Annex 1: POWERLINE OFFSET OPTIONS SUMMARY

This annex is a summary of a longer powerline offset options paper developed for Oyu Tolgoi (GBC 2016). Oyu Tolgoi LLC's (OT's) ESIA appendices identified inherent impacts on biodiversity from powerlines constructed by the project (TBC & FFI 2012a). The ESIA made recommendations for mitigation of direct mortality of birds caused by collisions and electrocution, and identified the installation of bird flight diverters (BFDs) to non-OT powerlines as a potential offset for residual mortality from collisions following mitigation (TBC & FFI 2012b)[1]. However, no suitable offset options were identified within the ESIA biodiversity offset strategy for compensating for indirect residual impacts on two of the project's priority biodiversity features - Houbara Bustard (*Chlamydotis undulata*) and Great Bustard (*Otis tarda*) - caused by direct footprint and anticipated avoidance of powerlines. Subsequent to the ESIA, the subspecies of Houbara found in the OT area has been confirmed to be a separate Vulnerable species, Asian Houbara (*Chlamydotis macqueenii*). For consistency and ease of understanding, however, the species is still referred to in this annex as 'Houbara Bustard'.

International Finance Corporation Performance Standard 6 (IFC PS6) requires No Net Loss of biodiversity in areas of natural habitat where feasible. With reference to powerlines, this is seen as applicable to priority species which may suffer mortality owing to collision with (e.g., Houbara Bustard, Great Bustard), or electrocution by (e.g., Saker Falcon), powerlines.

Since the project ESIA was compiled, OT has implemented two years of monitoring to better understand the magnitude of the project's impacts, and the effectiveness of mitigation that has been installed. These data were recently used to revise the project's NPI forecast (Oyu Tolgoi LLC 2016). Here we review the suitability of the installation of bird flight diverters as an offset option in light of revised predictions of impacts, and an improved understanding of the effectiveness/feasibility of current mitigation (Dashnyam *et al.* 2015). Six other offset options and an additional conservation action are also evaluated. The key objective of this annex is to assess and prioritise options for offsetting these residual impacts, or providing alternate benefits. Table 2 summarises findings. At present, no feasible options have been identified to achieve No Net Loss for Houbara Bustard or Great Bustard. As a result, OT continues to implement mitigation (reducing impacts, but not to the level of No Net Loss) and plans to continue investigating feasibility of offset options into the future. In addition, OT has planned an offset for Saker Falcon which aims for Net Positive Impact, exceeding IFC PS6 requirements.

[1] Note: Residual impacts from powerlines to non-avian priority features and corresponding offset requirements are detailed in the updated NPI forecast (GBC 2015).

Table 2: Summary of the results of analysis in this annex (green represents a positive scenario, orange acceptable, and red undesirable). A successful offset must demonstrate biodiversity gain and be politically and logistically feasible, so undesirable scenarios in the first three columns are problematic.

Option/Parameter	Demonstrable biodiversity gain	Political feasibility	Implementation risk	Cost	Other benefits	Recommended
Offset options for Houbara Bustard (and other collision-susceptible priority biodiversity)						
1. BFDs on non-OT powerlines						**No:** Unlikely to achieve No Net Loss as limited gains (from mitigation experience) and limited options for application
2. Burial of non-OT powerlines						**No:** Unlikely to achieve No Net Loss as limited options for application; costly and technical issues
3. Captive breeding programme 3a. Outside Mongolia						**No**: Following stakeholder engagement (with BirdLife International), this is not a preferred option
3b. Inside Mongolia (existing project)						
3c. Inside Mongolia (OT funded start up)						
4. Habitat improvement						**No**: Unlikely to achieve No Net Loss - tenuous connection to Houbara Bustard
5. Influence policy						**Yes**: Extends no net loss to other priority biodiversity features, e.g. Pallas's Sandgrouse
6. Anti-poaching in wintering grounds						**No:** Unlikely to achieve No Net Loss, stakeholders unlikely to agree to this option
Offset option for Saker Falcon (and other electrocution-susceptible priority biodiversity)						
7. Prevention of electrocution for Saker						**Yes**: It will not benefit Houbara Bustard, but will significantly benefit other priority biodiversity (e.g.

Falcon						Saker Falcon)
Additional conservation action						
8. Houbara research						**Yes:** Valuable to inform powerline offset activities

Analysis of options

Each option was assessed using five parameters chosen to represent the major trade-offs, these were:

i. Demonstrable biodiversity gain (i.e., an assessment of whether the option provides an averted loss of Houbara Bustard populations or an increase to the population and whether monitoring the offset option will provide a clear link to increases in the bustard population via robust data);
ii. The political feasibility of the option (i.e., an assessment of whether the option is likely to be credible and acceptable to all stakeholders (Rio Tinto, NGOs, Government, Lenders));
iii. Implementation risk (i.e., an assessment of whether there are likely to be any technical or other risks to achieving biodiversity gains linked to the option);
iv. Cost i.e. high level calculation of cost of implementing the option and comparison of cost against other options; and
v. Wider benefits to biodiversity (i.e., does an option designed to address critical and high risk impacts on Houbara Bustards also address medium and low risk impacts to other biodiversity?).

Each parameter was given a score from 1 (poor scenario) to 3 (good scenario). Inevitably there are trade-offs between the options: as achieving No Net Loss or NPI is the overall aim of an offset, 'demonstrable biodiversity gain' was considered a high priority parameter as were costs.

1. Installation of bird flight diverters (BFDs) on non-company powerlines

Objective: Install BFDs over sufficient length of non-OT-owned powerline to offset residual impacts on priority biodiversity features (most notably Houbara Bustards). Candidate powerlines would need to be a planned or constructed powerline with no BFDs, orientated in the same direction[2] and within the range of priority biodiversity features.

1.1 Demonstrable biodiversity gains

In order to assess gains by the project in terms of averted mortality of Houbara Bustards and other priority bird species it is necessary to understand the effectiveness of BFDs. It is not possible to establish this for OT's powerline because no baseline collision rate exists from prior to the installation of BFDs. In order to establish BFD effectiveness for reducing bustard collisions in Mongolia extensive trials would be required involving baseline monitoring, installation of a sample of BFDs (preferably a correctly functioning sample and a malfunctioning sample equivalent to those on OT lines), and follow-up monitoring to compare post-installation collision rates with the baseline. Alternatively, if all stakeholders agree, the ESIA estimated the effectiveness of combined flapper and spiral BFDs could be as high as 60% (Jenkins et al 2010, TBC & FFI 2012c) as we know that some BFDs are malfunctioning, 40% effectiveness could be assumed and the length of line required for

[2] OT's 220kv lines are strung at a height where they are expected to impact migrant Houbara Bustards travelling West-East-West.

offset based on this. Using this estimated effectiveness is not a robust approach but is suggested as a pragmatic way forward should this option be considered.

In addition to technical problems with demonstrable gains, this option is an averted loss offset option. If collision rates are found to be unsustainable, this option would not enable the project to achieve No Net Loss for Houbara Bustard. This parameter was scored '1'.

1.2 Political feasibility

Within OT the appetite for installing BFDs is likely to be limited as the experience with their use on OT powerlines has been challenging. Third parties such as the Government and particularly conservation NGOs are likely to be more receptive to this option as currently powerlines in Mongolia are not required to have any BFDs installed. Ultimately the decision rests with OT. As feasibility within OT is understood to be low, this parameter was scored '1'.

1.3 Implementation risk

The required length of non-OT powerlines that would require installation of BFDs will remain unknown until trials have been completed. There are several risks associated with this. OT has no control over powerline planning and construction carried out by third parties and therefore a suitable powerline may not be available. The Wildlife Science and Conservation Centre of Mongolia (WSCC) are actively monitoring powerline construction as part of a Saker Falcon conservation project and options for installing BFDs on existing or planned lines of 220kV and with the same orientation as OT's line in Houbara Bustard habitat are limited at present (N. Batbayar pers. comm.). There are additional technical risks over installation[3], maintenance and longevity of BFDs – these may well preclude correct installation on non-company powerlines. This parameter is therefore scored '1'.

1.4 Cost

For the 315 km of mitigated OT powerline, the purchase of BFDs cost approximately $2M, this does not include installation costs or the pre and post-installation monitoring costs. As BFDs only have a limited life, re-installation every 10-20 years may also be required. Compared with other offset options this option is relatively cost effective and is therefore scored '2'.

1.5 Additional benefits

This option would reduce collision risk for all priority (and non-priority) features. Additional benefits are therefore scored as '3'.

2. Bury non-company powerlines

Objective: Bury sufficient length of non-OT-owned powerline to offset residual impacts on priority biodiversity features (most notably Houbara Bustards). Candidate powerlines would need to be a planned or constructed powerline with no BFDs, orientated in the same direction and within the range of priority biodiversity features. The required length for burial can be calculated as:

3 Risks to contractor safety of installing BFDs on live wires, difficulties of shutting off power to fit to pre-strung wires, and problems with malfunctioning when attached to wires pre-stringing.

length of the OT powerline × residual mortality on the mitigated powerline

The residual mortality is calculated as:

1 / effectiveness of mitigation

To determine the overall length of powerline the project would need to bury, trials (similar to those described under option 1 above) would be required to estimate the effectiveness of powerline mitigation on OT's powerline. Alternatively, the ESIA estimated the effectiveness of combined flapper and spiral BFDs could be as high as 60% (Jenkins et al 2010, TBC & FFI 2012: Biodiversity Strategy). Some BFDs are malfunctioning so an adjusted effectiveness of 40% could be used, or the most precautionary estimate is to assume zero effectiveness of current mitigation and bury an equivalent length of non-company powerline to OT's powerlines.

2.1 Demonstrable biodiversity gains

There is a biodiversity gain from burial of powerlines as burial completely avoids collisions and habitat loss for Houbara Bustard (and other species) assuming rehabilitation of habitat post-burial is effective. However, uncertainty remains over the sustainability of collision rates within a suspected small population. If collision rates are unsustainable it is expected the powerline will eventually create a shadow effect with the population to the east being extirpated. As this happens any gains derived from options 1 or 2 will be eliminated, and No Net Loss will not be a feasible target for Houbara Bustards. Given the uncertainty this parameter is scored as '2'.

2.2 Political feasibility

Within OT the appetite for burying powerlines is considered to be low: it wasn't a viable option for OT powerlines which would have been the most logical powerlines to bury and so is unlikely to be seriously considered as an offset. Third parties such as the Government and particularly conservation NGOs are likely to be more receptive to this option as it's likely to be an effective measure. Ultimately the decision rests with OT. As feasibility within OT is thought to be low, this parameter is scored as '1'.

2.3 Implementation risk

As OT would not own the powerline(s) and would need to negotiate with a third party to bury their powerline(s) there are likely to be a number of potential technical feasibility issues – it is not simply a case of burying the line and walking away, there are lifecycle costs to also consider. Underground powerlines are expensive to maintain. Although faults might be less frequent, when they do occur they are difficult to locate and expensive to repair (taking up to 60% longer to repair in a US context [Navigant 2005] and therefore presumably considerably longer in the Mongolian context where burial of powerlines in not common practice). As the owner of the line could have chosen the cheaper overhead option it is considered likely that in any agreement with OT the third party would make OT liable for repairs to the line. Burial of powerlines in cold desert conditions increases risk of technical problems due to frost (Hall 2012). Indeed a full feasibility study and ESIA would need to be carried out if a suitable third party and powerline(s) can be found. If there is risk of lengthy interruptions to supply, this option may prove unviable for a third party. As burial is untested in the Mongolian context and many technical risks have been identified it is scored as '1'.

2.4 Cost

Burial of powerlines is considerably more complex than overhead cables and costs reflect this with higher voltage powerlines costing more than lower voltage. In addition to construction costs, maintenance costs are also higher than overhead cables as faults are difficult to locate and repair. Costs of burying can be anything from 4-14 times as much as an overhead cable. Since cable burial is untested in the Mongolian context, figures were taken from various case studies in the US and Europe to present a range of scenarios. The length of line required for burial is based on two figures: 78 km of line (this assumes that mitigation was 40% effective on 200kV and 35kV lines and no residual impacts from 5kV lines) and 315 km of line (the total length of all OT lines) (See Table 1). Note: as there is no experience of burying cables in a Mongolian context, costs are likely to be higher. Costs will also vary depending on the substrate and flood risk.

Table 1: Underground burial costs only

	Voltage	**Cost per km**	**Potential cost range for burying 78km-315km of line[4]**	**Country**	**Reference**
1.	138kV	$1.25M	$98M-$395M	US (Wisconsin)	PSC 2011
2.	unknown	$310,000-$1.12M	$24-87M to $98-353M	US (multiple case studies)	Navigant 2005*

*The average overhead line in the US context quoted in this study is $75,000/km. If this is considerably different to the OT experience this could be factored into an understanding of costs.

Additional costs for maintenance would also need to be factored in as well as for rehabilitation to the area directly impacted by the burial. A UK study estimated that the full lifecycle costs (40 years) for underground cables was $15.5-36.4M/km, i.e. $589-$1,383M for 38 km (variations in cost were related to the voltage of the line and the technology used; Parsons Brinckerhoff 2012). Monitoring of the site to ensure no impacts are experienced by other species e.g. ungulates by any maintenance roads that are required. Pre-construction work including trials to ascertain the length of line for burial, feasibility studies and an ESIA would also add to costs. These additional costs are difficult to factor in without expert consultation. Costs are scored as '1' for this option.

2.5 Additional benefits

As with BFDs this option is likely to benefit all collision-prone species. Whether there would be any disturbance and impact to ungulates or other terrestrial species would require further investigation should this option be considered. This would also be a test case for Mongolia

[4] These distances were chosen as guidance as 95km represents the length of the 200kV line between OT and the border where impacts to Houbara have so far been monitored, 315km is the total length of all OT powerlines

and so may attract significant media attention, which has potential benefits and consequences. Additional benefits are scored as '3'.

3. Support a Houbara Bustard captive breed and release programme

Objective: Breed and release sufficient numbers of Houbara Bustard to offset residual impacts to the species. There are 3 potential sub-options for OT under this scheme:

3.a. Support an existing scheme outside Mongolia

3.b. Support an existing/planned scheme in Mongolia

3.c. OT led initiative with a third party partner

3.1 Demonstrable biodiversity gains (Applies to all three sub-options)

Option 3.a. (outside Mongolia)

Although this option could result in demonstrable gains of Houbara Bustards (see below) it is highly unlikely these will benefit, or could be attributed to the population in Eastern Mongolia. (The exception to this might be if a centre was set up in Eastern China but the political feasibility of this option is considered to be non-viable and therefore this option was not included in the score for biodiversity gain). Given that this is unlikely to meet stakeholder needs this parameter is scored as '1' for option 3a.

Options 3.b. (link with existing/planned centre inside Mongolia) and 3.c. (OT led initiative with a third party partner)

Other studies have shown that it is possible to monitor released birds and measure recruitment (as a proportion of all birds released) to the wild population following successful migration (P. Dolman *in litt*. 2014). Furthermore, a question mark remains over whether current collision rates are sustainable (see above). If they are not, the Houbara Bustard population east of OT's powerline will eventually be extirpated so averted loss offsets (such as options 1 and 2 above) will cease to accrue project gains and No Net Loss becomes an unrealistic target for this species. In contrast, this option is effectively a maintenance or restoration offset that will maintain or boost population numbers, making the species resilient to any offtake on OT powerlines. The Emirates Birds Breeding Centre for Conservation (EBBCC) operate a Houbara Bustard breed and release programme in Uzbekistan. Preliminary data suggest a rate of recruitment to the wild population of 1 individual for every ten released birds (P. Dolman *in litt*. 2014). This suggests OT would need to fund the annual release of approximately 610 birds to compensate for the project's annual residual impacts of 61 Houbara Bustards. However, it should be noted that the EBBCC case above is exceptional. Most captive breed and release programmes fail to source local seed stock - this means started birds are from outside the local range. They are unable to migrate effectively and don't recruit to the population. Wild birds are effectively swamped by released birds and breeding success can be reduced as a result. As No Net Loss could be demonstrably achieved this parameter is scored as '2', noting the caveat above.

3.2 Political feasibility

Option 3.a. (outside Mongolia)

A captive breeding programme outside of Mongolia is unlikely to be acceptable to some stakeholders (e.g. WSCC). For others the clear link to a population increase in Houbara Bustards may be sufficient to outweigh any hesitation about location. This argument is

strengthened if it can be shown that birds bred further to the west recruit to the Mongolian breeding population which OT is impacting. Current satellite tagging studies of birds from a breed and release scheme established in Uzbekistan could show this, but it seems highly unlikely given the extreme distance from Mongolia. A more realistic option might be birds from the breed and release facility in Kazakhstan operated by the International Fund for Houbara Conservation, however this is still located in Shymkent in southern Kazakhstan approximately 3,000 km from the area of impact. A further option closer to Mongolia would be for a centre in Eastern China but this isn't considered to be a politically viable option, if stakeholders consider otherwise, this could be re-evaluated. This parameter is scored as '1' for option 3a.

Option 3.b. (link with existing/planned centre inside Mongolia)

This option may be more acceptable for all stakeholders as it would be inside Mongolia and but already established or in the process of establishment by a third party. It is scored as a '3'.

Option 3.c. (OT led initiative with a third party partner)

This option was not viable for external stakeholders (BirdLife International during a meeting held in Cambridge, February 2016) and within OT there is likely to be low levels of support. This parameter is scored as '1'.

3.3 Implementation risk

The most significant risk to achieving No Net Loss for this option is from mortality post-release due to predation and hunting along the migration route (Tourenq *et al*. 2005).

Option 3.a. (outside Mongolia)

If residual impacts to Houbara via collisions are found to be unsustainable to the Eastern Mongolian population of Houbara then it will be important for captive bred birds to arrive to Mongolia in order to maintain the population. This option poses higher risk as birds bred outside Mongolia are unlikely to recruit to the Mongolian population. The International Fund for Houbara Conservation's centre in Kazakhstan released, 99 birds with transmitters in 2012. By the end of the year 27 were still transmitting and 24 of the 27 had migrated with the furthest travelling 2,100 km to Iran. Houbara released from the EBBCC in Uzbekistan are also tracked and further research would be required to understand if individuals from either location recruit into the Mongolian population. If they do then the number of birds released could be varied according to the rate. As this sub-option potentially has higher associated risks (if collision rates are found to be unsustainable), this parameter is scored as '1' for option 3a.

Option 3.b. (existing/planned centre inside Mongolia)

There is no breed and release facility in Mongolia currently and this option is unfeasible until there is. Interest in establishing a Mongolian breed and release facility in Khanbogd soum has reportedly been expressed (OT *in litt.* 2015) but this risks around this remain and OT will need to establish the pro's and con's of engagement. Organisations interested in setting up breeding facilities in Mongolia are likely to ultimately be interested in boosting the population for hunting purposes, whether in Mongolia itself or elsewhere in the range of the population. There is a risk that such a facility merely provides an opening for unsustainable hunting, i.e. any gains made from releases are more than countered by losses from new hunting. This is, however, unlikely - the reason and interest of most underlying investors in such facilities (e.g. the Gulf States) are inherently in maintaining sustainable populations for hunting. Although Houbara are not currently hunted in Mongolia (WCS & Sustainability 2015), anti-

poaching measures and sensitization with stakeholder groups on the conservation importance of Houbara would need to be linked to the programme. This parameter is scored as '2' for option 3b.

Option 3.c. (OT led initiative with a third party partner)

As with option 3b the hunting risk associated with this option would need to be addressed via anti-poaching measures and sensitization with stakeholder groups on the conservation importance of Houbara. Assuming capital is available, this option has fewer implementation risks that 3a or 3b as it would be more under OTs control and so is scored as '3'.

3.4 Cost

Option 3.a. (outside Mongolia)

An estimate of the yearly cost to the Uzbekistan programme to achieve NPI is $240,000-$300,000 – this is based on the release of approximately 750 birds derived from estimates of costs to run the EBBCC breed and release facility in Uzbekistan (K. Scotland *in litt*. 2014). This is considered to be a low cost compared to other offset options and is therefore scored as '3'.

Option 3.b. (existing/planned centre inside Mongolia)

It is estimated that this option would be similar to a yearly cost to a centre outside Mongolia and therefore be in the region of $240,000-$300,000. This is considered to be a low cost compared to other offset options and is therefore scored as '3'.

Option 3.c (OT led initiative with a third party partner)

In addition to yearly running costs (assumed to be aligned to the contribution costs to sub-option 3.a. i.e. $240,000 to $300,000), set up costs for the centre would also be required, these are estimated to be in the region of $2,000,000[5]. Compared to other offset options this sub-option is scored as a '2'.

OT could establish a trust fund if one of the sub-options is selected. An investment of $4M into a trust fund at 5% interest would yield $200,000 per year to pay for annual operating costs.

3.5 Additional benefits (applies to all 3 sub-options)

As this option would only benefit Houbara Bustard additional benefits are limited and the option would not deliver NPI for all biodiversity (which is a key assumption of the project ESIA, TBC & FFI 2012a, b). This parameter is scored as '1' for all sub-options.

4. Habitat management

Objective: to improve the quality of habitat for breeding Houbara to improve breeding success. The assumption for this option would be that improvements could be made in rangeland quality that would benefit the Houbara population and lead to an increase in population sufficient to offset the residual impacts.

4.1 Demonstrable biodiversity gains

In the ESIA rangeland management was identified as a principal offset activity for the project. However it was mainly targeting wild ungulates by improving grazing conditions.

[5] This estimate is derived from communication with Keith Scotland of the Emirates Birds Breeding Centre for Conservation.

Habitat preference of Houbara Bustards is not well understood and rangeland management may not deliver benefits for bustards. This parameter is scored as '1' due to the current gap in understanding whether improving rangeland quality would benefit Houbara populations. Further study may reveal options for achieving gains vis this approach (see Appendix 2).

4.2 Political feasibility

If there is no clear link between improving rangeland quality and Houbara populations, this option is unlikely to be acceptable for stakeholders and is therefore scored as '1'.

4.3 Implementation risk

The location and activities associated with both rangeland management and anti-poaching will need to be carefully chosen as not all stakeholders will be open to improving habitat quality for wild animals and quality increases are likely to be difficult to create where multiple stakeholders and pressures on habitat are apparent. There is also great uncertainty over whether this approach can deliver biodiversity gains. This option therefore has technical challenges and is scored as '1'.

4.4 Cost

Improvements in rangeland quality are already designed as offset activities that target other species. Inclusion of Houbara Bustard into this programme could therefore be of low cost to the project, but uncertainty remains over what activities would need to be implemented and over what area to deliver required gains. Given the remaining uncertainty this parameter is scored as '2'.

4.5 Additional benefits

As both improvements to rangeland quality is considered to be beneficial to a range of priority species this option is scored as '3'.

5. Influencing national powerline planning and policy

Objective: Play a demonstrable role in updating policy and/or standards to reflect best practice in powerline mitigation to deliver wider biodiversity benefits in Mongolia.

5.1 Demonstrable biodiversity gains

Influencing powerline policy in Mongolia may not benefit Houbara Bustard but could benefit other priority biodiversity species (namely Great Houbara, Saker Falcon and Pallas's Sandgrouse). It will have a demonstrable biodiversity benefit in a national context. Although this is difficult to credit in typical NNL/NPI accounting, a dialogue with stakeholders is recommended to build support for this approach. GBC can continue to support accounting sensibly for biodiversity gains accrued through regional/national engagement. Because benefits to Houbara Bustard specifically may be low (owing to the limited building of powerlines in the South Gobi) but there may be benefit for other priority species this parameter is scored as '2'.

5.2 Political feasibility

The Government of Mongolia has proven to be receptive to OT and other stakeholder's advice in the past as demonstrated through the establishment of the cross-sectoral working group on linear infrastructure and the role TNC has played in developing offset policy. OT has clearly demonstrated that through strategic partnerships it can wield a strong influence within Government e.g. through collaboration with the MNMA to open a dialogue on offset policy. Other stakeholders are likely to supportive of OT in its engagement with the GoM on powerlines e.g. WSCC. Whether the current and future Governments will be receptive to such a dialogue is not fully known at this stage. Political feasibility is therefore scored as '3'.

5.3 Implementation risk

There is a level of risk associated with this option; the GoM may not be receptive to ideas presented, or that a change in Government may affect Government priorities and therefore the viability of this option. Even if a standard is developed, this may not reflect in any actual action on the ground and how this is approached would need to be planned as part of an engagement strategy. This parameter is therefore scored as '2.

5.4 Cost

The costs of this option are likely to the lowest of all the options. OT has experience of organizing Government engagement in the past via strategic partnerships and has funded for example a study tour to the US. A rough estimate for this work is $150,000/year initially, reducing to zero once policy is firmly establishes and implemented. Compared to other options, this is relatively inexpensive and is scored as '3'.

5.5 Additional benefits

This option would benefit biodiversity more broadly in Mongolia with potential for very significant biodiversity gains e.g. for Saker Falcons which are severely threatened by powerline mortality in Mongolia. Standards that require insulation to infrastructure, establish the use of vertical arrays, burial of low voltage powerlines, and correct installation (learning from OT experiences to date) of latest generation BFDs would have widespread and long lasting biodiversity benefits. This parameter is therefore scored as '3'.

6. Support anti-poaching work in Houbara Bustard wintering grounds

Objective: The principle threat to Houbara Bustard outside Mongolia is hunting and this most often occurs on their wintering grounds (Judas *et al.* 2009). This option would therefore provide support to a third party conservation organization(s) to carry out anti-poaching work (including for example enforcement of bans on illegal trade and hunting) in Houbara Bustard wintering grounds to reduce overall mortality.

6.1 Demonstrable biodiversity gain

Several difficulties in demonstrating a biodiversity gain exist with this option. First, little is known about where Mongolian Houbara Bustards migrate to. Secondly, accurately establishing reliable population data is challenging when numbers are low (as demonstrated with recent monitoring work carried out by WCS, Batbayar *et al.* 2011, Purev-Ochir *et al*. 2014) and therefore demonstrating a positive impact from anti-poaching work on the

population would be difficult. As it would be difficult for the project to demonstrate No Net Loss with this option, it is scored '1'.

6.2 Political feasibility

Stakeholders may not consider this to be an appropriate option for the project, whilst the rationale for carrying out the work is apparent, the anti-poaching work is likely to be required far from Mongolia so direct benefits are harder for stakeholders to see and understand without considerable effort on the part of OT to sensitize and explain. A score of '1' is therefore given.

6.3 Implementation risk

Risks associated with this option are thought to be high as the probability of problems arising from overseeing work carried out by multiple third parties in locations far from Mongolia is high. A score of '1' is therefore applied.

6.4 Cost

Anti-poaching costs have not been investigated as this option is thought to be non-viable from a biodiversity gains perspective. A provisional score of '2' is applied.

6.5 Additional benefits

Unlikely to bring any additional benefits to other priority biodiversity features, therefore it scores '1'.

7. Installation of insulation on non-OT powerlines

Objective: Install insulation or other mitigation measures on non-OT powerlines to reduce electrocution impacts to the Saker Falcon, an Endangered species. This would not provide benefits to Houbara Bustard, and no reduction in collision risk for other priority features impacted by OT powerlines, but would provide benefits to another priority species potentially affected by powerline electrocution.

7.1 Demonstrable biodiversity gains

WSCC estimate that between 713-7,951 Saker Falcons are electrocuted on powerlines in Mongolia every year and in a 5 month monitoring trial of a 56km 5kV powerline, 235 fresh Saker carcasses were encountered (N. Batbayar *in litt*. 2015). If robust baselines of Saker Falcon electrocutions along the chosen lines can be obtained prior to mitigation followed my monitoring post installation, a demonstrable averted loss to the Saker Falcon population will be known. This option is provisionally scored as a '2' (it could be a '1' or a '3' depending on stakeholder discussions).

7.2 Political feasibility

This option has received provisional verbal support from project lenders, WSCC and BirdLife International. It is also being proposed by a Qatari group operating in Mongolia who have received provisional governmental backing. This option is thus scored as '3'.

7.3 Implementation risk

From trials carried out by WSCC a suite of methods to reduce Saker electrocutions including insulation of certain section of line near to poles, the use of deflector spikes and reconfiguration of jump wires at anchor poles have been identified. The effectiveness of these methods still requires further analysis but trials suggest significant reductions in mortality are possible (N. Batbayar *in litt*. 2015). As the powerline where any offset action would take place would not be owned by OT, negotiations with the Government or private owners would need to take place. Technical risks are scored as '3' for this option.

7.4 Cost

Insulation costs (including purchase of materials and installation) along a 35 km 35kV line are estimated to be $525,000 (OT *in litt*.. 2015). Assuming costs for a 5kV line are similar, a 56 km powerline would cost in the region of $850,000. If this option was selected as an offset option, the length of powerline requiring insulation would need to be established. This option is scored as '3' for cost.

7.5 Additional benefits

This option clearly delivers major biodiversity benefits in a Mongolian context, including for project priority biodiversity features. It is therefore scored as a '3'.

8. Funding research into the Mongolian Houbara Bustards

Objective: A great deal of the uncertainty around selecting appropriate offset options comes from the current lack of understanding of Houbara Bustard population size, distribution and ecology in Mongolia, and the species' response to human influences in the landscape. Current monitoring by OT is not going to fill these knowledge gaps. Funding research e.g. via a PhD study, could potentially improve understanding in a number of areas such as population size and trend, migration routes, breeding sites, current collision rates, the effectiveness of OT's powerline mitigation, the sustainability of current mortality, predation rates and OT's influence on these etc.

The same scoring system as the offset options was applied to the additional conservation action to assess its suitability as a powerline offset action.

8.1 Demonstrable biodiversity gains

Whilst there are gaps in knowledge on Houbara Bustards and the research would enable a better understanding of OTs impacts on the Houbara Bustard population there is no direct conservation benefit and therefore this parameter is scored as a '1'.

8.2 Political feasibility

There are clearly gaps in knowledge on the Mongolian Houbara Bustard and stakeholders are likely to support OT funding additional research, this parameter is therefore scored '3'.

8.3 Implementation risk

The only risks associated with such research would be if a suitable candidate cannot be found or if suitable research advisors cannot be found but through stakeholder support (e.g. via WSCC), this risk is thought to be minimal and the parameter is therefore scored '3'.

8.4 Cost

Costs are estimated to be $60,000-$75,000 per year for 3-4 years to gather the required information. Costs could be substantially lower. Whilst this is an additional conservation action rather than an offset option it is still comparatively low cost and is therefore scored as '3'.

8.5 Additional benefits

This action is unlikely to deliver any additional conservation benefits for biodiversity and is therefore scored as '1'.