



Lime Down

Solar Park

Written Summary of the Applicant's Oral Submissions and Responses at Issue Specific Hearing 8 and Responses to Action Points

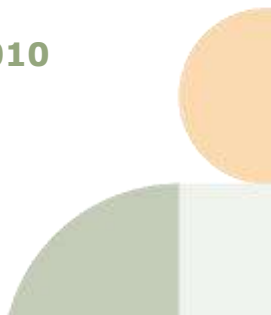
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1 Summary of Oral Submissions at Issue Specific Hearing 8

Agenda item	Comment
1. Welcome, housekeeping, purpose of the hearing, participant introductions	The ExA introduced the hearing and made some preliminary remarks. The purpose of the hearing is to address matters raised by the ExA following its consideration of the application documents in respect of matters relating to socio-economics, ecology and biodiversity. The following parties introduced themselves during ISH8: The Applicant • Claire Brodrick, Partner at Pinsent Masons LLP (solicitors for the Applicant) • Will Threlfall, Senior Project Development Manager at Island Green Power • Dr Suzanne Green, Equine Veterinary Surgeon at Greenway Equine Veterinary Services Ltd • Stephen Flynn, Senior Planner at Lanpro • Alison Powell, Senior Technical Director at Arcadis • Hannah Dennett, Associate Technical Director at Arcadis • Chris Jackson, Director of Landscape Architecture at Lanpro • Matthew Muirhead, Associate Director at AECOM • Peter Timms, Associate Director at Clarkson & Woods Wiltshire Council • Isabella Buono, Barrister at Landmark Chambers (Counsel for Wiltshire Council) • Russell Frith, Inward Investment Manager

	• Guy Sharp, Public Health • Emma Fisher, Senior Ecologist • Kate Tate, Arboriculture Officer Stop Lime Down (SLD) • Daniel Kozelko, Barrister at 39 Essex Chambers (Counsel for SLD) • Celia Reynolds, Barrister at 39 Essex Chambers (Counsel for SLD) • Nicholas Valori, Senior Ecologist at Betts Ecology • Philip Moore, Interested Party Other Interested Parties (IPs) • January Farrington, West Park Farm • Vanessa Shipp, Grittleton House • Sue Godwin, Sue Godwin Livery • Margot Hope • Alex Frost, Ladyswood Farm and Stud • Dr Annemarie Farrington, Equine Veterinary Surgeon
2. Socio-economics 2.1. Equine Business Impacts	The ExA asked the Applicant to set out its position on the anticipated effects of the Scheme on the local equine industry and the proposed mitigation measures set out in the Equine Business Report [REP5-105]. Stephen Flynn, on behalf of the Applicant, explained that the Applicant recognised a well-established and interconnected local equine sector, supported by a wider supply chain. An initial, high-level, review was undertaken in Environmental Statement (ES) Volume 1, Chapter 16 Socio-Economics, Tourism and Recreation [APP-068], which sought to identify the private and commercial equine facilities across the local area most likely to be affected by the Scheme. In

	response to matters raised during the Examination by IPs and requests from Wiltshire Council and the ExA, the Applicant produced the Equine Business Report [REP5-105] at Deadline 5, which provided further detail on the Applicant's understanding of the equine sector and reassessed the potential direct and indirect effects of the Scheme. The assessment considered effects on the environment surrounding equine facilities; horses as sensitive receptors, particularly in relation to construction noise, movement and activity; and horses using the public road and highway network. With the mitigation in Section 5 of the Equine Business Report [REP5-105], the Applicant considers that there would be no significant adverse effects on the equine business sector. The ExA noted that ES Volume 3, Appendix 16-2 Tourism and Recreation Receptor Tables [APP-241] described West Park Farm as a livery and equestrian care business, whereas Annex A of the Equine Business Report [REP5-105] described it as a thoroughbred stud farm, yet the effects were unchanged. The ExA asked whether the assessment was the same irrespective of whether the business was a livery yard or a stud farm, or whether the Applicant considered that the effects of the Scheme on either type of operation would be the same. Mr Flynn explained that the livery description resulted from an internal miscommunication; the assessment had nonetheless treated it as a business affected by the Scheme's environmental effects and by effects on access and use of the surrounding highway and public right of way (PRoW) network. Sensitivity had been based on the facility being a business, so the outcomes had not changed. Claire Brodrick, on behalf of the Applicant, noted that two separate points had been raised on behalf of SLD, January Farrington and Dr Farrington. The first related to the sensitivity of stud farms from a business perspective and the second related to equine health. The ExA requested that the latter be addressed first. Dr Suzanne Green, on behalf of the Applicant, agreed that thoroughbreds were generally more reactive but shared other horses' physiological and behavioural responses and capacity to habituate. She distinguished vigilance from flight or startle responses: horses initially move away from a
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	perceived threat but, if no negative experience is associated with the stimulus, learn to respond less to it over time. She explained that young stock respond to their dams but may learn and habituate more quickly than adult horses. With proposed dust and noise mitigation, the likely response was alertness rather than startle. In response to the ExA's questions, Dr Green explained that thoroughbreds were bred to be more reactive and alert for racing and other sporting activities. However, the response of an individual horse would depend on its temperament and previous learning experiences. A thoroughbred could be relatively placid or more reactive, while a horse previously exposed to traffic, tractors or farm machinery would be likely to respond less than one without that experience. Repeated exposure without a negative consequence would progressively reduce the response. Dr Green explained that an extreme response would be expected where an activity entered a horse's direct flight zone and was perceived as a real threat. At a distance, where the horse could move away, observe and learn, the anticipated response would be reduced to vigilance. The ExA asked what was meant by "training" in the Equine Business Report [REP5-105], particularly in the context of foals and mares that may not have been exposed to construction activity. Dr Green explained that this referred to horses' previous experiences, including horses trained from a young age to use roads and become accustomed to traffic, as well as the previous learning experiences of horses kept in fields. For horses without that experience, the initial response would be to move away, observe the activity and learn that it had no negative consequence. Short-term stress formed part of normal learning; chronic or prolonged stress could affect health. The ExA summarised its understanding that stud farms could therefore present a greater risk because thoroughbreds may not previously have experienced construction noise, and that foals could be more sensitive because they lacked previous learning experience. Dr Green explained that, in her previous practice, she had worked with a racing yard and two stud farms and had attended race meetings, although she no longer undertook racing or thoroughbred stud work.
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	The Applicant notes that Dr Farrington accepted that horses habituate but said some remain highly reactive. The ExA referred to paragraph 4.2.6 of the Equine Business Report [REP5-105], which attributes a 5-30 metre flight zone (footnote 15) to a report published by Equine Canada (<i>Equine Canada / NFACC (2013) Code of Practice for the Care and Handling of Equines, Appendix G: Understanding Flight Zone, Point of Balance and Field of Vision</i>). Ms Brodrick submitted that the relevant question was the response to this Scheme's specific activities: at West Park Farm the adjacent works were habitat management (Work No. 9), the solar array (Work No. 1) was around 50m away and there was intervening vegetation. The ExA considered it necessary first to establish the basis of the 30m flight zone and potential horse behaviours more generally, given the number of equine facilities in the area, the potential use of surrounding paddocks and other facilities, and the proximity of hacking routes to works areas. Dr Green clarified that the Equine Canada Code was cited to illustrate the flight zone concept and field of vision, not as the source of the 30m figure. She referred to her exhibit SGL6, a handling study of semi-feral horses showing flight distances of around 6.87m (a couple reaching the 12m enclosure limit) and said a 5-30m flight zone was typically understood to produce a reaction if entered, whereas horses outside that zone would remain vigilant and might look, walk or move away. She added that works would progress towards areas where horses were kept, allowing habituation. Ms Brodrick confirmed that the Applicant would identify the source of the 30m figure, and the Applicant agreed to submit the semi-feral horse study at SLD's request. Post Hearing Note: The Applicant has submitted a copy of <i>Equine Canada / NFACC (2013) Code of Practice for the Care and Handling of Equines, Appendix G: Understanding Flight Zone, Point of Balance and Field of Vision</i> at Deadline 7. See Appendix A to this written summary.
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	Post Hearing Note: Please see the response given to Action Point 3 in the List of Actions for the Applicant and Other Parties following Issue Specific Hearing 8 at Section 2 of this document in relation to further evidence with respect to the 30m flight zone. Post Hearing Note: The Applicant has submitted a copy of Christensen, J.W (2005) Fear responses in horses. Licentiate thesis at Deadline 7. See Appendix D to this written summary. The ExA requested that the Applicant explain the engagement it had had with the IPs present. Will Threlfall, on behalf of the Applicant, explained that Mr and Mrs Farrington had spoken to the project team at consultation events, and that whilst Mrs Farrington and Philip Moore had joined a heritage meeting at Bradfield Manor with the Applicant's landscape and heritage experts, wider project matters were discussed, but not the specific operations of the stud farm. Mr Threlfall confirmed that he had not yet visited West Park Farm, as an earlier offer to visit had been declined and a whilst the principle of a meeting had been agreed with Mr Farrington at the Accompanied Site Inspection (ASI), this had not yet taken place. In respect of Ladyswood Stud, an earlier meeting between SLD and the Applicant had been held at the property between the wider Applicant team and SLD members, later visits were discussed, but were either not confirmed or could not be arranged. In response to the ExA, Mr Threlfall agreed that no equine specialist had visited the studs and that he was not qualified to assess them. Post Hearing Note: While the Applicant acknowledges the in-principle objections to the Scheme of both Stud Farm owners, opportunities for engagement with the Applicant have remained available throughout the process, notwithstanding that these opportunities have not always been taken up. Should the Scheme receive consent, the Applicant hopes that the period between determination and the commencement of construction will provide a further opportunity for constructive engagement focused on the practical management of the Studs' particular concerns. The Applicant remains committed to engaging directly, so that any ongoing concerns can be discussed.
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	The ExA queried whether horses would react differently to noise where they could not see the source of the stimulus, compared with situations where the source of the noise was visible and could be assessed. Dr Green explained that reactions to unseen noise depended on the proximity and nature of the noise. In the context of equestrians using PRowS, where works could be 15m from the centre of the route and screened by a hedge, she explained that a sudden noise from a loud vehicle or machinery was more likely to cause a startle response than a consistent, quieter noise. The likely response would be shying or moving away rather than necessarily entering full flight. Depending on its severity, shying could unseat a rider, although it would commonly involve the horse moving sideways away from the noise. A herd might respond to one horse's perceived threat, from observing to moving away, but not necessarily extremely. The ExA queried the noise levels produced by tracker panels should the Applicant opt to use these when the Scheme is built out. Mr Threlfall explained that tracker motors were audible only within a few metres, mainly for 30-60 seconds when moving from the overnight horizontal position to their first position in the morning, with a similar movement back to the horizontal position at the end of the day; daytime movement was gradual and would be inaudible when standing next to the panels, while the initial movement would be inaudible at around 10–15m. The Applicant would provide relevant distance and noise references. The ExA noted that the ES appeared to assess one motor rather than all trackers operating together. As the noise expert was absent, Ms Brodrick agreed to respond in writing. <i>Post Hearing Note:</i> Please see the response given to Action Point 6 in the List of Actions for the Applicant and Other Parties following Issue Specific Hearing 8 at Section 2 of this document in relation to further evidence with respect to the noise levels of tracker panels.
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	The ExA raised a question in relation to herd mentality in horses, querying how horses' reactions differ when part of a herd. Dr Green explained that horses are herd animals and, if one horse detects a perceived threat, the others will become aware of it and assess whether it presents a threat. Their response would vary according to the nature, proximity and perceived severity of the stimulus. It could involve observing the stimulus, moving or trotting away, or running to the opposite end of the field, but would not necessarily involve an extreme flight response. The ExA asked the Applicant to explain, with reference to its specific location, the mitigation measures in place relating to West Park Farm. With reference to the Works Plan [REP6-004], Mr Flynn showed that Work No. 9 habitat areas lie between West Park Farm's paddocks and the fenced solar arrays with the Order Limits abutting some paddocks (fields D13 and D14). The Equine Business Report [REP5-105] notes that approximately 50m is measured from the nearest array fence to Gauze Brook, with it being the Applicant's understanding that this is the closest point horses would be able to reach. Ms Brodrick explained that Table 3 of the Equine Business Report [REP5-105] consolidated secured mitigation contained in the DCO application and additional measures committed to in response to representations made during the Examination and ongoing discussions with Wiltshire Council. She explained that the works closest to the square field comprised habitat mitigation, including tree planting, and were comparable to activities already undertaken in the agricultural field. The array fence was about 50m from the triangular field and 90m from the square field. The Applicant confirmed that no plan showing distances to the boundaries of all the West Park Farm fields was currently in the Examination and agreed to provide one at Deadline 7. <i>Post Hearing Note:</i> The Applicant confirms a plan showing the distances from the solar PV array areas to the nearest known boundaries of West Park Farm has been appended to this document. See <i>Appendix E to this written summary.</i>
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	The ExA requested an explanation of how the Community Liaison Group (CLG) would operate in respect of equine issues. Mr Flynn said the CLG, supported by a Community Liaison Manager, independent equine specialist and the Stakeholder Communication Plan secured by the Outline Construction Environmental Management Plan (CEMP) [REP6-029], would be the main contact for communities and equine businesses. The independent equine specialist would help bridge the technical gap between equine businesses and the Applicant or site operators, while the Community Liaison Manager would ensure that concerns were properly actioned. It would provide information on the location, nature and timing of works to support business and client confidence. It would also provide a two-way channel through which equine businesses could raise location-specific concerns. The information provided would enable business operators to decide where and when to place horses in adjacent fields and allow bridleway users to identify activities taking place along particular routes. Ms Brodrick added that the CLG would discuss timing preferences where practicable, subject to other constraints, and the Applicant was considering site or topic specific meetings. The ExA referred to fields D12, D13 and D14 and suggested that, once a detailed construction programme was available, information should be provided on the anticipated duration of works within individual fields. Mr Threlfall said construction would progress from the substation/compound field towards West Park Farm and fields D13 and D14: fencing, then ground preparation and access tracks furthest from the paddocks. Groundworks and piling were the noisiest activities, and shallow bedrock might require percussive piling following geotechnical ground surveys and clear communication about when that work would take place, particularly at the closest points. Works in a field could last weeks to two months, with the noisiest works at any location lasting a few weeks. Mr Threlfall explained that the CLG was intended to allow businesses to identify preferred timings for works, where flexibility existed,
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	so that this information could inform rather than simply be communicated through the construction programme. The ExA requested an indicative, caveated programme at Deadline 7. Post Hearing Note: Please see the response given to Action Point 8 in the List of Actions for the Applicant and Other Parties following Issue Specific Hearing 8 at Section 2 of this document in relation to the timetabling of activities to mitigate harm. In response to comments made by SLD, Mrs Farrington and Dr Farrington, Ms Brodrick explained that the Applicant sought to include proportionate and realistic mitigation. Table 3 of the Equine Business Report [REP5-105] required workers carrying out noise-generating works near equestrian facilities to be briefed on stopping work protocols, allowing works to pause temporarily for veterinary attention or handling of a distressed horse. Ms Brodrick added that the Applicant would consider any specific additional mitigation measures proposed. Ms Brodrick acknowledged that uncertainty was a significant factor in the impacts businesses considered might arise, but anticipated that greater clarity following consent would help to reduce that uncertainty and allow practical engagement through the CLG. She added that page 44 of the Equine Business Report [REP5-105] provides for complaints to be investigated and further construction mitigation applied where this could reduce the effect. Ms Brodrick clarified that the CLG operates across all Management Plans and was best addressed through its Terms of Reference rather than specific references in each Management Plan. Ms Brodrick noted that the independent equestrian expert's role is set out in Table 20 of the Outline CEMP [REP6-029] and agreed to consider committing to appoint the expert before the final CEMP is submitted. Ms Brodrick confirmed that the Applicant would share outline CLG Terms of Reference with Wiltshire Council and SLD before Deadline 7. Post Hearing Note: Table 20 of the Outline CEMP has been updated. Please see the response given to Action Point 9 in the List of Actions for the Applicant and Other Parties following Issue Specific Hearing 8 at Section 2 of this document.
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	The ExA noted that SLD would propose revised wording for Requirement 4 of the draft Development Consent Order (Draft DCO) [REP6-005] at the following day's hearing. The ExA queried the basis of the 30m trigger for additional measures on page 44 of the Equine Business Report [REP5-105] and requested supporting evidence, or an alternative buffer, at Deadline 7. Ms Brodrick explained that the trigger applied to solar PV site and cable route works near equestrian facilities; that fencing and habitat planting were normal rural activities; and that, if the Secretary of State (SoS) considered that 50m was required, the Applicant would need to comply with that, noting many facilities were 50m or more away in any case. The ExA agreed the focus should be on the noisiest works. Ms Brodrick explained that the 30m distance had been selected as an appropriate trigger for measures, including the screening of noise sources, taking account of the other information in the Equine Business Report [REP5-105]. In response to comments made by Mr Frith relating to insurers treating construction of the Scheme as a material change, affecting cover and premiums or leading to refusal of cover, Ms Brodrick noted that this evidence had not been provided and asked Wiltshire Council to supply it. In response to comments made by SLD, the ExA, noting that paragraph 4.2.8 states that horses generally hear higher frequencies and quieter sounds than humans, considered that the 11 dB and 7 dB increases could be significant for horses. Matthew Muirhead, on behalf of the Applicant, explained that construction noise was modelled as the noisiest activities occurring simultaneously, throughout most of the day, at the closest point of the panel areas; spot levels at 10m and 30m from the red line were typically in the low 60s dB. Mr Muirhead agreed to provide construction noise contour maps for West Park Farm and Ladyswood at Deadline 7, and the ExA requested commentary from Dr Green on the implications for horses.
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	Ms Brodrick noted that section 152 of the Planning Act 2008 provides compensation where a statutory nuisance defence applies. Post Hearing Note: Please see the response given to Action Point 12 in the List of Actions for the Applicant and Other Parties following Issue Specific Hearing 8 at Section 2 of this document in relation to additional modelling and noise contour maps. The ExA asked whether the Applicant had assessed the potential air quality effects of a BESS fire on horses, rather than by reference only to the human Acute Exposure Guideline Level 1 (AEGL) thresholds. Ms Hannah Dennett, on behalf of the Applicant, explained that the closest identified equine facility to the proposed BESS, Townleaze Farm, including its livery facility, is represented within the modelling by receptor R11, located approximately 700 m from the proposed BESS area. Predicted pollutant concentrations were therefore calculated for a location where horses are understood to be present. Hydrogen fluoride was identified as the pollutant with the highest predicted concentration relative to the assessment criteria, with a maximum one-hour mean concentration of 70.4 µg/m³ predicted at receptor R11 compared with the AEGL-1 threshold of 818 µg/m³, equivalent to approximately 9% of the relevant criterion. Ms Dennett noted that, whilst equine receptors were not assessed as a separate receptor category, the closest identified equine facility was represented within the modelling and the predicted concentrations were substantially below the relevant assessment criteria. Ms Dennett further explained that the assessment adopted a precautionary approach, including modelling worst-case BESS fire locations, conservative release and plume characteristics, and reporting the maximum concentrations predicted across five years of meteorological data. She noted that BESS fires are rare events and that the Scheme incorporates multiple layers of prevention and mitigation, including compliance with relevant industry standards, fire testing requirements, separation distances, fire protection systems and emergency response planning.
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	In relation to assessment criteria, Ms Dennett explained that AEGL-1 represents the most conservative AEGL threshold and was considered an appropriate benchmark for assessing a short-term accidental release scenario. She noted that there are currently no recognised acute exposure criteria specifically applicable to horses and that, in the absence of equine-specific standards, comparison against precautionary human health criteria provides the most appropriate basis for assessment. She further noted that this approach is consistent with that adopted on other NSIP projects where potential effects on horses or livestock have been considered. The ExA asked whether, taking account of the prevailing south-westerly wind direction, West Park Farm would be more affected by emissions from a potential BESS fire than Townleaze Farm, despite Townleaze Farm being located closer to the proposed BESS? Hannah Dennett, on behalf of the Applicant, explained that the air quality modelling accounts for all wind directions over the five year meteorological dataset. She noted that the assessment does not identify a single worst-case hour that is applied to all receptors. Instead, each receptor is assessed individually and the highest predicted concentration at that receptor over the modelled period is reported. Ms Dennett explained that, as the assessment is based on the worst-case concentration predicted at each receptor location, whether a receptor is upwind, downwind, or aligned with the prevailing wind direction is not of primary relevance to the reported results. The assessment therefore considers the worst-case exposure for each receptor. Dr Green explained that horses had substantially greater airflow capacities than humans and were obligate nasal breathers, meaning that inflammation of their nasal passages could cause respiratory distress more quickly. Although horses would inhale more pollutants if pollutants were present, at these distances there would not be pollutant levels capable of affecting them. The ExA notes there was no established methodology for horses.
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	The ExA asked whether there was any requirement for an operator or regulator to assess the effects following a BESS fire, including effects on animals, and whether the operator could undertake such an assessment if a BESS fire occurred during the 60-year operational period. Ms Brodrick confirmed that the Applicant's BESS expert would respond in writing, including on industry learning and practical monitoring, and would comment on the Moss Landing fire report, which Mr Frost agreed to submit. <i>Post Hearing Note:</i> Please see the response given to Action Point 10 in the List of Actions for the Applicant and Other Parties following Issue Specific Hearing 8 at Section 2 of this document in relation to BESS. The ExA asked whether the ES assessment and Equine Business Report [REP5-105] differentiated between the different types of livery and equine facilities, including the types of horses accommodated and the nature of their use, or whether all facilities had been assessed on a worst-case basis as though they accommodated thoroughbreds. In response to the ExA, Mr Flynn confirmed that, in ES Volume 1 Chapter 16 Socio Economics, Tourism and Recreation [APP-068] and ES Volume 3 Appendix 16-2 Tourism and Recreation Receptor Tables [APP-241], the type of horses at each facility had not been differentiated; sensitivity was driven by whether a facility was private or commercial, with commercial facilities assigned higher sensitivity. More detailed differentiation followed in the Equine Business Report [REP5-105] at Deadline 5. The ExA asked whether SLD's Appendix Z – Combined Baseline and Project Information Plan (Rev. 17) [REP6-082] (and previous versions [AS-019] and [REP1-188]) had been considered in establishing the baseline. Mr Flynn confirmed that the Applicant had been aware of SLD's information on equestrian facilities and its plan of routes of importance to equestrians (earlier provided by Mrs Farrington in a written
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	submission), and that the main difference was SLD's identification of more private owners keeping one or two horses, information that had not been available to the Applicant, which had relied on consultation responses and online sources. The Applicant agreed to cross-reference its baseline against the latest version of Appendix Z at Deadline 7. Post Hearing Note: Please see the response given to Action Point 13 in the List of Actions for the Applicant and Other Parties following Issue Specific Hearing 8 at Section 2 of this document. Alison Powell, on behalf of the Applicant, explained that the Equine Business Report [REP5-105] recognised commercial thoroughbred operations as potentially more sensitive, and identified client confidence as an impact pathway. She noted that client confidence could be influenced by several factors, including environmental setting, the operator's expertise and reputation, the quality of care and confidence in the proposed controls and mitigation. She concluded that there would be temporary disruption rather than sustained effects undermining business continuity, employment or the wider equine economy. This did not mean that individual facilities would experience no effects or no loss of customers, but that any effects were not expected to occur at a scale sufficient to be significant. The ExA queried the basis of the statement at paragraph 6.1.11 of the Equine Business Report [REP5-105] that, "on the information currently available", concerns about client confidence do not amount to a likely significant adverse effect on business viability, given that the effects could not be quantified. Ms Powell explained that it was a qualitative judgement, informed by the mitigation and management measures and discussions with equestrian experts; the Applicant did not have quantifiable data on how many customers might leave a business. She referred to experience on other DCOs. The ExA asked for that information to be submitted if relied on. Ms Powell clarified that the conclusion was based primarily on information relating to Lime Down.
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	Post Hearing Note: Please see the response given to Action Point 14 in the List of Actions for the Applicant and Other Parties following Issue Specific Hearing 8 at Section 2 of this document. In response to comments made by Wiltshire Council, Ms Brodrick explained that the vehicle tracking discussed should enable speed monitoring, which the Applicant would confirm, and that the use of cameras and white noise alarms would be reviewed. The Applicant agreed to add commentary to the Equine Business Report [REP5-105] explaining how likely significant effects are understood for equine businesses as compared with receptors generally in ES Volume 1, Chapter 16 Socio Economics, Tourism and Recreation [APP-068]. Ms Powell confirmed that business closure was the most severe outcome but not the only consideration or threshold applied; effects short of closure (such as contraction, reduced activity or employment effects) could be significant depending on magnitude and duration, but were unlikely to be sufficiently sustained or material in this case. Post Hearing Note: The Applicant has updated the Equine Business Report [EN010168/EXAM/9.62] (revision 2 as submitted for Deadline 7). Please see the response given to Action Point 15 in the List of Actions for the Applicant and Other Parties following Issue Specific Hearing 8 at Section 2 of this document. Post Hearing Note: The Applicant has updated the Outline CTMP [REP6-041] in relation to additional mitigation measures. Please see the response given to Action Point 16 in the List of Actions for the Applicant and Other Parties following Issue Specific Hearing 8 at Section 2 of this document.
2.2. Non-Equine Business Impacts 2.2.1. Viability of businesses	The ExA asked for an update on the Applicant's position in relation to Grittleton House, Whatley Manor and The Angel, Sherston (referring to the Applicant's Response to Submissions Received at Deadline 5 [REP6-060], WC-119 in relation to Grittleton House).

	Mr Threlfall, on behalf of the Applicant, said a site meeting had been held the previous week. The haul road would not reach the M4 and would serve only the open-cut cable works in two long fields, accessed a few fields away. Discontinuous ducting could be timed for quieter periods, such as January, with one to two weeks for installation and later cable pulling. The compound could remain for two years but serve only local works. In response to comments made by Ms Shipp on behalf of Grittleton House, Mr Jackson, on behalf of the Applicant, explained that temporary hoarding or fencing would be used to screen the construction compound and noted that the compound had been moved north to use woodland, the tennis-court hedge and field trees to provide screening, with Mr Jackson acknowledging that the field trees were sparse. Mr Threlfall apologised for the late engagement. Through the CLG and venue diary, works could be notified and planned around events, limiting invasive activity, noise generating compound use and visual intrusion, although firm commitments could not be until post consent and contractor appointment. Works would avoid known wedding days and potentially viewings where practicable. Mr Threlfall explained that the Applicant was considering reducing the size of the compound so that existing vegetation would provide greater screening, limiting the duration for which items extending above that vegetation would be stored there. He also said that he would explore the use of white-noise reversing alarms. He considered that reversing movements could not be avoided entirely and was seeking to establish the most constrained parameters that could reasonably be imposed on the contractor. <i>Post Hearing Note:</i> <i>In relation to the compound east of Grittleton House and in consideration of work parameters, the following measures have been included into Table 10 of the Outline CEMP [EN010168/APP/7.12] (Revision 8 submitted at Deadline 7):</i> • <i>Visual amenity will be protected by locating larger equipment in the northern portion of the compound;</i> • <i>Within the southern portion of the compound, construction activities will be minimised;</i>
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- *Stockpiles, parking and plant and equipment storage will be preferentially located within the northern and eastern portions of the compound; and*
- *A named contact will be provided to allow continued engagement with Grittleton House with feedback informing the planning of construction activities to minimise effects.*

In response to comments made by Ms Shipp and Wiltshire Council in respect of the listed status of Grittleton House and its ongoing maintenance, Ms Brodrick said the heritage and socio-economic EIA assessments were distinct, the works temporary and both matters part of the planning balance. She confirmed that the Applicant would respond in writing on optimum viable use, economic effects and the potential to revisit receptor sensitivity. The response on economic effects would take account of the mitigation measures being developed by Mr Threlfall.

Post Hearing Note: *The Applicant has considered that, applying the same methodology as applied to equine businesses to identify a qualitative interpretation of impacts to business, that the Scheme would not have a significant impact on the operation of the business at Grittleton House. This is because the Scheme works are short-term and temporary, and thus so are the visual impacts to Grittleton House and its clients. Furthermore, the Applicant has committed to means of limited working requirements at the location by utilising access points to the south to access HDD operations for the M4 crossing, and communicating with the owners of Grittleton House to avoid work coinciding with events as much as is practicable.*

Therefore, the Applicant considers that while some clients may be put off by the prospect of construction works, this would not be universal, and that as the works would not affect the ability of the operators at Grittleton House to undertake their role as wedding or event hosts, it would have a minimal impact on their reputation, and thus on the long-term interests of their business operations.

Therefore, the Applicant does not consider there is any material risk to the heritage value of the building as a result of decreased maintenance or impact on optimum viable use. The Applicant seeks to highlight that the causal link between the Scheme and risk to the building was made by Wiltshire Council. The Applicant considers that the nature and duration of works being undertaken for Scheme,

	<i>and the layering of physical and communicative mitigation measures ahead of and during construction are more than suitable to eliminate any causal pathway to the heritage value of the building being threatened.</i> Mr Threlfall clarified that, where a known wedding was taking place, the Applicant would seek to avoid ducting or cabling works for the full day, rather than only during the ceremony, and would explore arrangements for venue viewings. The ExA asked Mr Threlfall and Ms Shipp to discuss realistic measures before Deadline 7. <i>Post Hearing Note:</i> <i>To minimise construction effects at Grittleton House, a series of mitigation measures have been developed and included within Table 10 of the Outline CEMP [EN010168/APP/7.12] (Revision 8 submitted for Deadline 7). These include measures to minimise disturbance on wedding days together with measures to limit visual intrusion of the compound on views from Grittleton House and gardens. The Applicant can confirm that avoidance of works coinciding would (wherever practicable) be for the entire event (1-1.5 days). This therefore would mitigate the risk of events being interrupted by nearby works.</i> The ExA questioned whether the Applicant's consideration of Whatley Manor in its Technical Note on Impacts to Non-Equine Businesses [REP5-111] had properly addressed the hotel's wider business offer, including its promotion of walks using the local PRoW network. This was in the context of the Applicant's Written Summary of the Oral Submissions at the Open Floor Hearing 2 and the Applicant's Responses [REP4-088] and Whatley Manor's Post hearing submissions [REP4-134]. Referring to a walk advertised by the hotel towards Foxley and the Fosse Way, the ExA asked whether the Applicant had considered the effects of the Scheme on those routes, engaged with Whatley Manor regarding its use of the PRoW network, and discussed alternative walking routes that did not pass close to the Order Limits.
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	Ms Brodrick confirmed that the Applicant had not suggested alternative walks. Mr Flynn explained that the Applicant had responded in writing on each route; the Foxley walk had been scoped out of ES Volume 3 Appendix 16-2 Tourism and Recreation Receptor Tables [APP-241] as landform and vegetation prevented direct views, the nearest point being a few hundred metres away. The ExA questioned whether the Applicant's response to the concerns raised by The Angel, Sherston had properly addressed the potential loss of trade arising from disruption to the PRow network. The ExA noted that the concern appeared to be not the impact on the PRow network itself, but the possibility that users would avoid routes affected by construction works and therefore cease visiting the café. The ExA asked the Applicant to consider whether users were likely to avoid affected routes and, if so, whether there were reasonable alternative routes into Sherston that could be promoted. Mr Flynn, on behalf of the Applicant, referred to the Technical Note on Alternative Access to the Public Rights of Way Network [REP4-080], which identified a dense PRow network offering alternatives into Sherston, though routes from the south were harder to avoid, and noted that information in the outline Construction Traffic Management Plan would help cycle groups plan. He explained that the technical note had considered the displacement of users from affected routes and had concluded that the density of the PRow network around Sherston meant there would not be a detrimental impact on the quality of alternative routes arising from increased use. Post Hearing Note: Please see the response given to Action Point 19 in the List of Actions for the Applicant and Other Parties following Issue Specific Hearing 8 at Section 2 of this document.
2.2.2. Business compensation fund	With reference to the Applicant's conclusions in ES Volume 1, Chapter 16 Socio Economics, Tourism and Recreation [APP-068], the ExA asked Wiltshire Council to set out its position in relation to the need for a business compensation fund. The ExA noted that local benefits might bypass nearby businesses and instead be experienced regionally or nationally: ES Volume 1, Chapter 16 Socio Economics, Tourism and Recreation [APP-068] anticipated a peak of 692 workers (412 relocating), "non-local" was defined as 20km or

	more (question TT2.11 of the ExA's second written questions (ExQ2) [PD-014]), and SLD's Business Survey Report – Additional Submissions – Accepted at the discretion of the Examining Authority [AS-027] reported no construction companies near the Order Limits and no more than 40 with over ten employees in the South Cotswolds constituency. The ExA considered local benefits needed to be quantified and qualified. Mr Flynn, on behalf of the Applicant, explained that the 20km economic study area was based on geographic proximity and ONS data, and accepted that benefits would be spread more widely than adverse effects and fewer workers would be found within 5km. He explained that the study area was based on geographic proximity rather than administrative boundaries and drew on data from the Business Register and Employment Survey and the Annual Population Survey. He noted that the 20km area included larger settlements such as Chippenham, Melksham and Trowbridge and therefore extended beyond what residents might perceive as the local area. Mr Flynn explained that the Technical Note on Impacts to Non-Equine Businesses [REP5-111] had focused on a 5km study area in response to concerns regarding more localised effects. He noted that the study areas were measured from the Order Limits as a whole and therefore also took account of the cable route. He accepted that there were fewer construction industry employees within 5km than within 20km and that the resulting local economic benefits would therefore be less significant. Mr Flynn confirmed he would respond in writing on SLD's figures detailed in its Business Survey Report - Additional Submissions - Accepted at the discretion of the Examining Authority [AS-027]. Post Hearing Note: The Applicant has submitted a response to SLD's Business Survey Report [AS-027] at Deadline 7 (see Applicant's Response to SLD Deadline 6 Submission – Business Survey [EN010168/EXAM/9.86]). Post Hearing Note: The Applicant confirms that the datasets used in Table 1 of the Technical Note on Impacts to Non-Equine Businesses [REP5-111] were the 2025 edition of the UK Business Counts (ONS, 2025) and the 2024 Business Register and Employment Survey (ONS, 2025) to identify
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	<i>the number of businesses in each industry sector, and the number of people in employment in those industry sectors, within the 5 km Study Area.</i> <i>The datasets identify approximately 150 construction industry businesses employing 825 people within 5 km of the Solar PV Sites, and 625 businesses employing 3,275 people within the overall 5 km Study Area. This identified that the 5 km area around the Cable Route Corridor has a substantially greater construction industry than around the Solar PV Sites, as is expected due to the location of built-up areas and transport connections.</i> <i>The Applicant is aware that the construction industry in these datasets also includes a large variety of types of trades (ranging from utility construction companies to domestic builders, and including specialist trades such as electrical and plumbing installation, groundworks and fencing contractors) and as such includes trades that the Applicant does not necessarily consider are transferrable to work on the Scheme.</i> <i>The Applicant is therefore aware that opportunities to promote employment opportunities within 5 km of the Solar PV Arrays will be limited, and has stated this throughout the examination process, and has not relied upon this area to deliver employment for the Scheme. Recruitment and opportunities secured through the Outline Skills, Supply Chain and Employment Plan [REP3-104] will look to support business within the 5 km Study Area, particularly where there are opportunities to procure technical skillsets, suppliers, or long-term operation and maintenance contractors. However, the measures therein will also be available to businesses across the 20 km Study Area assessed in ES Volume 1, Chapter 16: Socio-Economics, Tourism and Recreation [APP-068], as this is considered a reasonable area over which people could travel to work on the Scheme, for construction, or long-term operation and maintenance work. The Applicant has looked to a 20 km Study Area to understand a realistic area within which employment to deliver the Scheme and therefore economic benefit can be located. Whilst the Applicant has repeatedly stated its understanding that adverse effects are most likely to be felt across a small area, it is not realistic to consider that all economic benefits generated by the level of employment needed for an NSIP can also be concentrated in the same area.</i>
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	In response to questions from the ExA and comments by Wiltshire Council on a business compensation fund, Ms Brodrick, on behalf of the Applicant, referred to the Outline Skills, Supply Chain and Employment Plan (Rev 3) [REP3-104] (Outline SSCEP), which supported smaller local firms to enable them participate in the Scheme, including by advertising opportunities for activities such as fencing and landscape planting and helping smaller businesses to comply with procurement processes that might otherwise discourage them from tendering. She explained that the Scheme was no different from other NSIPs and that the statutory compensation regime applicable to infrastructure projects was prescribed. Statutory compensation covered persons with interests in land affected by the Scheme, including owners, tenants and those with other proprietary interests; persons outside the works who experienced physical factors during operation, such as noise or emissions and section 152 claims where statutory authority provided a defence to nuisance. Ms Brodrick notes that compensation was available only in limited circumstances where the relevant criteria were met. The Draft DCO [REP6-005] also included specific compensatory provisions (e.g. article 12(5)) or losses arising from temporary interference with access as well as provisions relating to the use of private roads, protective works to buildings and surveys). Ms Brodrick submitted that there was no statutory or policy basis for generally compensating businesses for the indirect effects of infrastructure projects and therefore no obligation on the Applicant to provide such compensation. She distinguished community benefit funds, which could support different initiatives and organisations, from compensation paid to individual businesses. Ms Brodrick added that she was not aware of any DCO (including nuclear or high-speed rail schemes) providing compensation extending beyond those entitled under the statutory compensation regimes. Although some schemes referred to “business compensation” or included a business element in the title of a fund, the underlying arrangements did not provide compensation direct to any businesses within an area for loss of revenue.
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	The ExA referred to a country park operating as a business that was affected by the Lower Thames Crossing works and for which compensation had been discussed in relation to its loss of income. Wiltshire Council also referred to the Sizewell C business support fund. Ms Brodrick confirmed the Applicant would review the relevant examination material, but maintained that the Applicant was not aware of any general compensation scheme for businesses within a defined radius. She reiterated that promoters were not required to compensate for such effects under the existing regime. She also noted that the Government was consulting on statutory measures to provide local community with financial benefits in connection with electricity generation and transmission schemes, but that no statutory process currently applied. Ms Brodrick confirmed the Applicant's position is that there are no significant socio economic effects though acknowledged the concerns raised at the hearing. She explained that the Applicant's mitigation was proportionate and appropriate in planning terms, seeking to minimise effects and provide clarity and certainty about the location and timing of works. She added that the concerns raised were of the same nature as those raised on other NSIPs. Ms Brodrick clarified that, even if the SoS concluded that the Scheme's socio-economic effects would be significant, the Applicant did not accept that this would justify a general business compensation fund. The Applicant considered its proposed mitigation suitable and proportionate. <i>Post Hearing Note:</i> Please see the response given to Action Point 20 in the List of Actions for the Applicant and Other Parties following Issue Specific Hearing 8 at Section 2 of this document.
2.3 Community Facilities	The ExA referred to community facilities that could be particularly vulnerable to temporary reductions in bookings, visitors or volunteers, noting that facilities such as village halls often operated on limited resources and formed an important part of local communities. The ExA invited the Applicant to set out its position on the potential need for a community facility compensation fund for those facilities most directly affected by the works.

	With reference to the Applicant's response to ExQ2 [REP5-097] (SE2.3), Ms Brodrick, on behalf of the Applicant, confirmed that, through the mitigation measures contained in the various Management Plans, impacts on community facilities had been reduced as far as practicable and that a financial compensation fund was not appropriate or necessary. Ms Brodrick confirmed that the Applicant remained committed to a community benefit fund which would be available from commissioning and during the operational phase, but it was not anticipated to be available during construction.
3. Human Health	The ExA referred to the submission made by the NHS Bath and North East Somerset, Swindon and Wiltshire Integrated Care Board (ICB) at Deadline 6 [REP6-079] and invited the Applicant to provide a brief response to the issues raised. Mr Flynn, on behalf of the Applicant, responding to the ICB's Written Representations [REP6-079], stated that ES Volume 1, Chapter 18 Human Health [APP-070] provided a comprehensive, proportionate population-level assessment drawing on the other ES topics, identifying no significant adverse effects to physical and mental health, both at an individual level and in relation to community wellbeing with the secured mitigation; a standalone Health Impact Assessment was therefore not necessary. The Applicant would respond in full at Deadline 7. Mr Flynn noted that the ICB had since been engaging with Wiltshire Council's public health team and may now have additional information regarding the proposed mitigation measures and the Community Liaison Group, which the Applicant hoped would provide further confidence regarding the way in which human health concerns were being addressed. The ExA requested a position statement from the Applicant, Council and ICB at Deadline 7. Post Hearing Note: <i>The agreed position with Wiltshire Council and the Integrated Care Board is set out in the Position Statement on Human Health Matters submitted at Deadline 7.</i>

Outline Skills, Supply Chain and Employment Plan (moved from Item 10 of Issue Specific Hearing 7)	The ExA sought the parties' view on the Outline SSCEP [REP3-103], including any outstanding concerns or suggested improvements. The ExA invited Wiltshire Council and SLD to comment on whether they had any remaining issues with the Outline SSCEP and whether any amendments were required. The Applicant notes that Wiltshire Council had no outstanding concerns on the Outline SSCEP and offered help identifying local suppliers (including a low-carbon concrete supplier). In response to the ExA, Ms Brodrick, on behalf of the Applicant, referred to similar engagement on the West Burton Solar Project promoted by IGP, and it was confirmed that section 6.3 of the Outline SSCEP [REP3-103] already provides for engagement with Wiltshire Council.
4. Ecology 4.1 Avian Species	The ExA asked the Applicant to explain how it had reached its conclusions on the risks to avian species within the cable route corridor, having regard to the information presented in ES Volume 1 Chapter 9: Ecology and Biodiversity [REP4-010]. Referring to the table requested in the ISH8 agenda, the ExA noted that it was intended to bring together information on bird species assumed to be present within the cable route corridor, their conservation status and the Applicant's proposed protection measures. The ExA sought to understand the degree of potential harm associated with the Applicant's assessment and invited the Applicant to explain how its approach reflected both the precautionary principle and the avoidance stage of the mitigation hierarchy. The Applicant presented the species table requested in the agenda. Peter Timms, on behalf of the Applicant, explained that the bird assemblage assumed present in the cable route corridor, as assessed in ES Volume 1, Chapter 9 Ecology and Biodiversity (Rev 3) [REP4-010], was based on Wiltshire and Swindon Biological Records Centre and British Trust for Ornithology data, habitat surveys and the solar PV site bird surveys, assuming presence wherever suitable habitat existed at the relevant time of year. As works were short-term and habitats restored following construction, the main impacts were on nesting birds and temporary habitat loss. Mitigation was avoidance-led: vegetation clearance outside the nesting season where practicable; otherwise clearance only after an Ecological Clerk of Works (ECoW) check, with active nests retained within species-appropriate buffers

	(50m for ground-nesting birds) under the Outline Ecological Protection and Mitigation Strategy (Rev 6) [REP6-039] (Outline EPMS). Where active nests were identified, works would be delayed until the ECoW confirmed that the nest was no longer in use. Mr Timms explained that the assessment assumed species presence wherever suitable habitat existed and that the mitigation approach reflected both the short-term nature of the cable route works and the restoration of habitats following construction. Post Hearing Note: <i>The table displayed at ISH8 setting out the avian species listed by conservation status is set out in Appendix F of this written summary.</i> In response to questions from the ExA regarding the role of the ECoW, Mr Timms confirmed that impacts on active bird nests were a matter of legal compliance and that the ECoW would have the final say on whether works could proceed where an active nest had been identified. In response to comments by SLD, Mr Timms explained that the approach at each location would follow the habitats and likely receptors present; conflicts could be managed (e.g. clearing hedgerows above ground in winter and removing root balls in spring or summer), teams could work elsewhere along the corridor, which was wide enough, and nesting delays were typically weeks. Mr Timms explained that it was impossible to be outside the seasonality constraints for all species simultaneously and that an element of professional judgement would therefore always be required. He explained that the approach would be determined on a location-specific basis, having regard to the habitats present, their suitability for particular species and the likelihood of those species occurring at that location. The Outline EPMS [REP6-039] paragraph 6.4.1 requires clearance to avoid March-August or be preceded by nesting bird checks. Mr Timms confirmed that, where competing ecological constraints arose, works could be delayed or sequenced differently and that the linear nature of the cable route allowed activities to continue elsewhere while ecological constraints at a particular location were resolved. He also confirmed that, where active nests were identified, works would be delayed until nesting had concluded, typically for a matter of weeks rather than months.
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	Referring to Natural England's Responses to the ExA's second written questions [REP5-140] (EB2.8), the ExA noted Natural England's view that assuming the presence of widespread species and applying generic mitigation may be acceptable, but that assuming rarer species are absent without sufficient survey effort would not be precautionary. The ExA observed that concerns remained regarding the adequacy of survey effort within the cable route corridor and the potential for rarer species not to have been identified, and invited the Applicant to explain how its assessment addressed those concerns. On Natural England – Responses to the ExA's second written questions (ExQ2) [REP5-140] (EB2.8), Mr Timms explained that Natural England had since confirmed that its concern was sufficient safeguards for rare species, provided through pre-construction inspections, buffers, delay and micro-siting. Game-bird cover would have been identified in habitat surveys, and the OEPMS requires checks for wintering flocks before works start in each field, delaying works by a day or two. Mr Timms explained that these measures would apply regardless of whether game-bird cover crops were present and that works would be delayed where wintering bird flocks susceptible to disturbance were identified. The ExA requested that the SoCG with Natural England reflect this at Deadline 7. <i>Post Hearing Note:</i> <i>The Statement of Common Ground with Natural England has been amended to capture the positions regarding the approach to nesting bird species. The Statement of Common Ground with Natural England will be submitted at Deadline 8 in accordance with the Revised Timetable [PD-018] published on 25 September 2026.</i> The ExA raised queries in relation to Corsham Lake (raised in SLD's Comments on Responses to the ExA's Second Written Questions (ExQ2) and Comments on Deadline 5 Submissions [REP6-081]), around 500m away, where species such as goosander and gadwall had been assumed present; the lake was not a designated site.
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	Mr Timms explained that these species had been identified through desk studies and records searches and that some had also been recorded at ponds within the solar PV sites. In response to comments by SLD relating to a section of the cable corridor between CRF57 and CRF56 near Bath Road and Pudding Brook (Baseline Habitats Map – Cable Route Corridor [APP-114], page 9), Mr Timms considered the habitat there typical and farmland birds highly mobile. He also explained that Corsham Lake did not function like a designated wintering bird site supporting nationally important bird populations, where flocks of wintering birds will regularly return to the same agricultural fields to roost, and that the Applicant remained satisfied that its approach adequately accounted for species likely to be present. On SLD's concern about pressure on the ECoW from repeated wintering-bird delays, Ms Brodrick explained that such constraints were built into the programme, teams could move elsewhere, the risk of delay was a matter for the Applicant and protected species legislation continued to apply. <i>Post Hearing Note: The Applicant's position is that given the disturbance of overwintering birds is not subject to legal constraints, no amendments are necessary to the Outline EPMS [REP6-039].</i> Ms Brodrick explained that construction programmes for large linear schemes necessarily incorporated ecological, weather, supply-chain and other constraints, and that work in one field could be deferred whilst crews continued elsewhere along the cable route corridor. She reiterated that delays arising from ecological constraints were a risk borne by the Applicant and that works would have to stop where required by the mitigation measures. The ExA observed that, although concerns had been raised regarding the practicality of delaying works for wintering birds, the mitigation measure was as set out in the Outline EPMS [REP6-039] and invited the Applicant to consider whether the wording could be strengthened.
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	Post Hearing Note: Additional wording has been added to Section 6.2 of the Outline EPMS (Revision 7 submitted at Deadline 7) to reflect the Applicant's approach of prioritising avoidance of impacts on nesting birds through sensitive timing of works to avoid breeding season in the first instance.
4.2 Badgers 4.3 LONI	The ExA invited the Applicant to provide an update on its discussions with Natural England regarding badgers and to clarify whether it intended to seek a Letter of No Impediment (LONI) in respect of badgers. The ExA sought the Applicant's latest position following engagement with Natural England and any update on the need for a LONI. Mr Timms explained that Natural England had confirmed no fundamental concerns on badgers, provided setts were avoided or impacts licensed, to be reflected in the SoCG at Deadline 7. No Letter of No Impediment (LONI) would be sought for badgers or any other species: a LONI required a specific draft licence application, whereas all setts at the solar PV sites would be retained with fenced buffers, and whether any of the eight setts in the cable route corridor would be affected depended on the final alignment. Mr Timms explained that a hypothetical licence application would not be accepted by Natural England and that a LONI could only be considered where the relevant sett to be impacted and the proposed activities affecting it had been specifically identified. Post Hearing Note: The Statement of Common Ground with Natural England has been amended to capture the positions regarding the LONI. The Statement of Common Ground with Natural England will be submitted at Deadline 8 in accordance with the Revised Timetable [PD-018] published on 25 September 2026. Wiltshire Council noted the agreed rewording of Table 3 of the outline Operational Environmental Management Plan from ISH7. The Applicant notes that Ms Fisher confirmed that Wiltshire Council had no additional comments on the LONI issue and noted that agreement had been reached at ISH7 on amendments to Table 3 of the Outline OEMP in relation to badgers.

	In response to a further question from the ExA, Mr Timms confirmed that the Applicant was not proposing to seek a LONI for any species.
4.4 Biodiversity Net Gain (BNG)	The ExA referred to the Applicant's most recent Biodiversity Net Gain Assessment Report (Rev 5) [REP6-024] and noted that it identified increases of 37.64% in habitat units and 12.78% in hedgerow units. The ExA invited the Applicant to provide an update on its BNG position in relation to Requirement 9 of the draft DCO and asked whether, in light of those figures, the minimum BNG commitments secured through Requirement 9 should be updated. The ExA also sought the views of the Applicant and Wiltshire Council on the Applicant's approach to BNG in the context of the recently published Government guidance on BNG for NSIPs. Ms Brodrick, on behalf of the Applicant, confirmed no change to Requirement 9 was proposed: the minimum (30% for habitat units) allowed flexibility pending detailed design and metric changes. Ms Brodrick explained that the habitat enhancement measures committed to through the management plans, including areas where panels had been removed since submission of the application, would still be delivered, but that the precise BNG outcome remained dependent on detailed design and future metric calculations. She also confirmed that any additional biodiversity units generated by measures delivered for the Scheme would remain associated with the Scheme and would not be available for other projects. Mr Timms, on behalf of the Applicant, confirmed that areas where panels were removed count towards BNG in the updated metric [REP6-026]. He explained that the approach was consistent with the new NSIP BNG guidance. Mr Timms explained that the guidance requires an outline biodiversity gain plan, baseline information, a strategy for delivering BNG and a completed metric at the pre-consent stage, all of which the Applicant considered had been provided through the Biodiversity Net Gain Assessment Report [REP6-024] and accompanying metric [REP6-026]. He further explained that the new guidance expressly allows NSIPs to adopt a BNG boundary, rather than including the entirety of the Order Limits within the metric calculation. In the case of the cable route corridor, this would mean assessing only the working width affected by development rather than the full corridor

	width, which would likely reduce the baseline value and increase the overall percentage BNG outcome. The ExA asked for this in writing. Post Hearing Note: <i>In relation to the recently published Government guidance on BNG for NSIP projects (NSIPs: Biodiversity Gain Statement for Energy), the Applicant considers that the approach adopted for Lime Down remains consistent with the principles and requirements set out in that guidance.</i> <i>The guidance indicates that, at the application stage, applicants should provide an outline biodiversity gain plan, including baseline habitat information, the proposed strategy for delivering biodiversity net gain and completed biodiversity metric calculations. The Applicant considers that these requirements are met through the BNG Assessment Report [REP6-024] and accompanying Biodiversity Net Gain Assessment Appendix Statutory Biodiversity Metric Calculation [REP6-026].</i> <i>Of particular relevance is the clarification provided in the guidance regarding the use of a BNG boundary when establishing the pre-development baseline. The guidance explains that the BNG boundary should generally comprise habitats affected by the development, whether temporarily or permanently, together with any land specifically included to deliver biodiversity enhancements. It does not necessarily extend to the full extent of an NSIP's Order Limits.</i> <i>For Lime Down, this point is particularly relevant to the Cable Route Corridor. The current assessment has taken a precautionary approach by using the full extent of the Cable Route Corridor Order Limits when establishing the baseline for the biodiversity metric calculations. Under the approach described in the updated guidance, the relevant BNG boundary would likely only capture those areas directly affected by the proposed works and any associated enhancement areas.</i> <i>Consequently, the baseline habitat area included within the metric calculations would likely be smaller than that currently assessed. As the principal biodiversity enhancement measures are proposed within the Solar PV Site rather than the Cable Route Corridor, the Applicant does not consider that application of the updated BNG boundary approach would materially alter the conclusions of the</i>
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	<i>assessment. If anything, the current approach is likely to represent a precautionary assessment of biodiversity net gain outcomes adopting the new guidance approach would result in a higher net gain percentage being demonstrated.</i> <i>The Applicant considers the information currently before the Examination provides an appropriate and proportionate basis for assessment at the application stage. Furthermore, Requirement 9 of the draft DCO [REP6-005] secures the preparation and approval of a final BNG Strategy, which will incorporate updated survey information, detailed design proposals and any necessary refinements to the biodiversity metric calculations prior to implementation.</i> The Applicant notes that Wiltshire Council welcomed the increases to the BNG units (meeting Wiltshire Core Strategy Core Policy 50), with other matters continuing through the SoCG. In response to SLD's comments relating to temporary losses being restored within two or five years, Mr Timms explained that grassland and ditches would be restored to their original condition while removed hedgerows were counted as a loss followed by creation. Ms Brodrick referred to OEPMS Method Statement 6 and paragraph 7.1.3 (ECoW-led reinstatement and monitoring). The Applicant agreed to consider strengthening the OEPMS establishment wording and check consistency with the landscape management plans. Ms Brodrick explained that OEPMS paragraph 7.1.3 already provides for habitat reinstatement works to be designed with ECoW input and monitored for success thereafter. The ExA queried whether there should be greater consistency or cross-referencing between the ecological and landscape management plans regarding restoration and establishment measures, and Ms Brodrick agreed that the Applicant would review the documents to ensure there was no gap or inconsistency between them.
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	Post Hearing Note: Additional wording has been added to paragraph 7.1.3 and Method Statement 16 of the Outline EPMS [EN010168/APP/7.19] (Revision 7) with additional detail regarding monitoring of the reinstatement of temporarily impacted habitats.
4.5 OEPMS (moved from ISH7)	In response to the queries raised by Wiltshire Council concerning the TPO and Hedgerow Plan (Rev 2) [REP5-010] (sheets 25-27), Mr Timms explained that hedgerows not shown for removal are not expected to be removed, and that some features shown as hedgerows were actually fence lines; the Applicant would align the plans accordingly. Mr Timms confirmed that the Applicant had reviewed the area identified by Wiltshire Council and that, where discrepancies appeared between the plans, these generally arose because no hedgerow removal was proposed at those locations. He agreed that there were a small number of locations where features shown as hedgerows on the TPO and Hedgerow Plan were in fact fence lines and confirmed that the Applicant would review and update the plans to ensure consistency between them. Post Hearing Note: The Applicant confirms that the TPO and Hedgerow Plan [EN010168/APP/2.7] (Revision 3) and the Outline EPMS [EN010168/APP/7.19] (Revision 7) have been updated to align and have been submitted at Deadline 7. Referring to Natural England's position in the Statement of Common Ground with Natural England [REP4-063] and the approach set out in Method Statement 13, the ExA noted an apparent inconsistency regarding the treatment of dormice. The ExA understood the Statement of Common Ground to indicate that a seasonal avoidance approach would be adopted, but considered that this was not clearly reflected in Method Statement 13. The ExA therefore invited the Applicant to clarify its proposed approach to dormice. Mr Timms confirmed that seasonal avoidance for dormice would be adopted where practicable, but works outside those periods would proceed only after a licensed ECoW nest search. He explained that, regardless of timing, a licensed and suitably qualified ECoW would undertake nest searches and

	works would only proceed where no dormouse nests were identified. Timing windows in the Hazel Dormouse Mitigation Handbook (Mammal Society) related to clearance of up to 150m in a day, whereas cable crossings typically affected up to 12m, allowing fingertip searches. On SLD's cumulative effects point, he explained that any individual dormouse home range would be minimally affected. The Applicant would clarify the SoCG and respond in writing at Deadline 7, including on home range size and on the applicability of the guidance to the scale of hedgerow removal proposed for the cable route corridor. Post Hearing Note: Please see the response given to Action Point 26 in the List of Actions for the Applicant and Other Parties following Issue Specific Hearing 8 at Section 2 of this document. On white-clawed crayfish, Mr Timms explained that watercourse crossings (mostly ephemeral ditches, per the Watercourse Crossing Schedule [REP3-139]) would be reassessed and, where suitable, surveyed and micro-sited; the Applicant would update the OEPMS. Post Hearing Note: Paragraphs 15.3.1 and 15.3.2 of the Outline EPMS [EN010168/APP/7.19] (Revision 7) have been updated to include additional detail regarding the approach to white-clawed crayfish inspections.
5. Any oral representations arising from the Change Request (ISH1-ISH4)	The Applicant notes that no other party wished to speak.
6. Review of the issues and actions arising	The ExA would publish the action points as soon as practicable. Responses are due at Deadline 7 (Friday 2 October 2026).

2 List of Actions for the Applicant and Other Parties following Issue Specific Hearing 8

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
1.	Dr Farrington	To include as part of her post-hearing submission the papers she mentioned regarding horse behaviour.	Deadline 7	No response required from the Applicant.
2.	Applicant	To submit a copy of the study (Equine Canada, National Farm Animal Care Council (2013). Code of Practice for the care and handling of Equines. ISBN: 978-1-927392-409) which is cited as the source of 30m as a flight zone in the Equine Business Report [REP5-105] .	Deadline 7	The Applicant has submitted a copy of Equine Canada / NFACC (2013) Code of Practice for the Care and Handling of Equines, Appendix G: Understanding Flight Zone, Point of Balance and Field of Vision at Deadline 7. See Appendix A to this written summary.
3.	Applicant	To submit further evidence with respect to the 30m flight zone, noting that mitigation measures in table 3 of the Equine Business	Deadline 7	With respect to the 30m flight zone, it is a widely accepted approximate distance. It should be noted it is an approximate distance due to varying individual horse behaviour. Therefore, 30 metres would be the approximate upper level. All the evidence for flight distance has used

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
		Report [REP5-105] rely upon that distance for noise sources and visual intrusion to horses.		human handling as it would be unethical to study scaring horses with motor vehicles. The most relevant equine evidence is the paper by Birke et al (2011) (Appendix B to this written summary). This found that semi-feral horses approached by an unfamiliar person had a mean flight distance of avoidance when near to the horse at 6.87 metres during a direct approach and 2.32 metres during an indirect approach. Across their studies, the initial flight response was generally triggered at 2.5 metres with individual variation being present. The paper by Masuda et al (2008) (Appendix C to this written summary) concerning flight distance in thoroughbred foals and yearlings. The flight distance is the distance between the horse and the unfamiliar person before it begins to move away. This study showed that the mean flight distance of foals was 0.56 metres. Foals that had more frequency of human interaction displayed shorter flight distances and less fear of approaching humans. Yearlings had a flight distance of 0.27 metres.
4.	Dr Farrington	To submit the research mentioned which shows	Deadline 7	No response required from the Applicant.

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
		impacts for flight zones are greater than 30m.		
5.	Dr Farrington	To submit information on the more subtle stress effects on thoroughbreds from activities such as construction noise (as opposed to the flight response).	Deadline 7	No response required from the Applicant.
6.	Applicant	To provide noise levels for tracker panels moving in unison (and potential implication on equine establishments), as discussed in the hearing, considering the Applicant's response to ExQ1 [REP3-128] NV1.2 which noted that the noise assessment only considered the noise level of one tracker panel moving.	Deadline 7	The Equine Business Report [EN010168/EXAM/9.62] (Revision 2) has been updated for Deadline 7 to include a cross reference to paragraph 14.4.17 of ES Volume 1, Chapter 14 Noise and Vibration [REP5-024]. As explained in the Applicant's Response to the Examining Authority's First Written Questions [REP3-128], noise from multiple tracker panels would be comfortably below existing ambient sound levels and therefore would not have a noticeable impact on horses or their riders.
7.	Applicant	To submit a plan showing distances of the proposed development	Deadline 7	The Applicant confirms a plan showing the distances from the solar PV array areas to the nearest known boundaries

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
		(specifically edge of panel fields in D13 and D14) to the closest boundaries of West Park Farm.		of West Park Farm has been appended to this document. See Appendix E to this written summary.
8.	Applicant	To provide an indication of implications of timetabling activities to mitigate harm to equine businesses.	Deadline 7	The Applicant anticipates that construction of the solar PV Sites would typically be undertaken progressively through a series of defined smaller phases. For example, Lime D may be completed in 2 or 3 phases rather than all activities occurring across the site at the same time, therefore equine receptors will not experience disruption during the entire construction phase. Accordingly, the Applicant considers that the embedded and additional measures set out in Table 20 'Equine Mitigation' in the Outline CEMP [REP6-029] comprise a proportionate and practical set of measures to manage impacts to equine businesses during the construction phase. Table 20 contains a range of measures including provision for appointment of an independent equine expert to the Community Liaison Group in order to act as a key point of contact throughout the construction, replacement and decommissioning stages of the Scheme. The role of the equine expert includes providing early notification on the scheduling of construction activities with potential for generating high levels of noise (i.e., piling or abnormal load

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
				movements) in the vicinity of PRow frequently used by horse riders or equestrian facilities to enable the relocation of horses if required. The Applicant is unable to definitively commit to programming construction activities within certain timescales at this stage. As stated by the Applicant at Issue Specific Hearing 8, it may not be possible to accommodate all preferences of equine businesses as works may be constrained at certain times for other reasons, such as ecological considerations. Therefore, to the extent that there is flexibility in the timetabling of construction activities, this would be a matter for the independent equine expert and the Community Liaison Group to consider.
9.	Applicant	To update the outline Construction Environmental Management Plan (Outline CEMP) [REP6-029] to include that an Independent Equine expert is to be appointed before the final detailed CEMP is submitted for	Deadline 7	Table 20 of the Outline CEMP [EN010168/APP/7.12] (Revision 8) has been updated at Deadline 7 to state: <i><u>"An independent equestrian expert will be appointed prior to the submission of the detailed CEMP to undertake regular engagement and act as a key point of contact with equestrian receptors throughout the construction, replacement and decommissioning, where required. This will involve:</u></i>

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
		approval so that expert assists in informing the detail of the final CEMP.		<u>Informing the content of the detailed CEMP prior to submission to the LPA."</u>
10.	Applicant	To provide details confirming if a BESS fire post event impact assessment on receptors is required by any regulatory body. If not, please provide a commitment to do so within the relevant management document(s) for future learning. Also provide confirmation that the Moss Landing review has been used in the assessment.	Deadline 7	<u>Study Post BESS Fire</u> Whilst there is no requirement imposed by any regulatory body for a post-event receptor impact assessment following a BESS fire, the Scheme incorporates a number of measures to support incident monitoring, investigation and future learning. In accordance with the Outline Battery Safety Management Plan (BSMP) [REP3-106], a site-specific Emergency Response Plan (ERP) will be prepared at the detailed design stage in consultation with Dorset & Wiltshire Fire and Rescue Service and other relevant stakeholders. The ERP will include incident monitoring and communication procedures, post-incident recovery arrangements and access to operational data from the BESS monitoring systems. The BESS will be subject to continuous monitoring, including Battery Management System and data analytics functions, enabling operational data to be reviewed following an incident and compared against large-scale fire testing evidence and site-specific plume modelling where relevant. Any environmental monitoring undertaken during or following an incident would be determined by the

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
				emergency responders and relevant regulators based on the specific circumstances of the event. <u>Moss Landing</u> The Applicant has reviewed the publicly available information relating to the Moss Landing incident and the lessons arising from that event have informed the ongoing development of industry standards, guidance and good practice. These developments are reflected in the current guidance and standards relied upon by the Applicant. The Applicant has previously explained that the Moss Landing incident is not directly comparable to the Scheme (for example in the Applicant's Response to Submissions Received at Deadline 4 [REP5-098] and the Applicant's Detailed Response to Stop Lime Down Deadline 1 Submission on BESS Fire Emissions [REP2-042]), as it involved a fundamentally different, older-generation BESS design and operating configuration. The safety of the Scheme has therefore been assessed on the basis of its own design, the Outline BSMP [REP3-106], current industry standards and large-scale fire testing evidence, rather than by reference to a legacy facility that is not representative of modern BESS installations.
11.	Mr Frost	To submit the Moss Landing case study of	Deadline 7	No response required from the Applicant.

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
		BESS fire impacts on animals.		
12.	Applicant	To produce additional modelling assessment and noise contour maps to understand the construction noise levels close to the boundaries of West Park Farm Stud and Ladyswood Stud, applying the worst case noise in the modelling (piling and excavation). Include a commentary on the noise impact on horses (from Dr Greene) in light of the revised noise assessment required by this action and what was previously stated in paragraph 4.2.8 of the Equine Business Report [REP5-105] .	Deadline 7	The Equine Business Report [EN010168/EXAM/9.62] (Revision 2) has been updated to include such construction noise contours, modelled under the same assumptions outlined in ES Volume 3, Appendix 14-4 Noise Modelling [REP5-063]. There is little literature in terms of specific decibels and horses. Most of the literature is performed on frequency and this shows that horses have a higher frequency range than humans do. This is shown as 33-55,000 Hz for horses in comparison to 20-20,000 Hz for humans. Research by the FEI (Fédération Equestre Internationale) reports that horses hear frequencies approximately between 55 Hz and 33,500 Hz, with best sensitivity between 1,000 and 16,000 Hz. The FEI article notes that horses respond to roughly similar decibel levels as humans but across a broader frequency range (as listed in https://www.fei.org/stories/lifestyle/health-fitness/10-facts-horses-hearing). Sudden noises are more likely to trigger reactions from horses than continuous sounds. Severity generally increases as the sound source gets closer. Individual horses vary greatly in their tolerance and habituation to

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
				noise. It will be more the sudden noises that would elicit a response in the horse than the noise itself.
13.	Applicant	To cross reference the Applicant's baseline data in the Equine Businesses report with the SLD's Appendix Z mapping data (Appendix Z- Combined Baseline and Project Information Plan (Rev.17 [REP6-082])).	Deadline 7	The Applicant confirms that it was in receipt of a static raster version of the mapping data as provided by Mrs Farrington in her Deadline 4 submissions, against which the list of identified equine businesses was reviewed. The Applicant furthermore reviewed the 'hacking routes' plan layer and confirms that each of the identified PRowS likely to interact with the Scheme have already been assessed in ES Volume 3, Appendix 16-2: Tourism and Recreation Receptor Tables [APP-241]. Hacking routes using public highways also to be used for HGV construction access have been assessed in Highways Technical Note - Non-Motorised User Surveys [REP6-061]. The Applicant furthermore confirms that an updated version of the Equine Business Report has been submitted at Deadline 7. This has added any additional equine businesses that were identified in SLD's Appendix Z - Combined Baseline and Project Information Plan (Rev.17) [REP6-082] that were not able to be identified in previous versions of the plan (provided by Mrs. Farrington). The Applicant has therein stated where some business locations were not able to be verified, or lay

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
				beyond the 5 km Study Area for assessment. The update also confirms that additional private facilities have not been mapped.
14.	Applicant	To submit the information referred to as 'currently available' in paragraph 6.1.11 of [REP5-105] , which informed the Applicant's conclusion in that paragraph that there would be no likely significant adverse effect on business viability.	Deadline 7	Reference to the 'information currently available' at paragraph 6.1.11 refers to the information received from individual equine facilities in the form of questionnaire responses and relevant representations, with conclusions then based on professional judgement. Further detail relating to how 'significance' has been judged is referred to in Action Point 15.
15.	Applicant	To update [REP5-105] to identify what impacts would amount to major, moderate, minor and negligible effects on equine businesses.	Deadline 7	The Equine Business Report [EN010168/EXAM/9.62] (Revision 2) has been updated for Deadline 7 to include further information about how the magnitude of impacts has been identified, including specific reference to how this applies to equine facilities and where the threshold for 'significant effects' lies.
16.	Applicant	To provide an update on potential mitigation measures that are being explored in relation to	Deadline 7	Section 6.14 of the Outline CTMP [EN010168/APP/7.22] (Revision 7) has been updated to set out that HGV operators servicing the construction works will be required, where practicable and appropriate to the contract, to

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
		minimising impacts on the non-equine businesses, that can be secured in the Outline CEMP/ oCTMP .		operate in accordance with the Fleet Operator Recognition Scheme (FORS) and the Construction Logistics and Community Safety (CLOCS) Standard. CLOCS is specifically intended to reduce the risks associated with construction vehicle movements, including risks to vulnerable road users, while FORS provides an established framework through which fleet operators can demonstrate appropriate standards of vehicle safety and work-related road-risk management.
17.	Applicant	To provide specific mitigation measures implemented to reduce effects at Grittleton House including clarification whether activities will cease for the full day of a wedding, and how this commitment will be secured.	Deadline 7	To minimise construction effects at Grittleton House, a series of mitigation measures have been developed and included within Table 10 of the Outline CEMP [EN010168/APP/7.12] (Revision 8). These include measures to minimise disturbance on wedding days together with measures to limit visual intrusion of the compound on views from Grittleton House and gardens.
18.	Wiltshire Council	At ISH5, Wiltshire Council advised it agreed 'no harm' to the setting of Grittleton House in heritage terms	Deadline 8	No response required from the Applicant.

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		providing that there would be sufficient socio-economic mitigation measures. Wiltshire Council is asked to confirm whether the agreed mitigation measures by the time of deadline 8 are sufficient to agree to 'no harm' in heritage terms to Grittleton House.		
19.	Applicant	To provide an update on potential alternative PRow routes that can be used to/ from Sherston (particularly to the south) and review and justify the potential commercial impact on The Angel, Sherston.	Deadline 7	The Applicant has identified where construction and operational effect to public rights of way are anticipated to create a displacement effect, where users choose to avoid interacting with the Scheme, through the Technical Note on Alternative Access to the Public Rights of Way Network [REP4-080] . This has identified that public rights of way users from, and going to, Sherston are most likely to be impacted by Lime Down A. However, the availability of alternative routes to the north and west of Sherston demonstrates that there would not be a material impact on access to recreation for people living in or staying in

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
				Sherston, and therefore on those people using local services such as the Angel Café. For users coming from other locations towards Sherston from the south, the Scheme may be a discouraging factor in the choice of route taken. However, given the mitigation measures put in place to protect the safety and user experience of public right of way users (as secured through the Outline Public Right of Way and Permissive Paths Management Plan [REP1-104] by Requirement 16 of Schedule 2 to the Draft DCO [REP6-005]), that there are alternative routes that would reduce the amount of time interacting with the Scheme, and given the sparse population density of the area to the south of Sherston, it is not considered that this would have a material (and therefore not a significant) effect on the number of people accessing services in Sherston. Finally, as raised by representations made by the Angel Café and as raised in Issue Specific Hearing 8, the impact of the Scheme on cycling groups who are patrons of services in Sherston, such as the Angel Café has been requested to be given more detail.

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
				The Applicant understands that the area around the north of Wiltshire and the Cotswolds is popular with road cycling, with cycling clubs based in Chippenham, Corsham, Malmesbury, Sherston, and Swindon using this area to ride. Notably, many of these clubs have 'café rides' where a break or end point is set at a café, pub, or restaurant in the villages within this wider area. The Angel Café in Sherston is one of these locations, and is explicitly referred to by The Chippenham Wheelers, Malmesbury Cycle Club, and implicitly by the Sherston Velo Club. The routing of their cycles is therefore set over a large areas, with rides ranging widely in length (some from 50-150 km) dependent on time, starting location, skill level, and type of club (whether purely recreational, or partially competitive). Café or rest stops would therefore in the majority of instances be anticipated to be at a deliberately planned location, rather than ad hoc. Therefore, cycle clubs stopping at the Angel Café have planned to do so, and continue to do so based on not just the location and quality of roads for cycling, but on the café's service, quality, and reputation (which the Scheme is not able to influence). The direct impacts of the Scheme on cycle clubs are from additional HGV traffic on roads used for cycling during construction, and then visual impacts during operation. For long-distance rides, routes to Sherston would be planned in

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
				advance, and could easily account for HGV construction movements as these routes, and the times at which they are active, are controlled through the Outline CTMP [REP6-041] and secured by Requirement 15 of Schedule 2 to the Draft DCO [REP6-005] . For those rides, the extent to which diversions to avoid the Scheme may be required are likely to be proportionally much smaller than shorter, recreational trips by users of public rights of way. For Sherston, this would largely only affect approach routes from the south, where cyclists are approaching from Hullavington, or from the Fosse Way. Diversions therefore could be taken through Alderton and Luckington, or via Foxley that would largely avoid interaction with the Scheme. The Scheme would not impact on cycle groups accessing Sherston from any other direction. Therefore, the Applicant does not consider that the Scheme would have more than a slight, and therefore not a material effect on the number of road cycling clubs accessing Sherston, and therefore choosing to use the Angel Café.
20.	Applicant	To review business compensation funds provided to businesses in other NSIP schemes	Deadline 7	In response to Issue Specific Hearing 8, Action Point 20 [EV14-010] the Applicant was asked to review business compensation schemes implemented on other NSIPs. The ExA and Wiltshire Council cited two specific examples where such schemes had been utilised, these being,

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
		(e.g. Sizewell C, Lower Thames Crossing) and provide an update to the ExA on their view with regard to providing a similar fund.		Lower Thames Crossing (LTC) and The Sizewell C Project (Sizewell C). Wiltshire Council has requested the inclusion of a Requirement for a business compensation scheme whereby compensation would be payable by the Applicant to businesses that are able to demonstrate a reduction in income of greater than 30% in a three month period compared to a base year as a consequence of the Scheme. The Applicant's position is that the DCO already contains obligations to pay compensation to persons directly impacted by the exercise of the compulsory acquisition, temporary use and other powers in the DCO and that a separate, general, compensation scheme is not necessary to make the Scheme acceptable in planning terms, is disproportionate to the assessed impacts of the Scheme, is not directly measurable and is not replicated in previously made DCOs. This position is set out in the Applicant's Technical Note on Impacts to Non-Equine Businesses [REP5-111] and the Statement of Common Ground with Wiltshire Council submitted at Deadline 7. With regard to LTC, the Applicant understands (based on its review of the Examination Library) that National Highway's position was that the statutory compensation regime relating to compulsory acquisition powers applied

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
				(the Compensation Code) and no general business compensation fund was proposed or established pursuant to the LTC DCO. The Applicant assumes that the measures the ExA referred to in Issue Specific Hearing 8 related to a revenue compensation arrangement under a proposed bilateral side agreement with Kent County Council (KCC) specific to Shorne Woods Country Park (SWCP). SWCP is owned and operated by KCC. Item 2.1.32 of the Statement of Common Ground between (1) National Highways and (2) KCC [REP9A-052 in the LTC Examination Library] notes that the purpose of the proposed side agreement was to "deal with the payment of compensation related to land within SWCP required by the Project." As per Table 13.51 of Environmental Statement Chapter 13: Population and Human Health [APP-151 in the LTC Examination Library], National Highways sought to permanently acquire 0.44ha and sought rights over 1.06ha of land within the boundaries of SWCP. To mitigate this, National Highways offered replacement land as part of the LTC scheme. In addition to this, LTC required the closure of Brewers Road Bridge for a period of up to 18 months, which National Highways noted would cause disruption to SWCP. The works affecting the open space at SWCP

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				were anticipated to last for six years (with replacement land required for five years) (see paragraphs 13.6.27 to 13.6.30 of Environmental Statement Chapter 13: Population and Human Health [APP-151 in the LTC Examination Library]). The side agreement was therefore intended to mitigate these specific and direct impacts in a scenario where compensation would have been payable pursuant to the Compensation Code in any event. While its exact terms are confidential, item 2.1.201 of the Statement of Common Ground between (1) National Highways and (2) Gravesham Borough Council [REP9A-050 in the LTC Examination Library] states that it "sets a methodology for KCC to claim quarterly against losses based on baseline variance where it can be demonstrated that the loss is caused directly by the Project." The Applicant understands that the basis and valuation by which the compensation would be payable was pursuant to the Compensation Code as opposed to a separate compensation scheme. It is therefore the Applicant's position that the side agreement was required in these circumstances in order to mitigate the known long term disruption to access to SWCP as well as the LTC's requirement for land within the SWCP. The Applicant understands that no general

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
				business compensation scheme was provided on LTC and, as such, it is the Applicant's position that this example of a specific compensation mechanism for SWCP is not comparable to the general business compensation scheme requested by Wiltshire Council for Lime Down Solar Park. With regard to Sizewell C, again, the Applicant understands that a general business compensation scheme was not proposed. A Deed of Obligation [REP10-076 in the Sizewell C Examination Library] was entered into between NNB Generation Company (SZC) Limited, East Suffolk Council and Suffolk County Council on 8 October 2021 to secure contractual mitigation for the Sizewell C Project. Schedule 7 of the final Deed of Obligation addressed employment, skills, education and supply-chain matters. As summarised at paragraph 4.100 of the accompanying Explanatory Memorandum [REP10-086 in the Examination Library for Sizewell C], it secured an Economic Development Function, an Economic Development Business Support Service and a Business Support Fund, the stated purpose of which was to enable businesses to adjust their methods of operation so that they could work successfully alongside Sizewell C during the construction

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
				period. The Applicant understands that the anticipated construction period for Sizewell C was up to 12 years. Businesses seeking support were required to submit a business plan demonstrating both the need for the proposed adjustment and how the requested funding would deliver that adjustment. Applications were then considered by the Economic Review Group and, if approved, funding was paid to support the relevant business adaptation measure (see Schedule 7 of the Deed of Obligation [REP10-076 in the Examination Library for Sizewell C]) . The fund was therefore directed towards facilitating operational adjustments by businesses affected by construction of the project, rather than compensating businesses for demonstrated reductions in income or turnover attributable to the project. The Applicant does not therefore consider this fund to be comparable to the general business compensation scheme requested by Wiltshire Council for Lime Down Solar Park.
21.	Applicant, Wiltshire Council, NHS Bath and North	To submit agreed position with WC and ICB following the ICB	Deadline 7	The agreed position with Wiltshire Council and the Integrated Care Board is set out in the Position Statement on Human Health Matters [EN101068/EXAM/9.90] submitted at Deadline 7.

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
	East Somerset, Swindon and Wiltshire Integrated Care Board (ICB)	submission at D6 [REP6-079] .		
22.	Applicant	To submit the table prepared for, and displayed at, ISH8 showing the conservation status and risk level for various avian species.	Deadline 7.	The table displayed at ISH8 setting out the avian species listed by conservation status is set out in Appendix F of this written summary.
23.	Applicant	To review wording on mitigation measures as detailed in oLEMP, with regards to protecting nesting birds to ensure avoidance is the first priority.	Deadline 7	Additional wording has been added to Section 6.2 of the Outline EPMS [EN010168/APP/7.19] (Revision 7) to reflect the Applicant's approach of prioritising avoidance of impacts on nesting birds through sensitive timing of works to avoid breeding season in the first instance.
24.	Applicant	To review wording within the oEPMS on re establishing habitat and ensure there is	Deadline 7	Additional wording has been added to paragraph 7.1.3 and Method Statement 16 of the Outline EPMS [EN010168/APP/7.19] (Revision 7) with additional detail

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
		consistency between the different management plans (e.g. the oLEMP).		regarding monitoring of the reinstatement of temporarily impacted habitats.
25.	Applicant	To ensure, and if necessary, update the TPO and Hedgerow Plan [REP5-010] and the Hedgerow Removal Plan (annex A [REP6-039] , so they align with each other.	Deadline 7	The Applicant confirms that the TPO and Hedgerow Plan [EN010168/APP/2.7] (Revision 3) and the Hedgerow Removal Plan (annex A to the Outline EPMS [EN010168/APP/7.19] (Revision 7)) have been updated to align and have been submitted at Deadline 7.
26.	Applicant	To update the ExA, with regards to cumulative effects of hedgerow removal and how the home range of dormice is taken into consideration in this impact assessment and oEPMS Method Statement 13 [REP6-039] .	Deadline 7	The Applicant confirms that presence of dormice has been assumed across all suitable habitat within the Order Limits, including within the Cable Route Corridor, on a precautionary basis as no species-specific surveys for dormice have been undertaken. A precautionary non-licensed approach to avoidance and mitigation of potential impacts to dormice has been taken and is detailed in Method Statement 13 of the Outline Ecological Protection and Mitigation Strategy (EPMS) [REP6-039]. Where clearance of suitable dormouse habitat is required, single-stage vegetation clearance is proposed, preceded by a thorough finger-tip search of vegetation by a suitably licensed and experienced ecologist to search for dormouse nests. This methodology is proposed for clearance

Number	Responsible party	Action	Submission deadline	Applicant's response / commentary
				undertaken at any time of year. The Hazel Dormouse Mitigation Handbook (The Mammal Society, 2025) states that single-stage clearance should not remove more than 150m of continuous linear habitat in a single day. Habitat removal associated with the Scheme is substantially more limited in extent at any individual location, comprising up to 18 m of hedgerow removal for the provision of new site accesses from the highway network and up to 12 m for cable route installation works. As set out in Method Statement 13, the Applicant maintains that, due to the limited extent of habitat removal at any one location, affected sections can be comprehensively searched for dormouse nests prior to works commencing. The Applicant therefore maintains that the proposed approach is appropriate at any time of year and provides a proportionate means of avoiding impacts on dormice whilst remaining consistent with the principles of relevant good-practice guidance.
27.	Applicant	To update the oEPMS [REP6-039] regarding the timing of crayfish surveys.	Deadline 7	Paragraphs 15.3.1 and 15.3.2 of the Outline EPMS [EN010168/APP/7.19] (Revision 7) have been updated to include with additional detail regarding the approach to white-clawed crayfish inspections.

Appendix A Equine Canada, National Farm Animal Care Council (2013)



CODE OF PRACTICE



FOR THE CARE AND HANDLING OF EQUINES

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Preface

The National Farm Animal Care Council (NFACC) Code development process was followed in the development of this Code of Practice. This Code of Practice for the Care and Handling of Equines replaces its predecessor developed in 1998 and published by the Canadian Agri-Food Research Council.

The NFACC Code development process aims to:

- link Codes with science
- ensure transparency in the process
- include broad representation from stakeholders
- contribute to improvements in farm animal care
- identify research priorities and encourage work in these priority areas
- write clearly to ensure ease of reading, understanding and implementation
- provide a document that is useful for all stakeholders.

The Codes of Practice are nationally developed guidelines for the care and handling of farm animals. They serve as our national understanding of animal care requirements and recommended practices. Codes promote sound management and welfare practices for housing, care, transportation and other animal husbandry practices.

Codes of Practice have been developed for virtually all farmed animal species in Canada. NFACC's website provides access to all currently available Codes (www.nfacc.ca).

The Codes of Practice are the result of a rigorous Code development process, taking into account the best science available for each species, compiled through an independent peer-reviewed process, along with stakeholder input. The Code development process also takes into account the practical requirements for each species necessary to promote consistent application across Canada and ensure uptake by stakeholders resulting in beneficial animal outcomes. Given their broad use by numerous parties in Canada today, it is important for all to understand how they are intended to be interpreted.

Requirements - These refer to either a regulatory requirement, or an industry imposed expectation outlining acceptable and unacceptable practices and are fundamental obligations relating to the care of animals. Requirements represent a consensus position that these measures, at minimum, are to be implemented by all persons responsible for farm animal care. When included as part of an assessment program, those who fail to implement Requirements may be compelled by industry associations to undertake corrective measures, or risk a loss of market options. Requirements also may be enforceable under federal and provincial regulation.

Recommended Practices - Code Recommended Practices may complement a Code's Requirements, promote producer education and can encourage adoption of practices for continuous improvement in animal welfare outcomes. Recommended Practices are those which are generally expected to enhance animal welfare outcomes, but failure to implement them does not imply that acceptable standards of animal care are not met.

Broad representation and expertise on each Code Development Committee ensures collaborative Code development. Stakeholder commitment is key to ensure quality animal care standards are established and implemented.



Preface (continued)

This Code represents a consensus amongst diverse stakeholder groups. Consensus results in a decision that everyone agrees advances animal welfare but does not imply unanimous endorsement of every aspect of the Code. Codes play a central role in Canada's farm animal welfare system as part of a process of continuous improvement. As a result, they need to be reviewed and updated regularly. Codes should be reviewed at least every five years following publication and updated at least every ten years.

A key feature of NFACC's Code development process is the Scientific Committee. It is widely accepted that animal welfare codes, guidelines, standards or legislation should take advantage of the best available research.

A Scientific Committee review of priority animal welfare issues for the species being addressed provided valuable information to the Code Development Committee in developing this Code of Practice. The Scientific Committee report is peer reviewed and publicly available, enhancing the transparency and credibility of the Code.

The 'Code of Practice for the Care and Handling of Equines: Review of scientific research on priority issues' developed by the equine Code of Practice Scientific Committee is available on NFACC's website (www.nfacc.ca).



Introduction

The most significant influence on the welfare of equines is the care and management provided by the person(s) responsible for their daily care. Those responsible for equines should consider the following factors:

- shelter
- feed and water to maintain health and vigour
- freedom of movement and exercise for most normal behaviours
- the company of other equines
- veterinary care, diagnosis and treatment, disease control and prevention
- emergency preparedness for fire, natural disaster, and the disruption of feed supplies
- hoof care
- end of life.

An animal's welfare¹ should be considered in terms of the Five Freedoms (below). These freedoms form a framework for analysis of welfare within any system and those responsible for equines are encouraged to consider the Five Freedoms.^{2,3}

- Freedom from Hunger and Thirst - by ready access to fresh water and a diet to maintain full health and vigour.
- Freedom from Discomfort - by providing an appropriate environment including shelter and a comfortable resting area.
- Freedom from Pain, Injury and Disease - by prevention or rapid diagnosis and treatment.
- Freedom to Express Normal Behaviour - by providing sufficient space, proper facilities and company of the animal's own kind.
- Freedom from Fear and Distress - by ensuring conditions and treatment which avoid mental suffering.

All herd sizes require adequate human resources to ensure observation, care and welfare of individual animals. Neither financial cost nor any other circumstances should result in a delay in treatment or neglect of the animals.

Equines are classified as livestock in Canadian legislation (e.g. the *Health of Animals Act* and the *Animal Pedigree Act*). They have multiple uses and purposes and are raised for recreation, work, competition and for meat. The equine industry is very diverse and this Code has been written with consideration of the different management systems in use. The authors recognize that there is more than one way to provide good animal welfare for equines.

The scope of the equine Code of Practice is on-farm (i.e. premises where horses are kept). This is to avoid duplication or inconsistencies between Codes. The equine Code includes important **pre-transport** considerations but does not address animal care during transport. Consult the *Recommended Code of Practice for the Care and Handling of Farm Animals: Transportation*⁴ for information on animal care during transport. This Code does not specifically address the Pregnant Mare Urine (PMU) industry.

¹ The National Farm Animal Care Council supports the following definition of animal welfare: Animal welfare means how an animal is coping physically, physiologically and psychologically with the conditions in which it lives. Physically includes pain and injury; physiologically includes environmental or disease stressors; and psychologically includes stressors that affect the senses, especially those that result in fear, fighting, distress or stereotypic behaviours due to either frustration or boredom. Animal welfare refers to the state of the animal; the treatment that an animal receives is covered by other terms such as animal care, animal husbandry, and humane treatment.

² Farm Animal Welfare Council. Five Freedoms. Available: www.fawc.org.uk/freedoms.htm

³ The Five Freedoms are referenced by the World Organization for Animal Health (OIE), of which Canada is a member, in its Terrestrial Animal Health Code (Section 7 - Animal Welfare)

⁴ Canadian Agri-Food Research Council (2001) Recommended Code of Practice for the Care and Handling of Farm Animals: Transportation. Available www.nfacc.ca/codes-of-practice/transport



Introduction (continued)

The *Recommended Code of Practice for the Care and Handling of Horses on PMU Ranches*⁵ addresses aspects specific to this industry that are in addition to the equine Code. For specific guidelines or codes of conduct associated with equine activities that take place off farm, contact the respective governing body.

In this Code, the word “horse” refers to all domestic equine species, namely horses, ponies, miniature horses, donkeys, mules and hinnies. Specific reference is only made to donkeys, mules or other specific equines at the outset of each Code chapter, and within chapters, when necessary.

The term “knowledgeable and experienced horseperson” appears throughout the equine Code - consult the glossary for an explanation of this term as it is used in this Code.

The Equine Code Development Committee

To assemble the Code Development Committee (CDC), Equine Canada struck a Code Criteria Group to outline the criteria and process by which nominations would be solicited for the CDC. This collaborative selection process culminated in an 18-person Committee.

Representing a broad cross-section, the CDC members have significant expertise in care and custody, equine health and veterinary care, technical knowledge, research, animal protection legislation, enforcement, biosecurity and international best practices. Specifically, the CDC was composed of individuals with proven hands-on knowledge in the unique husbandry practices required for large-scale equine breeding, feedlot management, draft horses, donkeys and mules, Quarter Horses, Arabians and horses used in racing, jumping, dressage, eventing, driving, western sport, recreation and outfitting. *Appendix L* provides a list of participants on both the CDC and Scientific Committee. Consult the Preface for information on the Scientific Committee.

Broad Stakeholder Engagement through Surveys and the Public Comment Period

As part of the revision to the equine Code, NFACC and Equine Canada facilitated the development of three online surveys. The purpose was to allow wider engagement in the revision of the Code and to allow the CDC to gain further insights into stakeholder views on key Code topics as well as to garner a greater understanding of current practices of equine owners and industry professionals. Nearly 3500 people participated in these surveys and the results were used to facilitate the work of the CDC.

The final key component of the NFACC Code development process is the public comment period whereby the draft of the Code is made available online for 60 days. For the equine Code, approximately 580 individuals and 24 organizations provided submissions. The CDC was very pleased with the diversity of stakeholders who provided valuable input. Feedback was discussed by the CDC during a two-day meeting and the input informed final changes to the Code.

⁵ Pfizer Canada Inc. 2013. *Recommended Code of Practice for the Care and Handling of Horses on PMU Ranches*. Available www.naeric.org/about.asp?strNav=5&strBtn=5



Glossary

Ambient temperature: the air temperature in the surrounding area.

Ambulatory (general): able to walk. See also non-ambulatory.

Balanced (in the context of feed): a term applied to a diet or ration of feed that has all the known required nutrients in the proper amount.¹

Body condition scoring: a tool for determining the amount of fat on an animal's body. It involves a physical palpation and visual assessment of specific anatomical sites that are most responsive to a change in body fat. A body condition score is the value assigned to individual equines from the body condition scoring scale.

Box stall: a confinement area where horses are kept loose (not tied) when housed indoors in a barn or stable.

Broodmare: a female horse used for breeding.

Colic: a sign of pain in the horse's abdomen. The term colic can encompass all forms of gastrointestinal conditions which cause pain as well as other causes of abdominal pain not involving the gastrointestinal tract.

Concentrate: a feed used with forage to improve the nutritive balance of the total ration (e.g. grain, pelleted feed).

Conformation: the degree of correctness of a horse's bone structure, musculature, and its body proportions in relation to each other. Conformation is usually judged by the horse's intended use or by breed standards.

Creep feeding: the practice of using a creep feeder, which is a feeder designed so that foals can eat concentrates, but older horses will not be able to access the feed.

"Easy keeper": an informal term used to describe individual horses who easily gain weight or tend to maintain weight or body condition score above the ideal.

"Equine Cushings" (Pituitary Pars Intermedia Dysfunction, PPID): a syndrome whereby the middle lobe of the pituitary gland (located in the brain) becomes enlarged over time resulting in over production of hormones and hormone-like substances.

Equine Metabolic Syndrome (EMS): a multi-faceted condition of obesity (generalized and/or regional), insulin resistance and laminitis. Primary contributing factors to the development of EMS are genetics and the quantity and type of feed.²

Exercise: for the purpose of this Code, exercise refers to any indoor or outdoor physical activity for horses including, but not limited to, riding, lunging, walking in-hand and hand grazing.

Foal: the offspring of a horse or other equines from birth to weaning and under one year old.

Forage: bulky feeds such as grass or hay; can also refer to the act of foraging (eating hay, grazing pasture, browsing).

¹ Adapted from the Association of American Feed Control Officials (2005) in National Research Council (2007) Nutrient Requirements of Horses. 6th rev. ed. National Academies Press, Washington, DC.

² Equine Code of Practice Scientists' Committee (2012) Code of Practice for the Care and Handling of Equines: Review of Scientific Research on Priority Issues. Lacombe AB: National Farm Animal Care Council.



Glossary (continued)

Gait: a particular way or manner the horse moves on foot.

Grain: seed from cereal crops or corn.

Geriatric horse: for the purpose of this Code, geriatrics are ageing horses that need specialized care. Horses are **generally** considered to be geriatric when they are 15-20 years of age or older.

Gestation: the period of development of the fetus from conception to birth.

Hay: grasses or herbage especially cut and cured for animal feeding.³

Haylage: Feed that was cut as fresh forage and that has been chopped and stored at relatively high moisture content. Haylage undergoes a similar fermentation process as silage. See also silage.

Hyperlipemia/Hyperlipidemia: a medical condition caused, in part, by equines going off feed and that results in rapid mobilization of body fat. Fatty substances accumulate in the blood and infiltrate the liver. The syndrome can affect any equines although donkeys, ponies and miniature horses are at greater risk.

Jack: a male donkey.

Jennet: a female donkey.

Knowledgeable and experienced horseperson: For the purpose of this Code, this refers to people who have knowledge of a given topic or have successfully managed horses relative to a given topic. This includes those who have years of hands-on experience with horses and those who have knowledge gained through formal education, training and/or professional certification (some examples include experienced breeders, certified trainers/coaches and extension staff).

Lameness: for the purpose of this Code, lameness is any alteration in the horse's gait that appears to be caused by pain and discomfort. Lameness can manifest as a change in performance or willingness to move, head nodding or hip hiking.

Laminitis: inflammation in the foot (specifically the sensitive laminae connecting the hoof bone and the hoof capsule) that may result in severe pain, abnormal foot growth, and lameness. Also known as Founder.

Mare: an adult female horse.

Non-ambulatory: an animal that is unable to stand without assistance or move without being dragged or carried⁴, regardless of size or age.

Paddock: a small, fenced-in field or enclosure (with varying surface terrain) where horses are kept or exercised.

Parasitism: an infection with parasites.

Parturition: the act or process of giving birth to the foal (also referred to as foaling).

Pasture: a large, fenced-in area where horses are kept loose and can graze.

Pelleted feed: feed that has been ground and processed to produce a pellet shaped feedstuff.

³ Adapted from the Association of American Feed Control Officials (2005) in National Research Council (2007) Nutrient Requirements of Horses. 6th rev. ed. National Academies Press, Washington, DC.

⁴ Health of Animals Regulations. C.R.C. c. 296. Available: https://laws-lois.justice.gc.ca/eng/regulations/c.r.c._c._296/page-1.html#h-546840



Glossary (continued)

“Poor doer”: an informal term used to describe individual horses that have difficulty gaining weight or maintaining appropriate weight or body condition score.

Reinforcement: positive or negative reinforcement are training terms that refer to anything that will make a response from the horse more likely in the future.⁵ “Positive” and “negative” do not mean “good” and “bad” in this context, but describe whether the behaviour is reinforced by having something added (positive reinforcement) or removed (negative reinforcement).⁵

Ration: the total amount of feed that is provided.

Silage: succulent, moist feed (from forage, corn or other crops) that has gone through a process of fermentation that helps it stay free from spoilage.

Stable: an enclosed building with a roof and sides for housing horses.

Stallion: an adult male horse that has not been castrated and is typically kept for breeding.

Stereotypy: formerly referred to as a vice, a stereotypy is an abnormal behaviour that serves no apparent function and is performed in a repetitive, invariant way.⁵ One example is cribbing/wind sucking. *Section 6.1.1* provides other examples.

Social opportunities: for the purpose of this Code, this term refers to occasions when horses can interact with other horses via sight, sound and/or direct contact.⁵

Soring: the practice of inflicting pain on the limbs of a horse for the purpose of accentuating its gait. Note: this practice is not acceptable (see the Requirements in *Section 6.3*).

Soundness: freedom from lameness or disease that would affect the horse’s usability.

Teeth floating: A procedure of filing down the sharp enamel points on the horse’s teeth. Teeth floating is necessary because the teeth of horses continue to erupt from the gums until horses are approximately 17 years of age.

Temperament: the horse’s disposition.

Thermoneutral zone: a temperature range in which animals do not have to expend any additional energy to maintain normal body temperature. In horses, the thermoneutral zone is between 5-20°C.

Tie stall: a space in a barn or stable where horses are tied when housed indoors. Also called a standing stall.

Tractability: the horse’s capability to be easily led, taught, or controlled.

Turnout: for the purpose of this Code, this term refers to allowing horses “free time” (i.e. not under controlled exercise) in a dry lot, arena, pen or pasture. Turnout does not necessarily mean the horse is grazing.

Weanling: a term to identify equines from weaning until one year of age.

Yearling: a term to identify equines from one to two years of age.

⁵ Equine Code of Practice Scientists’ Committee (2012) Code of Practice for the Care and Handling of Equines: Review of Scientific Research on Priority Issues. Lacombe AB: National Farm Animal Care Council.

1

Duty of Care

Horses, donkeys, and mules can live for 30 years or longer. Ownership of these animals can be a great pleasure, but it is also a significant responsibility associated with a long-term commitment of time and money. Owners and staff have a duty of care for the animals they are permanently or temporarily responsible for. A parent or guardian of a minor needs to take responsibility for any animal that is owned or cared for by the minor. If an owner leaves the animal in the care of another person, it is the owner's duty to ensure the person is competent and has the necessary authority to act in an emergency. In this case, it may be advisable to have a written boarding contract in place.

Responsibility for an animal includes having an understanding of their specific health and welfare needs, and having the appropriate knowledge and skills to care for the animal. Those responsible will also have to comply with relevant legislation and be aware of the Requirements and Recommended Practices in this Code. They should also know when to seek advice from a knowledgeable person.

Donkeys and mules need the same good animal care for their health and well-being as do horses. Key points about specific animal care needs of donkeys and mules are included throughout this Code and are summarized in *Appendix F*.

REQUIREMENTS

Owners must have the resources for and knowledge of the basics of care as stated in this Code and ensure such care is provided.

Principal caregivers must be familiar with and provide the basics of care as stated in this Code.

1.1 Pre-Purchase Considerations

Before buying or agreeing to become responsible for a horse, consider the following:

What are the costs? The costs vary but can be substantial. The cost of purchasing a horse will be less than the ongoing costs associated with its care. Refer to *Appendix A-Template Budget for Horse Ownership*.

What type of horse is appropriate? In the context of your skill level and intended use for the horse, evaluate what breed, sex, age, level of training, and temperament will be most appropriate. Children and novice owners may benefit from buying a horse that is already well trained or that has experience in their intended discipline.

How much time is needed? Consider the time commitment for daily care (e.g. grooming, feeding, mucking out) along with non-daily tasks (e.g. veterinary visits, stable maintenance and hoof care).

How and where will the horse be kept? Suitable off-site accommodation needs to be available unless there is suitable accommodation on the home property.

What skills and knowledge are required? All persons responsible for horses **must** have good working knowledge of their feed and water requirements, stable maintenance, signs of ill health, humane handling, and common horse injuries.

What contingency plans should be made? A simple plan may involve identifying capable persons who can look after the horse should you be temporarily or permanently unable to care for the animal. Another aspect of horse ownership is planning for the time when you may want or need to bring your ownership of a horse to an end. Refer to *Section 9-Change or End of Career*.

RECOMMENDED PRACTICES

- a. gain experience in horse care prior to ownership (e.g. volunteer work, riding stables, Horse Clubs)
- b. develop a budget that includes short- and long-term costs to ensure you are financially capable of caring for the horse (see *Appendix A - Template Budget for Horse Ownership*)
- c. view a prospective horse with a knowledgeable and experienced horseperson (e.g. certified trainer or coach, extension staff)
- d. try the horse in all aspects of work the horse will be expected to perform
- e. find a knowledgeable and experienced horseperson to provide ongoing advice for horse care
- f. participate in continuing education opportunities (e.g. hands-on horse clinics, conferences, webinars).

1.1.1 Pre-Purchase Veterinary Examinations

A pre-purchase veterinary examination informs prospective owners of the horse's overall health and condition (1). The veterinarian's role during the examination is to discover pre-existing conditions or problems that potentially affect the future soundness of the horse (1). The results are interpreted relative to the intended use of the horse - a high performance prospect may require a more extensive examination compared to a pleasure horse. Prospective owners are strongly urged to have a pre-purchase examination performed by a veterinarian who is proficient in equine practice. The consequences of buying a horse that is not fit for the purpose for which it was purchased outweigh the costs of the examination.

RECOMMENDED PRACTICES

- a. arrange for the examination to be done by a veterinarian who is independent of the seller and who has expertise in the breed, discipline or use for which the horse is being purchased
- b. inform the veterinarian of your primary uses for the horse and your short- and long-term goals
- c. consult the veterinarian on what procedures should be included in the examination and the costs of those procedures (2)
- d. ensure that, as the buyer, you are present during the examination and/or have a trusted agent present.

2 Facilities and Housing

Horses, donkeys and mules are successfully managed in a variety of outdoor and indoor environments ranging from extensive range to relatively intensive housing in yards, pens or stables. Attentive management is important regardless of how horses, donkeys and mules are kept.

2.1 Pastures and Yards

Horses are highly adaptable to many weather conditions (3) - keeping them outdoors or giving them frequent outdoor access is encouraged. Mud management is an important factor in some regions. If horses do not have access to a mud-free site, they can become lame and/or acquire painful skin or hoof conditions. *Appendix K* provides references on pasture management.

The risk of injury increases when horses are overcrowded in pastures or yards or when there is competition for any resource. The amount of outdoor space horses need depends on many factors. Generally a **minimum** space allowance per horse, in m², is 2 to 2.5 times the height of the horse (at the withers) squared (4). Ideally, there should be enough space to allow horses to canter.

For an open-front shed housing more than one horse: provide 11.1m² (120ft²) each for the first two horses and 5.6m² (60ft²) for each additional horse kept in the pasture or paddock.

REQUIREMENTS

At a minimum, each horse must have enough space to move easily, walk forward, turn around with ease and lie down in a normal resting posture. There must also be sufficient space for subordinate horses to escape aggression.

In muddy conditions horses must, at a minimum, have access to a mud-free, well-drained area in the pasture/yard on which to stand and lie down.

The application of fertilizers, pesticides, herbicides and farm manure must be timed to prevent any health risks to grazing horses or contamination of ground water.

RECOMMENDED PRACTICES

- practice good pasture management (e.g. pasture rotation, weed control, appropriate stocking density)
- maintain pastures free from equipment, debris and poisonous plants.

2.1.2 Shade and Outdoor Shelter

Horses can adapt to a wide range of environmental conditions due to their physiological and behavioural responses that help them maintain body temperatures within a normal range (3). **Shelter can be natural (e.g. trees, hedges) or constructed (e.g. shade cloths, stables)** (3). Research shows that horses are particularly likely to seek shelter during rainy, windy conditions or snowy, windy conditions (3).

The following equines are more vulnerable to cold, damp weather:

- foals and geriatrics (3)
- equines that are injured, sick or have a low body condition score (3)
- equines with a moist or wet coat, due to rain or sweat (a wet coat has reduced insulation capacity) (3). The hair coat of donkeys makes them particularly vulnerable to cold, damp weather
- body clipped equines
- equines that are not acclimatized to cold, damp weather.

Blankets are sometimes used to offer protection from weather and insects. However, blankets can lead to sores and heat stress. Blankets can also mask changes in the horse's health, and some of these changes can occur quickly (e.g. skin infections, a change in weight or body condition score). Therefore, if blankets are used, the condition of the horse beneath the blankets must be examined at least weekly.

Thermoregulation

Within a temperature range called the “thermoneutral zone” animals do not have to expend any additional energy to maintain normal body temperature (3). In horses, the thermoneutral zone is between 5 and 20°C (3). Within the lower or upper temperatures of this range, horses may modify their behaviour without any increased energy needs. In temperatures outside the range, increased metabolic energy is required to maintain normal body temperature.

Shivering is a heat-producing response to cold temperatures. It may be seen particularly when the horse is unable to move around, whether indoors or outdoors. Shivering horses are not thermally comfortable (5).

Horses should also be monitored for heat stress in hot ambient temperatures. A horse facing heat stress may appear weak or disoriented. Other signs of heat stress include muscle tremors and shallow or rapid breathing.

Refer also to *Section 3.4.1-Thermal Impacts on Dietary Energy Needs* and *Appendix K-Resources for Further Information*.

REQUIREMENTS

Horses must have access to shelter (constructed or natural) that protects them from the harmful effects of extreme weather conditions.

Promptly assist individual horses that are showing signs of heat or cold stress.

If blankets are used, the condition of the horse beneath the blankets must be examined at least weekly.

Blankets must be appropriate for the weather conditions and not result in heat stress.

RECOMMENDED PRACTICES

- ensure there is sufficient shelter space to accommodate all horses in a given turnout area or paddock at the same time
- build or renovate shelters for the easy removal of wastes
- remove blankets daily to inspect the horse's condition
- ensure blankets are well fitted and in good repair. If blankets are used in wet conditions, they should be waterproof and breathable.

2.1.3 Mixing and New Arrivals

Horses are herd animals and prefer to live in groups. A single horse kept on a farm may benefit from increased human contact or the companionship of other grazing species (e.g. sheep). Donkeys have a particularly strong need for social opportunities and may become depressed or apathetic when separated from a former companion. This can have health implications, particularly if they go off feed.

Within a herd structure, horses interact on a dominance hierarchy. Some horses are more aggressive and may not be suitable for group turnout. When forming new groups, the introduction of new animals brings a risk of injury to horses.

Aggression can be reduced by increasing the space allowance (initially or permanently) and/or allowing horses to become familiar with an existing group by first keeping them in an adjacent area (but separated by a strong fence or stall wall). **Refer to Section 4-Health Management for information on disease transmission, an important consideration when mixing animals, especially new arrivals.**

REQUIREMENTS

Horses kept in groups must be managed in a way that minimizes the risk of injury.

RECOMMENDED PRACTICES

- a. get advice from a knowledgeable and experienced horseperson on the first introduction of horses
- b. segregate horses into compatible groups. Where necessary, take into consideration the nutritional needs, age, sex and size of the horses
- c. ensure newly formed groups are monitored frequently and checked for injury
- d. separate animals that prove to be incompatible.

2.1.4 Fences and Gates

Several types of fencing materials are suitable for horses, including wood, metal pipe, mesh and electric. Page wire, barbed wire and narrow gauge, high tensile steel wire are used in extensive grazing settings but should be avoided in closely-confined paddocks. These types of fencing can cause severe injury to horses, especially if in poor repair.

Unless horses are effectively contained through strong, well-maintained fencing and gates they may leave the property, which brings a significant risk of injury to that horse (e.g. road accidents) and the safety of other horses and humans. The strength and height of fencing is particularly important for stallion enclosures.

REQUIREMENTS

Fences must be constructed and maintained to minimize the risk of injury and must be strong enough to contain horses. Refer to municipal fencing by-laws, if applicable.

Electric fences must be installed according to the manufacturer's specifications. All power units for electric fences must be designed to prevent short circuits and/or stray voltage.

Temporary electric fences used for strip grazing or pasture rotation are not an acceptable permanent perimeter fence for horses.

RECOMMENDED PRACTICES

- a. introduce horses to unfamiliar fenced areas during daylight hours to reduce the risk of injury
- b. mark smooth wire and other hard-to-see fencing in such a way that it is more visible to horses (e.g. tie flags to the fencing)
- c. supervise horses when they are first introduced to electric fencing (and avoid mixing new horses at the same time as the group is first introduced to electric fencing)
- d. ensure gates used by horses are at least 1.22m (4ft) wide.

2.2 Facilities for Special Needs

2.2.1 Foaling

Foaling can take place in stalls, paddocks or pastures. The foaling area should be large enough to accommodate the ambulatory movements of the mare/jennet during foaling and allow her to comfortably lie down on her side during and after foaling. After foaling, the area should provide ample space for the addition of the foal. If box stalls are used to house the mare/jennet and foal (up to two months of age) they should be at least 30% larger than the average box stall.

If foaling takes place in a fenced area, the fencing should be constructed to prevent the mare's/jennet's legs from becoming entangled when she lies down to foal and to ensure the foal cannot become entangled. Stalls used for foaling should have solid walls for safety. It is also important to ensure the foaling area offers protection from predators.

Every effort should be made to ensure foals are thermally comfortable. Foals are sensitive to adverse weather conditions and can also lose body heat if they are wet, lie down on cold surfaces or are kept in drafty environments. **Keeping warm requires energy - letting a newborn foal become chilled is an immense drain on a foal's already modest energy reserves.** Weak, premature or sick foals are even more vulnerable to chilling, and the loss of body heat in these foals can substantially reduce their chances of survival.

Heat lamps or space heaters are sometimes used to warm the stall. However, unless used with caution, such heaters can be a fire hazard and can lead to overheating, particularly if the foal is not able to move away from the heat source. Using a foal blanket is often the most practical option and is effective. Any foal requiring an additional heat source or blanket should be monitored frequently.

RECOMMENDED PRACTICES

- a. provide a dry, sheltered foaling area
- b. allow the mare/jennet to become familiar with the foaling area by moving her to that site on the farm several days before the expected foaling date
- c. keep a familiar companion near the mare/jennet if she is to foal in an area isolated from herd mates
- d. if foaling coincides with adverse weather conditions or for any weak, premature or sick foal, ensure the foal is dried off promptly and that there is supplemental shelter and other means of keeping the foal warm (e.g. extra bedding, foal blankets).

2.2.2 Stallions

Stallions need specialized management and should only be handled and cared for by experienced horsepeople. While stallions may not be suitable for turnout with other horses, efforts should be made to meet their social needs and/or provide environmental stimulation.

RECOMMENDED PRACTICES

- a. ensure fencing and stall materials for stallions are particularly safe and strong.

2.2.3 Sick or Injured Horses

Sick or injured horses benefit from facilities (constructed or natural) that minimize stress and provide protection from environmental extremes. *Appendix K* provides references on preventing the spread of disease.

REQUIREMENTS

Owners must have the ability to segregate sick or injured horses for treatment.

If sick pens or stalls are used, they must be equipped with a source of feed and water and be cleaned between uses.

RECOMMENDED PRACTICES

- have sheltered, segregated and well-bedded sick pens/stalls for horses that are sick, injured or recovering
- when dealing with a contagious disease, situate sick pens/stalls such that contact is not possible between horses in adjoining pens
- build sick pens/stalls that can be easily cleaned and disinfected.

2.3 Indoor Housing

Depending on the region, horses may not need indoor housing. Horse welfare should be prioritized when constructing or renovating facilities. The main considerations are the safety and comfort of the horses, ease of access, and adequate drainage and ventilation. If poorly designed or managed, stabling can contribute to the spread of disease and the risk of injury. *Appendix K* provides references on preventing the spread of disease.

REQUIREMENTS

Facilities must be designed and maintained to minimize the risk of injury.

RECOMMENDED PRACTICES

- build or renovate facilities so that horses have contact with other horses via sight, sound and smell
- inspect equipment regularly to ensure it is in good working order
- avoid having sharp corners and projections and ensure facilities are free from dangerous objects
- build facilities that can be easily cleaned and disinfected
- when building new facilities, consider factors such as drainage and manure removal when determining where on the farm to situate the facilities.

2.3.1 Indoor Space Allowance

An appropriate space allowance, in m², is 2 to 2.5 times the height of the horse (at the withers) squared (4). This space allowance allows for the normal movements of the horse, including lying down.

Sample calculation based on the above formula for a horse that measures 15 hands at the withers: (Step 1) 15 x 4in = 60in, which converts to approx. 1.5m; (Step 2) 1.5m x 2 = 3m; (Step 3) 3 x 3 = 9m².

REQUIREMENTS

For indoor facilities: each horse must have enough space to lie down in a normal resting posture, stand with the head fully raised, walk forward and turn around with ease. For tie stalls, each horse must have enough space to lie down in a normal resting posture, stand with the head fully raised and step forward in comfort.

For group housing, there must also be sufficient space for subordinate horses to escape aggression.

RECOMMENDED PRACTICES

- ensure ceiling or support beam height allows a minimum clearance space of 61cm (2ft) above horse head height when standing (ideally, the clearance space should exceed 1m [3.3ft]). Ceiling height is important for horse comfort, safety and ventilation.
- ensure alleyways in indoor systems are wide enough to allow a horse to turn around comfortably (3m [9.8ft] is a suggested minimum width)
- ensure doorways used by horses are wide enough to allow easy passage (e.g. 1.22m [4ft] wide). Doorways that may need to accommodate two horses at once should be twice this width. The use of doorways built for human passage is not ideal for horses and is discouraged
- ensure entrances used by horses are at least 30.5cm (1ft) above head height when the horse is in a normal standing posture.

2.3.2 Indoor Lighting

Lighting in indoor facilities should provide uniform illumination and permit effective observation of horses. Lighting is important for normal reproduction, seasonal endocrine rhythms and seasonal adaptation (e.g. hair coat).

REQUIREMENTS

For horses kept indoors without natural light, artificial lighting must be provided during the day. Keeping horses in continuous darkness is not acceptable.

RECOMMENDED PRACTICES

- ensure light fixtures are safe and not accessible to horses (e.g. avoid the use of exposed light bulbs)
- provide horses, and especially foals, with a period of darkness (to encourage sleeping).

2.3.3 Indoor Flooring

The ground or flooring in stalls and alleyways should be well-drained and must provide non-slip surfaces to reduce the risk of horses slipping or falling. Examples of non-slip surfaces include sand, dirt (but not mud), rough cut planked floors, rubber mats, and stamped or grooved concrete. For shod horses, the addition of rubber mats or epoxy flooring to concrete helps avoid slipping. Ideally, stall flooring will be reasonably level but designed to move excess moisture away from horses. Soft ground surfaces (e.g. sand, earth) should be routinely maintained by leveling out any holes. Refer also to *Section 2.3.4-Indoor Bedding*.

REQUIREMENTS

Provide non-slip surfaces in stalls and alleyways to reduce the risk of horses slipping or falling.

RECOMMENDED PRACTICES

- ensure flooring is maintained as dry as possible and free from standing water or urine.

2.3.4 Indoor Bedding

Well-managed bedding provides comfort, warmth, dryness, traction and protection against abrasions. Examples of bedding include straw, shavings, shredded paper and peat moss. Each type of bedding has advantages and disadvantages (3). The Scientific Committee report for the equine Code, listed in the References, provides more detail.

Horses prefer to lie down in bedded areas in the stalls; therefore, providing ample clean bedding also helps ensure horses get enough rest, which is important for their well-being and performance (3).

REQUIREMENTS

Ensure stalls are kept clean. Horses must be provided with a dry lying area. The area must also be of a design or texture that will not bruise, cut or otherwise injure the horse. Concrete or hard rubber mats without bedding are not acceptable surfaces.

Bedding must be non-toxic.

RECOMMENDED PRACTICES

- a. ensure stalls have a depth of bedding sufficient to absorb urine and encourage the horses to lie down
- b. remove wet and soiled bedding at least once a day. For deep bedded systems, add clean, dry bedding daily
- c. provide disposable bedding on top of stall mats to help absorb urine and provide extra cushioning
- d. use bedding that is as dust free as possible
- e. where possible, remove horses from the building when cleaning stalls and allow airborne particles to settle before letting horses re-enter the stalls.

2.3.5 Indoor Air Quality and Humidity

Respiratory problems can be created or made worse by poor bedding practices and poor indoor air quality. The concentration of ammonia and airborne particles, such as dust and mould, are of particular concern (3). The concentration of fungal spores, the main component of dust in stables, is determined by the rate of release from feed and bedding and the rate of clearance, mainly by ventilation (6). Keeping facilities and bedding clean helps maintain good indoor air quality.

Excessive ammonia concentrations can pose a health threat to humans and animals. The concentration of ammonia should ideally be less than 10ppm and must not exceed 25ppm. **When a human observer can detect ammonia (by smell or irritation to the eyes) it is likely to be at a concentration of 20ppm or higher. There are also several tools for measuring ammonia concentration, including litmus paper, detection tubes and electronic devices.**

A good ventilation system will remove stale air, maintain ideal ambient temperature, bring in fresh air (without causing drafts, especially at horse level) and remove excess heat and moisture (a factor in mould development). The horses' respiration can be a significant contributor to indoor moisture.

REQUIREMENTS

Air quality in barns must be maintained to prevent the buildup of noxious gases, dust and moisture.

Ventilation must effectively maintain good indoor air quality.

The concentration of ammonia in the air must not exceed 25ppm. Refer to the above information on options for assessing ammonia concentration.

RECOMMENDED PRACTICES

- a. strive to maintain good indoor air quality at all times (see *Appendix K-Resources for Further Information*)
- b. avoid exposing horses to drafts when housed indoors.

2.4 Safety and Emergencies

Emergencies can necessitate the need to urgently release horses from a housing facility (e.g. in the case of a barn fire) or urgent evacuation from the farm (e.g. due to a flood or forest fire). **In the case of a fire, horses should be secured in a safe location as they may return to a barn that is on fire.** Refer also to *Section 8.2.1-Training to Load* and *Appendix K-Resources for Further Information*.

Toxic materials must be securely stored. Serious health consequences can arise if horses gain access to such materials.

REQUIREMENTS

Develop an emergency action plan for emergencies that may occur in your area.

Toxic materials must be securely stored such that horses cannot gain access to them.

RECOMMENDED PRACTICES

- a. consult a local fire department for specific advice on fire prevention, particularly before renovating or building a new facility
- b. ensure your emergency action plan includes evacuation procedures and emergency contacts.
Appendix K provides references on how to develop a plan and local fire authorities can perform a site visit to review emergency preparedness.
- c. ensure staff are familiar with your emergency action plan
- d. have fire extinguishers (Class A,B,C) located at various points in any facility and ensure staff know of their location and proper use
- e. do not store combustible materials near where horses are kept
- f. check electrical equipment regularly for stray voltage and ensure wiring or electrical panels are not accessible to horses
- g. use non-toxic paints or wood preservatives, especially on fences or stall doors
- h. maintain a perimeter fence to prevent horses from leaving the property
- i. ensure stalls and equipment that restrains horses have quick release mechanisms. A halter and lead rope should be available at each stall front to facilitate the rapid removal of horses
- j. build or renovate facilities for the rapid removal of horses (e.g. a door leading to a secure, fenced runway where horses can be released rather than haltering each horse).

3 Feed and Water

Horses, donkeys and mules require good quality feed. Good overall feed management includes providing feeds that are safe and that meet the nutritional and behavioural needs of horses, donkeys and mules.

Good quality forage (hay or pasture) should form the bulk of the diet for equines. *Section 4.5-Body Condition Scoring* includes other information relevant to feeding equines.

3.1 Water

Water is the single most important nutrient in the management of horses. Equines (in particular donkeys and mules) will limit their water intake to the point of dehydration if the quality (palatability) of drinking water is compromised. They may also limit their intake of water from a new source, such as when moved to a new location. It may be advisable to take a supply of water with you on trips.

Generally, the **minimum** daily amount of water required by horses at maintenance and in a moderate environment (i.e. 5°C-20°C) is 5L (1.32gal) of water for every 100kg (220lbs) of body weight (3). The amount of water the horse needs will go above this minimum with:

- increased humidity
- increased ambient temperature
- increase in the horse's metabolic activity level (in work, pregnant, lactating)
- the presence of some health conditions (e.g. diarrhea)
- a diet high in salt or potassium.

Refer to *Appendix B-Sample Water Intakes*.

Snow as a Water Source

There is limited research on snow as a sole water source for horses (3). Given the scientific research on the water needs of horses in general, snow alone will not meet their water requirements. Some research shows that limiting liquid water intake can lead to reduced feed intake, a particular concern in the winter months given the increased energy needs of horses in cold temperatures (3). Water requirements may even increase in cold temperatures because water intake increases as feed intake increases (3).

REQUIREMENTS

Horses must have access to safe, palatable and clean water in quantities to maintain health and vigour.

In extreme weather conditions (cold or hot), special attention must be paid to ensure water availability, access and intake.

Water troughs, containers and any automatic watering devices must be cleaned regularly and maintained in working order with no sharp or abrasive edges.

RECOMMENDED PRACTICES

- construct and locate water troughs and buckets so they are protected from contamination and freezing
- check automatic watering systems daily to ensure they are dispensing water properly
- check for stray voltage from the water source (e.g. electric fence ground rods and defective heaters). Horses may refuse to drink if they receive even a slight electric shock when drinking

- d. offer tepid water in cold temperatures to encourage intake, especially for geriatric horses (water can be heated up to 20°C to optimize intake in cold temperatures) (7)
- e. test water quality at least annually, unless it is from a previously tested water supply safe for human consumption.

3.2 Safety of Feedstuffs

Before feeding hay, ensure it is free from dust, mould, soil, weeds and poisonous plants. Concentrates should be dust-free and not too finely ground. Some feeds that are appropriate for other farm animals are **not** appropriate for horses (e.g. medicated cattle feeds).

Feed must also be securely stored. This will help prevent contamination of the feed which can impact horse health. When horses gain unrestricted access to concentrates (e.g. pellets, grains such as oats and barley), they are likely to overeat, which can also cause serious health problems (3).

REQUIREMENTS

Horses must have daily access to forage that is free from visible mould and has minimal dust.

Horses must only receive feedstuffs that are appropriate for the species.

Concentrates must be stored in a secure manner that prevents horses from overeating.

RECOMMENDED PRACTICES

- a. ensure the ration has been balanced for nutrient content and that all feed components used in the ration are of good quality and free from spoilage
- b. read labels on all feeds
- c. clean buckets and troughs regularly
- d. store concentrates in sealed, rodent-proof containers
- e. remove baling twine and any other debris from the feeding area.

3.3 Feeding Behaviour

Horses are strongly motivated to forage (eating hay, grazing pasture) based on their inherent nature (3). When given the opportunity, they exhibit approximately the same feeding patterns observed in free-ranging horses: eating an average of 12 hours per day and never voluntarily fasting for more than 3-4 hours (3).

Horses without available pasture or free-choice forage (e.g. round bales) should be fed at least twice daily. If feeding concentrates, a good practice is to feed forage first. Feeding forage increases the amount of time horses spend eating and results in slower digestion. Allowing large spans of time between meals (and thus with the horse's stomach essentially empty) appears to be linked to gastric ulcers and has sometimes been associated with increased frequency of stereotypic behaviour, such as cribbing.

RECOMMENDED PRACTICES

- a. employ feeding strategies that allow horses to forage (e.g. grazing pasture, eating hay in a dry lot) or that allow horses to mimic their natural feeding behaviour (e.g. slow-feeding hay nets, trickle feeders)
- b. maximize the time that horses have access to forage. Depending on dietary needs, this may be achieved by free-choice feeding of forage, feeding forage multiple times per day or using slow-feeding devices
- c. allow horses to feed in a head-down position, when possible. This results in natural dental wear and reduces the risk of respiratory conditions. The ground/flooring where horses are fed should be free from contaminants (e.g. sand and manure) or the feed should not be in direct contact with the ground.

3.4 Nutritional Content and Feed Management

The amount of feed horses need is based on the horse's maintenance needs (i.e. to maintain at rest or idle) plus the horse's activity needs (growing, in work, pregnant, lactating). The average mature horse will consume 1.5-2% of its body weight in feed per day to meet its daily maintenance needs. **As forage is important to maintain proper gut function, it is crucial that forage forms the majority of the ration.**

The nutrient content of hay can vary. With forages of good nutritional content, little to no supplementation is needed. Donkeys, mules, miniature horses, ponies, and some breeds of horses are particularly prone to obesity. These equines may need special feed management (e.g. provide coarse grass types of hay and/or some straw).

Feeding haylage or silage can be suitable for horses provided these feedstuffs are of excellent quality; are free from toxins and ruminant-specific additives; and the horses are given time to adapt to this type of feed. Horses fed haylage or silage should be vaccinated against botulism poisoning.

Concentrates are fed at different rates based on the increased energy needs not met by the forage. The quantity of concentrates fed should be no more than that necessary to provide the required energy - many horses will not need concentrates to meet their energy needs. Feeding excessive concentrates can contribute to obesity, digestive upset and laminitis.

Minerals and vitamins may be deficient in some diets. It is advisable to consult a nutritionist or veterinarian familiar with the nutrient content of feeds grown in your region.

Feed Space

Feed space varies depending on the size, number, and temperament of horses that will feed simultaneously from the same site (4). Generally, competition for feed can be reduced by providing horses in groups with multiple feeding sites (whether buckets or boxes) (4). Hay racks or feed troughs that provide 1m (3.3ft) of feeding space per animal are generally appropriate. **An extra feeding point (i.e. one more than the number of horses) can help reduce aggression.**

REQUIREMENTS

Horses must receive a diet that is adequate for maintaining health and vigour.

The daily ration must address the horse's maintenance and activity needs and other factors relevant to individual horses and the environment.

Horses must have access to salt either provided in the ration or free access (a block or loose salt).

RECOMMENDED PRACTICES

- consult a nutritionist or veterinarian to develop a feed program and balanced ration
- monitor the weight and body condition score of individual horses on a weekly basis and adjust the feed to maintain an optimum body condition score (refer to *Section 4.5-Body Condition Scoring*)
- have feeds, including forage, analyzed to obtain accurate nutrient values
- provide feed on a regular daily schedule, preferably divided into several meals
- make any changes to the type or quantity of feed gradually over 7-10 days to avoid gastrointestinal upset
- feed on the basis of the energy value and weight of the feed (not volume of feed).

3.4.1 Thermal Impacts on Dietary Energy Needs

Horses exposed to ambient temperatures below 5°C need more feed (particularly forage) for maintenance (3). Most horses will increase their feed intake in cold temperatures achieving their increased energy needs; however, some may need to be fed a more energy-dense diet (3). Horses may voluntarily decrease feed intake as temperatures increase (3). Refer also to *Section 2.1.2-Shade and Outdoor Shelter* and *Appendix K-Resources for Further Information*.

RECOMMENDED PRACTICES

- a. increase the quantity of forage in the diet during cold temperatures
- b. supply additional feeds (e.g. concentrates) for horses not maintaining their body condition on forage only during cold temperatures.

3.4.2 Growing Horses

Growing horses will generally consume 3% of their body weight in feed per day. Their specific feed requirements depend on their age, growth rate, activity level and anticipated weight at maturity. A key principle in feeding young, growing horses is to provide high quality feeds that are balanced for growth.

Foals and Weanlings

The dam's milk will normally meet the foal's nutrient requirements for the first 6-8 weeks of life. If creep feed is necessary, it should be provided to foals at a rate of 0.5-1% of body weight per day to a maximum of 1.8-2.3kg (4-5lbs) (8). The same formulation of creep feed can be fed to weanlings at a rate of 1% of body weight per day up to a maximum of 2.3-2.7kg (5-6lbs). Weanlings need high quality hay fed free choice or at 1.5-2% of body weight per day. Creep rations need to be balanced for growth.

Yearlings and Two-Year-Olds

Growth rate slows considerably by 12 months; however, even two-year-olds have higher nutrient requirements than mature horses at maintenance (8). It is advisable to feed yearlings and two-year-olds separately from mature horses as they may not compete well when fed with mature horses (8). If high quality hay or high quality pasture is available, yearlings and two-year-olds may not need concentrates (8).

REQUIREMENTS

Growing horses must receive a diet that is adequate for maintaining health, growth and vigour.

RECOMMENDED PRACTICES

- a. consult a veterinarian or nutritionist when caring for an orphan foal. Specialized knowledge is needed to meet their nutritional requirements
- b. ensure the total daily ration for growing horses consists of 13-15% protein overall (depending on the region, the protein content of forage will vary and should be balanced with the concentrate)
- c. consult a nutritionist or veterinarian to determine if your foal would benefit from creep feed
- d. consult a nutritionist or veterinarian to ensure the nutrient requirements of young horses entering training are met
- e. feed horses of similar nutritional needs together.

3.4.3 Horses in Work

Work increases nutrient needs. Dietary energy (the caloric content) is the nutrient most affected by increased work (9). Other nutrient requirements also increase marginally; however, the increased protein, vitamin and mineral needs are often met with the extra energy source (9). The addition of more energy-dense feeds (e.g. concentrates) to the ration is usually necessary for horses in work. Added fat can be used to reduce reliance on large amounts of carbohydrates (9).

REQUIREMENTS

Horses in work must receive a diet that is adequate for maintaining health and vigour.

RECOMMENDED PRACTICES

- divide the concentrate ration into at least two meals and avoid feeding more than 0.5-0.6kg (1.1-1.3lbs) of concentrate per 100kg (200lbs) of body weight in any single feeding
- avoid feeding immediately prior to or after strenuous exercise
- ensure sufficient salt is provided as horses lose salt in sweat during work
- ensure any increase in concentrate is done gradually over 7-10 days to prevent digestive upset.

3.4.4 Stallions

In the breeding season, stallions have higher energy requirements similar to horses in light work (see *Section 3.4.3*). Although the energy expended by the stallion during mating is modest, the additional activity or changes in behaviour (e.g. pacing, nervousness) can substantially increase energy needs (10). Stallions finishing the breeding season in good body condition can be tapered down to maintenance by increasing the hay portion and decreasing the concentrate portion (10). Adding extra feed or supplements will not enhance fertility for stallions already receiving a balanced diet (10).

REQUIREMENTS

Stallions must receive a diet that is adequate for maintaining health and vigour.

RECOMMENDED PRACTICES

- take advantage of the months prior to the breeding season to ensure the stallion's body condition is appropriate (refer to *Section 4.5-Body Condition Scoring*)
- ensure any increase in concentrate is done gradually over 7-10 days to prevent digestive upset (9)
- avoid feeding more than 0.5-0.6kg (1.1-1.3lbs) of concentrate per 100kg (200lbs) of body weight in any single feeding (9).

3.4.5 Reproductive Mares and Jennets

Proper nutrition improves fertility and promotes normal growth and development of the fetus. The energy requirements of mares and jennets increase significantly during late gestation (i.e. the last three months) and are the greatest during early lactation (i.e. months 1-3).

There are advantages to including a small amount of concentrate (i.e. 0.5-0.75% of body weight) during late gestation (11):

- growth of the foal in late gestation can compress the mare's digestive tract, reducing the mare's/jennet's digestive capacity. Including concentrate will supply the energy needed while reducing the amount of hay she needs to consume
- concentrate may help meet the mare's/jennet's increased nutrient requirements when the nutrient content of hay is poor
- it can help adapt the mare/jennet to increased concentrate feeding during lactation.

REQUIREMENTS

Pregnant and lactating mares/jennets must receive a diet that is adequate for maintaining health and vigour and that allows the mares/jennets to provide adequate nutrition to the foal.

RECOMMENDED PRACTICES

- consult a nutritionist or veterinarian to ensure the nutrient requirements that are of concern during pregnancy and lactation are met (e.g. calcium, phosphorous and micronutrients) (11)
- ensure mares/jennets are fed a diet with sufficient protein (11% during late gestation; 13.5% in early lactation [months 1-3]; 11% in late lactation [months 4-6]) (11)
- supplement with concentrate when: energy needs increase (late gestation and lactation), the mare/jennet needs to improve body condition, or if the nutrient content of hay is poor
- ensure any increase in concentrate is done gradually over 7-10 days to prevent digestive upset
- divide the concentrate into at least two meals and avoid feeding more than 0.5-0.6kg (1.1-1.3lbs) of concentrate per 100 kg (220lbs) of body weight in any single feeding.

3.4.6 Geriatric Horses

Geriatric horses (see glossary) will typically consume 1.5-2% of body weight in feed to meet their daily maintenance needs (12). Good quality forage is generally a good sole maintenance feed source provided the teeth are in good condition (12). Dental disease is common in geriatric horses and can result in slower eating, inadequate chewing and/or refusal to eat due to pain. Some geriatric horses may need specialized rations (refer to *Section 4.3-Dental Care*).

Weight loss or failure to maintain appropriate body condition in the face of perceived adequate feeding strategies are common problems in geriatric horses (12). **However, old age itself is not a cause for weight loss.** Therefore, owners need to make an effort to determine the cause and take corrective action. **Euthanasia may be necessary on welfare grounds if appropriate corrective actions fail to result in an increase in body condition above the minimum acceptable score.** Refer to *Section 4.5-Body Condition Scoring*.

Causes of weight loss or poor body condition in geriatric horses, include (12):

- underfeeding or giving feeds of insufficient nutritional content
- reduced feed intake (e.g. due to competition for feed)
- inability to eat (e.g. due to painful dental problems)
- lack of appetite due to health conditions
- increased nutrient requirements (e.g. due to health conditions)
- parasitism.

REQUIREMENTS

Geriatric horses must receive a diet that is adequate for maintaining health and vigour.

Refer to Section 4.5-Body Condition Scoring for other relevant Requirements.

RECOMMENDED PRACTICES

- have a veterinarian perform a dental examination on geriatric horses at least annually
- work with a nutritionist or veterinarian to establish a feeding program for geriatric horses
- monitor the weight and body condition score of geriatric horses regularly - identify animals that are too thin or fat, ascertain the specific cause and employ effective strategies to correct the problem
- ensure geriatric horses have sufficient access to feed (e.g. increase the number of feed locations or the amount of feed space at any single location, rearrange the groups such that competition is minimized)
- ensure changes to the type or quantity of feed are done gradually over 7-10 days to avoid gastrointestinal upset.

4

Health Management

4.1

Health Management Plans

The health of horses, donkeys and mules is a key component of their welfare. Horses should be regularly assessed for health and fitness relative to any work or activity they perform. Owners and managers should maintain the health of their animals through appropriate nutrition and housing and disease prevention, detection, and treatment. Veterinarians should be involved in helping meet these animal health obligations. Depending on the circumstances, it may only be possible to seek veterinary advice via phone or other contact.

A Veterinarian-Client-Patient Relationship (VCPR) is the basis for interaction among veterinarians, their clients and their clients' animals. The exact definition for a VCPR varies between provinces, but generally the relationship has been established when the veterinarian has examined the animals or visited the farm (to gain a close knowledge of the health status and management of the animals); the veterinarian has assumed responsibility for making clinical judgments related to the health of the animals; and the client has indicated a willingness to follow the veterinarian's instructions.

Infectious Disease and Biosecurity

Health management plans (which include biosecurity and vaccinations) reduce the risk of introduction or spread of infectious diseases. Biosecurity protocols are guidelines intended to prevent the introduction or spread of diseases within a farm or to other farms. Horses that are newly introduced or returning to the farm present the greatest risk of infectious disease. Biosecurity protocols should be in writing, especially on farms with a large number of horses.

For some diseases, a horse can be a carrier of the disease without showing signs. These carrier animals can play a significant role in disease transmission. Infectious diseases can also be transmitted by people (e.g. via clothing or footwear); other animals (e.g. dogs and wildlife); and objects not adequately cleaned and disinfected (e.g. tack, grooming equipment, halters, water buckets and trailers). *Appendix K* provides several resources to assist with biosecurity planning.

Medications

Medications, especially prescription medications, should not be administered unless under the advice of a veterinarian. Some medications or remedies may be ineffective or even unsafe. These include: natural and herbal remedies; supplements, medications that are unlabeled, untested or unregulated; and medications used in a way that differs from the originally intended and licensed use (i.e. extra-label). Regulated sources of medication include a veterinarian, pharmacy, veterinary pharmacy, and licensed animal medicines outlet. **Before administering any medication or remedy, read the label carefully and discuss its safety and proper use with a veterinarian.** It is also important to store medications correctly - this can affect their efficacy and safety.

REQUIREMENTS

Horses must be observed as often as required to maintain their health and well-being.

Purchase medications and veterinary pharmaceuticals from regulated, reputable sources. Refer to provincial and federal regulations.

Records or receipts of treatments provided must be available.

RECOMMENDED PRACTICES

- a. establish a working relationship with a practicing veterinarian (VCPR). In the case of feedlots, it is a requirement to have a VCPR in place
- b. work with a veterinarian and other experts to develop a written health management plan and review the plan in advance of making major changes to the farm
- c. include the following in your health management plan:
 - protocols for biosecurity
 - protocols for the prevention, detection and treatment of disease
 - protocols for pest and insect control
 - vaccination and deworming schedules
 - staff training
 - veterinary contact information for emergencies
- d. use veterinary products that are approved by Health Canada and have a valid Drug Identification Number (DIN)
- e. ensure treatment records include a record of the animal(s) treated, date, reason for treatment, dosage, withdrawal time, if applicable, and any adverse reactions
- f. schedule regular preventive care veterinary visits to minimize emergencies
- g. outline criteria for when to call a veterinarian
- h. obtain veterinary advice on appropriate treatment for diseases
- i. ensure a competent handler is present during a veterinary visit
- j. inspect stabled or group housed horses at least twice a day for health and well-being; observe horses on open range or pasture on a routine basis
- k. assess the horse's health and fitness for work/competition on a routine basis. *Appendix K* provides a resource on assessing fitness for competition
- l. segregate new arrivals from resident horses for at least seven days and monitor their health status.

4.1.1 Pest and Insect Control

Controlling pests and flying insects is an important component of an overall health management plan. Pests and insects can transmit diseases and cause discomfort.

RECOMMENDED PRACTICES

- a. implement procedures to monitor and control pests. The ideal program prevents the entry of wildlife and pests where horses are housed and eliminates sites on the farm that provide shelter and food for pests
- b. protect horses from excessive insect burden (e.g. stable horses at sunrise and sunset, the peak insect feeding hours; apply repellent products to the horse; use a fly sheet)
- c. implement protocols to reduce insect breeding sites (e.g. remove or cover manure piles, mosquito control in water troughs and standing water).

4.1.2 Vaccinations

Vaccinations offer horses protection from some infectious diseases, but do not completely eliminate disease risk. Good overall management directed at infection control remains important even for vaccinated horses. Vaccination guidelines vary by region and should take into account the risk for exposure. While there are costs associated with vaccines, those costs are generally much lower than the costs associated with an infectious disease.

Appendix K provides a reference to the vaccination guidelines of the American Association of Equine Practitioners.

RECOMMENDED PRACTICES

- a. consult a veterinarian to develop a vaccination program, including correct on-farm storage and administration of the vaccines
- b. ensure broodmares receive regionally appropriate vaccines
- c. ensure foals are properly immunized with primary and booster vaccines as this affects their response to vaccines later in life
- d. keep a record of the vaccinations that were administered (i.e. a record identifying the animal(s) vaccinated, date and any adverse reactions)
- e. know the vaccination status of new arrivals and ensure they are properly vaccinated.

4.1.3 Parasite Management

While *Section 4.1.3* focuses on internal parasites, external parasites (e.g. lice and ticks) also affect horses. A veterinarian should be consulted for advice on controlling external parasites.

Control of internal parasites is key to maintaining feed efficiency and horse health (3). Signs of severe parasitism include poor body condition, rough hair coat (especially in foals), weight loss, mild to moderate abdominal distension (“pot-bellied” appearance), colic, diarrhea and stunted growth. Foals and geriatric horses are particularly susceptible to internal parasites as are horses with lowered immunity (3).

Research shows that parasite resistance to several dewormers may be related to the traditional approach of deworming all horses every 6-12 weeks with rotating products (3). A more effective alternative may be targeted treatments based on the worm burden specific to individual horses and farms combined with effective pasture management (3). Fecal examination for parasite eggs is an important component of a parasite control program but results must be interpreted based on a thorough understanding of parasite life cycles. For example, immature (larval) stages of worms can cause disease before egg shedding is detected.

Parasite control programs will vary but may include the following (3):

- fecal examinations (to identify worm burden and estimate levels of shedding of strongyle eggs of individual horses)
- regular deworming of all horses or targeted treatments of horses known to have a high parasite burden
- fecal egg count reduction tests (to assess the efficacy of individual drugs used)
- good pasture management (e.g. prompt manure removal, composting to kill parasite eggs, pasture rotation).

REQUIREMENTS

A parasite control program to prevent parasite related disease must be in place. This Requirement applies to internal and external parasites.

RECOMMENDED PRACTICES

- a. consult a veterinarian to develop a control program for internal parasites. The plan should take into consideration risk factors such as the age of the horse; stocking density; the presence of drug-resistant parasites; seasonal and geographical factors; and additional management practices such as pasture hygiene
- b. consult a veterinarian to develop a control program for external parasites
- c. ensure records of parasite treatments include a record identifying the animal(s) treated, date, dosage and any adverse reactions.

4.2 Sick, Injured or Compromised Horses

The list of topics covered in *Section 4.2* (including 4.2.1 and 4.2.2) is not exhaustive but provides information on topics that are particularly relevant to horses.

It is essential that those responsible for horse care be able to recognize normal behaviour, signs of sickness or injury and have basic knowledge of first aid for horses. It is important to frequently check horses carefully in order to identify problems that may not be apparent from a distance. These inspections can be done during feeding or other chores.

The most common signs of illness include:

- change in the horse's behaviour (e.g. lethargic, depressed, anxious)
- reduced feed intake
- change in water intake
- change in consistency of manure
- unexplained change in weight (loss or gain)
- signs of pain or discomfort (e.g. reluctance to move, increased rate of respiration and sweating)
- signs of colic (see *Section 4.2.1*)
- lameness
- swelling
- discharge from the eyes, ears or nose
- coughing or difficulty breathing
- fever (see *Appendix C-Vital Signs in Horses and Donkeys*).

Compared to horses, donkeys and mules are stoic animals and are less likely to show behavioural signs indicative of illness. In donkeys and mules, a reduced or loss of appetite is a significant concern.

Take action immediately if any horse is injured or appears ill or distressed. If you are in doubt about the horse's health or the most effective treatment, consult a veterinarian without delay.

REQUIREMENTS

Equines that are sick, injured or in pain must receive appropriate treatment without delay or be euthanized without delay. Refer also to Section 10-Euthanasia.

For sick, injured or compromised horses that are not showing improvement, horse owners or caregivers must, without delay, obtain veterinary advice on appropriate care and treatment or make arrangements for euthanasia.

Records or receipts for treatments provided must be available.

Appropriate authorities must be advised of suspected or confirmed cases of federally reportable disease, such as Equine Infectious Anemia. Refer to the Canadian Food Inspection Agency (www.inspection.gc.ca).

RECOMMENDED PRACTICES

- a. learn how to take a horse's vital signs. Refer to *Appendix C-Vital Signs in Horses and Donkeys*
- b. consult a veterinarian when vital signs are abnormal for an unknown reason or when a horse shows signs of illness
- c. post veterinary contact information, including after-hours contact, where staff will easily see the information
- d. know in advance the route to the nearest veterinary hospital and have a plan in place for transport (refer to *Section 8-Transportation*)
- e. keep a first-aid kit on farm and in the transport vehicle. Ensure staff know its location and how to use it

- f. consult an experienced horseperson or other expert for advice on safe restraint when treating a horse and provide an appropriate means of restraint when a veterinarian attends the horse
- g. have sheltered, segregated and well-bedded sick pens/stalls for horses that are sick, injured or recovering
- h. have isolation facilities available on the farm
- i. monitor sick, injured and/or recovering horses at least twice daily
- j. ensure treatment records include a record of the animal(s) treated, date, reason for treatment, dosage, withdrawal time, if applicable, and any adverse reactions
- k. assign responsibility for health management decisions to a competent individual if you will be away from the farm for an extended period.

4.2.1 Colic

Colic is a sign of a painful condition in the horse's abdomen. While episodes of colic vary in their severity, every case should be taken seriously.

The most common signs of colic are:

- repeated lying down, rolling and getting up, or attempting to do so
- turning the head toward the flank; kicking or biting at the belly; pawing at the ground
- stretching out as if to urinate, without urinating
- depression and/or loss of appetite
- diarrhea or any change in manure output
- sweating with minimal physical exertion.

To reduce the risk of colic:

- provide safe, palatable and clean water at all times
- maintain a consistent daily schedule for feeding, exercise and turnout
- feed a high quality diet comprised primarily of forage (limit the amount of grain-based feeds)
- divide the daily concentrate ration into two or more meals
- avoid putting feed directly in contact with the ground especially on sandy soils (3)
- ensure feed sources are free from mould and spoilage
- maintain a parasite control program in consultation with a veterinarian.

4.2.2 Communicable Diseases

Infectious Respiratory Diseases

Young horses and horses that commingle with others (such as at a horse show or if living in high-traffic barns) are at particular risk for respiratory infections, such as influenza, rhinopneumonitis and strangles. These infections can be spread in the air, by nose-to-nose contact or by contaminated hands, clothing, equipment and tools (e.g. feed buckets, water troughs and grooming tools). With some diseases, the infection can be spread by horses not showing clinical signs.

Signs include fever, lethargy, nasal discharge, cough and swollen lymph nodes under the jaw (especially with strangles). Testing is often necessary to obtain a definitive diagnosis. The time between exposure to infection and the occurrence of signs (known as the incubation period) varies from a few days to two weeks. Prolonged rest periods after infection are often needed to prevent chronic problems. While many horses recover uneventfully if managed properly, some horses can develop life threatening complications. **Horses showing signs of respiratory infection should be strictly quarantined and should not be worked until a diagnosis and a treatment/management plan have been established.**

Equine Infectious Anemia (EIA, Swamp Fever)

Equine Infectious Anemia (EIA) is a contagious viral blood borne disease. The most common signs are fever and anemia; however, horses can appear healthy but still be carriers of the infection. The most common source of infection is other horses via blood feeding insects. Transmission may also occur via contaminated instruments (e.g. needles) or transfusions of untested blood or blood products.

There is no licensed vaccine or treatment for EIA. In order to prevent the spread of EIA, testing is strongly encouraged, particularly in areas where there are known cases. Infected animals are identified by a positive blood test (the official test is known as the Coggins test). A negative EIA test is required for export of horses and to enter many competitions and stables. EIA is a federally reportable disease - all suspected or confirmed cases must be reported to the Canadian Food Inspection Agency (CFIA). **Horses that are confirmed EIA carriers must either be euthanized or kept in permanent quarantine in accordance with CFIA protocols.** Refer to *Appendix K-Resources for Further Information*.

RECOMMENDED PRACTICES

- a. isolate a horse with a suspected or confirmed communicable disease, get a diagnosis, provide treatment and alert any owners of horses that may have come in contact with that horse.

4.3 Dental Care

Most dental conditions are painful and lead to other welfare issues, such as weight loss. Horses should have their teeth examined at least annually and receive appropriate dental care as needed (e.g. teeth floating). Young and old horses, as well as those with dental problems, may need to be examined more frequently. Proper dental care helps horses eat better, perform better and be healthier.

Signs of dental problems include:

- unexplained weight loss
- quidding (dropping feed while chewing)
- reluctant or slow to eat
- unusual tilting of the head while chewing
- unusually high amounts of long fibres in the manure
- resistance to the bit or bridle due to pain
- swelling in the cheeks or the upper or lower jaw
- excessive salivation (drooling or slobbering)
- unpleasant odour from the mouth or nostrils.

REQUIREMENTS

Horses showing signs of dental problems must be examined and treated.

Dental care procedures must only be performed by a veterinarian or competent individual working under direct veterinary supervision. Refer to provincial regulations.

RECOMMENDED PRACTICES

- a. have a dental examination done at least annually or as frequently as may be needed for individual horses. In particular, broodmares, foals, geriatrics and horses entering training should be examined for dental abnormalities
- b. observe horses regularly for signs of dental problems.

4.4 Lameness

Lameness is a significant welfare concern. For the purpose of this Code, it is defined as any alteration in the horse's gait that appears to be caused by pain or discomfort. Lameness can manifest as a change in performance or willingness to move, head nodding or hip hiking. Gait can be evaluated from a walk, moving in a straight line and turning in both directions; a trot may be necessary if the lameness is less severe (3).

Identifying the source of the lameness is essential to proper treatment. Prompt examination and diagnosis improves the welfare of the horse and can save time and money and prevent further damage (refer also to *Section 6.7-Hoof Care* and *Section 9-Change or End of Career*).

There are various forms of treatment for lameness, including rest, medication, surgical procedures, corrective trimming and shoeing, rehabilitation exercises and pain management. Pin firing is **not** recommended for treating lameness - the procedure itself causes pain and there is very little scientific evidence that shows that pin firing is beneficial (3,13).

REQUIREMENTS

Lameness must be addressed either through specific therapies or changes in management or workload.

RECOMMENDED PRACTICES

- a. reduce the risk of lameness by:
 - considering the horse's physical condition and soundness when determining the type and amount of work the horse will be asked to do
 - ensuring immature horses are not worked or trained excessively
 - providing horses with adequate rest periods between work sessions
 - ensuring good footing in exercise and turnout areas
 - ensuring regular hoof care
 - allowing low-grade injuries to heal by giving horses appropriate lay-ups (longer rest periods)
- b. obtain a veterinary diagnosis of the cause of lameness and veterinary advice on appropriate treatment.

4.4.1 Laminitis (Founder)

Laminitis is a serious condition that causes inflammation in the foot that may result in severe pain, abnormal foot growth and lameness. If untreated or if treatment is unsuccessful, laminitis can lead to permanent structural changes in the foot, gait abnormalities and continual or recurrent bouts of foot pain (3). **The pain from laminitis can become severe enough to necessitate euthanasia on humane grounds (3).**

Known or suspected causes of laminitis include grain overload, obesity, severe infections (such as severe diarrhea), Equine Metabolic Syndrome, "Equine Cushings" (PPID, see glossary) and excessive concussion of the hooves. Diet plays a key role in triggering laminitis, particularly the consumption of pasture or feeds high in simple sugars, starches and fructans (3).

Signs of acute laminitis include:

- lameness (including a cautious, stilted gait)
- increased heat in the feet and/or a bounding pulse in the feet (felt at the pastern or fetlock)
- shifting weight to the hind end and front feet stretched out
- reluctance to pick up the feet.

REQUIREMENTS

Horses with laminitis must receive appropriate lifelong management and treatment, which may include medications, dietary management and hoof care.

RECOMMENDED PRACTICES

- a. reduce the risk of laminitis through the following strategies:
 - do not let horses get too fat - ensure they are at an ideal body condition score and are not overfed relative to their energy needs (3) (refer to *Section 4.5-Body Condition Scoring*)
 - ensure any changes to the diet are gradual
 - restrict at-risk horses from grazing on lush pasture (i.e. plentiful, bright green grass) (3)
 - store grains securely such that horses cannot gain access. **In the case where a horse gains unrestricted access to grain, call a veterinarian immediately - do not wait for signs of laminitis to appear**
- b. consult a veterinarian to determine special care that may be needed for a horse that has had laminitis. Horses that have had laminitis are at increased risk of developing the disease again and the condition can become chronic
- c. ensure communication between the veterinarian and farrier to determine whether corrective trimming or therapeutic shoeing may be needed.

4.5 Body Condition Scoring

Body condition scoring (BCS) is a tool for determining if an animal is too thin, too fat or in ideal condition. In order to be done correctly, BCS involves both a physical palpation and visual assessment of specific anatomical sites that are most responsive to a change in body fat.

Appendix D provides the 1-9 scale for body condition scoring horses and ponies. *Appendix E* provides the 1-5 scale for body condition scoring donkeys and mules. **For the purpose of this Code, all body condition scores refer to the scales shown in either *Appendix D* or *E*.**

Be aware of the following when evaluating BCS:

- as horses increase BCS, they appear thicker and more solid; as donkeys and mules increase BCS, they get lumps of fat under the skin
- Thoroughbred conformation naturally has more prominent withers and back; the conformation of ponies and draft breeds is naturally more fleshy
- the flank and tail head area may be less reliable sites when assessing the BCS of pregnant mares/jennets in late gestation (the weight of the foal makes the flank area appear thinner and hormone changes make the tail head area appear flatter)
- a thick winter coat can make a horse appear to be in better condition than it actually is. Palpation is essential to assess body condition.

Depending on the animal's purpose, breed and life stage, a BCS of 4 to 6 (out of 9) is recommended for horses, miniature horses and ponies. For mules and donkeys, a BCS of 3 (out of 5) is recommended.

Poor Body Condition

Excessively thin equines may be underfed, ill, heavily parasitized or have dental problems. Equines in poor body condition are less able to cope with cold temperatures - they should be given additional shelter and may not even tolerate living outside in the winter.

Excessive Body Condition

Obesity in equines is most often caused by allowing animals to overfeed. Horses that are fat (BCS 8) and extremely fat (BCS 9) are prone to overheating during warmer temperatures and experience strain to the legs and feet. Obesity is also a risk factor associated with laminitis (3). Overweight donkeys, ponies and miniature horses are at severe risk of hyperlipemia if starved; therefore, any feed restrictions to reduce BCS must be gradual.

BCS and Reproduction

Reproductive efficiency is maximized by maintaining broodmares at a BCS of 5 to 7 throughout breeding, gestation and lactation (14,15). Mares that are too thin (BCS<5) at the beginning of the breeding season or at foaling have lower conception and pregnancy rates. They are also at risk of excessive weight loss at lactation. Increasing the energy fed to thin mares during lactation can improve rebreeding efficiency. An excess store of body fat (BCS 7) at foaling is not associated with foaling problems (16).

Horses in Work

Inadequate or excessive body condition adversely affects performance of horses doing physical, competitive work. Horses at a BCS>6 doing moderate to hard work may need more time to recover compared to horses at a BCS of 5 (17). A working horse that is too thin (BCS<4) may not have sufficient stored energy reserves for the work period (16,18).

Refer also to *Section 3-Feed and Water* and *Appendix K-Resources for Further Information*.

REQUIREMENTS

For horses and ponies: corrective action must be taken at a BCS of 3 or lower and at a BCS of 8 or higher (on the 1-9 scale). * Veterinary advice must be obtained if animals do not respond to the corrective action. Refer to Appendix D.

For donkeys and mules: corrective action must be taken at a BCS of 2 or lower and at a BCS of 4 or higher (on the 1-5 scale). Veterinary advice must be obtained if animals do not respond to the corrective action. Refer to Appendix E.

Veterinary advice must be obtained for geriatric equines that are emaciated (i.e. BCS of 1 or 2 out of 9 for horses and ponies; BCS of 1 out of 5 for donkeys and mules).

Equines must not be starved or prevented from eating for prolonged periods in order to reduce BCS - the change in feed to reduce BCS must be gradual.

****With the exception of horses in feedlots that are free from health conditions associated with obesity.***

RECOMMENDED PRACTICES

- a. use Appendices D and E to regularly assess BCS
- b. aim for the following ideal BCS ranges for horses:
 - weanlings and foals, 4 to 5
 - broodmares (throughout breeding, gestation, and lactation), 5 to 7
 - stallions (at the beginning of the breeding season), 5 to 7
 - work and performance horses (farm work, racing, endurance), 4 to 6
- c. keep records - identify animals that are outside their ideal BCS range, ascertain the cause, and take corrective action.

To increase BCS to an ideal level:

- a. seek advice from a nutritionist, knowledgeable, experienced horseperson or veterinarian
- b. ensure the increase in energy intake does not exceed 10-15% per week (4)
- c. put the horse on a weight gain program that first involves an increase in forage before concentrates are added (4)
- d. provide “poor doers” with forage containing high digestible energy and additional energy in the form of concentrates, including added fat.

To reduce BCS to an ideal level:

- a. seek advice from a nutritionist, knowledgeable, experienced horseperson or veterinarian
- b. ensure the decrease in energy intake does not exceed 10-15% per week (4)
- c. put the horse on a weight loss program that first involves the reduction/elimination of concentrate (3). A reduction in energy intake should be accomplished without decreasing total daily dry feed intake below 1.5% of ideal body weight
- d. provide a more mature hay to an “easy keeper” that is maintained on a hay diet (3)
- e. increase the horse’s activity level. Any such increase should be gradual
- f. prevent overeating (e.g. limit pasture access; keep the horse on a dry lot for part of the day; use a grazing muzzle) (3).

5

Feedlot Management

Feedlots are centralized feeding operations where animals are fed concentrated feed mixtures to efficiently reach a target weight prior to slaughter. *Section 5-Feedlot Management* outlines the additional requirements and recommended practices that apply specifically to the feedlot industry. Consult other sections of this Code, which also apply to the feedlot industry, unless otherwise specified.

5.1 Handling at Loading and Unloading

Properly designed facilities are key to low-stress handling. The ground in the holding pen must be well-drained and non-slip as horses can become injured when they slip or fall. Examples of non-slip surfaces include sand, dirt (but not mud) and stamped or grooved concrete. Refer also to *Section 6.2-Behaviour and Handling* and *Section 8.2-Loading and Unloading*.

With proper handling, animals experience less stress and fear, and the risk of injury to the handler and the animals is greatly reduced. Handling should accommodate the animal's behaviour and should be done in a calm manner. Refer to *Appendix G*.

REQUIREMENTS

The ground in the holding pen must be well-drained and non-slip.

Horses must be handled in a manner that does not subject them to avoidable pain or avoidable injury.

RECOMMENDED PRACTICES

- ensure temporary holding pens (i.e. pens that horses are held in for less than 24 hours) allow a minimum of 7.6-9.1m² (25-30ft²) of area per horse (19)
- ensure gates, alleyways and holding pens are smooth and free from protrusions
- build alleyways to the same height and spacing as corral and pen fencing (1.7-1.8m [5.6-5.9ft] high and to a width of 3.7-4.9m [12-16ft]) (19)
- build single file chutes that have the following: solid sides; a minimum width of 81cm (32in); a minimum height of 1.8m (6ft); and a gap of approximately 30cm (12in) at the bottom to allow for drainage (19).

5.2 New Arrivals

Horses arriving at feedlots come from a variety of backgrounds and with varying degrees of training or no training at all; therefore, they should be handled calmly and with caution (19). New arrivals may be tired, hungry, thirsty and stressed due to transport, mixing with unfamiliar animals and new surroundings (20).

REQUIREMENTS

Upon arrival to the feedlot, horses must be individually assessed for health and well-being and must be provided with water and good quality forage.

Horses in groups must be managed in a way to minimize the risk of injury.

RECOMMENDED PRACTICES

- a. ensure feed and water is easy to find as new arrivals will not be familiar with its location and may only be familiar with natural water sources
- b. monitor new arrivals at least twice daily to ensure they are healthy and are eating and drinking
- c. segregate groups of new arrivals from groups of resident horses for at least seven days
- d. segregate horses into groups according to age, sex and size
- e. remove shoes from shod horses arriving to the feedlot.

5.3 Feeding

Feedlot horses can be fed a ration of 60-70% grain; however, overfeeding grain without gradual adjustment is associated with laminitis and other health conditions.

REQUIREMENTS

Feedlot horses must receive a diet that is adequate for maintaining health and vigour.

Feedlot horses must have daily access to forage that is free from visible mould and has minimal dust.

RECOMMENDED PRACTICES

- a. introduce horses to the feedlot ration gradually over a minimum of 30 days and preferably 60 days
- b. consult with a nutritionist or veterinarian to develop a feed management plan
- c. provide continuous access to forage
- d. ensure feedlot horses have sufficient feed space (e.g. increase the number of feed locations or the amount of feed space at any single location, rearrange the groups such that competition is minimized).

5.4 Health Management in the Feedlot

Health management and disinfection are particularly important in feedlots. Refer also to *Section 4-Health Management*.

REQUIREMENTS

Feedlot owners must establish and maintain a Veterinary-Client-Patient Relationship (VCPR) with a practicing veterinarian.

A written biosecurity and disease management plan must be in place and developed with a veterinarian.

Feedlot horses must be observed at least once a day for health and well-being.

Feedlot horses requiring medical treatment must receive such treatment and be identified. Feedlot horses to be held over for a drug residue withdrawal period must be sufficiently healthy and sound to withstand this period without undue suffering.

Records or receipts of treatments provided must be available.

Drug withdrawal periods must be observed. For information on drug withdrawal periods, consult a veterinarian or the Meat Hygiene Manual of Procedures (Appendix K provides a reference for this manual).

Hospital pens must be available and must provide shelter, bedding, dryness, and a source of feed and water. Hospital pens must also be cleaned between uses.

Refer also to the Requirements in Section 4-Health Management.

RECOMMENDED PRACTICES

- build hospital pens that can be easily cleaned and disinfected
- situate hospital pens such that contact is not possible between horses in adjoining pens (21)
- ensure hospital pens are at least 4.88m (16ft) from pens used by healthy animals (21)
- segregate animals immediately if they show signs of illness.

5.5 Pen Condition and Shelter

Mud management is especially important in the feedlot and can be a challenge, particularly during certain seasonal conditions (e.g. before winter freeze). The following factors contribute to poor pen condition: insufficient bedding, poor drainage and overcrowding (22). Good mud management includes having well-drained sites, appropriate stocking density, shelter and a routine schedule for bedding changes and removal of manure. In high rainfall areas, it may be very difficult to achieve the Requirements below without the provision of overhead shelter.

Muddy conditions negatively impact on horse welfare and weight gain in the following ways:

- dirty and wet coat condition will lower the insulation capacity of the hair coat and may increase energy needs of the animal for maintenance (3)
- the animal will have reduced feed intake if reluctant to venture through muddy conditions to reach feed bunks (22)
- more energy is required for the animal to pull its hoof out of the mud or to spend more time standing if uncomfortable lying in the mud (22).

REQUIREMENTS

Feedlot owners must have a plan for mud management and access to any equipment necessary to implement the plan.

A dry lying area must be available in each pen.

RECOMMENDED PRACTICES

- ensure there are solid, non-slip surfaces around feed and water sources
- ensure drainage is away from the feeding and watering areas and at a slope of between 2 and 4%
- clean pens seasonally or more often as needed for individual facilities
- ensure bedding is kept clean
- provide protection from wind, such as a three-sided shed or wind-break fencing (20% porosity).

5.5.1 Stocking Density

Horses are social animals that establish a hierarchy within a group. The risk of injury to horses increases when they are overcrowded and competition for food, water and space leads to aggression.

REQUIREMENTS

At a minimum, each horse must have enough space to move easily, walk forward, turn around with ease and lie down in a normal resting posture. There must also be sufficient space for subordinate horses to escape aggression.

6

Husbandry Practices

6.1

Turnout, Exercise and Social Opportunities

For the purpose of this Code, turnout means allowing horses “free time” (i.e. not under controlled exercise) in a dry lot, arena, pen or pasture. Turnout does not necessarily mean the horse is grazing. Exercise refers to physical activity (indoors or outdoors) and includes, but is not limited to, walking in-hand, riding, lunging and hand grazing. Social opportunities refer to occasions when horses can interact with other horses via sight, sound and/or direct contact (3).

Horses are highly adaptable to many weather conditions (3) - keeping them outdoors or giving them frequent outdoor access is encouraged. There are several advantages to providing horses with turnout and social opportunities. Research shows that horses with turnout time have greater bone density than those that are strictly stalled (3). Horses with increased turnout and social opportunities have also shown themselves easier to train and handle (3). If given ample social opportunities (either turned out with other horses or group housed), horses learn training tasks more efficiently and perform fewer undesirable behaviours (e.g. biting, kicking, bucking) compared to stalled horses (3). For a small percentage of horses, turnout may bring a risk of injury (depending on their temperament and whether they are accustomed to turnout). These horses may need to be transitioned to turnout over a period of time (e.g. transition from a stall to a small paddock and then to pasture).

REQUIREMENTS

Horses must have some form of exercise or turnout unless under stall rest for medical reasons or severe environmental conditions make this temporarily impossible. Refer to the above explanations for the terms exercise and turnout.

RECOMMENDED PRACTICES

- a. turn horses out with other horses or other equine companions (3)
- b. allow daily exercise or turnout opportunities, ideally outdoors and with foraging opportunities
- c. build or renovate facilities to allow ample social opportunities (e.g. group housing or stall design that allows horses to have visual or tactile contact with other equines)
- d. provide stall-bound horses with continuous access to enrichment devices (e.g. trickle feeders, nibble nets, horse toys).

6.1.1 Stereotypies

A stereotypy (formerly referred to as a vice) is an abnormal behaviour that serves no apparent function and is performed in a repetitive, invariant way (3). Common examples include weaving (side-to-side swaying of the head, neck and forequarters); cribbing/wind-sucking (the horse grasps an object with its teeth and makes a grunting sound); and stall-walking (circular or patterned route-tracing inside the stable). Wood chewing, not usually classified as a stereotypy, involves stripping and apparently ingesting wood surfaces (3).

Working to prevent stereotypies is generally more effective than trying to “cure” the behaviour once developed. Stereotypic behaviour is most appropriately addressed via management changes that address the underlying cause of the stereotypy (3). Suggestions include providing ample forage and allowing stalled horses to have visual and tactile contact with other equines. Preventing the horse from performing the stereotypy without addressing its cause may lead to further stress, frustration, and the emergence of other stereotypies (3). A horse may continue to perform stereotypies even after the predisposing factors have been addressed (3). **This does not necessarily indicate their current welfare status is poor (3).**

RECOMMENDED PRACTICES

- a. minimize the risk of stereotypies by ensuring horses have ample turnout time and ample opportunities to forage and engage in social opportunities with other equines (these factors seem to be associated with equine stereotypies) (3)
- b. for horses with stereotypies: strive to address the underlying cause of the stereotypy (rather than physically preventing horses from performing the behaviour) (3).

6.2 Behaviour and Handling

Section 6.2 is particularly relevant to handling groups of horses or single horses not on halter. Handling should be based on the concepts of field of vision, flight zone and point of balance. Refer to *Appendix G*.

With proper handling, animals experience less stress and fear, and the risk of injury to the handler and the animals is greatly reduced. Handling should accommodate the animal's behaviour and should be done in a calm manner.

Horses evolved as prey species and have a strong fight-or-flight response. When frightened, horses will generally flee. If they feel they cannot flee, they may become aggressive. Compared to horses, donkeys and mules are less likely to flee when frightened. Instead, they tend to study the situation before reacting (this is often incorrectly interpreted as stubbornness).

Horse welfare and handler safety is improved when handlers respond promptly to signs of fear and agitation in horses. Some examples include:

- tail swishing/wringing, in the absence of flies
- the whites of the eyes are more visible
- sweating with minimal physical exertion
- flared nostrils or wrinkling at the mouth or nose
- both ears laid flat back
- pawing or striking
- running away from or charging at the handler
- vocalizations (e.g. snorting, squealing, calling)
- head held very high
- kicking or turning the hindquarters towards the handler.

REQUIREMENTS

Handlers must be familiar with equine behaviour and competent in humane handling techniques either through training, experience or mentorship.

Horses must be handled in a manner that does not subject them to avoidable pain or avoidable injury.

RECOMMENDED PRACTICES

- a. understand and apply the concepts of field of vision, flight zone, and point of balance (refer to *Appendix G*)
- b. avoid sudden actions or noises that may startle or frighten horses. Horses have sensitive hearing
- c. provide adequate lighting so that horses do not balk at shadows or poorly lit areas
- d. approach an unfamiliar horse carefully and at the shoulder (not the rear). Generally, horses are accustomed to riders/handlers approaching, mounting and leading on the left side of the horse.

6.2.1 Handling and Restraint Equipment

Equipment used for restraint and handling should be effective without causing stress to the horse and should be designed for maximum safety of the handler and horse. Any restraint method used to assist normal management or treatment of the horse should be the most mild and effective method available, and should be applied for the minimum amount of time necessary to carry out the task.

A halter and lead rope is the most common form of restraint. Generally, the safest knots are those that can be quickly untied even if the horse has pulled on it. When used by knowledgeable handlers, other acceptable forms of restraint include hobbles, twitches, lead chains, stocks and chutes.

Tethering is a form of restraint that brings a high risk of injury to horses unless used correctly. For the purpose of this Code, tethering means attaching a long rope or chain to the halter or leg hobble so the horse can graze. Tethering does not refer to tie stalls or briefly tying a horse to a fixed object.

Refer to *Appendix K* for other resources on handling and restraint equipment.

REQUIREMENTS

Corrective action must be taken if restraint devices or equipment cause injury to horses.

Tethering must not cause injury and must only be used if the horse is under supervision. The person applying the tether must be knowledgeable in its use. Refer to the above explanation of tethers.

Electric cattle prods must not be used for the routine movement or handling of horses on-farm. Discretion must be used in an individual extreme situation when animal or human safety is at immediate risk, but prods must never be used repeatedly or used on the face, anus or reproductive organs of horses.

RECOMMENDED PRACTICES

- a. use properly designed and maintained restraint devices in the manner they were intended to be used
- b. do not turn horses loose in a pasture or stall with a halter on unless the halter has a break-away design
- c. ensure handling equipment is engineered to minimize noise. Loud noises are disturbing to horses
- d. ensure chutes used to restrain horses have break-out walls to assist horses that go down during handling.

6.3 Principles in Training and Learning Theory

Training is an important investment in a horse, and the level of training (from basic skills to specialized work) will depend on the intended purpose of the horse. Horses well trained in ground skills, under saddle skills and/or in harness skills are safer to work with and more likely to have good welfare their entire life (3). Poor training methods can cause behavioural problems (3). Horses with behavioural problems are more vulnerable to neglect, rough handling and more likely to face the prospect of multiple temporary owners attempting to manage an untrained or poorly trained horse.

In training, the ideal is to make the “right thing easy and the wrong thing hard” for the horse. It is essential that horses be given a way to comply (i.e. respond in the way the trainer desires). Otherwise the horse is essentially in a “no win situation” and over time may show increased apathy or become dangerous and unemployable.

Tack and equipment must be maintained in good repair and must fit the horse correctly. Ill-fitting equipment may cause sores, irritation, and may also cause the horse to respond to the irritation rather than the handler.

Learning theory can be used to explain how horses learn, think and react during training. The following principles of learning theory can be applied to any training context: (23,3)

- use cues or aids that are easy for the horse to understand. Multiple cues or aids used together can confuse the horse, so it is essential that signals are applied clearly and consistently
- train and shape responses one-at-a-time. Each response should be broken down into its smallest possible components and then put together in a process called “shaping”
- train only one response per cue
- strive to minimize fear during training. When horses experience fear, they can come to associate everything about that environment with the fear, and fear can inhibit learning
- benchmark relaxation - observe the horse for aggressive or defensive behaviours and modify training methods to minimize them. Horses that stay relaxed during training are better able to learn
- include a system of reward to the training as it can make the task safer and easier for the horse and trainer (a reward does not have to be a food treat; wither scratching or the release of pressure are also good options)
- minimize the time between the performance of the horse’s trained response and its reward. Horses do not learn well when there is a delay in reward.

For more information on learning theory, consult *Appendix K-Resources for Further Information*. The Scientific Committee report for the equine Code, listed in the References, also provides more detail.

REQUIREMENTS

Horses must not be trained in a manner that subjects them to avoidable pain or that causes them injury as a direct result of the training method used. They must never be subjected to training methods which are abusive or intentionally injure the horse. This includes, but is not limited to, soring, excessive use of whips or forcing the horse’s head position by tying the horse to a fixed object. The glossary provides a definition of soring.

Horses must only undergo training that matches their physical capabilities and level of maturity.

Equipment in use must be maintained in good repair and must fit the horse correctly.

RECOMMENDED PRACTICES

- a. consult an experienced trainer/coach and attend training clinics (exercise due diligence researching the qualifications of trainers/coaches and ask for references)
- b. employ training methods that use the minimal force necessary to achieve the desired outcome
- c. train in short sessions and space training sessions over time
- d. ensure that, at a minimum, the horse is trained to lead, load into a trailer and stand for farriery, veterinary care and grooming (refer to *Section 8.2.1-Training to Load*)
- e. ensure you are familiar with the correct use of all tack and training equipment and that you have an understanding of how to be certain that it fits the horse correctly
- f. have a veterinarian examine the horse’s mouth for any dental problems that may interfere with comfortable biting and bridling.

6.4 Methods of Identification

Identification of horses is needed for reasons of animal and public health, proof of ownership, to ensure correct identification at competitions or shows, and when buying or selling horses. There are several methods of marking horses for identification or ownership, including permanent or temporary methods and methods that are visible or non-visible.

All methods of permanent identification cause some degree of pain to horses with the exception of the iris scan, which recently became available (3). Research shows that hot-iron branding is painful to horses (3). It leads to a skin burn that causes swelling and skin sensitivity for several days (3). Some studies comparing hot-iron branding to freeze branding suggest that freeze branding causes less pain and discomfort than hot-iron branding (3). The horse's response to microchipping, if any, is short lasting, compared to freeze or hot-iron branding (3). Lip tattooing is another means of identification; however, there is limited research on this.

Government and industry are encouraged to develop more humane identification methods for verifying ownership. Until a reliable form of permanent, visible marking is available, branding remains necessary in some sectors of the horse industry. However, hot-iron branding is strongly discouraged - if a permanent, visible mark is needed, freeze branding is recommended over hot-iron branding. When branding is necessary, it is critically important to use the correct technique. Refer to *Appendix K* for a reference on hot-iron and freeze branding.

REQUIREMENTS

Animal identification must be performed in a manner that causes the minimum of handling stress and pain, regardless of the method used.

If branding is necessary, do not brand horses on the jaw/cheek.

When registering new brands, select an approved site other than the jaw/cheek. Consult the appropriate provincial regulatory authorities, breed registry or sport council for more information.

Horses must never be branded when they are wet.

RECOMMENDED PRACTICES

- choose the least painful method that fits the purpose for the identification. Horse owners are **strongly encouraged** to avoid hot-iron branding and re-branding of any kind
- ensure that the method of identification is done by skilled personnel
- ensure the horse has some previous experience with handling and restraint before the identification procedure is performed
- discuss pain control options with a veterinarian, **particularly when branding.**

6.5 Castration

Horses are castrated to make them safer to handle, easier to manage, and easier to turn out in groups. In most provinces equine castration can only be done by a veterinarian. The Canadian Veterinary Medical Association (CVMA) regards castration of horses, donkeys and mules as a veterinary medical procedure which should only be performed by a veterinarian using appropriate surgical, anesthetic and analgesic techniques.

Castration is a surgical procedure that causes pain and inflammation that persists for several days (3,24,25). Veterinarians have formal surgical training to perform the procedure to a professional standard. Licensed veterinarians have access to drugs to reduce pain and inflammation. They also have access to sedatives and anesthetics which reduce the need for physical restraint and provide the optimal conditions for the procedure.

Equine castration should be performed by a veterinarian as it is a specialized procedure requiring considerable skill and expertise and has a high complication rate (3,24,25). Some complications (e.g. evisceration and hemorrhage) are potentially life-threatening (3,24). Castration of donkeys, mules and mature horses has an even higher risk of complication and must only be performed by a veterinarian.

Although equine castration by non-veterinarians may be exempt from certain provincial Veterinary Acts, this does not exclude non-veterinarians from being held accountable under animal protection laws if horses are put in distress by a non-veterinarian performing this procedure.

REQUIREMENTS

Castration of donkeys, mules and mature horses must only be performed by a veterinarian.

Horses with one or more retained testicle or other scrotal abnormalities (e.g. hernias) must only be castrated by a veterinarian.

Provincial regulations that restrict castration of horses to licensed veterinarians must be followed.

Where it is not prohibited by law, castration by a person who is not a licensed veterinarian must only be performed by a skilled operator and must meet the following requirements:

- ***there is a valid Veterinary-Client-Patient Relationship with a licensed veterinarian who is willing to supply training (on the procedure and pain management), prescribe the required drugs for pain control and provide interventions if needed***
- ***the scrotal area must be examined to ensure normal scrotal anatomy. If there is evidence of an abnormality, castration must only be performed by a veterinarian***
- ***the handling and restraint methods must not cause injury or unnecessary suffering***
- ***pain control must be provided. At a minimum, this must include a local anesthetic and a non-steroidal anti-inflammatory drug. Castration must not begin until the local anesthetic has taken effect***
- ***the horse must be monitored during and after the procedure and, if complications occur, a veterinarian must be contacted without delay.***

RECOMMENDED PRACTICES

- a. horse owners are **strongly encouraged** to arrange for castration to be done by a veterinarian. Veterinarians can provide a combination of sedatives, anesthetics and analgesics along with optimal surgical care.

6.6 Alterations of the Tail

Tail docking involves the removal of part of the horse's tailbone, leaving it significantly shorter (3). Tail docking was originally done to prevent the tails from interfering with the harness equipment and machinery, impairing the driver's ability to control the horses and potentially causing the horses to bolt (3).

Depending on the amount of tail that is removed, docking can compromise the horse's ability to swish the tail at flies and communicate with other horses or humans (3). Tail docking can also lead to serious health risks, such as infections. Research in other species suggests that both surgical and rubber ring methods of tail docking are painful; however, this has not been studied in horses (3). Any potential safety benefit of tail docking has also not been scientifically studied in horses.

Tail nicking involves cutting the horse's tail muscle to achieve an artificially high tail carriage for show purposes (3). Horses that have undergone this procedure wear a tail brace during their show career and their ability to use their tail is compromised (3).

Tail blocking is a procedure whereby the major nerves of the tail are injected with a substance that affects the horse's ability to lift, swish or control its tail (3). This procedure causes the horse to temporarily lose the use of its tail for any function (3). It is also associated with serious health risks and complications.

REQUIREMENTS

Tail nicking and blocking are unacceptable and must not be performed.

Tail docking for cosmetic purposes is unacceptable and must not be performed. Refer also to provincial regulations on tail docking, if applicable.

6.7 Hoof Care

“No foot no horse” - regular hoof care is essential towards achieving overall horse health and longevity through hoof and leg soundness (26). **All equines, including donkeys and mules, need regular hoof care but not all equines will need shoeing.** Shoes are necessary when wear exceeds growth, or for correction of conformation or gait (3). Horse boots are a potential alternative to shoeing. Trimming to correct leg and hoof deviations is most effective when done as early as possible in the foal's life. All hoof and leg deviations worsen with neglect and excess growth (26).

Cleaning the foot is important, particularly to prevent thrush and to inspect the foot for any foreign materials that may cause injury (3). Thrush is an infection caused by bacterial and fungal yeast-type organisms (3). Signs of thrush include a foul odour and a black putty-like appearance of the frog (the frog is located at the heel of the foot and forms a “V” into the centre). Regular cleaning of the hoof prevents thrush from developing by aerating the exposed area (3). Refer also to *Appendix K-Resources for Further Information*.

Strategies to maintain the hoof health of horses (26):

- keep hooves free of defects through regular trimming and/or shoeing
- keep corrals clean, dry and free from mud
- provide adequate nutrition and exercise
- clean out hooves regularly, ideally on a daily basis, and before exercise or riding
- avoid extended use of hoof polishes
- use hoof moisturizers or hoof hardeners as needed.

REQUIREMENTS

Hooves must be trimmed and/or shod as often as is necessary to maintain hooves in functional condition. Whether shod or unshod, hooves must not be allowed to grow to excessive lengths causing injury or discomfort to the horse.

RECOMMENDED PRACTICES

- a. ensure the farrier or other personnel is skilled and uses recognized techniques (exercise due diligence researching the qualifications/experience of farriers, ask for references and continuing education practices)
- b. train horses to stand for trimming and shoeing
- c. provide the farrier with a clean, safe and well-lit area (26)
- d. ensure the first hoof examination for foals takes place within the first month of life and regularly monitor the foal's feet for deviations
- e. ensure proper trimming or shoeing (which includes trimming and resetting) is done every 5-8 weeks or as may be needed for individual equines (depending on factors such as age, activity level, nutrition and breed) (3)
- f. clean out hooves before riding
- g. consult a farrier or veterinarian for advice on how to control thrush.

6.8 Grooming

Grooming is a good opportunity to form and maintain the bond between horse and handler, and can be calming to horses. It is also a good opportunity to inspect horses for injuries. Grooming loosens dirt and mud, which can cause skin irritation and infections. If allowed to accumulate, dirt and mud can reduce the insulating effect of the hair coat in cold environments. Debris (e.g. mud, burdocks) on the horse where the saddle and harness are placed or on the tack itself can cause injury and discomfort.

REQUIREMENTS

Horses must be free of debris where the saddle and harness are placed. The tack must also be free from debris before being placed on the horse.

Burdocks causing discomfort or injury must be removed without delay.

7

Reproductive Management

Horses, donkeys and mules are bred for multiple purposes. Established breeders generally follow a specific breeding program producing quality offspring for a specific market. The term “purpose-bred” describes horses bred for a specific industry, including meat production.

7.1 Responsible Breeding

Many welfare problems can be prevented through responsible breeding. Responsible breeding:

- is purposeful rather than accidental or indiscriminate
- is managed by owners and handlers that are trained and knowledgeable
- involves careful selection of a mare and sire that are proven in their field, have good conformation and temperament, are healthy and free from known hereditary conditions that will impact on the welfare of the offspring
- is based on comprehensive criteria for breeding, including past reproductive performance, age, size of the sire and mare
- produces offspring that has a known market or purpose.

Mares and jennets have special care requirements during pregnancy, foaling and the post-foaling period. A young foal also requires special care. The decision to breed should be carefully considered. Breeding can be very expensive, and is not without risk to the mare/jennet. If there are complications during gestation, costs can increase substantially. The horse market is unpredictable, and there is frequently an oversupply of average horses for sale. If you do not wish to sell the offspring, it is important to be aware that horses can live in excess of 30 years, which may be longer than your ability to care for the animal.

REQUIREMENTS

Do not breed horses unless you are familiar with and able to provide the basics of care as outlined in this Code for both the mares/jennets and foals.

RECOMMENDED PRACTICES

- seek advice from a veterinarian or experienced breeder prior to breeding a horse
- plan for what you will do if you are unable to sell the foal or if you are no longer able to care for the foal
- breed only if the foal has a known market or purpose.

7.2 Evaluating Soundness for Breeding

It is important to ensure that the mare/jennet is assessed by a veterinarian, professional breeder, or technician at a breeding facility prior to breeding to ensure she is physically fit and healthy for the pregnancy.

A breeding soundness examination is recommended in order to detect reproductive abnormalities. The examination is particularly important for mares/jennets that have never been bred before; previously lost a foal; or have failed to conceive in the past.

RECOMMENDED PRACTICES

- arrange for a breeding soundness examination to be done by a veterinarian proficient in equine reproduction
- select stallions/jacks with an appropriate body weight and size for the physical development and size of the mare/jennet, when natural breeding is used
- ensure mares have a body condition score of at least 5 out of 9 before breeding (refer to *Section 4.5-Body Condition Scoring*)
- ensure jennets have a body condition score of at least 3 out of 5 before breeding (refer to *Section 4.5-Body Condition Scoring*)
- treat mares/jennets for reproductive abnormalities before they are considered again for breeding in subsequent seasons.

7.3 Care of the Pregnant Mare or Jennet

Attentive management will help ensure the birth of a healthy foal with no injury incurred by the mare/jennet. The average length of gestation for mares is 341 days (+/-15 days); for jennets, it is 365 days (+/-20 days).

Appropriate vaccinations and biosecurity planning helps to protect the mare/jennet and fetus during gestation. They also help to protect the foal after foaling through the immunity transferred from the mare/jennet to the foal via colostrum. Vaccinations should be boosted three to four weeks before the projected foaling date to optimize the antibody concentrations in colostrum.

REQUIREMENTS

Mares/jennets requiring medical care during gestation must receive such care.

Pregnant mares/jennets must have some form of exercise or turnout, unless under stall rest for medical reasons or severe environmental conditions make this temporarily impossible.

RECOMMENDED PRACTICES

- consult a veterinarian to develop a health management plan tailored to the mare/jennet (e.g. pregnancy examination, pre-foaling instructions, contact information for emergency care during gestation or foaling). Refer to *Section 4-Health Management*
- ensure the mare/jennet is appropriately vaccinated and dewormed
- consult a veterinarian or experienced breeder for appropriate levels of exercise during late gestation.

7.4 Foaling

The physical changes indicative of impending parturition (foaling) may include: (27)

- development of an udder
- distended teats
- softening of the tail head
- the presence of a waxy substance on the end of the teats
- elongation of the vulva.

Some mares/jennets will foal without showing any of the above signs; therefore, it is essential that mares/jennets close to foaling are closely observed.

Most mares/jennets will foal unassisted; however, it is critically important to be knowledgeable about the foaling process so that a problem can be promptly identified and addressed. Survival of the foal and/or the mare/jennet is improved by rapid intervention when foaling difficulties arise. Contact a veterinarian or experienced personnel promptly when abnormalities during foaling occur, and be prepared to report relevant timelines (e.g. minutes since water broke). A normal foaling takes less than 20 minutes from the time the water breaks. **If after ten minutes of active labour the foal is not visible, provide appropriate intervention without delay.**

Individual mares/jennets tend to show similar signs of impending parturition and follow similar timelines from one breeding season to another. When reviewed in subsequent breeding seasons, the records also provide valuable information to better predict foaling of individual mares/jennets. *Appendix K* provides a reference to a template foaling record.

REQUIREMENTS

A plan must be in place for the foaling process, including a plan for getting prompt expert advice or help if needed.

Mares and jennets close to foaling must be observed at least twice a day for health, well-being and signs of foaling.

RECOMMENDED PRACTICES

- consult a veterinarian or experienced breeder to become knowledgeable in the foaling process and how to provide appropriate assistance when the mare/jennet is having difficulty foaling
- ensure mares/jennets foal on clean pasture or in a large, clean box stall
- ensure a veterinarian or experienced breeder is available to attend the foaling at the first sign of difficulty
- arrange for the veterinarian to examine the post-partum mare/jennet, primarily if they did not follow the normal foaling progressions. The placenta should pass within three hours and be saved so it can also be examined.

7.5 Care of the Newborn Foal

A healthy foal will be active, alert and responsive, and will keep the mare's udder empty. The most common signs of abnormalities in foals include:

- lethargy
- inability to rise within one hour after birth
- not nursing within two hours of birth
- not passing its first feces (the meconium) within three hours of birth
- straining to defecate or urinate
- excessive salivation or milk appearing in the nostrils
- grinding its gums
- signs of colic (e.g. rolling on its back)
- milk staining on the face (due to a sick foal standing at a full udder and not sucking).

REQUIREMENTS

Newborn foals must be monitored to ensure they can rise and suck unassisted.

Appropriate care must be provided without delay if abnormalities in the foal are observed.

RECOMMENDED PRACTICES

- treat the navel stump during the first 24 hours using an appropriate product, such as 0.5% chlorhexidine (dip the navel for 30 seconds each time) (28). The use of caustic substances (e.g. 7% iodine) is harmful.
- clean and dry the udder and inner thighs of the mare/jennet before the foal sucks (28) (note: this may not be possible when foaling takes place on pasture or range)
- have a veterinarian evaluate the foal and include a test for adequate colostrum intake. A veterinary evaluation is strongly advised in cases where the foal does not suck adequately in the first six hours of life (see *Section 7.5.1* for more details).

7.5.1 Colostrum

Colostrum is the first milk produced by the mare/jennet at parturition. It contains high concentrations of antibodies, which protect the newborn foal from infection until its own immune system is fully functional. Failure to receive adequate colostrum is one of the main risk factors for severe infection in foals.

The newborn foal's ability to absorb colostrum antibodies is highest immediately after birth and decreases by 6-8 hours after birth. A veterinarian can perform a blood test to assess whether a foal has received sufficient colostrum.

Mares produce colostrum only once in each pregnancy, approximately within the last 2-3 weeks prior to foaling. If mares stream colostrum prior to foaling, the colostrum can be collected by milking and frozen for later administration to the foal. If colostrum is not available from the mare, plans should be made to provide an alternative antibody source. When supplementation is necessary, provide the foal with frequent feedings of colostrum as soon as possible after birth.

REQUIREMENTS

Foals must receive colostrum or alternative care to maintain their health and vigour.

RECOMMENDED PRACTICES

- discuss colostrum management with a veterinarian or experienced breeder before the foal is born
- keep a frozen store of (or have access to) high quality colostrum
- thaw stored colostrum in warm water (not a microwave)
- use good hygiene practices when collecting, storing and feeding colostrum.

7.5.2 Weaning

Weaning is necessary in order to facilitate more handling and training of the foal and to allow the mare/jennet to regain lost body condition. Under managed conditions, the foal is typically weaned at 4-6 months of age and may experience one or more of the following stressors: separation from the mare/jennet, a change in diet, exposure to new surroundings, and the expectation for more handling than what the foal has previously experienced (29).

There are several weaning methods. Each method has advantages and disadvantages, and the method chosen will depend on past experiences and the facilities available on the farm.

REQUIREMENTS

Facilities or fencing used during weaning must be safe and made of strong materials free from protrusions.

Corrective action must be taken if the foal or mare/jennet injures themselves attempting to reunite during weaning.

RECOMMENDED PRACTICES

- a. consult a knowledgeable and experienced horseperson for advice on weaning methods
- b. base weaning decisions on the mare's/jennet's milk production and body condition as well as the foal's age, physical development, and health status
- c. wean foals in a manner that minimizes stress to the foal and mare/jennet
- d. keep weaned foals in the company of other equines, such as other weaned foals or older, calm horses (isolation is stressful to foals)
- e. plan weaning so it does not coincide with other stressful events or times when the foal's immune system may be compromised (e.g. adverse environmental conditions and painful practices)
- f. if creep feeding is to be provided, introduce foals to creep feed at least one month before weaning
- g. ensure foals have access to a high quality, high fibre diet (e.g. grass, hay or haylage) before, during and after weaning.

8

Transportation

Section 8-Transportation applies to both commercial haulers and individual transporters. Where necessary, specific provisions for either loose or halter loaded horses have been included. The scope of the equine Code of Practice ends at the farm gate, but includes Requirements and Recommended Practices that affect the transportation process. Refer to the Code of Practice-Transportation for the actual transportation process (30).

The federal requirements for animal transport are covered under the *Health of Animals Regulations, Part XII* (31). They are enforced by the Canadian Food Inspection Agency (CFIA) with the assistance of other federal, provincial and territorial authorities. Some provinces have additional regulations related to animal transport. Per the *Health of Animals Regulations*, each person responsible for transporting animals, or arranging for their transport, must ensure that no part of the transportation process causes suffering, injury or death to the animals (31). As these regulations may change over time, ensure that you have the most current information.

If you are responsible for loading, transporting or unloading animals, you must be familiar with, and follow, Canada's animal transport requirements. Your vehicle is subject to inspection at any time. If you do not comply with the regulations, you could be fined or prosecuted. If your actions or neglect are considered animal abuse, you could also be charged and convicted under the *Criminal Code of Canada* and/or provincial legislation (32).

8.1 Pre-Transport Decision Making

Per the *Health of Animals Regulations*, it is the responsibility of the party that is transporting or loading animals (or causing animals to be transported or loaded) to ensure that all animals are fit for the intended journey. Those responsible for arranging transport need to consider how long the horses will be in transit until their final destination and any additional services that may be required (e.g. feed, water, rest). If in doubt, assume the longest trip. Refer also to *Appendix H-Transport Decision Tree*.

8.1.1 Fitness for Transport

Horse owners and persons transporting horses have a primary responsibility for determining if an animal is fit for the expected duration of the trip. While the driver should not be relied upon to determine whether the horse is fit for transport, they have the right and responsibility to refuse to load a horse that they recognize as unfit.

Do not load horses with a reduced capacity to withstand transportation. These animals may show signs of infirmity, illness or injury (31). Never transport a horse unless you are sure it is healthy enough to withstand the stress of the entire expected trip (including intermediate stops). Each case must be judged individually, and the welfare of the horse must be the first consideration. **If you are not sure whether a horse is fit for the trip, do not transport - contact a veterinarian.**

When animals are unfit for transport, you must provide treatment until the animal is fit for the trip or not transport the animal, and, if necessary, euthanize the animal. Per the *Health of Animals Regulations*, it is illegal to load or unload a non-ambulatory animal unless the animal is being transported with special provisions for veterinary treatment or diagnosis, upon the recommendation of a veterinarian.

REQUIREMENTS

Horses must be individually assessed for fitness for transport before being transported. Evaluate fitness for transport in the context of each trip and all relevant factors (e.g. anticipated total trip duration from farm to final destination and prevailing weather conditions).

Unfit horses must not be transported, except for veterinary diagnosis or treatment and only if special provisions¹ are met.

Refer to Appendix H-Transport Decision Tree.

RECOMMENDED PRACTICES

- a. consult a veterinarian if uncertain about the horse's fitness for transport.

8.1.2 Preparing Horses for Transport

Preparation for transport starts long before the trip actually begins. Management factors such as lameness prevention, training to load, nutrition and other factors have a collective impact on fitness for transport, and should be considered as a whole.

REQUIREMENTS

If the expected duration of the horse's time without access to feed or water is longer than 24 hours, the horse must be fed and watered within four hours before being loaded. Horses must not be without access to feed, water, or rest for more than 28 hours².

RECOMMENDED PRACTICES

- a. check the vaccination and health status requirements for your destination well in advance of the transport date, particularly for transport to another country or province
- b. avoid changes in diet immediately before or during a trip (34)
- c. pack extra feed and water in case there are unanticipated delays during transport
- d. ensure the following is available before each trip:
 - contact details for veterinarians and local authorities along the route
 - information on rest stops where horses may be unloaded, rested, fed and watered
 - maps or other navigation systems for alternate route planning
- e. keep a first-aid kit in the transport vehicle.

If using protective equipment (e.g. wraps and shipping boots):

- a. seek advice from a knowledgeable and experienced horseperson
- b. ensure protective equipment fits the horse correctly and comfortably
- c. acclimate the horse to wearing protective equipment before training to load or transport.

¹ Section 139 (2) in Part XII (Transport of Animals) of the Health of Animals Regulations specifies four conditions that must be met when transporting unfit animals for veterinary care, including the recommendation of a veterinarian (31). Refer to Appendix H: Transport Decision Tree.

² Section 152.2 (1) (c) in Part XII (Transport of Animals) of the Health of Animals Regulations specifies that equines have to be provided with feed, safe water and rest at intervals that do not exceed 28 hours. As per section 152.2 (4), an interval begins: (a) when the animal was last fed; (b) when the animal was last given safe water; and (c) when the animal was last rested for a minimum of eight consecutive hours (31).

8.1.3 Arranging Transport

Horse owners and managers have a responsibility to ensure that the transporter is trained and qualified.

RECOMMENDED PRACTICES

- a. ensure only trained personnel load, unload and transport horses
- b. ensure all required paperwork is completed and provided to the transporter. The required paperwork varies - refer to the provincial authority and the *Health of Animals Regulations*
- c. ensure loading facilities are compatible with the type of trailer being used
- d. ensure the following information is discussed and agreed upon between the driver and consigner:
 - number of horses to be transported
 - class of horses to be transported (e.g. yearlings, mature stallions)
 - time and point of loading
 - destination
 - any special considerations for the horses being transported
 - protection from extremes of temperature (cold or hot), especially for foals and geriatrics.

8.2 Loading and Unloading

Research on farm animal transport shows that loading and unloading are stressful components of transport (35). A combination of stressors can occur in a short period of time, including exposure to unfamiliar surroundings and animals (35). Injuries may occur when animals slip or fall.

REQUIREMENTS

The requirements for loading and unloading procedures and equipment as described in the Health of Animals Regulations must be complied with³.

Mares and jennets that are in the last 10% of their gestation periods⁴ must not be transported.

Every mare with its suckling offspring must be segregated from all other animals during transport.

Every mature stallion must be segregated from all other animals during transport.

Horses must be individually assessed before loading and upon arrival back to the farm.

Refer to Appendix H-Transport Decision Tree.

RECOMMENDED PRACTICES

- a. ensure handlers are trained in proper loading and unloading practices
- b. ensure roads and loading areas are accessible in all kinds of weather
- c. ensure loading facilities have gentle ramps and are uniformly lit (avoid sharp contrasts and shadows)

³ Section 145 (1) in Part XII (Transport of Animals) of the Health of Animals Regulations prohibits loading and unloading in a manner that is likely to cause the animal's suffering, injury or death. Section 145 (2) also requires that fixed or movable ramps, gangways, chutes, steps and other equipment used for loading and unloading animals meet the following requirements (31):

- they can bear the weight to which they are subjected without collapsing, twisting, breaking or bending;
- they have sides of sufficient strength and height to prevent animals from falling off;
- they have a surface that is designed, constructed and maintained to prevent the animal from tripping, slipping and falling;
- they are placed so that there is no unprotected gap through which the animal could trip, slip or fall; and
- they cannot have a slope greater than 30 degrees.

⁴ Section 136 (1) in Part XII (Transport of Animals) of the Health of Animals Regulations defines animals in the last 10% of gestation as "unfit". Section 139 (2) specifies four conditions that must be met when transporting unfit animals for veterinary care, including the recommendation of a veterinarian (31). Refer to Appendix H: Transport Decision Tree.

- d. load horses calmly and quietly
- e. clean and sanitize vehicles between uses, especially if transporting horses of different origin
- f. for vehicles requiring horses to step up: use a rubber bumper to prevent injuries as the horse steps up
- g. for loose loading: determine the proper loading density (refer to the *Recommended Code of Practice for the Care and Handling of Farm Animals: Transportation*) and ship pre-socialized horses together.

8.2.1 Training to Load

Section 8.2.1 is applicable to halter loaded horses. Horses well trained to the halter should be taught loading procedures well before the anticipated date of transport. Horses that have had a positive experience loading are often less fearful than horses loaded for the first time. Training to load also facilitates loading during an emergency.

Techniques for training to load include: (34)

- teach the horse to lead, stop, turn in both directions, and back up in-hand before asking the horse to load in a vehicle
- ensure the vehicle entrance is wide and well lit
- load and unload the horse several times to reinforce training
- use caution when closing the trailer as some horses may panic
- consider using positive reinforcement (e.g. giving the horse a food reward when the horse loads successfully)
- use a trailer that is large and open (during initial training)
- load an experienced horse first (the horse in training may be more apt to load following a familiar companion).

Refer to *Section 6.3-Principles in Training and Learning Theory* for other details relevant to training.

RECOMMENDED PRACTICES

- a. seek assistance on training to load from a knowledgeable and experienced horseperson.

8.2.2 On-Farm Management Post-Transport

Research suggests that transport itself or the simultaneous management changes associated with transport (e.g. new surroundings, physical constraint and deprivation of water and feed) can predispose horses to colic and respiratory disease (36,37).

REQUIREMENTS

Horses must be provided with water upon arrival to the farm.

RECOMMENDED PRACTICES

- a. avoid changes in feed shortly after transport
- b. monitor recently transported horses carefully for dehydration, wounds, signs of colic, fever or respiratory disease, particularly after long distance transport or when horses of different origin were mixed (38,39)
- c. segregate new arrivals from resident horses for at least seven days and monitor their health status.

9

Change or End of Career

Horses, donkeys and mules can have multiple careers in their working lives. Responsible ownership includes making decisions for equines that are no longer able to carry out the work desired of them as a result of age, injury or illness.

9.1 Change or End of Career Options

Options include:

- retire completely
- transition to a lower performance level or easier job on the farm
- use as a companion to another horse, donkey or mule
- sell to a new owner or consign to a quality or specialized horse sale
- donate to a reputable facility, such as a university
- arrange for euthanasia
- arrange for humane slaughter.

Select an option based on the horse's physical condition, soundness, temperament, demeanor, socialization (with both humans and horses), and tractability. Euthanasia or humane slaughter are legitimate considerations and may be the desired or required course of action depending on the condition of the horse and availability of other options. Before choosing humane slaughter as an option, the rigours of transport to a slaughter facility must be considered. Appropriate withdrawal periods for medications must also be observed. Refer also to *Section 8-Transportation* and *Section 10-Euthanasia*. For information on drug withdrawal periods, consult a veterinarian or the Meat Hygiene Manual of Procedures (*Appendix K* provides a reference to this manual).

Sale by private treaty enables the seller to learn more about the buyer, their facilities and intended use for the horse. Sellers may wish to restrict the activity the horse is transitioned into, particularly when the horse is deemed unfit for certain work or athletic expectation. Refer to *Appendix K-Resources for Further Information*.

REQUIREMENTS

The welfare of the horse must be of paramount importance when making change or end of career decisions.

RECOMMENDED PRACTICES

- get a specific diagnosis of the horse's condition - this is the best way to identify acceptable uses for the horse and future care needs
- ensure the horse is transitioned to a responsible caregiver (e.g. perform a site visit, request references).

10 Euthanasia

Owners and managers are responsible for euthanasia decisions, and these decisions should never be made without careful consideration. Horses, donkeys and mules serve their owners in many ways and deserve an end of life that is humane. Euthanasia can be performed on farm or at an appropriate off-farm facility.

When caring for a sick or injured horse, consult a veterinarian to determine when to stop treatment and instead euthanize, taking the following into account:

- what is the likelihood of recovery or return to an acceptable quality of life?
- how long should the animal be given to recover?
- has the horse become depressed or lethargic?
- what kind of special care will the animal require and are you able to meet those needs in terms of your skill level, time, and available facilities?
- do you have the financial resources to continue to provide for the animal?
- have the chances of recovery improved or declined over the course of treatment?

RECOMMENDED PRACTICES

- a. work with a veterinarian to develop a plan for euthanasia. The written plan should be kept in a known location and include:
 - the name, and, if applicable, contact information of the person(s) responsible for making euthanasia decisions on farm and the person responsible for performing the procedure
 - a schedule for proper maintenance of any equipment
 - the protocols for disposal, in accordance with provincial and/or municipal regulations
 - b. discuss euthanasia with a veterinarian when the horse:
 - is enduring continuous or unmanageable pain from a condition that is chronic and incurable
 - has a medical condition that has a grave prognosis without surgery, and surgery is unavailable or unaffordable
 - possesses dangerous behavioural traits that renders it a hazard to itself, other horses or handlers
 - is suffering from a severe, traumatic injury (e.g. broken leg or wound significantly impacting a major organ, muscle or skeletal system)
 - has a disease or condition and the cost of treatment is prohibitive
 - has a transmittable disease, which is a serious health hazard to other horses or humans
- Or when you
- are unable to care for the horse and cannot find it a suitable new home.

10.1 Timelines for Euthanasia

A key component of euthanasia is timeliness. It is not acceptable to delay euthanasia for reasons of convenience or cost (40). When euthanasia is deemed necessary, it must be performed without delay, particularly in the case of a severe, traumatic injury. Leaving a suffering animal to die of natural causes (what is known as “letting nature take its course”) is not acceptable (40).

REQUIREMENTS

Equines that are sick, injured, or in pain must receive appropriate treatment without delay or be euthanized without delay.

For sick, injured or compromised horses that are not showing improvement, horse owners or caregivers must, without delay, obtain veterinary advice on appropriate care and treatment or make arrangements for euthanasia.

10.2 Methods

The euthanasia method used must be quick, cause minimal pain and distress, and render the horse immediately unconscious. The following are the only acceptable methods for euthanasia of equines: (41)

- lethal injection administered by a veterinarian
- free bullet deployed by a skilled individual
- penetrating captive bolt deployed by a skilled individual (depending on the model used, a secondary step will be required) (42). *Appendix I and J provide important further guidelines.*

REQUIREMENTS

An acceptable method of euthanasia must be used.

Euthanasia must be performed by persons knowledgeable in the method used for equines.

Disposal must be in accordance with provincial and municipal regulations.

RECOMMENDED PRACTICES

- when choosing a method of euthanasia consider
 - the medical condition of the horse being euthanized
 - ability to restrain the animal
 - human safety and the safety of other animals
 - disposal options
 - potential need for sample collection for diagnostic testing
 - the emotional comfort with the procedure for the owner, the person performing euthanasia and any bystanders
- consider disposal options well in advance as they may impact on the method and location for euthanasia. Refer to the relevant provincial and/or municipal regulations.

10.3 Confirmation of Death

In order to achieve a humane death, the horse must be rendered immediately unconscious and must go on to die without regaining consciousness. Death does not occur immediately-it may take several minutes.

Reflex motor activity or muscle spasms may follow the loss of consciousness and should not be mistaken as an indication of pain or distress. Following the use of the captive bolt or gunshot, the initial involuntary movements should not begin immediately, but approximately 5-20 seconds later. If lethal injection is used, there may be variable amounts of movement associated with deepening anesthesia.

There are several reasons why a secondary step may be needed. In some cases, the euthanasia tool may only be capable of temporarily stunning the animal; therefore, a secondary step is required to euthanize the animal (40). A secondary step is always required if the first step fails. *Appendix J-Technical Guidelines for Euthanasia Methods* **provides important information on acceptable secondary steps.**

An animal has not been rendered unconscious if the animal (40):

- vocalizes
- attempts to rise
- lifts its head
- blinks like an alive animal
- responds to a painful stimulus.

Use multiple indicators to confirm death:

- absence of all movement for at least five minutes
- absence of a heartbeat and pulse for at least five minutes
- lack of breathing for at least five minutes
- fixed, dilated pupil
- absence of all reflexes including the corneal reflex (i.e. no blinking when the eyeball is touched).

REQUIREMENTS

Confirm unconsciousness immediately when it is safe to do so.

Have a secondary euthanasia step or method available.

Confirm death before moving or leaving the animal.



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¹ This reference is no longer valid, as the Compromised Animals Policy was archived when Part XII (Transport of Animals) of the Health of Animals Regulations was amended (effective February 20, 2020).



Template Budget for Horse Ownership

This template is intended to assist prospective horse owners in developing a budget so they can plan for the short- and long- term costs of horse ownership. Actual costs depend on several factors; therefore, it is important to consult with experts in your area to establish your actual costs. Depending on the individual context, some costs listed below may not apply; other costs may need to be added.¹

	Initial Costs	
Pre-Purchase Exam		
Purchase of the horse		
Costs associated with transport (e.g. trailer)		
Tack - Saddle and pad - Bridle - Halter		
Grooming supplies		

Minimum Ongoing Costs			
	Approximate Cost/ Unit	Actual Cost/Unit	Annual Total
Boarding (or)	\$250 - \$1,000/month		
On-Farm Care ²	\$1,000 - \$2,000/year		
Routine Veterinary Care	\$300 - \$500/year		
Emergency Veterinary Care (consider also euthanasia and disposal)	Minimum \$1,000		
De-worming/Fecal Examinations	\$100/year		
Farrier Expenses	\$25 - \$50 trimming/ 6-8 weeks (or) \$60 - \$250 shoeing/ 4-8 weeks		
Insurance (optional)	3% of horse's value + \$250/year for medical/ surgical		
Liability insurance (optional)	Varies		

¹ The costs listed are not intended as suggestions for prices but rather a reflection of average expected costs based on 2013 dollars

² Assumes basic facilities are in place on farm and in good condition (e.g. shelter and water is set up).



Sample Water Intakes

The table below provides guidelines on expected water intakes for horses:¹

Class	Ambient Temperature	Average Total Water Intake (L/day)	Estimated Range of Water Intakes (L/day)
Idle, mature (500kg, 1100lbs)	20°C	25	21-29
Idle, mature (500kg, 1100lbs)	30°C	48	42-54
Idle, mature (500kg, 1100lbs)	-20°C	42	37-47
Pregnant (500kg, 1100lbs)	20°C	31	27-35
Lactating (500kg, 1100lbs)	20°C	51	40-63
Moderate exercise (500kg, 1100lbs)	20°C	41	36-46
Moderate exercise	35°C	82	72-92
Yearling (300kg, 660lbs)	20°C	19	17-21
Yearling (300kg, 660lbs)	-10°C	18	16-20

¹ National Research Council (2007) Page 131 in Nutrient Requirements of Horses. 6th rev. ed. National Academies Press, Washington, DC.



Vital Signs in Horses and Donkeys

Normal ranges for vital signs in horses and donkeys when at rest and relaxed:

Adult horses

Heart rate	28-44 beats per minute
Respiration rate	10-14 breaths per minute
Rectal temperature	37°C-38.5°C (99.5°F-101.3°F)

Foals

Heart rate	60-110 beats per minute
Respiration rate	25-60 breaths per minute
Rectal temperature (resting)	Increases for first 4 days and plateaus at 37.2°C-38.6°C (99°F-101.5°F)

Adult donkeys

Heart rate	36-68 beats per minute
Respiratory rate	12-44 breaths per minute
Rectal temperature	36.2°C-37.8°C (97.2°F-100°F)

Young donkeys (up to 2 years)

Heart rate	36-68 beats per minute
Respiration rate	12-20 breaths per minute
Rectal temperature	36.5°C-38.9°C (97.8°F-102.1°F)

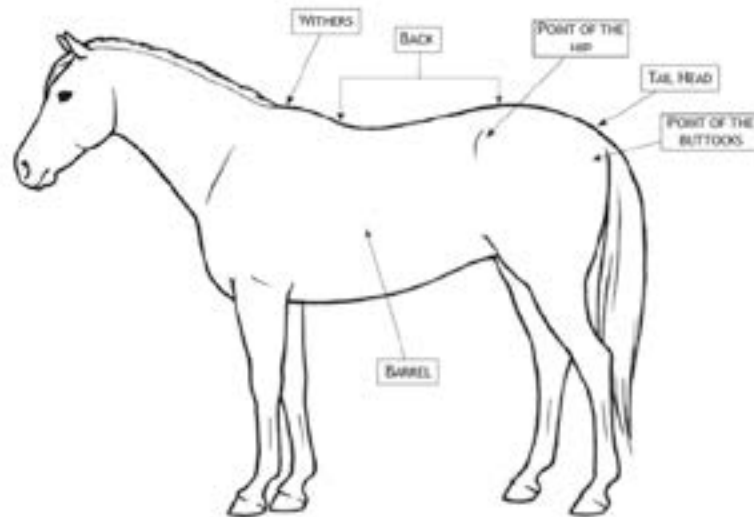
General

The gums should be pink and moist, and should return to that color within 2 seconds of pressing with your finger on the gum line above the teeth and then releasing (this is known as the capillary refill time).



Body Condition Scoring - Horses and Ponies

LABELLED ILLUSTRATION OF A HORSE¹



BCS 1

WHOLE BODY

- Poor condition
- Extremely emaciated
- No fat tissue felt

NECK

- Bone structure visible

WITHERS

- Bone structure easily visible

BACK

- Spinous processes project prominently

TAIL HEAD

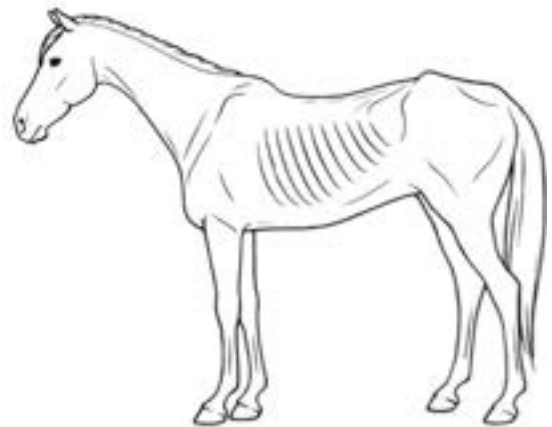
- Tail head, point of the buttocks and point of the hip project prominently

RIBS

- Project prominently

SHOULDER

- Bone structure easily noticeable



¹ Adapted from: What's the Score? Body Condition Scoring for Livestock CD-ROM CD 400/40-1 with permission of Alberta Agriculture and Rural Development. www.agriculture.alberta.ca Copies of the CD can be ordered on-line at: [www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex9622](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex9622)



Body Condition Scoring - Horses and Ponies (continued)

BCS 2

WHOLE BODY

- Very thin
- Emaciated

NECK

- Bone faintly discernible

WITHERS

- Bone structure faintly noticeable

BACK

- Spinous processes prominent
- Slight fat covering over base of spinous processes
- Transverse processes of lumbar vertebrae feel rounded

TAIL HEAD

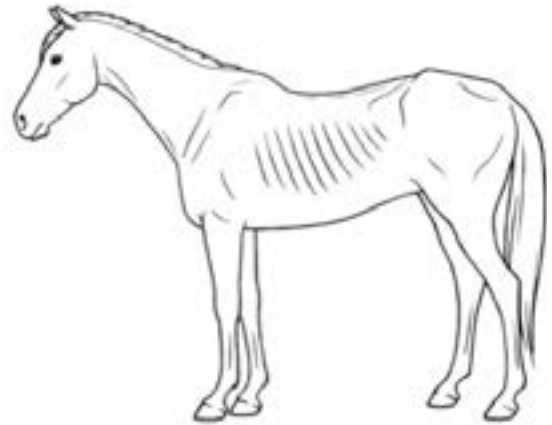
- Prominent

RIBS

- Prominent

SHOULDER

- Faintly discernible



BCS 3

WHOLE BODY

- Thin

NECK

- Accentuated

WITHERS

- Accentuated

BACK

- Fat build up halfway on spinous processes, but easily discernible
- Can't feel transverse processes

TAIL HEAD

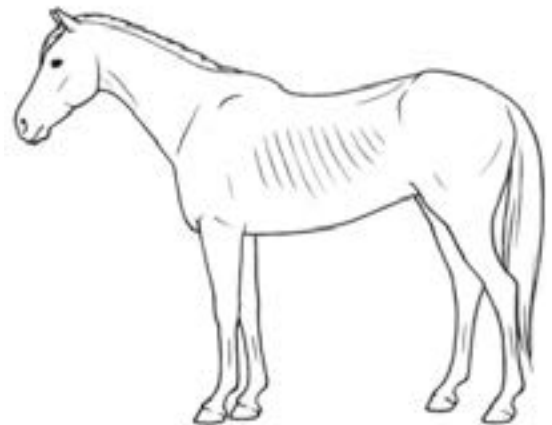
- Prominent but individual vertebrae can't be visually identified
- Point of the hip rounded, but easily discernible
- Point of the buttocks not distinguishable

RIBS

- Slight fat cover
- Individual ribs discernible

SHOULDER

- Accentuated





Body Condition Scoring - Horses and Ponies (continued)

BCS 4

WHOLE BODY

- Moderately thin

NECK

- Not obviously thin

WITHERS

- Not obviously thin

BACK

- Negative crease along back

TAIL HEAD

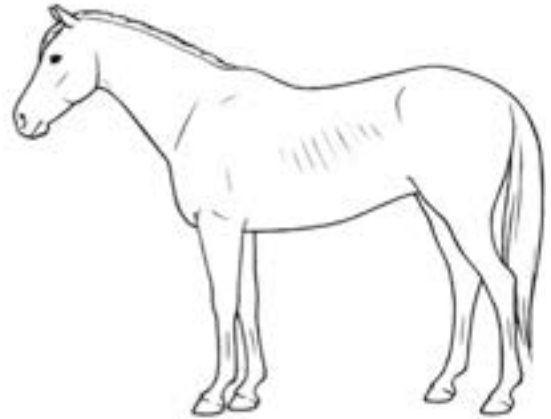
- Prominence depends on conformation
- Fat palpable
- Point of the hip not discernible

RIBS

- Faint outline discernible

SHOULDER

- Not obviously thin



BCS 5

WHOLE BODY

- Moderate condition

NECK

- Blends smoothly into body

WITHERS

- Rounded over spinous processes

BACK

- Back is level

TAIL HEAD

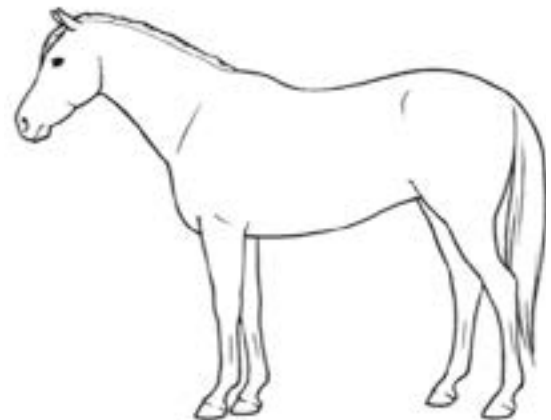
- Fat around tail head beginning to feel spongy

RIBS

- Individual ribs can be felt, but not visually distinguished

SHOULDER

- Blends smoothly into body





Body Condition Scoring - Horses and Ponies (continued)

BCS 6

WHOLE BODY

- Moderately fleshy

NECK

- Fat beginning to be deposited

WITHERS

- Fat beginning to be deposited

BACK

- May have slight positive crease down back

TAIL HEAD

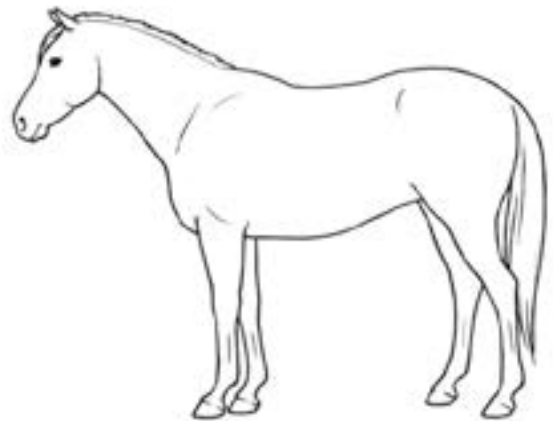
- Fat around tail head feels soft

RIBS

- Fat over ribs feels spongy

SHOULDER

- Fat beginning to be deposited
- Point-of-shoulder not discernible



BCS 7

WHOLE BODY

- Fleshy

NECK

- Fat deposited along neck

WITHERS

- Fat deposited along withers

BACK

- May have positive crease down back, behind shoulder

TAIL HEAD

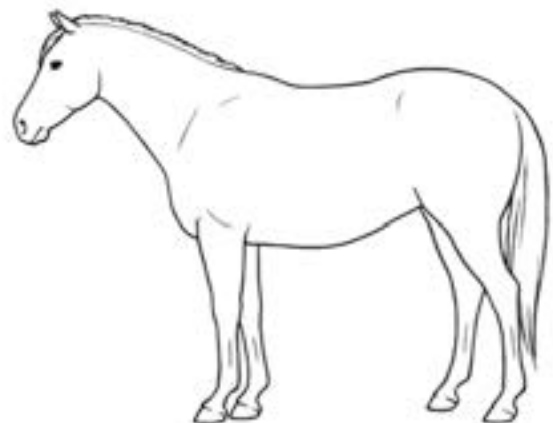
- Fat around tail head is soft

RIBS

- Individual ribs can be felt
- Noticeable fat fillings between ribs

SHOULDER

- Fat deposited behind shoulder





Body Condition Scoring - Horses and Ponies (continued)

BCS 8

WHOLE BODY

- Fat
- Fat deposited along inner buttocks

NECK

- Noticeable thickening of neck

WITHERS

- Area along withers filled with fat

BACK

- Positive crease down back

TAIL HEAD

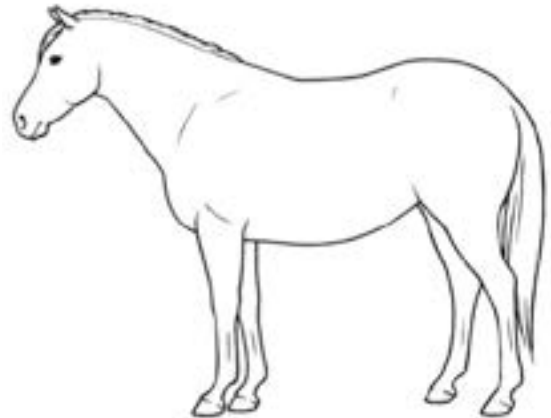
- Tail head fat very soft

RIBS

- Difficult to feel individual ribs

SHOULDER

- Area behind shoulder filled in, flush with body



BCS 9

WHOLE BODY

- Extremely fat
- Fat along inner buttocks may rub together
- Flank filled in flush

NECK

- Bulging fat

WITHERS

- Bulging fat

BACK

- Obvious positive crease down back

TAIL HEAD

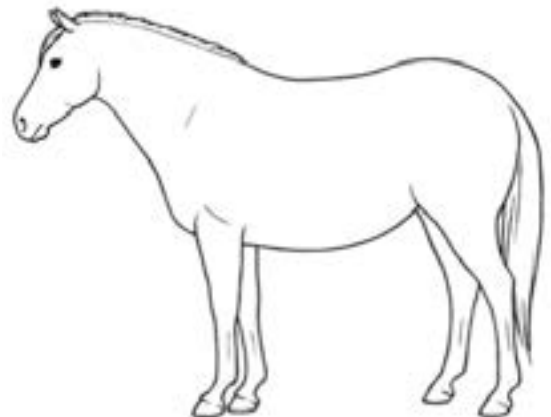
- Building fat around tail head

RIBS

- Patchy fat appearing over ribs

SHOULDER

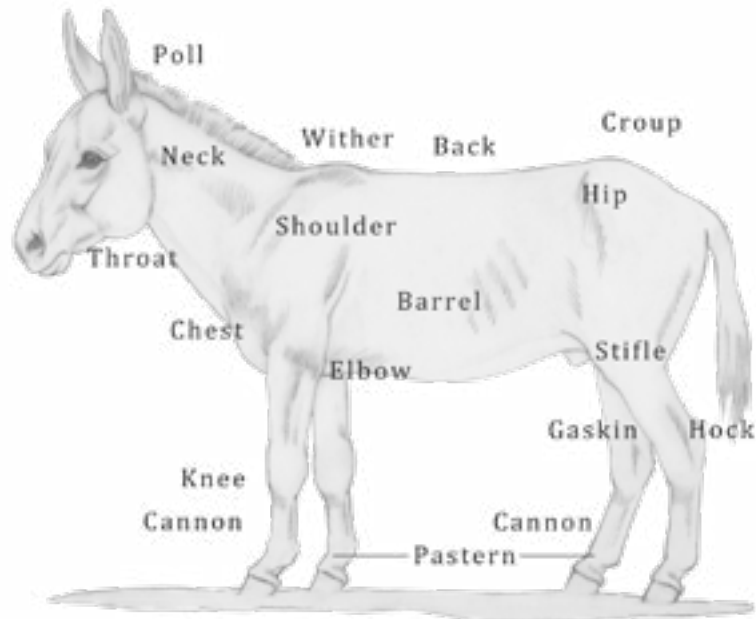
- Bulging fat





Body Condition Scoring - Donkeys and Mules

LABELLED ILLUSTRATION OF A DONKEY¹



BCS 1

NECK AND SHOULDERS

- Neck thin, all bones easily felt
- Neck meets shoulder abruptly, shoulder bones easily felt, angular

WITHERS

- Dorsal spine of withers prominent and easily felt

RIBS AND BELLY

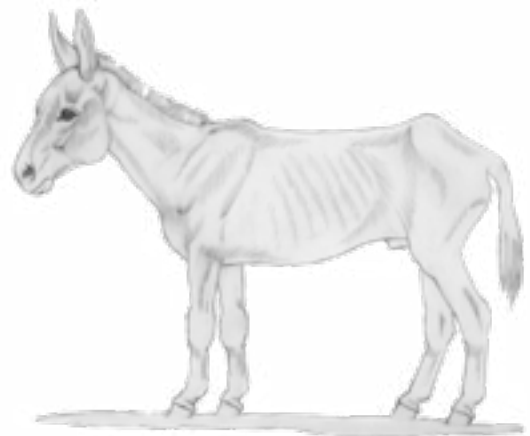
- Ribs can be seen from a distance and felt with ease
- Belly tucked up

BACK AND LOINS

- Backbone prominent, can feel dorsal and transverse processes easily

HINDQUARTERS

- Hip bones visible and felt easily (hock and pin bones)
- Little muscle cover
- May be cavity under tail



¹ Images in Appendix E developed by Michelle Grant (Calgary, Alberta). www.michellegrant.ca Text for body condition scoring of donkeys developed by and used with the permission of The Donkey Sanctuary. Copyright: The Donkey Sanctuary. www.thedonkeysanctuary.org.uk



Body Condition Scoring - Donkeys and Mules (continued)

BCS 2

NECK AND SHOULDERS

- Some muscle development overlying bones
- Slight step where neck meets shoulders

WITHERS

- Some cover over dorsal withers
- Spinous processes felt but not prominent

RIBS AND BELLY

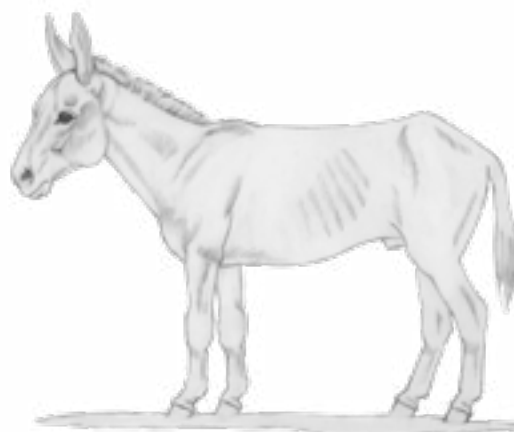
- Ribs not visible but can be felt with ease

BACK AND LOINS

- Dorsal and transverse processes felt with light pressure
- Poor muscle development either side of midline

HINDQUARTERS

- Poor muscle cover on hindquarters, hip bones felt with ease



BCS 3

NECK AND SHOULDERS

- Good muscle development, bones felt under light cover of muscle/fat
- Neck flows smoothly into shoulder, which is rounded

WITHERS

- Good cover of muscle/fat over dorsal spinous processes, withers flow smooth into back

RIBS AND BELLY

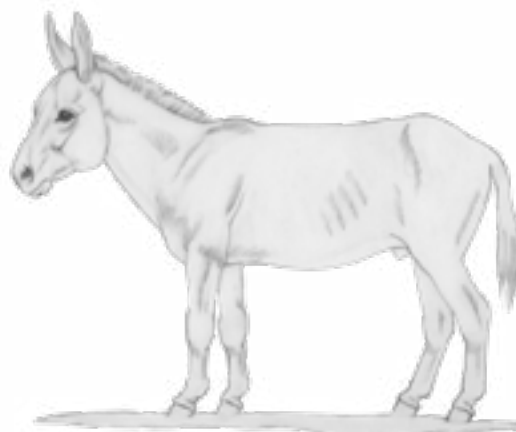
- Ribs just covered by light layer of fat/muscle, ribs can be felt with light pressure
- Belly firm with good muscle tone and flattish outline

BACK AND LOINS

- Cannot feel individual spinous or transverse processes
- Muscle development either side of midline is good

HINDQUARTERS

- Good muscle cover in hindquarters, hip bones rounded in appearance, can be felt with light pressure





Body Condition Scoring - Donkeys and Mules (continued)

BCS 4

NECK AND SHOULDERS

- Neck thick, crest hard, shoulder covered in even fat layer

WITHERS

- Withers broad, bones felt with firm pressure

RIBS AND BELLY

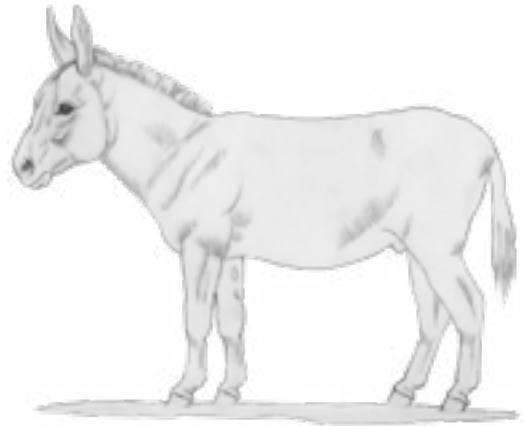
- Ribs dorsally only felt with firm pressure, ventral ribs may be felt more easily
- Overdeveloped belly

BACK AND LOINS

- Can only feel dorsal and transverse processes with firm pressure
- Slight crease along midline

HINDQUARTERS

- Hindquarters rounded, bones felt only with firm pressure
- Fat deposits evenly placed



BCS 5

NECK AND SHOULDERS

- Neck thick, crest bulging with fat and may fall to one side
- Shoulder rounded and bulging with fat

WITHERS

- Withers broad, unable to feel bones

RIBS AND BELLY

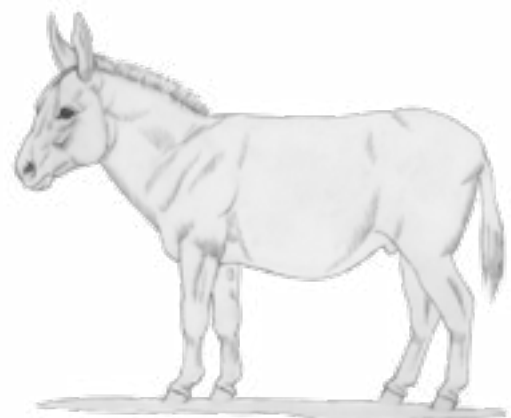
- Large, often uneven fat deposits covering dorsal and possible ventral aspect of ribs
- Ribs not palpable
- Belly pendulous in depth and width

BACK AND LOINS

- Back broad, unable to feel spinous or transverse processes
- Deep crease along midline, bulging fat either side

HINDQUARTERS

- Cannot feel hip bones, fat may overhang either side of tail head, fat often uneven and bulging.





Key Points for Owners of Donkeys or Mules

Donkeys and mules require the same good animal care for their health and well-being as do horses. Several key points are listed below, including how these equines differ from horses.

Facilities and Housing

Donkeys and mules need shelter from rain, snow and windy conditions. The thick, dense hair coat of donkeys makes them particularly vulnerable to cold, damp weather. Donkeys do not have the extra protective undercoat that horses have to repel moisture. Most mules, however, have a coat like a horse, including the protective undercoat. In winter, donkeys should be provided with an enclosed shelter and ample bedding.

Donkeys are social animals and benefit from the company of other equines. Some donkeys and mules may become depressed or apathetic when isolated from a former companion. This can have health implications, particularly if they go off feed.

Feed and Water

To maintain donkeys in good condition, they should be fed grass types of hay. Lush pastures and high quality legume hay is not recommended for these equines. Donkeys can be prone to obesity and certain conditions, such as laminitis and hyperlipemia, which can be fatal if not properly treated.

Concentrates are seldom needed except for young donkeys, nursing jennets and older donkeys. Salt and minerals are necessary for donkeys and mules to maintain good health and vigour.

It is essential that clean water is provided. Donkeys and mules are likely to limit their water intake to the point of dehydration unless clean drinking water is provided.

Health and Reproduction

Donkeys tend to be stoic. They often do not show behavioural signs indicative of illness until the condition is advanced. In donkeys and mules, a reduced or loss of appetite is a significant concern.

Like horses, donkeys and mules need routine care. Ensure proper trimming is done every 8-12 weeks or as may be needed for individuals. The time between hoof trims will depend on factors such as ground conditions, activity level, nutrition and age. Consult a veterinarian for advice on vaccinations and deworming.

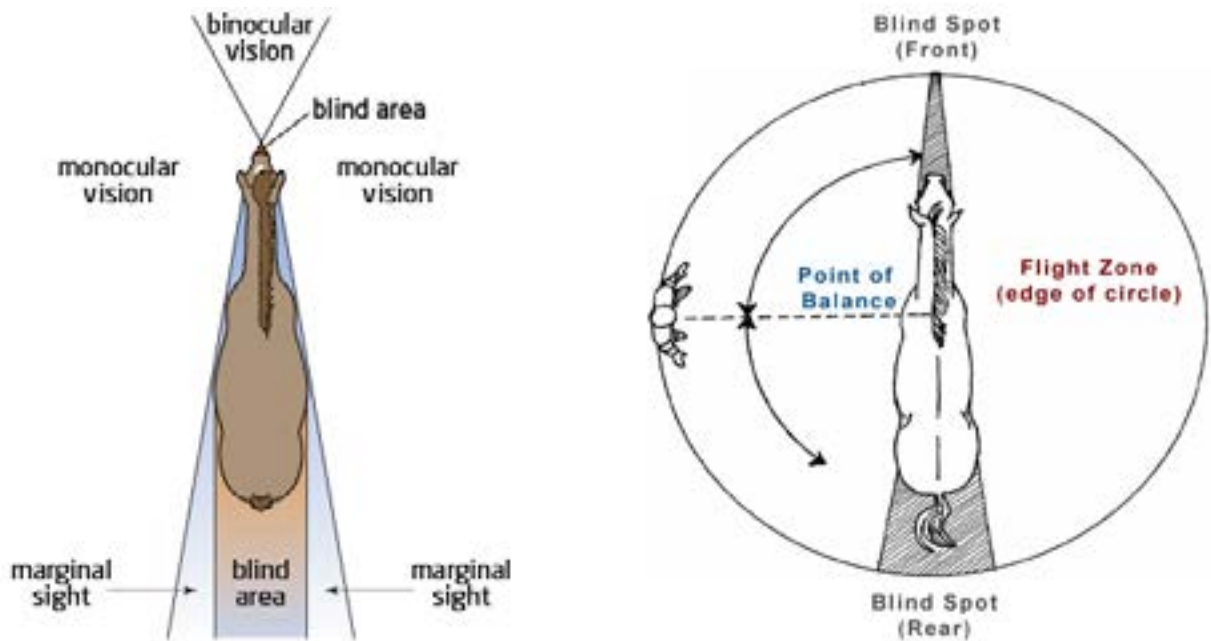
The gestation period for jennets is 365 days (+/- 20 days).

Jacks should only be handled by experienced horsepeople and can be very aggressive during breeding. Jacks should also have good basic ground skills and understand commands prior to being used for hand breeding. For pasture breeding, it is important to be aware of the breeding behaviour of jacks and mares/jennets. For instance, jacks typically bite the jennet/mare - while it may be possible to minimize this with training the behaviour is part of the animal's breeding behaviour.

Handling

Historically, donkeys lived in rugged regions. When they were threatened, they simply stood still and tried to blend into the landscape rather than bolt. To this day, when a donkey or mule feels threatened, they are likely to stop and assess the situation. This is often incorrectly interpreted as stubbornness. By contrast, the horse relies on "flight" and its instinct is to run away from perceived threats. Donkeys and mules are extremely intelligent. They respond well to positive training methods.

Understanding Flight Zone, Point of Balance and Field of Vision



Flight Zone:¹ This is the space surrounding a horse that, when penetrated, causes the horse to move to reestablish a comfortable distance. Low-stress handling is based on applying and releasing pressure on the edge of the flight zone ideally never penetrating the zone so aggressively that the horse becomes frightened and “takes flight”. You have entered a horse’s flight zone the moment your approach causes the horse to move away. As a horse becomes more fearful, its flight zone will increase.

Point of Balance:¹ The point of balance is located in the shoulder area of the horse. The handler should stand behind the point of balance at the shoulder to make the horse go forward and stand in front of the point of balance at the shoulder to make an animal back up.

Field of Vision:² When looking to the side, horses have monocular vision (each eye can operate independently). When looking forward, they have binocular vision (eyes operate in tandem). Horses take longer than humans to adjust to changes in light intensity and they have poor depth perception so may baulk at shadows or puddles.

¹ Grandin, T. (2010) How to improve livestock handling and reduce stress. Pages 64-87 in *Improving Animal Welfare: A Practical Approach*. T. Grandin, ed. CAB International, Oxfordshire, UK.

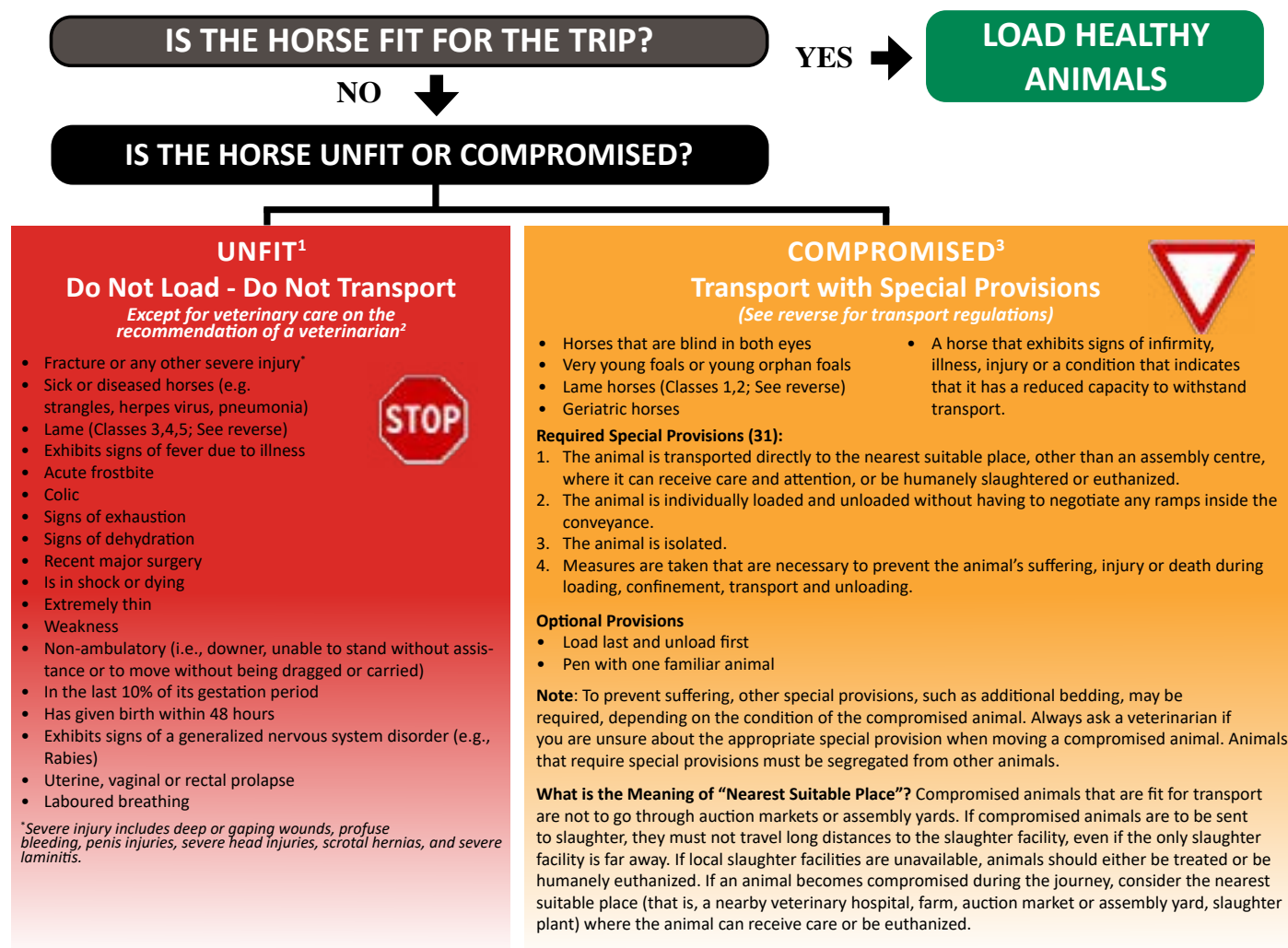
² Woods, J. (2010) Recommended handling guidelines and animal welfare assessment tool for horses. Horse Welfare Alliance of Canada.

Left image source: Developed by the Alberta Equine Welfare Group for the booklet “Humane Handling Guidelines for Horses – Standards for the Care of Unfit Animals” available for download under Resources at www.horsewelfare.ca

Right image source: J Woods (2010) Recommended handling guidelines and animal welfare assessment tool for horses. Horse Welfare Alliance of Canada.



Transport Decision Tree



Content for the Transport Decision Tree was created by the Equine Code Development Committee and is based on the Health of Animals Regulations.

¹ Section 136 (1) in Part XII (Transport of Animals) of the Health of Animals Regulations defines "unfit" (31).

² Section 139 (1) in Part XII (Transport of Animals) of the Health of Animals Regulations specifies that an unfit animal can only be transported directly to a place (other than a slaughter establishment or assembly centre) for veterinary care if (31):

- it is individually loaded and unloaded without having to negotiate any ramps inside the conveyance;
- it is isolated during confinement and transport;
- measures are taken to prevent the animal's unnecessary suffering, injury or death during loading, confinement, transport and unloading;
- and, a veterinarian recommends that the animal be transported to receive veterinary care.

³ Section 136 (1) in Part XII (Transport of Animals) of the Health of Animals Regulations defines "compromised" (31).



Transport Decision Tree (continued)

Guidelines for Transporting Horses

References, but does not exactly replicate the
Federal Transport Regulations (as of 2020)
www.inspection.gc.ca

DO

- Isolate incompatible animals (animals that are likely to suffer, sustain an injury or die if they are confined and transported together) (e.g., animals of different species or substantially different weights and ages; or if incompatible by nature [i.e., stallions, jacks]; mares with suckling foals; and horses with shoes on their hind legs).
- Ensure that animals segregated in trucks receive extra protection from cold and wind chill; supply ample bedding.
- Provide proper ventilation, drainage and material to absorb and prevent the pooling or escape of water, urine and liquid manure.
- Ensure that the animal is able to stand at all times with all feet on the floor, with head elevated, with sufficient space to permit a full range of head movement, and without any part of its body coming into contact with a deck, roof or top of the conveyance.
- Either strew the vehicle with sand or have the vehicle fitted with safe foot-holds, in addition to proper bedding.
- Ensure that animals unloaded for feed, water and rest remain at the rest stop for a minimum of eight hours or longer to ensure all animals receive feed and water.

DO NOT

- Continue to transport an animal that becomes unfit beyond the nearest place it can be treated or be humanely killed.
- Handle an animal in any way that is likely to cause the animal's suffering, injury or death.
- Use electric goads or prods.
- Load or unload animals in a way that would cause suffering, injury or death.
- Crowd animals to such an extent as to cause suffering, injury or death.
- Transport livestock in conveyances that are not suitable for the species of animal.

Lameness Classes

These categories can be used to determine the status of an animal's mobility, from normal to non-ambulatory.

Transport as Soon as Possible

Class 1

Visibly lame but can keep up with the group.

Class 2

Unable to keep up; some difficulty climbing ramps.
Load in rear compartment.

Do Not Load or Transport*

Class 3

Requires assistance to rise, but can walk freely.

Class 4

Requires assistance to rise; reluctant to walk; halted movement.

Class 5

Unable to rise or remain standing.

*** Any animal, including Lameness Classes 3, 4 or 5, may only be transported for veterinary treatment with special provisions⁴, including the recommendation of a veterinarian.**

Content for the Transport Decision Tree was created by the Equine Code Development Committee and is based on the Health of Animals Regulations.

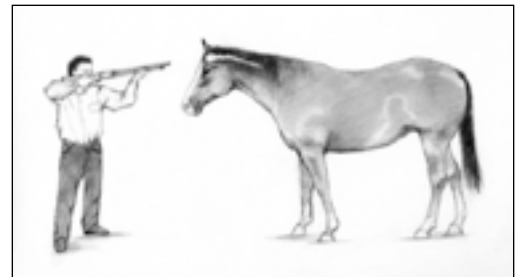
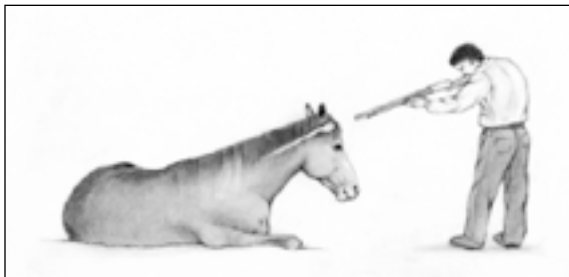
⁴ Section 139 (1) in Part XII (Transport of Animals) of the Health of Animals Regulations specifies that an unfit animal can only be transported directly to a place (other than a slaughter establishment or assembly centre) for veterinary care if (31):
- it is individually loaded and unloaded without having to negotiate any ramps inside the conveyance;
- it is isolated during confinement and transport;
- measures are taken to prevent the animal's unnecessary suffering, injury or death during loading, confinement, transport and unloading;
- and, a veterinarian recommends that the animal be transported to receive veterinary care.



Anatomical Landmarks for Euthanasia



**Not Between the Eyes!
- but above the eyes as
illustrated.**



In horses, the brain is situated high in the head. The correct point of entry of the bullet or captive bolt is approximately 2.5cm (1in) above the intersection of two diagonal lines each running from the inside corner of the eye to the base of the opposite ear (see top photo). Ideally, the firearm or captive bolt should be angled so the bullet follows the angle of the neck or the spine.

Proper positioning of the firearm or penetrating captive bolt is essential in order to ensure a quick death. When euthanasia is performed by gunshot, the firearm should be held within 15-30cm (6-12in) of the point of entry. When performed by penetrating captive bolt, the device must be held in contact against the head at the correct anatomical site.

Horses may require restraint in order to facilitate safe and effective euthanasia, particularly if using a penetrating captive bolt (options include a halter and lead rope or bridle).

Refer also to *Appendix J-Technical Guidelines for Euthanasia Methods*, for other important details.

Image Source: Images developed by the Alberta Equine Welfare Group for the booklet "Humane Handling Guidelines for Horses – Standards for the Care of Unfit Animals" available for download under Resources at www.horsewelfare.ca.



Technical Guidelines for Euthanasia Methods

Important Safety Guidelines

- Be aware that if euthanizing a standing horse by gunshot, the horse may lunge forward or rear up when shot.
- **If euthanizing a horse by gunshot, the bullet may ricochet or pass through the horse. Therefore, it is very important to ensure no person or other animal is within range.**

Guidelines for Euthanizing a Horse by Free Bullet

- **It is imperative to use a sufficiently powered firearm.** For horses heavier than 180kg (400lb) select a gun that provides a minimum of 1,000 ft lbs of muzzle energy. This information can be found on the box of the ammunition used with your firearm. Most handguns are NOT sufficient. A .22 calibre gun may not be a sufficiently powered firearm for horses. Appropriate options for horses include the 20, 16 and 12 gauge shotgun. Slugs are the best choice, No. 4, 5, or 6 birdshot is ONLY acceptable for close-range. Woods et al. (2010), listed in the References, provides further details.

Guidelines for Euthanizing a Horse by Penetrating Captive Bolt Gun

- **It is imperative to use a penetrating captive bolt gun that is designed to euthanize horses and is the correct caliber.** Some models are NOT designed to euthanize a horse - they merely stun the horse and a secondary step is required. There are captive bolt guns on the market now designed specifically for euthanasia on farm. A .25 calibre with an extended bolt is the most effective captive bolt gun for single-step euthanasia. If a less powerful captive bolt gun is used, there is a risk that the horse may only be temporarily stunned and a secondary method will be required. Woods et al. (2010), listed in the References, provides further details.
- Proper maintenance in accordance with the manufacturer's instructions is also essential.

Secondary Steps

- Acceptable secondary steps include: a second shot by free bullet or penetrating captive bolt and a second injection (administered by a veterinarian). Cardiac puncture, bleeding, and pithing (insertion of a rod into the hole created by the captive bolt and agitation of the rod to destroy the brain) are acceptable secondary steps ONLY if the animal is confirmed unconscious.
- If using a penetrating captive bolt gun, the requirement for a secondary step depends on the model used.
- Secondary steps performed on an unconscious animal should be performed within 30 seconds of the first step (with the exception of a second injection, which is at the discretion of the veterinarian).



Resources for Further Information

BIOSECURITY

Alberta Veterinary Medical Association and Alberta Equestrian Federation. *Equine Biosecurity Principles and Best Practices*. Available at:
<http://abvma.ca/resources/documents/EquineBiosecurityPrinciplesandBestPracticesguide.pdf>

Equine Guelph. *Biosecurity for horse owners: Information Sheet*. Available at:
http://www.equineguelph.ca/pdf/facts/bio_security_info_FINAL.pdf

Ontario Ministry of Agriculture, Food and Rural Affairs. *Preventing disease spread - personal hygiene and disinfectants around horse barns*. Available at:
<http://www.omafra.gov.on.ca/english/livestock/horses/facts/prev-disease-spread.htm>

Saskatchewan Horse Federation & Saskatchewan Ministry of Agriculture. *Horse Biosecurity Guidebook*. Available at: www.agriculture.gov.sk.ca/Default.aspx?DN=9d0ca434-3628-4e37-bf65-cf014fd933a9

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Hodges M. (1993) *Training Mules and Donkeys: A Logical Approach to Longears*. Loveland CO: Alpine Publications.

Svendsen E.D., Duncan J. & Hadrill D. (2008) *The Professional Handbook of the Donkey 4th ed*. Whittet Books Limited.

FACILITIES, PASTURE MANAGEMENT AND EMERGENCY PREPAREDNESS

Alberta Agriculture, Food and Rural Development (2003) *Horse Handling Facilities*. Agdex 460/722-1. Copies are available for purchase by phone 1 (800) 292-5697 or by online purchase:
[http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex45](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex45)

Alberta Agriculture, Food and Rural Development (2003) *Manure and Pasture Management for Horse Owners*. Agdex 460/27-1. Available at: [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex9377](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex9377)

Canada Plan Service. CPS 8000 Series - Special Structures. Available at: <http://www.cps.gov.on.ca/>

Horse Council British Columbia. *Disaster Preparedness Guidelines for Horse Owners*. Available at:
http://www.hcbc.ca/_customelements/uploadedResources/DisPrepGuidelines10.pdf

Horse Council British Columbia (2005) *Fire Prevention for your Barn: Barn Safety Checklist*. Available at:
http://www.hcbc.ca/_customelements/uploadedResources/Barn20Safety20Checklist.pdf

Ontario Ministry of Agriculture, Food and Rural Affairs (2010) *Horse Barn Ventilation*. Agdex 717/460. Available at: <http://www.omafra.gov.on.ca/english/engineer/facts/10-059.pdf>

Ontario Racing Commission. *Heat Exhaustion Action Plan*. Available at:
<http://www.ontarioracingcommission.ca/uploadedFiles/Heat%20Exhaustion%20poster.pdf>



Resources for Further Information (continued)

HORSE HEALTH AND REPRODUCTIVE MANAGEMENT

Alberta Agriculture, Food and Rural Development. *What's the Score? Body Condition Scoring for Livestock*. CD-ROM. 400/40-1. Copies available to order online at:
[http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex9622](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex9622)

American Association of Equine Practitioners. *Horse Health Articles*. Available at:
http://www.aaep.org/horse_health.htm

American Association of Equine Practitioners (2012) *Vaccination Guidelines*. Available at:
http://www.aaep.org/vaccination_guidelines.htm

Canadian Food Inspection Agency. *Equine Infectious Anemia - Factsheet*. Available at:
<http://www.inspection.gc.ca/animals/terrestrial-animals/diseases/reportable/eia/fact-sheet/eng/1329554028418/1329554166646>

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Marlin D. (n.d) *How to Ensure Your Horse is Fit*. British Equine Veterinary Association Trust. Available at:
<http://www.davidmarlin.co.uk/archive.html>

McKendrick S., Evans P. & Bagley C. (2010) *Proper Basic Hoof Care*. Utah State University Extension. AG/Equine/2006-03. Available at:
http://extension.usu.edu/files/publications/publication/AG_Equine_2006-03.pdf

Ontario Ministry of Agriculture, Food and Rural Affairs & the University of Guelph. *Foaling Record*. Available at: <http://www.omafra.gov.on.ca/english/livestock/horses/facts/foalingrecord.htm>

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Certified Horsemanship Association (2002) *Composite Horsemanship Manual*. Available for purchase at:
<http://cha-ahse.org/store/>

Hitzler, P & My Horse University. *Horse Handling and Restraint Techniques*. DVD. Available for purchase at:
<http://www.myhorseuniversity.com/node/542>

International Society for Equitation Science. *Principles of Learning Theory in Equitation*. Available at: <http://www.equitationsscience.com/learning-theory-in-equitation>

Pennsylvania University Veterinary Medicine. *Equine Restraint*. Available at:
<http://research.vet.upenn.edu/Equine/Restraint/tabid/3750/Default.aspx>



Resources for Further Information (continued)

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<http://www.agriculture.gov.sk.ca/adx/asp/adxGetMedia.aspx?DocID=2647,14528,14496,81,1,Documents&MediaID=6455&Filename=Cattle+and+Horse+Branding+-+Printer+Friendly.pdf>

NUTRITION AND FEED MANAGEMENT

Alberta Agriculture, Food and Rural Development (n.d.) Livestock Publications. Available at:
[http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex3897](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex3897)

Equi-Analytical Laboratories (n.d.) *Profiling Feed for Better Nutrition*. Available at:
<http://www.equi-analytical.com/>

Safergrass.org (n.d.) *Are You Feeding your Horse like a Cow?* Available at: <http://www.safergrass.org>

RESPONSIBLE OWNERSHIP

Horse Welfare Alliance of Canada and Alberta Farm Animal Care (n.d.) *Caregivers' guide to rehabilitating neglected horses*. Available at:
<http://www.horsewelfare.ca/horse-welfare-resources/147-rehabilitating-neglected-horses>

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Wright B. & Rietveld G. (2007) *Selecting Your Horse - Factsheet*. Ontario Ministry of Food, Agriculture and Rural Affairs. Agdex 460/11. Available at:
www.omafra.gov.on.ca/english/livestock/horses/facts/07-033.pdf

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Canadian Food Inspection Agency (2013) *Transportation of Animals Program Compromised Animals Policy*. Available: <http://www.inspection.gc.ca/english/anima/trans/polie.shtml>. Accessed May 23, 2012.

Canadian Livestock Transport (n.d.) *Certified Livestock Transport Training Program*. Information on this course is available at: <http://www.livestocktransport.ca/>

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Summary of Code Requirements

The following is a list of the Requirements within the equine Code of Practice. Refer to the cited Code section for further context about the Requirements.

SECTION 1 Duty of Care

- Owners must have the resources for and knowledge of the basics of care as stated in this Code and ensure such care is provided.
- Principal caregivers must be familiar with and provide the basics of care as stated in this Code.

SECTION 2 Facilities and Housing

2.1 Pastures and Yards

- At a minimum, each horse must have enough space to move easily, walk forward, turn around with ease, and lie down in a normal resting posture. There must also be sufficient space for subordinate horses to escape aggression.
- In muddy conditions horses must, at a minimum, have access to a mud-free, well-drained area in the pasture/yard on which to stand and lie down.
- The application of fertilizers, pesticides, herbicides and farm manure must be timed to prevent any health risks to grazing horses or contamination of ground water.

2.1.2 Shade and Outdoor Shelter

- Horses must have access to shelter (constructed or natural) that protects them from the harmful effects of extreme weather conditions.
- Promptly assist individual horses that are showing signs of heat or cold stress.
- If blankets are used, the condition of the horse beneath the blankets must be examined at least weekly.
- Blankets must be appropriate for the weather conditions and not result in heat stress.

2.1.3 Mixing and New Arrivals

- Horses kept in groups must be managed in a way that minimizes the risk of injury.

2.1.4 Fences and Gates

- Fences must be constructed and maintained to minimize the risk of injury and must be strong enough to contain horses. Refer to municipal fencing by-laws, if applicable.
- Electric fences must be installed according to the manufacturer's specifications. All power units for electric fences must be designed to prevent short circuits and/or stray voltage.
- Temporary electric fences used for strip grazing or pasture rotation are not an acceptable permanent perimeter fence for horses.

2.2.3 Sick or Injured Horses

- Owners must have the ability to segregate sick or injured horses for treatment.
- If sick pens or stalls are used, they must be equipped with a source of feed and water and be cleaned between uses.

2.3 Indoor Housing

- Facilities must be designed and maintained to minimize the risk of injury.



Summary of Code Requirements (continued)

2.3.1 Indoor Space Allowance

- For indoor facilities: each horse must have enough space to lie down in a normal resting posture, stand with the head fully raised, walk forward and turn around with ease. For tie stalls, each horse must have enough space to lie down in a normal resting posture, stand with the head fully raised, and step forward in comfort.
- For group housing, there must also be sufficient space for subordinate horses to escape aggression.

2.3.2 Indoor Lighting

- For horses kept indoors without natural light, artificial lighting must be provided during the day. Keeping horses in continuous darkness is not acceptable.

2.3.3 Indoor Flooring

- Provide non-slip surfaces in stalls and alleyways to reduce the risk of horses slipping or falling.

2.3.4 Indoor Bedding

- Ensure stalls are kept clean. Horses must be provided with a dry lying area. The area must also be of a design or texture that will not bruise, cut or otherwise injure the horse. Concrete or hard rubber mats without bedding are not acceptable surfaces.
- Bedding must be non-toxic.

2.3.5 Indoor Air Quality and Humidity

- Air quality in barns must be maintained to prevent the buildup of noxious gases, dust and moisture.
- Ventilation must effectively maintain good indoor air quality.
- The concentration of ammonia in the air must not exceed 25ppm. Options for assessing ammonia concentration are provided in *Section 2.3.5*.

2.4 Safety and Emergencies

- Develop an emergency action plan for emergencies that may occur in your area.
- Toxic materials must be securely stored such that horses cannot gain access to them.

SECTION 3 Feed and Water

3.1 Water

- Horses must have access to safe, palatable and clean water in quantities to maintain health and vigour.
- In extreme weather conditions (cold or hot), special attention must be paid to ensure water availability, access and intake.
- Water troughs, containers and any automatic watering devices must be cleaned regularly and maintained in working order with no sharp or abrasive edges.

3.2 Safety of Feedstuffs

- Horses must have daily access to forage that is free from visible mould and has minimal dust.
- Horses must only receive feedstuffs that are appropriate for the species.
- Concentrates must be stored in a secure manner that prevents horses from overeating.



Summary of Code Requirements (continued)

3.4 Nutritional Content and Feed Management

- Horses must receive a diet that is adequate for maintaining health and vigour.
- The daily ration must address the horse's maintenance and activity needs and other factors relevant to individual horses and the environment.
- Horses must have access to salt either provided in the ration or free access (a block or loose salt).

3.4.2 Growing Horses

- Growing horses must receive a diet that is adequate for maintaining health, growth and vigour.

3.4.3 Horses in Work

- Horses in work must receive a diet that is adequate for maintaining health and vigour.

3.4.4 Stallions

- Stallions must receive a diet that is adequate for maintaining health and vigour.

3.4.5 Reproductive Mares and Jennets

- Pregnant and lactating mares/jennets must receive a diet that is adequate for maintaining health and vigour and that allows the mares/jennets to provide adequate nutrition to the foal.

3.4.6 Geriatric Horses

- Geriatric horses must receive a diet that is adequate for maintaining health and vigour.
- Refer to *Section 4.5-Body Condition Scoring* for other relevant Requirements.

SECTION 4 Health Management

4.1 Health Management Plans

- Horses must be observed as often as required to maintain their health and well-being.
- Purchase medications and veterinary pharmaceuticals from regulated, reputable sources. Refer to provincial and federal regulations.
- Records or receipts of treatments provided must be available.

4.1.3 Parasite Management

- A parasite control program to prevent parasite related disease must be in place. This Requirement applies to internal and external parasites.

4.2 Sick, Injured or Compromised Horses

- Equines that are sick, injured or in pain must receive appropriate treatment without delay or be euthanized without delay. Refer also to *Section 10-Euthanasia*.
- For sick, injured or compromised horses that are not showing improvement, horse owners or caregivers must, without delay, obtain veterinary advice on appropriate care and treatment or make arrangements for euthanasia.
- Records or receipts for treatments provided must be available.
- Appropriate authorities must be advised of suspected or confirmed cases of federally reportable disease, such as Equine Infectious Anemia. Refer to the Canadian Food Inspection Agency (www.inspection.gc.ca).

4.3 Dental Care

- Horses showing signs of dental problems must be examined and treated.
- Dental care procedures must only be performed by a veterinarian or competent individual working under direct veterinary supervision. Refer to provincial regulations.



Summary of Code Requirements (continued)

4.4 Lameness

- Lameness must be addressed either through specific therapies or changes in management or workload.

4.4.1 Laminitis (Founder)

- Horses with laminitis must receive appropriate lifelong management and treatment, which may include medications, dietary management and hoof care.

4.5 Body Condition Scoring

- For horses and ponies: corrective action must be taken at a BCS of 3 or lower and at a BCS of 8 or higher (on the 1-9 scale).^{*} Veterinary advice must be obtained if animals do not respond to the corrective action. Refer to *Appendix D*.
- For donkeys and mules: corrective action must be taken at a BCS of 2 or lower and at a BCS of 4 or higher (on the 1-5 scale). Veterinary advice must be obtained if animals do not respond to the corrective action. Refer to *Appendix E*.
- Veterinary advice must be obtained for geriatric equines that are emaciated (i.e. BCS of 1 or 2 out of 9 for horses and ponies; BCS of 1 out of 5 for donkeys and mules).
- Equines must not be starved or prevented from eating for prolonged periods in order to reduce BCS - the change in feed to reduce BCS must be gradual.

^{*}With the exception of horses in feedlots that are free from health conditions associated with obesity.

SECTION 5 Feedlot Management

5.1 Handling at Loading and Unloading

- The ground in the holding pen must be well-drained and non-slip.
- Horses must be handled in a manner that does not subject them to avoidable pain or avoidable injury.

5.2 New Arrivals

- Upon arrival to the feedlot, horses must be individually assessed for health and well-being and must be provided with water and good quality forage.
- Horses in groups must be managed in a way to minimize the risk of injury.

5.3 Feeding

- Feedlot horses must receive a diet that is adequate for maintaining health and vigour.
- Feedlot horses must have daily access to forage that is free from visible mould and has minimal dust.

5.4 Health Management in the Feedlot

- Feedlot owners must establish and maintain a Veterinary-Client-Patient Relationship (VCPR) with a practicing veterinarian.
- A written biosecurity and disease management plan must be in place and developed with a veterinarian.
- Feedlot horses must be observed at least once a day for health and well-being.
- Feedlot horses requiring medical treatment must receive such treatment and be identified. Feedlot horses to be held over for a drug residue withdrawal period must be sufficiently healthy and sound to withstand this period without undue suffering.



Summary of Code Requirements (continued)

- Records or receipts of treatments provided must be available.
- Drug withdrawal periods must be observed. For information on drug withdrawal periods, consult a veterinarian or the Meat Hygiene Manual of Procedures (*Appendix K* provides a reference for this manual).
- Hospital pens must be available and must provide shelter, bedding, dryness, and a source of feed and water. Hospital pens must also be cleaned between uses.
- Refer also to the Requirements in *Section 4-Health Management*.

5.5 Pen Condition and Shelter

- Feedlot owners must have a plan for mud management and access to any equipment necessary to implement the plan.
- A dry lying area must be available in each pen.

5.5.1 Stocking Density

- At a minimum, each horse must have enough space to move easily, walk forward, turn around with ease, and lie down in a normal resting posture. There must also be sufficient space for subordinate horses to escape aggression.

SECTION 6 Husbandry Practices

6.1 Turnout, Exercise and Social Opportunities

- Horses must have some form of exercise or turnout unless under stall rest for medical reasons or severe environmental conditions make this temporarily impossible. *Section 6.1* provides explanations for exercise and turnout.

6.2 Behaviour and Handling

- Handlers must be familiar with equine behaviour and competent in humane handling techniques either through training, experience or mentorship.
- Horses must be handled in a manner that does not subject them to avoidable pain or avoidable injury.

6.2.1 Handling and Restraint Equipment

- Corrective action must be taken if restraint devices or equipment cause injury to horses.
- Tethering must not cause injury and must only be used if the horse is under supervision. The person applying the tether must be knowledgeable in its use. *Section 6.2.1* provides an explanation of tethers.
- Electric cattle prods must not be used for the routine movement or handling of horses on-farm or during loading/unloading. Discretion must be used in an individual extreme situation when animal or human safety is at immediate risk, but prods must never be used repeatedly or used on the face, anus or reproductive organs of horses.

6.3 Principles in Training and Learning Theory

- Horses must not be trained in a manner that subjects them to avoidable pain or that causes them injury as a direct result of the training method used. They must never be subjected to training methods which are abusive or intentionally injure the horse. This includes, but is not limited to, soring, excessive use of whips or forcing the horse's head position by tying the horse to a fixed object. The glossary provides a definition of soring.
- Horses must only undergo training that matches their physical capabilities and level of maturity.
- Equipment in use must be maintained in good repair and must fit the horse correctly.



Summary of Code Requirements (continued)

6.4 Methods of Identification

- Animal identification must be performed in a manner that causes the minimum of handling stress and pain, regardless of the method used.
- If branding is necessary, do not brand horses on the jaw/cheek.
- When registering new brands, select an approved site other than the jaw/cheek. Consult the appropriate provincial regulatory authorities, breed registry or sport council for more information.
- Horses must never be branded when they are wet.

6.5 Castration

- Castration of donkeys, mules, and mature horses must only be performed by a veterinarian.
- Horses with one or more retained testicle or other scrotal abnormalities (e.g. hernias) must only be castrated by a veterinarian.
- Provincial regulations that restrict castration of horses to licensed veterinarians must be followed.
- Where it is not prohibited by law, castration by a person who is not a licensed veterinarian must only be performed by a skilled operator and must meet the following requirements:
 - there is a valid Veterinary-Client-Patient Relationship with a licensed veterinarian who is willing to supply training (on the procedure and pain management), prescribe the required drugs for pain control, and provide interventions if needed.
 - the scrotal area must be examined to ensure normal scrotal anatomy. If there is evidence of an abnormality, castration must only be performed by a veterinarian.
 - the handling and restraint methods must not cause injury or unnecessary suffering.
 - pain control must be provided. At a minimum, this must include a local anesthetic and a non-steroidal anti-inflammatory drug. Castration must not begin until the local anesthetic has taken effect.
 - the horse must be monitored during and after the procedure and, if complications occur, a veterinarian must be contacted without delay.

6.6 Alterations of the Tail

- Tail nicking and blocking are unacceptable and must not be performed.
- Tail docking for cosmetic purposes is unacceptable and must not be performed. Refer also to provincial regulations on tail docking, if applicable.

6.7 Hoof Care

- Hooves must be trimmed and/or shod as often as is necessary to maintain hooves in functional condition. Whether shod or unshod, hooves must not be allowed to grow to excessive lengths causing injury or discomfort to the horse.

6.8 Grooming

- Horses must be free of debris where the saddle and harness are placed. The tack must also be free from debris before being placed on the horse.
- Burdocks causing discomfort or injury must be removed without delay.

SECTION 7 Reproductive Management

7.1 Responsible Breeding

- Do not breed horses unless you are familiar with and able to provide the basics of care as outlined in this Code for both the mares/jennets and foals.



Summary of Code Requirements (continued)

7.3 Care of the Pregnant Mare or Jennet

- Mares/jennets requiring medical care during gestation must receive such care.
- Pregnant mares/jennets must have some form of exercise or turnout unless under stall rest for medical reasons or severe environmental conditions make this temporarily impossible.

7.4 Foaling

- A plan must be in place for the foaling process, including a plan for getting prompt expert advice or help if needed.
- Mares and jennets close to foaling must be observed at least twice a day for health, well-being and signs of foaling.

7.5 Care of the Newborn Foal

- Newborn foals must be monitored to ensure they can rise and suck unassisted.
- Appropriate care must be provided without delay if abnormalities in the foal are observed.

7.5.1 Colostrum

- Foals must receive colostrum or alternative care to maintain their health and vigour.

7.5.2 Weaning

- Facilities or fencing used during weaning must be safe and made of strong materials free from protrusions.
- Corrective action must be taken if the foal or mare/jennet injures themselves attempting to reunite during weaning.

SECTION 8 Transportation

8.1.1 Fitness for Transport

- Horses must be individually assessed for fitness for transport before being transported. Evaluate fitness for transport in the context of each trip and all relevant factors (e.g. anticipated total trip duration from farm to final destination and prevailing weather conditions).
- Unfit horses must not be transported, except for veterinary diagnosis or treatment and only if special provisions¹ are met.
- Refer to *Appendix H-Transport Decision Tree*.

8.1.2 Preparing Horses for Transport

- If the expected duration of the horse's time without access to feed or water is longer than 24 hours, the horse must be fed and watered within four hours before being loaded. Horses must not be without access to feed, water, or rest for more than 28 hours².

¹ Section 139 (2) in Part XII (Transport of Animals) of the Health of Animals Regulations specifies four conditions that must be met when transporting unfit animals for veterinary care, including the recommendation of a veterinarian (31). Refer to Appendix H: Transport Decision Tree.

² Section 152.2 (1) (c) in Part XII (Transport of Animals) of the Health of Animals Regulations specifies that equines have to be provided with feed, safe water and rest at intervals that do not exceed 28 hours. As per section 152.2 (4), an interval begins: (a) when the animal was last fed; (b) when the animal was last given safe water; and (c) when the animal was last rested for a minimum of eight consecutive hours (31).



Summary of Code Requirements (continued)

8.2 Loading and Unloading

- The requirements for loading and unloading procedures and equipment as described in the Health of Animals Regulations must be complied with³.
- Mares and jennets that are in the last 10% of their gestation periods⁴ must not be transported.
- Every mare with its suckling offspring must be segregated from all other animals during transport.
- Every mature stallion must be segregated from all other animals during transport.
- Horses must be individually assessed before loading and upon arrival back to the farm.
- Refer to *Appendix H-Transport Decision Tree*.

8.2.2 On-Farm Management Post-Transport

- Horses must be provided with water upon arrival to the farm.

SECTION 9 Change or End of Career

- The welfare of the horse must be of paramount importance when making change or end of career decisions.

SECTION 10 Euthanasia

10.1 Timelines for Euthanasia

- Equines that are sick, injured or in pain must receive appropriate treatment without delay or be euthanized without delay.
- For sick, injured or compromised horses that are not showing improvement, horse owners or caregivers must, without delay, obtain veterinary advice on appropriate care and treatment or make arrangements for euthanasia.

10.2 Methods

- An acceptable method of euthanasia must be used.
- Euthanasia must be performed by persons knowledgeable in the method used for equines.
- Disposal must be in accordance with provincial and municipal regulations.

10.3 Confirmation of Death

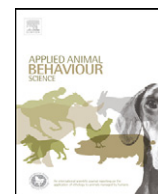
- Confirm unconsciousness immediately when it is safe to do so.
- Have a secondary euthanasia step or method available.
- Confirm death before moving or leaving the animal.

³ Section 145 (1) in Part XII (Transport of Animals) of the Health of Animals Regulations prohibits loading and unloading in a manner that is likely to cause the animal's suffering, injury or death. Section 145 (2) also requires that fixed or movable ramps, gangways, chutes, steps and other equipment used for loading and unloading animals meet the following requirements (31):

- they can bear the weight to which they are subjected without collapsing, twisting, breaking or bending;
- they have sides of sufficient strength and height to prevent animals from falling off;
- they have a surface that is designed, constructed and maintained to prevent the animal from tripping, slipping and falling;
- they are placed so that there is no unprotected gap through which the animal could trip, slip or fall; and
- they cannot have a slope greater than 30 degrees.

⁴ Section 136 (1) in Part XII (Transport of Animals) of the Health of Animals Regulations defines animals in the last 10% of gestation as "unfit". Section 139 (2) specifies four conditions that must be met when transporting unfit animals for veterinary care, including the recommendation of a veterinarian (31). Refer to Appendix H: Transport Decision Tree.

Appendix B Birke et al (2011)



Horses' responses to variation in human approach

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ABSTRACT

The behaviour of humans around horses is thought to have a substantial impact on how people are perceived in subsequent interactions and many horse trainers give detailed advice on how handlers should behave when initially approaching a loose horse. Here we report on three studies designed to explore the effect of different human approach styles on the behaviour of naïve and experienced horses.

In the first study, the change in flight distance (distance at which horses started to avoid an approaching human) of twelve semi-feral Dartmoor ponies, undergoing training to allow handling, was assessed. Over the 10 handling sessions median flight distance decreased significantly ($p < 0.001$) from 2.38 m to 0.00 m and there was a significant positive shift in the ponies' behaviour following the appearance of the researcher ($p = 0.002$).

In a second study the effect of a direct (vigorous, swinging a lead rope and with eye contact) versus indirect (relaxed, no rope swinging and without eye contact) approach style was assessed on six adult experienced riding horses. The mean flight distance during a direct approach style (6.87 m) was significantly greater than that which occurred during an indirect approach style (2.32 m). Direction of approach was not found to significantly affect flight distance.

In a third study, the effect of the rope was removed and a similar method to the second study applied to a group of naïve, feral ponies. The effect of different components of approach style, speed of approach, handler body posture and direction of gaze, which might contribute to observed differences in behavioural responses, were then examined systematically in this population. This revealed no significant difference in mean flight distance between the two approach styles (2.28 m indirect versus 2.37 m direct approach), but ponies were significantly more likely to move off in trot ($p = 0.025$) and to travel further ($p = 0.001$) when a direct approach was used. Speed of approach was the most salient factor, with a fast approach increasing both the tendency to move off in trot ($p < 0.001$) and distance travelled ($p < 0.001$). Body posture (relaxed or tense) had no effect, while flight distance was significantly greater when the person was looking away ($p = 0.045$).

These results suggest horses may have an important egocentric spatial barrier, which perhaps relates to personal space and triggering of the flight response. Contrary to popular belief, body posture did not appear to be very important in the contexts examined unless accompanied by extraneous aids, while the speed of approach is particularly significant. These results are of important practical relevance in reducing the risk of injury, and the effective management of horses with minimal stress.

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1. Introduction

Domestic horses spend their lives in relatively close contact with people, and human behaviour has considerable potential to affect their welfare. Recent work has looked at the effects of handler behaviour on the welfare of a range of captive species in different contexts, e.g. in agriculture, where livestock productivity may be adversely affected (reviewed in [Hemsworth, 2003](#)); or in zoos, where the activities of visitors can provoke aversive reactions ([Hosey, 2005](#)), while in laboratory animals, differences in physiological reactions to painful stimuli have been demonstrated resulting from different handlers ([Chesler et al., 2002](#)).

Despite the importance of human-horse interaction to the utility of horses, there is relatively little research on human interactive behaviour towards them, such as effects of posture and direction of gaze ([Hausberger et al., 2008](#)). Also, with increasing numbers of leisure horses in recent years, comes considerable variation in conditions of husbandry and expertise of handlers ([British Horse Industry Confederation, 2005](#)), with implications for both equine welfare and human safety. The review by [Hausberger et al. \(2008\)](#) identified research on horses' reactions to a motionless human, to human approach and touch. They note that direction of gaze, posture, positioning and speed of approach of the human are often poorly specified in these studies, and call for further research detailing how these specific variables affect horses' reactions. Such research has important applications in handler education to minimise the risk of injury, and in horse welfare where handler confidence may promote greater cooperation from the horse ([Chamove et al., 2002](#)).

The body posture adopted by a handler towards a horse is an explicit consideration in what has been called "natural horsemanship", which is becoming increasingly popular ([Birke, 2007](#)); natural horsemanship trainers frequently suggest approaching horses in a "soft", relaxed manner. For example [Roberts \(1996\)](#) claims that approaching naïve horses face-on with direct eye contact encourages them to flee, whereas a person approaching obliquely, at 45°, and not looking directly at the horse invites contact. Some trainers suggest that looking directly at the horse allows the human handler to maintain control, while others argue that direct gaze should be avoided ([Verrill and McDonnell, 2008](#)).

The degree to which horses respond to specific human body postures, movement or direction of gaze by an approaching person has been little studied, in either naïve animals or those habituated to frequent handling. This paper reports three small studies, done in separate locations, each of which investigated horses' responses to different human approach style, particularly differences between direct and indirect approach. Study 1 used semi-feral native Dartmoor ponies to examine flight responses before and after human handling. This study tested the hypothesis that the flight distance (that is, the distance from an approaching human at which the ponies would take flight) would decrease after handling. An "indirect" approach was used, which involved moving towards the ponies with the person's body angled, and no direct eye contact. Studies 2 and 3a, by contrast, compared effects of a similar indirect approach to a direct one, in which the per-

son approaching faced the animals, with an upright stance and looking at them. These studies tested the hypothesis that a direct approach would lead to stronger flight responses, using adult, well-handled horses (Study 2), or naïve semi-feral Welsh Mountain ponies (Study 3a). However, approach style, whether direct or indirect, is in effect a compound stimulus comprised of three different components of handler behaviour: body posture, direction of eye gaze and speed of approach. Study 3b aimed to dissociate these three parts of the compound stimulus and examined the effect of each component on the flight response and behaviour of naïve semi-feral Welsh Mountain ponies.

2. Methods and results

2.1. Study 1

2.1.1. Materials and methods

2.1.1.1. Subjects and housing. Twelve feral Dartmoor ponies were used (7 fillies; 5 geldings). They were taken from the moor in the autumn, and housed at a lairage on the edge of Dartmoor prior to testing and preparation for sale. Prior handling varied between subjects and included gelding or identification procedures such as branding and ear tagging on a previous occasion, but this was a considerable time earlier and at other sites, so they were naïve about the test site per se. The ponies received no other scheduled handling, and had not previously encountered the researcher. They were between 12 and 24 months at the time of testing.

2.1.1.2. Procedure and design. On arrival at the lairage, ponies were released into a pen as a group. For testing, individual ponies were separated and moved by an experienced researcher using just their body language and positioning to direct the selected animal through a gate into an empty adjacent high-sided pen (3.5 m × 8 m) for measuring and handling. This restricted visual but not auditory contact between subjects. After 2 h acclimatisation, during which animals were left without human contact, and appeared to become more relaxed, the controlled handling procedure began: on entering the pen, the researcher stood motionless for 30 s, with a relaxed, indirect stance (body slightly angled, no direct eye contact). The orientation of the horse's head relative to the researcher, and the direction of any movement in response to the entry of the researcher, was noted at this time. Head and feet movements were scored as no response (neutral), turned away from the human (avoidance), or towards (investigatory). The horse was thus given the opportunity to move to whatever distance from the researcher it preferred during this initial 30-s period. The next stage was not commenced until after the 30 s of exposure to the researcher, and the horse was stationary. Then the researcher began to approach in a line towards the horse's right shoulder, using an indirect stance. Approach stopped once the pony moved its feet to take a step, and flight distance in response to researcher approach was then measured at this time, using a Trimble HD360 handheld laser as the distance from researcher hip to horse shoulder at the time when the pony first moved off. The researcher continued to approach and pause until she was

Table 1

Study 1: changes in flight distance of naive young ponies over handling sessions ($N = 12$).

Session	Mean flight distance $\pm$ S.D. (in m)
1	2.40 $\pm$ 0.54
2	2.10 $\pm$ 0.54
3 ^a	1.66 $\pm$ 0.66
4	1.19 $\pm$ 0.62
5 ^a	0.97 $\pm$ 0.77
6	0.77 $\pm$ 0.48
7 ^a	0.54 $\pm$ 0.68
8	0.43 $\pm$ 0.37
9 ^a	0.15 $\pm$ 0.31
10	0.07 $\pm$ 0.17

Flight distance = the distance from an approaching human at which the ponies took flight.

^a Sessions following handling procedures.

able to make contact with the horse and undertake a pre-defined handling procedure. The handling procedure was undertaken by the same experimenter throughout (LP) and comprised: touching with a rope to familiarise the pony with pressure, introduction to the halter and haltering; leading from the halter. The ponies were then taught basic skills (picking up feet, tying up, loading into trailer) and introduced to novel objects (e.g. umbrella, football). This procedure conformed to a handling method called Positive Horsemanship (www.positivehorsemanship.com). Measurements of the orientation and movement of the head and feet in response to the appearance of the researcher in the pen and flight distance were recorded over 10 sessions over 6 days, as follows: initial measurements (day 1), before and after handling procedures (i.e. twice on days 2–5), and prior to ponies being moved for sale (day 6).

2.1.1.3. Data analysis. Data were analysed using Minitab 15 and were not normally distributed so a Kruskal–Wallis test was used to evaluate the effect of session number and individual horse identity on flight distance separately. A Chi-square test was used to compare frequencies of head and foot position (avoidance, neutral or investigatory) in response to the appearance of the researcher, before versus after the handling sessions (i.e. sessions 2–9 inclusive). To assess the overall change in the horse's behaviour, the head and foot responses of the horses in the first and last session were compared using a Wilcoxon sign test, with an improvement (i.e. avoidance to neutral or investigatory), scoring positively, no change scoring zero and a deterioration scoring negatively.

2.1.2. Results

2.1.2.1. Flight distance. Ponies showed a significant decrease in their flight distance over the 10 sessions ($K-W = 79.97$, 9 d.f., $p < 0.001$), with average flight distance falling by 97% over the 10 sessions (Table 1). The effect of individual horse was also significant ($K-W = 22.78$, 11 d.f., $p = 0.019$).

2.1.2.2. Behavioural response: head and foot position. In the first session 8 horses turned their head away and 7 of these also moved away in response to the appearance of the researcher, all other responses were neutral. In the final

session, only 1 horse turned its head away, 3 were neutral and the remaining 8 turned their head towards the researcher; 1 moved away, 5 were stationary and 6 moved towards the researcher. Changes in orientation from away to either no movement or towards the researcher, or from no movement to towards the researcher, were considered positive. The recorded changes in head and foot movement were significant (head movement: 11 positive and 1 no change: $p = 0.002$; foot movement: 11 positive and 1 no change: $p = 0.002$).

Concerning the sessions immediately preceding and following handling, there was a significant change in head orientation, with greater investigatory and reduced neutral or avoidance movement occurring in the sessions following handling ($\chi^2 = 7.6$, 2 d.f., $p = 0.022$).

The effect on leg movement was not significant, with the majority of sessions evoking a neutral response ($\chi^2 = 4.025$, 2 d.f., $p = 0.13$). This is consistent with handling having a specific effect on the ponies' perception of people, rather than a simple time dependent effect.

2.2. Study 2

Study 1 demonstrated that repeated exposure to humans using indirect approaches and careful handling over a period of 6 days, led to a reduced flight distance and more orientation towards the human, by ponies that had previously had little handling. Study 2 examined the responses to two different approach styles in adult subjects with considerable experience of handling.

2.2.1. Materials and methods

2.2.1.1. Subjects and housing. Six domesticated horses were used, housed at the Equestrian Centre, University of Lincoln, who were normally stabled for part of the day. They were three mares and three geldings, of mixed breeding, aged between 15 and 20 years old (mean age = 17) and between 15.1 hands (155 cm) and 17.2 hands (178 cm) in height.

2.2.1.2. Procedure and design. Subjects were turned loose individually into an outdoor arena, 60 m $\times$ 20 m, with an artificial substrate. Once the horse was stationary, one researcher (JM) began to approach, from a distance of approximately 10 m, at a practiced speed (0.8 m/s). Once the horse moved away, approach stopped. Approaches followed 8 different paths, counterbalanced between subjects: one each direct to the front or back of the horse, and one towards each of the following: the shoulder, middle or quarter, from the left or right. This controlled for effects of approach direction: an examination of results post hoc indicated that direction of approach was not significant.

Each horse was tested with the eight approaches three times for a given approach style to obtain means for each individual. Two approach styles were used, in counterbalanced order: these were:

Direct – with direct eye contact, and gently swinging a lead rope in the right hand.

Table 2

Study 2: mean flight distance for individual adult horses, direct versus indirect approach (N=6).

Horse	Mean flight distance $\pm$ S.D. (in m)	
	Direct	Indirect
A	9.49 $\pm$ 3.4	3.46 $\pm$ 3.97
B	2.70 $\pm$ 1.6	4.30 $\pm$ 1.99
C	8.11 $\pm$ 3.63	1.01 $\pm$ 1.44
D	7.08 $\pm$ 2.52	0.18 $\pm$ 0.34
E	8.04 $\pm$ 2.08	1.86 $\pm$ 2.8
F	5.81 $\pm$ 2.03	3.13 $\pm$ 3.1

Flight distance = the distance from an approaching human at which the horses took flight.

Indirect – no direct eye contact, and the lead rope held still in the right hand.

Flight distance was calculated from recordings made using a Trimble HD360 hand-held laser by a second researcher who remained stationary, in line with, but behind, the path taken by the first researcher towards the horse.

The horse's responses after each approach were observed using focal behaviour sampling and continuous recording, to measure movements of head or ears, or other behaviour, such as bucking. Bucking was defined as a lowering of the head and neck and shifting of the weight to the forelegs with both hind legs lifted off the ground in simultaneous backward extension (McDonnell, 2003).

2.2.1.3. Data analysis. Data were analysed using Minitab 15 and were not normally distributed. They were analysed using non-parametric tests to examine the effects of individual horse, approach style and direction of approach on flight distance. Chi squared tests were used to assess the association between specific behaviours and approach style.

2.2.2. Results

2.2.2.1. Flight distance. Style of approach had a significant effect on flight distance (Wilcoxon signed rank test = 9910, $p < 0.001$). The mean flight distance of horses approached directly was 6.87 m, and 2.32 m when approached indirectly (Table 2). There was significant individual variation in both circumstances (K–W Direct = 68.38, 5 d.f., $p < 0.001$, K–W Indirect = 12.55, 5 d.f., $p = 0.028$). There was no effect of direction ($p > 0.9$ in both instances), which is consistent with horses having a wide field of view.

2.2.2.2. Behavioural response. Head movement ($\chi^2 = 4.74$, $p = 0.029$), movement of one ear ($\chi^2 = 16.72$, $p \leq 0.001$) and both ears ($\chi^2 = 16.72$, $p \leq 0.001$) occurred significantly more often in association with indirect approaches (head movement was observed 12/144 direct approaches, 32/144 indirect; movement of one ear 10/144 direct, 36/144 indirect; movement of both ears 6/144 direct approaches, 32/144 indirect). Bucking was found to be significantly associated with the direct approaches ($\chi^2 = 13.62$, $p < 0.001$) being observed 12/144 direct approaches but not seen at all in response to indirect approaches.

2.3. Study 3

The first two studies indicated similar flight distances in response to indirect approaches in quite different captive populations (2.43 m in session one of Study 1 – naïve ponies; 2.3 m overall in Study 2 – horses accustomed to frequent handling). Study 2 also showed that direct approach accompanied by a swinging rope led to a threefold increase in mean flight distance (mean = 6.9 m) by well handled horses. The rope's movement could not, however, be dissociated from the researcher's approach style. Study 3 used naïve, feral ponies to compare responses to approaches differing only in the person's style (direct/indirect: Study 3a). A second experiment on the same group of ponies (Study 3b), examined separately the different components of approach style, speed of approach, handler body posture and direction of gaze, which might contribute to observed differences in behavioural responses.

2.3.1. Materials and methods

2.3.1.1. Subjects and housing. Thirty-six semi-feral Welsh mountain ponies (26 colts and 10 fillies) were used in two experiments. The ponies were 6–8 months old for Study 3a and 9–11 months old for Study 3b. The ponies were semi-feral until rounded up and transported to the study site (lairage in Buckinghamshire) 2 months prior to Study 3a. The ponies were housed in two mixed groups: 16 were housed in a 25 m $\times$ 8 m barn (A), and 20 in a 32 m $\times$ 8 m barn (B), separated from each other by a central walkway. Each group had access to an outside concrete yard of approximately 200 m². Apart from a brief veterinary examination in a crush shortly after arrival, they had little individual attention from caretakers.

2.3.1.2. General testing procedure. A temporary corral (9 m $\times$ 8 m) inside the home barn of the horses was used for testing. To avoid additional stress due to social separation, the ponies were tested in groups of three (Study 3a) or two (Study 3b). Allocation to groups was by convenience sampling, with ponies in close proximity in the barn tending to be grouped together. After each test procedure, the group was moved to the outside yard. To ensure that ponies were not left alone, not all animals were used at any one time. Study 3a used a total of 10 groups each consisting of three ponies.

In Study 3b, convenience sampling was again used, and pairs of ponies allowed to move into the corral naturally before the corral was closed off for testing. This was done over 2 days: 18 pairs of ponies were tested on one experimental day, and 17 pairs the following day, with allocation to testing conditions done in a balanced design. No individual was run in the same pair on the 2 days of testing, so that each pairing was unique. Thus, this study used groups or pairs rather than individuals as subjects, although data were recorded only from the first pony to move.

Inside the test corral a few pony nuts and/or carrots were pooled on the straw 4 m from the researcher waiting at the end of the corral. This attracted the ponies to one area to allow standardised start conditions for each trial. Each trial began when the group had been quietly eating for 1 minute and all were orientated towards the experimen-

ter (which they did naturally). The researcher approached the group according to the test condition until reaching the ponies' start point. The experimenter returned to the start position and the ponies were permitted to settle back before the second trial began. All trials were recorded on video, using a camera placed alongside the corral, opposite the feeding point.

The same researcher (JH) was used throughout and was trained until able to adopt a standard body posture, pace length and speed for each test condition. As in the previous studies, the researcher was a person unfamiliar to the ponies, though in this case wore dark red overalls identical to the ones worn by the animals' daily caretakers.

2.3.2. Study 3a

2.3.2.1. Study specific procedure and design. The aim of this experiment was to investigate effects of direct versus indirect approaches on the flight behaviour of the pony groups. It was a within subjects design, with a researcher approaching each of 10 test groups of three ponies directly and indirectly counterbalanced for order effects between groups. Once the ponies had moved away from the first approach, the researcher allowed them to settle, and return to the feeding site, before the second approach began.

In the *direct* condition the researcher walked assertively towards the ponies, adopting a tense, upright stance, with head and shoulders facing square onto the pony group, and eye gaze focused onto the group. In the *indirect* condition the researcher adopted a more relaxed posture, with relaxed upper body turned 45° away from the direction of movement, and eye gaze averted from the ponies. The researcher approached the middle of the pony group in each test, taking care to avoid directing their approach on an individual pony. Due to the way the ponies orientated themselves around the food on the ground while keeping the researcher in their field of view this was easily done.

Flight responses were coded from the video recordings as follows:

- distance of the researcher from the pony group when the first pony lifted its head (alert response (m));
- distance of the researcher from the pony group, when the first pony moved off (flight distance (m));
- distance of flight around the corral after first movement (the distance the first pony fled (m));
- pace of flight of lead pony (pace = walk or trot).

Distances were measured using a perspex perspective grid placed over the monitor screen to record the number of grid squares travelled (lines on grid = 1 m).

2.3.2.2. Study 3a: data analysis. Measures of distance in this study were found to be normally distributed, and distance data from experiment one were analysed using *t*-tests (SPSS v.14), to compare effects of the two types of approach. Data for pace of flight were analysed using a chi-squared test.

2.3.2.3. Study 3a: results. Flight distances in this experiment were similar to those observed in the previous two

Table 3

Study 3a: responses of naive young ponies, direct versus indirect approach (*N* = 10 groups of three).

Variable	Mean ± S.D. (distances in m)	
	Direct	Indirect
Alert response	2.78 ± 0.47	2.58 ± 0.83
Flight distance	2.37 ± 0.73	2.28 ± 0.85
Distance travelled	11.2 ± 1.58	7.10 ± 2.24

Flight distance = the distance from an approaching human at which the ponies took flight.

studies. However, there were no significant differences between direct and indirect approaches in flight distance or distance at first alert response (Table 3). There was a significant difference in distance travelled by the ponies ($t_9 = 5.23$, $p = 0.001$), and they were significantly more likely to move off in trot than in walk in response to direct approach ($\chi^2_{325} = 8.6$; $p < 0.025$).

2.3.3. Study 3b

2.3.3.1. Study specific procedure and design. The general test procedure was the same as for Study 3a (see Section 2.3.1.2). However, as the ponies were slightly older for Study 3b, they were tested in pairs rather than in groups of three. Pony pairs were tested with body posture (relaxed or tense), eye gaze ("on" the horse or "off"), and speed (fast or slow). The effects of body posture and eye gaze were tested between subjects (pairs of ponies). This was done in a counterbalanced design, so that each temporary pairing was allocated to one of four test conditions: relaxed/gaze on, relaxed/gaze off, tense/gaze on and tense/gaze off). However, speed of approach was tested within subjects, as a repeated measure, with pony pairs tested twice (as was done in Study 3a): the slow speed trial (approach at 0.6 ms^{-1}) always preceded the fast trial (1.2 ms^{-1}) to minimise any sensitisation effects arising from the fast approach, although data from Study 3a had not indicated any sensitisation effects on responses on the second trial. As in the previous experiment, the following were measured from the video recording: alert response (distance from researcher at first head-up); flight distance (distance from researcher when group moved off); pace of flight; and distance fled around the corral.

2.3.3.2. Study 3b: data analysis. The data from this experiment were normally distributed. The design combined between subject measures (posture, and direction of gaze) and within-subjects measures (speed of approach), requiring a mixed between-within subjects Analysis of Variance (Pallant, 2007), using SPSS v.14.

Chi-squared and Wilcoxon tests were used to analyse pace of flight (walk away versus trot away).

2.3.3.3. Study 3b: results. Table 4 shows distances from researcher at first alert, flight distance (FD), and the distance travelled after first moving away, in response to experimental variables (speed, approach style, direction of gaze).

Alert response: The multivariate analysis showed a significant effect of eye gaze; that is, alert responses

Table 4

Study 3b: responses of ponies to different approach speed (slow/fast), approach style (relaxed/tense) and gaze direction (on/off): total N = 35 pairs.

Response to approach	Mean $\pm$ S.D. (distances in m)			
	Relaxed		Tense	
	Gaze on	Gaze off	Gaze on	Gaze off
Alert				
Fast approach	2.5 $\pm$ 0.8	2.3 $\pm$ 0.9	2.2 $\pm$ 1.0	3.0 $\pm$ 0.5
Slow approach	2.1 $\pm$ 1.2	3.2 $\pm$ 0.7	1.9 $\pm$ 0.9	2.4 $\pm$ 1.3
Flight distance				
Fast approach	2.0 $\pm$ 1.0	2.2 $\pm$ 0.9	1.7 $\pm$ 0.9	2.4 $\pm$ 0.8
Slow approach	1.7 $\pm$ 1.1	2.6 $\pm$ 0.9	1.4 $\pm$ 1.1	1.8 $\pm$ 1.2
Distance travelled				
Fast approach	5.3 $\pm$ 1.9	5.9 $\pm$ 2.0	7.4 $\pm$ 2.0	4.9 $\pm$ 1.8
Slow approach	3.5 $\pm$ 1.8	2.8 $\pm$ 1.8	2.7 $\pm$ 1.7	3.2 $\pm$ 1.9

Flight distance = the distance from an approaching human at which the ponies took flight.

occurred at a greater distance from the researcher with eye gaze off ($F_{1,31}=4.17$; partial eta squared = 0.12; $p=0.05$). There was no significant effect of approach style. There was a significant speed $\times$ body posture $\times$ eye gaze interaction for within-subject contrasts (Wilk's lambda = 0.85; $F_{1,31}=5.35$; partial eta squared = 0.15; $p=0.028$), suggesting that the effect of eye gaze was affected by approach speed (slow approach with eyes off led to alert responses at a greater distance than other approaches).

Flight distance: There was one significant between-subjects effect, for eye gaze (on versus off): flight distance was greater (that is, flight was initiated sooner) when eye contact was off the horse ($F_{1,31}=4.38$; partial eta squared = 0.12; $p=0.045$). There were no other significant effects.

Distance of flight: There was a significant effect due to speed, with ponies travelling further in response to a fast approach (Wilk's lambda = 0.24; $F=96.2$; partial eta squared = 0.76; $p<0.0001$), and a significant interaction between speed $\times$ body posture $\times$ eye gaze (Wilk's lambda = 0.69; $F_{1,31}=14.0$; partial eta squared = 0.311; $p=0.001$); the greatest distance travelled was in response to fast speed, with tense posture and eyes on.

Pace of flight: The chi-square test showed a significant effect of treatment group ($\chi^2=26.2$; d.f. = 7; $p<0.001$). Separate examination of groups indicated that trot occurred significantly more often after fast approach (Wilcoxon $Z=4.36$; $p<0.0001$).

3. Discussion

Taken together, these separate studies indicate that both naïve and experienced horses, whether alone or in a group, show similar reactions to an initial approach by an unknown individual, with a flight response being triggered initially at around 2.5 m. Austin and Rogers (2007), examining the symmetry of flight responses and turning in horses, also reported an overall mean around 2.5 m, although they also report this may vary with side of approach and direction of turn, which we did not find. The consistency of this initial flight distance across the different populations studied is quite remarkable, but consistent with Heidegger's proposal (Heidegger, 1950) that the natural flight distance of an animal may be relatively hard-wired, which has been supported by more recent neurophysiolo-

gical work on egocentric spatial thresholds (e.g. Graziano and Cooke, 2006). Egocentric space refers to the definition of space by reference to the observer's own position within it and includes concepts such as personal space. This might be considered to be the distance at which an important psychological boundary is crossed, which has the potential to result in some form of avoidance response, similar to initial touch. Naturally there may be many other important boundaries and the significance of this boundary might be altered by learning as well as other factors which might trigger an avoidance response more readily (i.e. result in a greater flight distance). This is particularly likely to be the case in feral animals in an open environment.

Horses in these studies generally responded to approach by moving away, but "hard" approaches by a person led to stronger responses than "softer" ones. This is consistent with the suggestion made by natural horsemanship practitioners that a direct approach, facing the animal with a tense body posture and making eye contact is more likely to elicit flight. In Study 1, daily routines were designed to familiarise naïve ponies to the initial presence of a human, to human handling and to stable management practices (grooming, picking out feet, for example). This study demonstrated that the ponies' initial flight responses could be reduced as they became habituated to the presence of people and such procedures; over just 5 days with 2 exposures a day flight distance decreased and they displayed greater orientation towards the researcher and accepted their approach more readily. At the beginning of the training, these naïve ponies had little experience, and so little potential to predict human actions and body positioning on the basis of any learning. Indeed the main experience of people was likely to have been aversive as it was associated with branding or tagging and possibly castration. It is therefore somewhat surprising that even older, experienced, horses, such as those used in Study 2, reacted to similar human approach at a similar distance. The horses used here were accustomed to the routines of the riding school; such experienced horses would be expected to react positively to confident people when being handled, as Chamove et al. (2002) suggest. However, horses' perceptions of humans can be affected by prior experience of interacting with people (Fureix et al., 2009), and riding school horses might learn to associate human approach with negative outcomes (work, being ridden by inexperienced

ced novice riders). The greater flight distance and incidence of bucking observed after “hard” approaches in this study may, moreover, have been partly a reaction to the swinging rope, which could increase the arousal elicited by the approaching human.

Approach styles are compound stimuli. “Soft” or “hard” approaches may differ, for example, in body posture, speed or approach, how humans look at the horse, or whether they carry things in their hands. Study 3a confirmed that direct approaches lead to greater arousal and stronger reactions, particularly in the speed of movement (trot versus walk) and distance moved from the human. The study also demonstrated that there was little effect of varying approaches on flight distance when a rope was not used. The distance from the human at which animals became alert (head up) or moved off remained fairly constant, and was consistent with findings from the previous two studies. There were, however, notable differences in response intensity – pace of movement, and distance moved.

The purpose of Study 3b was to tease out some of the stimulus components involved, particularly in relation to the behaviour of the human. Contrary to claims made by many practitioners, body posture per se does not seem to be important: ponies reacted similarly to humans with “hard”/tense or “soft”/relaxed body tone. There was a small effect of eye gaze direction – but, surprisingly, eye gaze away led to the ponies reacting sooner. Direct eye gaze (staring) can be perceived as a threat in some vertebrate species, such as dogs (Bradshaw and Nott, 1995), macaques (Coss et al., 2002) and iguanas (Burger et al., 1992). Staring similarly elicited more locomotor movement and vigilance behaviour by sheep than indirect gaze (Beausoleil et al., 2006). In horses, by contrast, Verrill and McDonnell (2008) found no difference between the effects of direct eye contact versus looking away on the ease with which a researcher could catch a horse in a pasture. Horses, like many other species such as dogs (Soproni et al., 2001) and jackdaws (von Bayern & Emery, 2009) are clearly sensitive to human gaze patterns, since Proops and McComb (2010) have shown that individuals with long experience of handling choose humans whose visual gaze is directed at them in food-related discrimination tasks.

The ponies in Study 3 were little handled, but the encounters they had previously had with humans were likely to involve humans looking directly at them before or during a direct approach. These ponies would be expected to make an assessment, similar to the vigilance responses shown by sheep (Beausoleil et al., 2006) and perhaps humans approaching with averted gaze might be a less familiar and unpredictable stimulus, so eliciting quicker reactions.

By far the strongest effect on flight behaviour was due to approach speed. Fast approaches led to more intense responses (faster pace, further distance travelled). This finding corroborates claims made by many horse trainers that approaching horses “softly” has less effect on their flight, but dissects out a key feature of this style of approach. Thus, in practice people need to modulate speed, rather than body posture to avoid arousing the horse excessively. Personal observations by the authors, suggest that many individuals involved in “natural horsemanship”

approach much faster when using their direct “hard” form of approach. This is consistent with the suggestion that the distribution of ganglion cells and retinal structure of horses, like many prey species, is such that it allows particular sensitivity to movement and acceleration (Saslow, 2002).

Taken together, these three separate studies indicate that horses react more strongly if approached in certain ways. Of particular importance is their response to faster or more direct human movement – not only do they react more quickly but also they are more likely to move off at a faster pace, indicating a startle response. There are clearly implications for human safety in how quickly such large animals respond, particularly if startled.

4. Conclusion

These studies support the general claim made by many trainers that how people approach horses affects the animals’ responses. Speed is a particularly salient factor, but body posture, contrary to trainers’ claims, does not appear to be important. How horses are approached prior to handling is important not only for the animals’ welfare, but also in terms of human safety; moving slowly is clearly preferable.

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Appendix C Masuda et al (2008)

—NOTE—

Flight Distance and Avoidance Score in Thoroughbred Foals and Yearlings and the Relationship with Handling Frequency in the Young Ages

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Flight and avoidance reactions from human were examined using 168 postweaning Thoroughbred foals in 22 breeding farms. Further 114 yearlings of 168 foals were tested in the following summer. The foal handlings by the stabler were asked in questionnaire. The relationship between the behavioural reactions and the foal handling frequencies was analyzed. The flight reaction was estimated as the distance from the animal to a stranger when the animal began to flight away from his approach. The avoidance scores were set up from (1) (not resistant) to (5) (touch rejection) from human touching. In the stabler questionnaire, handling frequencies of "body brushing", "rectal temperature measurement", "hoof cleaning", and "stall cleaning" in the early nursing period were asked. The handling frequencies were scored from (1) (not done) to (5) (every day). In the preliminary test, a measurement reliability of the flight distance and the avoidance score was confirmed. The mean flight distances were 0.56 m and 0.27 m in the postweaning foals and the yearlings, respectively. Touch-avoidance scores of the highest frequency were (3) and (2) in the postweaning foals and the yearlings, respectively. As the results of Spearman's rank-correlation analysis, "body brushing" showed highly negative relationships with "flight distance" ($\rho=-0.31$, $P<0.001$) and "avoidance score" ($\rho=-0.37$, $P<0.001$) in the postweaning foals. In the yearlings, "hoof cleaning" also showed significantly negative relationships with these behavioural indices ($\rho=-0.24$, $P<0.01$; $\rho=-0.22$, $P<0.01$, respectively).

Key words: avoidance score, flight distance, foal handling, Thoroughbred foal, Thoroughbred yearling

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Although thousands of years have passed since some wild animals were domesticated, the domestic animals still hold similar, sensitive temperaments as their ancestors [7, 11, 13, 15, 18]. Horses need escape and evasion from carnivores. Horses also have fear of strange circumstances, such as strangers, novelty objects, large noises, fire, and so on [2, 20, 21, 23].

Dairy cows remember the persons or the circumstances from which they experienced pains [14, 17]. Gentle and friendly handlings for young horses will decrease the fear, and aversive handlings will

increase the fear in foals [10]. The animal fear of humans can cause injuries in both of animals and humans, and it results in the productivity reduction. The fear can be guessed by their behaviour of a flight away from human approach and an avoidance reaction from human touch [5].

In general in Thoroughbred raising in Japan, foals are nursed and raised in breeding farms of small scale. After the next summer of birthyear, yearling colts and fillies are raised and trained in training farms of large scale. A large part of the characters of the Thoroughbred yearlings will be formed in the progress of nursing and raising in the young ages. Horses of gentle characters are desired for race in future [9].

Horse behaviour researches were performed in "test

areas" for flight [12] and for approach and body touch [19, 22]. The measurement in "test area" enables measurements of many kinds of behaviour, however, the standardized "test area" setting in private farms might rather lead inaccurate test results, because the new, separate surrounding will affect the psychological state of animals. An individual person is distinguished by horse [8] and also by cattle [3, 14]. Contacts of animal with persons were generalized in horses [6]. Therefore, in the measurement and evaluation of the reaction behaviour, a stranger for animals is required.

In the preliminary test in November, 2003, measurement value reliabilities of the reaction tests were confirmed. The preliminary test was performed using 36 Thoroughbred foals in 6 farms of all the 168 foals in 22 farms. Further in the following summer, 28 yearlings of all the 114 yearlings were also used for the preliminary test.

In the main test, 168 Thoroughbred foals (81 males, 87 females) born in spring, 2003, in Mitsuishi-cho, Hokkaido, Japan, were used for "human approach-horse flight away (approach-flight away)" test and "human touch-horse avoidance (touch-avoidance)" test. The foals were nursed and raised in 22 Thoroughbred breeding farms of 4–17 mares. The reaction tests were performed after weaning of 168 foals in the individual farm in November and December, 2003. Nine months later from the test after weaning, 114 yearlings (47 males, 67 females) of 168 foals were again used for the tests before moving into the training farm where the yearlings were trained for the race. Mean age of the foals at the postweaning test was 240 ± 30 d and that of the yearlings at the test before moving into the training farm was 501 ± 32 d.

The method of "approach-flight away" test basically followed that of Purcell *et al.* (1988) [16]. The test was performed during 9:00–15:00 after foal entering into the usual pasture, areas of which varied from ca. 0.2 to ca. 0.6 ha according to each farm. A foal for the test was selected at random. A stranger wearing a grey jacket slowly approached it with a step of 0.6 m/sec from a distance of 10 m. When the foal showed a warning posture, the stranger stopped his step for some minutes. After when the animal began grazing at the same site, the man approached again. The distance of flight away was estimated as the distance (m) from the man to the animal when the animal began to flight away. When the animal walked toward the stranger during the test and could be easily touched by him, the distance was judged 0 m. The test was repeated three

times for an animal. The test was further continued using other animals, one by one, but taking rests of some time. The animal which was estimated "0 m" was submitted to the following "touch-avoidance" test. The same method of "approach-flight away" test was applied to the yearlings before moving into the training farm before training start.

The method of "touch-avoidance" test was performed on the animal of that flight distance was judged 0 m. The forehead of the animal was touched with a right hand of the stranger. The reaction of the animal was estimated by five scores; (1) quiet and not resistant, (2) a little resistant, (3) less resistant but not flight, (4) much resistant and flight, and (5) flight away without touching including animals with flight away distance of more than 0 m.

The handling of foals in their early nursing period by the stabler in the breeding farms were orally asked in August and September, 2004. The following four handlings were asked; "body brushing", "hoof cleaning", "rectal temperature measurement" and "stall cleaning". The frequency of the handling in a week was estimated by 5 scores; (1) no working, (2) working once or twice, (3) working three or four times, (4) working 5 or 6 times, and (5) working every day.

Although the values of flight distance didn't show a formal distribution, the means and standard deviations were calculated for convenience. The values in the avoidance reaction and the animal handling frequency were treated as non-parametric values. In difference analysis of means, the method of Wilcoxon signed rank test was used. In correlation analysis, the method of Spearman's rank-correlation was used.

In the preliminary test, the flight distance of 24 foals was 0.00 m. The mean distances of 36 foals were 0.58 ± 0.89 m and 0.66 ± 0.98 m in the first and the second trials, respectively (Table 1). Difference of the two trials was not significant. No significant difference was also recognized between the mean distances of two trials in 12 foals which showed over 0.10 m distances. In the subsequent preliminary test, the flight distance of 23 yearlings was 0.00 m. The mean distances of 28 yearlings were 0.34 ± 0.79 m and 0.38 ± 0.84 m in the first and the second trials, respectively (Table 1). Difference of the two trials was not significant. No significant difference was also recognized between the mean distances of two trials in 5 yearlings which showed over 0.10 m distances. The measurement values obtained in the "approach-flight away" test were verified to be statistically reliable.

Table 1. Comparison of flight distances between the first and the second measurements in the behaviour test of Thoroughbred foals and yearlings

Animal	Measurement		Number of animal	Mean (m)	S.D (m)
Postweaning foal	First time	(All animals)	36	0.58	0.89
		(Except 0 m animals)	12	1.49	0.90
	Second time	(All animals)	36	0.66	0.98
		(Except 0 m animals)	12	1.59	0.81
Yearling before training start	First time	(All animals)	28	0.34	0.79
		(Except 0 m animals)	5	1.88	0.51
	Second time	(All animals)	28	0.38	0.84
		(Except 0 m animals)	5	1.92	0.41

Table 2. Comparison of avoidance scores between the first and the second measurement in the behaviour test of Thoroughbred foals and yearlings*

A. Postweaning foal**1 (n=36)							
Avoidance experiment		Score in 1st measurement					Total
		[1]	[2]	[3]	[4]	[5]	
Score in 2nd measurement	[1]	2	1	0	0	0	3
	[2]	2	4	1	0	0	7
	[3]	0	3	6	0	0	9
	[4]	0	0	2	1	0	3
	[5]	0	0	2	0	12	14
	Total	4	8	11	1	12	36
B. Yearlings before training start**2 (n=28)							
Avoidance experiment		Score in 1st measurement					Total
		[1]	[2]	[3]	[4]	[5]	
Score in 2nd measurement	[1]	6	2	0	0	0	6
	[2]	1	5	3	0	0	9
	[3]	0	2	3	0	0	5
	[4]	0	0	0	1	0	1
	[5]	0	0	0	0	5	5
	Total	7	9	6	1	5	28

*"Cross-classification" method was used for analysis.

**1 The agreement ratio 0.69 and κ coefficient 0.59 ($P<0.001$) were calculated.

**2 The agreement ratio 0.71 and κ coefficient 0.62 ($P<0.001$) were calculated.

In the "touch-avoidance" test of the preliminary test of 36 foals, the frequency of score (3) was highest in both of the first and the second trials (Table 2). The result was analyzed by "Cross-classification" method. Same scores in the first and the second trials were observed in 25 of 36 foals. In the Cross classification, 0.59 of *Kappa* coefficient was obtained ($P<0.001$).

In the subsequent "touch-avoidance" test of the preliminary test of 28 yearling, the frequency of score (2) was highest in both of the first and the second trials (Table 2). The result was analyzed by "Cross-classification" method. Difference of the scores was not

significant. Same scores in the first and the second trials were observed in 20 of 28 yearlings. In the Cross classification, 0.62 of *Kappa* coefficient was obtained ($P<0.001$). The avoidance scores obtained in the "touch-avoidance" test were verified to be statistically reliable.

In the main test, mean distances in the approach-flight away test were 0.56 ± 0.90 m in 168 postweaning foals and 0.27 ± 0.70 m in 114 yearlings before training start (Table 3). The distances were zero in 109 of 168 foals. No significant difference was recognized between the flight distances of male ($n=81$) and female

Table 3. Flight distances of horse at the approach-flight away test

Horse	n* (head)	M (m)	S.D. (m)	Max. (m)	Min. (m)
Postweaning foal	168 (109)	0.56	0.90	5.90	0.00
Yearling before training start	114 (98)	0.27	0.70	2.70	0.00

* Parenthesized numbers show horses which reacted by zero meter.

Table 4. Correlations between behavioural reaction scores of postweaning foals and handling frequency in the young ages (n=168, all of the foals)

Stabler handling	Distance of flight away		Score of avoidance reaction	
	r	P-value	r	P-value
Body brushing	-0.31	< 0.001	-0.37	< 0.001
Rectal temperature measurement	-0.22	< 0.01	-0.14	ns
Hoof cleaning	-0.24	< 0.01	-0.22	< 0.01
Stall cleaning	-0.11	ns	-0.22	< 0.01

(n=87) foals. The maximal flight distance was recorded in No. 15 farm (mean=1.7 m), and the minimal distance in No.11 and No. 12 farms (mean=0.0 m). The difference was significant ($P<0.01$).

In the subsequent main test, the touch-avoidance test was applied to the animals that were estimated 0.00 m distance. The animals which gave flight distances over 0 m were estimated at score (5). In the postweaning foals, the animal ratio of score (5) was the highest (35.1%), however, the ratio of score (1) was the highest in the yearling before training start. A significant correlation was recognized between the avoidance scores of the postweaning foals and the avoidance scores of the corresponding yearlings (Spearman's rank correlation, $r=0.53$, $P<0.001$). No significant difference was recognized between avoidance scores of male (n=47) and female (n=67) yearlings (Wilcoxon signed rank test). The maximal score between breeding farms was recorded in No. 13 farm (mean=4.4), and the minimal score in No. 12 farm (mean=1.5). The difference was significant (Wilcoxon signed rank test, $P<0.01$).

The relationship between the behavioural reactions of 168 postweaning foals and the stabler handling frequencies in 22 breeding farms are shown in Table 4. The "body brushing" showed high negative correlations with flight distance ($\rho=-0.31$, $P<0.001$) and with avoidance score ($\rho=-0.37$, $P<0.001$). The "hoof cleaning" also showed negative correlations with flight distance ($\rho=-0.24$, $P<0.01$) and with avoidance score

($\rho=-0.22$, $P<0.01$). The "rectal temperament measurement" showed a significant correlation only with flight distance ($\rho=-0.22$, $P<0.01$). A high frequency of human touching with animals was suggested to be effective to make animals familiar to humans.

The relationship between behavioural reactions of 114 yearlings and stabler handling frequencies was shown in Table 5. All of the stabler handling frequencies showed low correlations with flight distance and also with avoidance score for 114 yearlings. While in the corresponding 114 foals, "body brushing", "rectal temperature measurement" and "hoof cleaning" showed significant correlations with avoidance score ($\rho=-0.30$, $P<0.001$; $\rho=-0.24$, $P<0.05$; $\rho=-0.22$, $P<0.05$; respectively). The general high correlations of behavioural reactions with handlings in the young ages in the experimented foals became lower in the experimented yearlings. It was suggested that the frequent animal-human relationship in the age from postweaning to training start in the following spring/summer will also be more important for a mild character formation in yearlings.

The following articles were discussed. In the approach-flight away test, it was apprehended that a stranger will become not strange to other animals during the test in the same pasture division. However, the test was finished in 40 min in one division. It was hypothesized that an animal acclimation to the stranger would not increase in the short period and the

Table 5. Correlations between behavioural reaction score of postweaning foals/yearlings and handling frequency in the young ages (n=114)

A. Postweaning foals (n=114, corresponding to the yearlings mentioned below)				
Stabler handling	Distance of flight away		Score of avoidance reaction	
	r	P-value	r	P-value
Body brushing	-0.15	ns	-0.30	< 0.001
Rectal temperature measurement	-0.18	ns	-0.24	< 0.05
Hoof cleaning	-0.17	ns	-0.22	< 0.05
Stall cleaning	-0.06	ns	-0.12	ns
B. Yearlings before training start (n=114, re-tested after 9 months after weaning)				
Stabler handling	Distance of flight away		Score of avoidance reaction	
	r	P-value	r	P-value
Body brushing	-0.07	ns	-0.14	ns
Rectal temperature measurement	-0.14	ns	-0.01	ns
Hoof cleaning	-0.15	ns	-0.18	ns
Stall cleaning	—	—	—	—

warning nature of animals would be kept.

In the similar approach-flight away test, the mean distance was 3.3 m in foals experiencing little contact with humans [12], and 7.0 m in Japanese breed in Hokkaido, which was kept outdoor all year round [1]. The small flight distances in our study will reflect a large amount of contact of foals and mares with humans in the usual Thoroughbred management by stablers.

When the approach-flight away test was tried by a farm manager before this study using several foals, almost all of the flight distance were 0.0 m and the avoidance score (1) occupied a large part of the score. The gentle character of animals, which was cultivated by the farm persons, would be generalized to a stranger from outside of the farm. The similar character generalization was also reported by Heusberger and Mueller [6].

An importance of the stableman handling, especially “body brushing”, was confirmed in this study. In the similar behavioural investigation, the body brushing was also effective for reducing equine high tensions [4].

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Appendix D Christensen, J.W (2005)



Fear in Horses

Responses to Novelty and Habituation

Janne Winther Christensen



Thesis (Licentiate)

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Abstract

Christensen, J.W., 2005. Fear responses in horses. Licentiate thesis.

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Fear is generally considered to be an undesirable emotional state that may reduce welfare, growth and reproductive performance in animals. Fear in horses is additionally problematic, because fear reactions can cause serious injury to both horse and human. Horses are primarily used for sports and leisure for a large number of children and young women. Unfortunately, horse riding ranks as one of the most dangerous sports in terms of the number and seriousness of accidents, and the ability of a horse to habituate to a range of otherwise frightening stimuli greatly increases safety in the horse-human relationship. However, there is a lack of research on fear reactions and no published research on basic habituation processes in horses. This licentiate project aimed to investigate the types of fear responses horses show towards novel stimuli acting on different senses, and to study how horses learn to be confident with an otherwise frightening stimulus using classical learning theory techniques. The experiments were conducted on two different groups of naïve stallions (n=24 and n=27). The first experiment showed that horses responded differently towards an olfactory stimulus compared to auditory and visual stimuli. The heart rate responses correlated between tests and probably reflected a non-differentiated activation of the sympathetic nervous system, while the behavioural responses were linked to the type of stimulus. The second experiment showed that gradual habituation was the most effective training method for horses to learn to react calmly to an otherwise frightening stimulus, compared to classic habituation and associative learning. Heart rate data revealed that horses may show physiological responses even when their behavioural response towards the stimulus has ceased. Choice of training method is likely to be especially important for the most fearful horses.

Keywords: Horses, behaviour, heart rate, fear, novelty, habituation.

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Appendix

Papers I-II

The present thesis is based on the following papers, which will be referred to in the text by their Roman numerals:

Paper I. Christensen, J.W., Keeling L.J., Nielsen, B.L., 2005. Responses of horses to novel visual, olfactory and auditory stimuli. *Appl. Anim. Behav. Sci.* 93, 53-65. (Journal Impact Factor: 1.40)

Paper II. Christensen, J.W., Rundgren, M., Olsson, K., 2005. Training methods for horses: Habituation to a frightening stimulus (submitted to *Equine Vet J*). (Journal Impact Factor: 1.44)

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Introduction

Fear can have negative effects on welfare, health and reproduction in animals (Boissy, 1995). In horses fear is additionally problematic, because fear reactions can cause serious injury to both horse and human. Investigations have shown that the major cause of horse-human accidents is unexpected fear reactions in the horse (Keeling *et al.*, 1999). However, basic fear responses and habituation processes have not yet been scientifically investigated in horses. The ability of a horse to habituate to a range of otherwise frightening stimuli greatly increases safety in the horse-human relationship, and finding appropriate methods for reducing fear in horses has important practical applications. This licentiate project investigates how horses respond to novel stimuli, acting on their different senses, as well as how horses learn to be confident with an otherwise frightening stimulus.

The concept of fear

Fear can be regarded as a “state of the brain or the neuroendocrine system arising under certain conditions and eventuating in certain forms of behaviour” (Gray, 1987). Stimuli, which members of a species will avoid, work to prevent, or flee from can be categorised as fear-releasing. Since states of fear do not lead to an obvious behavioural expression in all cases, both behavioural and physiological measures should be considered when assessing the state of fear (Manteca & Deag, 1993).

According to Moberg (1985) “the central nervous system assesses whether a stimulus or a group of stimuli represents a significant challenge to the animal. If the stimulus is perceived as threatening, three general types of biological responses are available: behavioural, autonomic, and neuroendocrine”. This assessment of stimuli may differ between individuals, and the predisposition for assessment of stimuli may be termed fearfulness. Jones *et al.* (1997) defined fearfulness as “an underlying behavioural characteristic” defined as “propensity to be easily frightened by diverse alarming stimuli”. Boissy (1995) defined fearfulness as a “basic psychological characteristic of the individual that predisposes it to perceive and react in a similar manner to a wide range of potentially frightening events.”

The elicitation of fear at the right moment, *e.g.* when an animal encounters a predator, is needed for rapid evasive action in which adrenal hormones play a crucial role (Korte, 2001). The body’s immediate physiological reaction is characterised by activation of the sympathetic system, which speeds things up and gets the body ready for action. The fight or flight reaction of the sympathetic nervous system is started by stimulation of the hypothalamus which sends out signals that are transmitted via the reticular formation in the brain stem into the spinal cord to cause sympathetic discharge. This immediately results in a number of physiological changes, which lead to a greater physical and mental ability so that the animal can perform more strenuous physical activity than would otherwise

be possible. Sympathetic stimulation increases both the rate and force of contraction of the heart, as well as the arterial blood pressure. Blood flow is redirected, because the muscles in the blood vessels supplying the gut constrict so that less blood goes there and more blood is directed to the skeletal muscles and the brain. The glycolysis in both liver and muscle increases and blood glucose levels rise (Guyton & Hall, 1997). The transmitter at the neuromuscular junction is noradrenaline, a close relative of the hormone adrenaline, which is the chief neurotransmitter in the sympathetic system. These hormones prepare the body for bursts of physical exercise, for example when about to take flight from a predator.

The sympathetic system is counteracted and modulated by the parasympathetic system, where the actions are principally opposite to those of the sympathetic system (Guyton & Hall, 1997). The parasympathetic system becomes active when the body is engaged in processes relating to general body maintenance, such as eating and ingesting food. It slows the heart and respiration rates, and increases the blood supply to the gut. The normal state of rest is characterised by a predominant parasympathetic nervous activity. In stressful situations, the parasympathetic nervous activity will decrease in favour of a higher sympathetic activity, enabling the animal to react in a biological appropriate manner, for example with flight.

The secondary physiological reaction to danger is characterised by the release of corticosteroids from the adrenal cortex. In response to external or internal stimuli the hypothalamus produces corticotrophin-releasing factor (CRF). CRF stimulates the pituitary gland to secrete adrenocorticotrophic hormone (ACTH), which in turn activates the adrenal cortex to release corticosteroids (*e.g.* cortisol), which facilitates energy availability over prolonged periods. The reaction of the hypothalamic-pituitary-adrenal-cortical system takes a few minutes and is somewhat slower than the sympathetic response, which happens in a matter of seconds (Guyton & Hall, 1997). Circulating corticosteroids reach a peak some minutes after the stressful event (Korte, 2001).

After 'fight or flight' responses, corticosteroids are required to re-establish homeostasis via feedback mechanisms. The animal needs to consolidate its memories of the predator's appearance, location, smell, and sound, because such information may predict the occurrence and nature of the next encounter, thereby maximising the likelihood of survival. Corticosteroids act to facilitate behavioural adaptation via their effect on the consolidation and potentiation of fear or the facilitation of avoidance extinction, *i.e.* habituation (Korte, 2001).

Fear has definite survival value in wild animals. The life expectancy of an animal is obviously increased if it can react to avoid sources of danger. In this context fear related behaviour is adaptive. In contrast, excessive fear may be regarded as abnormal behaviour, defined as behaviour unable to attribute positively to the survival of an offspring (Malmkvist, 2001). Excessive fear can lead to psychopathology and mental suffering as well as physical damage (Korte, 2001), and fear is generally considered to be an undesirable emotional state that may reduce welfare, growth and reproductive performance in farm and zoo animals. Boissy (1995) states that studies aimed at reducing fear in animals reared

in captivity are of ethical significance due to the potential impact on animal welfare.

Fear has been investigated in many species (reviewed by Boissy, 1995), but there is a lack of research on fear in horses. Several studies have investigated temperamental traits (*e.g.* Scolan *et al.*, 1997; Visser *et al.*, 2001; Seaman *et al.*, 2002), reactivity (*e.g.* McCann *et al.*, 1988; Lansade *et al.*, 2005; McCall *et al.*, 2005), or emotionality (*e.g.* Wolff *et al.*, 1997) in horses, but these have mainly been concerned with the consistency of performance in different test situations, while none have dealt with basic fear reactions, nor investigating which situations and which stimuli are perceived as frightening.

Although it is biologically relevant to respond to frightening stimuli, it is also highly relevant to suppress non-functional behaviour, *i.e.* it is adaptive to learn not to respond to non-threatening stimuli. Investigation of fear responses in horses therefore inevitably involves investigations of learning.

Learning in horses

Learning may be defined as “the process of adaptive changes in individual behaviour as a result of experience” (Thorpe, 1963). If animals are to learn to change their behaviour to meet a new situation anything new happening in their environment will have to be taken note of and its importance assessed. However, if a novel stimulus has no consequences, *i.e.* there is no reinforcement, a repeated stimulation will cause the stimulus to capture less and less of the animal’s attention and it will eventually ignore the stimulus. This waning of responsiveness is termed habituation. Reduced responsiveness may also be caused by motivational changes, muscular fatigue as well as sensory adaptation. Manning & Dawkins (1998) defined habituation as “a persistent waning of responsiveness which is a property of the central nervous system and not the sense organs”. Habituation can be regarded as a simple form of learning because it involves reduction of a response which is already there. In contrast, associative learning is about acquiring new responses. After some repetitions of an event followed by the same consequences, a long-term association is built up between the event and its result and the animal’s response changes accordingly (Manning & Dawkins, 1998). In classical or Pavlovian conditioning, an environmental event or stimulus is followed predictably by some other events. A second type of associative learning is instrumental or operant conditioning, where the first event is a response made by the animal and the second event is the associated reinforcing consequence. Horses are well able to form associations where the relationship between two events guides behavioural change (Nicol, 2005). Mackenzie *et al.* (1987) and Gough (1999) studied the use of food as a conditioned stimulus to reduce the reactions of horses to clipping. However, these studies were performed on a very limited number of animals, lacking a control group, and Nicol (2005) argues that more controlled studies of application of learning theory to a practical problem are desperately needed.

An adaptive feature of learning is that animals are able to generalize many of the properties of the stimuli involved in the expression of a classical or instrumental response. Rather than focusing on some small and unique feature of a given stimulus, animals are able to form associations with a broader range of stimulus features than were present during training (Nicol, 2005).

There has been considerable scientific interest in learning in a wide range of animals *e.g.* rats, pigeons, and primates, while there is no published research on such basic learning abilities as habituation and sensitisation in horses, and very little research on basic associative learning processes (see review by Nicol 2002). This is surprising given the importance of these processes in every elementary training programme. However, there has been a scientific interest in horse learning in more complex situations (*e.g.* Sappington & Goldman, 1994; Flannery, 1997; Hanggi, 1999, 2003; McCall *et al.*, 2003), on the effects of handling or training schedule on learning (Heird *et al.*, 1986b; Mal *et al.*, 1994; Kusunose & Yamanobe, 2002; Lansade *et al.*, 2005), and on consistency of performance in learning situations (*e.g.* Heird *et al.*, 1986a; Sappington *et al.*, 1997; Visser *et al.*, 2003). Low correlations between learning performance in different tests suggest that other characteristics, such as fearfulness and motivation, may be the factors which govern success or failure in learning performance tests (Nicol, 2002). For instance Heird *et al.* (1986b) found that less emotional horses tended to perform better in a discrimination task and ultimately achieved a higher level of performance. Better learning by horses that are naturally calm may be due to reduced interference with the learning process (Nicol, 2002).

Aims

The project consists of two parts; the first part investigates the types of fear responses horses show towards novel stimuli acting on different senses (Paper I), whereas the second part focuses on how horses learn to be confident with an otherwise frightening stimulus (Paper II).

Paper I. The aim of this study was to investigate i) whether horses show different behavioural responses to novel visual, olfactory and auditory stimuli under standardised conditions; ii) whether behavioural responses reflect heart rate responses; iii) whether responses correlate between tests.

Paper II. The aim of this study was to investigate which of three different training methods, based on learning theory, was the most effective for horses to learn to act calmly in an otherwise frightening situation; i) classic habituation, ii) gradual habituation, and iii) associative learning. The study further aims to investigate whether behavioural and heart rate responses correlate during the training sessions.

Summary of materials and methods

The response of a particular horse in a given test situation is highly dependent on previous experiences, and the use of naïve individuals is therefore necessary to ensure the scientific quality of the experiments. Also, the social nature of horses contributes significantly to their responses in different test situations, and it is necessary that the animals are habituated to the test conditions prior to the experiment, and especially to being socially isolated.

I was kindly allowed to use two groups of young stallions from a large stud during 2003 and 2004. The two experiments in the present thesis were carried out in the same test arena, on two different groups of 2-year old stallions (2003: $n=29$; 2004: $n=39$), all of which were relatively unhandled and had experienced the same housing conditions prior to the experiments. The majority of the stallions were born at the stud; others were purchased after weaning at six months of age. All the stallions were kept on pasture with the dam before weaning and were subsequently housed in large groups in straw-bedded boxes with access to outdoor areas during the winter. The horses received a minimum of handling, only for necessary veterinary or farrier treatment. During the summer (May - October) the stallions were pastured in a large enclosure (30 ha) with hills, natural vegetation and access to an inlet, which also served as their water source. The horses received no additional feed or minerals during the summer period.

Within the 30-ha enclosure, a smaller capture enclosure (1-ha) contained a fenced waiting area (50 m²). Next to the waiting area a start box (2.5 m²) and a test arena (10 m in diameter) were constructed out of straw bales (1.2 x 1.2 x 2.4 m³) in two layers, making the height of the walls of the arena 2.4 m (Paper I and II, Fig. 1). The set-up enabled the horses to hear, but not see their group mates during the tests. The arena was equipped with a feed container with a mixture of alfalfa and the horses' usual winter feed (oat, barley, soybeans, minerals and molasses).

Prior to the experiments, the stallions were habituated to separation from the group and to receiving a food reward inside the arena in a gradual, step-wise approach (Paper I, Table 1). This preparation of the animals prior to the experiment was rather time consuming, since some horses showed strong aversive reactions towards the initial handling and fitting of halters. Additionally, the fact that the horses were kept in a large (30 ha) and long (1 km) enclosure made the capturing of the group difficult. During the first summer, we walked the enclosure with a feed container in order to attract the group of stallions to our capture enclosure. However, this procedure turned out to be quite dangerous, so during 2004 we changed our capture procedure and used a 4x4 truck, with a second person feeding the horses on the truck body, whereas a third person followed behind the horses in order to make all horses keep up with the group. Once inside the capture enclosure we identified and caught the horses that were to be tested and led them to the fenced waiting area. Horses sometimes escaped from the waiting area, and on very few occasions, the entire group was frightened by incidental happenings in the environment (*e.g.* a passing helicopter), broke

through the fence of the capture enclosure and escaped. After such random events we did not try to recapture the horses and the experiment was postponed until the next day. During 2003, the stallion group escaped from the pasture several times, and we had to suspend our experiment until the stallions had calmed down. Although the use of naïve, unhandled horses strengthens the quality of the experiment it is also a significant challenge for everybody engaged in the experiments. For future experiments, I recommend that sufficient time is allocated to the initial handling of the animals, as well as to unexpected incidents. It is also very important that all experimental staff has experience with horses and is able to read the signals of the horses before they panic.

We used the highest possible number of horses within each group to fit the experimental design (2003: 24 of 29 horses; 2004: 36 of 39 horses). A few horses were left out due to apparent illness, or lameness; otherwise the capturing was random. During 2004, we first carried out an experiment with social transmission of fear responses in horses, which will be reported in my Ph.D. thesis. The experiment included training some horses to be confident with a frightening stimulus. These horses were considered to be treated differently from the rest of the group, so Experiment II in the present thesis was carried out on only $n=27$ horses.

The choice of test stimuli was based on reactions of horses in pilot studies, and the test stimuli are discussed further in the discussion section. Detailed descriptions of the test designs are given in the respective papers.

Paper I

The horses ($n=24$) were exposed to three 2-minute tests in a balanced design where, in addition to the feed container, a visual, an auditory, or an olfactory stimulus was presented. Prior to the visual test, a 75 cm high, orange traffic cone with two reflective bands was placed 1 m in front of the feed container, forcing the horse to pass the stimulus in order to approach the food. During the auditory test a novel sound (white noise, 10-20.000 Hz, 60 dBA) was played from a CD player, hidden behind the feed container. For the olfactory test, eucalyptus oil was applied to the edges and the inside of an identical feed container, which was used for this test only. The horses were tested in two blocks of 12 horses. Between test days the horses were exposed to the usual arena without novel stimuli (control). Heart rate and behavioural responses were registered.

Paper II

The horses ($n=27$) were trained according to three different methods, based on classical learning theory. In the first method (Classic habituation), the horses ($n=9$) were exposed repeatedly to the full stimulus (a moving, white nylon bag, 1.2 x 0.75 m) until they met a predefined habituation criterion. In the second method (Gradual habituation), the horses ($n=9$) were introduced gradually to the moving stimulus and were habituated to each of three steps, before the full stimulus was

applied. In the third method (Associative learning), the horses (n=9) were trained to feed on the bag, *i.e.* to associate the stimulus with a positive reward, before they were exposed to the full stimulus. Five training sessions of 3 minutes each were allowed per horse per day. Immediate behavioural reaction, latency to return to the feed container, and heart rate responses were registered.

Summary of results

Paper I. Responses of horses to novel visual, olfactory and auditory stimuli

- All novel stimuli resulted in reduced feeding time, compared to the control situation.
- The visual and auditory test stimulus elicited significantly increased heart rate (HR) in the horses compared to their response to the control situation, whereas there was no increase in HR response to the olfactory stimulus.
- There was no difference in locomotion activity in the various test situations and generally very little locomotion activity during the tests.
- During the olfactory test the horses had an increased number of eating bouts and became more vigilant towards their surroundings.
- During the visual and auditory tests, more time was spent alert towards the stimulus.
- Significant, negative correlations were found between time spent eating and HR in the auditory and visual tests, whereas there was no correlation in the control and olfactory test.
- The heart rate responses correlated between tests and reflect a non-differentiated activation of the sympathetic nervous system, while the behavioural responses were linked to the type of stimulus.

Publications

- Christensen, J.W., Keeling, J., Nielsen, B.L., 2005. Responses of horses to novel visual, auditory and olfactory stimuli. *Appl. Anim. Behav. Sci.* 93, 53-65.
- Christensen, J.W., Keeling, L., Nielsen, B.L., Rundgren, T.M.K., 2004. Do horses generalise their responses to novel stimuli? *Proc. 38th Int. Congr. of the ISAE, Helsinki, Finland*, p. 115.
- Christensen, J.W., 2005. Heste er ikke bange for ukendte lugte. *Månedsmagasinet HEST* 5, Maj 2005, 44-45.

Paper II. Training methods for horses: Habituation to a frightening stimulus

- Horses that were habituated gradually showed fewer flight responses totally and needed fewer training sessions to learn to be confident with the test stimulus.
- All horses trained gradually eventually habituated to the test stimulus, whereas a few horses on the other treatments did not.

- Heart rate and behavioural responses correlated well during the first training session.
- Variations in HR existed between horses even when the behavioural response had ceased.
- There were strong correlations between the initial response of a horse and the number of required training sessions, except for horses trained gradually.

Publications

- Christensen, J.W., Rundgren, M., Olsson, K., 2005. Training methods for horses: Habituation to a frightening stimulus (submitted to Equine Vet J.).
- Christensen, J.W., Olsson, K., Rundgren, T.M.K., Keeling, L., 2005. Learning performance in relation to fear in young horses. Proc. EAAP, Uppsala, Sweden, June. Book of abstracts 11, 333.
- Christensen, J.W., 2005. Træningsmetoder - hvordan vænnes hesten lettest til nye situationer? Appendix: "Opdræt af ungheste - godt management", April 1st 2005. Danish Institute of Agricultural Sciences, Report 219, 15-16.
- Christensen, J.W., 2005. Risikoen for rideulykker kan nedsættes med træning. Månedsmagasinet HEST 5, Maj 2005, 36-41.
- Christensen, J.W., 2005. Gradvis tilvænning - den hurtigste måde. Månedsmagasinet HEST 5, Maj 2005, 42-43.

Discussion

Detailed discussion of the results can be found in the respective papers. In the following I discuss general results, methodological considerations as well as practical applications.

General results

Exposure to a suddenly moving test stimulus caused more arousal behaviour and higher heart rate responses (Paper II), compared to horses exposed to stationary novelty in the same test conditions (Paper I). Likewise, it has been shown in lambs that responses to suddenness are stronger than responses to novelty *per se* (Désiré *et al.*, 2003), probably due to similarities with moving predators. This is in accordance with the finding that horses react to any new movement in their environment, regardless of the intensity (Paper II), *i.e.* it is biologically relevant to react rapidly to suddenness. We also found that horses are likely to use their visual and auditory senses for immediate detection and orientation towards danger, while olfactory cues may cause the animal to become more vigilant towards its surroundings (Paper I).

Interpretation of responses in fear tests requires that the animal is motivated to explore or approach a test object (novelty tests), or return to a point of interest (surprise tests), for instance through the use of positive reinforcement (*e.g.* food or social partners), thereby creating a motivational conflict between avoiding the novelty and approaching the reward. In our experiments, we used food as a reinforcer; the use of which can be criticised due to the difficulty of controlling feeding motivation in the animals. However, in the present study the horses were of similar age, breed and exercise level, and as they were pastured, their food resources were unlimited. Therefore I find it reasonable to assume that the horses were equally motivated to eat. Indeed we found that time spent eating (Paper I), and latency to return to the feed container (Paper II) correlated very well with physiological responses within tests, indicating that the use of positive reinforcement can be a valuable indicator of reactions in fear tests. Discrepancies between other studies of horse reactivity may partly be due to the lack of reinforcement during novelty tests (*e.g.* Scolan *et al.*, 1997; Wolff *et al.*, 1997; Visser *et al.*, 2001; Seaman *et al.*, 2002). An animal which does not approach a novel object during a test may not do so either because it is fearful, or simply because it has no reason to approach and explore. In contrast to carnivores, where investigation is an important part of food localisation, horses are less dependent on exploration in their foraging and they instinctively avoid novelty. This pleads for the use of positive reinforcement in novelty tests for horses.

In Experiment I we found that heart rate responses correlated between test situations and probably reflect the immediate physiological reaction to perceived danger, characterised by activation of the sympathetic system, while the behavioural responses were linked to the type of stimulus. This result is in perfect

agreement with recently published results by McCall *et al.* (2005) who compared four methods of ranking horses based on reactivity and found that mean heart rates correlated between tests, while behavioural measures ranked horses differently. These results may be a further explanation of the lack of consistency of behavioural reactions in previous reactivity tests (Scolan *et al.*, 1997; Wolff *et al.*, 1997; Visser *et al.*, 2001; Seaman *et al.*, 2002).

In Experiment I, all horses approached and ate from the feed container within the test time of 2 min, although they either had to pass the visual stimulus, or approach the unknown sound or smell. In Experiment II, the horses on the associative learning method needed several training sessions to learn to feed from the test stimulus. This may have been caused either by a stronger fear-eliciting strength of the white nylon bag, compared to the novel stimuli in Experiment I, or that the horses had to learn a new behaviour; to feed on the bag, rather than continue feeding from the feed container, which they were trained to do. The mere presence of the well-known feed container may act to calm the horses. Time taken to learn to feed from the test stimulus during the associative learning in Experiment II meant that this training method was considerably more time consuming, compared to the other training methods. However, it is unknown whether associative learning may be more resistant to extinction, and future studies should focus on this aspect in horses.

Methodological considerations

We chose to use ‘unnatural’ test stimuli due to difficulties of mimicking natural stimuli. Predator urine can probably be applied in odour experiments whereas it is less obvious whether recordings of predator roar or howl contain the right frequencies, and whether a visual image of a predator has the right appearance. The novel stimuli in Experiment I were chosen in accordance with results in pilot studies; we wanted stimuli which were sufficiently strong to elicit responses in the majority of the test animals, but not to be so frightening that a large part of the animals would not approach the feed container within a relatively short test time. In pilot studies horses did not react to artificially produced boar smell, whereas they did react to eucalyptus oil. Drops of eucalyptus oil have previously been used in novelty tests for animals (*e.g.* Hutson *et al.*, 1993; Herskin *et al.*, 2003). Likewise, white noise is commonly applied in auditory experiments (*e.g.* Talling *et al.*, 1995; Malmkvist *et al.*, 2004). The traffic cone was chosen as a visual stimulus, because riding horses are likely to encounter such stimuli at some point in their lives.

Comparison of responses to different types of stimuli requires that the stimuli are equally fear-eliciting. However, the strength of a visual stimulus cannot be equated to the strength of an auditory or olfactory stimulus, and a study of the specific responses horses show towards a particular type of stimuli requires exposure to a range of different stimuli. However, the selected test stimuli all reduced eating time to the same amount, indicating a similar fear-eliciting strength. The finding that responses to visual and auditory stimuli were similar,

whereas responses to the olfactory stimulus differed, calls for further research into the importance of olfactory cues to horses. Such research should include exposure to biologically relevant smells, *e.g.* predator odour.

In Experiment II, we exposed the animals to a combination of novelty and suddenness. We wanted to make sure that the test stimulus elicited sufficiently strong responses to be able to see a decrease during the subsequent training sessions. On the other hand, we had to take care that the stimulus was not so strong as to make the most fearful horses panic, *i.e.* the stimulus should not be too mild for the most calm horses and not too frightening for the most fearful horses. The choice of test stimulus was made more difficult by horses varying widely in their reactions; even similarly housed and aged horses as in the present experiment, *e.g.* some horses on each treatment did not react to the test stimulus at all whereas others showed major reactions and did not habituate within the course of the experiment. Nevertheless, the selected stimulus elicited appropriate responses in most horses and a sudden movement in a nylon or plastic bag is likely to be an appropriate stimulus in fear tests for horses, which can be easily applied and standardised under a wide range of conditions.

Considering the large variation in responses even in these groups of similarly aged and housed stallions, there is a need for a large number of animals in experiments concerning fear and learning. This is often difficult to achieve in horse research, because horses are expensive animals and scientists typically have to borrow horses from private owners, which may cause limitations to the experiment. In the reported experiments we were lucky to have access to relatively unique horse groups.

Other studies on fearfulness or reactivity in animals have often included measurements of HPA axis activity, such as a change in plasma cortisol concentration, in response to an acute stressor (*e.g.* Rivera *et al.*, 2002; Van Reenen *et al.*, 2005), because these are less dependent on behavioural reactions (locomotion, flight responses) compared to heart rate data. However, obtaining blood samples from relatively unhandled horses can be a challenge and may jeopardise the safety of the handlers as well as the horses' willingness to be caught and take part in the rest of the experiment. Another method of obtaining physiological data, which are less affected by locomotion, is the use of data on heart rate variability (HRV; *e.g.* Visser *et al.*, 2002; Bachmann *et al.*, 2003; Rietmann *et al.*, 2004). HRV is an established parameter to quantify the state of the autonomic nervous system, reflecting the sympatho-vagal balance (Bachmann *et al.*, 2003). Relations between heart rate variability measures and behavioural responses will be studied in my Ph.D.

Practical applications

It has previously been hypothesised that certain smells (chemicals) can cause horses to be fearful (*e.g.* Mills & Nankervis, 1999). However, it is likely that horses are not innately fearful of certain smells; rather they have learned to

associate some smells with fear or alarm. Riders often report that horses are afraid of passing pig farms due to the smell. Our pilot studies showed that horses did not react to artificially produced boar smell, and it is likely that horses learn to associate the smell of pigs with the sound of screaming pigs, which may have startled the horse when passing the farm in the past. Rather than worrying about unknown smells, I recommend that riders are aware of associations that horses may make to a novel smell, *e.g.* if the rider is nervous that the horse will react to the smell, this nervousness is likely to affect the horse.

Horses instinctively avoid entering dark narrow areas, such as the interior of a horse trailer. To perform such tasks, the modern horse must learn to suppress many of its natural instincts as well as learn to discriminate and to respond appropriately to a wide variety of stimuli. The ability to learn and to respond appropriately to different stimuli usually directly influences the horse's usefulness and monetary value to humans (McCall, 1990; Cooper, 1998), and there are several good reasons to avoid the most fearful horses. Firstly, fearful horses can be a significant safety risk for both horse and rider. Also, fearful horses are more difficult to handle and thus more time consuming, and research indicates that they may have a poorer learning ability (Fiske & Potter, 1979; Heird *et al.*, 1986b), possibly due to increased interference with the learning process. Additionally, very fearful horses may be costly due to more veterinary treatment, partly because of injuries and partly because there is higher risk of diseases since prolonged stress can depress immune system function (Manning & Dawkins, 1998).

Horses, however, are well able to habituate to a range of different unnatural situations, and they generally have a good learning ability (Nicol, 2002). The ability of a horse to habituate to a range of fear-eliciting situations can reduce the risk of accidents, and safety training should – and can easily – be applied at public riding schools. Our results show that the choice of training method is important mainly for the most fearful horses. In police horse training, they aim at never provoking the unwanted behavioural responses (*e.g.* the flight response) and thereby avoid the risk of the horse getting a bad experience during training. This procedure corresponds well to the gradual habituation training applied in the present project, which showed to be the most gentle and effective training method for horses in frightening situations.

Conclusions

Paper I

- Horses showed similar responses towards a novel visual and auditory stimulus, whereas responses to a novel olfactory stimulus differed.
- Behavioural responses reflected heart rate responses.
- Heart rate responses correlated between tests and reflected a non-differentiated activation of the sympathetic nervous system, while the behavioural responses were linked to the type of stimulus.

Paper II

- Horses were more easily trained to be confident with an otherwise frightening stimulus if trained using a gradual habituation procedure.
- Behavioural and heart rate responses correlated well during the first training session.
- Although the behavioural reactions towards a repeated stimulus had ceased, variations in heart rate responses persisted.
- Choice of training method is likely to be especially important for more fearful horses.

Thoughts for future studies

To my knowledge this is the first scientific study of basic fear responses and habituation processes in horses. A number of highly relevant research questions arose during the study, including whether horses learn from the responses of other horses by social transmission of behaviour. Although previous studies have failed to demonstrate social learning in horses in more complex learning situations (Baer *et al.*, 1983; Baker & Crawford, 1986; Nicol, 1995; Lindberg *et al.*, 1999), social influence is very likely for responses in simpler, biologically relevant situations, such as responses to fear-eliciting stimuli.

Another area of research is whether habituation is stimulus specific, or whether horses are able to generalise across fear-eliciting situations, so that once habituated to a range of fear-eliciting stimuli a horse is less likely to respond fearfully to any novel stimulus, *i.e.* its general fearfulness is reduced. Generalisation of behavioural responses across several different situations has been demonstrated in other species (*e.g.* Boissy & Bouissou, 1995; Malmkvist & Hansen, 2002), whereas results on horses have been less convincing (*e.g.* Sclan *et al.*, 1997; Wolff *et al.*, 1997).

Research on other species has shown that enrichment of the animals' environment can reduce fear responses (Jones & Waddington, 1992; Meehan & Mench, 2002). It would be relevant to investigate the effects of introducing different fear-eliciting objects in the home environment on horse reactivity.

Bachmann *et al.* (2003) found that crib-biting horses had a lower basal parasympathetic activity and suggest that stereotyping horses are more stress sensitive and less flexible when coping with stress than non-stereotyping horses. Minero *et al.* (1999) found that the overall mean heart rate was higher in crib-biting horses in a fear-eliciting situation. Further investigations into the fear responses of stereotyping and non-stereotyping horses could help throw light on the possible differences in response to challenging events.

Some of these questions will be addressed in my Ph.D. project.

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Responses of horses to novel visual, olfactory and auditory stimuli

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Abstract

Responses of horses towards fear-eliciting stimuli can have important consequences for both human and horse safety. This experiment was designed to investigate behavioural and heart rate (HR) responses of horses to novel visual, auditory and olfactory stimuli. Twenty-four 2-year-old, previously unhandled, stallions were habituated to receive a food reward from a container in a test arena. Each horse was exposed to three 2 min tests in a balanced design where in addition to the feed container, either a traffic cone (visual test), white noise (auditory test) or eucalyptus oil applied to the inside of the container (olfactory test) were used as the novel stimuli. Compared to the control, less time was spent eating during all tests. There was no difference in locomotion activity in the different test situations, but presentation of the novel visual and auditory stimuli elicited significantly increased HR responses in the horses, compared to their response to the arena without novel stimuli (control), whereas there was no increase in HR response to the olfactory stimulus. However, during the olfactory test, the horses had an increased number of eating bouts and became more vigilant towards their surroundings, whereas during the visual and auditory tests, more time was spent alert towards the stimulus. The horses also took significantly more steps backwards in response to the auditory test. The heart rate responses correlated between tests and reflect a non-differentiated

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activation of the sympathetic nervous system, while the behavioural responses were linked to the type of stimulus.

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1. Introduction

The appropriate response of a horse towards a potentially dangerous stimulus has been important to its survival through millions of years in the wild and domestic horses respond to perceived threats and novelty in much the same way as their wild ancestors. For instance, horses tend to react with a rapid flight response when alarmed and to avoid potentially fear-eliciting situations in general, e.g. they do not approach threatening stimuli and they tend to respond nervously to novelty in a known environment. Responses towards novelty have often been used in tests of fearfulness or emotionality in animals (Gray, 1987; Boissy, 1995). Novel object tests have been applied to a wide variety of animal species from rodents, to poultry, fish, carnivores and prey animals (e.g. Hemsworth et al., 1996; Malmkvist and Hansen, 2002; Meehan and Mench, 2002; King et al., 2003; Sneddon et al., 2003). Like other prey species, the horse's sensory systems have adapted to facilitate early detection of danger (Saslow, 2002). Horses probably use a combination of visual, auditory and possibly olfactory cues for detection of danger. Currently, we have little knowledge of how horses respond to potentially fear-eliciting situations, which act on their different senses.

In contrast to predators, where exploration is an important part of localising food, the survival of many prey species in their natural environment is less dependent on the tendency of the animal to explore. Responses in novel object tests, therefore, may reflect exploratory motivation, fearfulness or simply that the animal is not interested in the object. In order to be able to interpret responses, it is required that the animal under study is motivated to approach the test object, for instance through the use of positive reinforcement (e.g. food or social partners), thereby creating a motivational conflict between avoiding the novelty and approaching the reward (e.g. Boissy and Bouissou, 1995; Désiré et al., 2003).

In prey species, it is especially likely that responses to suddenness are stronger than responses to novelty per se, due to similarities with moving predators. In this experiment, we separate novelty from suddenness, focussing only on the effects of novelty in a known environment. This is in contrast to previous studies of novelty responses in horses, which have included exposure to a combination of novelty and suddenness (e.g. Visser et al., 2001, 2002; Momozawa et al., 2003).

It is hypothesised that exposure to novelty causes the emotional state fear, which may be reflected in changes in behaviour, an increase in heart rate and neuroendocrine changes. The body has two principally different pathways of reaction to perceived danger: the immediate reaction of the sympathetic nervous system and the slower endocrine secretion of cortisol (Guyton and Hall, 1997). Sympathetic stimulation increases both the rate and force of contraction of the heart, preparing the organism for

flight. Although behaviour and heart rate responses are often linked, they may also occur separately. The aim of this study was to investigate this interrelationship in different test situations. The present experiment was designed to explore: (i) whether horses show different behavioural responses to novel visual, olfactory and auditory stimuli under standardised conditions; (ii) whether behavioural responses reflect heart rate responses; (iii) whether behavioural and heart rate responses are correlated between tests.

2. Materials and methods

2.1. Animals and housing

A total of 24, 2-year-old Danish Warmblood (*Equus caballus*) stallions from a large stud were used in this study. Three breeding stallions sired the colts, of which the majority were born at the stud, others were purchased after weaning at six months of age. All colts were kept on pasture with the dam before weaning and were subsequently housed in large groups in straw-bedded boxes with access to outdoor areas during the winter. The colts received a minimum of handling, only for necessary veterinary or farrier treatment. During the summer (May–October), the colts were pastured in a large enclosure (30 ha) with hills, natural vegetation and access to an inlet, which also served as their water source. The horses received no additional feed or minerals during the summer period.

2.2. Experimental design

Within the 30 ha enclosure, a smaller capture enclosure (1 ha) contained a fenced waiting area (50 m²). Next to the waiting area, a start box (2.5 m²) and a test arena (10 m in diameter) were constructed out of straw bales (1.2 m × 1.2 m × 2.4 m) in two layers, making the height of the walls of the arena 2.4 m (Fig. 1). The set-up enabled the horses to hear, but not see their group mates during the tests. The arena was equipped with a feed container, placed opposite the entrance, with a mixture of alfalfa and the horses' usual winter feed (oat, barley, soybeans, minerals and molasses). The ground in the arena was covered with a thin layer of wood shavings.

2.2.1. Habituation

Prior to the experiment, the stallions were habituated to being isolated and receiving a food reward inside the arena in a gradual, step-wise approach (Table 1). Most horses (75%) passed directly through the three habituation steps, whereas six horses needed more than one trial on one or more of the steps (up to four trials on a step). When a horse met the habituation criteria, it was not exposed further to the test arena until the rest of the horses were habituated. The day prior to a test, all horses were again exposed to the arena, ensuring that all horses fulfilled the habituation criteria and to standardise the time interval between last exposure to the arena and the test.

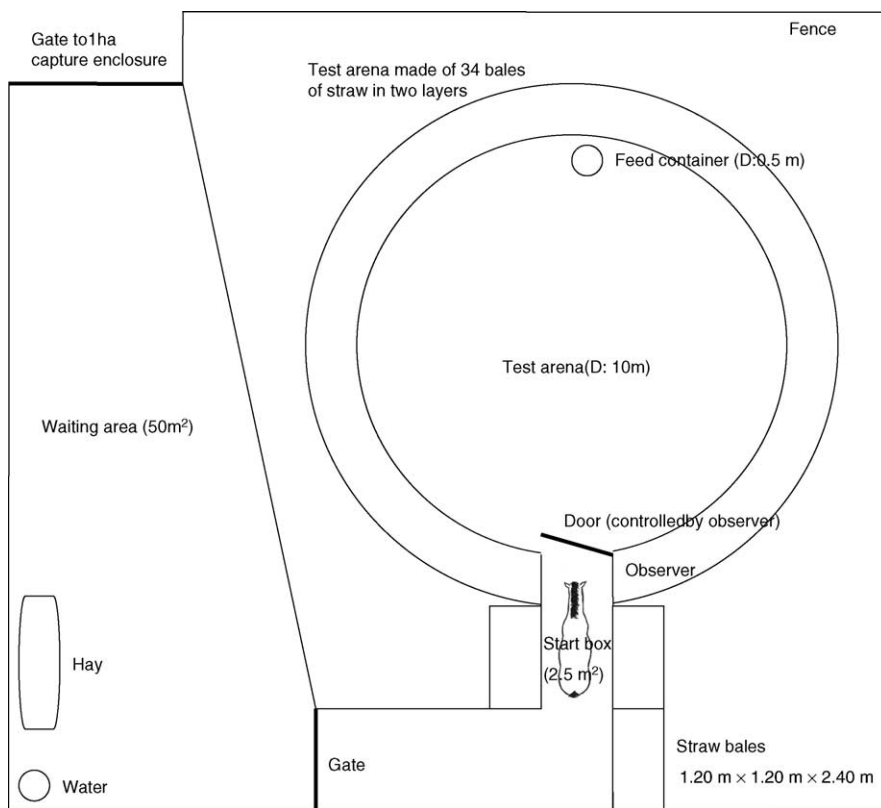


Fig. 1. Diagram of the test arena, start box and waiting area.

2.2.2. Tests

The horses were exposed to three 2 min tests in a balanced design where, in addition to the feed container, a visual, an auditory or an olfactory stimulus was presented. Prior to the visual test, a 75 cm high, orange traffic cone with two reflective bands was placed 1 m in front of the feed container, forcing the horse to pass the stimulus in order to approach the food. During the auditory test, a novel sound (white noise, 10–20,000 Hz, 60 dBA) was played from a CD player, hidden behind the feed container. For the olfactory test, eucalyptus oil was applied to the edges and the inside of a similar feed container, which was used for this test only. The horses were tested in two blocks of 12 horses. Between test days, the horses were exposed to the usual arena without novel stimuli (control). The experiment was carried out in August and September 2003, during which the average temperature was approximately 20 °C. Testing on days with heavy rain, wind or other extreme weather conditions was avoided.

The behavioural variables described in Table 2 were recorded using a handheld computer (Workabout, PSION PLC, UK). The observer sat quietly on top of the straw wall next to the start box during all exposures. Subsequently, the data were transferred

Table 1
Habituation procedure

	Training session	Procedure	Note
1.	Identification and 3-step introduction to arena	The horse is caught, identified using ID cards and fitted with a coloured ring in the mane for recognition The handler leads the horse directly to the feed container inside the arena and offers it feed. The horse is led around in the arena once and is offered feed again before returning to visual contact with the other horses. The horse is led to the arena again, the observer closes the door and the same procedure as above is carried out. During the third entry, the horse is allowed to run loose for 2 min, while the handler stands by the feed container. The horse is caught and led to the feed container, if not already there, whereupon it returns to the group	A varying number of horses (2–12) were introduced daily due to their varying willingness to be caught and led
2.	Habituation, step 1	The horse is led to the feed container inside the arena, the door is closed, the handler releases the horse and stands by the feed container for 2 min. The horse is caught and returns to visual contact with the group	A step is passed when the horse stands and eats from the feed container for a period of 30 s during the 2 min exposure. Upon passing a step, the horse carries on to the next step, whereas a failed horse carries on with the same step, until the criterion is reached. A maximum of five trials were allowed per horse per day. On the next day, a horse started on the last passed step
3.	Habituation, step 2	The horse is led to the feed container inside the arena, the door is closed, the handler releases the horse and leaves the arena for 2 min. The handler returns, the horse is caught and returns to visual contact with the group	
4.	Habituation, step 3	The horse is led to the start box in front of the arena while the arena door is closed. The handler releases the horse, the observer opens the door and the horse is free to enter the arena. When inside, the arena door is closed and the horse is left alone inside the arena for 2 min. The handler enters, the horse is caught and returns to the group.	If no eating occurred during the 2 min, the handler led the horse to the feed container and offered it feed before leaving the arena. An observer was always present on top of the arena wall next to the door, habituating the horses to the presence of an observer

Table 2
Ethogram of recorded behaviours

Behaviour	Definition
Duration (s)	
Stand	Standing relaxed, head and neck relaxed
Walk	Walking, energetically or relaxed
Canter/trot	Cantering or trotting
Alert food	Vigilant with elevated neck, with or without tail elevation, head and ears oriented towards food container/novel stimulus, standing or walking
Alert other	As above, but with head and ears oriented in other directions
Investigate food	Neck horizontal or lower, head and ears oriented towards food container/novel stimulus, standing or walking
Investigate other	As above, but with head and ears oriented in other directions, includes touching and manipulating arena walls or ground
Investigate cone	As above, but with head and ears oriented towards the cone
Touch cone	Touching or manipulating the cone
Sniff food	Head within 1 m of food container, neck horizontal or lower, clear exhalations from nostrils
Eat food	Chewing the food; the head may be lifted from the food container for short periods while chewing continues
Frequency	
Eat bout	Eating after pauses of more than 5 s were recorded as a new bout
Nicker	Low amplitude call of long duration
Whinny	High amplitude call of long duration that fluctuates in frequency
Snort	Short powerful exhalations from nostrils
Back	Stepping backwards (minimum two steps)
Flehmen	Head elevated and neck extended, upper lip curled (olfactory investigation)
Paw bout	Striking the ground or air with a forelimb, pawing after pauses of more than 5 s were recorded as a new bout
Defecation	Elimination of faeces
Urination	Elimination of urine

from the PSION to a PC, using the software PSION Manager, Version 1.1. Heart rate (HR) was recorded with Polar Vantage (Polar Electro OY, Kempe, Finland), which consisted of an electrode belt with a built-in transmitter and a wristwatch receiver. Water and exploratory gel were used to optimise the contact between electrode and skin. The HR monitoring equipment was fitted on the horse in the waiting area prior to testing and the receiver stored data from the transmitter (every 5 s). Subsequently, data were downloaded via a Polar Interface to a PC, using the software Polar Precision PerformanceTM SW 4.

2.2.3. Test procedure

The 12 horses of a particular block were caught and led into the waiting area prior to testing and stayed there until all horses had been tested. Hay and water were available in the area. The rest of the group was kept inside the 1 ha capture enclosure next to the waiting area, ensuring proximity of the entire group during the tests. The test horse was fitted with HR equipment and led to the start box by a handler with whom the horses became familiar during the initial habituation training. After approximately 1 min, the arena door opened,

allowing the horse to enter the arena. After the test, the horse was caught by the handler and led back to the waiting area where the HR equipment was removed. After each test, defecations were removed from the arena and extra feed added to the container, if necessary. The test order was the same during all test and control days.

2.3. Data analysis

Latencies, frequencies and time spent on different behaviours were calculated in SAS 8.0 (<http://www.sas.com/>). Behaviours, which were observed in less than three horses, were excluded from further analysis, i.e. defecation, urination, flehmen and all vocalisations (nicker, whinny and snort). The order in which the horses received the tests was balanced between horses and block and was not considered further in the analysis.

Preliminary tests showed that there was no effect of horse on the initial HR (before the tests), probably due to the similar age, breed and exercise level of the horses, making it unnecessary to correct for individual differences in initial HR. Thus, the analysis was carried out on data for average HR (reflecting the shape of the HR curve; HR_avg) and maximum HR (reflecting the immediate response of a horse towards the test stimulus; HR_max) during the tests. Likewise, preliminary analysis showed that there were no significant differences in behaviour and HR responses between the control days, indicating that there was no carry-over effect from the different test situations and no trend to increasing or decreasing HR during the course of the experiment. Thus, an average for each horse from all control exposures was used as control data in the analysis. The HR data were analysed using Mixed Models in SAS estimating degrees of freedom using Satterthwaite's formula (Littell et al., 1996) with test ($n = 4$), sire ($n = 3$) and their interaction as fixed effects and animal within block within test as a random effect. The model was reduced if terms were not significant ($P > 0.05$). The response variables were HR_avg and HR_max.

Due to skewed distributions and non-constant variances of the behaviour data, these were analysed for effect of test, block and sire separately by Friedman Repeated Measures Analysis of Variance on Ranks, using SigmaStat 3.0 (<http://www.spss.com/>). All horses, except one horse in the auditory test, approached and ate from the feed container within the test period of 2 min. However, this horse did approach and eat from the container before the handler entered the arena after the end of the test period. It was, therefore, considered unnecessary to treat the latency data as censored values. One horse reared during the olfactory test, which was its first test and the test was stopped due to risk of injury. The horse had previously reacted with this type of behaviour during the initial handling, but did not respond with rearing during the habituation, nor in any of the subsequent tests. However, the Repeated Measures ANOVA on Ranks does not allow for missing data in a balanced design and the horse had to be deleted from the analysis. Thus, this part of the analysis was carried out on $n = 23$ horses.

Correlations between variables within tests and correlations between tests were carried out by Spearman rank-order correlations (coefficients denoted as r_s). Technical problems with the heart rate equipment caused a loss of data in the first block and the correlations between tests were thus based upon smaller sample sizes ($n = 16, 13$ and 11). Due to the low occurrence of many behavioural variables, some related behaviours were grouped (all behaviours related to focussing on 'other' or 'food'; Table 3).

Table 3

Number of animals (out of 23) showing the behaviour in each test and median [25, 75% quartiles]

Behaviour	Control	Visual	Olfactory	Auditory	Chi-square	P-value
Stand	9	1	4	3		
(s)	0 [0, 0.4]	0 [0, 0]	0 [0, 0]	0 [0, 0]	6.33	0.097*
Walk	23	23	23	21		
(s)	8 [7, 9]	6 [3, 9]	8 [7, 9]	7 [4, 9]	9.95	0.019*
Canter/trot	3	4	4	4		
(s)	0 [0, 0]	0 [0, 0]	0 [0, 0]	0 [0, 0]	1.52	0.677
Alert food	1	9	1	13		
(s)	0 [0, 0]	0 [0, 5]	0 [0, 0]	2 [0, 10]	21.25	<0.001**
Alert other	6	8	10	8		
(s)	0 [0, 0]	0 [0, 4]	0 [0, 7]	0 [0, 3]	5.45	0.142
Investigate food	2	6	11	14		
(s)	0 [0, 0]	0 [0, 2]	0 [0, 6]	2 [0, 5]	19.24	<0.001**
Investigate other	13	5	10	7		
(s)	0 [0, 1]	0 [0, 0]	0 [0, 5]	0 [0, 3]	3.79	0.285
Investigate cone		21				
(s)	–	6 [2, 13]	–	–	–	–
Touch cone		3				
(s)	–	0 [0, 0]	–	–	–	–
Sniff food	2	0	10	2		
(s)	0 [0, 0]	0 [0, 0]	0 [0, 6]	0 [0, 0]	20.73	<0.001**
Eat food	23	23	23	22		
(s)	105 [103, 107]	97 [85, 104]	92 [76, 105]	95 [75, 105]	20.85	<0.001**
Eat bout	23	23	23	22		
(freq)	1 [1, 2]	2 [2, 3]	3 [2, 5]	2 [1, 3]	34.75	<0.001**
Back	0	0	0	6		
(freq)	0 [0, 0]	0 [0, 0]	0 [0, 0]	0 [0, 0.8]	18.00	<0.001**
Paw bout	11	8	10	6		
(freq)	0 [0, 0.6]	0 [0, 1]	0 [0, 2]	0 [0, 1]	1.84	0.606
Latency to enter arena	23	23	23	23		
(s)	3 [2, 5]	3 [2, 5]	2 [2, 5]	2 [2, 4]	5.45	0.142
Latency to eat	23	23	23	22		
(s)	10 [9, 11]	12 [10, 20]	10 [8, 10]	12 [10, 17]	19.51	<0.001**
Focus food ^a	2	22	12	18		
(s)	0 [0, 0]	9 [4, 20]	2 [0, 8]	9 [2, 15]	37.14	<0.001**
Focus other ^b	17	10	18	11		
(s)	1 [0, 2]	0 [0, 7]	5 [1, 11]	0 [0, 5]	8.87	0.031*

Test statistics for the comparison between tests are given in the two last columns.

^a Time spent focussing on the food/test stimulus (alert food + investigate food + investigate cone).^b Time spent focussing on other (alert other + investigate other).

3. Results

3.1. Responses to the different test stimuli

All test stimuli resulted in reduced eating time and increased investigation (investigate food, cone or other features of the arena) compared to the control situation. The number of animals, which showed the different behaviours in the respective test situations, medians (25, 75% quartiles) and the test statistics are shown in Table 3. The latency to eat was

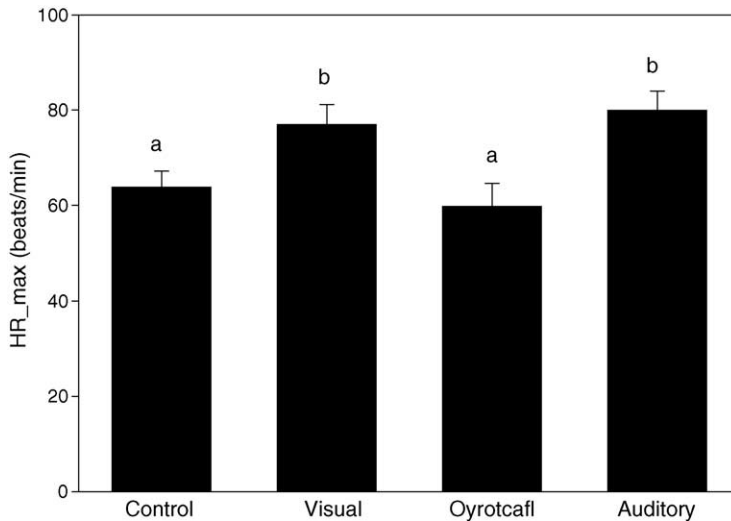


Fig. 2. Maximum heart rate responses (mean $\pm$ S.E.) during the tests. Different letters indicate significant difference at $P < 0.05$.

significantly increased for the visual and auditory tests, whereas more disrupted feeding (an increased number of eating bouts) was shown in the olfactory test. Likewise, sniffing the food and focussing on other features in the arena was primarily shown during the olfactory test, whereas the horses spent more time focussing on the food/stimulus in the visual and auditory tests. Backing away from the test stimulus was only shown in the auditory test. In general, very little locomotion was shown by the horses during the tests.

Exposure to the novel visual and auditory stimuli elicited significantly increased HR responses in the horses compared to their response to the control arena, whereas there was no increase in HR to the olfactory stimulus. The maximum HR responses during exposure to the control arena and the three test stimuli are shown in Fig. 2 ($F_{3,65} = 5.73$, $P = 0.002$). The average HR responses to the different test situations gave a similar picture (control: 52.26 ± 2.05 , visual: 57.49 ± 2.34 , olfactory: 51.02 ± 2.72 , auditory: 62.22 ± 2.28 ; $F_{3,70} = 4.84$, $P = 0.004$).

There were no significant differences between the test days in HR or behavioural response, indicating that the horses did not habituate nor sensitize to being tested. There was no effect of sire in any variables in any tests.

3.2. Correlations between behaviour and heart rate responses

Time spent eating was negatively correlated with all other variables, i.e. the more time a horse spent eating, the less it responded to the test stimulus. Thus, time spent eating was used as a reference variable to study the interrelationship between behaviour and HR responses. There were significant, negative correlations between time spent eating and HR in the visual and the auditory tests (HR_avg: visual: -0.49 , $P = 0.032$; auditory: -0.51 , $P = 0.022$; HR_max: visual: -0.41 , $P = 0.076$; auditory: -0.46 , $P = 0.041$), whereas there was no correlation in the control and olfactory tests.

3.3. Correlations between test situations

Horses, which responded with a high HR in the auditory test, also had a high HR in the olfactory and the visual test, i.e. there were significant, positive correlations between HR responses in the olfactory and auditory tests (HR_max: $r_s = 0.66$, $P = 0.013$ and HR_avg: $r_s = 0.72$, $P = 0.005$) and between the visual and auditory tests (HR_max: $r_s = 0.55$, $P = 0.026$ and HR_avg: $r_s = 0.48$, $P = 0.056$). However, there was no correlation in HR between the visual and olfactory tests. Also, there were no significant correlations between the test situations for any behavioural variables.

4. Discussion

4.1. Responses to the different test stimuli

The test stimuli elicited different behavioural responses in the horses and the heart rate increased in response to the visual and auditory stimuli, but not to the olfactory stimulus. Apart from a significantly reduced eating time in all test situations compared to the control situation, it is noteworthy that the behavioural responses to the novel visual and auditory stimuli were similar, whereas the responses towards the novel olfactory stimulus differed. The visual and auditory stimuli elicited increased latencies to eat and more time spent alert towards or investigating the stimulus. During the olfactory test, the horses spent more time sniffing and focussing on other things in the arena and they showed more disrupted feeding. Boissy (1995) suggested that transitions between behaviours can be induced by conflicts between emotional states and motivations and thereby are expressions of fear. In the present study, we found significantly increased heart rate responses to the visual and auditory stimuli, whereas the heart rate did not increase during exposure to the olfactory stimulus. Herskin et al. (2003) also found behavioural but no heart rate responses in cattle towards different types of novel food, including drops of eucalyptus oil added to their usual food. The horses in our study showed very little locomotion activity in all tests; thus, the difference in heart rate responses cannot be attributed to differences in physical activity. The question is why horses only show behavioural and not heart rate responses to an unknown smell and whether this applies to this particular smell only or whether it is adaptive? An increase in heart rate is the body's physiological response to localised danger, preparing the animal for flight. Since smell travels slowly in air, there may be no sense in running away from an unknown smell because the source of the smell may have moved before the animal perceives the smell. However, unknown smells may act to make the animal more vigilant towards the surroundings. In our study, increased vigilance was identified by a significant increase in the number of eating bouts. Vigilance may thus be a measure of fearfulness as suggested by Welp et al. (2004), who studied fear in dairy cattle and found alterations in vigilance according to their degree of fearfulness. Terlouw et al. (1998) investigated responses of cattle to odours of urine and blood from conspecifics and faeces from carnivores and found that the odours induced heightened vigilance, e.g. increased sniffing, but that the odours did not interfere with the expression of feeding motivation. These results correspond to the responses of horses towards a novel smell in the present experiment. On the contrary, it is biologically relevant to

be prepared to run away from an unknown sound or visual stimulus and maybe these senses are primarily used for immediate predator detection. Thus, it seems that horses respond to unknown visual and auditory stimuli by both behavioural and heart rate changes, whereas an unknown olfactory stimulus elicits behavioural changes only in terms of increased vigilance towards the surrounding environment. Boissy (1995, 1998) discussed the concepts of fear and anxiety and suggested that the perception of actual danger causes the emotional state fear, whereas potential danger causes the emotional state anxiety. The responses of the horses in the visual and the auditory tests probably reflect the fact that in these tests, the horses were able to localise the stimulus, inducing behaviours to avoid the stimulus (“fear”), whereas the olfactory test induced an expectation of danger (“anxiety”). Further experiments, in which horses are exposed to more biologically relevant smells, e.g. predator odour, are necessary in order to investigate the interrelationship between behavioural and heart rate responses to novel olfactory stimuli.

Backing away from the stimulus was only shown in the auditory test, indicating that this type of behaviour may be an innate response to an unknown sound. However, differences in responses between the test stimuli may not only be attributed to the type of stimulus. Responses may also be linked to the fear-eliciting strength of the test stimulus, which cannot be compared in the present study. The strength of a visual stimulus cannot be equated to the strength of an auditory or olfactory stimulus. However, in the present study, the total eating time was reduced to the same amount in all test situations. This equal eating time indicates a relatively similar strength of the stimuli. Further experiments in which horses are exposed to same type of stimulus but with different fear-eliciting properties would be necessary in order to link specific responses to the activation of different senses. While this may be achieved by studying responses to the same sound at different intensities, it is not so obvious whether a larger visual object is more frightening than a small or a stronger smell more frightening than a weak one.

There were no indications of carry-over effects, which probably relates to the fact that all horses managed to eat within the duration of the tests. The infrequent occurrence of some behaviours, e.g. defecations, vocalisations and the flehmen response, may be a consequence of these behaviours relating to different situations. Defecations and whinnying were shown during the initial habituation, indicating that once habituated to social isolation, these behaviours cease and do not reoccur even when horses are exposed to novelty in a known environment. Our results would also suggest that flehmen behaviour, which is typically shown by stallions when investigating urine, is probably associated more with sexual behaviour rather than the smell of novelty.

4.2. Correlations between behaviour and heart rate responses

The total eating time was found to reflect the reactions of the horses in all test situations in that the more a horse responded to the test stimulus, the greater the reduction in total eating time. The total eating time also reflected the heart rate response in the visual and auditory tests, but not in the control and olfactory tests. The results indicate that an interrelationship between behavioural and heart rate responses exists, given that the heart rate responses are sufficiently strong. This is in agreement with other studies on horses (e.g. Jezierski and Górecka, 1999; Lansade et al., 2003).

4.3. Correlations between test situations

There were no significant correlations in any behavioural variables between the tests, which is most likely due to the stimuli eliciting different and not very strong behavioural responses. Previous studies of consistency of behavioural variables across test situations in horses have shown varying results (e.g. Scolan et al., 1997; Wolff et al., 1997; Visser et al., 2001; Seaman et al., 2002). Discrepancies between studies may relate to the variation in tests to which the horses are exposed, sometimes mixing social and non-social situations. In other species, generalisation of behavioural responses across several different situations has been demonstrated (e.g. mink: Malmkvist and Hansen, 2002; cattle: Boissy and Bouissou, 1995; dogs: Goddard and Beilharz, 1984).

The strong correlation between heart rate responses in the olfactory and auditory tests may reflect the way in which these stimuli were presented as they were probably perceived only as the horses approached the food. This is in contrast to the visual stimulus, which could be easily seen from the start box when the door opened. Considering the small sample sizes, due to loss of heart rate data, as well as the fact that the horses were very similar in their responses, which gives only little variation, it is very likely that even stronger correlations in heart rate responses between different test situations exist. Other studies on horses have also shown correlations in heart rate responses between different tests (Visser et al., 2002). The heart rate correlations across situations indicate that heart rate responses simply reflect a non-differentiated activation of the sympathetic nervous system, whereas the behavioural responses are linked to the type of stimulus.

In conclusion, the responses of the horses to the novel olfactory stimulus differed from those to the visual and auditory stimuli, since the horses showed behavioural responses without a corresponding increase in heart rate towards the novel smell. Heart rate responses correlated between test situations, while the behavioural response was linked to the type of stimulus.

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Training methods for horses: Habituation to a frightening stimulus

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Summary

Responses of horses in frightening situations are important to both horse and human safety. While considerable scientific interest has been shown to the development of reactivity tests, little effort has been dedicated to the development of appropriate training methods for reducing fearfulness. The process, where young horses learn not to react to otherwise frightening stimuli, was studied using 27, 2-year-old, naïve Danish Warmblood stallions. The horses were trained according to three different methods, based on classical learning theory. In the first method (Classic habituation), the horses (n=9) were exposed repeatedly to the full stimulus (a moving, white nylon bag, 1.2 x 0.75 m) until they met a predefined habituation criterion. In the second method (Gradual habituation), the horses (n=9) were introduced gradually to the moving stimulus and were habituated to each step, before the full stimulus was applied. In the third method (Associative learning), the horses (n=9) were trained to feed from the bag, i.e. to associate the stimulus with a positive reward, before they were exposed to the full stimulus. Five training sessions of 3 minutes were allowed per horse per day. Heart rate and behavioural responses were registered. There was no significant difference between methods in behavioural or heart rate responses during the first training session. However, horses that were habituated gradually showed fewer flight responses totally and needed fewer training sessions to learn to react calmly to test stimulus. Variations in heart rate persisted even when the behavioural responses had ceased. We conclude that gradual habituation is the most effective training method for horses in frightening situations. Further research is needed in order to establish the role of positive reinforcement, such as food, in the training of horses.

Keywords: Horse, behaviour, fear, habituation, learning, training.

Introduction

Horses are primarily used for sports and leisure for a large number of children and young women. Unfortunately, horse riding ranks as one of the most dangerous sports in terms of the number and seriousness of accidents, and investigations have shown that unexpected flight responses are a major cause of accidents (Keeling *et al.* 1999). The ability of a horse to habituate to a range of otherwise frightening stimuli greatly increases safety in the horse-human relationship. Development of effective methods for reducing fear in horses therefore has important practical applications for safety of both horse and handler. While considerable scientific interest has been shown in the development of reactivity tests (e.g. Wolff *et al.* 1997; Visser *et al.* 2001; Seaman *et al.* 2002; McCall *et al.* 2005), very little effort has been dedicated to the development of appropriate training methods for reducing fearfulness in horses.

Habituation is the waning of responsiveness towards a repeated stimulus and is probably one of the most common types of learning in horses (Cooper, 1998). Habituation can be regarded as a simple form of learning because it involves reduction of a response which is already there. Associative learning, on the other hand, is about acquiring new responses. After some repetitions of an event followed by the same consequences, a long-term association is built up between the event and its result and the animal's behaviour changes accordingly. The best known example of associative learning is Pavlov's dogs, which learned to associate the sound of a bell with food. Pavlov also found that dogs were able to generalize their responses to include stimuli similar to the conditioned one (Manning and Dawkins 1998). There has been considerable scientific interest in animal learning in a wide range of animals e.g. rats, pigeons and primates, while there is no published research on such basic learning abilities as habituation and sensitisation in horses, and very little research on basic associative learning processes (see review by Nicol 2002). This is surprising given the importance of these processes in every elementary training programme, and Nicol (2005) states that more studies of the application of learning theory to practical problems are desperately needed.

In this study we trained horses according to three different methods; 1) classic habituation, 2) gradual habituation and 3) associative learning in order to investigate which of the three methods is most efficient for training horses to react calmly to an otherwise frightening stimulus. We hypothesise that horses are able to generalize about the test stimulus so that once familiar with the test stimulus in one situation, the stimulus will appear less frightening, i.e. elicit a reduced response, even when presented differently. Based on this assumption, we further hypothesise that alternative methods, such as gradual habituation and associative learning, will be more efficient, compared to the more simple type of learning in a classic habituation approach.

Recent studies have shown that behavioural reactions combined with physiological data are reliable measurements of horse reactivity (Christensen *et al.* 2005; McCall *et al.* 2005). In this study we use heart rate data, combined with two

behavioural scores (immediate reaction to the test stimulus as well as latency to return to a feed container) to determine reactions of the horses during the training sessions. Equine reactions may be influenced substantially by human handlers, and we therefore developed training methods without human handling.

The aim of this study was to investigate which of three different training methods, based on learning theory, was the most effective for horses to learn to react calmly in an otherwise frightening situation.

Materials and Methods

Animals

A total of 27, 2-year old Danish Warmblood stallions from a large stud were used in this study. All colts were kept on pasture with the dam before weaning and were subsequently housed in large groups in straw-bedded boxes with access to outdoor areas during the winter. The colts had received a minimum of handling, only for necessary veterinary or farrier treatment. During the summer (May - October) the colts were pastured in a large enclosure (30 ha). Prior to the experiment, the stallions were habituated to wearing halters, heart rate monitoring equipment, to being socially isolated and to feeding from the container inside the test arena. Before the present experiment the horses took part in a different research project, investigating social transmission in horses, during which they all had similar experiences with the test arena. The horses were assigned to one of three treatments (training methods) based upon their reactions during the initial handling and in the first experiment, balancing the number of highly reactive horses and calm horses on each treatment. One horse became lame during the experiment and had to be excluded from the study, i.e. the data analysis is carried out on n=26 horses.

Test arena

Within the 30-ha summer enclosure, a smaller capture enclosure (1-ha) contained a fenced waiting area (50 m²). Next to the waiting area a start box (2.5 m²) and a test arena (10 m in diameter) was constructed out of straw bales (1.2 x 1.2 x 2.4 m³) in two layers, making the height of the walls of the arena 2.4 m (Fig. 1). The set-up enabled the horses to hear, but not see their group mates during the tests. A feed container, placed in the middle of the arena, contained a mixture of alfalfa and the horses' usual winter feed (oat, barley, soybean oil meal, minerals and molasses).

Test stimulus and training methods

The test stimulus was a white nylon bag (1.2 x 0.75 m) which was pulled from outside the arena from a flat, folded to an unfolded, upright position by use of a string. The test stimulus was applied when the horse had been feeding for at least 30 sec. The horses were trained according to three different methods (Table 1). In the first method (**Classic habituation; MET1**), the horses (n=9) were exposed

repeatedly to the full stimulus until they met the predefined habituation criterion (see below). In the second method (**Gradual habituation; MET2**), the stimulus was divided into several less frightening steps, i.e. the intensity of the movement was lower during the first steps, and the horses (n=9) were habituated to each step, before the full stimulus was applied. In the third method (**Associative learning; MET3**), the horses (n=8) were trained to feed from the bag, i.e. to associate the stimulus with a positive reward, before they were exposed to the full stimulus.

An equal number of horses on each method were trained during a test day. The study conforms to the 'Guidelines for Ethical Treatment of Animals in Applied Animal Behaviour and Welfare Research' prepared by the Ethics Board of the International Society of Applied Ethology (www.applied-ethology.org).

Recordings

Behavioural reaction to the test stimulus (Table 2) and latency to return to the food were registered using a handheld computer (Workabout, PSION PLC, UK). The observer sat quietly on top of the straw wall next to the start box, and the horses were used to the presence of the observer. Heart rate (HR) was recorded with Polar Vantage (Polar Electro OY, Kemple, Finland), which consisted of an electrode belt with a built-in transmitter and a wristwatch receiver. Water and gel were used to optimise the contact between electrode and skin. The HR monitoring equipment was fitted on the horse in the waiting area prior to testing, and the receiver stored data from the transmitter (every 5 sec). Subsequently, data were downloaded via a Polar Interface to a PC, using the software Polar Precision Performance™ SW 4.

Habituation criteria

The habituation criterion was met when the horses showed only 'head up' or no behavioural response to the test stimulus (Table 2). For MET3 the first step was passed when the horse fed from the bag for at least one minute during the 3-minute training session. Horses which did not habituate within 20 training sessions were excluded from further training.

Data analysis

Data on the number of required training sessions were registered as the number of extra sessions a horse needed in order to meet the habituation criterion, i.e. a horse on MET1 which did not react to the test stimulus at the first presentation was scored as receiving 0 training sessions. A horse on MET2 or MET3, which passed directly through the three different steps corresponding to their training method, was also scored as receiving 0 training sessions. In case a horse needed e.g. two extra sessions in order to learn to feed from the bag in MET3, and passed directly through the other two steps, the horse was scored as receiving two training sessions, and so forth.

The number of horses on each training method was balanced between test days, and test day is not considered further in the analysis. Preliminary tests showed that there was no effect of horse on the initial HR (before the training sessions), probably due to the similar age, breed, and exercise level of the horses, making it unnecessary to correct for individual differences in initial HR. Thus, the analysis was carried out on data for average HR (HR_avg) and maximum HR (reflecting the immediate response of a horse towards the test stimulus; HR_max).

The number of required training sessions was analysed in Kaplan-Meier Survival Analysis: Log-Rank test, considering censored values, in the statistical program SigmaStat 3.0 (www.spss.com). The analysis was carried out on 'number of training sessions + 1', to include also horses with zero extra training sessions. Behavioural scores, latencies, and heart rate data (HR_max and HR_avg) were analysed for effect of training method by One Way Analysis of Variance (ANOVA; SigmaStat 3.0). Correlations were analysed using Spearman Rank-Order correlations (SigmaStat 3.0). A significance level of $P < 0.05$ was used throughout.

Results

Number of required training sessions

Four of the 26 horses (15.4%) did not habituate within the course of the experiment (MET1: 1 horse (11.1%); MET3: 3 horses (37.5%)). Horses which were trained according to MET2 (Gradual habituation) needed fewer training sessions (Required training sessions (mean $\pm$ se): MET2: 2.4 ± 0.7 , MET1: 4.6 ± 2.0 , MET3: 12.0 ± 2.8 ; $U_2 = 9.16$, $P = 0.01$; Fig. 2) to learn to react calmly to the test stimulus.

Reactions during the first training session

Surprisingly, there was no significant difference between horses on MET1 and horses on MET2 in their behavioural reaction, latency to return to the food, HR_max, or HR_avg during the first training session, i.e. the horses did not react more to the full stimulus (MET1) than to the slower, less moving test stimulus (MET2) during the very first presentation. MET3 differed from the other two methods during the first training session in that the horses only had to learn to feed from the bag and they were not exposed to a sudden stimulus. Although insignificant, their HR responses suggest that this situation may be even more frightening than exposure to a sudden stimulus (HR_avg (bpm, mean $\pm$ se): MET3: 89.3 ± 9.9 , MET1: 75.6 ± 8.6 , MET2: 71.0 ± 6.2 , n.s.; HR_max: MET3: 117.1 ± 12.1 , MET1: 95.7 ± 10.7 , MET2: 86.9 ± 8.3 , n.s.).

Reactions upon presentation of the full stimulus

There was a significant difference between the horses' reaction to the first presentation of the full stimulus in that horses on MET1 received a higher reactivity score (Fig. 3), a longer latency to return to the food (seconds (mean $\pm$ se);

MET1: 21.7 ± 7.7 ; MET2: 4.4 ± 1.1 ; MET3: 3.6 ± 1.0 , $F_2=3.88$, $P=0.038$), and showed a higher HR response (e.g. HR_max: MET1: 95.7 ± 10.7 , MET2: 68.1 ± 3.0 , MET3: 66.4 ± 6.4 , $F_2=4.52$, $P=0.024$) than did horses on MET2 and MET3. There was no difference between horses on MET2 and MET3.

Correlations between HR and behavioural responses

There were significant correlations between the horses' HR response and their behavioural response (score and latency) during the first training session (Table 3), i.e. horses with a high HR also received a higher behavioural score and took longer to return to the food.

Correlations between HR and number of required training sessions

There was a strong correlation between HR responses during the first training session and the total number of required training sessions, i.e. horses which were highly reactive during the first training session needed more training sessions to learn to react calmly to the stimulus (all horses, $r_s=0.73$, $P<0.001$). However, looking at the correlations separately for each training method it appears that while the correlation remains strong for horses on MET1 ($r_s=0.86$, $P<0.001$) and MET3 ($r_s=0.90$, $P<0.001$), it is insignificant for horses on MET2 ($r_s=0.62$, n.s.).

Variations in HR at point of habituation

There were large variations between horses in their HR response, even when the behavioural response towards the test stimulus had ceased, but the variation did not differ between the methods (max_HR range (bpm): MET1: 60-105, MET2: 59-77, MET3: 50-85).

Discussion

Our results show that gradual habituation was the most effective and gentle training method for horses in order to learn to react calmly in an otherwise frightening situation. In addition, all horses on this method eventually habituated to the frightening stimulus, whereas some horses on the other two methods did not habituate within the experimental period. Associative learning appeared to be the least appropriate training method. In this method we encouraged the horses to explore the test stimulus by the use of food. Although food is a very strong motivator and is the most commonly used reinforcer in experimental work on equine learning (Nicol 2002), our results imply that the use of food in order to train horses not to be fearful is inefficient.

Feeding from frightening objects is often applied in police horse training where it appears to be useful (pers. com. UC Carlsson-Lindkvist, responsible for education of Swedish police horses). However, the police horses are typically left with a task in an enclosure, e.g. food is placed in the middle of a large piece of plastic and the horse needs to step on the plastic in order to get to the food. In this way the horse is able to train itself and has plenty of time to solve the problem

(obtain the food). Since the high number of required training sessions for horses on MET3 in the present experiment were caused by the time taken to learn to feed from the test stimulus, the training method may prove useful in other circumstances when horses are able to train alone. Gough (1999) succeeded in reducing fear responses towards a clipper by allowing the horses to listen to the sound of the clipper while feeding during 2 weeks. However, the study was carried out on a small number of animals and there was a lack of control, meaning that the reduction in response may be caused by a general habituation. Further research is necessary in order to identify possible benefits of the use of positive reinforcement and associative learning in relation to fear reactions in horses.

In the present experiment, food was used in all methods to estimate the responses of the horses in terms of their latency to return to the feed container after being exposed to the test stimulus. The latency shows when the horse has calmed sufficiently to start feeding again and there were strong correlations between behavioural (latency and score) and HR responses of the horses during the first training session. The strong correlation between heart rate responses during the first training session and the total number of required training sessions shows that the immediate response of a horse in a frightening situation may be used to predict its trainability. However, the result that the correlation was insignificant for horses trained gradually implies that a more gentle training method is beneficial for the more emotional horses. In combination with the result that all horses passed on this method whereas some horses never habituated on the other two methods, our study indicates that the choice of training method is likely to be especially important for the more reactive horses. In fact, the horses which did not habituate seemed to sensitize, i.e. they became more and more reactive, to the test stimulus. The risk of developing phobias in horses further emphasizes the importance of choosing appropriate and gentle training methods for the most fearful horses.

In this experiment we based the habituation criterion on behavioural measures, since a reduction in behavioural response typically is the end goal for horse trainers. However, the analysis of the heart rate data revealed large individual variations between horses, which met the behavioural habituation criterion. Thus some horses may still be frightened by the test stimulus, even when the behavioural reaction has ceased. Previous experiments have shown that more emotional horses are poorer learners and are less trainable for riding (Heird *et al.* 1986), and it may therefore be beneficial to promote the use of heart rate data as a quick, easy and non-invasive tool in the daily training of horses.

Surprisingly, there were no significant differences between the methods in heart rate and latency to return to the food during the first training session in the present experiment, i.e. the horses did not react more to the full stimulus (Classic habituation) than to the slower, less moving test stimulus (Gradual habituation) during the very first presentation. This is in accordance to results on lambs where behaviour towards a novel object was independent of the speed of appearance (Désiré *et al.* 2004). The results probably reflect the biological relevance of prey species reacting to any unknown movement in the environment, regardless of the

intensity. Despite the lack of difference during the first training session, the weaker and gradually increasing movement intensity of the test stimulus in MET2 had a positive effect on the speed of learning in the test horses, which was due to the fact that the horses reacted less during subsequent exposures.

Results from the first presentation of the full stimulus showed that horses on MET2 and MET3 had learned to generalize about the test stimulus from previous presentations and reacted less even when the stimulus was presented differently, i.e. they reacted less during the first presentation of the full stimulus, compared to horses on MET1. The similar responses towards the full stimulus in horses on MET2 and MET3 indicate that any difference between these methods has disappeared for horses that do get this far in the training program. It should be noted though that horses may become used to being tested, rather than learn to generalize about the test stimulus. However, the test horses already had experience with the test arena and test situations prior to the present study. In fear tests, there is also a risk of the animals becoming sensitized, because they know that something is going to happen in the test arena. While a few horses appeared to sensitize on MET1 and MET3, all horses on MET2 habituated to the test stimulus and they needed fewer training sessions in total, supporting that a gradual approach is more easily learned by the animals.

Conclusion

We conclude that gradual habituation is the most effective and gentle training method for horses in frightening situations.

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Table 1. Training methods

Training method	Procedure	Comment
MET1: Classic habituation	<i>Step 1:</i> The horse is exposed to the full stimulus while feeding from the feed container in the middle of the test arena (i.e. the bag is lifted from a flat folded to an upright position at full speed).	Prior to a training session, the test horse is fitted with a halter and HR equipment and led to the start box where it is released. The session starts when the arena door is opened by the observer and the horse is free to enter the arena. The horse is allowed to feed for at least 30 sec. before the test stimulus is applied.
MET2: Gradual habituation	<i>Step 1:</i> As in MET1, but with the bag lifted only halfway up at half speed. <i>Step 2:</i> The bag is lifted all the way up at half speed. <i>Step 3:</i> The horse is exposed to the full stimulus (as in MET1).	If the horse does not return to the feed container within the test time of 3 min. it is led to the container by the handler and offered feed before leaving the arena. Each horse receives a maximum of five training sessions per day. Between each training session the horse returns to visual contact with the group mates in the capture enclosure, while the arena is prepared for the next training session (e.g. placing the test stimulus in the start position, removal of defecations, and adding extra feed if necessary).
MET3: Associative learning	<i>Step 1:</i> A similar bag is placed with the test stimulus and feed is spread on the bag, while the usual feed container is removed from the arena. The horse is allowed to feed from the bag during the entire test time. <i>Step 2:</i> The horse is exposed to the full stimulus, while feeding from the other bag below the test stimulus. <i>Step 3:</i> The horse is exposed to the full stimulus while feeding from the usual feed container in the middle of the test arena (as in MET1).	Whenever a horse meets the habituation criterion (see text) it carries on with the next step until it is habituated to the full stimulus. A horse, which needs more than five training sessions, starts on the last passed step on the subsequent training day. MET3, step 1: If the horse does not feed within the test time of 3 min. it is led to the bag by the handler and offered feed before leaving the arena.

Table 2. Ethogram of behavioural reactions

Reaction	Description
1. None ¹	The horse does not react to the test stimulus and chewing is not interrupted
2. Head up ¹	The horse raises the head from the feed container and chewing is interrupted, but it is not alert and does not move away from the feed container
3. Alert	The horse stands vigilant with elevated neck, with or without tail elevation, head and ears oriented towards test stimulus, chewing is interrupted and the horse may move up to two steps away from the feed container
4. Away	The horse moves three or more steps backwards or sideways from the feed container in response to the test stimulus, typically followed by alertness
5. Flight	The horse turns/jumps away from the feed container in a sudden movement, typically followed by trotting/galloping, alertness and possibly snorting

¹Reaction allowed in habituation criterion

Table 3. Correlations between HR and behavioural responses during first training session

	MET1 (Classic hab.)	MET2 (Gradual hab.)	MET3 (Ass. learning)
Max_HR vs. React. score	$R_s=0.83$; $P=0.002$	$R_s=0.80$; $P=0.006$	Data not analysed*
Max_HR vs. Latency	$R_s=0.71$; $P=0.025$	$R_s=0.63$; $P=0.058$	
Latency vs. React. score	$R_s=0.78$; $P=0.009$	$R_s=0.82$; $P=0.004$	

* The horses did not receive a reactivity score during the first step in MET3. Besides, 7 of 8 horses were censored, i.e. did not approach the bag with food within the test time.

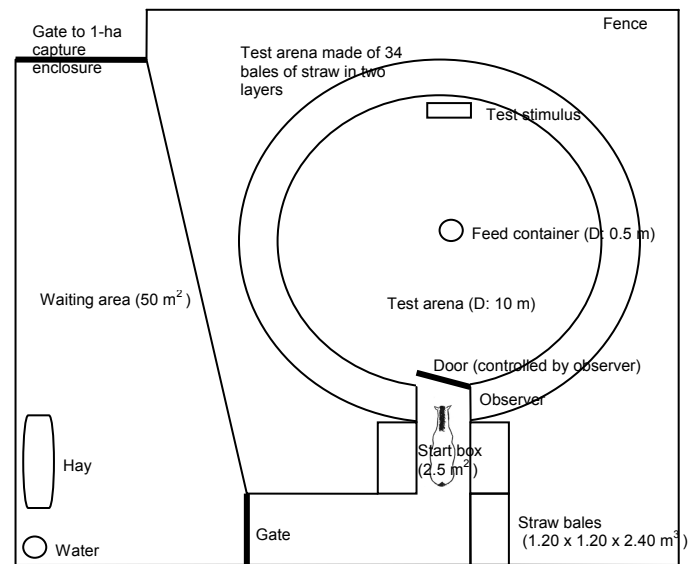


Figure 1. Test arena.

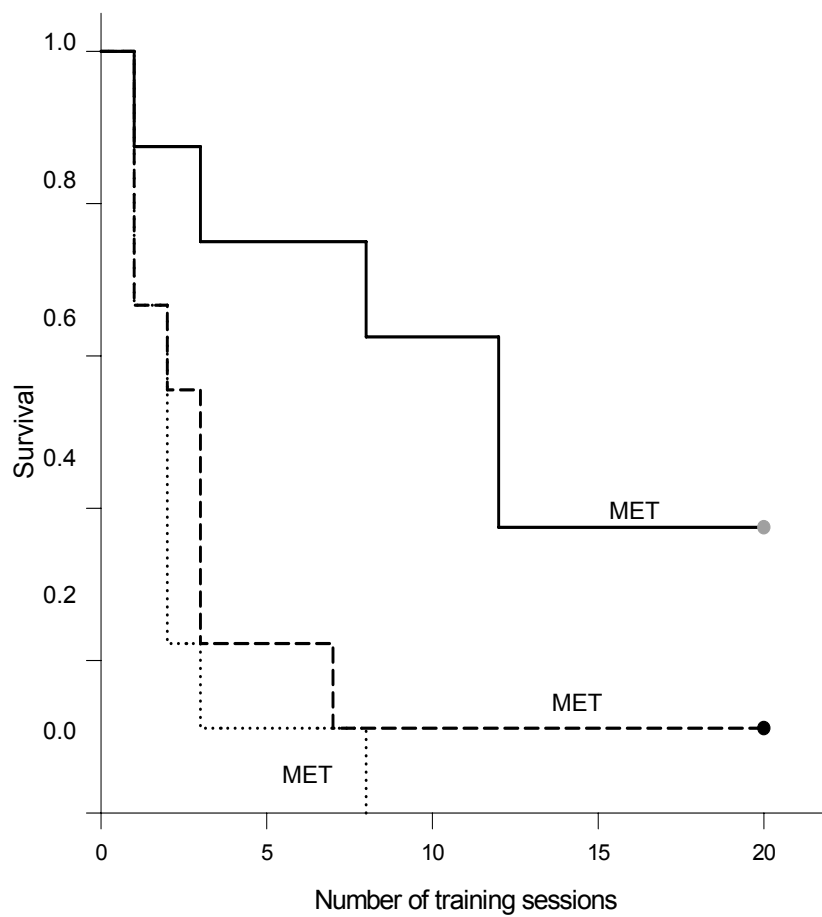


Fig.2. Required training sessions: Kaplan-Meier Survivor functions for each training method.

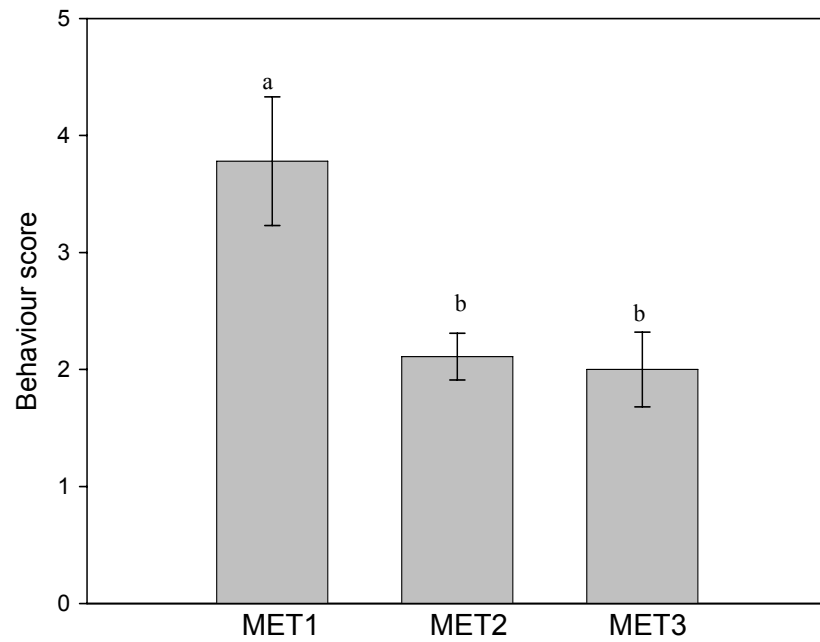
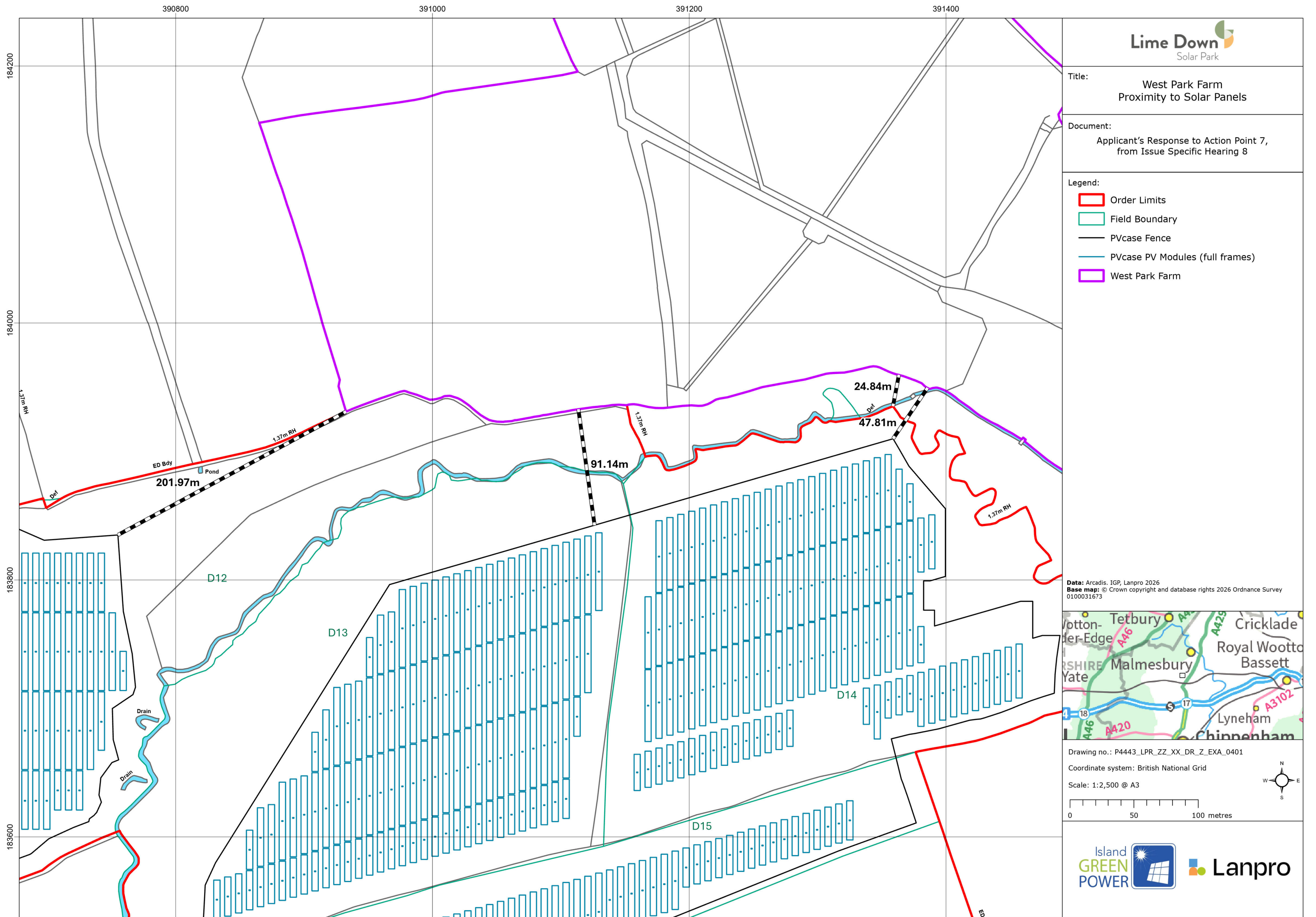


Fig. 3. Behavioural reaction to first presentation of full stimulus. Bars with different letters differ at $P < 0.05$.

Appendix E Solar PV Array Areas to the nearest known boundaries of West Park Farm



Title:
West Park Farm
Proximity to Solar Panels

Document:
Applicant's Response to Action Point 7,
from Issue Specific Hearing 8

- Legend:
- Order Limits
 - Field Boundary
 - PVcase Fence
 - PVcase PV Modules (full frames)
 - West Park Farm

Data: Arcadis, IGP, Lanpro 2026
Base map: © Crown copyright and database rights 2026 Ordnance Survey
0100031673



Drawing no.: P4443_LPR_ZZ_XX_DR_Z_EXA_0401

Coordinate system: British National Grid

Scale: 1:2,500 @ A3



Appendix F Avian Species

1 Introduction

- 1.1.1 This document has been prepared in response to the agenda for Issue Specific Hearing 8 published by the Examining Authority, specifically with reference to Item 4.1 which states the following:

‘The Applicant will be invited to set out how it has arrived at its conclusion of risk to avian species within the cable route corridor based on the current level of information within the ES.

To assist the examination, the Applicant is requested to complete the table below using information contained within ES Chapter 9 [REP4-010], Appendices 9-1 Ecological Baseline Report [REP4-019], 9-4 Breeding Bird Survey Report [APP-201] and 9-7 Wintering Bird Survey Report [APP-204], and Figures 9-1-5 to 9-1-24 [APP-111, APP-112, APP-113, REP1-036].

The table should provide, for each relevant species, its conservation status, and the level of risk identified by the Applicant, with reference to the mitigation hierarchy. It would greatly assist the Examining Authority (ExA) if the table were sorted by conservation status and presented on screen at the hearing during this agenda item to enable discussion.’

- 1.1.2 The species are listed by conservation status according to the following criteria:

- BoCC Red List – Species included on the Birds of Conservation Concern 5 (BoCC5) Red List, published by the Birds of Conservation Concern partnership¹. Species are assigned to the Red List where they meet one or more of the following criteria: severe declines in breeding population or range (typically 50% or greater over 25 years), global threat status, or severe historical decline.
- BoCC Amber List - Species included on the Birds of Conservation Concern 5 (BoCC5) Amber List. Species are assigned to the Amber List where they meet one or more of the following criteria: moderate declines in population or range, historical declines followed by partial recovery, international importance of UK populations, or small and localised breeding populations within the UK.

¹ The Birds of Conservation Concern partnership is a coalition of the UK’s leading bird conservation and monitoring organisations, which comprises the British Trust for Ornithology (BTO), Game and Wildlife Conservation Trust, Joint Nature Conservation Committee (JNCC), Natural England, Northern Ireland Environment Agency, Natural Resources Wales, NatureScot, and the Royal Society for the Protection of Birds (RSPB).

- S41 – Species listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 as Species of Principal Importance for the purpose of conserving biodiversity in England.
- Annex 1 - Species listed on Annex I of the Birds Directive (Directive 2009/147/EC on the conservation of wild birds). These species are afforded special conservation measures because they are threatened with extinction, vulnerable to specific habitat changes, considered rare due to small populations or restricted distributions, or otherwise require particular attention owing to their habitat requirements.
- Sch 1 - Species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). These species receive additional legal protection against disturbance whilst nesting and during other sensitive stages of the breeding cycle.

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
Corn Bunting	Red BoCC; S41	Nest destruction at field edges, ditch banks and hedgerow bases during clearance and trenching in the nesting season, with temporary displacement from the working width (ES 9.10.257, 9.10.259). Pre-mitigation risk: Moderate.	AVOID - clearance and field entry outside March–August where practicable, with EcoCoW nesting checks and a 50 m nest buffer (EPMS MS10, 11.2). MINIMISE - works confined by fencing at each field boundary crossing, gaps limited to 12 m (10 m in Bat Impact Zones), EcoCoW supervision (EPMS 3.4.2–3.4.3). RESTORE - grassland and hedgerow reinstatement (EPMS MS6). Residual risk: Low.
Cuckoo	Red BoCC; S41	Destruction of active nests (of host birds) and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID - no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE -fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE - translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Curlew	Red BoCC; S41	Not recorded breeding within the Order Limits; risk relates to disturbance and displacement of feeding and roosting flocks in open fields during unavoidable winter working (ES 9.10.278, 9.12.43). Pre-mitigation risk: Low–Moderate.	AVOID - November to February, a morning EcoCoW inspection precedes entry into any field, with mobilisation postponed where wader or wildfowl flocks are present (EPMS MS11, 12.2). RESTORE - reinstatement of the working width (EPMS MS6). Residual risk: Negligible; neutral and non-significant.
Fieldfare	Red BoCC; Sch 1	Schedule 1 listed, but does not nest in UK, so the nesting provisions are not engaged. Non-breeding here, so risk relates to displacement of flocks from fields and hedgerows during winter working and to temporary loss of berry and seed resources where boundary vegetation is removed (ES 9.10.278, 9.10.281). Pre-mitigation risk: Low–Moderate.	AVOID - morning EcoCoW inspection for flocks before works commence or re-commence in fields, November to February, with mobilisation postponed where flocks are present (EPMS MS11, 12.2). MINIMISE - hedgerow removal limited to the minimum length at crossings (EPMS 6.2.6). RESTORE - translocation or replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Negligible.

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
Goldeneye	Red BoCC	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	AVOID - HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE - silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE — marginal replanting and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Grasshopper Warbler	Red BoCC; S41	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID - no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE - fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE - translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Greenfinch	Red BoCC	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID - no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE - fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE - translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Grey Partridge	Red BoCC; S41	Nest destruction at field edges, ditch banks and hedgerow bases during clearance and trenching in the nesting season, with temporary displacement from the working width (ES 9.10.257, 9.10.259). Pre-mitigation risk: Moderate.	AVOID - clearance and field entry outside March–August where practicable, with EcoCoW nesting checks and a 50 m nest buffer (EPMS MS10, 11.2). MINIMISE - works confined by fencing at each field boundary crossing, gaps limited to 12 m (10 m in Bat Impact Zones), EcoCoW supervision (EPMS 3.4.2–3.4.3). RESTORE - grassland and hedgerow reinstatement (EPMS MS6). Residual risk: Low.

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
Hawfinch	Red BoCC; S41	No woodland loss is proposed; risk relates to removal of hedgerow trees, scrub and woodland-edge vegetation at crossings in the nesting season and to a temporary reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Low–Moderate.	AVOID - woodland retained outside the working width; no clearance of woody vegetation March–August; gaps limited to 12 m, or 10 m in Bat Impact Zones (EPMS 3.4.2–3.4.3, 6.4.1). MINIMISE - tree inspections, nesting checks with a 10 m nest buffer, existing gaps used in preference. RESTORE - translocation or like-for-like replanting (EPMS MS6, 7.3). Residual risk: Low.
Herring Gull	Red BoCC; S41	No nesting habitat present; birds overfly or forage opportunistically on arable, so risk is limited to short-term displacement, with extensive similar habitat nearby (ES 9.10.280). Pre-mitigation risk: Negligible–Low.	AVOID - winter flock inspections before mobilisation into fields, November to February (EPMS MS11, 12.2). MINIMISE - works confined to the defined working width (EPMS 3.4.2), and progressive rather than simultaneous construction. Residual risk: Negligible; no species-specific measures required.
House Martin	Red BoCC	No existing buildings are proposed for removal, so nests unlikely to be impacted (EPMS 6.3.1; ES 9.10.264). Pre-mitigation risk: Negligible–Low.	AVOID - no existing building removal; (EPMS 6.3.1, 6.4.1). MINIMISE - pre-works building inspections, nesting checks with a 10 m nest buffer, noise and light control near retained structures (EPMS 6.3, 6.4.2). Residual risk: Negligible.
House Sparrow	Red BoCC; S41	No existing buildings are proposed for removal, so risk is limited to loss of cavity-bearing trees at crossings and to disturbance of birds nesting in structures near the working width (EPMS 6.3.1; ES 9.10.264). Pre-mitigation risk: Low.	AVOID - no existing building removal; mature trees retained outside the working width; no tree removal March–August (EPMS 6.3.1, 6.4.1). MINIMISE - pre-works tree and building inspections, nesting checks with a 10 m nest buffer, noise and light control near retained structures (EPMS 6.3, 6.4.2). Residual risk: Low.
Lapwing	Red BoCC; S41	Nest destruction and temporary displacement where the working width is stripped and trenched in the March–August nesting season; habitats are reinstated, so no permanent CRC loss (ES 9.10.259, 9.10.270). Risk relating to disturbance and displacement of feeding and roosting flocks in open fields during unavoidable winter working (ES	AVOID - open-field works timed outside March–August where practicable, with EcoCoW nesting checks and a 50m nest buffer held to fledging (EPMS MS10, 11.2). November to February, a morning EcoCoW inspection precedes entry into any field, with mobilisation postponed where wader or wildfowl flocks are present (EPMS MS11, 12.2). MINIMISE - pre-season dissuasion, 12 m

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
		9.10.278, 9.12.43). Pre-mitigation risk: Low–Moderate.	crossing widths, EcoCoW watching brief. RESTORE - reinstatement of the working width (EPMS MS6). Residual risk: Negligible; neutral and non-significant.
Lesser Spotted Woodpecker	Red BoCC	No woodland loss is proposed; risk relates to removal of hedgerow trees, scrub and woodland-edge vegetation at crossings in the nesting season and to a temporary reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Low–Moderate.	AVOID - woodland retained outside the working width; no clearance of woody vegetation March–August; gaps limited to 12 m, or 10 m in Bat Impact Zones (EPMS 3.4.2–3.4.3, 6.4.1). MINIMISE - tree inspections, nesting checks with a 10 m nest buffer, existing gaps used in preference. RESTORE - translocation or like-for-like replanting (EPMS MS6, 7.3). Residual risk: Low.
Linnet	Red BoCC; S41	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID - no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE -fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE - translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Marsh Tit	Red BoCC; S41	No woodland loss is proposed; risk relates to removal of hedgerow trees, scrub and woodland-edge vegetation at crossings in the nesting season and to a temporary reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Low–Moderate.	AVOID - woodland retained outside the working width; no clearance of woody vegetation March–August; gaps limited to 12 m, or 10 m in Bat Impact Zones (EPMS 3.4.2–3.4.3, 6.4.1). MINIMISE - tree inspections, nesting checks with a 10 m nest buffer, existing gaps used in preference. RESTORE - translocation or like-for-like replanting (EPMS MS6, 7.3). Residual risk: Low.
Merlin	Red BoCC, Sch 1, Annex 1	Not present during breeding season, so risk is limited to short-term displacement during winter, with extensive similar habitat nearby (ES 9.10.280). Pre-mitigation risk: Negligible–Low.	MINIMISE - works confined to the defined working width (EPMS 3.4.2), and progressive rather than simultaneous construction. Residual risk: Negligible; no species-specific measures required.

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
Mistle Thrush	Red BoCC	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID - no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE - fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE - translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Pochard	Red BoCC	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	AVOID - HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE - silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE - marginal replanting and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Skylark	Red BoCC; S41	Nest destruction and temporary displacement where the working width is stripped and trenched in the March–August nesting season; habitats are reinstated, so no permanent CRC loss (ES 9.10.259, 9.10.270). Pre-mitigation risk: Moderate.	AVOID - open-field works timed outside March–August where practicable, with EcoCoW nesting checks and a 50 m nest buffer held to fledging (EPMS MS10, 11.2). MINIMISE - pre-season dissuasion, 12 m crossing widths, EcoCoW watching brief. RESTORE - full reinstatement of the working width (EPMS MS6). Residual risk: Low.
Smew	Red BoCC; Annex 1	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	AVOID - HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE - silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE - marginal replanting and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
Spotted Flycatcher	Red BoCC; S41	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID - no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE - fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE - translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Starling	Red BoCC; S41	No existing buildings are proposed for removal, so risk is limited to loss of cavity-bearing trees at crossings and to disturbance of birds nesting in structures near the working width (EPMS 6.3.1; ES 9.10.264). Pre-mitigation risk: Low.	AVOID - no existing building removal; mature trees retained outside the working width; no tree removal March–August (EPMS 6.3.1, 6.4.1). MINIMISE - pre-works tree and building inspections, nesting checks with a 10 m nest buffer, noise and light control near retained structures (EPMS 6.3, 6.4.2). Residual risk: Low.
Swift	Red BoCC	No existing buildings are proposed for removal, so nests unlikely to be impacted (EPMS 6.3.1; ES 9.10.264). Pre-mitigation risk: Negligible–Low.	AVOID - no existing building removal; (EPMS 6.3.1, 6.4.1). MINIMISE - pre-works building inspections, nesting checks with a 10 m nest buffer, noise and light control near retained structures (EPMS 6.3, 6.4.2). Residual risk: Negligible.
Tree Sparrow	Red BoCC; S41	No existing buildings are proposed for removal, so risk is limited to loss of cavity-bearing trees at crossings and to disturbance of birds nesting in structures near the working width (EPMS 6.3.1; ES 9.10.264). Pre-mitigation risk: Low.	AVOID - no existing building removal; mature trees retained outside the working width; no tree removal March–August (EPMS 6.3.1, 6.4.1). MINIMISE - pre-works tree and building inspections, nesting checks with a 10 m nest buffer, noise and light control near retained structures (EPMS 6.3, 6.4.2). Residual risk: Low.
Whimbrel	Red BoCC; Sch 1	Schedule 1 listed, but occurs on passage only, so the nesting provisions are not engaged. Breeding elsewhere and wintering outside the UK, use of the Order Limits is transient and risk is limited to short-term displacement of individuals from open ground	No species-specific mitigation is required, and the winter working precautions at EPMS MS11 are not relied upon, the species being absent from November to February. AVOID - works confined to the defined working width, no clearance of vegetation March–August, EcoCoW watching brief (EPMS 3.4.2, 6.2.9, 6.4.1). RESTORE -

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
		during spring and autumn passage. Pre-mitigation risk: Negligible.	reinstatement of the working width (EPMS MS6). Residual risk: Negligible.
Whinchat	Red BoCC	Summer visitor, absent from the UK between October and March, so no risk arises from winter working. Risk is therefore destruction of nests, eggs and young concealed at the base of tussocks and scrub during vegetation clearance, topsoil strip and trenching in the March-August nesting season, together with short-term displacement of passage birds from open ground and field boundaries. Pre-mitigation risk: Moderate.	AVOID - works timed outside March-August where practicable; pre-commencement EcoCoW inspection of the working width for nesting birds, including tussocky grassland, rough margins and scrub, with any nest mapped and a protective buffer held until fledging is confirmed (EPMS MS10, 11.2; 6.4). MINIMISE - works confined to the defined working width, EcoCoW watching brief (EPMS 3.4.2, 6.2.9). RESTORE - reinstatement of the working width (EPMS MS6). Residual risk: Low.
Woodcock	Red BoCC	No woodland loss is proposed; risk relates to removal of woodland-edge vegetation at crossings in the nesting season and to a temporary reduction in edge habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Low.	AVOID - no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE - fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE - reinstatement of the working width (EPMS MS6). Residual risk: Negligible
Yellow Wagtail	Red BoCC; S41	Nest destruction and temporary displacement where the working width is stripped and trenched in the March–August nesting season; habitats are reinstated, so no permanent CRC loss (ES 9.10.259, 9.10.270). Pre-mitigation risk: Moderate.	AVOID - open-field works timed outside March–August where practicable, with EcoCoW nesting checks and a 50 m nest buffer held to fledging (EPMS MS10, 11.2). MINIMISE - pre-season dissuasion, 12 m crossing widths, EcoCoW watching brief. RESTORE — full reinstatement of the working width (EPMS MS6). Residual risk: Low.
Yellowhammer	Red BoCC; S41	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID - no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE - fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE - translocation

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
			with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Black-headed Gull	Amber BoCC	No nesting habitat present; birds overfly or forage opportunistically on arable, so risk is limited to short-term displacement, with extensive similar habitat nearby (ES 9.10.280). Pre-mitigation risk: Negligible–Low.	AVOID - winter flock inspections before mobilisation into fields, November to February (EPMS MS11, 12.2). MINIMISE - works confined to the defined working width (EPMS 3.4.2), and progressive rather than simultaneous construction. Residual risk: Negligible; no species-specific measures required.
Black Redstart	Amber BoCC	Scarce migrant; no urban or industrial nesting habitat present. Desk study or isolated records only, with none of the habitat these species depend on present in the CRC, so no credible source–pathway–receptor link exists. Pre-mitigation risk: Negligible.	AVOID — no species-specific measures required or relied upon; generic precautions (no clearance March–August, nesting checks, EcoCoW authority to stop works) would apply in the unlikely event of occurrence (EPMS 6.2.9, 6.4). Residual risk: Negligible.
Bullfinch	Amber BoCC; S41	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID - no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE - fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE - translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Common Gull	Amber BoCC	No nesting habitat present; birds overfly or forage opportunistically on arable, so risk is limited to short-term displacement, with extensive similar habitat nearby (ES 9.10.280). Pre-mitigation risk: Negligible–Low.	AVOID - winter flock inspections before mobilisation into fields, November to February (EPMS MS11, 12.2). MINIMISE - works confined to the defined working width (EPMS 3.4.2), and progressive rather than simultaneous construction. Residual risk: Negligible; no species-specific measures required.
Common Sandpiper	Amber BoCC	Occurs on passage only, breeding elsewhere and wintering outside it, so use of the Order Limits is transient and risk is limited to short-term	No species-specific mitigation is required, and the winter working precautions at EPMS MS11 are not relied upon, the species being absent from November to February.

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
		displacement of individuals from watercourse margins during spring and autumn passage. Pre-mitigation risk: Negligible.	AVOID - HDD at watercourse crossings, avoiding in-channel and bank works; no clearance of waterside vegetation March-August (EPMS 3.4.1, 6.4.1, MS7). RESTORE - reinstatement of the working width (EPMS MS6). Residual risk: Negligible.
Common Tern	Amber BoCC	No nesting habitat present; birds overfly or – unlikely - forage opportunistically on arable, so risk is limited to short-term displacement, with extensive similar habitat nearby (ES 9.10.280). Pre-mitigation risk: Negligible–Low.	AVOID - winter flock inspections before mobilisation into fields, November to February (EPMS MS11, 12.2). MINIMISE - works confined to the defined working width (EPMS 3.4.2), and progressive rather than simultaneous construction. Residual risk: Negligible; no species-specific measures required.
Dunnock	Amber BoCC; S41	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID - no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE - fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE - translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Gadwall	Amber BoCC	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	AVOID - HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE - silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE — marginal replanting and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Garganey	Amber BoCC	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	AVOID - HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE - silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE - marginal replanting

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
			and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Great Black-backed Gull	Amber BoCC	No nesting habitat present; birds overfly or forage opportunistically on arable, so risk is limited to short-term displacement, with extensive similar habitat nearby (ES 9.10.280). Pre-mitigation risk: Negligible–Low.	AVOID - winter flock inspections before mobilisation into fields, November to February (EPMS MS11, 12.2). MINIMISE - works confined to the defined working width (EPMS 3.4.2), and progressive rather than simultaneous construction. Residual risk: Negligible; no species-specific measures required.
Great Crested Grebe	Amber BoCC	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	AVOID - HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE - silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE — marginal replanting and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Great White Egret	Amber BoCC	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	AVOID - HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE - silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE — marginal replanting and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Green Sandpiper	Amber BoCC	Not recorded breeding within the Order Limits; risk relates to disturbance and displacement of feeding and roosting flocks in open fields during unavoidable winter working (ES 9.10.278, 9.12.43). Pre-mitigation risk: Low–Moderate.	AVOID — November to February, a morning EcoCoW inspection precedes entry into any field, with mobilisation postponed where waders or wildfowl flocks are present (EPMS MS11, 12.2). RESTORE — reinstatement of the working width (EPMS MS6). Residual risk: Negligible; neutral and non-significant.
Grey Wagtail	Amber BoCC	Loss and disturbance of marginal and ditch-bank nesting vegetation where open-cut trenching is used,	AVOID - HDD at watercourse crossings, avoiding in-channel and bank works; no clearance of waterside

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
		with risk of sediment release, pollution and drainage disruption (ES 9.10.267; EPMS 7.4–7.5). Pre-mitigation risk: Moderate.	vegetation March–August (EPMS 3.4.1, 6.4.1, MS7). MINIMISE - nesting checks with a 10 m nest buffer, silt traps and temporary dams, lighting kept off the channel. RESTORE - aquatic and marginal replanting, EcoCoW-designed reinstatement and construction-phase monitoring (EPMS 7.1.3, 7.5, MS16). Residual risk: Low.
Greylag Goose	Amber BoCC	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	AVOID - HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE - silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE- marginal replanting and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Kestrel	Amber BoCC	Wide-ranging foragers not dependent on the working width; risk is limited to temporary loss of hunting habitat and to disturbance where birds nest in retained woodland, hedgerow trees or structures nearby (ES 9.10.265). Pre-mitigation risk: Low.	AVOID - woodland, hedgerow trees and existing buildings retained outside the working width; no tree removal March–August; works confined by fencing at each field boundary crossing (EPMS 3.4.2, 6.4.1). MINIMISE — pre-works tree inspections and nesting checks with buffers held to fledging. RESTORE — reinstatement of the working width (EPMS MS6). Residual risk: Negligible–Low.
Lesser Black-backed Gull	Amber BoCC	No nesting habitat present; birds overfly or forage opportunistically on arable, so risk is limited to short-term displacement, with extensive similar habitat nearby (ES 9.10.280). Pre-mitigation risk: Negligible–Low.	AVOID - winter flock inspections before mobilisation into fields, November to February (EPMS MS11, 12.2). MINIMISE - works confined to the defined working width (EPMS 3.4.2), and progressive rather than simultaneous construction. Residual risk: Negligible; no species-specific measures required.
Mallard	Amber BoCC	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary	AVOID — HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE — silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel,

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
		disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	EcoCoW supervision. RESTORE — marginal replanting and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Meadow Pipit	Amber BoCC	Nest destruction at field edges, ditch banks and hedgerow bases during clearance and trenching in the nesting season, with temporary displacement from the working width (ES 9.10.257, 9.10.259). Pre-mitigation risk: Moderate.	AVOID — clearance and field entry outside March–August where practicable, with EcoCoW nesting checks and a 50 m nest buffer (EPMS MS10, 11.2). MINIMISE — works confined by fencing at each field boundary crossing, gaps limited to 12 m (10 m in Bat Impact Zones), EcoCoW supervision (EPMS 3.4.2–3.4.3). RESTORE — grassland and hedgerow reinstatement (EPMS MS6). Residual risk: Low.
Mediterranean Gull	Amber BoCC; Annex 1	No nesting habitat present; birds overfly or forage opportunistically on arable, so risk is limited to short-term displacement, with extensive similar habitat nearby (ES 9.10.280). Pre-mitigation risk: Negligible–Low.	AVOID — winter flock inspections before mobilisation into fields, November to February (EPMS MS11, 12.2). MINIMISE — works confined to the defined working width (EPMS 3.4.2), and progressive rather than simultaneous construction. Residual risk: Negligible; no species-specific measures required.
Moorhen	Amber BoCC	Loss and disturbance of marginal and ditch-bank nesting vegetation where open-cut trenching is used, with risk of sediment release, pollution and drainage disruption (ES 9.10.267; EPMS 7.4–7.5). Pre-mitigation risk: Moderate.	AVOID — HDD at watercourse crossings, avoiding in-channel and bank works; no clearance of waterside vegetation March–August (EPMS 3.4.1, 6.4.1, MS7). MINIMISE — nesting checks with a 10 m nest buffer, silt traps and temporary dams, lighting kept off the channel. RESTORE — aquatic and marginal replanting, EcoCoW-designed reinstatement and construction-phase monitoring (EPMS 7.1.3, 7.5, MS16). Residual risk: Low.
Nightjar	Amber BoCC; Annex 1, S41	No heath, clear-fell or open woodland with bare ground present. Desk study or isolated records only, with none of the habitat these species depend on present in the CRC, so no credible source–pathway–receptor link exists. Pre-mitigation risk: Negligible.	AVOID — no species-specific measures required or relied upon; generic precautions (no clearance March–August, nesting checks, EcoCoW authority to stop works) would apply in the unlikely event of occurrence (EPMS 6.2.9, 6.4). Residual risk: Negligible.

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Osprey	Amber BoCC; Annex 1	Occurs in Wiltshire on passage only, with no nesting potential within or adjacent to the Order Limits, so no nest disturbance pathway arises. Risk is limited to transient use of airspace and open ground by individuals moving through in spring and autumn. Pre-mitigation risk: Negligible.	No species-specific mitigation is required. AVOID - woodland, hedgerow trees and existing buildings retained outside the working width; works confined by fencing at each field boundary crossing (EPMS 3.4.2, 6.4.1). RESTORE - reinstatement of the working width (EPMS MS6). Residual risk: Negligible.
Pintail	Amber BoCC	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	AVOID — HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE — silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE — marginal replanting and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Quail	Amber BoCC; Sch 1	Schedule 1 applies while nesting. Nest destruction at field edges, ditch banks and hedgerow bases during clearance and trenching in the nesting season, with temporary displacement from the working width (ES 9.10.257, 9.10.259). Pre-mitigation risk: Moderate.	AVOID — clearance and field entry outside March–August where practicable, with EcoCoW nesting checks and a 50 m nest buffer (EPMS MS10, 11.2). MINIMISE — works confined by fencing at each field boundary crossing, gaps limited to 12 m (10 m in Bat Impact Zones), EcoCoW supervision (EPMS 3.4.2–3.4.3). RESTORE — grassland and hedgerow reinstatement (EPMS MS6). Residual risk: Low.
Redshank	Amber BoCC	Not recorded breeding within the Order Limits; risk relates to disturbance and displacement of feeding and roosting flocks in open fields during unavoidable winter working (ES 9.10.278, 9.12.43). Pre-mitigation risk: Low–Moderate.	AVOID — November to February, a morning EcoCoW inspection precedes entry into any field, with mobilisation postponed where wader or wildfowl flocks are present (EPMS MS11, 12.2). RESTORE — reinstatement of the working width (EPMS MS6). Residual risk: Negligible; neutral and non-significant.
Redstart	Amber BoCC	No woodland loss is proposed; risk relates to removal of hedgerow trees, scrub and woodland-edge vegetation at crossings in the nesting season and to a temporary reduction in habitat quality	AVOID — woodland retained outside the working width; no clearance of woody vegetation March–August; gaps limited to 12 m, or 10 m in Bat Impact Zones (EPMS 3.4.2–3.4.3, 6.4.1). MINIMISE — tree inspections,

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
		pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Low–Moderate.	nesting checks with a 10 m nest buffer, existing gaps used in preference. RESTORE — translocation or like-for-like replanting (EPMS MS6, 7.3). Residual risk: Low.
Redwing	Amber BoCC; Sch 1	Schedule 1 listed, but does not nest here, so the nesting provisions are not engaged. Non-breeding here, so risk relates to displacement of flocks from fields and hedgerows during winter working and to temporary loss of berry and seed resources where boundary vegetation is removed (ES 9.10.278, 9.10.281). Pre-mitigation risk: Low–Moderate.	AVOID - morning EcoCoW inspection for flocks before works commence or re-commence in fields, November to February, with mobilisation postponed where flocks are present (EPMS MS11, 12.2). MINIMISE - hedgerow removal limited to the minimum length at crossings (EPMS 6.2.6). RESTORE - translocation or replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Negligible.
Reed Bunting	Amber BoCC; S41	Loss and disturbance of marginal and ditch-bank nesting vegetation where open-cut trenching is used, with risk of sediment release, pollution and drainage disruption (ES 9.10.267; EPMS 7.4–7.5). Pre-mitigation risk: Moderate.	AVOID - HDD at watercourse crossings, avoiding in-channel and bank works; no clearance of waterside vegetation March–August (EPMS 3.4.1, 6.4.1, MS7). MINIMISE — nesting checks with a 10 m nest buffer, silt traps and temporary dams, lighting kept off the channel. RESTORE - aquatic and marginal replanting, EcoCoW-designed reinstatement and construction-phase monitoring (EPMS 7.1.3, 7.5, MS16). Residual risk: Low.
Rook	Amber BoCC	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID - no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE - fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Sedge Warbler	Amber BoCC	Loss and disturbance of marginal and ditch-bank nesting vegetation where open-cut trenching is used, with risk of sediment release, pollution and drainage	AVOID — HDD at watercourse crossings, avoiding in-channel and bank works; no clearance of waterside vegetation March–August (EPMS 3.4.1, 6.4.1, MS7). MINIMISE - nesting checks with a 10 m nest buffer, silt

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
		disruption (ES 9.10.267; EPMS 7.4–7.5). Pre-mitigation risk: Moderate.	traps and temporary dams, lighting kept off the channel. RESTORE - aquatic and marginal replanting, EcoCoW-designed reinstatement and construction-phase monitoring (EPMS 7.1.3, 7.5, MS16). Residual risk: Low.
Shelduck	Amber BoCC	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	AVOID - HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE - silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE - marginal replanting and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Short-eared Owl	Amber BoCC; Annex 1	Mainly a winter visitor in this location; breeding in the arable CRC is unlikely but not impossible. Risk is disturbance of hunting and roosting birds during winter working, and nest destruction where rough grassland is cleared March-August. Pre-mitigation risk: Low.	AVOID - November to February, morning EcoCoW inspection before entry into any field, with mobilisation postponed where sensitive species are present (EPMS MS11, 12.2); pre-commencement ground-nest inspection before entry into undeveloped fields, any nest buffered until fledging (EPMS MS10, 11.2). MINIMISE - works confined to the working width (EPMS 3.4.2). RESTORE - reinstatement (EPMS MS6). Residual risk: Negligible.
Shoveler	Amber BoCC	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	AVOID - HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE - silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE — marginal replanting and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Snipe	Amber BoCC	Not recorded breeding within the Order Limits; risk relates to disturbance and displacement of feeding and roosting flocks in open fields during unavoidable winter working (ES 9.10.278, 9.12.43). Pre-mitigation risk: Low–Moderate.	AVOID - November to February, a morning EcoCoW inspection precedes entry into any field, with mobilisation postponed where wader or wildfowl flocks are present (EPMS MS11, 12.2). RESTORE - reinstatement of the

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
			working width (EPMS MS6). Residual risk: Negligible; neutral and non-significant.
Song Thrush	Amber BoCC; S41	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID - no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE - fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE - translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Sparrowhawk	Amber BoCC	Wide-ranging foragers not dependent on the working width; risk is limited to temporary loss of hunting habitat and to disturbance where birds nest in retained woodland, hedgerow trees or structures nearby (ES 9.10.265). Pre-mitigation risk: Low.	AVOID - woodland, hedgerow trees and existing buildings retained outside the working width; no tree removal March–August; works confined by fencing at each field boundary crossing (EPMS 3.4.2, 6.4.1). MINIMISE - pre-works tree inspections and nesting checks with buffers held to fledging. RESTORE - reinstatement of the working width (EPMS MS6). Residual risk: Negligible–Low.
Stock Dove	Amber BoCC	No existing buildings are proposed for removal, so risk is limited to loss of cavity-bearing trees at crossings and to disturbance of birds nesting in structures near the working width (EPMS 6.3.1; ES 9.10.264). Pre-mitigation risk: Low.	AVOID - no existing building removal; mature trees retained outside the working width; no tree removal March–August (EPMS 6.3.1, 6.4.1). MINIMISE - pre-works tree and building inspections, nesting checks with a 10 m nest buffer, noise and light control near retained structures (EPMS 6.3, 6.4.2). Residual risk: Low.
Tawny Owl	Amber BoCC	No woodland loss is proposed; risk relates to removal of hedgerow trees, scrub and woodland-edge vegetation at crossings in the nesting season and to a temporary reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Low–Moderate.	AVOID - woodland retained outside the working width; no clearance of woody vegetation March–August; gaps limited to 12 m, or 10 m in Bat Impact Zones (EPMS 3.4.2–3.4.3, 6.4.1). MINIMISE - tree inspections, nesting checks with a 10 m nest buffer, existing gaps used in preference. RESTORE - translocation or like-for-like replanting (EPMS MS6, 7.3). Residual risk: Low.

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
Teal	Amber BoCC	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	AVOID - HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE - silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE — marginal replanting and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Wheatear	Amber BoCC	Summer visitor, absent from the UK between October and March, so no risk arises from winter working. Risk is therefore destruction of nests, eggs and young in cavity features during vegetation clearance, topsoil strip and trenching in the March-August nesting season, together with short-term displacement of passage birds from open ground. Pre-mitigation risk: Moderate.	AVOID - works timed outside March-August where practicable; pre-commencement EcoCoW inspection of the working width for nesting birds, including cavity features such as burrows, walls and stone heaps, with any nest mapped and a protective buffer held until fledging is confirmed (EPMS MS10, 11.2; 6.4). MINIMISE - works confined to the defined working width, EcoCoW watching brief (EPMS 3.4.2, 6.2.9). RESTORE - reinstatement of the working width (EPMS MS6). Residual risk: Low.
Whitethroat	Amber BoCC	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID - no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE - fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Wigeon	Amber BoCC	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	AVOID- HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE - silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE - marginal replanting

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
			and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Willow Warbler	Amber BoCC	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID - no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE - fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE - translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Woodpigeon	Amber BoCC	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID - no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE - fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Wren	Amber BoCC	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID - no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE - fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE - translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Yellow-legged Gull	Amber BoCC	No nesting habitat present; birds overfly or forage opportunistically on arable, so risk is limited to short-term displacement, with extensive similar habitat nearby (ES 9.10.280). Pre-mitigation risk: Negligible–Low.	AVOID - winter flock inspections before mobilisation into fields, November to February (EPMS MS11, 12.2). MINIMISE - works confined to the defined working width (EPMS 3.4.2), and progressive rather than simultaneous

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
			construction. Residual risk: Negligible; no species-specific measures required.
Barn Owl	Sch 1	Recorded nesting or potentially nesting in buildings in and around the Order Limits, with noise and vibration the main disturbance pathway (ES 9.10.265; EPMS 6.3.2). Disturbance of nesting birds and dependent young - a Schedule 1 offence - from plant, personnel, noise and lighting near nest sites in buildings and mature trees (ES 9.10.265-9.10.268). Pre-mitigation risk: Moderate-High (legal compliance).	AVOID - no existing building removal; sensitive timing near known or likely nests; bespoke nest-site exclusion buffers set case by case by the EcoCoW; tree removal only to take place on confirmation by the EcoCoW of no active nests (EPMS 3.3.8, 3.4.1; ES 9.10.268). MINIMISE - pre-commencement and regular EcoCoW monitoring, toolbox talks, lighting control. Residual risk: Low, temporary.
Crossbill	Sch 1	Schedule 1 listed; mature conifer habitat absent. No woodland loss is proposed; risk relates to removal of hedgerow trees, scrub and woodland-edge vegetation at crossings in the nesting season and to a temporary reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Low-Moderate.	AVOID - woodland retained outside the working width; no clearance of woody vegetation March–August; gaps limited to 12 m, or 10 m in Bat Impact Zones (EPMS 3.4.2–3.4.3, 6.4.1). MINIMISE - tree inspections, nesting checks with a 10 m nest buffer, existing gaps used in preference. RESTORE — translocation or like-for-like replanting (EPMS MS6, 7.3). Residual risk: Low.
Hobby	Sch 1	Disturbance of nesting birds and dependent young - a Schedule 1 offence - from plant, personnel, noise and lighting near nest sites in retained woodland and mature hedgerow trees (ES 9.10.265-9.10.268). Pre-mitigation risk: Moderate-High (legal compliance).	AVOID - mature trees retained outside the working width; no tree removal March-August (EPMS 6.3.1, 6.4.1); sensitive timing near known or likely nests; bespoke nest-site exclusion buffers set case by case by the EcoCoW (EPMS 3.3.8, 3.4.1; ES 9.10.268). MINIMISE - pre-commencement and regular EcoCoW monitoring, toolbox talks, lighting control. Residual risk: Low, temporary.
Peregrine	Sch 1	Disturbance of nesting birds and dependent young - a Schedule 1 offence - from plant, personnel, noise and lighting near nest sites on structures and mature trees (ES 9.10.265-9.10.268). Pre-mitigation risk: Moderate-High (legal compliance).	AVOID - no existing building removal; mature trees retained outside the working width; no tree removal March-August (EPMS 6.3.1, 6.4.1); sensitive timing near known or likely nests; bespoke nest-site exclusion buffers set case by case by the EcoCoW (EPMS 3.3.8, 3.4.1; ES 9.10.268). MINIMISE - pre-commencement

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
			and regular EcoCoW monitoring, toolbox talks, lighting control. Residual risk: Low, temporary.
Red Kite	Sch 1, Annex 1	Disturbance of nesting birds and dependent young - a Schedule 1 offence - from plant, personnel, noise and lighting near nest sites in retained woodland and mature hedgerow trees (ES 9.10.265-9.10.268). Pre-mitigation risk: Moderate-High (legal compliance).	AVOID - mature trees retained outside the working width; no tree removal March-August (EPMS 6.3.1, 6.4.1); sensitive timing near known or likely nests; bespoke nest-site exclusion buffers set case by case by the EcoCoW (EPMS 3.3.8, 3.4.1; ES 9.10.268). MINIMISE - pre-commencement and regular EcoCoW monitoring, toolbox talks, lighting control. Residual risk: Low, temporary.
Kingfisher	Sch 1, Annex 1	Suitable nesting habitat is present in watercourse banks. Disturbance of nesting birds and dependent young - a Schedule 1 offence - from plant, personnel, noise and lighting at and near watercourse crossings (ES 9.10.265-9.10.268). Pre-mitigation risk: Moderate-High (legal compliance).	AVOID - HDD beneath watercourses suitable for kingfisher, avoiding in-channel and bank works; sensitive timing near known or likely nests; bespoke nest-site exclusion buffers set case by case by the EcoCoW (EPMS 3.3.8, 3.4.1, MS7; ES 9.10.268). MINIMISE - pre-commencement and regular EcoCoW monitoring, toolbox talks, lighting control. Residual risk: Low, temporary.
Little Egret	Annex 1	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	AVOID — HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE — silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE — marginal replanting and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Little Gull	Annex 1	No nesting habitat present; birds overfly or (unlikely) forage opportunistically on arable, so risk is limited to short-term displacement, with extensive similar habitat nearby (ES 9.10.280). Pre-mitigation risk: Negligible–Low.	AVOID — winter flock inspections before mobilisation into fields, November to February (EPMS MS11, 12.2). MINIMISE — works confined to the defined working width (EPMS 3.4.2), and progressive rather than simultaneous construction. Residual risk: Negligible; no species-specific measures required.

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
Golden Plover	Annex 1	Named in the winter working precautions (ES 9.12.43). Not recorded breeding within the Order Limits; risk relates to disturbance and displacement of feeding and roosting flocks in open fields during unavoidable winter working (ES 9.10.278, 9.12.43). Pre-mitigation risk: Low–Moderate.	AVOID — November to February, a morning EcoCoW inspection precedes entry into any field, with mobilisation postponed where wader or wildfowl flocks are present (EPMS MS11, 12.2). RESTORE — reinstatement of the working width (EPMS MS6). Residual risk: Negligible; neutral and non-significant.
Lesser Redpoll	S41	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID — no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE — fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Bearded Tit	No listed status	No reedbed present. Desk study or isolated records only, with none of the habitat these species depend on present in the CRC, so no credible source–pathway–receptor link exists. Pre-mitigation risk: Negligible.	AVOID — no species-specific measures required or relied upon; generic precautions (no clearance March–August, nesting checks, EcoCoW authority to stop works) would apply in the unlikely event of occurrence (EPMS 6.2.9, 6.4). Residual risk: Negligible.
Blackbird	No listed status	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID — no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE — fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Blackcap	No listed status	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality	AVOID — no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE — fencing either side of each field boundary crossing,

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
		pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Blue Tit	No listed status	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID — no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE — fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Brambling	No listed status	Non-breeding here, so risk relates to displacement of flocks from fields and hedgerows during winter working and to temporary loss of berry and seed resources where boundary vegetation is removed (ES 9.10.278, 9.10.281). Pre-mitigation risk: Low–Moderate.	AVOID — morning EcoCoW inspection for flocks before works commence or re-commence in fields, November to February, with mobilisation postponed where flocks are present (EPMS MS11, 12.2). MINIMISE — hedgerow removal limited to the minimum length at crossings (EPMS 6.2.6). RESTORE — translocation or replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Negligible.
Buzzard	No listed status	Wide-ranging foragers not dependent on the working width; risk is limited to temporary loss of hunting habitat and to disturbance where birds nest in retained woodland, hedgerow trees or structures nearby (ES 9.10.265). Pre-mitigation risk: Low.	AVOID — woodland, hedgerow trees and existing buildings retained outside the working width; no tree removal March–August; works confined by fencing at each field boundary crossing (EPMS 3.4.2, 6.4.1). MINIMISE — pre-works tree inspections and nesting checks with buffers held to fledging. RESTORE — reinstatement of the working width (EPMS MS6). Residual risk: Negligible–Low.
Canada Goose	No listed status	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary	AVOID — HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE — silt traps, temporary dams and pollution control at

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
		disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE — marginal replanting and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Carrion Crow	No listed status	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID — no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE — fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Cetti's Warbler	No listed status	Loss and disturbance of marginal and ditch-bank nesting vegetation where open-cut trenching is used, with risk of sediment release, pollution and drainage disruption (ES 9.10.267; EPMS 7.4–7.5). Pre-mitigation risk: Moderate.	AVOID — HDD at watercourse crossings, avoiding in-channel and bank works; no clearance of waterside vegetation March–August (EPMS 3.4.1, 6.4.1, MS7). MINIMISE — nesting checks with a 10 m nest buffer, silt traps and temporary dams, lighting kept off the channel. RESTORE — aquatic and marginal replanting, EcoCoW-designed reinstatement and construction-phase monitoring (EPMS 7.1.3, 7.5, MS16). Residual risk: Low.
Chaffinch	No listed status	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID — no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE — fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Chiffchaff	No listed status	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a	AVOID — no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
		short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	— fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Coal Tit	No listed status	No woodland loss is proposed; risk relates to removal of hedgerow trees, scrub and woodland-edge vegetation at crossings in the nesting season and to a temporary reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Low–Moderate.	AVOID — woodland retained outside the working width; no clearance of woody vegetation March–August; gaps limited to 12 m, or 10 m in Bat Impact Zones (EPMS 3.4.2–3.4.3, 6.4.1). MINIMISE — tree inspections, nesting checks with a 10 m nest buffer, existing gaps used in preference. RESTORE — translocation or like-for-like replanting (EPMS MS6, 7.3). Residual risk: Low.
Collared Dove	No listed status	No existing buildings are proposed for removal, so risk is limited to loss of cavity-bearing trees at crossings and to disturbance of birds nesting in structures near the working width (EPMS 6.3.1; ES 9.10.264). Pre-mitigation risk: Low.	AVOID — no existing building removal; mature trees retained outside the working width; no tree removal March–August (EPMS 6.3.1, 6.4.1). MINIMISE — pre-works tree and building inspections, nesting checks with a 10 m nest buffer, noise and light control near retained structures (EPMS 6.3, 6.4.2). Residual risk: Low.
Coot	No listed status	Loss and disturbance of marginal and ditch-bank nesting vegetation where open-cut trenching is used, with risk of sediment release, pollution and drainage disruption (ES 9.10.267; EPMS 7.4–7.5). Pre-mitigation risk: Moderate.	AVOID — HDD at watercourse crossings, avoiding in-channel and bank works; no clearance of waterside vegetation March–August (EPMS 3.4.1, 6.4.1, MS7). MINIMISE — nesting checks with a 10 m nest buffer, silt traps and temporary dams, lighting kept off the channel. RESTORE — aquatic and marginal replanting, EcoCoW-designed reinstatement and construction-phase monitoring (EPMS 7.1.3, 7.5, MS16). Residual risk: Low.
Cormorant	No listed status	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	AVOID — HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE — silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE — marginal replanting

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
			and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Feral Pigeon	No listed status	No existing buildings are proposed for removal, so risk is limited to loss of cavity-bearing trees at crossings and to disturbance of birds nesting in structures near the working width (EPMS 6.3.1; ES 9.10.264). Pre-mitigation risk: Low.	AVOID — no existing building removal; mature trees retained outside the working width; no tree removal March–August (EPMS 6.3.1, 6.4.1). MINIMISE — pre-works tree and building inspections, nesting checks with a 10 m nest buffer, noise and light control near retained structures (EPMS 6.3, 6.4.2). Residual risk: Low.
Garden Warbler	No listed status	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID — no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE — fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Goldcrest	No listed status	No woodland loss is proposed; risk relates to removal of hedgerow trees, scrub and woodland-edge vegetation at crossings in the nesting season and to a temporary reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Low–Moderate.	AVOID — woodland retained outside the working width; no clearance of woody vegetation March–August; gaps limited to 12 m, or 10 m in Bat Impact Zones (EPMS 3.4.2–3.4.3, 6.4.1). MINIMISE — tree inspections, nesting checks with a 10 m nest buffer, existing gaps used in preference. RESTORE — translocation or like-for-like replanting (EPMS MS6, 7.3). Residual risk: Low.
Goldfinch	No listed status	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID — no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE — fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
Goosander	No listed status	Recorded from waterbodies in the wider Study Area, not the CRC, where standing water is limited to a few ponds and ditches; risk is confined to temporary disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low.	AVOID - HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE - silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE — marginal replanting and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Great Spotted Woodpecker	No listed status	No woodland loss is proposed; risk relates to removal of hedgerow trees, scrub and woodland-edge vegetation at crossings in the nesting season and to a temporary reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Low–Moderate.	AVOID — woodland retained outside the working width; no clearance of woody vegetation March–August; gaps limited to 12 m, or 10 m in Bat Impact Zones (EPMS 3.4.2–3.4.3, 6.4.1). MINIMISE — tree inspections, nesting checks with a 10 m nest buffer, existing gaps used in preference. RESTORE — translocation or like-for-like replanting (EPMS MS6, 7.3). Residual risk: Low.
Great Tit	No listed status	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID — no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE — fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Green Woodpecker	No listed status	No woodland loss is proposed; risk relates to removal of hedgerow trees, scrub and woodland-edge vegetation at crossings in the nesting season and to a temporary reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Low–Moderate.	AVOID — woodland retained outside the working width; no clearance of woody vegetation March–August; gaps limited to 12 m, or 10 m in Bat Impact Zones (EPMS 3.4.2–3.4.3, 6.4.1). MINIMISE — tree inspections, nesting checks with a 10 m nest buffer, existing gaps used in preference. RESTORE — translocation or like-for-like replanting (EPMS MS6, 7.3). Residual risk: Low.
Grey Heron	No listed status	Lack of suitable nesting habitat within the CRC, where standing water is limited to a few ponds and	AVOID - HDD at watercourse crossings, avoiding in-channel and bank works (EPMS 3.4.1, MS7). MINIMISE

Species	Conservation Status	Potential Sources of Impact and Level of Risk (Pre-Mitigation)	Mitigation Hierarchy Approach and Residual Risk
		ditches; risk is confined to temporary disturbance and to siltation or pollution at crossings (ES 9.10.279). Pre-mitigation risk: Low	- silt traps, temporary dams and pollution control at open-cut ditch crossings, lighting kept off the channel, EcoCoW supervision. RESTORE — marginal replanting and construction-phase monitoring (EPMS 7.5, MS16). Residual risk: Negligible.
Hoopoe	No listed status	A vagrant here. Desk study or isolated records only, with none of the habitat these species depend on present in the CRC, so no credible source–pathway–receptor link exists. Pre-mitigation risk: Negligible.	AVOID — no species-specific measures required or relied upon; generic precautions (no clearance March–August, nesting checks, EcoCoW authority to stop works) would apply in the unlikely event of occurrence (EPMS 6.2.9, 6.4). Residual risk: Negligible.
Jackdaw	No listed status	No existing buildings are proposed for removal, so risk is limited to loss of cavity-bearing trees at crossings and to disturbance of birds nesting in structures near the working width (EPMS 6.3.1; ES 9.10.264). Pre-mitigation risk: Low.	AVOID — no existing building removal; mature trees retained outside the working width; no tree removal March–August (EPMS 6.3.1, 6.4.1). MINIMISE — pre-works tree and building inspections, nesting checks with a 10 m nest buffer, noise and light control near retained structures (EPMS 6.3, 6.4.2). Residual risk: Low.
Jay	No listed status	No woodland loss is proposed; risk relates to removal of hedgerow trees, scrub and woodland-edge vegetation at crossings in the nesting season and to a temporary reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Low–Moderate.	AVOID — woodland retained outside the working width; no clearance of woody vegetation March–August; gaps limited to 12 m, or 10 m in Bat Impact Zones (EPMS 3.4.2–3.4.3, 6.4.1). MINIMISE — tree inspections, nesting checks with a 10 m nest buffer, existing gaps used in preference. RESTORE — translocation or like-for-like replanting (EPMS MS6, 7.3). Residual risk: Low.
Lesser Whitethroat	No listed status	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID — no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE — fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.

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Little Owl	No listed status	No existing buildings are proposed for removal, so risk is limited to loss of cavity-bearing trees at crossings and to disturbance of birds nesting in structures near the working width (EPMS 6.3.1; ES 9.10.264). Pre-mitigation risk: Low.	AVOID — no existing building removal; mature trees retained outside the working width; no tree removal March–August (EPMS 6.3.1, 6.4.1). MINIMISE — pre-works tree and building inspections, nesting checks with a 10 m nest buffer, noise and light control near retained structures (EPMS 6.3, 6.4.2). Residual risk: Low.
Long-tailed Tit	No listed status	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID — no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE — fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Magpie	No listed status	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID — no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE — fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Nuthatch	No listed status	No woodland loss is proposed; risk relates to removal of hedgerow trees, scrub and woodland-edge vegetation at crossings in the nesting season and to a temporary reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Low–Moderate.	AVOID — woodland retained outside the working width; no clearance of woody vegetation March–August; gaps limited to 12 m, or 10 m in Bat Impact Zones (EPMS 3.4.2–3.4.3, 6.4.1). MINIMISE — tree inspections, nesting checks with a 10 m nest buffer, existing gaps used in preference. RESTORE — translocation or like-for-like replanting (EPMS MS6, 7.3). Residual risk: Low.
Pheasant	No listed status	Nest destruction at field edges, ditch banks and hedgerow bases during clearance and trenching in	AVOID — clearance and field entry outside March–August where practicable, with EcoCoW nesting checks

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		the nesting season, with temporary displacement from the working width (ES 9.10.257, 9.10.259). Pre-mitigation risk: Moderate.	and a 50 m nest buffer (EPMS MS10, 11.2). MINIMISE — works confined by fencing at each field boundary crossing, gaps limited to 12 m (10 m in Bat Impact Zones), EcoCoW supervision (EPMS 3.4.2–3.4.3). RESTORE — grassland and hedgerow reinstatement (EPMS MS6). Residual risk: Low.
Pied Wagtail	No listed status	Destruction of active nests and temporary loss of nesting and foraging habitat where walls or rubble piles etc may be removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID — no clearance of rubble piles or walls March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE — fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Raven	No listed status	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID — no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE — fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Red-legged Partridge	No listed status	Nest destruction at field edges, ditch banks and hedgerow bases during clearance and trenching in the nesting season, with temporary displacement from the working width (ES 9.10.257, 9.10.259). Pre-mitigation risk: Moderate.	AVOID — clearance and field entry outside March–August where practicable, with EcoCoW nesting checks and a 50 m nest buffer (EPMS MS10, 11.2). MINIMISE — works confined by fencing at each field boundary crossing, gaps limited to 12 m (10 m in Bat Impact Zones), EcoCoW supervision (EPMS 3.4.2–3.4.3). RESTORE — grassland and hedgerow reinstatement (EPMS MS6). Residual risk: Low.

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Robin	No listed status	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID — no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE — fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Siskin	No listed status	Non-breeding here, so risk relates to displacement of flocks from fields and hedgerows during winter working and to temporary loss of berry and seed resources where boundary vegetation is removed (ES 9.10.278, 9.10.281). Pre-mitigation risk: Low–Moderate.	AVOID — morning EcoCoW inspection for flocks before works commence or re-commence in fields, November to February, with mobilisation postponed where flocks are present (EPMS MS11, 12.2). MINIMISE — hedgerow removal limited to the minimum length at crossings (EPMS 6.2.6). RESTORE — translocation or replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Negligible.
Stonechat	No listed status	Destruction of active nests and temporary loss of nesting and foraging habitat where hedgerow and scrub is removed at crossings of up to 12 m, with a short- to medium-term reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Moderate.	AVOID — no clearance of woody or tussocky vegetation March–August; where unavoidable, nesting checks and a 10 m nest buffer held to fledging (EPMS 6.4). MINIMISE — fencing either side of each field boundary crossing, existing gaps used in preference, EcoCoW watching brief (EPMS 3.4.2, 6.2.6–6.2.9). RESTORE — translocation with rootballs, or like-for-like replanting in the first planting season (EPMS MS6, 7.3). Residual risk: Low.
Swallow	No listed status	No existing buildings are proposed for removal, so nests unlikely to be impacted (EPMS 6.3.1; ES 9.10.264). Pre-mitigation risk: Negligible–Low.	AVOID - no existing building removal; (EPMS 6.3.1, 6.4.1). MINIMISE - pre-works building inspections, nesting checks with a 10 m nest buffer, noise and light control near retained structures (EPMS 6.3, 6.4.2). Residual risk: Negligible.
Treecreeper	No listed status	No woodland loss is proposed; risk relates to removal of hedgerow trees, scrub and woodland-	AVOID — woodland retained outside the working width; no clearance of woody vegetation March–August; gaps

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		edge vegetation at crossings in the nesting season and to a temporary reduction in habitat quality pending re-establishment (ES 9.10.264, 9.10.270). Pre-mitigation risk: Low–Moderate.	limited to 12 m, or 10 m in Bat Impact Zones (EPMS 3.4.2–3.4.3, 6.4.1). MINIMISE — tree inspections, nesting checks with a 10 m nest buffer, existing gaps used in preference. RESTORE — translocation or like-for-like replanting (EPMS MS6, 7.3). Residual risk: Low.
Water Rail	No listed status	Loss and disturbance of marginal and ditch-bank nesting vegetation where open-cut trenching is used, with risk of sediment release, pollution and drainage disruption (ES 9.10.267; EPMS 7.4–7.5). Pre-mitigation risk: Moderate.	AVOID — HDD at watercourse crossings, avoiding in-channel and bank works; no clearance of waterside vegetation March–August (EPMS 3.4.1, 6.4.1, MS7). MINIMISE — nesting checks with a 10 m nest buffer, silt traps and temporary dams, lighting kept off the channel. RESTORE — aquatic and marginal replanting, EcoCoW-designed reinstatement and construction-phase monitoring (EPMS 7.1.3, 7.5, MS16). Residual risk: Low.