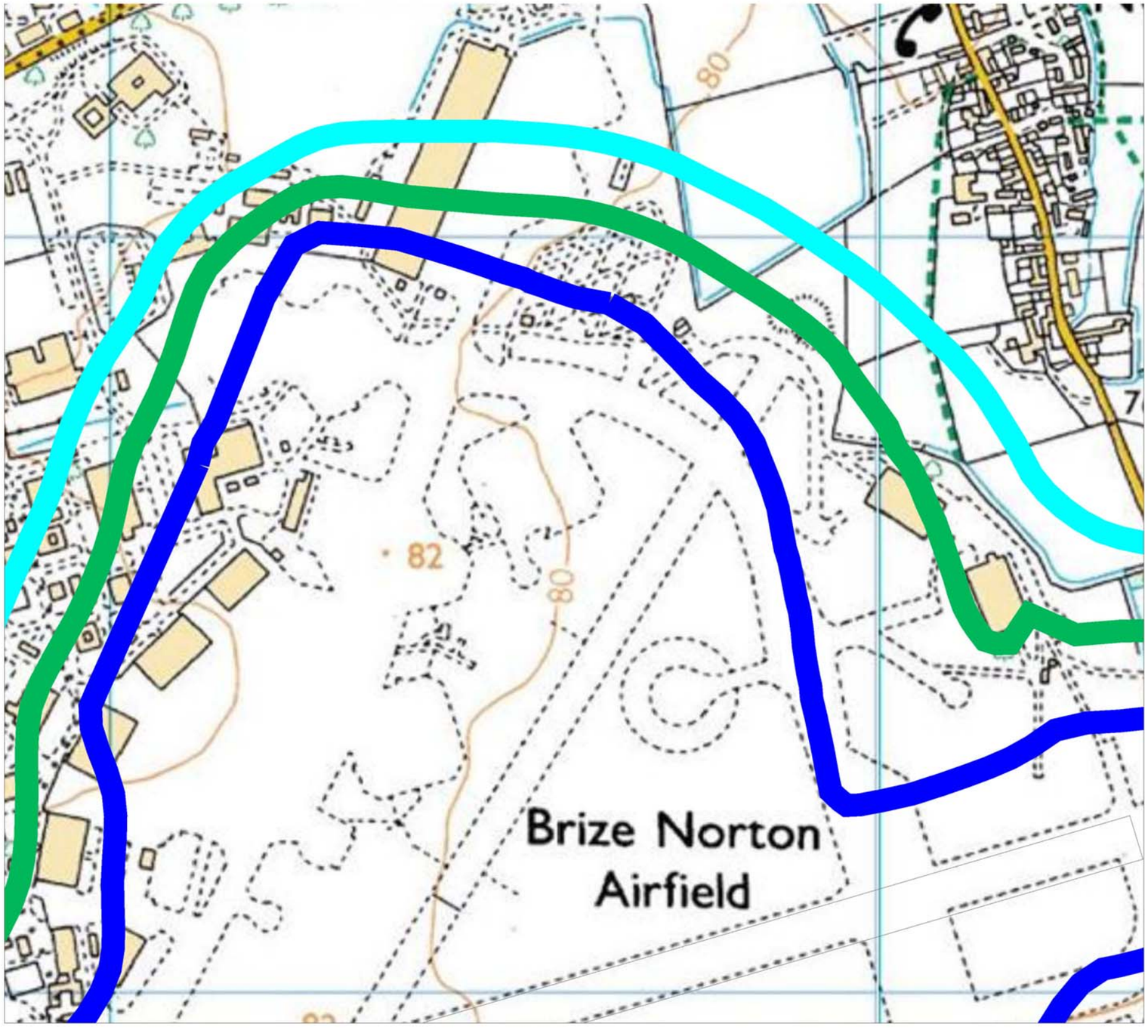


KEY

- BZN 72dB $L_{Aeq,\ 16h}$ Contour.
- BZN 66dB $L_{Aeq,\ 16h}$ Contour.
- BZN 63dB $L_{Aeq,\ 16h}$ Contour.

RAF CENTRE OF AVIATION MEDICINE
NOISE AND VIBRATION DIVISION
[redacted]

PROJECT	RAF Brize Norton
TITLE	LAeq,16 Hour Noise Contour with Administrative Adjustments-South EGR Locations
DRAWING NUMBER	1
DRAWN BY	[redacted]
DATE	29.01.2014
REVISION	1
CAD FILE	BZN Scaled adjusted.dwg
CAM FILE REFERENCE	0409100905
CLASSIFICATION	None

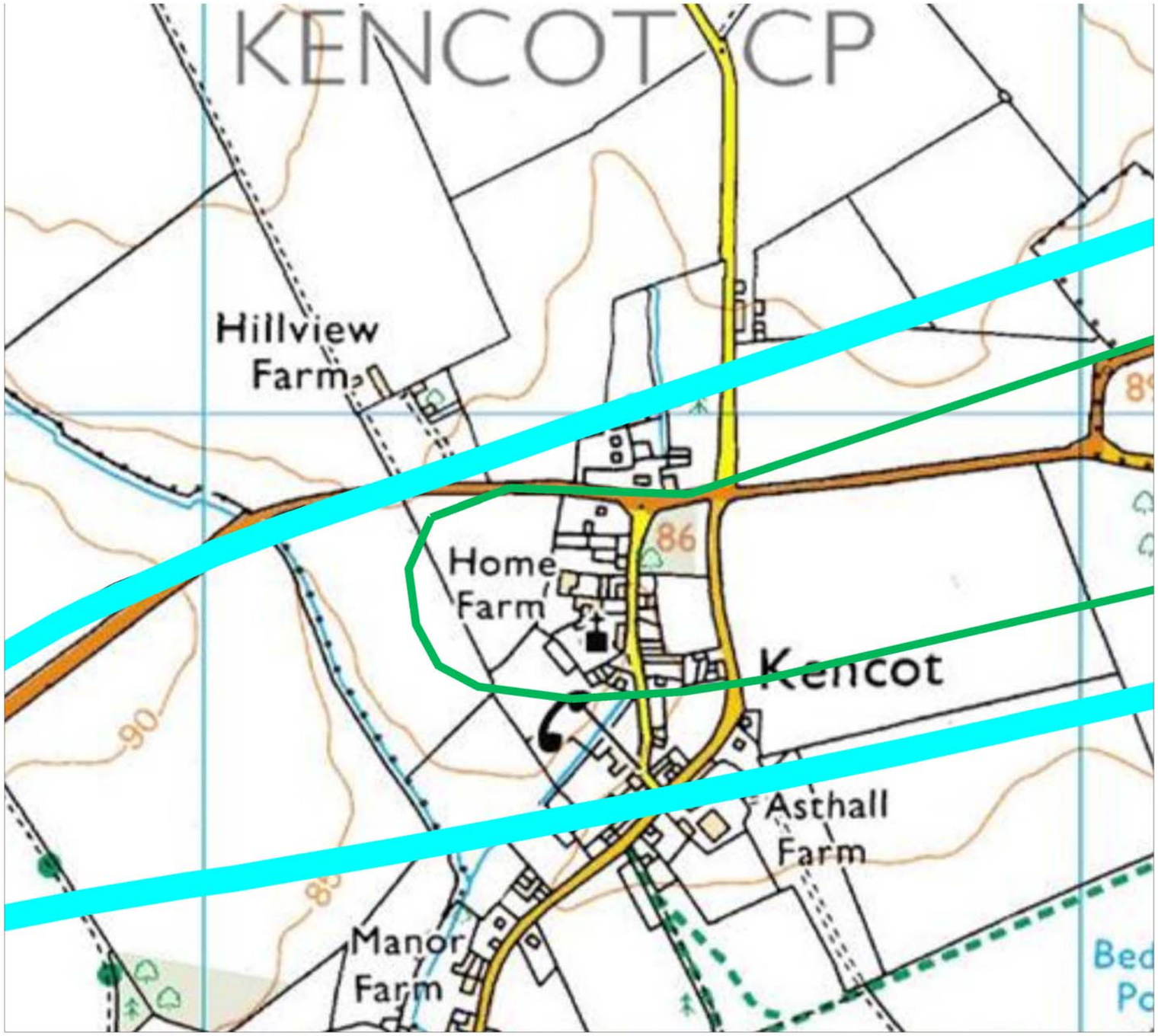


KEY

- BZN 72dB $L_{Aeq,\ 16h}$ Contour.
- BZN 66dB $L_{Aeq,\ 16h}$ Contour.
- BZN 63dB $L_{Aeq,\ 16h}$ Contour.

RAF CENTRE OF AVIATION MEDICINE
NOISE AND VIBRATION DIVISION
[redacted]

PROJECT	RAF Brize Norton
TITLE	LAeq,16 Hour Noise Contour with Administrative Adjustments-North EGR Locations
DRAWING NUMBER	1
DRAWN BY	[redacted]
DATE	29.01.2014
REVISION	1
CAD FILE	BZN Scaled adjusted.dwg
CAM FILE REFERENCE	0409100905
CLASSIFICATION	None

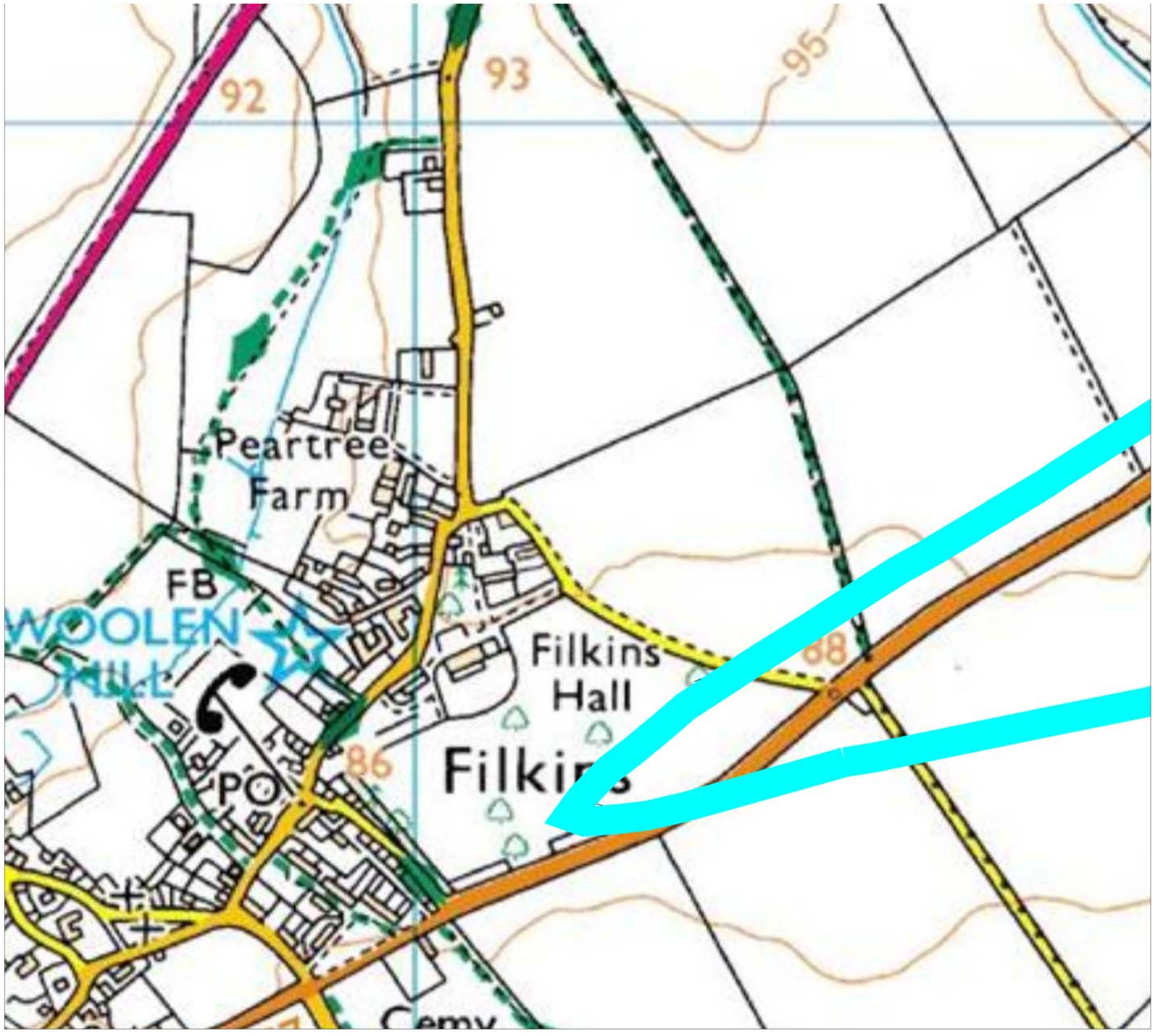


KEY

- BZN 72dB $L_{Aeq,\ 16h}$ Contour.
- BZN 66dB $L_{Aeq,\ 16h}$ Contour.
- BZN 63dB $L_{Aeq,\ 16h}$ Contour.

RAF CENTRE OF AVIATION MEDICINE
NOISE AND VIBRATION DIVISION
[redacted]

PROJECT	RAF Brize Norton
TITLE	LAeq,16 Hour Noise Contour with Administrative Adjustments-Kencot
DRAWING NUMBER: 1	DRAWN BY: [redacted]
DATE: 29.01.2014	REVISION: 1
CAD FILE	BZN Scaled adjusted.dwg
CAM FILE REFERENCE	0409100905
CLASSIFICATION	None

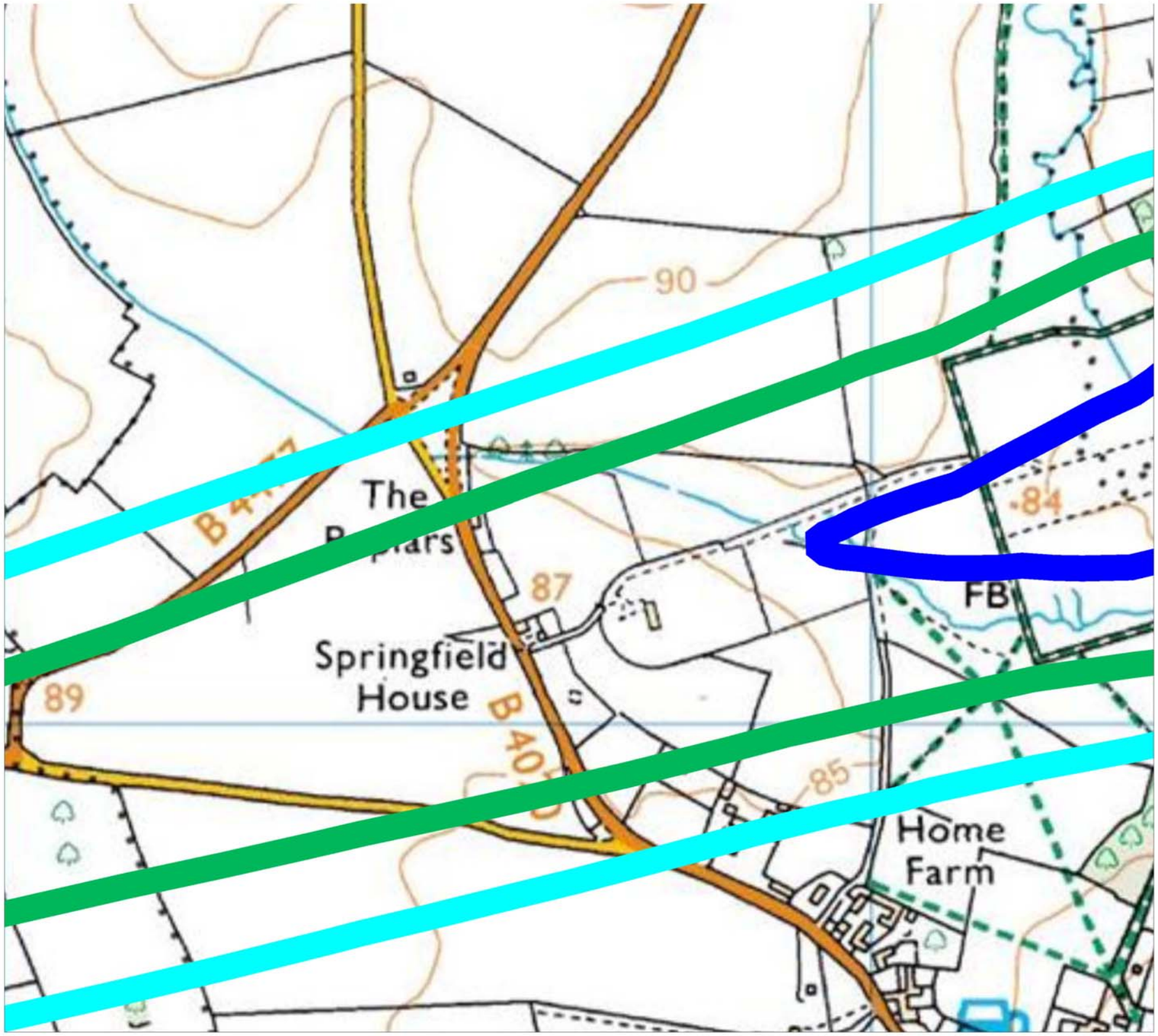


KEY

- BZN 72dB $L_{Aeq,\ 16h}$ Contour.
- BZN 66dB $L_{Aeq,\ 16h}$ Contour.
- BZN 63dB $L_{Aeq,\ 16h}$ Contour.

RAF CENTRE OF AVIATION MEDICINE
NOISE AND VIBRATION DIVISION
[redacted]

PROJECT	RAF Brize Norton
TITLE	LAeq,16 Hour Noise Contour with Administrative Adjustments-Filkins
DRAWING NUMBER	1
DRAWN BY	[redacted]
DATE	29.01.2014
REVISION	1
CAD FILE	BZN Scaled adjusted.dwg
CAM FILE REFERENCE	0409100905
CLASSIFICATION	None



KEY

- BZN 72dB $L_{Aeq,\ 16h}$ Contour.
- BZN 66dB $L_{Aeq,\ 16h}$ Contour.
- BZN 63dB $L_{Aeq,\ 16h}$ Contour.

RAF CENTRE OF AVIATION MEDICINE
NOISE AND VIBRATION DIVISION
[redacted]

PROJECT	RAF Brize Norton
TITLE	LAeq,16 Hour Noise Contour with Administrative Adjustments-08 Rwy End
DRAWING NUMBER: 1	DRAWN BY: [redacted]
DATE: 29.01.2014	REVISION: 1
CAD FILE	BZN Scaled adjusted.dwg
CAM FILE REFERENCE	0409100905
CLASSIFICATION	None