Mayfield/Tranent Ridge

General location

The Mayfield/Tranent Ridge is located on the north-eastern edge of East Lothian and extends into neighbouring Midlothian. This character area comprises an elongated north-east/south-west orientated low, undulating ridge forming a backdrop to the well-settled Esk valley.

Findings of original capacity study on larger typologies

The original capacity study concluded that there was overall low capacity for larger turbines within the Mayfield/Tranent Ridge landscape character area, reflecting the very limited scope for development to be sited to avoid impacts on this low ridge which forms a highly visible feature in the wider landscape.

Existing/consented and proposed wind farm development

A single small turbine (15m height to blade tip) has recently been erected near Falside Hill within the part of this character area that lies within East Lothian.

Potential offshore wind farm sites lie within the outer reaches of the Firth of Forth and there may be some visibility from the elevated and more open northern edge of this landscape, although they will be very distant with visual effects unlikely to be significant.

Summary of sensitivity

The larger development typologies sited within this area would diminish the appreciation of the apparent vertical scale of the Mayfield/Tranent Ridge by providing an element of 'scaling' and could affect the presently predominantly rural backdrop which this landscape provides to the wider setting of Edinburgh and the Dalkeith area. Larger turbines would also exacerbate the clutter of tall built structures evident in some parts of the ridge and could detract from the setting and scale of settlement and areas where a more diverse landscape pattern occurs. Larger turbines would also be highly visible, particularly from the wider area due to the visual prominence of this ridge. There would be a ***High*** sensitivity to Typology A and a ***Medium-high*** sensitivity to Typology B.

Sensitivity would be reduced for Typology C to ***Medium***, reflecting the greater scope for turbines of this size to relate to more open areas with a weaker landscape pattern and where they would minimise impact on prominent skylines and interaction with transmission lines and masts. There are greater opportunities to accommodate small turbines to minimise impacts on key sensitivities with an overall ***Low*** sensitivity assessed for Typology D.

Constraints

- The steep north-west facing slopes and ridge top of this landscape which is visually prominent from parts of Edinburgh and other settlements and major transport routes such as the A1
- Designed landscapes, including Carberry and Oxenfoord (the latter sited within the adjacent Scottish Borders) where turbines could impact on their integrity and setting.

- Cumulative effects with existing transmission lines, particularly in the Tranent/Elphinstone area, where turbines would exacerbate visual clutter.
- The relatively well-settled nature of this landscape where small settlements and houses could be dominated by larger turbines

Opportunities

- Lower south-east facing hill slopes away from sensitive ridges where small turbines could be visually associated with farms and other buildings

Guidance on development

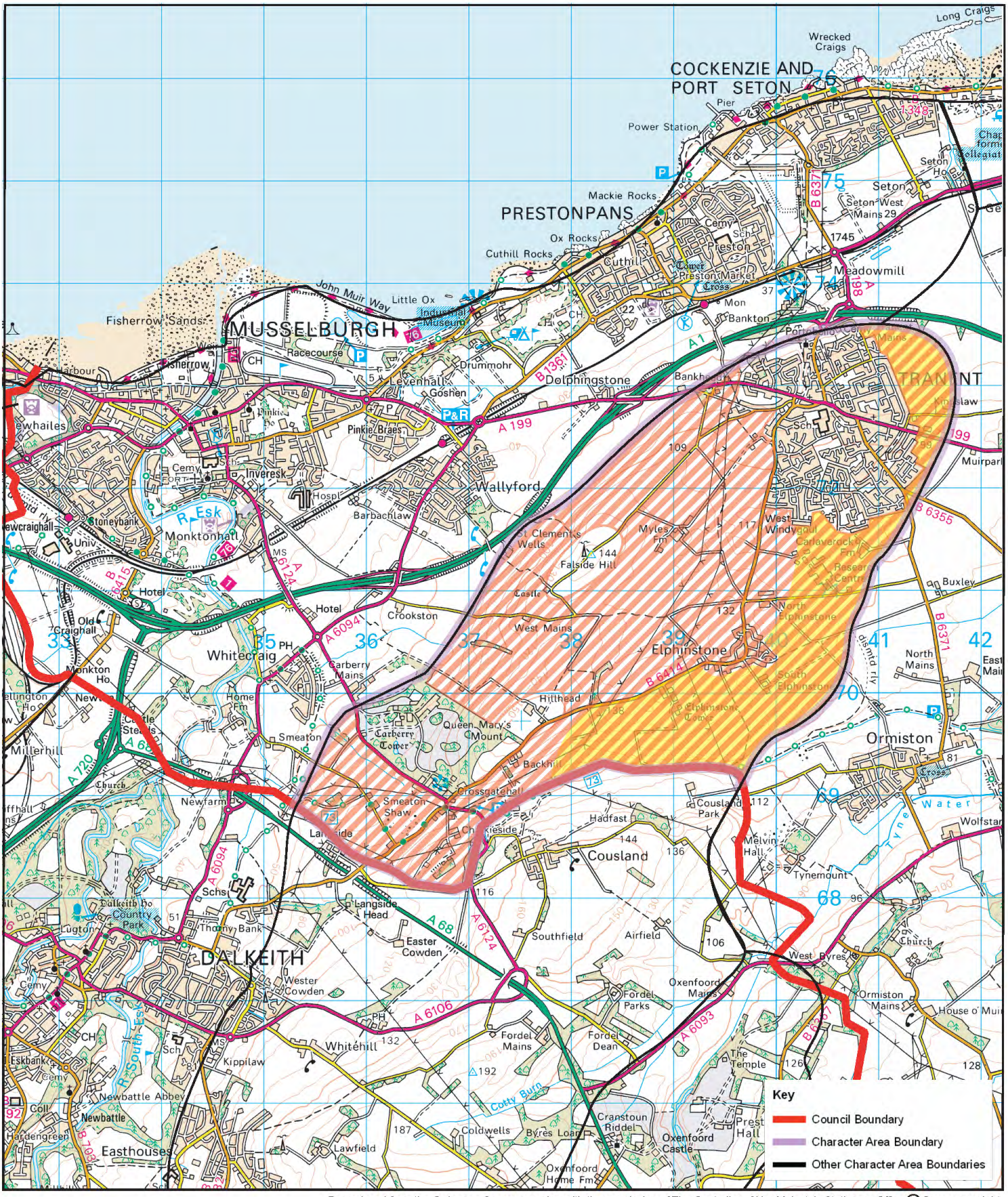
There is no scope to locate Typologies A and B (turbines up to and including 42m) in this landscape due to the significant effects likely to occur across a range of sensitivity criteria.

Typology C, single and small groups of turbines between 20m and up to and including 42m high, could be accommodated in this landscape, although opportunities are very limited within the part of this landscape which lies in East Lothian. Turbines should be sited away from more prominent steep north-west facing slopes and ridges and should avoid exacerbating the visual clutter of existing transmission lines and masts evident in some parts of this character area. They should be associated with broader, gentler hill slopes where a backdrop of rising ground may reduce visual impact (particularly for turbines towards the lower height band of this typology <30m high). Turbines should avoid breaking the skyline of the ridge seen from Edinburgh and other settlements to the north-west. There is limited scope for multiple developments of single and small groups of turbines due to the cumulative effects likely to occur with existing masts and pylons in this landscape.

Small turbines below 20m high should be sited where they can be clearly associated with existing built development, farms or other settlement to minimise visual clutter. They should avoid prominent ridgelines and be sited on lower slopes where a backdrop of higher ground would minimise visual impact.

All turbines should be sited to avoid intrusion on key views to Edinburgh from the A68 and other elevated routes. They should also avoid impacting on the setting of the designed landscapes and wider policy features of Carberry and Oxenfoord Castle. It is important that the variety of turbine designs is restricted to avoid exacerbating clutter in this landscape.

Detailed siting and design should follow the guidance set out in Section 4 of this report.



Opportunities for Development Typologies

To be read in conjunction with Fig No 1

none	A No scope to locate turbines of this size
none	B No scope to locate turbines of this size
	C Limited opportunities, Area of Search indicated subject to impact on key views, cumulative impacts with existing masts and transmission lines and on designed landscapes
	D Opportunities to locate small turbines if visually associated with farms / buildings

Fig No 9

Supplementary Landscape Capacity Study for Wind Turbine Development 2011

Mayfield / Tranent Ridge

0 1 2 km

Humbie/ Gifford/ Whittingehame River Valleys

General location

The Humbie, Gifford and Whittingehame Waters cut in a generally north/south alignment through the Agricultural Plain. They lie within consistently incised valleys characterised by dense woodland cover and policy landscapes.

The boundary of the Gifford River Valley landscape character area has been extended slightly to the north to include the Lennoxlove policies.

Findings of original capacity study on larger typologies

The original capacity study concluded that there was no capacity to accommodate windfarm development in the River Valleys and that all development typologies would incur significant adverse impacts on both landscape character and views and visibility. The original capacity study only considered turbines above 42m height to blade tip.

Existing/consented and proposed wind farm development

There is no existing windfarm or smaller turbine development within this character area.

Visibility of existing or currently proposed windfarm development in other landscape character areas (and within the approaches to the Firth of Forth) is likely to be very limited due to the incised and often rolling landform of these valleys and their dense woodland.

Summary of sensitivity

There are likely to be physical and technical constraints to accommodating larger development typologies within these valleys. The often complex rolling and incised landform together with the richly intricate pattern of woodlands, designed landscapes and small fields also present a major landscape constraint. These features provide an often highly scenic setting to the small historic settlements and mansion houses that are a key characteristic of these valleys, further increasing sensitivity, particularly to larger typologies. Although views from the River Valleys are restricted by landform and vegetation, larger turbines would extend beyond the visual containment of the incised landform and woodland and would result in intrusion on views from elevated roads and hills within surrounding landscapes. There would be a ***High*** sensitivity to Typologies A and B and a ***Medium to high*** sensitivity to Typology C.

There would be reduced sensitivity to smaller turbines below 20m height due to their ability to fit with the scale of larger buildings and woodlands. However, the complex landform and intricately patterned woodlands and other designed landscape features would still be sensitive even to these small turbines. Overall sensitivity would be ***Medium*** to typology D.

Constraints

- The complex rolling and incised landform of these river valleys and their rich pattern of woodlands and small enclosed pastures which would be sensitive to all development typologies
- The integrity and landscape setting to designed landscapes and small historic settlements located within these river valleys
- Footpaths and other recreational routes within these valley landscapes

Opportunities

- Broader, less rolling slopes with a more open character at the transition with the adjacent Agricultural Plain character area

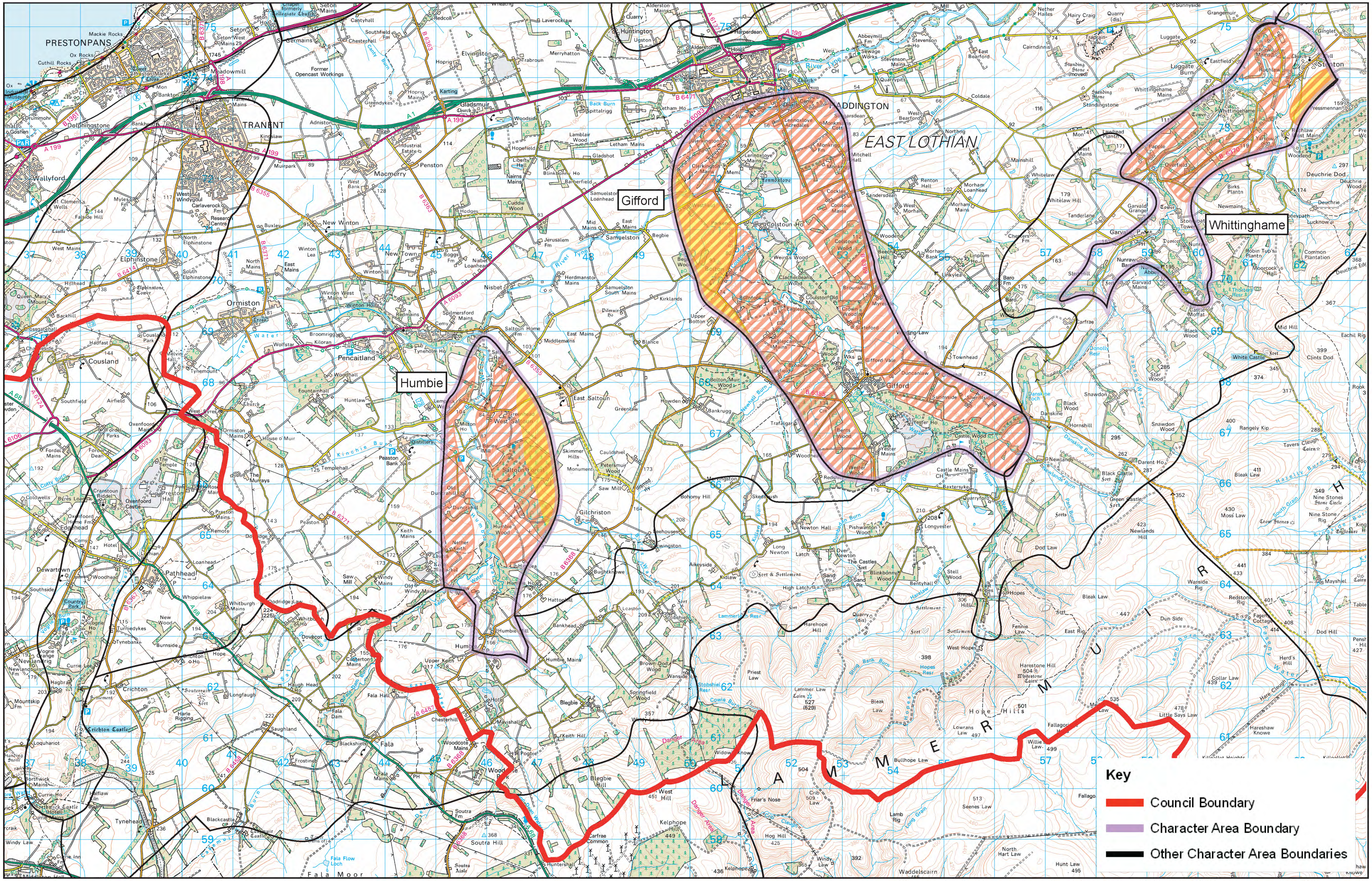
Guidance on development

There is no capacity to accommodate larger development typologies (turbines over 42m high) within these valleys due to the significant adverse landscape and visual effects likely to occur across a wide range of sensitivity criteria.

There is some very limited scope to locate turbines towards the lower height band of Typology C (below 30m height) away from the intimately scaled valley floor and the complex rolling landform of valley sides. Turbines would need to avoid intrusion on designed landscapes, the setting of settlements and be sited to avoid significant intrusion on key views from adjoining landscape character areas. These constraints are likely to severely restrict opportunities to site this typology within the Whittingehame and Gifford Valleys (which feature extensive policies, and also an intricate interlocking landform in the case of the Gifford Valley) with increased scope associated with the broader and more gently undulating upper slopes of the Humbie Valley which occur at the transition with the 'Agricultural Plain' landscape character area. Turbines should be sited away from the sensitive 'edge' of upper slopes where they may overwhelm the scale of the incised valley and views from footpaths.

There is increased scope to site small turbines below 20m high within these River Valleys. These should be sited where they can be clearly associated with existing built development, farms or other settlement to minimise visual clutter in these highly sensitive valley landscapes. All turbines should be sited to avoid intrusion on the setting of settlements and impacting on the integrity of designed landscapes. Special care is needed to ensure that only well-designed turbines are used in this particularly sensitive landscape with limits on the range of designs used in order to minimise cumulative landscape and visual effects. There is limited scope for multiple developments of single and small groups of turbines in this landscape character area.

Detailed siting and design should follow the guidance set out in Section 4 of this report.



To be read in conjunction with Fig No 1

Opportunities for Development Typologies

Symbol	Typology
none	A No scope to locate turbines of this size
none	B No scope to locate turbines of this size
(yellow)	C Limited opportunities to acommodate turbines **below 30m** subject to impact on key views
(hatched)	D Opportunities to locate turbines of this size if visually associated with farms and other buildings and sited to avoid impacts on designed landscapes and key views

Fig No 10

Supplementary Landscape Capacity Study for Wind Turbine Development 2011

Humbie, Gifford & Whittingehame River Valleys

0 1 2 3 km

Eastern Lammermuir Fringe

General location

The Eastern Lammermuir Fringe comprises rolling foothills edging the Lammermuir Plateau and sweeping round to the east to form the backdrop to the Eastern Coastal Margin.

Findings of original capacity study on larger typologies

The original study concluded that there was no capacity to accommodate windfarm development in the East Lammermuir Fringe due to the sensitivities of the rolling and often complex rolling landform, the diverse land cover pattern and scale of this landscape but also the potential for cumulative effects to arise in combination with pylons, masts and windfarm development in adjacent landscape character areas.

Existing/consented and proposed wind farm development

There is a small turbine (15m to blade tip) at Danskine within this character area.

The rolling landform of this character area tends to contain views although the Crystal Rig and Aikengall windfarms, sited within the adjacent Lammermuir Plateau, are visible in close proximity from elevated roads, footpaths and hill tops. The proposed Wester Dod wind farm may be visible from the Oldhamstocks area.

Summary of sensitivity

Larger development typologies would conflict with the often complex rolling landform of small hills and strongly contained narrow valleys found within this character area. The diverse land cover pattern and distinctly rural character of this landscape would also be diminished by larger turbines and they could exacerbate the visual clutter associated with pylons and masts in the eastern part of this area. In some areas, there would be cumulative landscape and visual impacts with existing windfarm development in the adjacent East Lammermuir Plateau character area. While views from this character area are often restricted by landform, extensive and dramatic views from more elevated footpaths, hill tops and also occasionally from elevated roads at the transition with the adjacent East Lammermuir Plateau are a feature and larger turbines would impinge on the foreground of these views. All development typologies would be visually prominent if sited on the broader topped hills adjacent to the Eastern Coastal Margin landscape character area. There would be a ***High*** sensitivity to Typologies A and B and a ***Medium to high*** sensitivity to Typology C.

There would be reduced sensitivity to smaller turbines below 20m height due to their ability to fit with the scale of larger buildings and woodlands. However, the complex landform and intricately patterned woodlands and other designed landscape features found in parts of this character area would be sensitive even to these small turbines. Overall sensitivity would be ***Medium to low*** to typology D.

Constraints

- The complex rolling landform, intimate narrow valleys and the dramatic landform of the steep-sided Lothian Edge and pattern of distinctive knolly hills against the scarp of the Lammermuir Hills
- Visually prominent hill tops seen from key transport routes such as the A1, the East Coast railway and settlements
- Small scale settlements and designed landscapes within the adjacent Whittingehame Valley which would be particularly sensitive to larger turbines
- Cumulative landscape and visual effects with existing windfarm developments within the adjacent Lammermuir Hills and with existing transmission lines within parts of this landscape

Opportunities

- Broader, lower hill slopes with a more open character away from sensitive hill tops

Guidance on development

There is no capacity to accommodate larger development Typologies A and B (turbines over 42m high) within this landscape due to the significant adverse landscape and visual effects likely to occur across a wide range of sensitivity criteria.

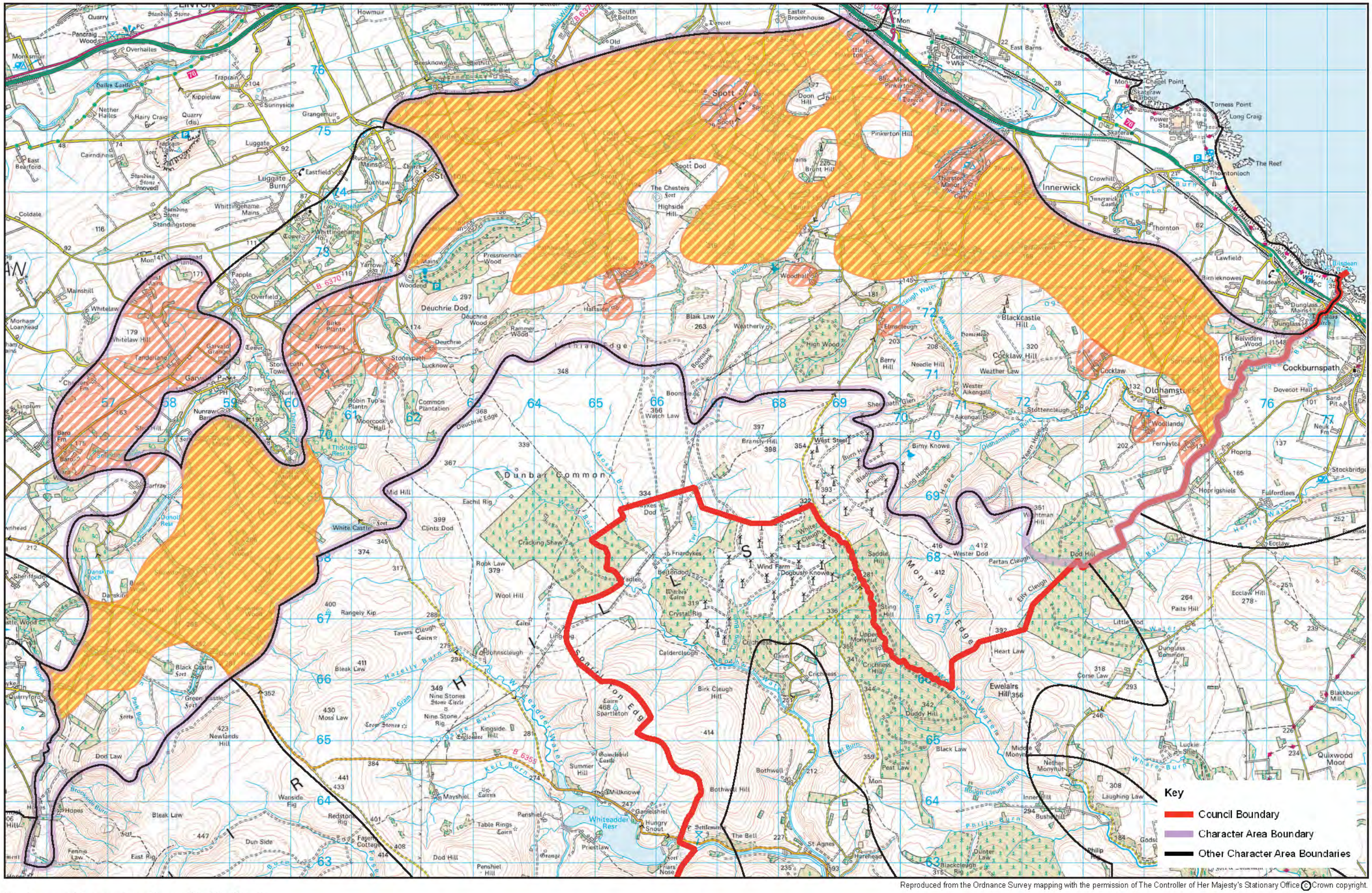
There is some limited scope to locate Typology C (turbines between 20 and up to and including 42m high) within this character area. Turbines should be sited on less complex broader hill slopes away from more complex rolling landform. Turbines should avoid eastern hill tops which are highly visible from the A1 and where they would be likely to incur significant cumulative effects with existing masts, transmission lines and the large turbines of the Crystal Rig windfarm. The distinctive band of small 'foothills' against the edge of the Central Lammermuir Plateau character area (these commonly featuring hill forts of archaeological interest) should also be avoided. Cumulative effects could also potentially arise close to the transition with the East Lammermuir Plateau where the turbines of Crystal Rig are clearly visible and the steep slopes of the Lothian Edge and Monynut Edge should be avoided with turbines instead being located on hill slopes (set down from more prominent hill tops) where a degree of 'back-cloth' from rising slopes would reduce visual impact in views from roads and settlement to the north.

There is increased scope to site small turbines below 20m high within this character area. These should be sited where they can be clearly associated with existing built development, farms or other settlement to minimise visual clutter within this landscape.

All turbines should be sited to avoid significant intrusion on the setting of settlements of Spott, Oldhamstocks and Innerwick and also settlements such as Stenton and Garvald within the adjoining Whittingehame Valley landscape character area. The designed landscapes of Whittingehame and Biel are also highly sensitive to intrusion, particularly from larger turbines located on the steep slopes which provide a backdrop to these richly patterned policies in views from Traprain Law and elevated roads to the north. Small turbines and turbines towards the lower height band of Typology C (below 30m) are likely to minimise impacts on settlements and designed landscapes. Special care is needed to ensure that only well-designed turbines are used in this sensitive landscape with limits on

the range of designs used in order to minimise cumulative landscape and visual effects. There is limited scope for multiple developments in this landscape character area.

Detailed siting and design should follow the guidance set out in section 4 of this report.



To be read in conjunction with Fig No 1

Opportunities

none A No scope to locate turbines of this size

none B No scope to locate turbines of this size

C Limited opportunities to acommodate turbines of this size subject to detailed siting and design, impact on key views and cumulative impacts

D Opportunities to locate small turbines if visually associated with buildings / farms

Fig No 11

Supplementary Landscape Capacity Study for Wind Turbine Development 2011

Eastern Lammermuir Fringe

0 1 2 km

North Lammermuir Platform

General location

The North Lammermuir Platform forms a long band of undulating farmland and small foothills fringing the northern edge of the Lammermuir Hills. This character area extends west into Midlothian.

Findings of original capacity study on larger typologies

The original 2005 capacity study concluded that there was low capacity to accommodate larger single and wind farm development typologies within the North Lammermuir Platform character area. Some limited scope was however identified for turbines towards the lower height band of typology (2) considered in the study (65m-42m turbine height).

Existing/consented and proposed wind farm development

There is no existing wind farm development within this character area although a few single small turbines are present in the Gifford area. Existing and consented wind farms located within the Lammermuir plateau are visible from parts of this character area.

Summary of sensitivity

A number of key constraints limit scope for accommodating larger turbines in this area. These principally relate to the effect of tall turbines on the scale and pattern of dispersed settlement and field and woodland pattern. Occasional distinctive landform features would be highly sensitive to development. These include the dramatically steep and rugged scarp slopes of the Lammermuir Hills which form the backdrop to this character area and also the series of pronounced small hills lying at the foot of this scarp which commonly feature hill forts of archaeological interest. This character area provides the foreground to extensive views to and from the Lammermuir Plateau and larger turbines could intrude on these views, particularly where sensitivity to development is thus increased. Cumulative landscape and visual effects are more likely to occur between larger typologies and existing wind farms within the Lammermuir Hills. There would be a ***High*** sensitivity to Typology A and a ***Medium-high*** sensitivity to Typology B.

Sensitivity would be reduced to ***Medium*** for Typology C due to the increased scope to associate smaller turbines with broader hill slopes, away from more sensitive complex landform which tends to occur close to the scarp edge of the Lammermuir Hills. There would be ***Low*** sensitivity to Typology D due to the ability of these small turbines to fit with the scale of landscape features and to be visually contained by woodlands and landform.

Constraints

- Distinctive knolly hills lying at the foot of the Lammermuir Hills which also commonly feature hill forts of archaeological interest
- The dramatic steep scarp of the Lammermuir Hills which provides a backdrop to this character area and key views to it from the B6368
- The strong and distinctive pattern of policy woodlands, field trees and hedgerows characteristic of the western part of this landscape

- Small scale settlements and designed landscapes within this and the adjacent Humbie Valley which would be particularly sensitive to larger turbines
- Cumulative landscape and visual effects with existing windfarm developments within the adjacent Lammermuir Hills

Opportunities

- Broader, gentle hill slopes away from prominent hill tops

Guidance on development

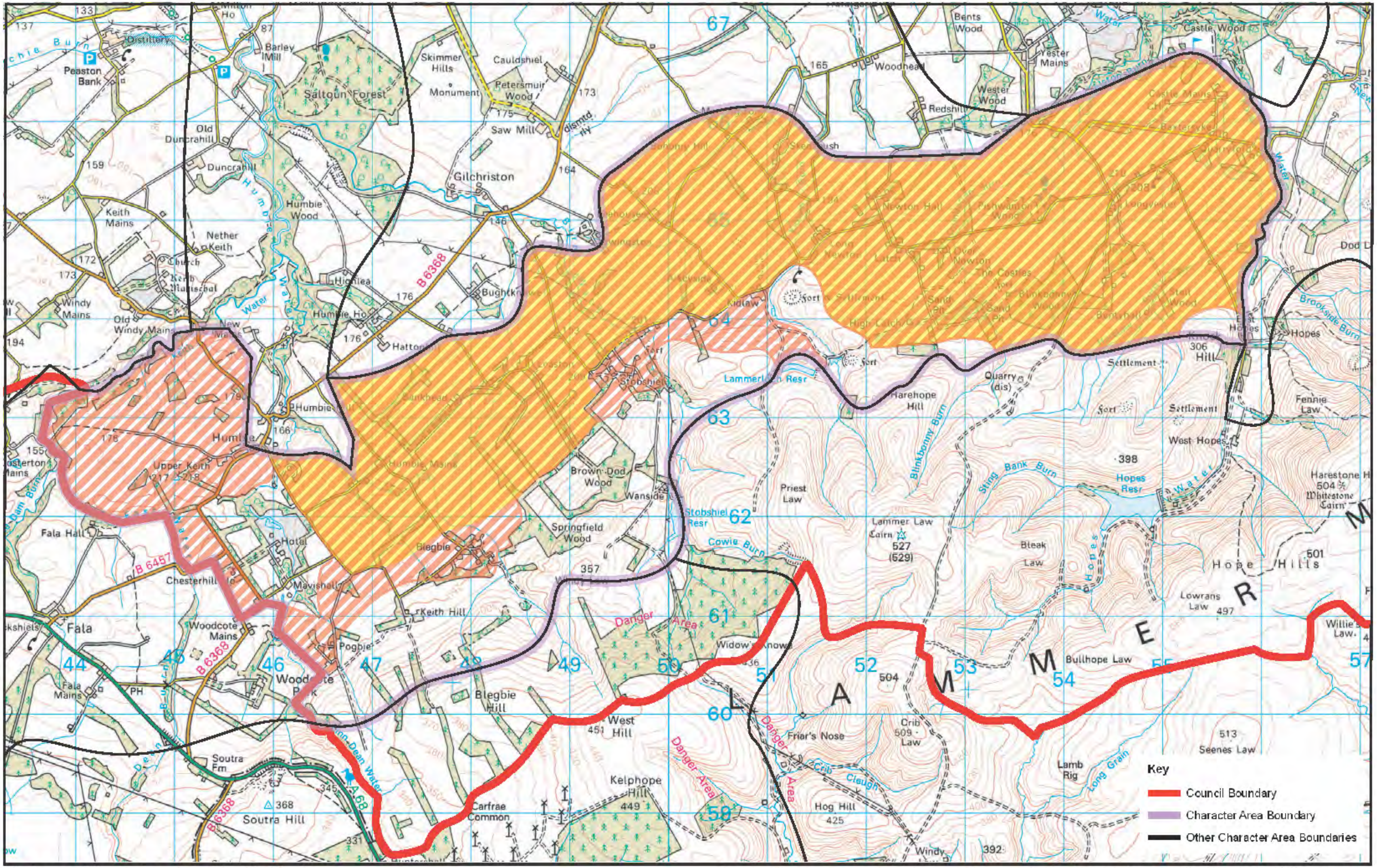
There is no scope to accommodate the larger turbines of Typologies A and B within this character area due to the significant adverse effects likely to occur across a number of key characteristics.

There is some scope to locate Typology C, with its single and small clusters of turbines between 20m and up to and including 42m height, although cumulative effects with the consented windfarm of Pogbie may be a constraint particularly in the western part of this character area. Turbines should be located on more gently undulating areas at the transition with the Agricultural Plain avoiding the more pronounced small, knolly hills lying at the foot of the Lammermuir Plateau. They should be sited on broader, gentle hill slopes, set down from prominent hill tops where visibility could be minimised by a backdrop of rising ground. Multiple developments of this typology could quickly dominate the strong, coalescing pattern of woodlands and field trees and uncluttered character of this landscape and on-going review of cumulative landscape and visual effects will be essential. There is likely to be increased capacity to accommodate multiple developments of turbines towards the lower height band of this typology (<30m high) as these would be less visually prominent and be likely to have less of a cumulative impact with existing/consented windfarm development.

There are greater opportunities to locate the small turbines of Typology D in this landscape provided these are located so visually associated with farms and other buildings in order to limit the spread of built structures in the landscape.

All turbines should be sited to avoid significant intrusion on the setting of settlements such as Humbie, on designed landscapes in this and adjoining character areas, and on key views to the dramatic scarp face of the Central Lammermuir Plateau, for example from the B6368 and on the setting of hill forts. The use of a restricted number of turbine designs will be essential in optimising capacity to accommodate multiple developments.

Detailed siting and design should follow the guidance set out in section 4 and Annex A.



To be read in conjunction with Fig No 1

Opportunities for Development Typologies

Symbol	Typology
none	A No scope to locate turbines of this size
none	B No scope to locate turbines of this size
(yellow)	C Limited opportunities, Area of Search subject to impact on key views to Lammermuir scarp, effects on distinctive pattern of woodland, hedges and field trees and cumulative effects with other windfarm development
(hatched)	D Opportunities to locate smaller turbines if visually associated with farms and buildings

Fig No 12 Supplementary Landscape Capacity Study for Wind Turbine Development 2011

North Lammermuir Platform

0 1 2 km

East Lammermuir Plateau

General location

The eastern part of the Lammermuir Hills comprises an undulating plateau cut by the Whiteadder Valley. This upland area forms a backdrop to the eastern coastal plain and foothills of East Lothian and to the sparsely populated farmed valleys of the Borders to the south.

Findings of original capacity study on larger typologies

The original 2005 capacity study concluded that there was low capacity to accommodate larger single and wind farm development typologies within the East Lammermuir Plateau. This was because although some key characteristics of this upland landscape could relate to larger scale turbines, the presence of existing and consented wind farm development increased sensitivity due to potential cumulative landscape and visual effects.

Existing/consented and proposed wind farm development

The existing large scale wind farm of Crystal Rig 1, 1a, 2 and 2a (85 turbines, 125m max height) and the Aikengall wind farm (16 turbines, 125m height) are sited in this character area. The proposed Wester Dod wind farm (30 turbines, 145m height) is also located within this character area.

The consented Fallago Rig wind farm is located in the adjacent Central Lammermuir Plateau character area but will be visible across much of this character area and seen cumulatively with the existing Crystal Rig and Aikengall wind farms.

Summary of sensitivity

There would be a ***High*** sensitivity to Typologies A and B within this character area due to the cumulative landscape and visual effects likely to occur in association with existing and consented wind farm developments in this and adjacent upland character areas. The sheer-sided dramatic landform features of the Spartleton and Monynut Edges are now dominated by wind farm development and remaining open and distinct hill tops, such as Spartleton, Penshiel and Priestlaw Hills, and the contained Whiteadder valley and reservoir are important features providing visual relief. Larger wind turbine development would diminish the unity and integrity of remaining open hill tops and valleys with a less fragmented landscape pattern and the proportion of open sweeping hills to 'developed' skyline within this character area.

While there would be a reduced sensitivity to Typology C with ***Medium-high*** sensitivity due to some very limited opportunities for turbines towards the lower height band of this typology (<30m high) to be sited so less visually prominent, cumulative landscape and visual impacts remain key limiting factors. Although the smaller turbines of Typology D (below 20m to blade tip) have greater potential to provide a clear scale differential with larger turbines within surrounding wind farm developments, sensitivity would be ***Medium***, reflecting the potential for even small turbines to appear out of scale within these more extensive uplands and to incur cumulative landscape and visual impacts if not closely associated with existing buildings within this sparsely settled area.

Constraints

- Cumulative landscape and visual effects likely to occur in association with existing and consented wind farm developments in this and adjacent upland character areas.
- Remaining open and distinct hill tops, such as Spartleton, Penshiel and Priestlaw Hills, and the Whiteadder valley and reservoir which are important features providing visual relief from existing/consented windfarm development.

Opportunities

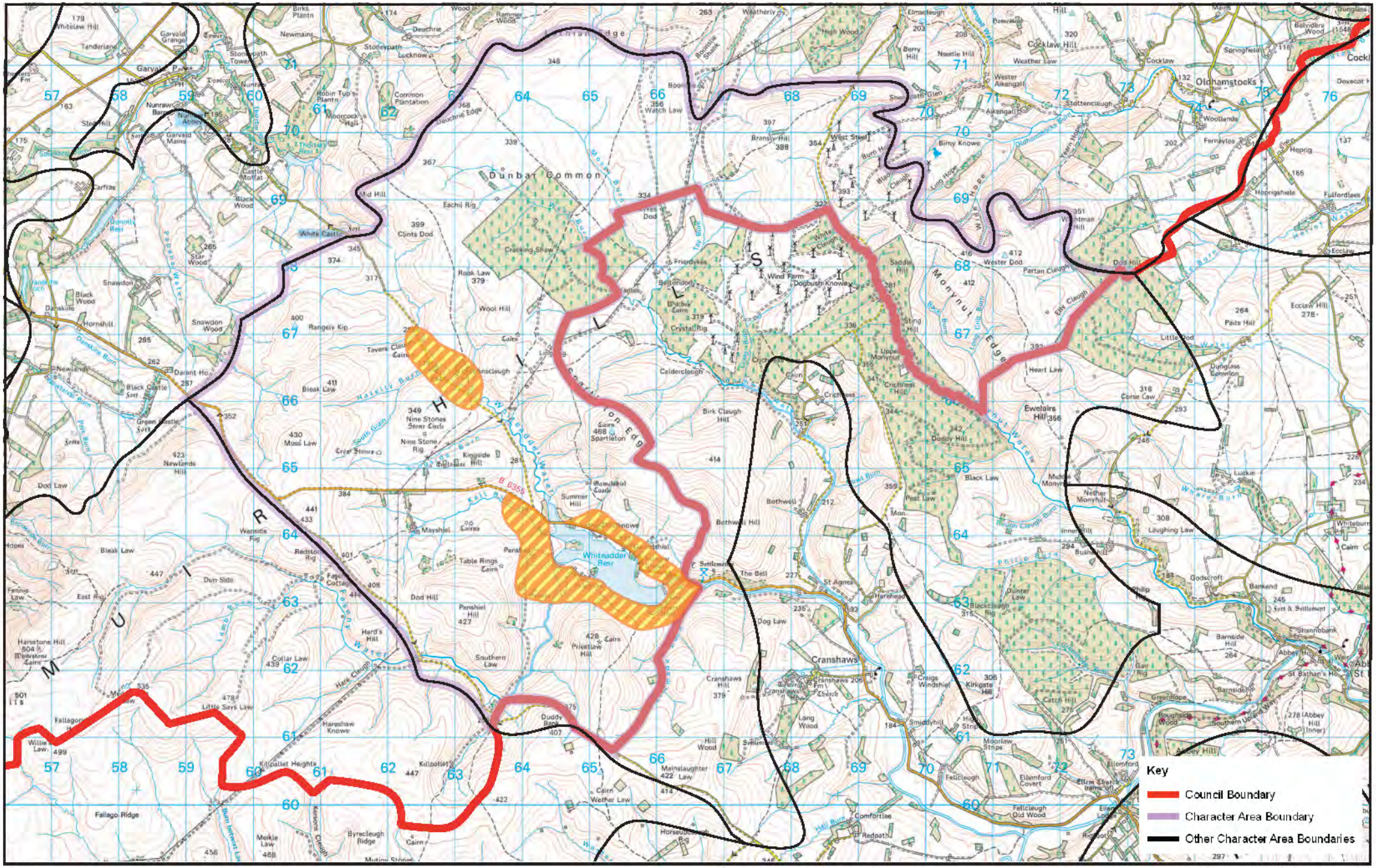
- Lower hill slopes visually associated with existing settlement within the Whiteadder valley

Guidance on development

There is no scope for the larger development Typologies A and B to be accommodated within this character area. This is because capacity is considered to have been reached in terms of the degree of large scale wind farm development which already characterises this landscape and the significant cumulative effects that would be associated with any further development of larger turbines.

There is some very limited scope for smaller turbines, towards the lower height band of Typology C (below 30m height in order to achieve a clear differential with existing windfarm development) and Typology D to be accommodated. Turbines should be associated with existing buildings such as farms which are set within the Whiteadder Valley or on gentler slopes or low hills where they could be back-dropped by rising ground. They should be sited away from sensitive scarp edges and prominent open hill tops which are important landscape features, separating existing windfarm developments and providing the setting to settled valleys and the adjacent Eastern Lammermuir Fringe. Development should avoid the more intricate edges of the Whiteadder Reservoir.

Detailed siting and design should follow the guidance set out in Section 4 of this report.



To be read in conjunction with Fig No 1

Opportunities for Development Typologies

none	A No scope to locate turbines of this size
none	B No scope to locate turbines of this size
	C Limited opportunities to acommodate turbines **below 30m** sited on lower hill slopes and visually associated with farm buildings
	D Opportunities to locate small turbines if visually associated with buildings / farms

Fig No 13 Supplementary Landscape Capacity Study for Wind Turbine Development 2011

East Lammermuir Plateau

Plateau Grassland

General location

The Plateau Grassland character area covers the western part of the Lammermuir Hills and comprises an upland plateau of smooth, gently undulating hills covered by rough grassland and coniferous woodland. Only a small part of the Plateau Grassland falls within East Lothian and the assessment which follows only considers sensitivity within the small part of the Plateau Grassland which lies within East Lothian.

Findings of original capacity study on larger typologies

The original 2005 capacity study concluded that there was moderate to high capacity for development within the Plateau Grassland character area with an extension to existing windfarm development considered to be the optimum typology in terms of minimising landscape and visual impacts. This assessment considered sensitivity across the whole of the Plateau Grassland character area lying in East Lothian, Midlothian and Scottish Borders. The Dun Law windfarm extension was proposed, but not consented, at the time of the 2005 study and this has now been constructed. The Pogbie windfarm was also consented in 2009 and would be located on the northern edge of this character area within East Lothian This scheme comprises 6 turbines, 76m high. These windfarms did not form part of the landscape and visual baseline assumed for the original sensitivity assessment and the conclusions on sensitivity have therefore been substantially reviewed within this current supplementary assessment.

Existing/consented and proposed wind farm development

The existing large scale wind farm of Dun Law I and II is located in this character area (within Scottish Borders) and comprises a total of 61 turbines between 62.5m and 75m high. The Pogbie windfarm was also consented in 2009 and is located on the northern edge of this character area within East Lothian. This scheme comprises 6 turbines, 76m high.

Summary of sensitivity

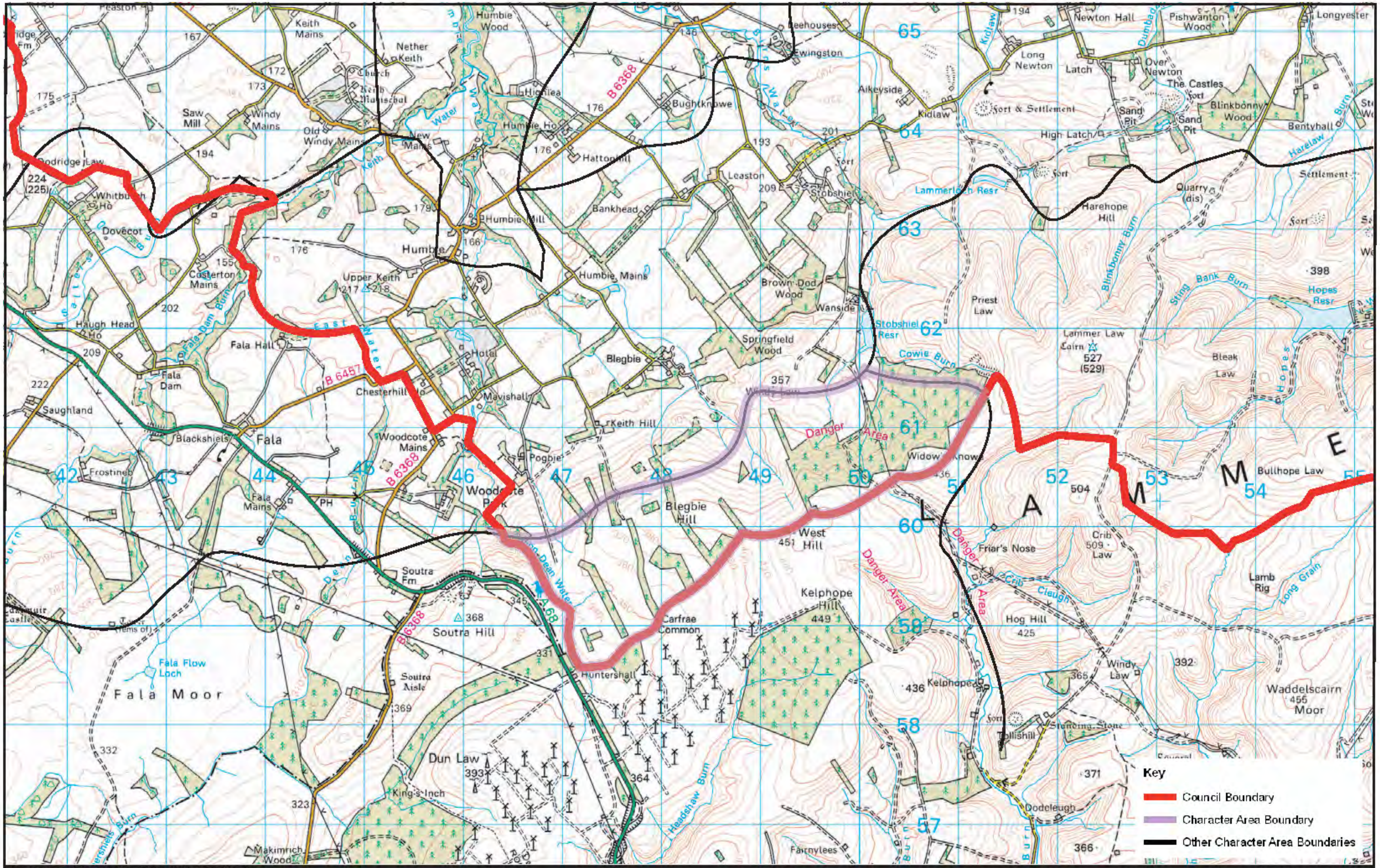
Existing and consented windfarm development is a key characteristic of the wider Plateau Grassland landscape character area. The part of this character area which lies within East Lothian comprises the steep scarp slopes of the Lammermuir Hills. These scarp slopes are sensitive to all development typologies in that they form a highly visible backdrop to the adjacent ‘North Lammermuir Platform’ and the western part of the ‘Agricultural Plain’ character areas. Blegbie Hill and West Hill are also important in forming a rim of higher ground which visually contains the expansive upland basin of the plateau to the south where the existing Dun Law windfarm is located and thus limits close views of this development from the ‘North Lammermuir Platform’. Significant cumulative effects would be likely to occur on views from the A68 and from longer views from the north if any of the development typologies considered in this study were sited on these largely open scarp slopes as they would be seen in conjunction with the existing and consented windfarms of Dun Law and Pogbie. There would be a ***High*** sensitivity to all typologies within this character area.

Constraints

- Cumulative landscape and visual effects likely to occur in association with existing and consented wind farm developments in this character area
- The highly visible steep scarp slopes of the Lammermuir Hills and the rim of slightly higher ground formed by Blegbie Hill and West Hill which is important in providing the setting to the existing windfarm of Dun Law and allowing dramatic views from the A68 across East Lothian

Guidance on development

There is no scope for any further development to be accommodated within the part of this character area which falls within East Lothian.



To be read in conjunction with Fig No 1

Opportunities for Development Typologies

none	A No scope to locate this size of turbine	none	C No scope within East Lothian due to cumulative constraints
none	B No scope to locate this size of turbine	none	D No scope within East Lothian due to absence of existing buildings

Fig No 14 Supplementary Landscape Capacity Study for Wind Turbine Development 2011

Plateau Grassland

0 1 2 km

4. Guidance on the siting of smaller turbines

Introduction

The height of turbines relative to other structures in the landscape is a key consideration in terms of landscape 'fit'. With this in mind, three heights of 'small' turbines were considered when developing the guidance for this supplementary assessment. These are:

	Height	Approximate kW output
Micro wind	Freestanding < 12m	Up to 1.5kW
Small wind turbine	12m and <20m	1.5 kW – 15kW
Small – medium wind turbine	20m and <42m	15kW – 50kW

Micro wind developments

Domestic roof/wall mounted systems are most likely to have an impact on townscape and add to cumulative effects in urban areas. They have not been included in this landscape capacity assessment, as it is difficult to identify a robust list of sensitivities for this size of development which can be properly assessed at the strategic scale required for this locational guidance.

Freestanding <12m high turbines would generally relate well to the size of existing buildings in the landscape, including farm buildings. They are just over twice the height of a single storey house, while a two storey house is about 9m high to roof pitch. This height of turbine is also similar to small telephone masts and tall telegraph poles[7].

A single turbine of this height is most likely to be used to contribute to the energy needs of a house, farm or other rural based small business. The size means that it is relatively easy to accommodate in a settled landscape, if sited to be associated with a building cluster. Therefore, while it is recognised that the free standing turbines of up to 12m may have cumulative effects on the landscape, they have been excluded from the landscape sensitivity assessments.

Small turbines (12m and <20m in height)

This size of turbine has been included as a development typology in the landscape sensitivity assessments carried out in this supplementary study. The sensitivity assessment has assumed that single turbines and small groups of up to 3 turbines are most likely to be associated with this typology. Proposals for 'wind clusters' of small turbines over 3 in number are likely to have adverse impacts as the speed of blade movement seen on mass would be visually confusing and distracting.

Within the East Lothian landscape, the following issues have been identified as being particularly influential in terms of detailed siting of turbines of this size within character types and units identified as being appropriate for this typology:

- *Turbine height in relation to the scale of the landscape*
- *Landform and landscape shape*
- *Settlement and land use pattern and features*
- *Visibility*

[7] Telegraph poles are available in heights from 6m to 25m, although based on site observations most appear to be 10m or less in height.

- *Cumulative issues*

Turbine height in relation to the scale of the landscape

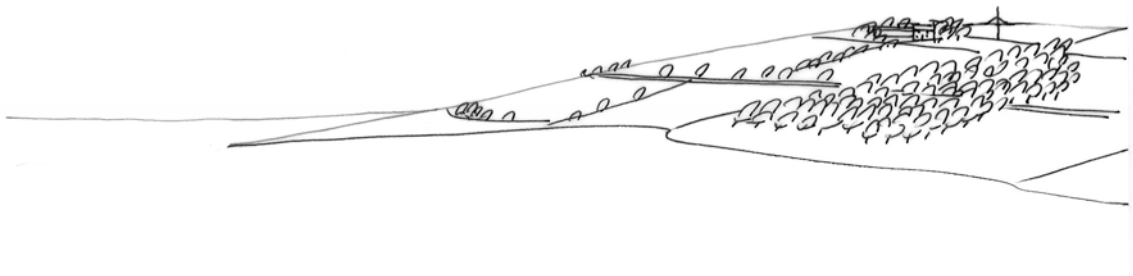
Landscape scale is made up of two factors, the scale of the landform and the scale of the pattern of land use. Assessing the scale of the landform involves assessing the perceived vertical height and horizontal expanse of the topography, as well as the degree of openness and containment created by topographical relief. The pattern of land use can create an additional layer of possible enclosure, for example where woodland and hedges provide containment, or conversely can reinforce openness, for example where moorland dominates. In addition, while we often assess sense of scale relative to ourselves within the landscape, individual elements, from trees to pylons, can offer reference points against which the scale of the landscape or the size of other elements is perceived and understood.

Small wind turbines from 12m to <20m, will appear as being up to about two and a half times the size of a two storey house. While this size of turbine is therefore likely to be prominent and may appear to tower above the buildings, a mature woodland, broadleaved or conifer tree is also about 15-20m in height. In the fertile lowland landscapes of East Lothian, where trees often achieve a good stature, turbines of this size may therefore relate well to the size of mature broadleaved or conifer trees in the landscape. Other structures of a similar height include taller telecom masts and small pylons.

Turbine size in relation to other landscape features: A turbine which is 2 times the height of the house, or a taller turbine located behind the ridge to reduce overall height from this view. The turbine is well scaled in relation to the size of other individual features. It is also located on the side of the hill, rather than the hill top, where it can be 'read' in conjunction with the farm buildings. This forms a 'cluster' of development, which reduces landscape and visual impact.

In some coastal areas, trees are more limited in height due to wind pruning and exposure and buildings may be low, or tucked away in sheltered locations. In such areas, the relationship between the turbines and landscape features is likely to be more sensitive, as turbines could easily dominate the scale of these individual elements which are key characteristics of these landscapes.

Care should be taken to site turbines where they do not dominate individual features. Turbines should avoid the immediate coastal edge and their size should be closely associated with the size of the features – which may be smaller than in more sheltered areas.



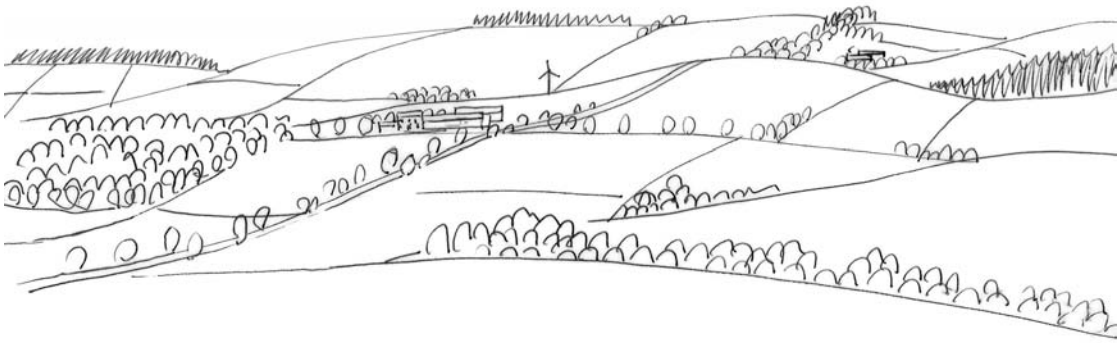
Coastal scenario: This turbine (Approx 1.5 times the height of the house) is located where it can relate to the farm steading cluster and the larger trees which are associated with these better soils. Note that the turbine is not located right on the skyline, where it would appear higher and more dominant. The smaller size fits in with the lower growing 'wind pruned' trees which are a feature of these coastal areas.

In the upland fringes, settlement is more dispersed. Trees, if present, may also be slow growing or short due to increased exposure. The size of the turbines should be closely associated with the size of these few features – which, like on the coast, may be smaller than in more sheltered areas. In these upland areas, however, there is also the opportunity to site turbines where they can be associated with the larger upland landform. Turbines can relate to the scale of the relief, foothills and ridges, or be back-dropped against higher land.

Landform shape

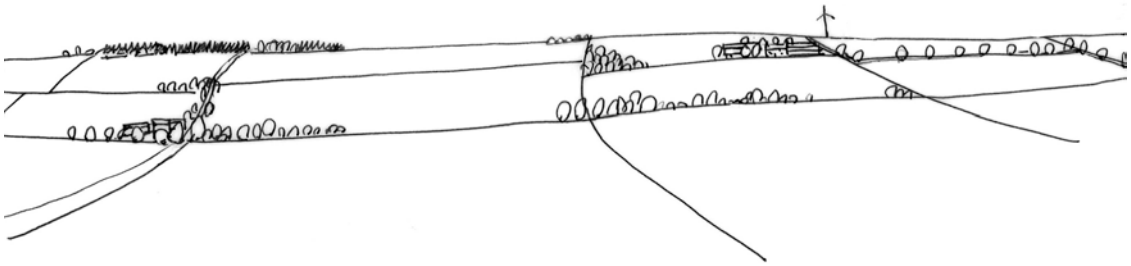
It was noted in site work that many of the lowland landscape character types are generally either more complex lower hill slopes (fringing the Lammermuirs), long ridges or wider, gently undulating plains.

Lower hill slopes are characterised by relatively complex, interlocking, rounded hill forms. They often have terraces, narrow ledges, folds and subtle hollows or distinct changes in gradient associated with rising slopes or dips which have the potential to create natural platforms for siting wind turbines.



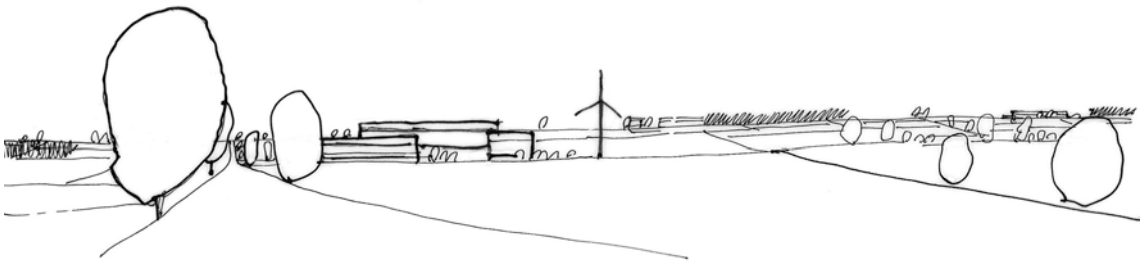
Landform shape – Lower hill slopes: This turbine, an indicative 2.5 times the size of the house, is clearly located on a flatter terrace below sloping ground. This interim ridge is back-dropped by more distant hills. The turbine is also close to the farm, creating a 'development cluster'.

Long ridges, which are a common feature of the East Lothian lowlands, tend to have low relief, with regular-shaped fields and woodlands extending up over the horizon. They have simple topography, with often gentle, evenly graded side slopes – and they do not rise very high. Turbines should be located where there are subtle changes of gradient in the topography, or clear breaks in slope. Aim to avoid the highest stretches of the ridgelines.



Landform shape – Long ridges: This indicative small turbine is located on the edge of the ridge, not on its highest point, which makes it less visually dominated than if it was located on the highest section of the ridge. The turbine is sited close to the farm, so that it creates a visual 'cluster'.

Wide valleys and plains are expansive and often relatively open landscapes. Large, regular fields and occasional woodlands extend across the gently undulating broad plains. Turbines should be located near to groups of buildings as far as possible, to limit visual clutter. In the absence of distinct folds in the landform or other topographical details, turbines should aim to be located at the field edges, so that they are linked to the landscape pattern.



Landscape shape – Wide valleys and plains: *This turbine, approximately 2x the height of the large sheds, is located at the edge of a field, reflecting the pattern of the landscape which has open fields edged with occasional individual field trees along the fencelines.*

Settlement and land use pattern and features

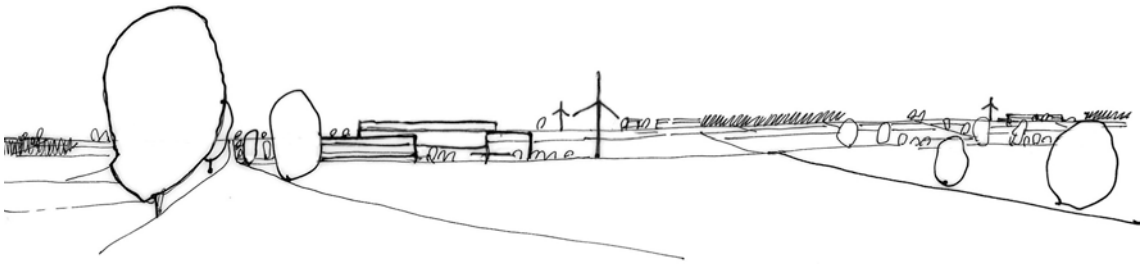
Small turbines are most easily accommodated in areas where there is settlement and other existing infrastructure. In such areas, the distribution of existing built development can form a recognisable pattern to which wind turbines can be visually and physically linked.

In East Lothian, lowland and foothill landscape character types are well settled, with farms, small villages and larger towns dispersed across a relatively cultivated and managed

landscape. Farms vary in size, and in more prosperous low-lying plains and shallow valleys, the steadings can be large. There are also warehouses, former aircraft hangars and industrial units and retail outlets which form clusters of large sheds in more low lying landscapes, and occasionally very large buildings such as the cement works at Dunbar. Smaller farms and lower buildings are associated with the more upland areas and villages are often nestled in folds in the landscape.

While small turbines are likely to be larger than most buildings, it is still appropriate to establish a visual relationship between a turbine and a farm or other group of buildings – especially the clusters of large sheds and farm steadings – in all these lowland or foothill landscapes. Turbines may also appear frequently enough in a settled or farmed landscape to create a helpful 'sub-pattern' of consistent association with farms or small clusters of buildings if the turbines are located close enough to the buildings.

Larger farm steadings and groups of industrial buildings are generally associated with more fertile low-lying plains and some of the ridges, where there are also larger fields, open landscapes with occasional trees or woodlands and more infrastructure, including wider roads, more frequent overhead lines and settlement. Turbines in these areas are best sited where they avoid prominent hilltops or landmark features such as clumps of trees, as well as the setting of villages and small buildings. Close association with farms or industrial buildings will limit visual clutter across these developed landscapes.



Settlement pattern - Wide valleys and plains: These turbines are all of a similar size in relation to each other and the buildings. They are all arranged so that they are in relatively close proximity to the farms, creating a 'sub-pattern' which is consistent across the landscape.

Smaller farms**,** designed landscapes and small villages nestled into the folds of the landscape tend to be found in more intimate areas of more complex landform. The small scale of the topography is reinforced by smaller fields and often more woodland, which may range from field trees to policy and commercial woods. In these landscapes, turbines should be located where they relate to the pattern and rhythm of the farm buildings and avoid hill top features or the edge of steep sided valleys.

Visibility

Unsurprisingly, small turbines are likely to be less visible than the larger ones over a wider area. Turbines which are 20m or less in height are more likely to be able to be screened or hidden within a wooded landscape, or by relatively low landforms and buildings. This is because they are about the same size as mature trees and, especially from lower viewpoints, have the potential to be hidden by other elements in the landscape. This is particularly the case in more complex, undulating landscapes.

Built features can often be seen from a great distance on the more open landscape and broader, more sweeping topography of the low-lying plain. In these landscapes, however, small turbines may be difficult to see from a distance, simply because they will not be prominent in such a large space.

As applicants may own farms or larger land holdings, there may be the potential to screen turbines from viewpoints if required, for example to reduce cumulative visual impacts, by establishing trees adjacent to the viewpoint (for quicker, maximum screening affect).

Cumulative issues

Given the current incentives, these small turbines may become a frequent and common occurrence in farmed landscapes. Key cumulative issues for small turbines are likely to relate strongly to potential clutter in the landscape. Issues may include:

- *Several individual, or small groups of turbines, could begin to dominate local character; The landscape could appear 'cluttered' if single or groups of turbines were associated with the majority of land holdings;*
- *Clusters, frequent single turbines or several groups of small turbines could begin to dominate local character;*
- *While one turbine breaching a skyline may be a focal point, a number of diverse structures, all spinning at different speeds – or even several groups of the same type of turbine – strung along a prominent or important skyline may become a visual distraction from other landscape features or from perceived visual amenity, especially from key viewpoints;*
- *The variety of potential different types of wind turbines within the landscape could lead to clutter with different styles, sizes of structures and speeds of blade movement dotted across a landscape;*
- *Lack of a clear siting strategy could lead to fragmentation of an existing robust, recognisable, consistent and characteristic pattern of development, especially if turbines do not relate well to existing buildings and point features in the landscape;*
- *There may be the added complication of increased visual clutter created by a wide range of different heights of turbine within a farmed landscape with micro-, small and small/medium sized turbines;*
- *Potential clutter may also be exacerbated if there are other masts, such as telecoms masts, overhead wires and pylons within the same vicinity*

Small – medium size turbines (20m and up to and including 42m in height)

This size of turbine has been included as a development typology in the landscape sensitivity assessments carried out for this supplementary study. The sensitivity assessment has assumed that single turbines and small groups of up to 5 turbines are most likely to be associated with this typology. In some landscapes, where topography is more complex, characterised by low relief or where vegetation pattern is more diverse, then groups of up to 3 turbines might be a more appropriate maximum number. Such decisions need to be made when considering the scale of the immediate setting of a proposal.

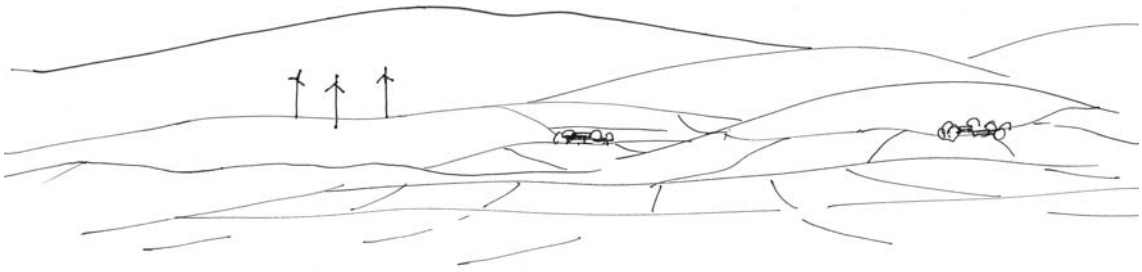
In general within the East Lothian landscape, the following issues have been identified as being particularly influential in terms of detailed siting of this typology within character types and units identified as being appropriate for this typology:

- *Turbine height in relation to the scale of the landscape*
- *Landform and landscape shape*
- *Settlement and landscape pattern and features*
- *Visibility*
- *Cumulative issues*

Turbine height in relation to the scale of the landscape

Turbines of between 20m and up to and including 42m are going to be one of the tallest structures in any landscape. They are going to be taller than most buildings and most trees. They are still, however, similar in height to some pylons.

Turbines of this height can be accommodated most readily by relating the height of the turbines to the scale of the landform, rather than trying to link them to the size of other structures and trees. If well sited, turbines of this size, even in small groups of up to three turbines, may be able to take advantage of the degree of relief created by medium scaled landforms.

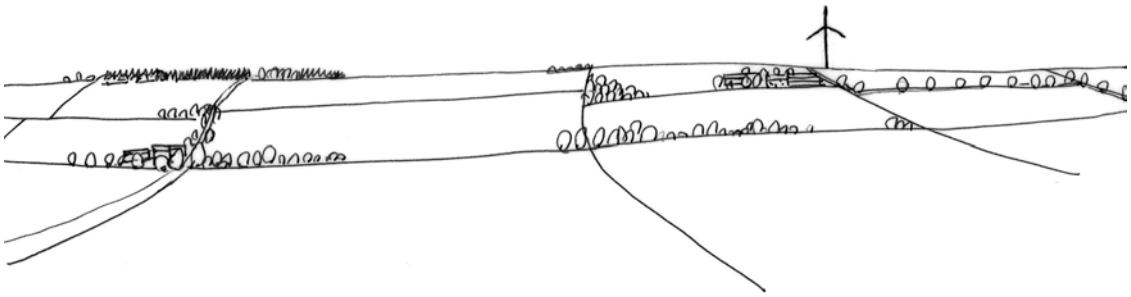


Foothills – Landscape scale: Indicative turbines of about 6 times house height located on a ridgeline where there are few features in immediate proximity against which to judge the scale. They are also located at a slight dip in the ridge, and back-dropped in this view by higher ground. Note that even so, they are large in this landscape, especially when referenced against fields and nearby buildings – they would be difficult to accommodate any closer to the valley without dominating the scale of the smaller features.

Turbines of this size are likely to be difficult to accommodate in landscapes of intimate or complex topography, on low ridges or hills where there is low relief, within narrow river valleys or along the upper edges or rims of smaller valleys. This size of turbine will also be difficult to accommodate where the landscape scale is relatively small. Small scale

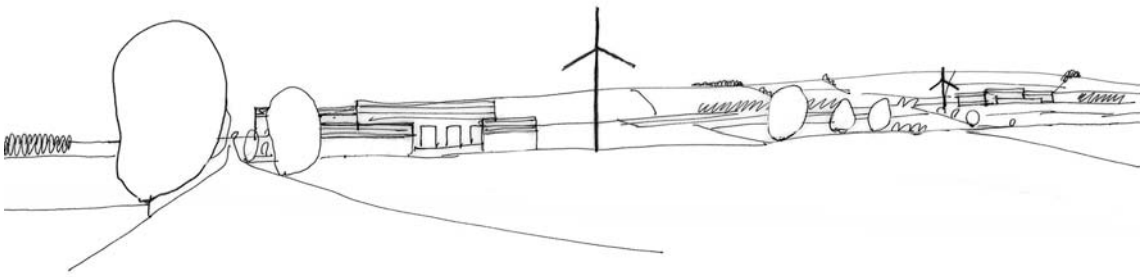
landscapes are characterised by complex land form, small fields and diverse land use and pattern. These turbines may also be difficult to site close to settlements and houses which act as reference points against which size can be easily perceived.

Outcrops of low hills and low ridges are likely to be sensitive to this size of turbine, which will diminish the perceived scale of the low relief. The size of these turbines may be more easily accommodated surrounded by the broad, sweeping scale of the low-lying plains, on the higher ridgelines and more extensive hilly areas, or areas back-dropped by more sweeping, larger scale uplands.

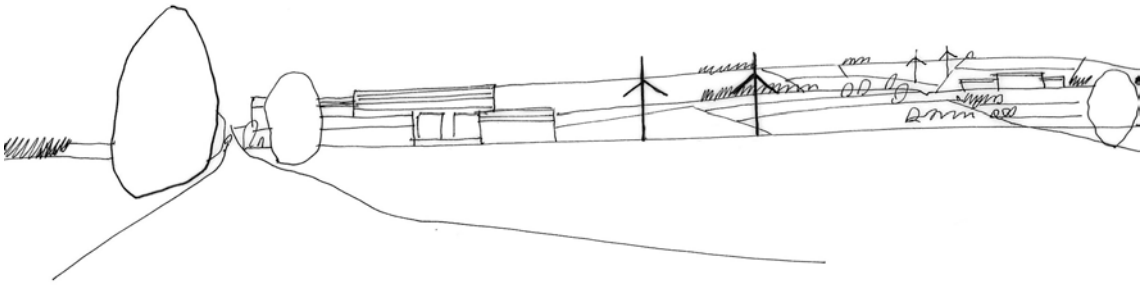


<u>Long ridges – Landscape scale:</u> This turbine, about 4.5x the height of the house, dominates the farm and buildings – although it relates well to the height of the ridge, and is also much less dominant than a turbine placed on the highest point of the ridge.

Where the size of a turbine is going to impact negatively on landscape scale, developers should be encouraged to consider the suitability of two or three small turbines instead of one large turbine, which may be easier to accommodate in the landscape.



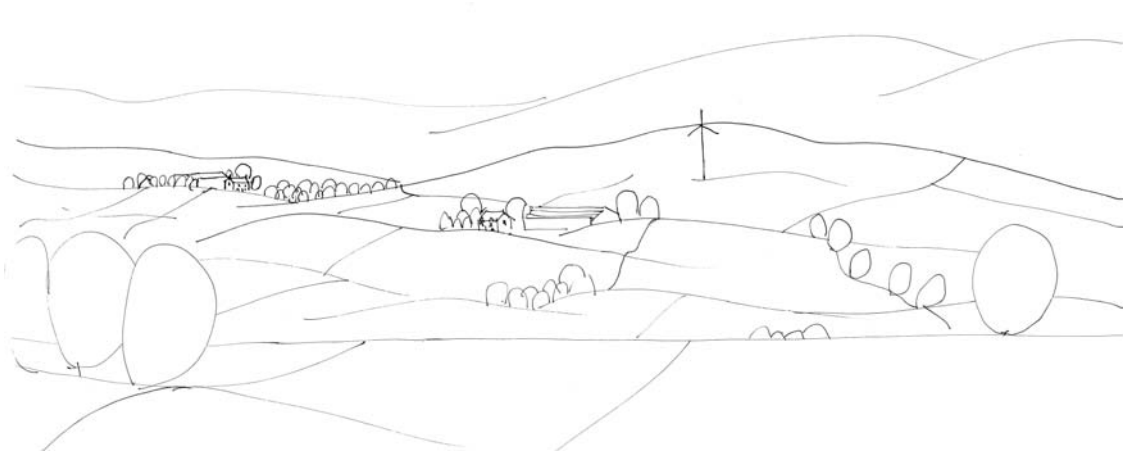
<u>Landscape scale</u> – single small-medium sized turbines can be difficult to accommodate without dominating the size of other features in the landscape, even when the landform scale is broad and sweeping and fields are large.



<u>Landscape scale</u> – two smaller turbines replace the one large turbine, and these are more in scale with the buildings and trees in this landscape.

Landform shape

Distinct changes in gradient associated with a break in slope, well defined dips within undulations, broad terraces or more expansive concave landforms and interim hills along the lower edges of the foothills, as well as the edges of more expansive plateaux all provide potential opportunities for micro-siting turbines of this size.



*<u>Lammermuir fringes – Landform shape</u>**:** An indicative turbine 4.5x house height located on the side of a hill, sited where there is a distinct fold or dip in the landform. The turbine has been located on a hillside where there are no other nearby features – like trees or houses – against which to gauge its height.*

Settlement and land use pattern and features

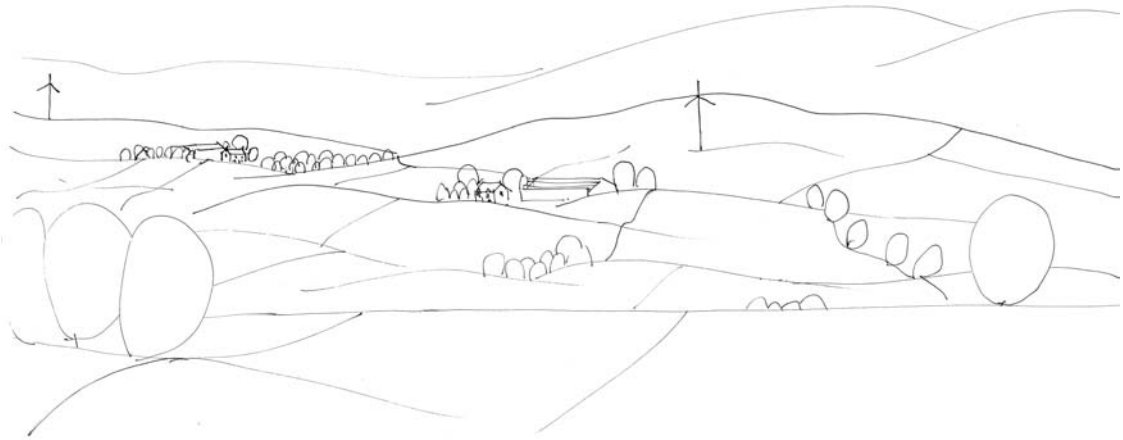
These turbines are larger than most buildings found in rural areas. They therefore should be sited where they can more readily be accommodated by landform scale, and avoid overshadowing or dominating smaller elements in the landscape, including small and complex landforms, small fields and intricate patterns of settlement.

It is more likely that this size of turbine will be located at a distance from farms or settlements. Care should therefore be taken not to disrupt the pattern and prominence of small clumps of trees on top of rounded hills or features of designed landscapes. If they can be accommodated in the sweeping scale of broader low-lying landscapes, they should be

sited along field boundaries or other linear elements in the landscape, or close to large buildings and industrial sites.

The alignment of tracks and location of supporting infrastructure, as well as the turbines themselves, should reflect the pattern of existing infrastructure.

Developing a recognisable pattern of development – for example, locating turbines at a similar elevation, and/or on similar topographical features across a landscape type will help create a pattern of development which will appear less cluttered and will also develop a distinctive and consistent landscape characteristic over time.



Landscape pattern*: These two turbines are located on similar, low lying hills, carefully sited to relate to a break in slope or fold in the landscape. They are also loosely associated with the farms. This similarity in size, location and elevation helps to maintain the unity of the landscape pattern.*

Visibility

Turbines which are more than 20m in height are more difficult to screen than small turbines. They are taller than most trees and large farm buildings, and are therefore likely to have wider visibility than those turbines less than 20m in height.

In East Lothian there are often long views across low-lying land. Recognised and valued views to local points such as outcrop hills, the Laws and historic landmarks will be particularly sensitive in this landscape.

Cumulative issues

Given the current incentives, these small-medium sized turbines may become a frequent and common occurrence, especially in farmed landscapes. Key cumulative issues are likely to relate strongly to potential clutter in the landscape and the visual relationship with other wind farms. Issues are similar to those identified in the analysis of small wind turbines, but because of the larger size of these turbines the issues are likely to occur more quickly and may include:

- *Several individual, or small groups of turbines, could begin to dominate local character;*
- *Diverse designs of turbine, all spinning at different speeds – or even several turbines of the same type – strung along a*

prominent or important skyline could become a visual distraction from other landscape features or from perceived visual amenity, especially from key viewpoints;

- *The larger the turbine, the harder it is likely to be to accommodate a number of them in a single view or recognisable tract of landscape without them becoming the dominant feature. It is also harder to accommodate the turbines in a sequence of views experienced, for example, when travelling along a road;*
- *The variety of potential different types of wind turbines within the landscape could lead to clutter with different styles, sizes of structures and speeds of blade movement dotted across a landscape;*
- *Lack of a clear siting strategy could lead to fragmentation of an existing robust and recognisable landscape pattern – where possible, it is important to site turbines on similar landforms, at similar elevations and with a similar relationship to the existing settlement pattern;*
- *Potential clutter may also be easily created if there are other masts, such as telecoms masts, overhead wires and pylons within the same vicinity – this is likely to be a bigger problem with this typology than with much larger turbines;*
- *There may be the added complication of increased visual clutter created by a wide range of different heights of turbine within a farmed landscape with micro-, small and small/medium sized turbines;*
- *Other complications may be the visual inter-relationship with larger wind farms of large and medium sized turbines, especially within the upland areas of the East Lammermuir Plateau and Plateau Grassland character areas but also in adjoining character areas which fringe the Lammermuirs.*

Other issues associated with smaller turbines

The construction of new access tracks should be minimised by careful siting of turbines to utilise existing tracks and to avoid more difficult terrain. Care should also be taken in the alignment and design of any access tracks to ensure that sensitive landform and vegetation is not adversely affected and that intrusion on key views is avoided. Electricity cables should be undergrounded to avoid a clutter of disparate built elements in the landscape.

5 Summary and conclusions

Introduction

5.1 This supplementary study has considered landscape and visual sensitivity to the following development typologies:

- Typology A: Turbines between 65m and 120m high
- Typology B: Single turbines between >42m to <65m high
- Typology C: Turbines between 20m and up to and including 42m high
- Typology D: Turbines between 12m and <20m high

All turbine heights are to blade tip.

Summary of landscape and visual sensitivity

5.2 Sensitivity is summarised against each of the landscape character areas in table 5.1 below:

Table 5.1: Summary of sensitivity to development scenarios

Landscape Character Area	**A**	**B**	**C**	**D**
Eastern Coastal Margin	MH	MH	M	L
Northern Coastal Margin	H	H	H	M
Musselburgh/Prestonpans Fringe	MH	MH	M	L
Agricultural Plain sub-type 1 East	H	H	MH	L
Agricultural Plain sub-type 2 North	MH	MH	M	L
Agricultural Plain sub-type 3 South	MH	MH	M	L
Garleton Hills	H	H	H	MH
Mayfield/Tranent Ridge	H	MH	M	L
River Valleys	H	H	MH	M
Eastern Lammermuir Fringe	H	H	MH	ML
North Lammermuir Platform	H	MH	M	L
East Lammermuir Plateau	H	H	MH	M
Plateau Grassland	H	H	H	H

Conclusions

5.3 The study concludes that there is no capacity for Typologies A and B, turbines above 42m and to 120m high within any of the landscape character areas considered in the sensitivity assessment.

5.4 Landscapes with a 'High' sensitivity score will present major landscape and visual constraints to the specific development typology assessed, with significant adverse impacts likely to occur in relation to the majority of key sensitivity criteria. A 'Medium-high' combined sensitivity indicates a landscape where the constraints are such that

there would be unavoidable significant adverse impacts on some key criteria despite other criteria being potentially less sensitive to the development typology. A 'Medium-high' sensitivity will generally preclude capacity for the development typology under consideration although in some landscape character areas there may be some very limited scope in a small area for a restricted number of developments of typologies C and D.

5.5 A landscape accorded 'Medium' sensitivity would have increased opportunities for wind turbine development, although there would still be some constraints which would be likely to restrict scope for multiple developments. 'Medium-low' and 'low' sensitivity landscapes would have fewer constraints and therefore present greater scope for accommodating multiple developments, although careful siting and design would still be necessary to mitigate impacts on more sensitive landscape features or limit visual intrusion in some instances.

5.6 There are greater opportunities to accommodate Typology C although the Northern Coastal Margin, the Garleton Hills and the Plateau Grassland would be highly sensitive to this development typology. Capacity would also be severely limited for turbines of this size to be accommodated within the Agricultural Plain 1, the River Valleys, the Eastern Lammermuir Fringe and the East Lammermuir Plateau with turbines towards the lower height band of this typology, <30m high, only likely to be able to be sensitively accommodated in the majority of these character areas and within very restricted locations.

5.7 There are greater opportunities to accommodate the smaller turbines of Typology D because of the ability of these smaller turbines to relate to the scale of woodlands and buildings in the landscape and to minimise visibility by being screened by intervening landform and vegetation. All of the landscape character areas considered in the study would be able to accommodate this small typology except the part of the Plateau Grassland character area lying within East Lothian.

5.8 The assessment identifies constraints in analysis and at a strategic scale and developers would need to demonstrate how they have dealt with potential effects on the constraints identified in the sensitivity assessment at a more detailed level.

Annex A: Guidance on design of smaller turbines

Introduction

The 'Feed-in Tariff' has generated substantially increased interest in smaller wind turbines. Current applications within East Lothian are for turbines which vary considerably in height. The majority are generally between 20m and 40m to blade tip in height, with a lesser number of proposals for turbines between 47m and 100m to blade tip. It is likely that the Feed in Tariff, which varies payments according to kW output, will influence the popularity of specific sizes or even styles of small turbines, depending on payback over the lifetime of individual turbines.

The study brief required advice on the design of small wind turbines. This design guidance annex principally considers the design of free-standing turbines below 80m height (these being the scale of turbine most commonly proposed in current applications to East Lothian and some other Scottish local authorities). This guidance does not consider roof mounted wind devices.

The guidance has been informed by our observations in the field of a number of smaller turbines including the Gaia model (seen at Drem, East Lothian), the Proven models (sited extensively across Scotland) and the Northwind model (Girvan community hospital). We have also attended a Small Wind Energy conference and exhibition and have been able to view a wide variety of turbine models and discuss specification with manufacturers and agents. Consultation has also been undertaken with RenewableUK, the advisory body for wind and marine energy.

The research on available models is not exhaustive within the limited scope of this supplementary study. Smaller turbines are rapidly evolving with many designs and sizes currently on the market. These are likely to develop further in future in terms of enhanced efficiency. Future update of this guidance will therefore be necessary.

Size and output of turbines

There is not always a direct correlation between the size of turbine and its power output. This can be seen when comparing the tower heights, blade diameters and power outputs for small turbines set out in Table A.1 which lists current models.

Key design issues

Variations in the design of smaller turbines principally relate to the following:

- The size of the turbine
- The type of turbine – whether vertical axis or horizontal axis
- Number of blades – whether two or three – and the rotation speed
- The proportion of the turbine in relation to the tower height/blade diameter
- The materials used for the tower (whether lattice or tubular) and blades including colour finishes

Key design issues in relation to these characteristics are discussed below.

Turbine size

The size of turbine in relation to the scale of the landscape is discussed in more detail within the sensitivity assessment for each landscape character area and also in the guidance on

micro-siting of smaller turbines in section 4 of this supplementary study. Table A.1 lists current turbine models and overall heights to blade tip. Taller turbines will generally be more visible than lower turbines particularly in relation to other features in the landscape such as trees, woodland and buildings

Type of turbine
Horizontal axis turbines are more common than vertical axis turbines. Vertical axis turbines tend to be quieter but are less efficient than horizontal axis models. Some vertical axis models currently on the market, for example the Quiet Revolution turbine shown in photograph 2, have a sleek, well-designed appearance. Vertical axis turbines tend to be more popular in urban areas where noise is a key consideration.

Proportion
There are significant differences in the proportion of turbine height to blade diameter in the products currently available. Taller towers with smaller diameter rotors are generally used in lowland areas to capture more available wind. They can have a different proportion and perceived visual balance to larger rotors mounted on similar height towers. Large blades on short towers will appear 'top heavy' and disproportionate.

Blade rotation speed
Smaller blade diameter turbines turn round more quickly than turbines with larger blades. In strong winds, the small blades whiz round and catch the light. This may also be accompanied by an increase in noise which could adversely affect the sense of tranquillity associated with some less developed landscapes. The rotation movement of twin blade turbines is maintained at a regular pace, regardless of wind speed by the gearing system and they tend to have a regular but uneven rhythm (tipping down relatively quickly in relation to the slower rise of the blade).

Quickly rotating blades are more common with smaller turbines and can be less restful on the eye, possibly heightened by the relatively slow movement of other features in the rural landscape. This effect could be amplified by multiple turbines creating a less tranquil landscape experience when seen together.

Materials and colour
There is considerable variation in the design of small turbines. Towers can be metal lattice or tubular with either a painted or galvanised steel finish. The Gaia turbine, shown in photograph 10, features a lattice tower and white painted blades. From our observations during field work we have noted that the lattice tower tends to merge very successfully into the backdrop of land and sky but the blades of this turbine then appear dislocated, 'floating' above a less visible tower which can produce a disconcerting visual effect. Solid tubular towers are therefore preferable and guidance should aim to encourage consistency.

Turbine colour also varies and it is possible to customise colour according to location, although this is usually a more expensive option. We note that while the black UPVC 'hood' and blades of the Proven models (photograph 5) can reduce visibility where they are back-dropped by land, overall this turbine appears bulky and inelegant due to its large, relatively 'clunky' components. This type of design seems to be more appropriate when seen in conjunction with industrial type buildings.

The more successful models in terms of design appear as 'mini' versions of large turbines commonly found in commercial wind farm developments where there is little variation in the finish used for tower and blades and a more streamlined appearance is attained. The white painted models generally provide a clean and uncluttered image although they can stand out more where they are seen against a darker backdrop of land or woodland.

Some turbines feature manufacturers branding and this can be quite prominently displayed.

Other issues
A small boxed fencing surround at the base of some turbines is shown in some manufacturer's promotional material. Some smaller turbines may also require guying. Access tracks may be required for construction and this may be an issue in some landscapes. The electricity connection to smaller turbines usually comprises underground cabling. Overhead wires and any additional fencing or other structures should be discouraged, as they simply introduce additional visual 'clutter' to the landscape.

Cumulative landscape and visual impacts
Cumulative landscape and visual impacts will be dependent on the number of small turbines, their size and also their design.

Occasional turbines widely dispersed across the landscape may be perceived as a novel and incidental feature. Increased numbers of turbines more closely spaced may appear ubiquitous (in the same way as lighting columns or electricity transmission towers) or possibly even dominant features depending on their height and density. It is considered that there is no capacity for turbines over 42m high to be accommodated in the lowland landscapes of East Lothian due to key landscape and visual constraints. Multiple turbines of this size would quickly dominate the scale of the landscape and would be likely to detract from the characteristic landform, land-cover and settlement pattern.

While the number of small turbines will be a key factor in determining perceived impact, variations in design could also significantly exacerbate adverse impact. This can be demonstrated by other tall structural elements in the landscape such as telecommunications masts which can vary considerably in their design and scale (although, unlike turbine blades there are no visibly moving parts). Transmission line towers tend to feature a common lattice tower design, although variations to the norm are easily spotted, for example the line between Bogg Holdings and Macmerry in East Lothian.

Cumulative impacts are likely to occur where a large number and wide variety of turbine designs are seen, either in one view or in quick succession when travelling through the landscape. They are also likely to occur where different sized turbines are inter-visibility in close proximity and this is considered in section 4 of the study report.

Detailed guidance

Turbine design
We recommend that the range of turbine designs should be limited in order to minimise cumulative impacts. The following guidance should be adhered to:

- Groups of smaller turbines below 20m high to blade tip should be limited to no more than 3 in order to reduce the visual impact of tightly spaced turbines with quick rotor speeds being seen on mass.

- A simple turbine design is essential, avoiding the juxtaposition of different materials and favouring turbines which have a more streamlined appearance with little contrast between tower/blade.

- Tubular tower design is generally likely to be neater and less obtrusive (in terms of the contrast between tower and blades) than lattice towers.

- Turbine colour should relate to the predominant backdrop to the development. Where the main background is sky then an off white colour would be more appropriate and where the turbine is principally back-dropped by rising ground in key views, then a darker colour will reduce visibility.

- Corporate branding should be discreet and brightly coloured/contrasting details used for hubs and to highlight blade tips should be avoided.

- Potential cumulative impacts of proposed wind turbine development with larger commercial wind farms in the Lammermuir Hills should be considered. Design compatibility between differently scale turbines may help minimise landscape and visual impacts so there is a consistency between structures which avoids a clutter of disparate built elements in rural locations.

- Design compatibility should also be carefully considered where existing small turbines have already been erected. Although to date, existing small turbines within East Lothian primarily comprise two models, where a number of these have been approved in one area then it would be better to restrict new turbines to a similar design particularly where they would be seen in close proximity or be inter-visible from key roads and settlement.

Where turbines are sited within or close to settlements, particular care should be taken to ensure that only well-designed models are used. This is because turbines would be seen in close proximity from properties and roads, where the poor quality of design and components would be obvious and would contrast with the often high architectural integrity of buildings within East Lothian.

Ancillary features

Formally constructed access tracks should be avoided to reduce impacts where open and elevated views are possible. Removable matting could be used during construction and simple reinforced grass tracks, aligned close to the edge of field boundaries, installed where necessary post construction. Fencing should be avoided around the base of turbines in order to minimise clutter in the landscape.

All grid connections should be buried underground to reduce the accumulation of overhead wires and present a simple uncluttered setting to turbines.

Table A.1: List of current small turbine specifications

Model	*Pylon Height (m)*	*Rotor Diameter (m)*	*Height to Blade Tip (m)*	*Output (KW)*
Evoco 10	12	9.7	16.85	10
	15		19.85	
	18		22.85	
Airsurfer	12	3.2	15.2	1.5
Evance R9000	10	5.5	12.75	5
	12		14.75	
	15		17.75	
	18		20.75	
Quietrevolution	3.4	3.1	4.95	4.2
	6		7.55	
	15		16.55	
Xzeres 110	No Data	3.6	3.6+	2.5
Xzeres 442SR	12	7.2	15.6	10
	15		18.6	
	18		21.6	
Gaia Wind 133	18	13	31	11
Ampair 300	12	1.7	13.7	0.3
Ampair 6000	15	5.5	20.5	6
Fortis Wind Turbines Passatt	12	3.12	13.56	1.4
	18		19.56	
Skystream 3.7	No Data	3.72	3.72+	2.4
Proven 7	6.5	3.5	8.25	2.5
	11		12.75	
Proven 11	9	5.5	11.75	5.2
	11.6		14.35	
	15		17.75	
Proven 35-2	15	8.5	19.25	12.1
	20		24.25	
Swift	No data	2.08	2.08+	1.5
Northern Power Northwind 100	30	21	40.5	100
	37		47.5	

Endurance Wind Power E3120	25	19.2	34.6	50
Endurance Wind Power S-343	27.5	6.37	30.685	5.2
	31.1		34.285	
	36.6		39.785	
Endurance Wind Power G-3120	30.5	19.2	40.1	35
	36.5		46.1	
	42.7		52.3	
Fortis Wind Alize	18	7	21.5	10
	36		39.5	
Fortis Wind Montana	12	5	14.5	5
	24		26.5	
Enercon E44	45	44	67	900
	55		77	
Enercon E33	44	33.4	60.7	330
	50		66.7	

1: Evance R9000

2: Quiet Revolution

3: Xzeres 442SR

4: Evoco 10

5: Proven 11

6: Skystream 3.7

7: Northwind 100

8: Endurance E3120

9: Endurance Wind Power G-3120

10: Gaia 133 11kW Lattice

11: Enercon E33

12: Fortis Montana

References :

Aikengall II – Wester Dod Windfarm Environmental Statement (2009)

ASH Consulting Group. 1998. *The Borders Landscape Character Assessment*. Scottish Natural Heritage Review No 112.

ASH Consulting Group. 1998. *The Lothians Landscape Character Assessment.* Scottish Natural Heritage Review NO 91.

East Lothian Council. Draft Planning Guidance for the Location and Design of Wind Turbines in the Lowland Areas of East Lothian (December 2010).

Envision and Horner+maclennan, 2006. *Visual Representation of Windfarms Good Practice Guide*, Scottish Natural Heritage, The Scottish Renewables Forum and the Scottish Society of Directors of Planning.

Grant, A. 2010. *Landscape Capacity Studies in Scotland – a review and guide to good practice*. Scottish Natural Heritage Commissioned Report No 385.

RenewableUK, 2010. *Small Wind Systems: UK Market Report*

Scott, K.E.,Anderson, C. and Benson, J.F. (2005). *An assessment of the sensitivity and capacity of the Scottish seascape in relation to offshore windfarms*. Scottish Natural Heritage Commissioned Report No. 103.

Scottish Government, February 2010. *Scottish Planning Policy*

Scottish Government website updates on *Onshore Wind Turbines* (5th August 2011) and *Process for preparing spatial frameworks for windfarms (11th February 2011).*

Scottish Government - Marine Scotland (website review of Round 3 lease sites for offshore wind farm development)

Scottish Natural Heritage, 2011. Siting and designing single and groups of small turbines in the landscape (consultative draft).

Scottish Natural Heritage, 2002. *Strategic Locational Guidance for Onshore Windfarms in Respect of Natural Heritage* (SNH Policy Statement No. 02/02 updated March 2009).

Scottish Natural Heritage. *Cumulative Effect of Wind Farms*, Version 2 revised 13/4/05

Scottish Natural Heritage. *Siting and Designing windfarms in the landscape (version 1) December 2009*.

Scottish Natural Heritage. 2009. *Assessing the Cumulative Effect of Onshore Wind Energy Developments Version 3 – Draft for Consultation*.

Swanwick, C and Land Use Consultants, 2002. *Landscape Character Assessment: Guidance for England and Scotland.* Countryside Agency & Scottish Natural Heritage. CAX 84, CA, Cheltenham.

Swanwick, C, University of Sheffield and Land Use Consultants 2005. *Landscape Character Assessment Guidance for England and Scotland – Topic Paper 6: Techniques and Criteria for Judging Capacity and Sensitivity.* The Countryside Agency and Scottish Natural Heritage.

Versions of this document are available on request on audiotape, in Braille, large print or your own language.

TEL: 01620 827199

Policy and Projects
Services for Communities
East Lothian Council
John Muir House
Haddington
East Lothian
EH41 3HA

T:01620 827396
E: policy&projects@eastlothian.gov.uk
W: www.eastlothian.gov.uk

East Lothian Council