Easter Coltfield

APPENDIX ONE

MASTERPLAN

Tulloch
OF CUMMINGSTON LTD
For homes of Distinction

Easter Coltfield

MASTERPLAN

SCALE - 1:500

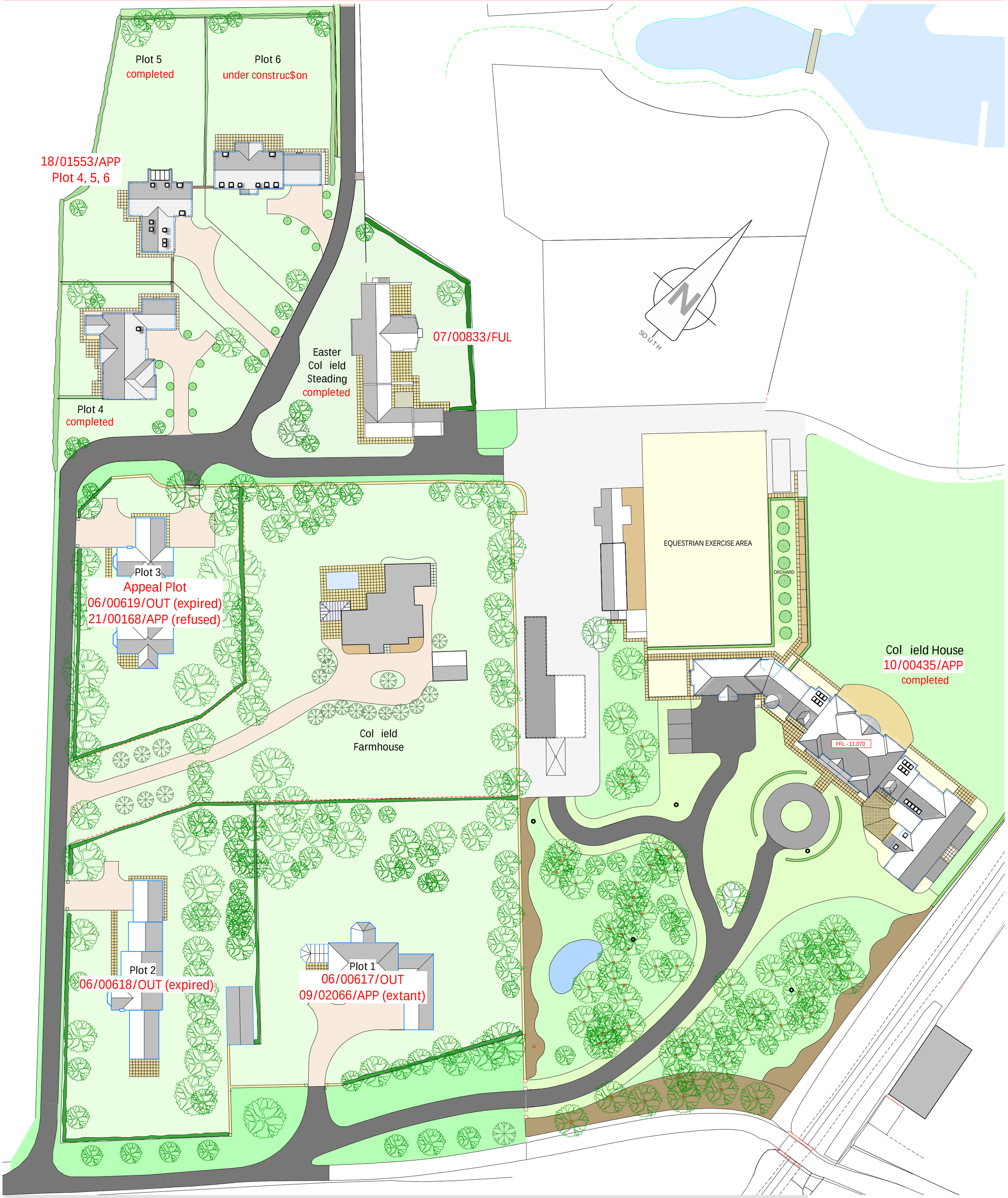
Tulloch of Cummingston Ltd
For homes of Distinction

t - (01343) 835600 f - (01343) 835700
e - reception@tullochofcummingston.co.uk
web - www.tullochofcummingston.co.uk

APPENDIX TWO

PLANNING HISTORY

Easter Coltfield



PLANNING HISTORY

SCALE - 1:500

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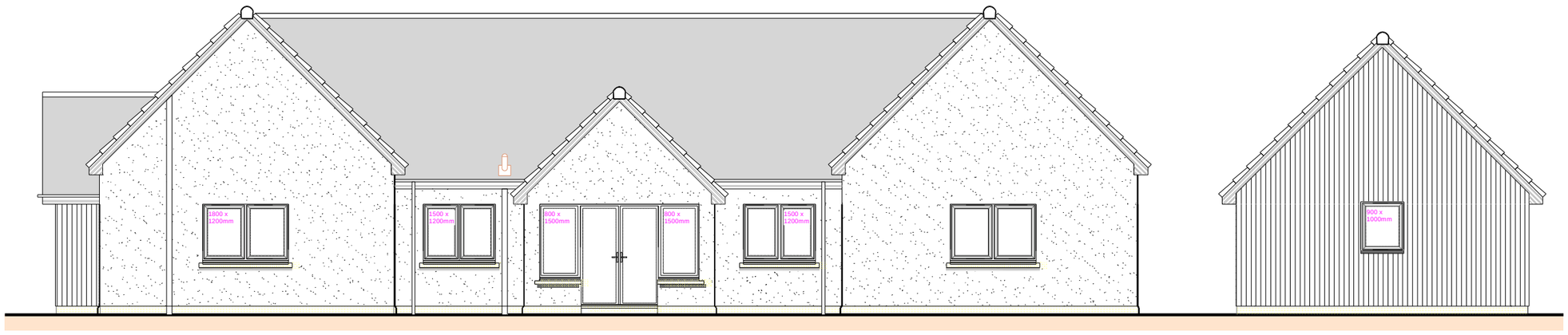
Easter Coltfield

APPENDIX THREE

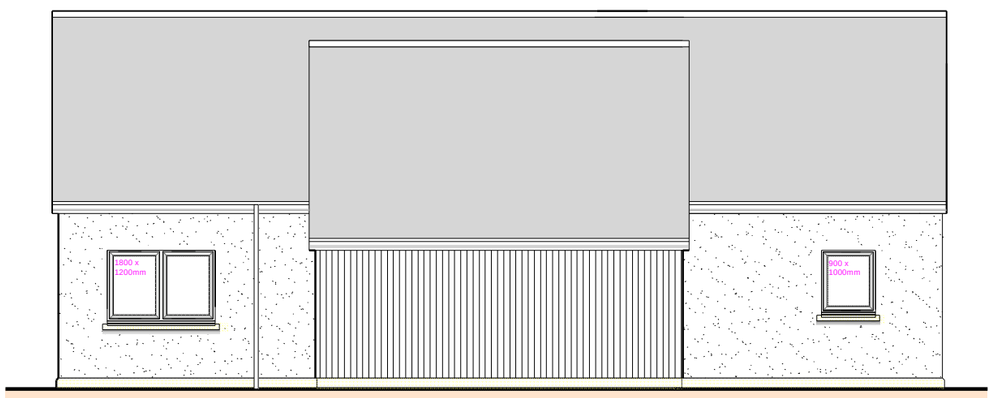
PLANNING SUBMISSION DOCUMENTS

E a s t e r C o l t f i e l d

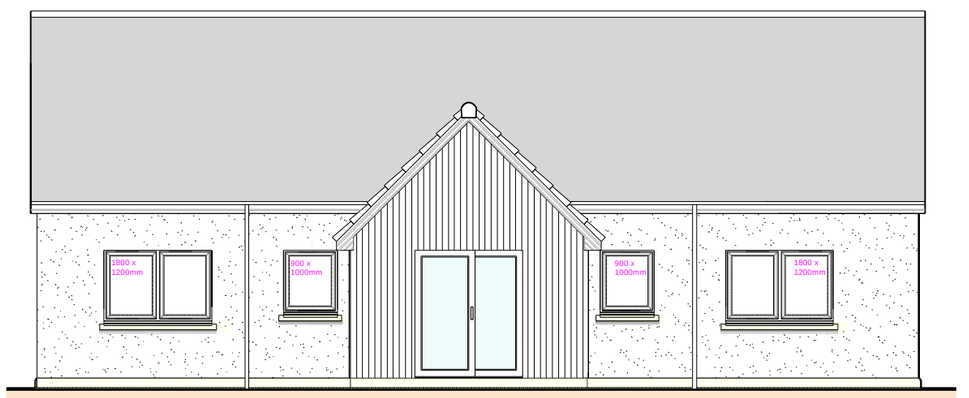
FRONT ELEVATION



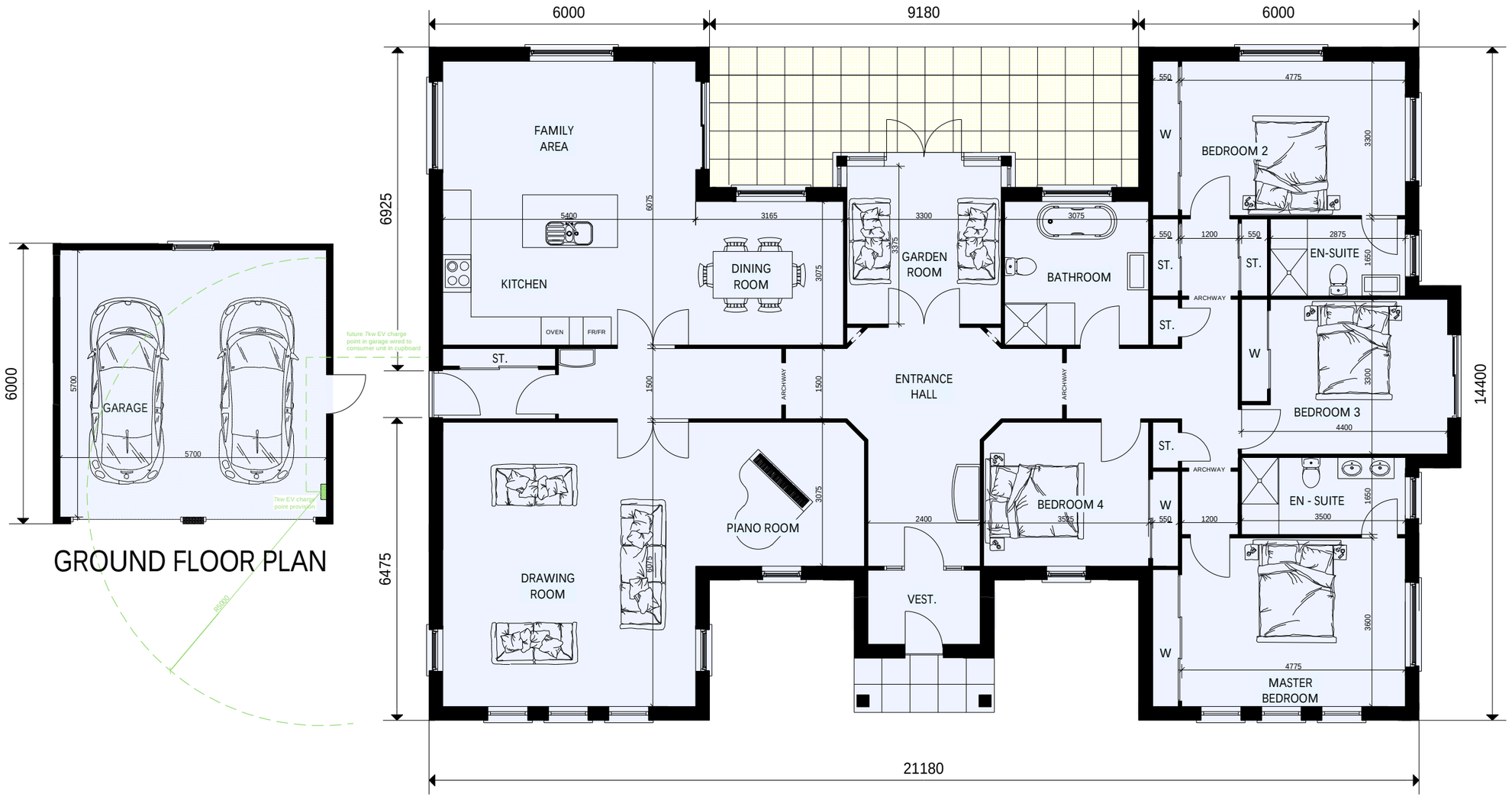
REAR ELEVATION



SIDE ELEVATION



SIDE ELEVATION



GROUND FLOOR PLAN

PLANNING SUBMISSION DOCUMENTS
FLOORPLAN & ELEVATIONS 1:100

MATERIALS (AS PER OTHER BUILDS ON THE DEVELOPMENT):
- NATURAL SLATE
- SANDSTONE
- BROWN/BUFF ROUGHCAST
- VERTICAL TIMBER LININGS
- IRISH OAK WINDOWS
- GREY COMPOSITE DOOR
- GREY FASCIA/SOFFITS
- BLACK GUTTERS/DOWNPIPES

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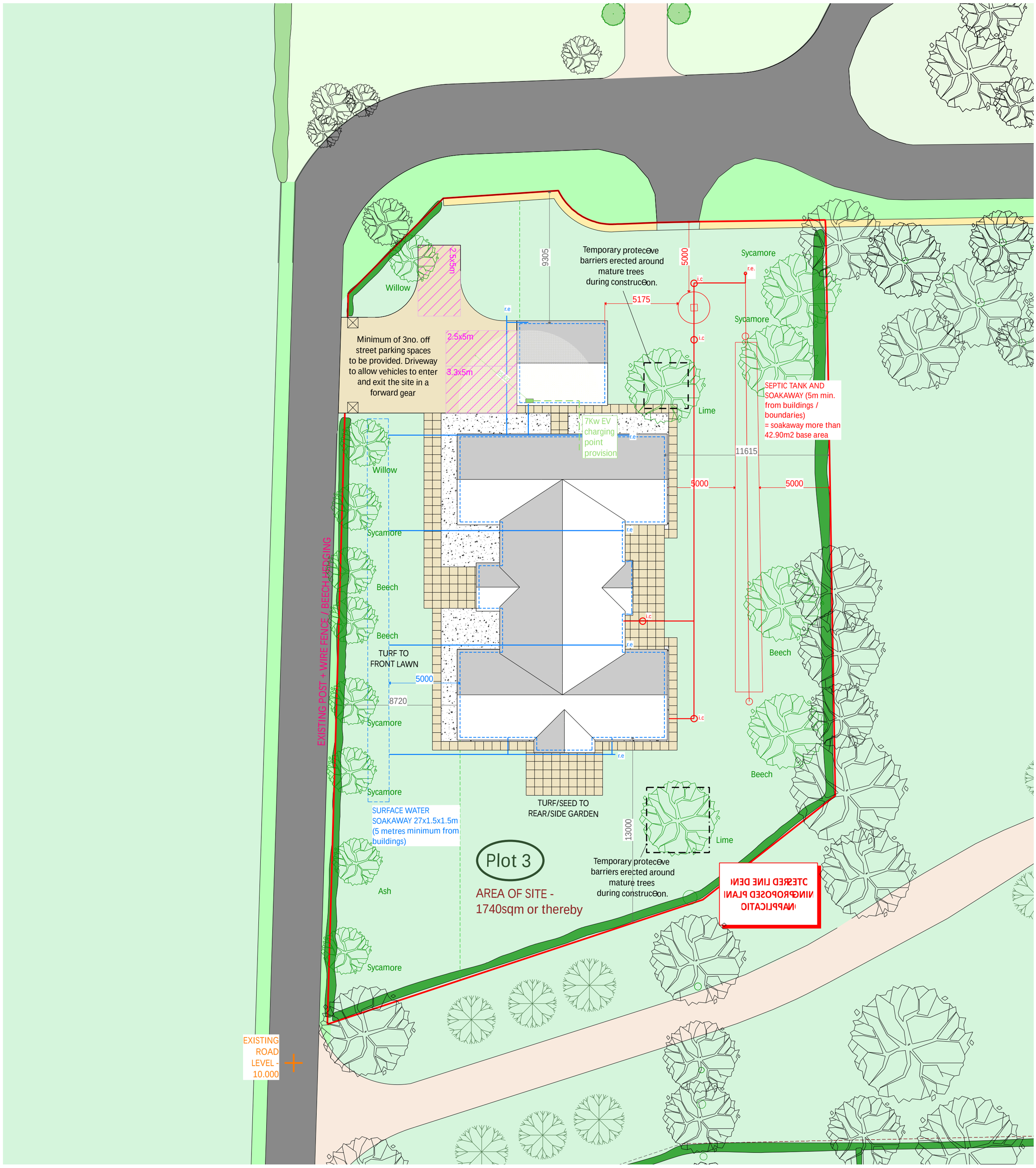
E a s t e r C o l t f i e l d



PLANNING SUBMISSION DOCUMENTS
SITE PLAN 1:200

Tulloch OF CUMMINGSTON LTD
For homes of Distinction

t - (01343) 835600 f - (01343) 835700
e - reception@tullochofcummingston.co.uk
web - www.tullochofcummingston.co.uk

Easter Coltfield

APPENDIX FOUR

SITE INVESTIGATION

Tulloch
OF CUMMINGSTON LTD
For homes of Distinction

Gary Mackintosh
Email: gmcsurveys@gmail.com
Tel: 07557431702

gmcsurveys

Surveys, Setting-Out Civil Engineering Design

Site Investigation & Drainage Assessment

EASTER COLTFIELD

Gary Mackintosh Bsc
gmcsurveys@gmail.com

Contents

Client:

Tulloch of Cumminston

Site Address:

Plot 3
Easter Coltfield
Elgin

Planning Reference:

TBC

Date:

8th February 2021

Job Number:

0807

Company Information:

Assessment completed by:

Gary Mackintosh Bsc
GMCSurveys
34 Castle Street
Forres
Moray
IV36 1PW
Email: gmcsurveys@gmail.com
Telephone: 07557431702

Site Description:

The proposals are to erect a new 4bed private dwelling and associated infrastructure within Plot 3, Located at Easter Coltfiled, By Elgin.

The SEPA flood maps have been consulted which indicate that the site lies within an area of pluvial flood risk during a 1:200year event. Based on the mapping flooding occurs adjacent to the existing access track to the south west of the proposed site. Based on this, it is recommended that any surface water system installed should be sized to manage flows up to and including a 1:200year event with 35%allowance for climate change to ensure that the proposals have no detrimental impact on the area.

GMC Surveys were asked to carry out a site investigation to provide a drainage solution for the proposed development.

Soil Conditions:

Excavations were carried out using a mechanical digger on 4th February 2021 to assess the existing ground conditions and carry out infiltration and percolation testing for the dispersal of foul and surface waters via soakaways.

The trial pits were excavated to depths of 2.0m. The pits were left open and no ground water was encountered.

The excavations provided existing ground conditions of 300 - 450mm Topsoil with many roots, dark brown and light brown intermixed fine sands with some gravels used as fill material within the site to a depth ranging from 450mm –1500mmbgl overlying light brown, medium dense, slightly silty Sands proved to the depth of the excavations.

The trial pits were left open and there was no evidence of ground water or contamination within the trial pits.

Percolation/Soakaway Testing:

Percolation testing was carried out in full accordance with BS6297: 2007 + A1: 2008 and as described in Section 3.9 of the Scottish Building Standards Technical Handbook (Domestic). The results can be found in the table below.

	1st	2nd	3rd	Mean
Date of Test	04/02/21	04/02/21	04/02/21	
TP1	2400s	3720s	4380s	3500s
TP2	4320s	5340s	5580s	5080s
Average Soil Vp				28.60s/mm

Infiltration testing:

Infiltration testing was carried out in full accordance with BRE digest 365. The results can be found in the table below.

Infiltration Test	Pit Dimensions (w/l)	Test Zone (mbgl)	Infiltration Rate (m/s)
INF01	1.0mx 1.0m	1.0 - 1.8	1.652 x 10-5

Conclusion and Recommendations:

Based on the onsite investigations it can be confirmed that the underlying soils are suitable for the use of standard stonefilled soakaways as a drainage solution for both foul and surface waters.

The Vp rate is above the maximum threshold of 15s/mm therefore a 'Standard Septic Tank' would be suitable, the final details of which are to be confirmed by the chosen supplier.

Foul Water Discharge via Soakaway:

The proposals are for a 4bed property therefore the foul water soakaway dimensions can be established as:

Soil Percolation Value –28.60s/mm

No of Persons (4bed) –6

Min Base Area (A=Vp x PE x 0.25) = 42.90m^2

This can be provided with dimensions of 11.00m x 4.0m x 0.45m below the invert level of the pipe. The soakaway dimensions may be altered to provide a better fit within the plot ensuring that the base area of 42.90m^2 is maintained.

Surface Water Dispersal via Soakaway:

Please see attached surface water calculations detailing the requirement and suitability for soakaway dimensions of 27.0m x 1.5m at a depth of 1.5m below the invert level based on the proposed contributing area of 400m^2 (new roof area with extra over for hard standing) up to and including a 1:200 year event with 35% allowance for climate change.

The proposed soakaway has been designed to accommodate flows up to and including a 1:200year event with 35% allowance for climate change to ensure the surrounding flood risk areas are not impacted by the proposed development.

Soakaway Details can be found in Appendix A.

SEPA and Building Regulations require that infiltration systems (soakaways) are located at least:

- 50m from any spring, well or borehole used as drinking water supply
- 10m horizontally from any water course and any inland and coastal waters, permeable drain (including culvert), road or railway
- 5m from a building or boundary

Rectangular pit design data :-

Pit length = 27 m
Depth below invert = 1.5 m
Imperm. area = 400 m ²
Return period = 200 yrs

Pit width = 1.5 m
Percentage voids = 30.0%
Infilt. factor = 0.000017 m/s
Climate change = 35%

Calculations :-

Surface area of soakaway to 50% storage depth (not inc. base):-

a_{s50} = 2 x (length + width) x depth/2 = 42.8 m ²

Outflow factor : O = a_{s50} x Infiltration rate = 0.0007268 m/s

Soakaway storage volume : S_{actual} = length x width x depth x % voids/100 = 18.2 m ³

Duration	Rainfall mm/hr	Inflow m ³	Depth (hmax) m	Outflow m ³	Storage m ³
5 mins	134.7	4.5	0.35	0.22	4.25
10 mins	106.5	7.1	0.55	0.43	6.64
15 mins	89.8	9.0	0.69	0.65	8.33
30 mins	64.4	12.9	0.95	1.31	11.57
1 hrs	43.7	17.5	1.22	2.62	14.87
2 hrs	28.2	22.6	1.43	5.23	17.35
4 hrs	17.9	28.6	1.49	10.47	18.14
6 hrs	13.6	32.7	1.40	15.70	16.97
10 hrs	9.6	38.4	1.01	26.16	12.27
24 hrs	5.3	50.5	0.00	62.79	0.00

Actual volume S_{actual} = 18.225 m ³

Required volume : S_{req} = 18.140 m ³

Soakaway volume storage OK.

Minimum require a_{s50} : 42.55 m ²

Actual a_{s50} : 42.75 m ²

Minimum depth requi 1.49 m

Time to maximum 4 hrs

Emptying time to 50% volume = t_{s50} = S_{req} x 0.5 / (a_{s50} x Infiltration rate) = 03:28 (hr:mi

Soakaway emptying time is OK.

MD	gmcsurveys Surveys.Setting Out Civil Engineering Design	Shiree Villa, 43 Castle Street Forres IV36 1PD email: gmcsurveys@gmail.com Mobile: 07751 431 734	Job No. 7333 Sheet no. 2 Date 12/03/13		
MasterDrain SW 16.31	Project Plot 3 Easter Coltfield		By GM	Checked	Approved
	Title Surface Water Soakaway				

Location hydrological data (FSR):-

Location = ELGIN

M5-60 (mm) =

Soil index = 0.40

WRAP

Grid reference = NJ2162

r = 0.24

SAAR (mm/yr) = 800

Area = Scotland and N.

Soil classification for WRAP type 3

i) Relatively impermeable soils in boulder and sedimentary clays, and in al

in eastern England;

ii) Permeable soils with shallow ground water in low-lying areas;

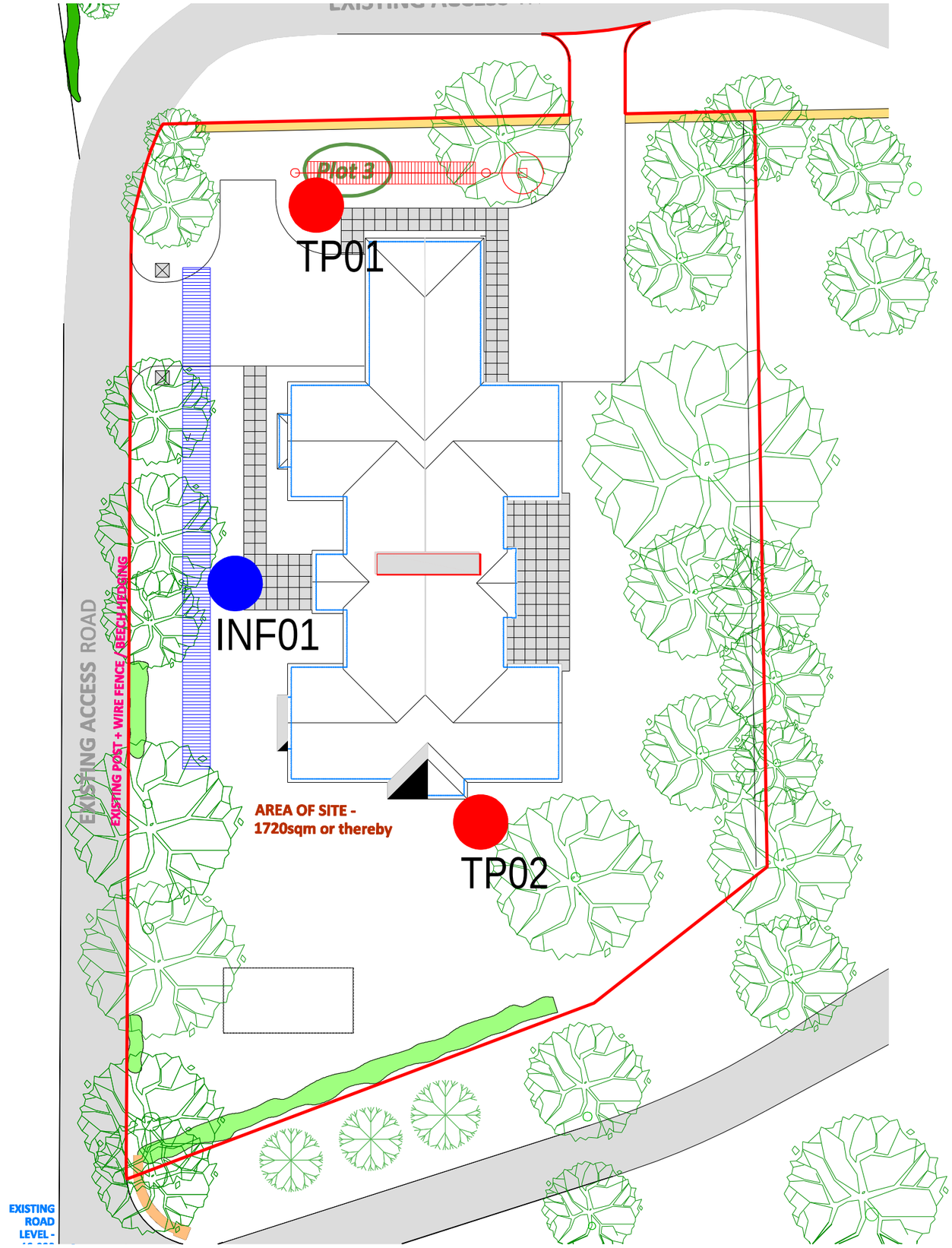
iii) Mixed areas of permeable and impermeable soils, in approximately equal pro

N.B. The rainfall rates are calculated using the location specif

values above in accordance with the Wallingford procedure.

APPENDIX A

Site/Testhole Location



REV:	DESCRIPTION:	BY:	DATE:

STATUS: ISSUE

gmcsurveys
Surveys, Setting Out, Civil Engineering Design
T: 07557 431 702
E: gmcsurveys@gmail.com

CLIENT: Tulloch Of Cummingston

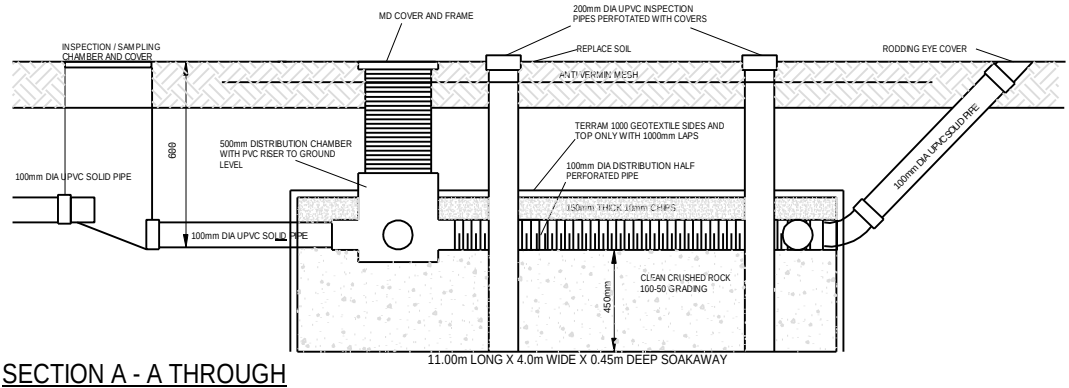
SITE: Plot 3
Easter Coltfield, Elgin

TITLE: Test Hole Location/
Site Plan/ Indicative Layout

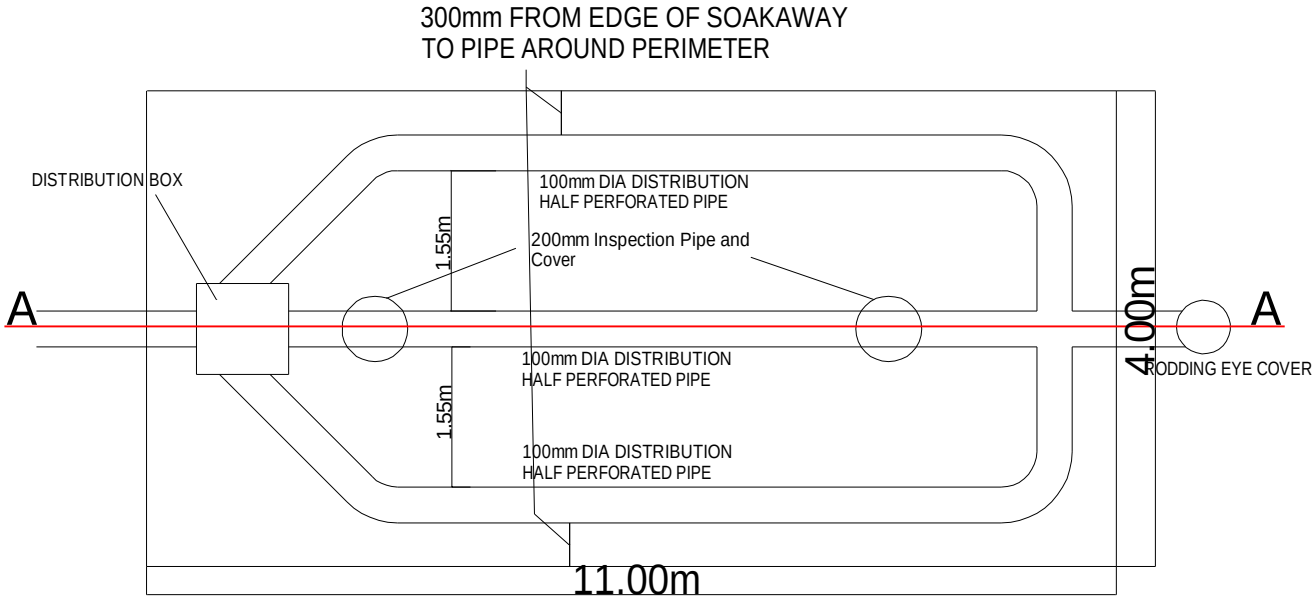
SCALE AT A4:	DATE:	DRAWN:	CHECKED:
NTS	FEB21	GM	
PROJECT NO:	DRAWING NO:		REVISION:
0807	Appendix A		-

APPENDIX B

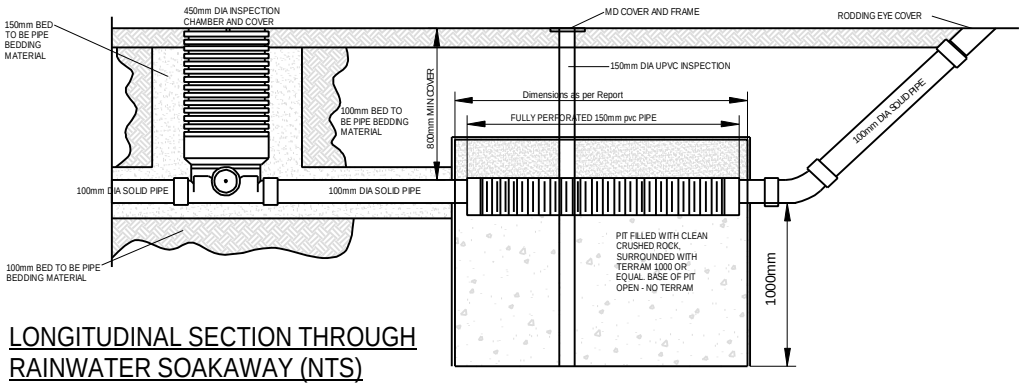
Soakaway Details/Certificates



SECTION A - A THROUGH
FOUL WATER SOAKAWAY (NTS)



PLAN VIEW
SOAKAWAY ARRANGEMENTS (NTS)



LONGITUDINAL SECTION THROUGH
RAINWATER SOAKAWAY (NTS)

REV:	DESCRIPTION:	BY:	DATE:

STATUS: ISSUE

gmcsurveys
Surveys, Setting Out, Civil Engineering Design
T: 07557 431 702
E: gmcsurveys@gmail.com

CLIENT: Tulloch Of Cummingston

SITE: Plot 3
Easter Coltfield, Elgin

TITLE: Soakaway Details

SCALE AT A4:	DATE:	DRAWN:	CHECKED:
NTS	FEB21	GM	

PROJECT NO:	DRAWING NO:	REVISION:
0807	Appendix B	-

gmcsurveys
Surveys,Setting Out Civil Engineering Design

Certificate For Proposed Sub – Surface Soakaways
Foul Water

Applicants Name: Tulloch of Cummingston
Address: Forsyth Street, Hopeman, Elgin IV30 5ST
Site Address: Plot 3 Easter Coltfield, Elgin
Date of Tests: 4th February 2021
Weather Conditions: Overcast/Occasional Winter Showers

Percolation Test/Soakaway Sizing:

	1st	2nd	3rd	Mean
Date of Test	**04/02/21**	**04/02/21**	**04/02/21**	
TP1	2400s	3720s	4380s	3500s
TP2	4320s	5340s	5580s	5080s
Average Soil Vp				**28.60s/mm**

Location: TP1&TP2
Average Soil Vp: 28.60s/mm
PE: 6
Base Area (min): 42.90m^2

I hereby certify that I have carried out the above tests in full accordance with BS6297: 2007 + A1: 2008 and as described in Section 3.9 of the Scottish Building Standards Technical Handbook (Domestic).

Signed: G Mackintosh Gary Mackintosh BSc. Date: 8th February 2021

Company: GMC Surveys, 34 Castle Street, Forres, Morayshire. IV36 1PW

gmcsurveys
34 castle Street
Forres
Moray
IV36 1PW
T: 07557 431 702
E:gmcsurveys@gmail.com

gmcsurveys
Surveys,Setting Out Civil Engineering Design

Certificate For Proposed Sub – Surface Soakaways
Surface Water

Applicants Name: Tulloch of Cummingston
Address: Forsyth Street, Hopeman, Elgin IV30 5ST
Site Address: Plot 3 Eater Coltfield, Elgin
Date of Tests: 4the February 2021
Weather Conditions: Overcast/Occasional Winter Showers

Trial Pit Test – Surface Water:

Depth of Excavation: 1.8
Water Table Present: No

Infiltration Test:

Location: INF01
Infiltration Test Zone: 1.0 – 1.8mbgl
Infiltration Rate (m/s): 1.652×10^{-5}
Contributing Area: 400m2
Soakaway Size: 27.0m x 1.5m x 1.5m below the invert of the pipe (1:200)

I hereby certify that I have carried out the above tests in accordance with the procedures specified in BRE Digest 365:1991.

Signed: G Mackintosh Gary Mackintosh BSc. Date: 8th February 2021

Company: GMC Surveys, 34 Castle Street, Forres, Morayshire. IV36 1PW

gmcsurveys
34 castle Street
Forres
Moray
IV36 1PW
T: 07557 431 702
E:gmcsurveys@gmail.com

APPENDIX FIVE

DECISION NOTICE / REPORT OF HANDLING

MORAY COUNCIL
TOWN AND COUNTRY PLANNING (SCOTLAND) ACT 1997, as amended

REFUSAL OF PLANNING PERMISSION

[Heldon And Laich]
Application for Planning Permission

TO Tulloch Of Cummingston Ltd
Tulloch House
Forsyth Street
Elgin
Mora
IV30 5ST

With reference to your application for planning permission under the above mentioned Act, the Council in exercise of their powers under the said Act, have decided to **REFUSE** your application for the following development:-

Erect dwellinghouse with detached garage on Plot 3 Easter Coltfield Alves Elgin Moray

and for the reason(s) set out in the attached schedule.

Date of Notice: **8 October 2021**

[redacted]

HEAD OF ECONOMIC GROWTH AND DEVELOPMENT
Economy, Environment and Finance
Moray Council
Council Office
High Street
ELGIN
Moray
IV30 1BX

Ref: 21/00168/APP

IMPORTANT
YOUR ATTENTION IS DRAWN TO THE REASONS and NOTES BELOW

SCHEDULE OF REASON(S) FOR REFUSAL

By this Notice, Moray Council has REFUSED this proposal. The Council's reason(s) for this decision are as follows: -

The proposal would be contrary to policies DP1, DP4 and EP14 of the Moray Local Development Plan 2020 for the following reasons:

1. The site lies within a Pressurised and Sensitive Area and as such policy DP4 outlines that no new housing will be permitted within these areas on the basis that further housing would exacerbate the build-up of housing which has already negatively impacted on the character of the countryside in this area.

2. The applicants have not provided a Noise Impact Assessment in support of the application and as such have failed to demonstrate that the occupants of the proposed house would not be subject to harmful noise pollution as a result of aircraft utilising RAF Kinloss.

LIST OF PLANS AND DRAWINGS SHOWING THE DEVELOPMENT

The following plans and drawings form part of the decision:-

Reference Version	**Title**
3 E.COLT/P.D/01	Site and location plan
	Elevations and floor plans
3 E.COLT/P.D/LP	Location plan
3 E.COLT/P.D/VS	Passing place and visibility splay

NOTICE OF APPEAL
TOWN AND COUNTRY PLANNING (SCOTLAND) ACT 1997

If the applicant is aggrieved by the decision to refuse permission for or approval required by a condition in respect of the proposed development, or to grant permission or approval subject to conditions, the applicant may require the planning authority to review the case under section 43A of the Town and Country Planning (Scotland) Act 1997 within three months from the date of this notice. The notice of review should be addressed to The Clerk, Moray Council Local Review Body, Legal and Committee Services, Council Offices, High Street, Elgin IV30 1BX. This form is also available and can be submitted online or downloaded from www.eplanning.scotland.gov.uk

If permission to develop land is refused or granted subject to conditions and the owner of the land claims that the land has become incapable of reasonably beneficial use in its existing state and cannot be rendered capable of reasonably beneficial use by the carrying out of any development which has been or would be permitted, the owner of the land may serve on the planning authority a purchase notice requiring the purchase of the owner of the land's interest in the land in accordance with Part 5 of the Town and Country Planning (Scotland) Act 1997.

REPORT OF HANDLING

Ref No:	21/00168/APP	**Officer:**	Iain T Drummond
Proposal Description/ Address	Erect dwellinghouse with detached garage on Plot 3 Easter Coltfield Alves Elgin Moray		
Date:	05.10.2021	**Typist Initials:**	LMC

RECOMMENDATION		
Approve, without or with condition(s) listed below		**N**
Refuse, subject to reason(s) listed below		**Y**
Legal Agreement required e.g. S,75		**N**
Notification to Scottish Ministers/Historic Scotland		**N**
Hearing requirements	**Departure**	**N**
	Pre-determination	**N**

CONSULTATIONS

Consultee	**Date Returned**	**Summary of Response**
Aberdeenshire Council Archaeology Service	01/03/21	No objections
Moray Flood Risk Management	22/06/21	No objections
Planning And Development Obligations	23/02/21	Contributions sought towards transport (dial-a-bus) Healthcare and sports and recreation (3g pitch in Forres)
Environmental Health Manager	21/09/21	Recommend refusal of the proposal due to lack of noise impact assessment
Contaminated Land	24/02/21	No objections
Transportation Manager	17/02/21	No objections subject to conditions and informatives
Scottish Water	17/02/21	No objections
Strategic Planning And Development	10/06/21	Recommend refusal of the application due to failure to comply with housing in the countryside policy.

DEVELOPMENT PLAN POLICY

Policies	**Dep**	**Any Comments (or refer to Observations below)**
PP3 Infrastructure and Services	N	
DP4 Rural Housing	Y	
EP2 Biodiversity	N	
EP7 Forestry Woodland and Trees	N	
EP8 Historic Environment	N	

DP1 Development Principles	Y	
EP12 Management and Enhancement Water	N	
EP13 Foul Drainage	N	
EP14 Pollution Contamination Hazards	Y	

REPRESENTATIONS		
Representations Received	YES	
Total number of representations received: ONE		
Names/Addresses of parties submitting representations Name and address details of parties submitting representations withheld in accordance with the General Data Protection Regulations.		
Summary and Assessment of main issues raised by representations		
Issue: Concern regarding the impact of the development on flora and fauna, with specific reference to hibernating animal and nesting birds. **Comments (PO):** This application is being refused on the basis of failing to comply with policies in relation to the principle of new housing in the countryside, however, were the application being approved, the applicants have outlined that it is their intension to retain, protect and enhance the existing trees/habitat on site and allow free movement of animals such as hedgehogs. With this in mind this issue is not considered to merit the refusal of this application.		

OBSERVATIONS – ASSESSMENT OF PROPOSAL

The Proposal
This application seeks planning permission in for the erection of an H-shaped single storey pitch roof house and detached garage at, Plot 3, Easter Coltfield, Alves, Elgin.

It is proposed that the site be served via an access from the existing track which bounds the site to the south west. The house is to be served by a septic tank and soakaway and separate soakaway for disposal of surface water.

The Site and Surroundings
The site comprises an area of rough ground described as Plot 3 by the applicants. Planning permission in principle was granted in 2006 for the erection of a house on this site, however, this consent has since expired. The site is bounded by a mixture of hedging and mature trees and forms part of a larger grouping of houses surrounding Coltfiled Farmhouse.

The site lies within open countryside in an area of landscape designated as a Pressurised and Sensitive Area within the Moray Local Development Plan 2020.

Appraisal
Section 25 of the 1997 Act as amended requires applications to be determined in accordance with the development plan i.e. the adopted Moray Local Development Plan 2020 (MLDP) unless material considerations indicate otherwise. The main planning issues are considered below:

Principle of development (DP1 and DP4)
Scottish Planning Policy (SPP) states rural development proposals should promote a pattern of development that is appropriate to the character of the particular area and the challenges it faces. In

Moray there are identified issues relating to the adverse landscape and visual impacts associated with the cumulative build-up of new housing in and around our main towns, particularly Elgin and Forres.

SPP also states that in pressurised areas easily accessible from Scotland's cities and towns, where ongoing development pressures are likely to continue, it is important to protect against an unsustainable growth in car-based commuting and the suburbanisation of the countryside. On that basis areas within Moray where cumulative build up is prevalent were identified as pressurised and sensitive areas.

Policy DP4: Rural Housing of the Moray Local Development Plan (MLDP) 2020 contains the necessary criteria for assessing new rural housing in the countryside. In this case the site lies within a Pressurised and Sensitive Area and as such policy DP4 outlines that no new housing will be permitted within these areas.

The justification text within policy DP4 explains the ethos behind the designation of Pressurised and Sensitive Areas and outlines that there are locations within Moray where the cumulative build-up of houses in the countryside has negatively impacted on the landscape character of an area and as such these areas have been designated to restrict any further housing. The landscape surrounding the proposed site, leading from Kinloss golf club in the west to Hopeman in the east has experienced a significant growth in new housing in the countryside over the past 25 years and this has undoubtedly eroded the rural character of the area. The proposed new house site would add to this overall build-up of housing in the area and exacerbate the existing impact on the rural character of the surrounding landscape and as such this proposal is recommended for refusal on this basis.

The applicants have outlined that whilst the site may be within the Pressurised and Sensitive Area, the site is well enclosed and defined from the surrounding open fields and will form part of what is an existing grouping of houses and as such will integrate well into the surrounding landscape. In response, policy DP4 is clear that no new housing within Pressurised and Sensitive Areas should be permitted and as such the merits of the siting of any proposed house is not something that could overcome the fundamental issue, that the proposed site lies within the Pressurised and Sensitive Area. Whilst the proposed site does have enclosure, the house would be visible from the west and as such would contribute to the overdeveloped appearance of the area. Also whilst the site does form part of an existing grouping, this is not identified as a rural grouping within the MLDP 2020 and as such the proposal cannot be assessed under the terms of policy DP4 in relation to development within rural groupings.

Noise Pollution (DP1 and EP14)
Following consultation with Environmental Health the site has been identified as falling within the RAF Kinloss noise contour map as agreed by the Planning and Regulatory Services Committee in 22/04/14, which outlined the following position:

> "Routine flying operations at Kinloss ceased on 31 July 2011. However, there remains a current Defence requirement for the airfield to act as a Relief Landing Ground (emergency only) for RAF Lossiemouth Tornado GR4 and soon Typhoon aircraft. While fast jet aircraft will not routinely use the airfield at Kinloss Barracks the airspace will continue to be used as part of a standard circuit. This involves RAF Lossiemouth fast jet aircraft flying above the unit at a height of 1000 feet. The airfield will continue to be used by the Moray Flying Club and No 663 Volunteer gliding Squadron. Although no longer an active airfield, MOD retains the right to reactive the airfield in the future. Use of the airfield for circuit work will still mean that the area will be exposed to noise which may be considered disturbing by residents. When resources allow we plan to revisit Kinloss and produce revised contours. Until then the noise contours defined in 1984 will remain extant."

The proposed site is within the 66 to 72 dBA contour and as such a Noise Impact Assessment (NIA)

was requested. By the time the applicants were asked for a NIA, they were aware that the site lay within the Pressurised and Sensitive Area and would be refused on this basis and as such did not wish to go to the expense of having a NIA carried out. Without an NIA this proposal fails to comply with policies DP1 and EP14 and has been recommended for refusal by Environmental Health. Whilst this issue could potentially be overcome by the submission of an NIA, without this information, this issues forms a further reason for refusal of this proposal.

Access/Parking (PP3 & DP1)
The Transportation service has been consulted in relation to the development has no objection to the approval of the application subject to conditions to ensure access and parking is provided to an acceptable standard. Amongst other things the conditions recommended require the provision of an EV charging point at the house and a passing place on the public road leading to the site and the applicants have confirmed they are happy to meet these requirements.

Water Supply and Drainage (PP3, EP12 & EP13)
Moray Flood Risk Management have no objection to the proposed drainage arrangements comprising foul drainage disposed of via treatment plant and soakaway and separate surface water soakaway and as such the proposals are compliant with policies PP3, EP12 and EP13.

Scottish water has no objection to the use of the proposed water supply.

Developer obligations and affordable housing (PP3 and DP2)
An assessment has been carried out and a contribution has been identified towards transport (dial-a-bus) Healthcare and sports and recreation (3g pitch in Forres), which the applicant has agreed to pay in the event of approval being given.

Recommendation
The application is to be refused on the basis that it fails to meet the requirements of DP4 and DP1, in that, there is no policy exception to allow new housing in pressurised and sensitive areas. The introduction of a new house in this identified pressurised and sensitive location would have a detrimental landscape and visual impact as well as impacting on the character and appearance of this rural area.

Furthermore, the application is contrary to policies DP1 and EP14 in that a supporting Noise Impact Assessment has not be provided and therefore there is insufficient information to demonstrate that adequate mitigation can be implemented to address any adverse noise impacts.

OTHER MATERIAL CONSIDERATIONS TAKEN INTO ACCOUNT

None

HISTORY

Reference No.	**Description**			
06/00619/OUT	Outline to erect 1no detached dwellinghouse on Plot C Easter Coltfield Farm Alves Moray			
	Decision	Permitted	**Date Of Decision**	05/12/06

ADVERT		
Advert Fee paid?	**Yes**	
Local Newspaper	**Reason for Advert**	**Date of expiry**
Northern Scot	No Premises	18/03/21
PINS	No Premises	16/02/21

DEVELOPER CONTRIBUTIONS (PGU)	
Status	**Contributions sought**

DOCUMENTS, ASSESSMENTS etc. *

** Includes Environmental Statement, Appropriate Assessment, Design Statement, Design and Access Statement, RIA, TA, NIA, FRA etc*

Supporting information submitted with application?	YES	

Summary of main issues raised in each statement/assessment/report

Document Name: Drainage assessment

Main Issues: Outlines the drainage methodology for the site.

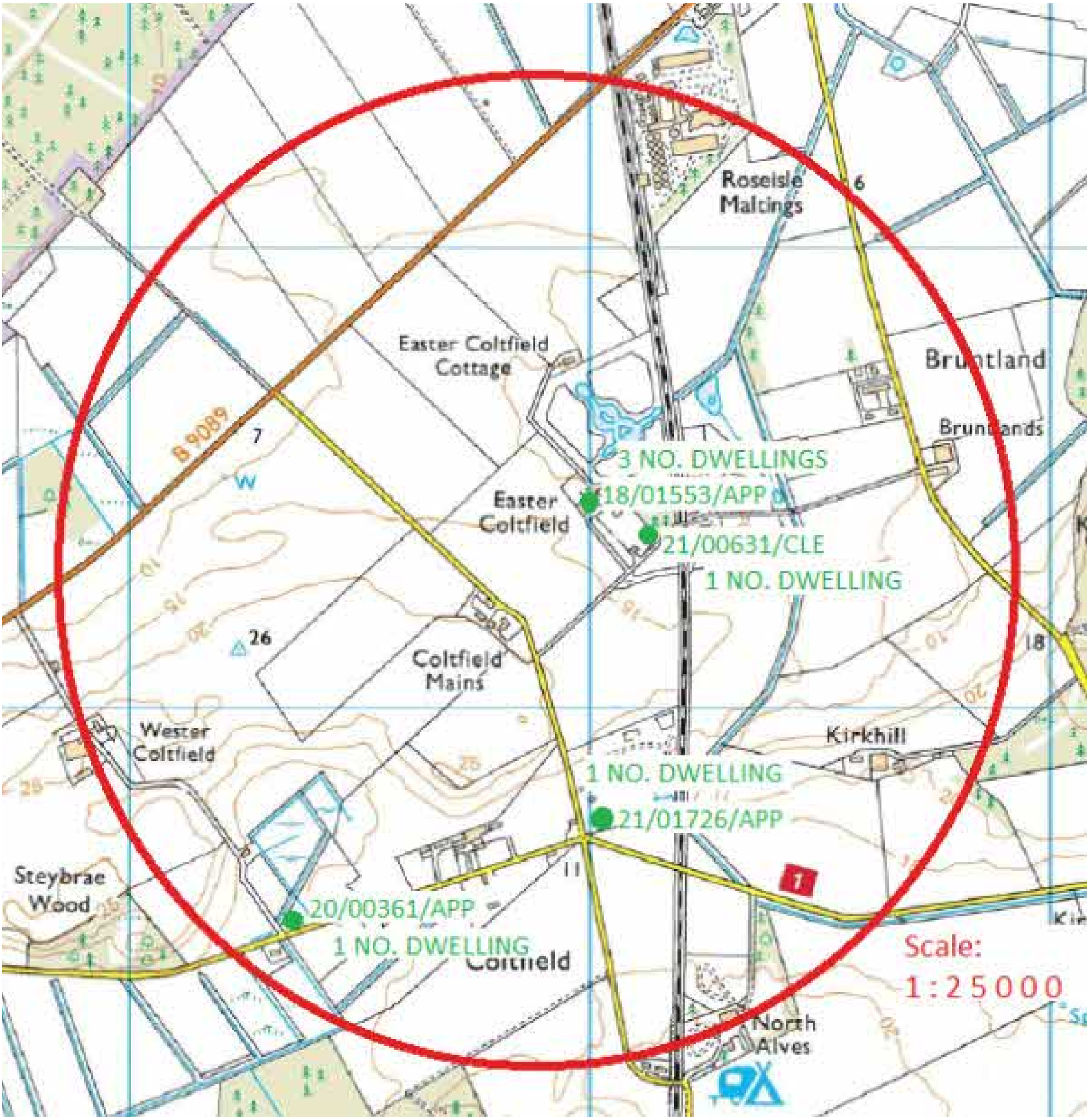
S.75 AGREEMENT		
Application subject to S.75 Agreement		NO
Summary of terms of agreement:		
Location where terms or summary of terms can be inspected:		

DIRECTION(S) MADE BY SCOTTISH MINISTERS (under DMR2008 Regs)			
Section 30	Relating to EIA		NO
Section 31	Requiring planning authority to provide information and restrict grant of planning permission		NO
Section 32	Requiring planning authority to consider the imposition of planning conditions		NO
Summary of Direction(s)			

APPENDIX SIX

NEW BUILD PLANNING APPLICATIONS BETWEEN JANUARY 2018 & JANUARY 2022

E a s t e r C o l t f i e l d



NEW BUILD PLANNING APPLICATIONS BETWEEN JANUARY 2018 - JANUARY 2022

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APPENDIX SEVEN

COLTFIELD HOUSE NOISE IMPACT ASSESSMENT

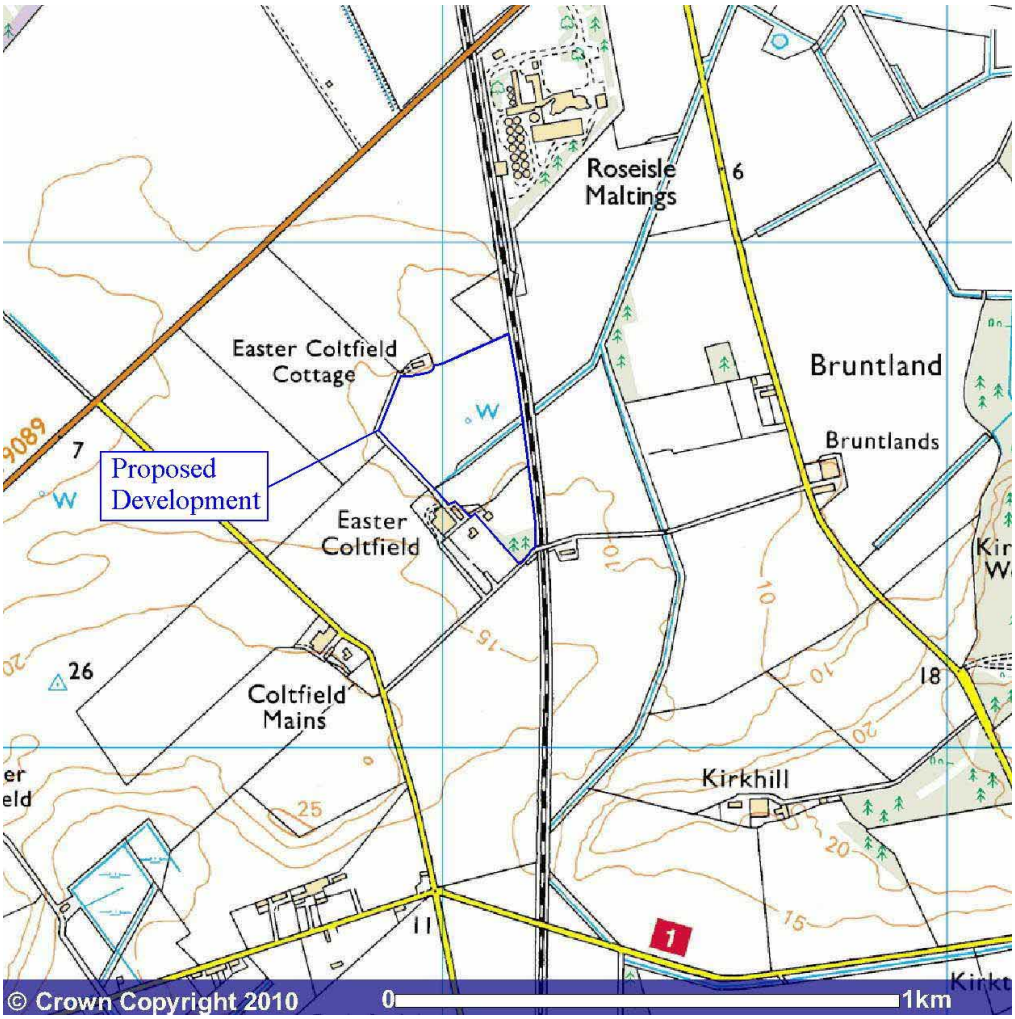
Table of Contents **Page No.**

1.0 Introduction

1.1 Tulloch of Cummingston proposes to construct a house, stables and cattery, on a plot of land at Easter Coltfield, near Alves, in Moray. The boundary of the land is shown outlined in blue below in Figure 1, which is reproduced with the permission of Ordnance Survey. Kinloss Royal Air Force (RAF) base lies some 5500m to the west-south-west of the land.

Figure 1

Location of Proposed Development
(Courtesy of Ordnance Survey)



1.2 The concern was raised at the planning stage, by officers of The Moray Council, that the noise of military aircraft might disturb the occupants of the proposed house. Charlie Fleming Associates was asked, by Mr Alex Sanderson, of Tulloch of Cummingston Ltd, to assess the level of aircraft noise affecting the site and confirm whether it would be acceptable.

1.3 It is usual to assess air traffic noise affecting the site of proposed residential development in accordance with The Scottish Executive Development Department publication titled *Planning Advice Note 56 Planning and* Noise[1], (PAN56).

1.4 PAN56 stipulates that the noise be considered over two periods, daytime from 07.00hrs to 23.00hrs, and night-time from 23.00hrs to 07.00hrs. The noise level over these periods determines which of 4 Noise Exposure Categories (NEC) the site falls into. Each NEC is accompanied by a series of recommendations.

1.5 To establish which NEC the land on which it is proposed to construct the house falls into, the noise on the land could be measured, over the daytime and night-time periods mentioned above. The noise around military airports, however, varies considerably from day to day, week to week, and month to month. To encompass these variations, it would be necessary to measure the noise over a period of several months, which would be prohibitively expensive.

1.6 The noise around RAF Kinloss has been predicted by the Noise and Vibration Division, of the Occupational and Environmental Medicine Wing, of the RAF Centre of Aviation Medicine. These noise levels are calculated and plotted as contours by a computer programme. The programme contains a number of variables which have a significant bearing on the results. The values ascribed to these variables are not generally available. Charlie Fleming Associates has, however, learned how some of them were input into the computer model of noise around RAF Lossiemouth. It is assumed that similar parameters have been put into the computer model of the noise around RAF Kinloss, which leads the author to have some reservations as to the accuracy of the contours.

1.7 Whilst the author has reservations about the accuracy of the RAF noise contours, in the absence of being able to measure the noise over several months, these were used in determining the NEC of the land on which it is proposed to construct the house, as discussed in Section 2.0 of this report. In Section 3.0, the noise levels in the proposed house are calculated, and compared to the limit usually adopted by The Moray Council.

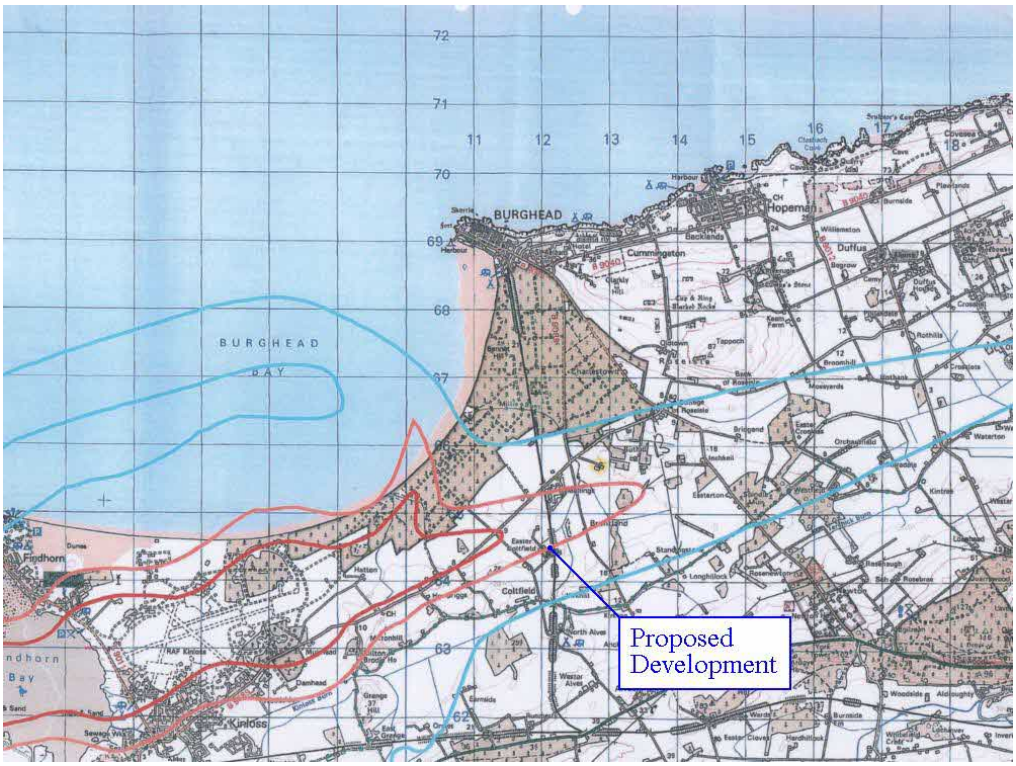
Section 4.0 concludes the main text of the report, and is followed by a list of the documents referred to herein. The Appendix describes basic principles of acoustics and explains the technical terms used in the report.

2.0 Royal Air Force (RAF)/The Moray Council Air Traffic Noise Level Data

2.1 The noise level contours produced by the RAF Centre of Aviation Medicine Noise and Vibration Division, have been issued by The Moray Council. These are shown below in Figure 2. Where it is proposed to build the house is also shown on Figure 2, on the 66dB(A) contour.

Figure 2

RAF Kinloss Aerodrome Noise Contours L_{Aeq}
(Courtesy of The Moray Council)



2.2 Where it is proposed to build the house is therefore in both NEC B and NEC C, of which PAN56 states;

NEC B
Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise. For proposed development subject to the high end of the category a Noise Impact Assessment will assist authorities in identifying appropriate noise mitigation measures.

NEC C
Planning permission should not normally be granted. Based upon the evidence contained within a Noise Impact Assessment, however, it may be possible to grant permission subject to measures that ensure an adequate level of protection against noise.

2.3 With the site of the house falling into both NEC B and NEC C, it is appropriate to calculate the noise level inside it. How this has been done is described in Section 3.0.

3.0 Calculation of Internal Levels of Air Traffic Noise

3.1 It is usual in an assessment of this type to calculate the noise levels inside one of the most exposed rooms, which, in this case, will be the Lounge. The principle in this is that, if the noise is acceptable in the most exposed room, it follows that it will also be acceptable in the other, less exposed ones. The noise in the room has been calculated using the following equation:

$$L_{Internal} = L_{External} - R + 10 \log S - 10 \log 0.161 V + 10 \log T$$

Where, R = sound reduction index of façade.
S = area of façade.
A = acoustical absorption in receiving room.
V = volume of receiving room.
T = reverberation time of receiving room.

3.2 Charlie Fleming Associates has measured the noise of military aircraft movements at a site in Wester Buthill, approximately 1.3km to the north-east of this one. The octave band noise levels, measured at that site, have been adjusted to a level of 66.0dB(A), which is that present in this case, according to the contours. (It is more accurate to calculate the internal noise using octave band levels as opposed to A-weighted ones). These are shown overleaf in Table 1 which shows the variables used in the calculations.

3.3 Most air traffic noise contours include a 2dB(A) addition to allow for that component of the sound which is reflected off the ground. It is not clear whether the RAF model has incorporated this, but it is assumed that it has, because the model is one developed for civilian air traffic movements. This may overestimate the noise of the military aircraft as they take-off, land and manoeuvre, because they are closer to the ground than the civilian ones, and the angle of sound propagation towards the earth not steep enough to cause the full 2dB(A) increase. Hence it would seem reasonable to reduce the noise level suggested by the contours by 1dB(A), as shown overleaf in Table 1.

When sound propagating from a source hits the side of a building, such as a house, it is reflected off it. The reflected sound wave interferes with the incident wave causing what is known as facade effect, or pressure doubling. This is similar to the ground effect described above. This is normally taken to increase the noise, at most, by 3.0dB(A), for an angle of incidence of 90 degrees. This has been added to the measured noise levels as shown overleaf in Table 1. This will over-estimate the noise slightly, by 0.7dB(A), as the angle of incidence of the sound will actually be 70 degrees.

3.4 At the time of writing, the glazing had not been specified. It was thus assumed to be at least the minimum standard required in the *Building Standards (Scotland) Regulations* for thermal insulation, of 2 panes of 6mm thick glass separated by a 16mm wide cavity. The sound reduction indices of this glazing have been derived from values given in the literature[2&3].

The noise has been calculated with the windows closed and the trickle ventilator open, as is usually required by The Moray Council. The sound reduction index of the open part of the trickle ventilator has been taken to be 0dB.

3.5 The dimensions of the glazing in the Lounge were scaled off the architect's drawings and found to be equivalent to 12.8m^2. The area of the trickle ventilators was taken to be 10,000mm^2.

3.6 The dimensions of the Lounge were read off the architect's drawings, and found to be 5.4m x 4.0m x 2.7m. The reverberation times of the room have been taken to be the same as those measured by Charlie Fleming Associates in a living room of the same size, in Nether Johnstone House, just outside Johnstone in Renfrewshire.

3.7 The variables discussed in Sections 3.2 to 3.6 have been put into the equation, given earlier in Section 3.1, as shown below in Table 1.

Table 1

Calculation of Internal Noise Levels, L_{eq}
(dB re 2 x 10^{-5} Pa)

Parameter	**Octave Band Centre Frequency (Hz)**								
	31.5	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Level $_{External}$	57.3	58.8	60.5	65.8	61.3	57.0	42.7	22.2	18.0
Correction to 16 hour level	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Correction for Ground Effect	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Correction for Facade Effect	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
R $_{Glazing}$	*24.7*	24.7	21.9	20.1	29.5	37.9	35.1	39.6	*39.6*
10log S	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1
10log 0.161 x V	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
T	0.9	*0.7*	0.6	0.6	0.5	0.5	0.5	0.4	*0.4*
10log T	-2.2	-3.0	-3.8	-3.3	-3.9	-4.4	-4.5	-5.3	-5.3
Level $_{Internal}$	35.3	36.0	39.3	46.6	34.1	26.4	12.6	-9.7	-13.9

Figures shown in italicised print have been extrapolated.

3.8 The "Level $_{Internal}$", with the trickle ventilator open, is 39dB(A), which is just within the limit of 40dB(A) which The Moray Council usually applies to this type of noise. As the noise is only just within the limit, that in various other rooms was calculated. In the Dining Room, Master Bedroom and Bedroom 5, it proved to be 40dB(A), 40dB(A) and 38dB(A) respectively. On the southern elevation of the house, in the Study and Sun Lounge, it proved to be 31dB(A) and 34dB(A).

4.0 Conclusions

4.1 Tulloch of Cummingston proposes to construct a house on a plot of land at Easter Coltfield, near Alves, in Moray. Kinloss Royal Air Force (RAF) base lies some 5500m to the west-south-west of the land. The concern was raised at the planning stage, by officers of The Moray Council, that the noise of military aircraft might disturb the occupants of the proposed house. Charlie Fleming Associates was asked to assess the level of aircraft noise affecting the land, and confirm whether it would be acceptable.

4.2 The assessment of the noise has been performed as suggested in The Scottish Executive Development Department document titled *Planning Advice Note 56 Planning and Noise*, (PAN56). The air traffic noise was quantified using equivalent continuous noise level, L_{Aeq}, contours provided by The Moray Council. According to these, the site is exposed to 66.0dB(A), which places it in both Noise Exposure Category (NEC) B and C, of which PAN56 states;

NEC B
Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise. For proposed development subject to the high end of the category a Noise Impact Assessment will assist authorities in identifying appropriate noise mitigation measures.

NEC C
Planning permission should not normally be granted. Based upon the evidence contained within a Noise Impact Assessment, however, it may be possible to grant permission subject to measures that ensure an adequate level of protection against noise.

4.3 With the development site falling into both NEC B and C, it is appropriate to calculate the noise level in the proposed house. This was done as described in Section 3.0.

4.4 In the Lounge, which will be one of the most exposed rooms of the house, the noise level will be around 39dB(A), with the trickle ventilator open. This is just within the 40dB(A) limit which The Moray Council usually applies to this type of noise.

As the noise is only just within the limit, that in various other rooms was calculated. In the Dining Room, Master Bedroom and Bedroom 5, it proved to be 40dB(A), 40dB(A) and 38dB(A) respectively. On the southern elevation of the house, in the Study and Sun Lounge, it proved to be 31dB(A) and 34dB(A).

5.0 References

1) The Scottish Executive Development Department, *Planning Advice Note PAN56 Planning and Noise*, Crown Copyright April 1999, ISBN 0 7480 8157 7.

In such cases, internal noise levels within individual living apartments should be less than 45dB(A) during the day and 35dB(A) during the night. Levels should be predicted using appropriate time periods and the L_{Aeq} parameter.

2) Inman C., *A Practical Guide to the Selection of Glazing for Acoustic Performance in Buildings*, Acoustics Bulletin, **19**, (5), September/October 1994, pp19-24.

3) Saint Gobain, *Acoustic Performance of Glazing*.

Appendix

A1.0 Basic Principles of Acoustics

A1.1 Sound Pressure

The sound we hear is due to tiny changes in pressure in the air, caused by something disturbing the air, such as a loudspeaker cone moving back and forward, the blades of a fan heater going round, the moving parts of a car engine, and so on. From the initial point of the disturbance the sound travels to the receiver in the form of a wave. It is not like a wave in water, rather like one that would travel along a stretched spring, such as a child's *Slinky* toy laid flat on the ground and "pinged" at one end. Whether the human ear can hear the sound wave as it travels through the air, however, depends on the size of the disturbance and the frequency of it. That is, if the loudspeaker moves very slightly we may not be able to hear the changes in air pressure that it causes because they are too small for the ear to detect. The magnitude of sound pressures that the human ear can detect ranges from about 0.00002Pascals (Pa) to 200Pa. This enormous range presents difficulties in calculation and so, for arithmetic convenience, the sound pressure is expressed in decibels, dB. Decibels are a logarithmic ratio as shown below:

Sound Pressure Level $L\ (dB) = 20Log_{10}\{ {}^{p}/_{P}\}$
Where p = the sound pressure to be expressed in dB
and P = reference sound pressure 0.00002Pa

Hence, if we substitute 0.00002Pa, the smallest sound the ear can hear, for *p*, the result is 0dB. Conversely, if we substitute 200Pa, the loudest sound the ear can hear, for *p*, the result is 140dB. Hence, sound is measured in terms of sound pressure level in dB relative to 0.00002Pa.

A1.2 Range of Audible Sound Pressure Levels

An approximate guide to the range of audible pressures is presented overleaf in Table A1. The sound pressure levels noted are typical of the source given and should not be considered to be precise. The notes in the "Threshold" column of the Table are for general guidance, the sound pressure levels of those thresholds varying between individuals.

Table A1

Range of Audible Sound Pressure Levels and Sound Pressures

Sound Pressure Level (dB re $2x10^{-5}$ Pa)	Sound Pressure (Pa)	Source	Threshold of:
160	2000	Rifle at ear	Damage
140	200	Jet aircraft take off @ 25m	Pain
120	20	Boiler riveting shop	Feeling
100	2	Disco, noisy factory	
80	0.2	Busy street	
60	0.02	Conversation @ 2m	
40	0.002	Quiet office or living room	
20	0.0002	Quiet, still night in country	
0	0.00002	Acoustic test laboratory	Hearing

A1.3 Frequency and Audible Sound

Returning to the example of the loudspeaker cone, if it moves back and forward very slowly, for example once or twice a second, then we will not be able to hear the sound because the ear cannot physically respond to such a low frequency sound. Human ears are sensitive to sound pressure waves with frequencies between about 30Hertz (Hz) and 16,000Hz, where Hz is the unit of frequency and is also known as the number of cycles per second. That is, the number of times each second that the loudspeaker cone moves in and out, the fan blade goes round, etc. At the other end of the frequency spectrum, a sound with a frequency of 30,000Hz will also be inaudible, again because the ear cannot physically respond to sound pressure waves having such a high frequency.

Across the audible frequency range, the response of the ear varies. For example, a sound having a frequency of 63Hz will not be perceived as being as loud as a sound of exactly the same sound pressure level, having a frequency of 250Hz. A sound having a frequency of 500Hz will not be perceived as being as loud as a sound of the same sound pressure level with a frequency of 1,000Hz. Indeed, for a given sound pressure level, the hearing becomes progressively more sensitive as the frequency increases up to around 2,500Hz. Thereafter, from 2,500Hz upwards to about 16,000Hz, the sensitivity decreases, with sounds having frequencies above 16,000Hz being inaudible to most adults.

Virtually all sounds are made up of a great many component sound waves of different sound pressure levels and frequencies combined together. To measure the sound pressure level contributed at each of the frequencies between 30Hz and 16,000Hz, that is, 15,970 individual frequencies, would require 15,970 individual measurements. This would yield a massive, unwieldy amount of data.

A1.4 Octave Bands of Frequency

As a compromise, the sound pressure level in particular ranges, or "bands", of frequencies can be measured. One of the commonest ranges of frequency is the octave band. An octave band of frequencies is defined as a range of frequencies with an upper limit twice the frequency of the lower limit, eg 500Hz to 1,000Hz. This octave is exactly the same as a musical octave, on the piano, violin, etc, or *doh* to high *doh* on the singing scale. Octave bands are defined in international standards

and are identified by their centre frequency. Sound measurements are generally made in the eight octave bands between 63Hz and 8,000Hz. This is because human hearing is at its most sensitive, in terms of its frequency response, over this range of frequencies. Furthermore, speech is made up of sound waves having frequencies in this range.

A1.5 "A-Weighting" and dB(A)

Whilst an octave band analysis gives quite detailed information as to the frequency content of the sound, it is rather clumsy in terms of presenting results of measurements, that is, having to note sound pressure levels measured at eight separate octave bands. Furthermore, the ear hears all these separate frequency components as a whole and thus it would seem sensible to measure sound in that way.

When sound pressure level is measured with a sound level meter, the instrument can analyse the sound in terms of its octave band content as described above in section A1.4, or measure all the frequencies at once. Bearing in mind that the response of the ear varies with frequency, the sound level meter can apply a correction to the sound it is measuring to simulate the frequency response of the ear. This correction is known as "A-weighting" and sound pressure levels measured with this applied are described as having been measured in dB(A).

A1.6 Variation of Sound Level With Time

Most sounds, for example, speech, music, a person hammering, road traffic, an aircraft flying overhead, vary with respect to time. Various terms can be applied to describe the temporal nature of a sound as shown in Table A2.

Table A2

Examples of the Temporal Nature of Sound

Description	Example of Noise Source
Constant or steady state	Fan heater, waterfall
Impulsive	Gun shot, hammer blow, quarry blast
Irregular or fluctuating	Road traffic, speech, music
Cyclical	Washing machine, grass mowing
Irregular impulsive	Clay pigeon shooting
Regular impulsive	Regular hammering, tap dripping, pile driving

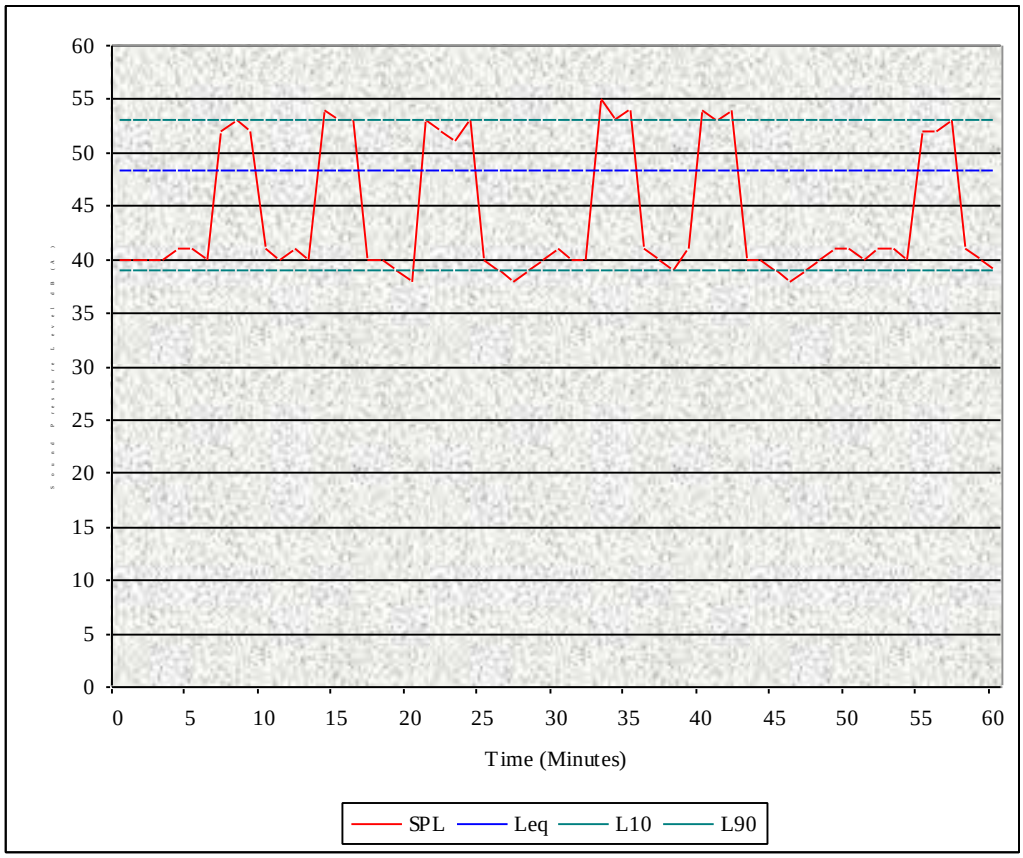
In practice, combinations of virtually any of the above can exist. In measuring noise it is necessary to deal with the level as it varies with respect to time.

A1.7 Time History

Consider the time history, as it is known, shown overleaf in Figure A1. Note that it is not an actual time history, rather an approximate representation of that which a person might experience some 100m away from a building site on which a man is operating a pneumatic drill.

Figure A1

Example of Time History of Construction Site Noise



The noise of the compressor and other activity on the site is reasonably constant with time, having a level of between 38dB(A) and 41dB(A). When the drill operates the noise level rises to between around 51dB(A) and 55dB(A).

A measurement of the noise between the 25th minute and the 32nd minute, when the noise is that of the compressor, would result in a level of about 40dB(A). This is very different from the result of a measurement made between the 33rd minute and the 35th minute, when the drill is operating, which would give a noise level of about 54dB(A). In the past acousticians therefore had to develop some way of measuring the noise which gives us information as to its variation in time. The easiest parameters to understand are the maximum and minimum levels, in this case 55dB(A) and 38dB(A) respectively. These do not tell us much about the noise other than the range of levels involved. The most widely used parameter is the equivalent continuous sound level, L_{eq}, which is explained in Section A1.8.

A1.8 Equivalent Continuous Sound Level, L_{eq}

A representative measurement of the noise to which the person in the example is exposed must deal with these changes in level. This can be done by measuring what is known as the equivalent continuous sound level, denoted as L_{eq}. If the measurement has been made in dB(A) it can be denoted as L_{Aeq} and expressed in dB. This is the sound level which, if maintained continuously over a given period, would

have the same sound energy as the actual sound (which varied with time) had. In the example the L_{eq} is 48.4dB(A) and it is shown on Figure A1 as a blue line. In layman's terms it may be considered to be the average of the sound over a period of time.

A1.9 Sound Exposure Level, L_{AE}

This is the sound level which if maintained constant for a period of one second would have the same sound energy as the time varying sound had. It may be considered to be a L_{eq} normalised to one second. It is very useful for measuring the noise of discrete events such as train pass-bys, aircraft flyovers, explosions and gunfire. A series of L_{AE}'s can be added together relatively easily and an L_{eq} calculated for a long period of time such as a whole day or night.

A1.10 Percentiles, L_x

Another parameter often used in describing noise is the percentile. This is a statistical parameter and with respect to noise is that level exceeded for x% of the measurement period. Hence the L_{10} is that level which was exceeded for 10% of the measurement period. In the example this is 53dB(A) and it is shown in green on Figure A1. It can be seen to be a reasonable representation of the typical value of the peaks in the time history. The L_{10} is often used to describe road traffic noise, such as in the *Calculation of Road Traffic Noise* by the Department of Transport and in the *Noise Insulation Regulations 1975/1988*.

Conversely, the L_{90} is that level exceeded for 90% of the time. In the example it is 39dB(A) and is also shown in green. It is a good descriptor of the troughs in the time history. Another way of thinking of the L_{90} is that it describes the background noise, during lulls in the more obvious noise, in this case the drill. The L_{90} is used in *British Standard BS 4142:1997 Method for Rating industrial noise affecting mixed residential and industrial areas*, as the descriptor of the background noise.

Any percentile can be specified such as L_{21}, L_{65}, L_8 ,L_{87} and so on. In practice however the only other percentiles used are the L_1, which is very similar to the maximum level that occurred during the measurement period and the $L_{99,}$ which is similar to the minimum level that occurred. Very occasionally the L_5 and L_{95} might be specified in a measurement procedure.

A1.11 Maximum and Minimum, L_{Amax} and L_{Amin}

These are the maximum and minimum noise levels which occurred during a given measurement. On Figure A1, they are 55dB(A) and 38dB(A) respectively. They are easy to understand, but do not tell us much about the noise other than the range of levels involved. The maximum level is, however, sometimes important, as it correlates well with sleep disturbance due to isolated noise events.

A1.12 Time Weighting, Fast, L_F, or Slow, L_S

Time weighting refers to the speed at which the sound level meter follows variations in the time history. The “fast” weighting of 125 milli-seconds corresponds to the way in which the human ear follows sound. The “slow” weighting effectively introduces more averaging of the noise. Note that the L_{eq} is independent of the time weighting, which only applies in the measurement of maxima, minima and percentiles.

A1.13 Free-field

As sound propagates from the source it may do so freely, or it may be obstructed in some way by a wall, fence, building, earth bund, etc. The former is known as free-field propagation. The noise exposure categories prescribed in PAN56 are based on free-field noise levels.

A1.14 Hemi-spherical

Most noise sources, being on the ground, radiate sound into a half, or hemi-sphere. Exceptions to this are road traffic noise and railway noise which is considered to radiate into a hemi-cylinder, and flying aircraft noise which radiates into a sphere.

A1.15 Level Difference, *D*

This is the most basic of sound transmission measurements. It is the difference in sound pressure level due to a building element, that is, a floor or wall. It is determined by placing a sound source in one room, measuring the sound pressure level in that room, which is then known as $L_{1\ (source)}$. Whilst the sound source is still radiating, the sound pressure level is measured in the room upstairs in the flat below, for a floor test, or next door through the separating wall, for a wall test. This is known as $L_{2\ (received)}$. The level difference D is then simply:

$$\text{Level Difference } D = L_{1\ (source)} - L_{2\ (received)}$$

Hence the parameter D represents the reduction in sound pressure level that occurs as the sound passes from one room to another through the floor or wall. This applies equally to the noise of televisions, hi-fi systems, speech and so on, as it does to the noise used in conducting the test. The greater the value of D the better the "sound insulation". This can be seen if we re-arrange the above equation and work out the received level as:

$$L_{2\ (received)} = L_{1\ (source)} - \text{Level Difference } D$$

That is, for a given source of noise such as a television, the bigger the level difference D, the less $L_{2\ (received)}$ will be.

A1.16 Sound Reduction Index, *R*

The level difference described above is a function of the wall in terms of how much sound is transmitted through that element. It is, however, also a function of the acoustical absorption in the receiving room, and the area of the wall radiating the sound.

Considering the acoustical absorption first, for example, the same sound energy will be transmitted through a wall depending on the construction of that element. If the receiving room is full of furniture, curtains and carpeting, the measured sound pressure level $L_{2\ (received)}$ will be less than if all the furnishings were removed. Thus, with the furnishings present, D, equal to $L_{1\ (source)} - L_{2\ (received)}$ will be greater, (because $L_{2\ (received)}$ will be less). If the furnishings are removed, $L_{2\ (received)}$ will increase as there is no longer anything to absorb the sound, and hence D will decrease.

The level difference D is also a function of the area of the partition radiating the sound from one room to the other. The bigger the area, the more sound will be transmitted, the received level will increase, and the difference D will decrease.

To determine the sound transmission performance of the wall itself, regardless of the effect of the acoustical absorption in the receiving room, and the area of the partition, the sound reduction index *R* is defined as:

$$R = D + 10 \text{ Log } S - 10 \text{ Log } A$$

Where *S* = area of wall radiating sound into receiving room.
A = the acoustical absorption in the receiving room.

A1.17 Reverberation Time, *T*

The acoustical absorption of a room can be quantified by measuring what is called the reverberation time, in seconds, of the room.

$$A = 0.161\ V / T$$

where *V* = volume of the room.

In turn, the reverberation time is defined as the time taken for the sound pressure level in a room to decay to -60dB relative to its original value from the time the sound source is switched off. It may be subjectively described as a measure of the amount of echo in a room, which is dependent on the room's volume, internal surface area and acoustical absorption.