251000

611500

Over Hill

EnergieKontor

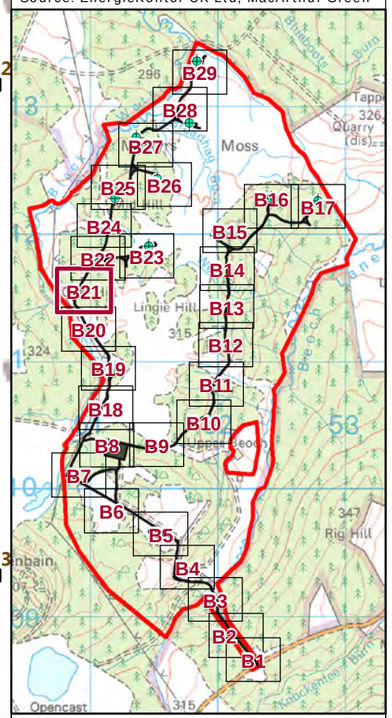
Legend:

- Planning Boundary
- Infrastructure
- Peat Study Area

Peat Depth Location (labels in cm)

- Phase 1 Grid (100m x 100m)
- Phase 2 Samples: Turbines
- Phase 2 Samples: Infrastructure

Source: EnergieKontor UK Ltd, MacArthur Green



MacArthur Green

Over Hill Wind Farm FEI 2

Figure B21

Phase 1 and Phase 2
Peat Sample Locations/Depths

N

0 25 50
Metres

MAP SCALE: 1:1,250 @ A3

Status: Rev1
Approved: DM
Checked: BJF
GIS TM: LNF

Document Path: S:\Project GIS\EnergiekontorOver Hill\H_FEI2_FigB_P2_PeatSamples_OVH.mxd

Datum: OSGB 1936, Projection: British National Grid

Date: 20/08/2018

251000

EnergieKontor

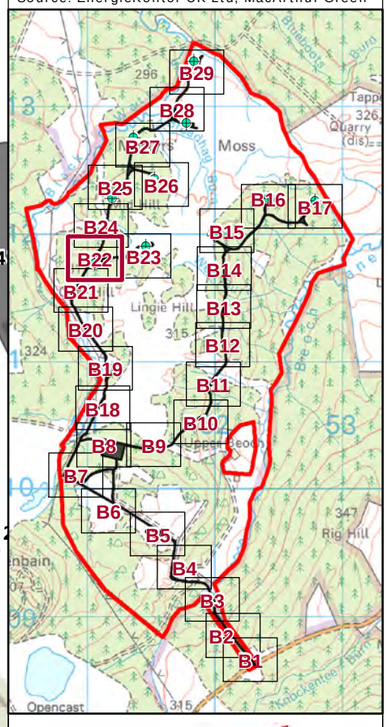
Legend:

- Turbine
- Planning Boundary
- Infrastructure
- Peat Study Area

Peat Depth Location (labels in cm)

- Phase 1 Grid (100m x 100m)
- Phase 2 Samples: Turbines
- Phase 2 Samples: Infrastructure

Source: EnergieKontor UK Ltd, MacArthur Green



MacArthur Green

Over Hill Wind Farm FEI 2

Figure B22

Phase 1 and Phase 2
Peat Sample Locations / Depths

N

0 25 50
Metres

MAP SCALE: 1:1,250 @ A3

Status: Rev1
Approved: DM
Checked: BJF
GIS TM: LNF

Document Path: S:\Project GIS\EnergiekontorOver Hill\H_FEI2_FigB_P2_PeatSamples_OVH.mxd

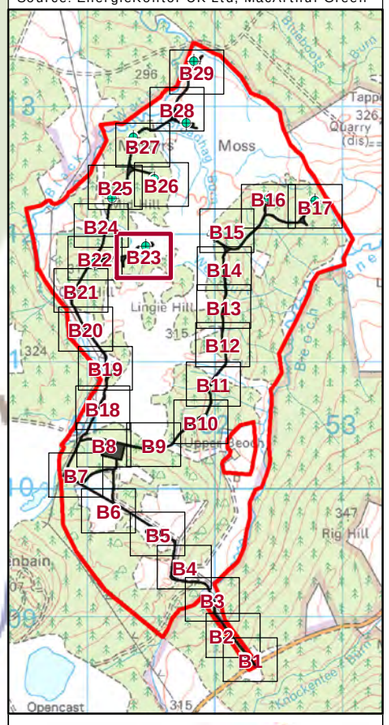
Datum: OSGB 1936, Projection: British National Grid

Date: 20/08/2018

612000

251500

260 240 240 337 331 330 341 324 340 269 329 308 336 378 270 284 318 350 322 306 309 235 260 282 318 285 318 311 301 358 210 307 350 250 240 317 304 311 396 272 263 300 318 322 355 345 355 245 172 279 460 328 391 268 301 210 247 265 75 309 310 107 240 242 208 323 287 260 190 250 390 290 166 272 273 141 263 310 300 310 250



EnergieKontor

Legend:

- Turbine
- Planning Boundary
- Infrastructure
- Peat Study Area

Peat Depth Location (labels in cm)

- Phase 1 Grid (100m x 100m)
- Phase 2 Samples: Turbines
- Phase 2 Samples: Infrastructure

Source: EnergieKontor UK Ltd, MacArthur Green

N

MacArthur Green

Over Hill Wind Farm FEI 2

Figure B23

Phase 1 and Phase 2
Peat Sample Locations/Depths

0 25 50
Metres
MAP SCALE: 1:1,250 @ A3

Status: Rev1
Approved: DM
Checked: BJF
GIS TM: LNF

Document Path: S:\Project GIS\Energiekontor\Over Hill\H_FEI2_FigB_P2_PeatSamples_OVH.mxd

Datum: OSGB 1936, Projection: British National Grid

Date: 20/08/2018

251000

612000

Palmsike Burn

196 277 254 230 364 267

361 413 452 298

394 414 387

351 301 358

209 159 269 205

236 232 206

256 228 255

320 332 271 260

364 319 300

335 350 262

N

EnergieKontor

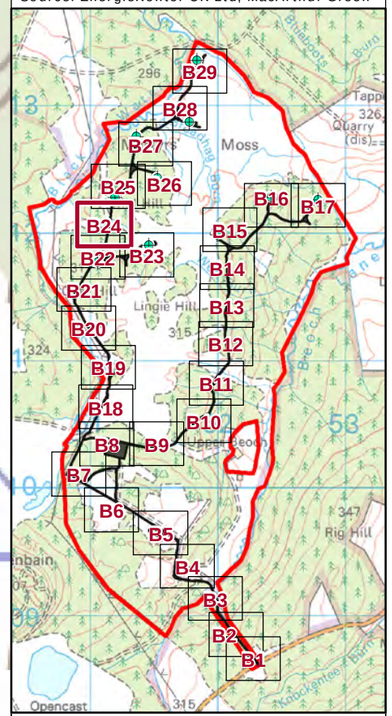
Legend:

- Planning Boundary
- Infrastructure
- Peat Study Area

Peat Depth Location (labels in cm)

- Phase 1 Grid (100m x 100m)
- Phase 2 Samples: Turbines
- Phase 2 Samples: Infrastructure

Source: EnergieKontor UK Ltd, MacArthur Green



MacArthur Green

Over Hill Wind Farm FEI 2

Figure B24

Phase 1 and Phase 2
Peat Sample Locations/Depths

0 25 50
Metres

MAP SCALE: 1:1,250 @ A3

Status: Rev1
Approved: DM
Checked: BJF
GIS TM: LNF

Document Path: S:\Project GIS\Energiekontor\Over Hill\H_FEI2_FigB_P2_PeatSamples_OVH.mxd

Datum: OSGB 1936, Projection: British National Grid

Date: 20/08/2018

612500

64 120 169 199 83 122 284 285 253 273 312 281 254 249 269 257 238 246 289 236 275 230 242 257 260 224 196 254 230 364 267 277 192 141 142 226 224 255 232 238 224 243 239 183 221 204 85 76 92 125 71 156 127 68 77 87 108 138 142 72 47 87 79 80 259 104 75 155 117 118 142 197 98 50 104 82 246 247

N

EnergieKontor

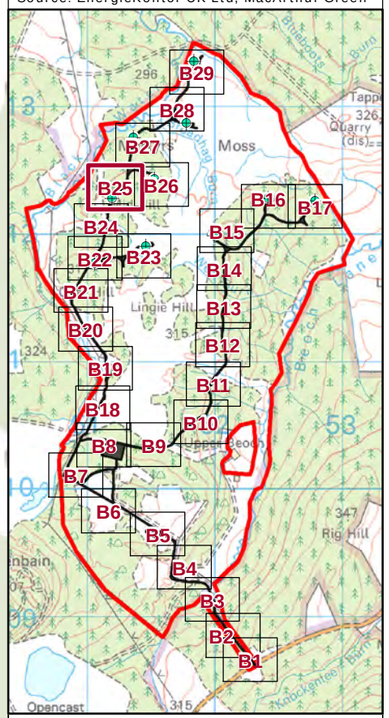
Legend:

- Turbine
- Planning Boundary
- Infrastructure
- Peat Study Area

Peat Depth Location (labels in cm)

- Phase 1 Grid (100m x 100m)
- Phase 2 Samples: Turbines
- Phase 2 Samples: Infrastructure

Source: EnergieKontor UK Ltd, MacArthur Green



MacArthur Green

Over Hill Wind Farm FEI 2

Figure B25

Phase 1 and Phase 2
Peat Sample Locations/Depths

0 25 50
Metres
MAP SCALE: 1:1,250 @ A3

Status: Rev1 Approved: DM Checked: BJF GIS TM: LNF

Document Path: S:\Project GIS\EnergiekontorOver Hill\H_FEI2_FigB_P2_PeatSamples_OVH.mxd

Datum: OSGB 1936, Projection: British National Grid

Date: 20/08/2018

251500

612500

Mid Hill

EnergieKontor

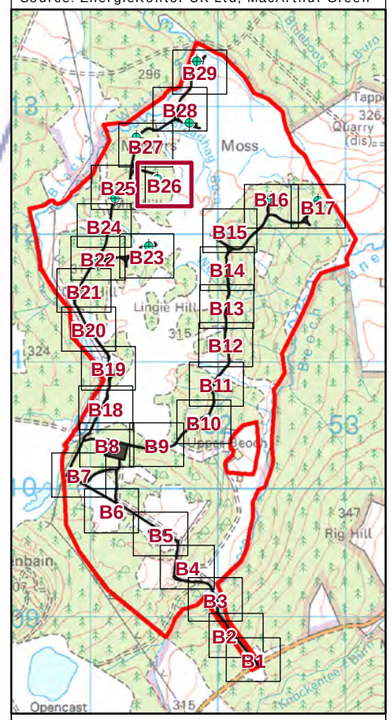
Legend:

- Turbine
- Planning Boundary
- Infrastructure
- Peat Study Area

Peat Depth Location (labels in cm)

- Phase 1 Grid (100m x 100m)
- Phase 2 Samples: Turbines
- Phase 2 Samples: Infrastructure

Source: EnergieKontor UK Ltd, MacArthur Green



MacArthur Green

Over Hill Wind Farm FEI 2

Figure B26

Phase 1 and Phase 2
Peat Sample Locations / Depths

N

0 25 50
Metres

MAP SCALE: 1:1,250 @ A3

Status: Rev1
Approved: DM
Checked: BJF
GIS TM: LNF

Document Path: S:\Project GIS\Energiekontor\Over Hill\H_FEI2_FigB_P2_PeatSamples_OVH.mxd

Datum: OSGB 1936, Projection: British National Grid

Date: 20/08/2018

251500

Lainhag Burn

Otter

109 260 241 263 276 396 228 190 142 108 201 170 198 208 271 310 398 343 228 120 99 257 265 242 201 212 312 325 289 255 269 249 340 76 90 192 233 218 275 188 160 261 215 231 239 226 222 191 216 212 282 224 258 214 228 134 76 162 256 93 192 134 200 360 243 124 117 88 210 77 257 73 141 83 95 85 92 60 140 140 120 107 85 117 107 92 189

N

EnergieKontor

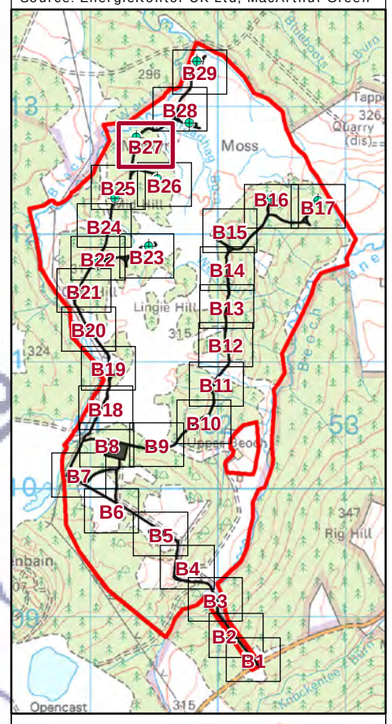
Legend:

- Turbine
- Planning Boundary
- Infrastructure
- Peat Study Area

Peat Depth Location (labels in cm)

- Phase 1 Grid (100m x 100m)
- Phase 2 Samples: Turbines
- Phase 2 Samples: Infrastructure

Source: EnergieKontor UK Ltd, MacArthur Green



MacArthur Green

Over Hill Wind Farm FEI 2

Figure B27

Phase 1 and Phase 2
Peat Sample Locations/Depths

0 25 50
Metres
MAP SCALE: 1:1,250 @ A3

Status: Rev1 Approved: DM Checked: BJF GIS TM: LNF

Document Path: S:\Project GIS\Energiekontor\Over Hill\H_FEI2_FigB_P2_PeatSamples_OVH.mxd

Datum: OSGB 1936, Projection: British National Grid

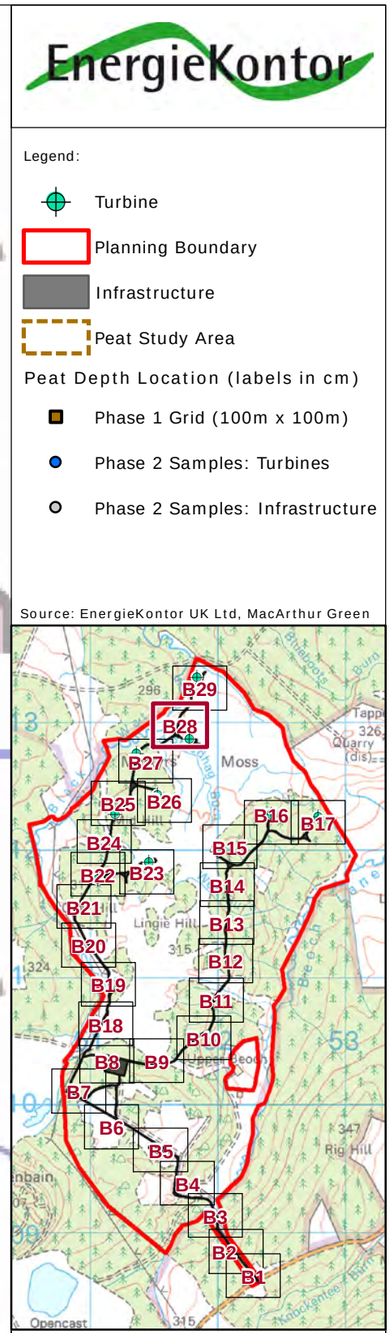
Date: 20/08/2018

251500

613000

142 149 303 234 246 154 420 233 113 200 350 229 261 237 176 415 131 196 223 269 58 251 41 27 201 53 100 200 370 136 271 160 48 85 228 154 189 172 77 36 273 260 268 272 230 250 274 300 127 302 172 250 250 310 232 146 190 251 380 142 275 281 284 270 276 279 278 310 245 303 311 322 375 142 108 245 299 283 262 262 228 190 300 320 368 201 159 293 300 280 321 396 170 130 278 310 398 280 260 507

N



EnergieKontor

Legend:

- Turbine
- Planning Boundary
- Infrastructure
- Peat Study Area

Peat Depth Location (labels in cm)

- Phase 1 Grid (100m x 100m)
- Phase 2 Samples: Turbines
- Phase 2 Samples: Infrastructure

Source: EnergieKontor UK Ltd, MacArthur Green

MacArthur Green

Over Hill Wind Farm FEI 2

Figure B28

Phase 1 and Phase 2
Peat Sample Locations/Depths

0 25 50
Metres
MAP SCALE: 1:1,250 @ A3

Status: Rev1
Approved: DM
Checked: BJF
GIS TM: LNF

Document Path: S:\Project GIS\EnergiekontorOver Hill\H_FEI2_FigB_P2_PeatSamples_OVH.mxd

Datum: OSGB 1936, Projection: British National Grid

Date: 20/08/2018

252000

EnergieKontor

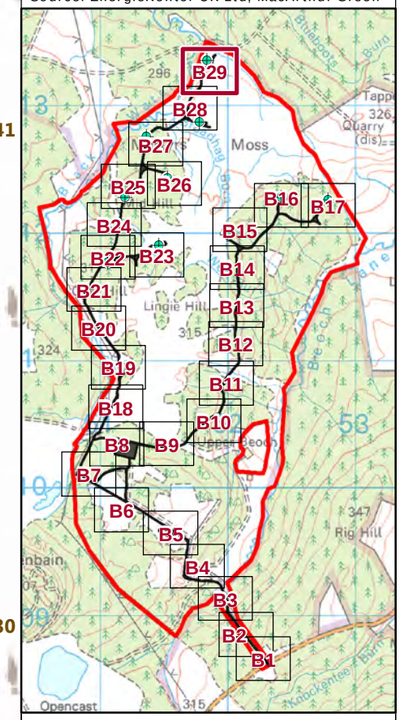
Legend:

- Turbine
- Planning Boundary
- Infrastructure
- Peat Study Area

Peat Depth Location (labels in cm)

- Phase 1 Grid (100m x 100m)
- Phase 2 Samples: Turbines
- Phase 2 Samples: Infrastructure

Source: EnergieKontor UK Ltd, MacArthur Green



MacArthur Green

Over Hill Wind Farm FEI 2

Figure B29

Phase 1 and Phase 2
Peat Sample Locations/Depths

N

0 25 50
Metres

MAP SCALE: 1:1,250 @ A3

Status: Rev1
Approved: DM
Checked: BJF
GIS TM: LNF

Document Path: S:\Project GIS\Energiekontor\Over Hill\H_FEI2_FigB_P2_PeatSamples_OVH.mxd

Datum: OSGB 1936, Projection: British National Grid

Date: 20/08/2018

Over Hill Wind Farm

Technical Appendix 6.1

Outline Habitat Management and Research Plan

Update for FEI August 2018

Prepared by: David H. MacArthur

Date: 20 August 2018

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Document Quality Record

Version	Status	Person Responsible	Date
Version 2	Final	David H. MacArthur	14 March 2018
Version 3	Final	David H. MacArthur	24 April 2018
Version 4	Final	David H. MacArthur	20 August 2018

CONTENTS

Figure 6.11a&b Outline Habitat Management and Research Plan

1. INTRODUCTION

This Outline Habitat Management and Research Plan (OHMRP) detail the proposed habitat management in relation to Over Hill Wind Farm (hereafter referred to as the 'Proposed Development').

For ease of reference, an erratum table indicating the changes to this document is included within this FEI 2 submission in Section 1.

This OHMRP sets out in the following sections the:

- Habitat Management Area and Management Units;
- Aims, objectives and management prescriptions;
- Monitoring programme;
- Research proposals; and
- Management and monitoring timetable.

The management recommendations within this OHMRP are based on the findings of Chapter 8: Ornithology and Chapter 9: Ecology (with reference to Chapter 12: Geology, Hydrology and Hydrogeology) within the Over Hill Wind Farm ES. These have been updated appropriately for blanket and wet modified bog in the Chapter 6 (Ecology & Ornithology) of the Further Environmental Information (FEI) submitted March 2018.

The key habitats addressed are Annex I habitats blanket bog, including wet modified bog. The loss of wet modified bog and blanket bog are assessed within Chapter 6: Ecology & Ornithology of the Over Hill FEI. The effect of the Proposed Development on wet modified bog and blanket bog habitats, prior to mitigation, is considered to be **Moderate Adverse** and **Significant** under the terms of the EIA Regulations (see Chapter 6: Ecology & Ornithology). The proposals in this OHMRP will reduce the effect on bog to **negligible/beneficial** and **Not Significant** as detailed within Chapter 6 of the March 2018 FEI.

The key ornithological species considered within this OHMRP is black grouse. The construction and operational effects of the Proposed Development on black grouse, prior to mitigation, are considered to be **Moderate Adverse** and **Not Significant** in the context of the EIA Regulations (see Chapter 8: Ornithology). As detailed in the ES, restrictions on activity during the construction period will reduce this effect to **Minor Adverse** and **Not Significant**, as will the habitat enhancement measures during the operational period, which will allow a net benefit to be delivered for black grouse. No unmitigated effects on any other species were predicted to reach **Moderate Adverse** significance. The management prescriptions outlined within this OHMRP for black grouse are also likely to provide benefit for other bird species, including raptors and waders.

Proposals are also detailed for a research plan for the Proposed Development. The research will include two elements: 1) investigate the impact of floating roads and piled and excavated turbines

on blanket bog hydrology to better inform future impacts and carbon calculator assumptions; and 2) establish the activity of Leisler's bats at wind turbine locations.

The final details of the OHMRP will be agreed with East Ayrshire Council in consultation with the Scottish Environmental Protection Agency (SEPA), and Scottish Natural Heritage (SNH) prior to the commencement of construction.

A Habitat Management Group (HMG) will oversee and monitor the implementation of the agreed OHMRP. The HMG should include representatives from East Ayrshire Council, SNH and RSPB and will meet on an annual basis for the first 5 years of the operational period of the wind farm. An appropriate meeting or reporting schedule will be agreed by the HMG after the first five years.

An annual report will be submitted by the wind farm owner to the HMG detailing the tasks (management and monitoring) completed over the last year and those planned for the year ahead. Any monitoring reports will be issued to the HMG as they are produced.

Management prescriptions in the HMP may be amended in light of monitoring results to ensure progress towards the stated aims of the plan.

2. ENVIRONMENTAL IMPACT ASSESSMENT

2.1 Ecology

A relatively small number of habitats account for the majority of the Proposed Development Area. The most common and widespread habitats are coniferous plantation and blanket bog with smaller areas of marsh/marshy grassland, wet modified bog and unimproved neutral grassland. Small areas of broadleaved semi-natural woodland are restricted to the south of the Proposed Development Area.

The variation in habitats largely reflects soil type, topography and anthropogenic influences on the vegetation (e.g. drainage). The area is underlain by peat of various depths and this is reflected in the presence of the active blanket bog communities.

The most abundant blanket bog community within the Proposed Development Area is M18 NVC community which covers a large tract of land in the north and centre of the Proposed Development Area. There are small pools, runnels or haggs containing M2 and M3 NVC communities within the expanse of M18. The blanket bog habitat remains good condition despite the planting of conifers. Blanket bog occupies 35.64% of the Proposed Development Area.

Wet modified bog, highlighted by the presence of M19 and M25, is mainly present within the forestry rides within the northern and central coniferous plantations. Wet modified bog occupies 5.89% of the Proposed Development Area.

2.2 Ornithology

In general, bird activity rates recorded within the Proposed Development Area were low, with the key breeding species recorded being black grouse, goshawk and snipe. Although other species of high sensitivity were recorded (e.g. hen harrier, peregrine), records were infrequent and no breeding

evidence was observed. Small numbers of other wader territories (e.g. curlew, lapwing) were observed, but these are either unaffected by the Proposed Development, or in numbers that do not reach significance.

Results from surveys in 2015 and 2016 indicated that, unlike in 2014, there is one regular lekking area, just outside of the Proposed Development Area (ES Confidential Figure 8.9). The maximum count at this lek site was four males in May 2015. Individual females were also recorded within the survey area in 2014 and 2015. Birds were occasionally recorded within the Proposed Development Area, in 2015 and 2016 but no lekking was observed.

Goshawks were recorded on a small number of occasions during baseline surveys and it is possible that the Proposed Development Area forms part of a territory, with a bird heard calling in April 2015 (ES Figure 8.10). No further breeding evidence was however observed. An adult male was recorded in flight during the 2015 and 2016 breeding seasons (ES Figures 8.7 and 8.8).

Approximately 5-10 snipe territories are likely to be present within the Proposed Development Area, and numbers of up to 10 individuals recorded together in winter (ES Figures 8.11 to 8.14).

3. HABITAT MANAGEMENT UNITS

The OHMRP comprises four Management Units within the Proposed Development Area (see Figure 6.11), within which management and monitoring works will be implemented.

3.1 Management Unit A – Wet Modified Bog and Blanket Bog - Unplanted

Management Unit A comprises the area of wet modified and blanket bog which is currently considered to be in good condition and not overlain by conifer plantation. Within Unit A, the aim is to maintain and, where possible, enhance the bog and increase the proportion of *Sphagnum* mosses and dwarf shrubs, via measures including managing deer grazing densities. Improving this habitat will also be of benefit to black grouse which may be displaced during construction of the Proposed Development.

3.2 Management Unit B – Wet Modified Bog and Blanket Bog – Forestry Removal

Management Unit B comprises the area of currently afforested bog habitats. Within Management Unit B, the aim is to fell the conifers and restore the bog by increasing the water table and encouraging the growth of bog plants such as peat forming *Sphagna*. This will also be of benefit to black grouse through increasing the available foraging habitat for them.

3.3 Management Unit C – Native Broadleaved Woodland

Management Unit C comprises areas with peat depth of less than 0.5m (or where non-peat soils were recorded) for new broadleaf planting. These areas are accessible by birds using the nearby regular lek site, whilst being of sufficient distance from proposed turbine locations to avoid displacement effects.

3.4 Management Unit D & E – Thinning of Sitka Spruce Plantation & & Peat Edge Woodland

Within Management Unit D an area of Sitka spruce plantation will be thinned to increase habitat quality for black grouse. Increasing open space within this Management Unit will aim to ensure that

the ground flora will be enhanced for foraging and nesting opportunities, and provide more suitable cover. This area will also link directly to the borrow pit restoration as peat-edge woodland.

This management unit will be accessible to birds using the nearby regular lek site, whilst being of sufficient distance from proposed turbine locations to avoid displacement effects.

3.5 Management Unit F– Upper Beoch Visual Screening

The objective of management Unit F is to provide visual screening of the proposed wind turbines from the residence, Upper Beoch. The trees will be managed throughout the operational life of the wind farm with the intention of maintaining the screening from the blocks shown in Figure 11.

4. AIMS, OBJECTIVES AND MANAGEMENT PRESCRIPTIONS

The Aims define the general OHMRP's goals and the related Objectives further define the Aims into quantifiable targets. The Prescriptions detail the management works to be implemented to achieve these Aims and Objectives. Annex 1 provides an indicative timetable for the implementation of the various prescriptions.

4.1 Management Unit A – Wet Modified Bog and Blanket Bog - Unplanted

Aim 1: Maintain / enhance 254.96ha of blanket bog and wet modified bog.

Objective 1.1) Maintain/increase the abundance and distribution of *Sphagnum* mosses, particularly key indicator species such as *Sphagnum papillosum* and *S. magellanicum*. A particular focus of this objective is to improve the condition of the wet modified bog areas (M19 and M25) that have experienced drying/fragmentation effects from plantation forestry. Areas of blanket bog (largely M18 bog) are currently in good condition and so the focus is ensuring this condition is maintained.

Prescription 1.1) Manage deer densities as required to achieve Objective 1.1. This will be done in a way so as to avoid conflicts with the black grouse element of the HMP, e.g. by avoiding the use of deer fencing. Deer densities are considered to be high if they exceed a density of ~15 deer/km^2 (Cummins *et al.* 2011). However, in general impacts can be site specific with densities generally accepted to be a poor indicator of damage. Long-term management should be based on assessment both of actual impacts and apparent density of deer (Putman et al., 2011). Deer densities would also be managed in accordance with a Deer Management Plan, which will be produced prior to construction.

Prescription 1.2) The following activities will be prohibited within Management Unit A[1]:

- Clearing out of existing ditches.
- Application of any insecticides, fungicides or molluscicides.
- Application of lime or any other substance to alter the soil acidity.
- Cutting or topping vegetation except to control injurious weed species.
- Burning of vegetation or other materials.
- Use of roll or chain-harrow.

[1] These activities are not currently happening on site however this prescription ensures that these activities will not take place during the life of this Plan.

- Planting trees.
- Carrying out any earth moving activities.
- Use for off-road vehicle activities.
- Construction of tracks, roads, yards, hardstandings or any new structures, other than those for the Proposed Development.
- Storage of materials or machinery.

Prescription 1.3) Remove regenerating confiders as required on an annual basis.

Prescription 1.4) Blocking drains and erosion gullies (even if vegetated) to raise the water table of adjacent peatland. A survey of these areas will be completed within the first year of operation and a programme of drain and gully blocking agreed in consultation with SNH.

4.2 Management Unit B – Wet Modified Bog and Blanket Bog - Planted

Aim 2: Restore 99.35ha blanket bog and wet modified bog.

Objective 2.1) Increase the abundance and distribution of *Sphagnum* mosses, particularly key indicator species such as *Sphagnum papillosum* and *S. magellanicum*.

Objective 2.2) Increase the abundance of dwarf shrubs including *Calluna vulgaris, Empetrum nigrum* and *Vaccinium myrtillus*.

Prescription 2.1) Remove conifers to promote recovery of the bog habitat. Commercially viable trees should be removed from the Proposed Development Area where possible. Non-commercially viable trees should be chipped on site using an appropriate technique and in accordance with SEPA guidance.

Brash will be chipped and spread across the open ground of felling area. The aim of this will be to aid the natural regeneration of blanket bog. Tree stumps in these areas will be ground down to ground level. The brash/stumps will be spread in strict accordance with SEPA guidance (2014a) and involve spreading chipped material in a thin layer, allowing for 25% light penetration with brash 'particles' of between 5-30cm in length. Care must be taken to limit damage to underlying peat within which some brash may be embedded. Brash mats can be pressed into the ground by the routine actions of forest machinery during timber extraction: digging up brash would cause further ground disturbance and increase pollution risk and it is therefore recommended that brash matts (if required) are left in situ.

Prescription 2.2) Remove regenerating conifers as required on an annual basis.

Prescription 2.3) Remove the stump/ridge furrow legacy of the conifer plantation in line with emerging best practice methods for peatland restoration (e.g. see Short and Robson, 2016). This will need to be undertaken with care to limit the impact on existing bog vegetation within plantation areas.

Prescription 2.4) Dam active drains in order that the water level is raised sufficiently to create conditions suitable for the *Sphagnum* species mentioned within Objective 1.1.

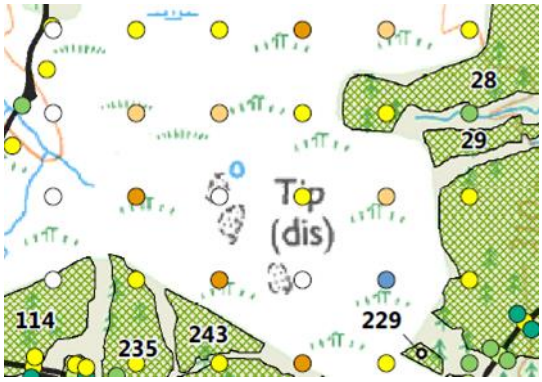
Prescription 2.5) As per Prescription 1.1.

Prescription 2.6) As per Prescription 1.2.

4.3 Management Unit C – Native Broadleaved Woodland

Aim 3: Enhance foraging habitat and cover for black grouse

Objective 3.1) Plant native broadleaved woodland within an area of 1.96ha designed to optimise habitat for black grouse (indicated by the zero peat areas (white dots) in the figure below).



Prescription 3.1) Plant low density native woodland to increase tree cover. Tree planting within Management Unit C will occur in coupes of around 10-20m^2 and the density within coupes will be 1600 stems per ha. The exact species mix will depend on local conditions, but is likely to comprise: common willow, birch and rowan. Tree planting should be undertaken during the first year of construction of the Development. Tree tubes are likely to be used for this however, if fencing is required around coupes to prevent damage from deer, fencing will be made more visible to grouse by the use of chestnut paling, sawn softwood droppers, or orange plastic netting (see Trout and Kortland, 2012 for example). The fences will be removed as soon as practicably possible.

Prescription 3.2) Manage deer densities to allow successful establishment of trees planted under prescription 3.1.

4.4 Management Unit D & E – Thinning of Sitka Spruce Plantation & Peat Edge Woodland

Aim 4: Enhance foraging habitat and cover for black grouse

Objective 4.1) Improve 3.7ha of Sitka spruce plantation for black grouse.

Prescription 4.1) Selectively fell within 3.7ha of Sitka spruce plantation so that a minimum of 40% open space is achieved. Forestry felling should follow recommendations detailed in prescription 2.1 above.

Objective 4.2) Plant approximately 1.92ha of peat edge woodland at the borrow pit restoration location which lies adjacent to the Sitka spruce thinning areas.

4.5 Management Unit F – Upper Beoch Visual Screening

Aim 5: Provide 8.05ha visual screening of the wind turbines at Over Hill wind farm to the property at Upper Beoch

Objective 5.1) Manage 8.05ha of commercial plantation to retain its capacity to provide screening of the wind turbines from Upper Beoch.

Prescription 4.1) Regular monitoring (approx. every 3-5 years) to check on any management works required to maintain these forestry coupes.

5.0 MONITORING

Habitat monitoring, conducted by suitably qualified and experienced ecologists, will evaluate the success of restoration and enhancement of blanket bog and wet modified bog. This will be achieved by recording changes to the structure and composition of the vegetation and species abundance, evenness and diversity. Recording of impacts from deer will also be included in the monitoring programme. A representative sample of around 40 permanent quadrats will be established within Management Units A and B together, to gather sufficient data to inform future management and assess the trajectory of plant species and habitats. The final detailed methods will be agreed with East Ayrshire Council, SNH and RSPB.

Habitat monitoring will commence during the first year of operation of the wind farm to establish the baseline and will be repeated in years 3, 5, 10 and 15 of the operational life of the Proposed Development. The frequency of monitoring thereafter will be agreed in consultation with East Ayrshire Council, SNH and RSPB.

Black grouse surveys (following standard methodologies) will be undertaken in years 1, 2, 3, 5, 10 and 15 during the operational life of the Proposed Development. The main objectives of this monitoring will be to assess the status of the black grouse lek in the vicinity of the Development Area and to establish the success of the habitat management measures.

It should be noted that the OHMRP is a live document, and may require revision based on the findings from the monitoring programme, unexpected events or evolving guidance. Any proposed amendments would be put to East Ayrshire Council (and SNH & RSPB if required) for approval, before implementation.

6. RESEARCH PROJECT PROPOSALS

It is proposed that two research projects will form the overall plan: 1) investigate the impact of floating roads, piled foundations and excavated turbines on blanket bog hydrology to better inform future impacts and carbon calculator assumptions; and 2) establish the activity of Leisler's bats at wind turbine locations.

6.1 Research proposal on the impact of wind farm infrastructure on peatland

A detailed research project to assess the impact of wind farm infrastructure on peatland hydrology will involve a Before and After Control Impact (BACI) design to assess changes to the water table after the Proposed Development is constructed. This research would be developed with SNH and SEPA and would help to inform future assumptions within the carbon calculator and assess the efficacy of certain construction techniques at reducing impacts on peatland.

The research project would aim to monitor the following potential likely environmental effects:

- Magnitude and extent of excavation and dewatering on the water level, water content, hydraulic conductivity and flow boundaries within the peatland habitat;
- The effect of dewatering on the water quality of the peatland habitat in relation to concentrations of dissolved organic carbon and acidity levels;
- Long-term effect of loss of peat store on flows within the surrounding watercourses; and
- Localised effect of floating roads on up and down gradient water levels within the peatland habitat, and, water quality as a result of track runoff.

SEPA (2014b) has developed guidance (LUPS 31) on monitoring groundwater levels in relation to groundwater abstractions; this provides the most relevant guidance for to the proposal. The SEPA LUPS 31 guidance requires a minimum of one up-gradient and two down-gradient monitoring locations around each area of infrastructure of interest. To establish a baseline dataset, monitoring should begin one year prior to construction. In accordance with the guidance, a minimum of 10 measurements equally spaced over a minimum six month period is required, including a minimum of five summer drawdown points. Monitoring would continue monthly throughout construction, followed by a minimum of 3 years post-construction monitoring.

In order to assess the changes to the water table and allow for a sufficient statistical analysis to be undertaken, it is proposed that a series of at least seven transects would be established across the infrastructure. These transects would be situated perpendicular to the locations where they intersect with the proposed tracks and perpendicular to the slope where they intersect the proposed turbine locations. The requirement for additional clustered monitoring will be reviewed when designing the monitoring plan. Given the number of proposed turbines on the site, it is recommended that at least five of these turbines locations are monitored including piled turbines on variable depths of remaining peat.

Careful consideration of the dipwell layout is required based on the areas of interest and their relative topography. Water levels are directly affected by gradient and will need to be considered to develop a monitoring strategy that allows directl comparison of results. Research into monitoring water tables in blanket peatlands was undertaken by Allott et al (2009). The research covered a number of key sites monitored using 30 m by 30 m clusters of manual and automated dipwells. A minimum number of 15 monitoring points was recommended to develop an understanding of water table fluctuations within a study area. A similar density of monitoring should be considered in key study areas, across the Proposed Development area. Automated monitoring allows increased temporal assessment of potential affects which may be particularly pertinent during the construction phase of the Proposed Development. It is proposed that at least one continuous

monitor is installed on site in order to monitor the natural variation within the water table throughout the entire monitoring period.

Monitoring will mainly comprise dipwells focussed to water levels within the superficial peat deposits. Consideration can be given to a number of deeper boreholes that will allow further information on the groundwater exchange between the peat hydrology and underlying aquifer. Whilst it is known if there is limited movement (often assumed as zero) due to the limited hydraulic gradient within peat, a level of vertical connectivity may still exist, which is less understood. Whether this connectivity increases under pressure and a change in the hydraulic head (i.e. from floating infrastructure) is not known.

Using appropriate technology, sample areas could also be surveyed to understand the potential frequency of peat pipes in the less degraded areas. The results may guide the level of consideration peat pipes should be given in future assessments.

The scope of the research would be discussed and agreed with statutory bodies so that they provide the most benefit for future developments.

6.2 Research proposal on the impact of wind farm infrastructure on bats

A detailed research project will be undertaken to assess the impact of wind turbine generators on bats, specifically on Leisler's bat (*Nyctalus leisleri)*.

A detailed method will be agreed with SNH in advance of commencing monitoring, however it is likely to comprise the following:

- Monitoring at relevant turbine locations for 30 days per season (spring, summer and autumn[2]).
- One year of pre-construction monitoring to allow a comparison of bat activity pre and post construction to be made. This will employ identical acoustic monitoring methods as that to be used during post-construction monitoring.
- The programme of post-construction bat monitoring should span a minimum of 3 years. Carcass searches and acoustic monitoring will be required, along with simultaneous monitoring of key weather parameters (wind speed and temperature). If repeated casualties are detected during operation, a trial curtailment regime informed by bat activity, temperature and wind speed data should be implemented – the SCADA system on the turbines can be programmed to switch the turbines to be feathered during periods of high risk (high bat activity), i.e. at above the normal cut-in speed and up to the appropriate wind speed above which bat activity drops off.
- 'Ecobat' online database (http://www.ecobat.org.uk) will be used, as this may help give a clearer picture of whether curtailment will ultimately be required.

[2] Or for a period of time in line with the most current guidelines at the time the surveys are due to be conducted, as updates to current guidelines on bats and wind farms are expected in 2018.

7. REFERENCES

Allott, T.E.H., Evans, M.G., Lindsay, J.B., Agnew, C.T., Freer, J.E., Jones, A. & Parnell, M. (2009). Water Tables in Peak District blanket peatlands. https://www.escholar.manchester.ac.uk/api/datastream?publicationPid=uk-ac-man-scw:18867&datastreamId=FULL-TEXT.PDF

Cummins, R., Donnelly, D., Nolan, A., Towers, W., Chapman, S., Grieve, I. and Birnie, R.V. (2011). Peat erosion and the management of peatland habitats. *Scottish Natural Heritage Commissioned Report No. 410.*

Putman, R., Longbein, J., Green, P., Watson, P (2011) Identifying threshold densities for wild deer in the UK above which negative impacts can occur. Mammal Review.

SEPA (2014a) Use of Trees Cleared to Facilitate Development on Afforested Land, Land Use Planning System SEPA Guidance Note LUPS-GU27, Version 1, 09 April 2014. Joint guidance from SEPA, SNH and FCS.

SEPA (2014b). Land Use Planning System SEPA Guidance Note 31.

Short, R., and Robson, P. (2016). An Innovative Approach to Landscape-Scale Peatland Restoration. CIEEM In-Practice, Issue 93, September 2016.

Trout, R. and Kortland, K. (2012). Fence marking to reduce grouse collisions. Forestry Commission Technical Note. http://www.forestry.gov.uk/PDF/FCTN019.pdf/$FILE/FCTN019.pdf

ANNEX 1 MANAGEMENT AND MONITORING TIMETABLE

Activity	Year - 1*	2	3	4	5	6	7	8	9	10	11	12	13	14	15…
Drain Blocking (Unit B)	✓														
Tree planting and beat up (Unit C and E)	✓	✓	✓	✓	✓	✓									
Selected Plantation thinning (Unit D)	✓														
Deer Management (Units A, B, C)	Continues for 25 years														
Fencing (if required for implementation of management; Units A, B C)	Note, any fences should only be erected after construction is completed and should be marked to avoid black grouse collisions. Fences should be removed as soon as practicably possible.														
Habitat Monitoring (Units A, B)	✓		✓		✓					✓					✓
Black Grouse Surveys	✓	✓	✓		✓					✓					✓
Bat Surveys (also requires pre-construction monitoring)	✓	✓	✓												
Hydrology Monitoring (also requires pre-construction monitoring)	✓	✓	✓												
Reporting to HMG	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

251000 252000 253000

613000 612000

Black Water
Blueboots Burn
Knowe
Blueboots Moss
Old March Burn
Loch Rig
Tappethill Moss
Tappet Hill
Quarries (dis)
Sheepfold
Martyrs' Moss
Whig Hole
Otter Sike
Broadhag Burn
Harecraigs Hill
Birny Brae
Peat Sike
Old March Burn
West Knowe
Reive Knowe
Lingie Hill
Pumarleuch Burn
Beech Lane
Stannery Knowe
Coyle
Manei

T1 T2 T3 T5 T6 T7 T8 T9 T10 T11

13 12

316 280 270 260 250 285 383 464

a b

N

0 250 500
metres
MAP SCALE: 1:10,000 @ A3

EnergieKontor

Legend:

- Planning Boundary
- Piled Turbine
- Standard Turbine

Infrastructure

- Piled Crane Pads
- Standard Crane Pads
- Substation
- New Floating Tracks
- New Access Track
- Existing Track

Management Units (Ha)

- A (254.96)
- B (99.35)
- F (8.05)

Forestry Plan

- Mixed Conifer (Retained)

Source: EnergieKontor UK Ltd, MacArthur Green DGA

MacArthur Green

Over Hill Wind Farm FEI 2

Figure 6.11a

Outline Habitat Management and Research Plan

Status: Rev1 Approved: DM Checked: BJF GIS TM: LNF

Document Path: S:\Project GIS\Energiekontor\Over Hill\E_FEI2_Fig6.11_HMP_OVH.mxd

Datum: OSGB 1936, Projection: British National Grid

Date: 20/08/2018

250000 251000 252000 253000

611000 610000 609000

Lingie Hill 316
Knowe Shaft (disused)
Burnt Knowe
Quarry (disused)
Tip (dis)
Upper Beoch
Sheepfold
Rig Hill
Auldhaw Glen
Benbain
Shafts (dis)
Beoch Lane
Pit (dis)
MP
Knockenlee Burn
Stannery Knowe
Coyle
Manei
B741

EnergieKontor

Legend:

- Planning Boundary

Infrastructure

- Construction Compound
- New Floating Tracks
- New Access Track
- Existing Track
- Borrow Pit

Management Units (Ha)

- A (254.96)
- B (99.35)
- C (1.96)
- D (3.70)
- E (1.92)
- F (8.05)

Forestry Plan

- Mixed Conifer (Retained)

Source: EnergieKontor UK Ltd, MacArthur Green DGA

MacArthur Green

Over Hill Wind Farm FEI 2

Figure 6.11b

Outline Habitat Management and Research Plan

0 250 500
metres
MAP SCALE: 1:10,000 @ A3

N

Status: Rev1 Approved: DM Checked: BJF GIS TM: LNF

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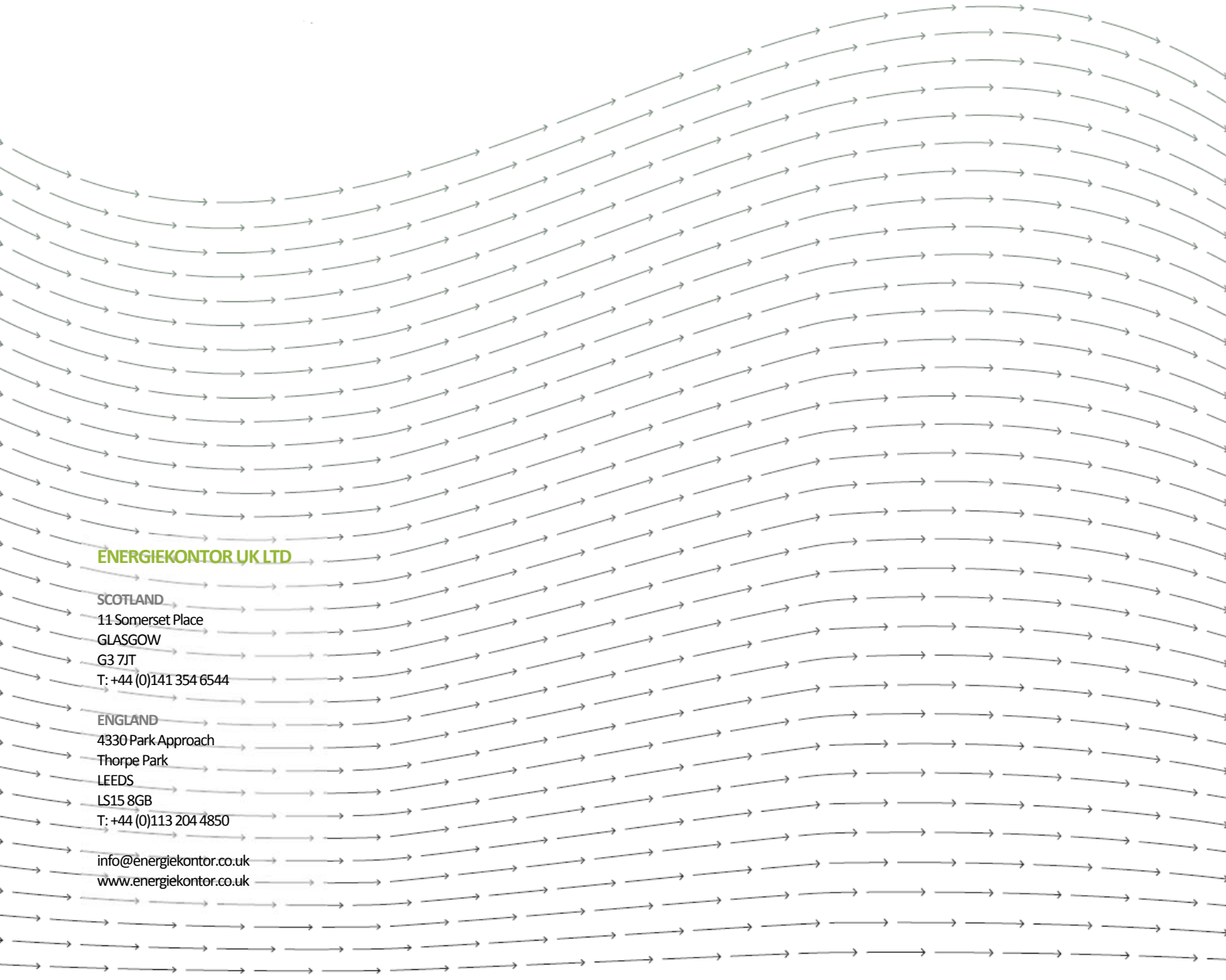
Datum: OSGB 1936, Projection: British National Grid

Date: 20/08/2018



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