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Saylor Creek Herd Management Area
Wild Horse Bait and Water Trap Gather Plan
Environmental Assessment

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1.0 Purpose and Need for Action

1.1 Introduction

This Environmental Assessment (EA) has been prepared to analyze the Bureau of Land Management (BLM) Jarbidge Field Office's (JFO) proposal to conduct a bait and/or water trap to gather and remove excess wild horses from within the Saylor Creek Herd Management Area (HMA, Map 1, Appendix A). This wild horse gather plan would allow for an initial gather and follow-up maintenance gathers to achieve and maintain appropriate management level (AML), to be conducted until policy changes occur or the affected environment changes to an extent that the analysis is no longer valid. The EA assists the JFO in project planning, compliance with applicable laws and policy, and determining whether any significant impacts could result from the analyzed actions. This EA provides evidence for determining whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI).

1.2 Background

In 2011, wild horses were released back into the Saylor Creek HMA following the 2010 wildfires that resulted in an emergency gather and removal of 195 out of 200 wild horses in the HMA (5 wild horses remained in unburned portions of the HMA). Out of the gathered wild horses, 30 were selected and released back into the Saylor Creek HMA. Over the past eight years, the herd has grown to approximately 112 wild horses, with an annual average growth rate of 23%. The herd population is estimated to reach 137 wild horses by the end of the 2019 foaling season.

1.3 Purpose and Need for Action

The purpose of the Proposed Action is to: (1) remove excess wild horses from within the Saylor Creek HMA to achieve the established AML, (2) reduce the wild horse population growth rate to minimize the need for repeated gathers, and (3) restore a thriving natural ecological balance and multiple use relationship on the public lands. These action are consistent with the provisions of Section 1333 (a) of the Wild Free-Roaming Horses and Burros Act (WFRHBA) of 1971 (as amended).

The need for the Proposed Action is to protect rangeland resources and to prevent unnecessary or undue degradation of the public lands associated with excess populations of wild horses within the HMA, and to provide the best opportunities for excess horses to be placed into private care, rather than removed to off-range pastures (ORP).

1.4 Decision to be Made

The BLM's authorized officer will determine if excess wild horses exist in the HMA and decide whether or not to conduct a bait and/or water trap gather to remove adoptable excess wild horses and implement population control measures. The decision would affect wild horses within the Saylor Creek HMA. The BLM's authorized officer would not set or adjust AML nor would it adjust livestock use.

1.5 Conformance with Applicable Land Use Plan

In 2015, the BLM adopted a record of decision (ROD) that identified management direction for the JFO. With respect to the Saylor Creek HMA, the ROD specified an AML of 50-200 non-reproducing horses. However, this decision was challenged in *American Wild Horse Preservation Campaign et al., v. Zinke*, No 1:16-cv-00001-EJL (D. Idaho.) On September 29, 2017 the U.S. District Court overturned the BLM's wild horse management decisions, concluding that the BLM's analysis failed to explain how managing for a non-reproducing herd was consistent with the WFRHBA. Until a revision or amendment is completed, the Saylor Creek HMA will be managed using direction provided in the 1987 Jarbidge RMP, which calls for an AML of 50 horses (p. II-4).

1.6 Relationship to Statutes, Regulations or Other Plans

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The Federal Land Policy and Management Act of 1976 (FLPMA) requires that an action under consideration be in conformance with the applicable BLM land use plan, and be consistent with other Federal, State, local, and tribal policies to the maximum extent possible.

Wild horses and burros are considered an integral part of the national system of public lands. The WFRHBA provides the BLM the authority and responsibility to manage healthy wild horse and burro populations on healthy rangelands in a "thriving natural ecological balance and multiple use relationship" (16 USC 1333(a)). The Proposed Action is in conformance with the WFRHBA 16 U.S.C. 1333(b)(2) (requiring removal of excess horses to achieve AML) and 1334 (addressing wild horses that stray from public to private lands and prohibiting destruction of wild horses except by agents of the Secretary of the Interior), and their implementing regulations found at Title 43 of the Code of Federal Regulations (CFR) 4700.

1.7 Scoping, Public Involvement, and Issues

On November 8, 2018, BLM released a scoping packet detailing the purpose and need for action, preliminary issues, and potential alternatives for action to the public for comment. Copies were delivered to the Shoshone-Paiute and Shoshone-Bannock Tribes and 62 individuals, organizations, and Federal, State, and county agencies. BLM received eight letters and emails from individuals, organizations, and agencies regarding the scoping package.

Appendix C contains a list of all substantive comments received along with BLM's response. Every comment was considered; however, not all non-substantive comments received a response. Non-substantive comments included open-ended questions, opinions without supporting rationale, or comments about other projects or activities.

During the analysis process, the BLM JFO interdisciplinary team (IDT) considered several resources and supplemental authorities (Appendix F). Through internal and external scoping, the IDT identified the following issues for analysis in the EA:

Wild Horses
What would be direct effects of the alternatives on wild horses?
What would be the effects of the population suppression methods being considered in the alternatives have on wild horse behavior?
Upland Vegetation
What would be the effects of the alternatives on upland vegetation?
Wildlife
What would be the effects of the alternatives on wildlife species?
Livestock Grazing Management
What would be the effects of the alternatives on livestock grazing management and associated ranch operations?
Noxious Weeds and Invasive Plants
What are the effects of a wild horse gather on spreading noxious weeds or invasive plant species?

2.0 Description of the Alternatives

2.1 Alternative 1: No Action

Under this alternative, the BLM would not remove excess wild horses in the Saylor Creek HMA. There would be no active management to control the size of the wild horse populations at this time. The No Action Alternative is included as a baseline for comparison with the action alternative, as required under NEPA.

2.2 Alternative 2: Proposed Action

Under Alternative 2, BLM's principal management goal for the HMA would be to retain an AML of 50 wild horses. BLM would gather 90-100% of the wild horses from the HMA, and permanently remove up to 89 excess horses. Fifty horses, including two mares from different HMA, will be released to reach the AML of 50 wild horses. BLM will apply GonaCon or PZP (*Porcine zona pellucida*) fertility control treatment to mares to be released, and will release an equal number of stallions to reach 50:50 male to female sex ratio. BLM will select horses to be released to the HMA to maintain a diverse age structure, herd characteristics and conformation. In order to maintain genetic diversity of the Saylor Creek wild horses, the two mares from a different HMA, meeting the same criteria, will be released.

Implementation would begin in the summer 2019, depending on available funding, and BLM would continue to periodically gather excess wild horses to maintain AML, or to administer PZP or GonaCon boosters. After the initial gather, the target removal number for additional gathers would be adjusted according to population inventories for the HMA. Gathering and handling wild horses would follow the Comprehensive Animal Welfare Program (CAWP) for Wild Horse Gathers (Appendix E)

To maximize adoption potential, younger horses would be removed before older ones. Horses 20 years old or older would not be removed unless circumstances prevent them from being turned back to the range (e.g., fire or illness).

Wild horses would be gathered using the bait and/or water trapping method. Gathering of the excess wild horses utilizing bait/water trapping would continue until the target number of animals are removed. Traps would consist of portable panels set up at water sources (troughs) frequented by wild horses. Generally, bait/water trapping is most effective when a specific resource is limited, such as water during the summer months. Saylor Creek wild horses rely solely upon artificial water sources, so traps would be placed around commonly utilized water troughs throughout the year. Other water troughs in the pastures would be turned off, ensuring that the horses are utilizing the water troughs where the traps have been constructed. Certified weed-free hay or other attractants (such as mineral or processed cubes) may be used to lure horses to the area. Prior to any wild horses being captured, the trap or bait may be placed to accustom wild horses to their presence. When a band of horses or individuals enters the trap, the gate would be closed by BLM or contract personnel and the trap would be monitored at least once daily while the gate is set. Animals identified for removal or fertility control treatment would be sorted at the trap site and transported to BLM off-range corrals (ORC) in Boise or Bruneau with horse/stock trailers pulled behind pickups. Wild horses are segregated by age and sex and loaded into separate compartments. A small number of mares may be shipped with foals.

Multiple trap sites would be set up at existing water sources (troughs) in the West Pasture of the Twin Butte Allotment, the North Pasture of the Dove Springs Allotment, and the South end of Pasture #4 of the Thompson Allotment (Map A, Appendix A). No additional capture sites would be set up in the HMA; the wild horses in the HMA have a strong affinity to these home ranges and remain in these areas throughout the year. When actively trapping wild horses, the trap would be checked on a daily basis. Wild horses would be either removed immediately or fed and watered for up to several days prior to transport to an ORC. No additional effects would occur to the wild horses if kept in the trap for up to several days because very few disturbances (humans, traffic, etc.) would occur and high quality forage and water will be provided. Areas with known infestations of noxious weeds would be avoided.

In cases where a contraceptive booster vaccine is required, the mares to be released could be held for 30 days at BLM ORC and given a booster shot. The BLM would return to the HMA as needed to re-apply

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GonaCon or PZP fertility control treatment, with single dose inoculations, via remote darting, to maintain contraceptive effectiveness. Darting can be implemented opportunistically by applicators near water sources or along main trails out on the range. Blinds may be used to camouflage applicators to allow efficient treatment of as many mares as possible. Native PZP (or currently most effective formulation) would be administered by PZP certified and trained applicators in the one year liquid dose inoculations by field darting the mares. Prior to actually darting, an inventory of the wild horses would be conducted. This would include a list of marked horses and / or a photo catalog with descriptions of the animals to assist in identifying which animals have been darted and which need to be darted.

Animals that exhibit exceptional characteristics may be chosen for release outside of the selective removal priorities on a case-by-case basis. Weak, unhealthy, and unthrifty animals would not be selected for release back into the Saylor Creek HMA.

Most foals would be removed and transported to ORC if they are 5-7 months of age. If foals too young to wean are encountered, they would be released back to the HMA with their dam. If the dam is unable to be released, the dam and foal would be kept together and the foal would not be weaned until of an appropriate age (approximately 6 months).

During the gather, herd health and characteristics data would be collected as part of continued monitoring of the wild horse herds. Other data, including sex and age distribution, body condition score (BCS, using the Henneke rating system), color, size and other information may also be recorded for all gathered wild horses. Genetic data would be collected from approximately 25 individuals to monitor the genetic health of the wild horses and compare to samples taken in 2010 in accordance with BLM Policy (IM 2009-062).

Gathered excess wild horses would be prepared for adoption and/or sale to qualified individuals who could provide them with a good home. Wild horses that do not meet adoption age or temperament criteria may be shipped to ORC or ORP. Old, sick or lame horses unable to maintain an acceptable body condition (greater than or equal to a Henneke body condition score of 3) or with serious physical defects such as club feet, severe limb deformities, parrot mouth, or sway back would be humanely euthanized in conformance with BLM policy (BLM IM 2015-070).

The BLM would work with livestock operators to set up traps at locations in the allotment that livestock are not currently utilizing. Livestock may be moved to different pastures to avoid trapping operations.

Gather trap sites would be located in previously disturbed areas (trough sites) and would be smaller than 0.5 acres in size. These area would be prioritized for follow up inventory and treatment reducing the potential for establishment and spread of noxious or invasive weeds. Setting gather trap sites outside of areas known to contain noxious or non-native plant species would limit the potential to spread invasive vegetation.

To further minimize the potential for introduction and spread within the project area, all equipment and vehicles exposed to weed infestations or arriving on site carrying dirt, mud, or plant debris would be cleaned before moving onto project sites or between project areas.

2.3 Alternatives Considered But Eliminated From Detailed Study

BLM considered a number of additional alternatives, but decided not to analyze them in detail for various reasons.

<u>Alternative Gather Methods</u>

Helicopter drive trapping is effective when gathering large numbers of wild horses in expansive HMAs. However, with this small removal of horses in an easily accessible HMA, bait trapping is more cost effective.

Gathering wild horses with saddle horses alone has proven to be inefficient and impractical, as it poses safety hazards to wild horses, personnel, and saddle horses. Wild horses often outrun and outlast domestic horses carrying riders.

For these reasons, these two types of gathering methods will not be analyzed in detail.

Remove or Reduce Domestic Livestock within the HMA
Under this alternative no wild horses would be removed from the HMA. Instead livestock would be removed from the HMA to provide adequate forage for excess wild horses.

This alternative does not meet the purpose and need to manage wild horses within AML established in the 1987 Jarbidge RMP. It is also inconsistent with the WFRHBA, which directs the Secretary to remove excess wild horses. Livestock grazing can only be reduced or eliminated if BLM follows regulations at 43 CFR Part 4100 (2005) and must be consistent with multiple use allocations set forth in the land-use plan. Such changes to livestock grazing cannot be made through a wild horse gather decision, and are only possible if BLM first revises the land-use plans to allocate livestock forage to wild horses and to eliminate or reduce livestock grazing. In the next several years, permit renewals and livestock grazing evaluations would be completed on all eight of the Allotments within the HMA. Changes to the permitted livestock use, including animal unit months (AUM) and season of use, on each of these allotments will be evaluated at that time. Therefore, this alternative was dropped from detailed analysis.

Manage the HMA as a non-reproducing herd
The 2015 Jarbidge RMP called for managing the Saylor Creek HMA as a non-reproducing herd with an AML of 50-200. As discussed in Section 1.5 above, the District Court of Idaho struck down that aspect of the 2015 Jarbidge RMP. Until BLM undertakes further analysis to support a non-reproducing herd, BLM has elected to continue management under the 1987 Jarbidge RMP, so this option was not given detailed consideration.

Manage the HMA with an AML of 50-200
Under this alternative the AML of Saylor Creek HMA would be 50-200 horses, as the 2015 Jarbidge RMP provides. As noted in the preceding section, the 50-200 AML was predicated on the establishment of a non-reproducing herd. Therefore this alternative was dropped from detailed analysis.

Fertility Control Treatment Only (No Removal)
Under this alternative, no excess wild horses would be removed. BLM completed population modeling to analyze the potential impacts associated with conducting gathers about every 2-3 years over the next 10 year period to treat captured mares with fertility control. Even with the application of contraceptives, the population is anticipated to increase by 4% annually. Thus, the population would continue to be above AML; this alternative would not meet the Purpose and Need for the Action, and would be contrary to the WFRHBA. Therefore, the alternative was dismissed from further analysis.

3.0 Affected Environment and Environmental Effects

3.1 Introduction

This chapter details the affected environment section, which is the baseline resource data displaying current conditions of each identified resource with an issue (i.e., the physical, biological, and resources) that could be potentially affected by the Proposed Action. Direct effects are caused by the action and

occur at the same time and place. Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.

The No Action Alternative reflects the current situation within the project area and will serve as the baseline for comparing the environmental effects of the analyzed alternative.

3.2 Wild Horses

3.2.1 Affected Environment

The Saylor Creek HMA is located in the northern portion of the JFO approximately 15 miles south of Glenns Ferry, Idaho (Map 1, Appendix A). The HMA contains portions of eight livestock grazing allotments (Table 2), which are divided into 10 pastures; the wild horses reside in three of these pastures. The Saylor Creek HMA contains about 101,876 acres of Federal, State and private land. Table 1 shows the approximate acres by ownership/land status in the Saylor Creek HMA. Topography varies from relatively flat to gently rolling top prominent buttes and ridgelines which dominate the landscape.

Table 1. Land Status within the Saylor Creek Herd Management Area.

Land Status	Acres
Bureau of Land Management	94,964*
Private	1,144
State Endowment Land	5,750
Total	**101,858**

*Includes Bureau of Reclamation

The foundation for the present herd is believed to have come from mares captured near Challis, Idaho (the present Challis HMA) by a group of horse runners from the Wendell, Idaho, area. According to local history, several mares were transported into the Saylor Creek area in the early 1960s. A registered stud was then purchased and turned out with the mares. Until the passage of the WFRHBA, the group of horse runners would capture as many colts as possible in annual roundups.

The Saylor Creek HMA was established in 1971, after the WFRHBA was enacted. Prior to passage of the WFRHBA, small bands of horses were present in the vicinity of Dove Springs and the Sailor Creek seep, as well as the upland benches along the Snake River. Constant human presence associated with development of private agricultural lands and some conversion of public lands to private land beginning in the 1960s slowly eliminated access to natural water at the Snake River.

Over the last four decades, increased human activities associated with private lands and motorized recreation in the northeastern portion of the HMA has resulted in avoidance of portions of the HMA by the wild horses. The horses have developed a strong affinity to preferred areas or “Home Ranges,” within the Twin Butte, Thompson, and Dove Springs Allotments. The horses tend to remain in these areas year round.

There are no naturally occurring perennial water sources (e.g., streams, springs) in the HMA. Currently, wild horses rely solely on water sources installed to facilitate domestic livestock management. The HMA has approximately 93 miles of underground pipelines and 69 troughs providing water to livestock and the wild horse herd year round. All pipelines are supplied by drilled wells on both public and private lands.

The 1987 Jarbidge RMP established an AML of 50 horses for the HMA. Because the wild horse herd is present in the HMA year round, adequate forage and water must be available year round. Consequently, the 1987 RMP allocated 600 Animal Unit Months (AUMs) of forage to horses (50 horses for 12 months).

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An AUM is the amount of forage (approximately 800 pounds of air-dried forage) necessary to sustain one adult horse or two burros for one month (BLM 2010).

BLM gathered and removed horses in the fall of 1982 and again in the fall of 1989 to reduce herd numbers and return the HMA to the AML. In 2005 and 2010, wildfires burned enough acres within the HMA to require emergency gathers to remove all wild horses in order to maintain the health of the horses and allow for restoration and recovery of burned areas. In 2010, four fires occurred within the HMA, burning approximately 56% of the HMA. An emergency gather was conducted resulting in 195 horses captured with 5 remaining in unburned portions of the HMA. In the fall of 2011, 30 horses were released into unseeded areas of the HMA when vegetative resource objectives were achieved.

The 30 wild horses released were selected based on desirable conformation, size and color and ranged in age from 8 to 20 years old. Between 2011 and 2017, the wild horse herd had an annual growth rate of 23%. Since 2011 the herd has grown to 91 adults and 10 foals in July 2018, of which approximately 58 adult horses would be six years of age or younger. Annual population growth rates approaching 20% or higher are realized in many horse populations, which includes survival and fecundity rates (NRC 2013).

In 2014, a simultaneous double-count survey was conducted using methods recommended by BLM policy (BLM 2010, IM 2010-057) and a recent National Academy of Science (NAS) review (NRC 2013). It was determined that due to the relatively flat to gently rolling terrain that allows for easy sight ability, and horse' affinity to their home ranges, a ground census would be conducted in years that funding would not allow a simultaneous double-count via a helicopter. When conducting the ground census a team of personnel independently count bands of horses and take photographs of each band on three separate days within a week. The photographs are then taken into the office, and counted several times to ensure that the ground counts match the photographic evidence. Written protocol for the method is on file at the JFO. In July 2018, repeat-visit ground counts were conducted in the HMA, 101 wild horses (91 adults and 10 foals) were counted in four separate bands. It is assumed that not all the foals born in 2018 were counted, therefore, the 23% growth rate was applied and the 2018 population is estimated to be 112 (adults and foals). The population in 2019 including the 2019 foal crop, is estimated to be a total of 137 horses (adults and foals), based on the observed growth rate of 23%.

The WinEquus program, developed by Dr. Steven Jenkins at the University of Nevada at Reno, was designed to assist Wild Horse and Burro Specialists in modeling various management options and projecting possible outcomes for management of wild horses. Population modeling was completed to analyze possible differences that could occur to the wild horse population within the Saylor Creek HMA between Alternative 1 (No Action) and Alternative 2 (Proposed Action). Scenarios were put through the model (simulated) to assess potential effects to the population by implementation of Alternative 1 and Alternative 2. Growth rates and population sizes over the next 10 years are provided for both alternatives. Graphic and tabular results are displayed in detail in Appendix D.

Genetic tests of the Saylor Creek herd were completed following the 2010 emergency gather. Test results show strong genetic viability and no evidence to indicate the Saylor Creek horses suffer from reduced genetic fitness. Overall similarity of the Saylor Creek HMA herd to domestic breeds was about average for wild horse herds. Highest mean genetic similarity of the Saylor Creek HMA herd was with the Light Racing and Riding breeds, followed by the Oriental and Arabian breeds. These results indicate that the herd has a mixed ancestry with no specific breed as the clear primary ancestral type (Cothran 2010). However, to lessen the chance of accelerated genetic homogenization which can occur within smaller herd populations (<200 horses), two mares from other HMAs will be introduced to the Saylor Creek HMA.

In Fiscal Year 2017, the BLM spent nearly 60% of its $81 million budget on the care of animals removed from the range. That's nearly $48,000 for one unadopted horse that remains in BLM's care over its lifetime. At this time the majority of the horses in the Saylor Creek HMA are young and within the desirable age range for placement into private care. Many of the horses would be over the desirable age range within a few years resulting in potential holding costs of $48,000 per horse if a gather and removal is delayed.

Horses that are gathered and removed permanently from the range will be made available for adoption or sale. Adoption applicants are required to have at least a 400 square foot corral with panels that are at least six feet tall for horses over 18 months of age. Applicants are required to provide adequate shelter, feed, and water. The BLM retains title to the horse for one year and the horse and the facilities are inspected to assure the adopter is complying with the BLM's requirements. After one year, the adopter may take title to the horse, at which point the horse becomes the property of the adopter. Adoptions are conducted in accordance with 43 CFR 4750.

Potential buyers must fill out an application and be pre-approved before they may buy a wild horse. A sale-eligible wild horse is any animal that is more than 10 years old; or has been offered unsuccessfully for adoption three times. The application also specifies that all buyers are not to re-sell the animal to slaughter buyers or anyone who would sell the animal to a commercial processing plant. Sales of wild horses are conducted in accordance with Bureau policy.

3.2.2 Alternative 1 – No Action

Direct and Indirect Effects

Under this alternative, the risks to horses due to gathering, handling, and transport would be avoided.

Based upon the Jenkins Model results for wild horse herds, the No Action Alternative (no removal or fertility control), would result in approximately 234 to 511 (in the median trial) and 1,227 (in the highest trial) adult horses in the HMA by 2029 (Appendix D). The model was run for 10 years and 100 trials as recommended in the BLM Wild Horse and Burro Handbook (H-4700-1). This would result in the need for a helicopter drive gather, as bait and/or water trapping would be infeasible with that number of horses to gather.

The BLM has observed that the horses remain in their home ranges throughout the majority of the year. Taking no action on removing horses from the HMA or applying fertility control would only exacerbate the problem of them remaining in the home range areas year-round, and exceed the carrying capacity of the range over time. Though it may require many years for the population to reach catastrophic or self-limiting levels, the No Action Alternative poses the greatest risk to the long term rangeland health of the Saylor Creek HMA. As per the National Research Council (NRC, 2013, page 76), "It can be expected—on the basis of logic, experience, and modeling studies cited above—that because horses or burros left to "self-limit" will be food-limited, they will also have poorer body condition on the average. If animals are in poorer condition, mortality will be greater, particularly in times of food shortage resulting from drought or severe winter weather. Indeed, when population growth rate is zero, mortality must balance natality. Whether that is acceptable to managers or the public is beyond the purview of the committee, but it is a biological reality."

As the population increases, not only would horses have competition for forage and water from wildlife and livestock, but amongst themselves as well. Horses occupy home ranges (undefended, nonexclusive areas) in the Twin Butte, Dove Springs, and Thompson Allotments, however, when resources are limited, mutual avoidance occurs but can intensify into increased aggression for territory (defended, exclusive areas). Increased occurrences of aggressive activities, caused by lack of necessary resources, and the consequent acute injuries or effects to the health and wellbeing of wild horses would not follow the

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WFRHBA objective of managing for a thriving natural ecological balance within an HMA. In time the horses may begin to try to move outside the HMA boundaries as the population increases. Wild horse populations would be expected to eventually crash at some ecological threshold in the future.

3.2.3 Alternative 2 - Proposed Action

Direct and Indirect Effects

Under the Proposed Action 90 to 100% of the herd would be gathered, with up to 89 excess (adults and foals) wild horses removed permanently. Fifty horses, including two mares from different HMA, will be released to reach the AML of 50 wild horses. The use of GonaCon or PZP is expected to reduce the growth rate to 3.4-6.1% according to the Jenkins Model (Appendix D). BLM would return to the HMA to continue fertility control treatment annually via remote darting. BLM would also conduct periodic follow-up bait/water trap gathers in the HMA to achieve AML. These actions may result in stress, injury or, in rare circumstances, death. The procedures outlined in IM 2015-151 (Appendix E) would be implemented to ensure a safe and humane gather occurs, which would minimize potential stress and injury to wild horses.

Bait and/or Water Trapping

Bait and/or water trapping generally requires a long window of time for success. Although the trap would be set in a high probability area for capturing excess wild horses residing within the area and at the most effective time periods, time is required for the horses to acclimate to the trap and/or decide to access the water/bait.

Trapping involves setting up portable panels around an existing water source, attractants or bait may also be placed inside the trap. Traps would be set around water troughs where the horses drink. The portable panels would be set up to allow wild horses to go freely in and out of the corral until they have adjusted to it. When the wild horses fully adapt to the corral, it is fitted with a gate system. The acclimatization of the wild horses creates a low stress trap. During this acclimation period the horses would experience some stress due to the panels being setup and perceived access restriction to the water/bait source.
When actively trapping wild horses, the trap would be checked on a daily basis. Wild horses would be either removed immediately or fed and watered for up to several days prior to transport to an ORC. No additional effects would occur to the wild horses if kept in the trap for up to several days because very few disturbances (humans, traffic, etc.) would occur and high quality forage and water will be provided. Existing roads would be used to access the trap sites.

Impacts to individual animals could occur as a result of stress associated with the gather, capture, processing, and transportation of animals. The intensity of these impacts would vary by individual and would be indicated by behaviors ranging from nervous agitation to physical distress. Mortality of individual horses from these activities is rare but can occur. Other impacts to individual wild horses include separation of members of individual bands and removal of animals from the population.
In any given gather, gather-related mortality averages only about one half of one percent (0.5%), which is very low when handling wild animals (GAO 2008). As the proposed bait and/or water trapping in this area is a low stress approach to gathering of wild horses, such trapping can continue into the foaling season without harming the mares or foals. Approximately, another six-tenths of one percent (0.6%) of the captured animals could be humanely euthanized due to pre-existing conditions and in accordance with BLM policy (GAO 2008). Through the capture and sorting process, wild horses are examined for health, injury and other defects. Decisions to humanely euthanize animals in field situations would be made in conformance with BLM policy. BLM Euthanasia Policy IM-2015-070 is used as a guide to determine if animals meet the criteria and should be euthanized. Animals that are euthanized for non-gather related reasons include those with old injuries (broken or deformed limbs) that cause lameness or prevent the animal from being able to maintain an acceptable body condition (greater than or equal to BCS 3); old animals that have serious dental abnormalities or severely worn teeth and are not expected to maintain an

acceptable body condition, and wild horses that have serious physical defects such as club feet, severe limb deformities, or sway back. Some of these conditions have a causal genetic component and the animals should not be returned to the range to prevent suffering, as well as to avoid amplifying the incidence of the problem in the population.

Indirect individual impacts are those which occur to individual wild horses after the initial event. These may include miscarriages in mares, increased social displacement, and conflict in studs. These impacts, like direct individual impacts, are known to occur intermittently during wild horse gather operations. An example of an indirect individual impact would be the brief 1-2 minute skirmish between older studs which ends when one stud retreats. Injuries typically involve a bite or kick with bruises which do not break the skin. Like direct individual impacts, the frequency of these impacts varies with the population and the individual. Observations following capture indicate the rate of miscarriage varies, but can occur in about 1 to 5% of the captured mares, particularly if the mares are in very thin body condition or in poor health.

A few foals may be orphaned during a gather. This can occur if the mare rejects the foal, the foal becomes separated from its mother and cannot be matched up following sorting, the mare dies or must be humanely euthanized during the gather, the foal is ill or weak and needs immediate care that requires removal from the mother, or the mother does not produce enough milk to support the foal. On occasion, foals are gathered that were previously orphaned on the range (prior to the gather) because the mother rejected it or died. These foals are usually in poor, unthrifty condition. Every effort is made to provide appropriate care to orphan foals. Veterinarians may administer electrolyte solutions or orphan foals may be fed milk replacer as needed to support their nutritional needs. Orphan foals may be placed in a foster home in order to receive additional care. Despite these efforts, some orphan foals may die or be humanely euthanized as an act of mercy if the prognosis for survival is very poor.

Transport, Off-Range Corral (ORC) Holding, and Adoption (or Sale) Preparation

Up to 89 excess horses would be removed. Animals would be transported from the capture/temporary holding corrals to the designated BLM ORC(s). From there, they would be made available for adoption or sale to qualified individuals or to off-range pastures (ORP).

Wild horses selected for removal from the range are transported to the receiving ORC in a straight deck semi-trailers or goose-neck stock trailers. Vehicles are inspected by the BLM Contracting Officer's Representative (COR) and Project Inspectors (PIs) prior to use to ensure wild horses can be safely transported and that the interior of the vehicle is in a sanitary condition. During transport, potential impacts to individual horses can include stress, as well as slipping, falling, kicking, biting, or being stepped on by another horse. Unless wild horses are in extremely poor condition, it is rare for an animal to be seriously injured or die during transport.

Upon arrival at the ORC, recently captured wild horses are off-loaded by compartment and placed in holding pens where they are fed good quality hay and water. Most wild horses begin to eat and drink immediately and adjust rapidly to their new situation. Due to the generally longer timeframe it takes to complete and the low stress environment/operation of a bait/water trap gather, a veterinarian is not needed at the trap site. However, at the ORC, a veterinarian examines each load of horses and provides recommendations to the BLM regarding care, treatment, and if necessary, euthanasia of the recently captured wild horses. Any animals affected by a chronic or incurable disease, injury, lameness or serious physical defect (such as severe tooth loss or wear, club feet, and other severe congenital abnormalities) would be humanely euthanized using methods acceptable to the American Veterinary Medical Association (AVMA). Wild horses in very thin condition or animals with injuries are sorted and placed in hospital pens, fed separately and/or treated for their injuries as indicated. Recently captured wild

horses, generally mares, in very thin condition may have difficulty transitioning to feed. Some of these animals are in such poor condition that it is unlikely they would have survived if left on the range. Similarly, some mares may lose their pregnancies. Every effort is taken to help the mare make a quiet, low stress transition to captivity and domestic feed to minimize the risk of miscarriage or death.

Mortality at ORCs averages approximately 5% per year (GAO 2008), and includes animals euthanized due to a pre-existing condition; animals in extremely poor condition; animals that are injured and would not recover; animals which are unable to transition to feed; and animals which are seriously injured or accidentally die during sorting, handling, or preparation. At ORCs, a minimum of 700 square feet is provided per animal.

After recently captured wild horses have transitioned to their new environment in the ORC, they are prepared for adoption, sale or release back into the HMA. Preparation for adoption or sale (which usually takes approximately 30 days) involves freeze-marking the animals with a unique identification number, drawing a blood sample to test for equine infections anemia, vaccination against common diseases, castration, and de-worming. During the preparation process, potential impacts to wild horses are similar to those that can occur during handling and transportation. Serious injuries and deaths from injuries during the preparation process are rare, but can occur.

Adoption or Sale with Limitations, and Off-Range Pastures (ORP)

Potential impacts to wild horses from transport to adoption, sale or ORP are similar to those previously described. One difference is that when shipping wild horses for adoption, sale or ORP, animals may be transported for a maximum of 24 hours. Immediately prior to transportation, and after every 18-24 hours of transportation, animals are offloaded and provided a minimum of 8 hours on-the-ground rest. During the rest period, each animal is provided access to unlimited amounts of clean water and 25 pounds of good quality hay per horse with adequate bunk space to allow all animals to eat at one time. Most animals are not shipped more than 18 hours before they are rested. The rest period may be waived in situations where the travel time exceeds the 24-hour limit by just a few hours and the stress of offloading and reloading is likely to be greater than the stress involved in the additional period of uninterrupted travel.

ORPs are designed to provide excess wild horses with humane, life-long care in a natural setting off the public rangelands. There wild horses are maintained in grassland pastures large enough to allow free-roaming behavior and with the forage, water, and shelter necessary to sustain them in good condition. About 36,000 wild horses, that are in excess of the existing adoption or sale demand (because of age or other factors), are currently located on private land pastures in Iowa, Kansas, Oklahoma, Missouri, Montana, Nebraska, Wyoming, Utah, and South Dakota. Located mainly in mid or tall grass prairie regions of the United States, these ORP are typically highly productive grasslands as compared to more arid western rangelands. These pastures comprise about 370,000 acres. The majority of these animals are older than six years.

At ORPs, mares and castrated stallions (geldings) are segregated into separate pastures except one facility where geldings and mares coexist. Although the animals are placed in ORP, they remain available for adoption or sale to qualified individuals. No reproduction occurs in the ORP, but foals born to pregnant mares are gathered and weaned when they reach about 8-10 months of age and are then shipped to ORCs where they are made available for adoption. Handling by humans is minimized to the extent possible although regular on-the-ground observation and weekly counts of the wild horses to ascertain their numbers, well-being, and safety are conducted. A very small percentage of the animals may be humanely euthanized if they are in very thin condition and are not expected to improve to a BCS of 3 or greater due to age or other factors. Natural mortality of wild horses in ORP pastures averages approximately 8% per year, but can be higher or lower depending on the average age of the horses

pastured there (GAO 2008). The savings to the American taxpayer which results from contracting for ORP averages about $2.00 per horse per day as compared with maintaining at $5.00 per horse per day in ORC.

BLMs Use of Contraception in Wild Horse Management

BLM has identified fertility control as a method that could be used to protect rangeland ecosystem health and to reduce the frequency of wild horse and wild burro gathers and removals. Expanding the use of population growth suppression to slow population growth rates and reduce the number of animals removed from the range and sent to ORP is a BLM priority. The WFRHBA specifically provides for contraception (section 3.b.1). PZP or GonaCon vaccines would be administered only to females.

Contraception has been shown to be a cost-effective and humane treatment to slow increases in wild horse populations or, when used with other techniques, to reduce horse population size (Bartholow 2004, de Seve and Boyles-Griffin 2013, Fonner and Bohara 2017). All fertility control methods in wild animals are associated with potential risks and benefits, including effects of handling, frequency of handling, physiological effects, behavioral effects, and reduced population growth rates (Hampton et al. 2015). Contraception by itself does not remove excess horses from an HMA's population, so if a wild horse population is in excess of AML, then contraception alone would result in some continuing environmental effects of horse overpopulation. Successful contraception reduces future reproduction, but does not eliminate it.

Bartholow (2007) concluded that the application of 2 or 3-year contraceptives to wild mares could reduce operational costs in a project area by 12-20%, or up to 30% in carefully planned population management programs. He also concluded that contraceptive treatment would likely reduce the number of horses that must be removed in total, with associated cost reductions in the number of private placements and total holding costs. Population suppression becomes less expensive if fertility control is long-lasting (Hobbs et al. 2000). Although contraceptive treatments may be associated with a number of potential physiological, behavioral, demographic, and genetic effects, detailed below and in Appendix B, those concerns do not generally outweigh the potential benefits of using contraceptive treatments in situations where it is a management goal to reduce population growth rates (Garrott and Oli 2013).

Porcine Zona Pellucida (PZP Vaccine)

PZP may be applied to mares prior to their release back into the HMA. PZP vaccines meet most of the criteria that the National Research Council (2013) used to identify promising fertility control methods, in terms of delivery method, availability, efficacy, and side effects. PZP is relatively inexpensive, meets BLM requirements for safety to mares and the environment, and is produced as ZonaStat-H, an EPA-registered commercial product (EPA 2012, SCC 2015), or as PZP-22, which is a formulation of PZP in polymer pellets that can lead to a longer immune response (Turner et al. 2002, Rutberg et al. 2017).

For the PZP-22 formulation administered during gathers, each released mare would receive a single dose of the two-year PZP contraceptive vaccine at the same time as a dose of the liquid PZP vaccine with modified Freund's Complete adjuvant. Most mares recover from the stress of capture and handling quickly once released back into the HMA and none are expected to suffer serious long term effects from the injections, other than the direct consequence of becoming temporarily infertile. Injection site reactions associated with fertility control treatments are possible in treated mares (Roelle and Ransom 2009, Bechert et al. 2013, French et al. 2017), but swelling or local reactions at the injection site are expected to be minor.

In the following years, Native PZP (or currently most effective formulation) would be administered in the one year liquid dose inoculations by field or remote darting. The dart-delivered formulation produced injection-site reactions of varying intensity, though none of the observed reactions appeared debilitating

to the animals (Roelle and Ransom 2009). Joonè et al. (2017a) found that injection site reactions had healed in most mares within 3 months after the booster dose, and that they did not affect movement or cause fever. Application of fertility control treatment would be conducted in accordance with the approved standard operating and post-treatment monitoring procedures (SOPs, Appendix E).

The historically accepted hypothesis explaining PZP vaccine effectiveness posits that when injected as an antigen in vaccines, PZP causes the mare's immune system to produce antibodies that are specific to zona pellucida proteins on the surface of that mare's eggs. The antibodies bind to the mare's eggs surface proteins (Liu et al. 1989), and effectively block sperm binding and fertilization (Zoo Montana 2000). Because treated mares do not become pregnant but other ovarian functions remain generally unchanged, PZP can cause a mare to continue having regular estrus cycles throughout the breeding season. Research has demonstrated that contraceptive efficacy of an injected liquid PZP vaccine, such as ZonaStat-H, is approximately 90% or more for mares treated twice in one year (Turner and Kirkpatrick 2002, Turner et al. 2008). The highest success for fertility control has been reported when the vaccine has been applied November through February. High contraceptive rates of 90% or more can be maintained in horses that are boostered annually (Kirkpatrick et al. 1992). Approximately 60% to 85% of mares are successfully contracepted for one year when treated simultaneously with a liquid primer and PZP-22 pellets (Rutberg et al. 2017). Application of PZP for fertility control would reduce fertility in a large percentage of mares for at least one year (Ransom et al. 2011).

In depth literature review on the effects of PZP is included in Appendix B.

GonaCon

GonaCon may be applied to mares prior to their release back into the HMA. Taking into consideration available literature on the subject, the National Research Council concluded in their 2013 report that GonaCon-B (which is produced under the trade name GonaCon-Equine for use in feral horses and burros) was one of the most preferable available methods for contraception in wild horses and burros (NRC 2013), in terms of delivery method, availability, efficacy, and side effects. GonaCon-Equine is approved for use by authorized federal, state, tribal, public and private personnel, for application to wild and feral equids in the United States (EPA 2013, 2015).

GonaCon is an immunocontraceptive vaccine which has been shown to provide multiple years of infertility in several wild ungulate species, including horses (Killian et al., 2008; Gray et al., 2010). GonaCon uses the gonadotropin-releasing hormone (GnRH), a small neuropeptide that performs an obligatory role in mammalian reproduction, as the vaccine antigen. When combined with an adjuvant, the GnRH vaccine stimulates a persistent immune response resulting in prolonged antibody production against GnRH, the carrier protein, and the adjuvant (Miller et al. 2008). The most direct result of successful GnRH vaccination is that it has the effect of decreasing the level of GnRH signaling in the body, as evidenced by a drop in luteinizing hormone levels, and a cessation of ovulation. The lack of estrus cycling that results from successful GonaCon vaccination has been compared to typical winter period of anoestrus in open mares. As anti-GnRH antibodies decline over time, concentrations of available endogenous GnRH increase and treated animals usually regain fertility (Powers et al., 2011).

Changes in hormones associated with anti-GnRH vaccination lead to measurable changes in ovarian structure and function. The volume of ovaries reduced in response to treatment (Garza et al. 1986, Dalin et al. 2002, Imboden et al. 2006, Elhay et al. 2007, Botha et al. 2008, Gionfriddo 2011a, Dalmau et al. 2015). Treatment with an anti-GnRH vaccine changes follicle development (Garza et al. 1986, Stout et al. 2003, Imboden et al. 2006, Elhay et al. 2007, Donovan et al. 2013, Powers et al. 2011, Balet et al. 2014), with the result that ovulation does not occur.

Under the Proposed Action, the BLM would return to the HMA as needed to re-apply GonaCon-Equine by field or remote darting as described in the PZP section above. GonaCon-Equine can safely be reapplied as necessary to control the population growth rate. Even with one booster treatment of GonaCon-Equine, it is expected that most, if not all, mares would return to fertility at some point, although the average duration of effect after booster doses has not yet been quantified. Although it is unknown what would be the expected rate for the return to fertility rate in mares boosted more than once with GonaCon-Equine, a prolonged return to fertility would be consistent with the desired effect of using GonaCon (e.g., effective contraception). Once the herd size in the project area is at AML and population growth seems to be stabilized, BLM could make a determination as to the required frequency of new mare treatments and mare re-treatments with GonaCon, to maintain the number of horses within AML.

Injection site reactions associated with immunocontraceptive treatments are possible in treated mares (Roelle and Ransom 2009). Whether injection is by hand or via darting, GonaCon-Equine is associated with some degree of inflammation, swelling, and the potential for abscesses at the injection site (Baker et al. 2013). Swelling or local reactions at the injection site are generally expected to be minor in nature, but some may develop into draining abscesses.

In depth literature review on the effects of GonaCon is included in Appendix B.

PZP and GonaCon Indirect Effects

One expected long-term, indirect effect on wild horses treated with fertility control, such as PZP or GonaCon would be an improvement in their overall health (Turner and Kirkpatrick 2002). Many treated mares would not experience the biological stress of reproduction, foaling and lactation as frequently as untreated mares. The observable measure of improved health is higher body condition scores (Nuñez et al. 2010). After a treated mare returns to fertility, her future foals would be expected to be healthier overall, and would benefit from improved nutritional quality in the mare's milk. This is particularly to be expected if there is an improvement in rangeland forage quality at the same time, due to reduced wild horse population size. Past application of fertility control has shown that mares' overall health and body condition remains improved even after fertility resumes. PZP treatment may increase mare survival rates, leading to longer potential lifespan (Turner and Kirkpatrick 2002, Ransom et al. 2014a). To the extent that this happens, changes in lifespan and decreased foaling rates could combine to cause changes in overall age structure in a treated herd (i.e., Turner and Kirkpatrick 2002, Roelle et al. 2010), with a greater prevalence of older mares in the herd (Gross 2000). Observations of mares treated in past gathers showed that many of the treated mares were larger than, maintained higher body condition than, and had larger healthy foals than untreated mares.

Wild Horses Remaining or Released Back into the HMA following Gather

Under the Proposed Action, the wild horses that are not captured may be temporarily disturbed and may move into another area during the gather operations. Studies over the past 40 years have shown that the herd's social structure and interactions among individual horses are likely to return to normal once the horses have acclimated back to the range.

No observable effects associated with these impacts would be expected within one month of release, except for a heightened awareness of human presence. There is the potential for the horses that have been desensitized to vehicles and human activities to return to areas where they were gathered if released back into HMA's. No observable effects to the remaining population from the gather is expected.

Genetics

Under the WFRHBA, BLM is charged with maintaining self-reproducing populations of wild horses and burros. The National Academies of Sciences (NRC 2013) encouraged BLM to manage wild horses and burros at the spatial scale of "metapopulations" – that is, across multiple HMAs and complexes in a

region. In this context, the wild horses in Saylor Creek HMA should not be considered as an isolated population – rather, they are part of a larger set of wild horse herds with genetic interchange over time. As is true for horses in many HMAs, the wild horses in Saylor Creek HMA have historical genetic and demographic connections with other HMAs. BLM routinely moves animals from one HMA to another to improve local herd traits and maintain high genetic diversity.

The genetic monitoring report from Cothran (2010) indicates that horses in the Saylor Creek HMA herd had levels of genetic variation that were "…well above the feral mean…" as measured by heterozygosity. It is expected that heterozygosity (one measure of genetic diversity) will be lost from a population at a rate described by the following equation, where H1 is the expected heterozygosity one generation into the future, H0 is the current level of heterozygosity, and Ne is the genetic effective population size.

$$H1 = (1-1/2Ne)H0$$

Immediately after the proposed gather, the number of horses in the Saylor Creek HMA is expected to be approximately 25 mares and 25 stallions for Proposed Alternative. The population would subsequently increase due to population growth, albeit at a slower than natural reproductive rate. BLM recognizes that not all of these animals will necessarily breed, particularly the males. Nonetheless, based on the above equations, the expected value of Ne would be 50, with a resulting expected loss of heterozygosity of less than 1% per generation. Because the post-release founding population will contain animals that may be somewhat related, the actual Ne may be lower, with the resulting loss of heterozygosity slightly higher per generation. With this number of breeding animals and the expected rates of heterozygosity loss, introducing new breeding animals from outside of the original Saylor Creek HMA is a prudent management strategy that will maintain genetic diversity and mitigate the risk of inbreeding (BLM 2010). Given the plans to introduce of 2 or more mares from outside the Saylor Creek every 10 years or less, the Proposed Alternative is not expected to cause an unacceptable loss of genetic diversity or risk of inbreeding.

In summary, Cothran (2010) concluded "For this herd, the values related to allelic diversity are near (but slightly above) the average while heterozygosity is high. The data do not suggest recent mixing with animals from outside the herd. Also, the data is consistent with a fairly stable population size, although the *Fis* value could indicate some recent reduction in herd size. The data is not clear on this point. Genetic similarity results suggest a herd with mixed ancestry." Further, Cothran (2010) suggested that "Current variability levels are high enough that no action is needed at this point. The herd should be re-sampled in five to seven years to determine if there are any changes in variability."

3.3 Livestock Grazing Management

3.3.1 Affected Environment

Saylor Creek HMA encompasses all or portions of eight livestock grazing allotments: Black Mesa, Blue Butte, Dove Springs, Grindstone, Hallelujah, Saylor Creek/N Three Island, Thompson, and Twin Butte. The horses occupy three pastures in the Twin Butte (West Pasture), Dove Spring (North Pasture), and Thompson (Pasture #4) Allotments. Table 2 summarizes the livestock use information for the allotments in the HMA. A formal grazing rotation is not employed on the any of the allotments; however, the livestock are moved from one pasture to the next according to use levels and livestock management purposes.

Table 2. Livestock use within the Saylor Creek HMA

Allotment	Season of Use Kind of Livestock	Percent of Allotment in HMA	Permitted Use (AUMs)	TNR (AUMs)	Ten Year Average AUM Use
Black Mesa	03/01-03/31 01/01-02/28 Cattle	78%	1,007	NA	930
Blue Butte	03/01-02/28 Cattle	100%	1,311	1,306	1,858
Dove Springs *	03/01-11/15 Cattle	100%	1,360	973	1,130
Grindstone	04/01-11/15 Cattle	100%	675	602	1,099
Hallelujah	03/01-02/28 Cattle	25%	2,271	NA	1,341
Saylor Creek/ N Three Island	04/01-11/15 Cattle	56%	2,040	496	2,480
Thompson*	04/01-11/15 Cattle	58%	1,867	1,238	3,195
Twin Butte*	03/01-03/31 12/01-12/31 Sheep 03/01-02/28 Cattle	76%	5,616	5,543	5,896

*Allotments that contain wild horses and their home ranges.

In addition to permitted AUMs, six of the allotments in the HMA have temporary non-renewable (TNR) permits that authorize additional AUMs beyond those permitted. TNR AUMs are listed in the fifth column in Table 2. Over the life of the 1987 Jarbidge RMP, changes to vegetation due to range improvement projects designed to increase forage production for livestock grazing, wildland fire creating more grasslands, and rehabilitation projects in burned areas, forage production has increased. To take advantage of the increased availability of forage in the planning area, permittees requested TNR permits that would authorize additional AUMs when forage was available and resource objectives could be maintained or achieved (CFR 4130.6-1). A court order in *Western Watersheds Project v. Bennett* (CV-04-181-S-BLW) enjoined the JFO from issuing TNR permits until an updated environmental analysis could be completed. A subsequent Congressional appropriations rider authorized BLM to issue TNR permits consistent with the most recently expired TNR permit between March 1, 1997 and February 28, 2003.

Due to the lack of natural water sources available to wild horses, livestock water systems are their only water source. Damage to water systems and other infrastructure by wild horses is common and increases maintenance and operating expenses, mainly in the Twin Butte Allotment where the majority of the horses remain in one large (>70 horses) herd throughout the year. A large number of horses attempt to utilize water troughs at the same time, increasing the damage to floats, troughs, etc. The permittees have agreed to be responsible for maintaining the water system while livestock are in the pastures, and the BLM assumes those responsibilities for the remainder of the year.

Although horses and cattle are often compared as grazers, horses can be more destructive to the range than cattle due to their differing digestive systems and grazing habits. The dietary overlap between wild

horses and cattle is much higher than with wildlife, and averages between 60 and 80% (Hubbard and Hansen 1976, R. Hansen, et al. 1977, Hanley 1982, Krysl et al. 1984, McInnis and Vavra 1987). Horses are cecal digesters while most other ungulates including cattle, pronghorn, and others are ruminants (Hanley and Hanley 1982, Beever 2003). Cecal digesters do not ruminate, or have to regurgitate and repeat the cycle of chewing until edible particles of plant fiber are small enough for their digestive system. Ruminants, especially cattle, must graze selectively, searching out digestible tissue (Olsen and Hansen 1977). Horses, however, are one of the least selective grazers in the West because they can consume high fiber foods and digest larger food fragments (Hanley and Hanley 1982, Beever 2003). Wild horses can exploit the high cellulose of graminoids, or grasses, which have been observed to make up over 88% of their diet (McInnis and Vavra 1987, Hanley 1982). However, this lower quality diet requires that horses consume 20-65% more forage than a cow of equal body mass (Hanley 1982, Menard et al. 2002). Wild horses tend to use areas further from water (Beever and Brussard 2000) and with steeper topography than cattle (Ganskopp and Vavra 1987). With more flexible lips and upper front incisors, both features that cattle do not have, wild horses trim vegetation more closely to the ground (Symanski 1994, Menard et al. 2002, Beever 2003).

3.3.2 Alternative 1 - No Action

Direct and Indirect Effects

Livestock would not be disturbed or displaced due to trapping operations under the No Action Alternative. Damage to rangeland improvements, such as troughs, would continue as the population of wild horses increases. Similarly, there could be increasing conflicts, including competition for forage, between livestock grazing and wild horses as the wild horse numbers increase.

3.3.3 Alternative 2 - Proposed Action

Direct and Indirect Effects

Past experience has shown that wild horse gather operations have few direct impacts to cattle and sheep grazing. Livestock located near gather activities would be temporarily disturbed or displaced by the traps and the increased vehicle traffic during the gather operation. The BLM would work with livestock operators to set up traps at locations in the allotment that livestock are not currently utilizing. Livestock may be moved to different pastures to avoid trapping operations. Typically livestock would move back into the area once gather operations cease.

Damage to rangeland improvements by wild horses may continue, although at a much lower rate, as the horses in the Twin Butte Allotment remain in one large herd throughout the year. However, damage to range improvements would be expected to be minimal due to the relatively low number of horses present. Similarly, there would be minimal conflicts, including competition for forage, between livestock grazing and wild horses.

3.4 Noxious Weeds and Invasive Plants

3.4.1 Affected Environment

Currently, the Idaho Noxious Weed List contains 67 weed species. Invasive plants are non-native species whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112). Comprehensive noxious weed and invasive plant inventories have not been completed by BLM in the HMA; however, some documentation exists of noxious weeds and invasive plants and their locations. Six of these noxious weeds are known to occur in the HMA (Table 3).

Table 3. Noxious Weeds occurring in the HMA.

Common Name	Scientific Name
Black henbane	*Hyoscyamus niger*
Canada thistle	*Cirsium arvense*
Diffuse knapweed	*Centaurea diffusa*
Field bindweed	*Convolvulus arvensis*
Rush skeletonweed	*Chondrilla juncea*
Scotch thistle	*Onopordum acanthium* L.

Currently, multiple invasive plants not listed on the Idaho Noxious Weed list occur in the HMA. The most prevalent invasive plant is cheatgrass (*Bromus tectorum*). Originally limited to travel routes, cheatgrass has expanded throughout the HMA. Density varies with areas of relative dominance or monoculture, but cheatgrass primarily occupies the interspaces between perennial plants. Other invasive species such as bull thistle (*Cirsium vulgare*), Russian thistle (*Salsola*, spp.), and tumble mustard (*Sisymbrium altissimum)* occur. Abundance of these three species is episodic, and directly associated with soil disturbance such as wildfire, road maintenance, off-road vehicle traffic, and other authorized uses that may disturb soil surfaces. Invasive species may also establish in localized areas disturbed by wildlife such as mounds of soil adjacent to burrows.

Noxious weeds and invasive plants can spread and invade from areas of high disturbance into adjacent native and non-native perennial plant communities. Mechanisms for introduction and spread include but are not limited to (not priority order): cross-country motorized travel, passenger vehicles, road maintenance, non-motorized recreational use, wild horse and wildlife movements, livestock movements and management activities including facility construction and maintenance, wind, gravel pit and mining operations, wildfire and fire suppression activities. Noxious weeds and invasive plants can also spread to public land from adjacent private lands. Increased occurrence of wildland fire has created opportunities for introduction and spread of noxious weeds and invasive plants, especially cheatgrass (Jessop and Anderson 2007; Kinter et al. 2007).

Some invasive plants dry earlier during spring and summer compared to native vegetation. This, coupled with periodic high biomass production, can contribute to wildland fire risk by increasing availability of fine fuels. Annual grasslands dominated with cheatgrass and other annual invasive plants are of particular concern because of this increased wildland fire risk and their ability to expand rapidly into disturbed areas. Rehabilitation or restoration treatments, such as seeding burned or otherwise disturbed areas with desirable native or non-native perennial vegetation, reduces the potential for the introduction and spread of noxious weeds and invasive plants (Evans and Young 1978; Thompson et al. 2006).

3.4.2 Alternative 1 - No Action

Direct and Indirect Effects

The increasing number of wild horses would increase the soil disturbance and vector for the introduction and spread of noxious weeds and invasive plants. Areas of disturbance associated with grazing, trailing, loafing, and water sources would continue to increase. Wild horses would be expected to travel from water sources to forage; thereby, providing a vector to disperse seed in fecal deposits or seed attached to hooves and hair.

3.4.3 Alternative 2 - Proposed Action

Direct and Indirect Effects

Areas most vulnerable to establishment of noxious weeds and invasive plants are heavily disturbed areas, such as gather trap sites. These areas would be prioritized for follow up inventory and treatment of noxious weeds reducing the potential for establishment and spread. Setting gather trap sites outside of

areas known to contain noxious or non-native species would limit the potential to spread invasive vegetation. Areas with known infestations of noxious weeds would be avoided to reduce the potential for expansion and spread of noxious weeds in those areas.

Increases in vehicle use along roads within the assessment area by transportation of wild horses, and transportation of support personnel could potentially introduce weed seed into the area. These areas would be prioritized for follow up inventory and treatment to reduce the potential for establishment and spread. Promoting on-road use and limiting off-road travel would also prevent the spread of non-native species into areas that were not previously infested.

Indirect impacts to invasive, non-native species from gathering wild horses and implementing population control measures would, over an extended period of time, reduce areas of bare ground caused from concentrated wild horse grazing and hoof action thereby decreasing the areas available for weed infestation. While the removal of excess wild horses and fertility control would make areas more resilient to infestation by invasive species, other activities within the assessment areas that spread invasive species would still continue.

To further minimize the potential for introduction and spread within the project area, all equipment and vehicles exposed to weed infestations or arriving on site carrying dirt, mud, or plant debris would be cleaned before moving onto project sites or between project areas.

3.5 Vegetation

3.5.1 Affected Environment

Historically, the HMA was vegetated primarily by big sagebrush (*Artemisia tridentata*) and native grasses which varied depending on the ecological site. Fire and subsequent stabilization efforts since the mid-1970s have greatly altered the vegetation communities present within the HMA. Table 4 shows the vegetation subgroups by acre within the HMA. The primary native grass within the HMA is Sandberg bluegrass (*Poa secunda*). Other native grasses present include Thurber's needlegrass (*Achnatherum thurberianum*), Indian ricegrass (*A. hymenoides),* bottlebrush squirreltail (*Elymus elymoides*), basin wildrye (*Leymus cinereus*), and needleandthread (*Hesperostipa comata*). Thurber's needlegrass, bottlebrush squirreltail, and basin wildrye are typically found on more loamy soils; whereas, needleandthread and Indian ricegrass are more abundant on sandier soils. Native shrubs in the HMA include yellow rabbitbrush [also known as twistedleaf or green rabbitbrush] (*Chrysothamnus visiciflorus*), rubber rabbitbrush (*Ericameria nauseosus*), and big sagebrush (*Artemesia tridentata*). Native forbs are limited due to low precipitation and past disturbances. Native forbs present include skeletonplant (*Lygodesmia juncea*), lemon scurfpea (*Psoralidium lanceolatum*), milkvetches (*Astragalus* sp.), sagebrush phlox (*Phlox aculeata*), spiny phlox (*P. hoodii*), biscuitroots (*Lomatium* sp.), and fleabane (*Erigeron* sp.). The most abundant native forb is tansy mustard (*Descurainia pinnata*). This forb is relatively abundant in disturbed areas. Native grasses and forbs vary, reflecting changes in soils and range sites.

Table 4. Vegetation Subgroups within the Saylor Creek HMA (BLM only).

	Annual Grassland (acres)	Non-native Perennial Grassland (acres)	Native Grassland (acres)	Native Shrubland (acres)	Shrub/ nonnative understory (acres)	Unvegetated* (acres)
HMA Vegetation Subgroups	30,232	42,259	25,465	824	1,631	400

*Areas categorized as unvegetated are those sites where vegetation is generally lacking. The unvegetated category includes cliffs, talus, rock outcrops, playa bottoms, sand dunes and soil classified as barren.

Non-native annual grasses, primarily cheatgrass (*Bromus tectorum*), are widespread and dominate some areas. Fire and subsequent emergency stabilization have played a role in the existing vegetation in the HMA since the mid-1970s, with the frequency and size of fires increasing over the last few decades. The primary grasses seeded following wildfires in the 1970s through mid-1990s were cultivars of crested wheatgrass (*Agropyron cristatum* and *A. desertorum*), Siberian wheatgrass (*A. fragile*), or both. In some instances, a shrub, four-wing saltbush (*Atriplex canescens*), was seeded. As a result, the vegetation is now dominated by non-native perennial grasses.

Wild horses tend to use areas further from water (Beever and Brussard 2000) and with steeper topography than cattle (Ganskopp and Vavra 1987). In the Great Basin, areas of concentrated horse use have elevated soil density values and altered vegetation compared to random areas or areas without wild horses (Beever 2003, Ostermann-Kelm et al. 2009). Wild horses transport plant seeds and the moisture and nutrients deposited with waste may enhance establishment (Ostermann-Kelm et al. 2009). Due to soil loss following the fires, some grasses have portions of their root systems exposed. These plants have a greater likelihood of being pulled from the ground when grazed, particularly when soils are wet. Wild horses, with their upper incisors, clip vegetation closer to the ground compared to livestock and native ungulates, potentially delaying recovery of grazed plants (Beever 2003). A potential benefit of a horse's digestive system may come from seeds passing through system without being digested but the benefit is likely minimal when compared to the overall impact wild horse grazing has on vegetation in general.

3.5.2 Alternative 1 - No Action

Direct and Indirect Effects

Under the No Action Alternative, wild horses in excess of the AML would not be removed. The increased number of horses on the range would increase the amount of utilization and decrease the amount of available forage. Based upon the normal 20% annual population growth rate for wild horse herds (NRC 2013), the no action alternative (no removal or fertility control) would result in approximately 234 to 511 (in the median trial) and 1,227 (in the highest trial) horses in the HMA by 2028 (Appendix D). Consistent heavy (>61%) utilization in wild horse use areas would likely lead to severe range degradation in the future. If native, perennial vegetation is degraded, the potential for the invasion of annual grasses would occur.

No action to maintain the wild horse population within AML is expected to reduce the vigor and resiliency of perennial grasses in the HMA as utilization levels increase, therefore increasing the potential for annual grass invasion. Annual grass communities lack the plant community structure, root occupancy of the soil profile, ability to provide the amount and distribution of plant litter that native communities provide. Annual grass communities, as compared to the potential and capability of native perennial communities, lack the ability to protect the soil surface from raindrop impact; do not provide detention of overland flow; and do not provide maintenance of infiltration and permeability, and protect the soil surface from erosion (Pellant et al. 2005). Under this alternative increases in annual grasses would occur and the condition of the range would deteriorate over time. The loss of native vegetation would lead to soil loss due to exposure to wind and water erosion and would expose previously uninfested areas to noxious and invasive weeds.

3.5.3 Alternative 2 - Proposed Action

Direct and Indirect Effects

Due to the hoof action and vehicle use around trap sites, upland vegetation is often trampled and/or uprooted. Because of these effects, trap sites would be located in areas previously used or those which have been disturbed in the past such as trough sites. The trap sites would be approximately 0.5 acres in

size which would have a minimal effect on upland vegetation in the HMA. Keeping gather sites in previously used areas or areas previously disturbed would minimize or reduce potential new effects to upland vegetation since vegetation will already have been impacted.

Reducing wild horse numbers to AML would reduce the potential for heavy, annual utilization levels in wild horse use areas and associated erosion. Disturbance areas (e.g., trailing routes including territory perimeters, dung posts or stud piles, dusting, and watering sites [Beever 2003]) in the wild horse home range area would be reduced because fewer horses are present. Reductions in horse numbers would result in decreased demand for forage thus providing opportunity for some plants in use areas to have a full growing season of no use to restore vigor and complete a reproductive cycle. Removal of excess horses would allow native and non-native seeded vegetation to improve in areas where they have received continuous moderate to heavy growing season use. Annual utilization of herbaceous plants during the growing season is widely known to reduce plant vigor, reproduction and productivity.

Applying the fertility vaccine would slow down the reproductive rate reducing the grazing pressure over a longer period of time and give native vegetation a greater stronghold. Healthy, diverse and productive plant communities promote improved resiliency, reducing the threat of noxious weed establishment and spread.

3.6 Wildlife (Other than BLM Special Status Species)

3.6.1 Affected Environment

A number of wildlife species are present in the HMA. The primary mid-sized mammalian predators include: coyote (*Canis latrans*), badger (*Taxadea taxus*), striped skunk (*Mephitis mephitis*), and weasels (*Mustela* spp). Raptors observed in the area include golden eagles (*Aquila chrysaetos*), red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), short-eared owl, and burrowing owl. Birds present are primarily those that use grasslands. A variety of rodents are present including deer mouse (*Peromyscus maniculatus*), montane vole (*Microtus montanus*), western harvest mouse (*Reithrodontmys megalotis*), grasshopper mouse (*Onychomys leucogaster*), Great Basin pocket mouse (*Perognathus parvus*) and kangaroo rats (*Dipodomys* spp.). Small mammals dependent on sagebrush steppe [least chipmunk (*Tamias minimus*) and sagebrush vole (*Lemmiscus curtatus*)] will likely be extirpated because of the small limited sagebrush steppe habitat in the area and lack of suitable habitat for dispersing individuals (Hanser and Huntly 2006). The nearest large area of intact sagebrush steppe is more than 11 miles away with no connecting islands. The most common big game species is currently the pronghorn (*Antilocapra americana*), which are present year round. Elk (*Cervus elaphus*) are expanding from the south. Elk and wild horse diets overlap seasonally (Olsen and Hansen 1977) and both species along with cattle consume primarily grasses. Although many of the elk return to Nevada in the summer, an increasing number remain in Idaho. A few elk are observed in the summer near the Horse Butte, Poison Butte, and Coonskin Butte areas. Elk have occasionally been noted in the Twin Butte and Notch Butte Allotments.

3.6.2 Alternative 1 - No Action

Direct and Indirect Effects

Wildlife would not be directly disturbed or displaced by gather activities. However, competition between wildlife and wild horses for forage and/or water resources would continue to increase. Wild horses are aggressive around water sources and some wildlife may not be able to compete.

Burrow collapse is a natural phenomenon. Burrows near the soil surface are potentially at a higher risk of collapse than burrows well underground. Burrows in loamy sand and sandy loam soils are more likely to collapse compared to silt loam soils when trampled (Holmes et al. 2003). Wild horses as well as pronghorn and livestock are expected to collapse some burrows used by rodents, reptiles, and mid-size predators such as coyotes and badgers. Mammalian species are expected to re-excavate the collapsed

portions of burrows. Additionally, many rodent burrow systems have multiple openings making entrapment of rodents or reptiles less likely. Hibernating rodents (e.g., ground squirrels, chipmunks) are expected to excavate around the collapsed portion of the burrow, use an alternate opening or create a new opening once they become active.

Infrequently individual animals die from trampling. Surface trampling of reptiles is more likely for slower reptiles, such as horned lizards, or when the weather is cool and the reptiles are sluggish. Larger burrows used by burrowing owls can collapse regardless of the cause, potentially trapping owls or eggs (Holmes et al. 2003). New burrows excavated by badgers or coyotes replace collapsed burrows and can be used by burrowing owls for nesting. Impacts of collapsed burrows to wildlife due to trampling by wild horses are expected to be negligible at both the local and pasture-wide scales.

Wild horses behaviorally dominate and can displace both pronghorn and mule deer (*Odocoileus hemionus*) (Berger 1985). Because there are few mule deer in the area, this species is not expected to be impacted. Wild horse diets have less overlap with pronghorn and are more similar to cattle (Olsen and Hansen 1977; Hanley and Hanley 1982; McInnis and Vavra 1987) and elk (Olsen and Hansen 1977; Krysl et al. 1984). A few pronghorn (*Antilocapra americana*) are in the area. Pronghorn use of vegetation is considered negligible at current management levels. Although pronghorn numbers fluctuate over time, pronghorn numbers are not expected to increase to the extent they would compete for forage with wild horses.

Following a release of elk in the late 1980s and early 1990s in northern Nevada, elk herds have expanded from the southern part of the planning area. Elk have been occasionally observed in the Notch Butte Allotment just south of the West Pasture of the Twin Butte Allotment. Elk and wild horse diets overlap seasonally (Olsen and Hansen 1977) and both species along with cattle consume primarily grasses. Interactions between livestock, increasing elk, and wild horses could result in additional high use areas being created which could impact forage availability over the long term as horse numbers increase.

Although some small scattered islands of sagebrush remain in the HMA, sagebrush obligate rodents, such as sagebrush vole or least chipmunk, are likely to become extirpated (Hanser and Huntly 2006) irrespective of the presence of wild horses.

3.6.3 Alternative 2 - Proposed Action

Direct and Indirect Effects

Compared to the No Action Alternative, there would be an initially lower chance for trampling of burrows or wildlife, primarily reptiles and rodents. Trampling of burrows or individual animals would increase to a limited extent as the herd size increased. Impacts would be generally restricted to areas favored by horses. At both the local and pasture-wide scales, impacts to wildlife and habitats are considered negligible. Impacts to pronghorn would consist of some displacement or changes in movements.

Indirect impacts would be related to decreases in wild horse densities. Reducing the wild horse population to AML would decrease competition for available cover, space, forage, and water between wild horses and wildlife. Reduced utilization of vegetation by wild horses would result in increased plant vigor, production, seedling establishment, and ecological health of important wildlife habitat. Resident populations of, pronghorn antelope, elk and a myriad of other species would benefit from an increase in forage availability, vegetation density, and heterogeneous structure.

Some wildlife could be temporarily disturbed or displaced by the placement of traps. Impacts would be short term (<2 months) and many species of wildlife would return to regular use of the areas after the disturbance has passed. Reduction of wild horse numbers to AML would reduce utilization of forage and

water resources by horses, reducing competition for these resources and allowing for improvement of habitat conditions for wildlife species.

4.0 Cumulative Effects

Cumulative effects are those impacts resulting from the incremental impact of an action when added to other past, present, or reasonably foreseeable future actions (RFFA) regardless of what agency or person undertakes such other actions. RFFAs include those Federal and non-federal activities not yet undertaken, but sufficiently likely to occur, that a responsible official of ordinary prudence would take such activities into account in reaching a decision.

4.1. Analysis Areas

The geographic extent of cumulative impacts varies by the type of resource and resource issues and by the type of potential impact. Different cumulative effects analysis areas (CEAAs) have been developed for each resource and are listed in Table 5.

Table 5. Cumulative Effects Analysis Area (CEAA) Summary

CEAA Boundary	Issue/Resource	Selection Rationale
1. Grazing Allotments overlapping the Saylor Creek HMA (See Table 2 in Section 3.3.1)	Livestock , Vegetation, Noxious Weeds and Invasive Plants	Livestock are managed at the allotment level and vegetation is unlikely to move outside the allotment boundary during the reasonably foreseeable future. Direct and indirect effects of wild horse use on livestock grazing and vegetation can be detected within the allotment boundary. Outside of this area, there is no wild horse use and no direct or indirect effects from wild horses will occur. At greater distances from the allotment, it becomes even more difficult to determine any impacts due to the dilution effect that comes with the increased acreage.
2. Saylor Creek HMA boundary	Wild horses	Resources are contained within the Saylor Creek HMA or interact weakly with elements outside the Allotment boundaries.
3. Saylor Creek HMA + five mile buffer	Wildlife	A five mile buffer around the HMA as pronghorn antelope can travel that distance.

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Table 6. Timeframes for Short- and Long-Term Cumulative Effects Analysis

Resource	Short-Term Definition and Rationale	Long-Term Definition and Rationale
Wild Horses	One to two months per gather, extending the life of the project. The majority of these impacts would be short-lived and temporary in nature.	Ten years - Wild horse population is expected to continue to increase. The rate of increase would be dependent on the alternative chosen and would be lowest under the Proposed Action.
Livestock	One to two months per gather, extending the life of the project. Livestock grazing is expected to continue at similar stocking rates.	Ten years - Less impacts to livestock grazing with wild horse numbers at AML.
Noxious Weeds and Invasive Plants	One year - Establishing trap sites leading to wild horses congregating in specific locale, the impacts associated with transportation, and observation in the gather area would exacerbate soil and vegetative stresses that resulted from past grazing pressures and on degraded soils. However, these stresses would be minimal due to existing degraded conditions at the trap sites.	Ten years - The cumulative impacts of the Proposed Action would positively affect long term management goals to maintain rangeland health and healthy wild horse populations, which would reduce trailing; this would reduce the probability of invasive species being transported to new locations. The reduction would also reduce the amount of herbivory of native perennial species which compete with invasive species.
Vegetation	One to two months per gather, extending the life of the project – Direct and indirect, concentrated impacts to vegetation related to gather activities would occur throughout the proposed gather period, and would extend slightly beyond due to post-gather clean up and project completion.	Ten to forty years – The direct and indirect impacts to vegetation associated with overgrazing would persist for extended periods of time. Arid vegetation communities can change quickly with disturbance, but take a great deal of time to recover.
Wildlife	Over the 10 year period of the proposed action, cumulative effects of the Proposed Action would impact wildlife.	Ten years - After the 10-year period of the Action Alternative, management of wild horse populations as described in those alternatives would cease. Wild horse populations would then increase at 20-25% per year until once again exceeding AML within about 1 years. Therefore the long-term time period is 11 years.

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Table 7. Past, Present, and Reasonably Foreseeable Actions

Action Type	Past	Present	Reasonably Foreseeable
Livestock Grazing	X	X	X
Issuance of decisions and grazing permits for ranching operations through the allotment evaluation process/standards and guidelines assessment	X	X	X
Recreation (including OHVs)	X	X	X
Non-native, Invasive and noxious weed inventory/treatments; pesticide application	X	X	X
Wild horse management: issuance of multiple use decisions, AML adjustments, gathers and planning	X	X	X
Wildfire and Emergency stabilization and rehabilitation	X	X	X
Gateway West Transmission Line (GWW)			X

4.2 Past, Present, and Reasonably Foreseeable Future Actions

Past actions in the CEAAs include fires (Browns Creek AKA Bi-Centennial Fire 1976, Clover Fire 2005, Long Butte Fire 2010, and Kinyon Road Fire 2012) and its associated post-fire rehabilitation. Fire prevention and suppression, and post-fire rehabilitation includes fuel breaks along existing roads, establishment of dozer lines to create a fire break, re-seeding, and if necessary, emergency horse gathers. Additional past actions include livestock grazing, water developments such as pipelines and wells, fuel breaks, and wild horse use. RFFAs occurring in the CEAAs include fires, livestock grazing, wild horse management (issuance of multiple use decisions, AML adjustments, gathers and planning), the Gateway West Transmission Line Project (GWW), and off-highway vehicle (OHV) use.

Livestock grazing will be managed in accordance with applicable laws, regulations and policies, including the regulatory requirement that livestock grazing be managed to meet, or make significant progress towards meeting, the Idaho Standards for Rangeland Health. In the next several years, permit renewals and livestock grazing evaluations would be completed on all eight of the Allotments within the HMA. Changes to the permitted livestock use, including AUMs and season of use, on each of these allotments would be evaluated at that time. Issuance of grazing permits would be completed through appropriate NEPA analysis.

The GWW right-of-way (ROW) crosses the Twin Butte (West Pasture) and Thompson (Pasture #4) Allotments. The GWW Transmission Line segment 9 routes can be found at http://www.gatewaywestproject.com. Construction of the GWW would cause surface disturbance from structure installation, creation of permanent roads for construction and maintenance, and temporary storage areas for supplies and equipment. After construction is complete, BLM expects the GWW operators to perform routine maintenance.

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Off-highway vehicles (OHV) are used for recreation and resource management. Until 2009, the Saylor Creek HMA was open to cross-country OHV travel. Since 2009, motorized use has been confined to travel along existing routes. The travel management established in 2009 is expected to continue for the foreseeable future. Motorized recreational activity is expected to continue to increase in portions of the HMA where there is an existing Special Recreation Management Area (SRMA) and Extensive Recreation Management Area (ERMA).

4.3 Wild Horses

Four gathers of wild horses have occurred throughout the HMA in the past. The most recent gather of wild horses was in September 2010; this was an emergency gather as a result of the 2010 Long Butte Fire. Past wildfires have temporarily reduced/eliminated forage and habitat for wild horses and any future wildfires would be expected to do the same. Immediate removal of wild horses would be required if a wildfire were to occur on the HMA as was done in the past. This would depend on extent and severity of the wildfire, as well as the location. If wild horses were removed due to a wildfire, the wild horses would be returned to AML when burned area rehabilitation objectives were achieved.

Other past activities which may continue to affect wild horses within the HMA include recreational uses, livestock grazing and past wild horse gathers. These activities can impact wild horses by reducing the quantity and quality of vegetation resources. Past repeated gathers in the same areas or conducted too close together can affect wild horse behavior making them harder to capture.

The increased presence and noise associated with motorized recreation could increase disruption of normal grazing and social behavior of the horses if they move to those areas. At this time, none of the horses' home ranges are near the SRMA and ERMA. Livestock grazing would continue to cause minor impacts to wild horse forage and their habitat. Diet overlap exists, however, past and present competition of forage and habitat have been low. In addition, competition of forage and habitat in the future is expected to be less due to scheduled livestock grazing permit renewals in the area and the expectation that if land use plan objectives and the Idaho Standards for Rangeland Health are not met, changes would be made to livestock grazing to ensure progress towards them. Range improvements, in particular barbed-wire fencing, that have been constructed are well known to wild horses in the HMA and don't provide any hazard. Future construction of fences could be a temporary hazard to wild horses, but wild horses in this HMA are well accustomed to fences. All water on the HMA is provided by wells that move water through pipelines to troughs. No natural water (springs, streams, etc.) is present on the HMA. Therefore, all past, present, and future water developments would be beneficial to wild horses and could provide access to other areas of the HMA.

Although invasive or noxious weeds and the Gateway West Transmission line are actions within the CEAA, very few impacts are expected to occur on the wild horse population in the HMA. Past, present and future effects from non-native/invasive/noxious weeds are expected to be minimal due to the successful post-wildfire treatments and upcoming livestock grazing permit renewals. It is likely that invasive or noxious weeds would increase in the area following wildfires, which would cause a decrease in forage and habitat for the wild horses. However, forage and habitat has returned in past burned area rehabilitation efforts and would be expected to be the same in the future. The GWW may have impacts at the large scale for many resources as outlined in the Gateway West EIS. Wild horses in this HMA have become accustomed to infrastructure, including transmission lines, and no additional impacts are expected. Minor displacement would occur during construction, but wild horses would be expected to return once construction activities ended. The increased human activity associated with GWW ROW through the HMA and on adjacent State and private lands could increase risk of wildfire, introduction and spread of noxious weeds and invasive plant species, and increase disturbances to the horses. This may cause the horses to temporarily move to other locations in the West Pasture and Thompson Allotment Pasture #4 until construction is completed.

Overall, cumulative effects from past, present, and foreseeable future actions are minimal and not expected to result in any meaningful disturbance to wild horses.

4.4 Livestock

Under both alternatives, livestock grazing would continue at this time. In the next several years, permit renewals and livestock grazing evaluations would be completed on all eight of the Allotments within the HMA. Changes to the permitted livestock use, including AUMs and season of use, on each of these allotments would be evaluated at that time. Issuance of grazing permits would be completed through appropriate NEPA analysis. Any changes that will occur would result in meeting or making significant progress towards rangeland health standards and RMP objectives. In addition to any disturbance to livestock from gather operations listed above, livestock in areas outside of the gather area may be frightened and leave the area due to traffic, and human interactions.

Cumulative impacts identified above in Section 4.3 (Cumulative Impacts - Wild Horses) would be the same or very similar from past, present, and foreseeable future actions from wildfires, recreation, non-native/invasive/noxious weeds, and the GWW Transmission line. Instead of wild horses being impacted, livestock would be impacted in a very similar way. For example, during wildfires, pastures or allotments are closed to livestock grazing (as compared to removing wild horses) until burned area rehabilitation objectives are met.

Cumulative impacts from wild horses in the No Action alternative would incrementally increase damage to rangeland ecosystems. With unchecked population growth and no planned gathers, rangeland resources would become degraded at an accelerated rate. Livestock would be continually reduced to accommodate the increasing wild horse numbers. Impacts to livestock grazing in the No Action alternative would be substantial as time (through ten years and beyond) progresses and wild horse populations continue to grow.

Cumulative impacts to livestock grazing from wild horses in the Proposed Action alternative would be negligible. Temporary and occasional (every few years) disturbance and displacement of livestock could occur, causing livestock to utilize different pastures or different areas depending on what water troughs/pipelines are used to conduct bait/water trap gathers from.

Overall, cumulative impacts would be negligible from the Proposed Action alternative and past, present, and foreseeable future actions. However, as time progressed (ten years), the No Action alternative would result in wild horse numbers to be significantly over AML and would cause resource degradation to vegetation. This would also likely result in some additional management to livestock grazing, including but not limited to reductions or changes in grazing rotations.

4.5 Noxious Weeds and Invasive Plants

The establishment of roads, trails, past water pipelines, and current lands and realty projects (GWW) within the CEAA result in varying degrees of ground disturbance. Past impacts from road maintenance, grazing, recreation, wild fires, and other ground disturbing activities have introduced and spread invasive species throughout the HMA. Disturbances that are not re-vegetated with desirable competitive species create opportunities for a non-native takeover. Past and current implementation of best management practices including treatments on ground disturbing activities have been occurring on public and private land within the assessment area and reduce the spread of invasive species. Preventive measures such as cleaning equipment and vehicles prior to on-site arrival and using certified weed free seed in reclamation (lands, and/or post wildland fire) activities have also reduced introduction and spread

In addition, these non-natives, especially invasive annual grasses such as cheatgrass, contributed to high levels of fine fuel loading, resulting in more frequent fires. Without rehabilitation, burn areas have and would continue to be extremely susceptible to invasive species dominance. Existing areas dominated with invasive species would continue to be susceptible to wildfire ignition. Wildfires have been documented to have a wide ranging impact to invasive or noxious weed infestations, much of which depends on pre-wildfire resource conditions. On the Saylor Creek HMA, a small amount of the area is native vegetation and almost the entire HMA has been previously burned and seeded.

Disturbances that are not re-vegetated with native species create opportunities for non-native establishment, and spread. Future implementation of best management practices including implementing prevention measures and treatments on ground disturbing activities have been occurring on public and private land within the assessment area and reduce the spread of invasive species.

In areas with recreation sites or use past and current implementation of best management practices including treatments have been occurring on public and private land; these have reduced the spread of invasive species within the assessment area. Past, present, and foreseeable future recreation use is not expected to change or increase invasive or noxious weed infestations.

Livestock grazing would continue to cause minor impacts to native/invasive/noxious weeds. Under both alternatives, livestock grazing would continue at this time. In the next several years, permit renewals and livestock grazing evaluations would be completed on all eight of the Allotments within the HMA to assess whether the Idaho Standards for Rangeland Health and land use plan objectives are met. By achieving the Standards and land use plan objectives, the permit renewal process would improve the ability for native and seeded species to more effectively compete with non-native/invasive/noxious weeds. Range improvements (fencing, pipelines, troughs, etc.) have been constructed across the HMA. Past and current range improvements have been monitored and rehabilitated when necessary to reduce the potential for invasive or noxious weeds. Future construction of range improvements would follow the same practice of rehabilitation of disturbed areas and spot weed treatment when necessary.

The introduction of new species and distribution of existing noxious weeds and invasive plants is expected to increase due to disturbance to vegetation and soil surfaces associated with the GWW through the Twin Butte and Thompson Allotments (and on adjacent State and private lands). Disturbed areas would provide increased opportunity for introductions and spread of existing noxious weed populations. Stipulations for noxious weed control associated with ROWs would help limit noxious weed outbreaks in ROW area. Vehicles are one of the primary vectors for the transport of seed and the risk of seed introduction through these means is expected to increase.

Under the No Action Alternative, the increasing number of wild horses would increase the soil disturbance and vector for the introduction and spread of noxious weeds and invasive plants. Areas of disturbance associated with grazing, trailing, loafing, and water sources would continue to increase. Wild horses would be expected to travel from water sources to forage; thereby, providing a vector to disperse seed in fecal deposits or seed attached to hooves and hair. With unchecked population growth and no planned gathers, rangeland resources would become degraded at an accelerated rate. This would result in invasive or noxious weeds being more competitive and more likely to establish in heavily grazed areas.

The impacts of the Proposed Action would positively affect long term management goals to maintain rangeland health and healthy wild horse populations. This would minimize trailing as well as reduce the probability of invasive or noxious species being transported to new locations. The reduction of wild horses would also lower the amount of herbivory of native perennial species which compete with invasive species. The impacts from the No Action with correct management, continued livestock grazing within the project area should maintain current conditions. Above AML use of the HMA by wild horses would

continue to adversely impact soil and vegetative health, promoting establishment and spread of non-native species in the future.

Overall, cumulative effects from the Proposed Action alternative and past, present, and foreseeable future actions would likely be negligible. There is potential for invasive or noxious weeds to be spread due to wildfires, GWW, and other potential range improvements. Wildfire has the greatest potential to disturb the HMA and completely change the vegetation community, but future wildfires are impossible to predict. However, weed treatments and rehabilitation of these actions should minimize the potential spread. The overall cumulative effects from the No Action and past, present, and foreseeable future actions is higher due to the expectation that as time progresses (ten years) and no gathers take place, the wild horse population on the HMA would be significantly over AML. This would cause increased utilization throughout the HMA and stress native and seeded plant species which would cause them to be less capable of competing with invasive or noxious weed species, thus the potential for spread and invasion is increased (Kimball and Schiffman 2003).

4.6 Vegetation

The direct and indirect effects of the alternatives on vegetation would likely interact cumulatively with the effects on vegetation related to the following past, present, and reasonably foreseeable future actions: livestock grazing, non-native invasive species treatments, wild horse management, and wildfires. Several large wildfires have burned the area since the mid-1970s: Browns Creek Fire aka Bicentennial Fire 1976, Clover Fire 2005, Long Butte Fire 2010 and Kinyon Fire 2012. Erosion of exposed soil following these fires has altered the site potential. Additionally, planting thousands of acres to non-native perennial grass to stabilize soils has also influenced native vegetation. Repeated wildfires have promoted invasive annual grasses and noxious weeds. The increase in herbaceous vegetation (fine fuel) promotes the rapid spread of wildfires in the area. Some wildfires are expected to continue to burn in the area, reducing native needlegrass, while promoting non-native vegetation

Historically, livestock grazing has been one of the primary modifiers of vegetation communities in the Great Basin. In the past – and in some cases, in the present – the effects of livestock grazing on native ecosystems have been principally negative: perennial herbaceous species have declined, non-native species have been introduced and provided opportunities for invasion, shrubs have come to dominate many communities, wildfire intensity and frequency have been modified, and woodlands have replaced shrublands (Beck and Mitchell 2000; Curtin 2002; Fleischner 1994; Holechek et al. 2010). The result of these impacts is that few rangelands are found in a reference state, and many – even in the absence of overgrazing by wild horses – lack resilience and are at risk of transitioning to an undesirable alternative state.

Much like livestock grazing, wild horse management and wildfires have the potential to interact cumulatively with the effects of the alternative proposed in this EA. Past wild horse management, which has allowed wild horse numbers to exceed AML, has likely been a contributing factor in putting vegetation communities at risk, as explained in the analysis in this section. Implementing the No Action Alternative would result in cumulative impacts as communities put at risk in part by past wild horse management are additively compromised by the effects of the No Action Alternative. As detailed in the effects analysis, the Proposed Action would overall have neutral to positive effects on the vegetation communities in the project area; the effects of these alternatives would mitigate to a limited extent the impacts of past and future wild horse management, but no cumulative effect would occur.

The frequency and intensity of disturbance events such as wildfire play an important role in determining the resilience of plant communities throughout the project area. The effects of the No Action Alternative would likely be magnified in those areas subjected to frequent or intense wildfires in the past or in the future. The No Action Alternative would likely interact cumulatively with past wildfires by allowing inappropriate grazing to continue on herbaceous perennial species in recovering burned areas.

The No Action Alternative would not likely interact cumulatively with non-native invasive treatments; however, it's possible that some cumulative effects would be realized with the selection the Proposed Action. These cumulative effects would be tied to the reduction in inappropriate grazing; overgrazed systems might be aided in their recovery by successful non-native invasive treatments that reduce competition from invasive species.

The GWW will cross the Twin Butte and Thompson Allotments within the HMA. The roads associated with the ROW for construction and maintenance would reduce vegetation in the disturbed areas. The disturbed sites would be reclaimed and the ROW would include stipulations for controlling noxious weeds, helping to limit expansion of noxious weeds. However, periodic disturbances associated with maintenance will likely create some sites suitable for invasive species establishment.

Substantial cumulative effects are not likely to be realized with ROWs, and recreation as these past, present and RFFAs are not likely to strongly interact with the impacts of the Proposed Action. Although the GWW construction is likely to directly impact vegetation through the removal or destruction of vegetation (to various extents), these impacts would not interact with the effects of the No Action Alternative. They would completely supersede these effects, but this would occur only in the limited area where these past, present and RRFAs occur. There would be no synergistic effect on vegetation across the project area (as compared to livestock grazing). As described in the analysis for this resource, the Proposed Action would likely not have substantial unmitigated direct or indirect effects on vegetation; therefore cumulative effects are not likely.

As detailed in the analysis above, the No Action Alternative is likely to put further stress on native plant communities in the project area. In combination with the past, present, and RFFAs of livestock grazing, the No Action Alternative is likely to result in substantial cumulative effects. These cumulative impacts would manifest primarily in the accelerated compromising of ecological resilience and movement towards and across undesirable ecological thresholds.

4.7 Wildlife (Other than BLM Special Status Species)

Cumulative effects of the Proposed Action would be most impactful to wildlife during the short-term (the 10-yr time period of the Alternative), specifically human activity associated with the water/bait gather operations could temporarily disturb or displace wildlife in these areas. However, when added to past, present, and RFFAs, the aggregate impacts of direct and indirect effects are not expected to significantly impact wildlife populations in a negative way. Over both the short and long-term (10-11 years), when added to past, present, and RFFAs, the aggregate impacts are expected to be beneficial for wildlife and their habitats including immediate benefit to wildlife through less competition for forage and water and gradual improvement of upland health. The cumulative impacts from the No Action Alternative would not see beneficial impacts to habitats and wild horse numbers in excess of AML would result in continuing decline of habitat conditions.

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The construction and maintenance of the GWW could potentially displace some of the wild horses, shifting Home Ranges and displacing wildlife. Traffic, noise, and increased human activity in the project area during construction activities would create short-term cumulative impacts on wildlife. A long-term cumulative impact would also be created by the presence of human activity and noise associated with maintenance activities. Possible use of the two-track road by the public for recreation and viewing wild horses could also cumulatively increase the presence of human activity and noise in the analysis area. The severity of the cumulative impacts would depend on factors such as the sensitivity of the species affected, seasonal intensity of use, type of activity, and physical parameters (e.g., topography, forage, and cover availability). Research in southwestern Idaho comparing breeding bird point count numbers along roads to areas more than 400 meters from roads concluded roads did not affect bird counts in sagebrush steppe or grasslands (Rotenberry and Knick 1995). The road used to maintain the GWW is expected to receive little use once construction is completed and should have minimal impact on wildlife.

5.0 Consultation and Coordination

On November 8, 2018, a scoping packet detailing the purpose and need for action, preliminary issues, and potential alternatives for action was released to the public for a 30 day comment period. Copies were delivered to the Shoshone-Paiute and Shoshone-Bannock Tribes and 62 individuals, organizations, and Federal, State, and county agencies. These individuals included permittees within the HMA and current Twin Falls District Resource Advisory Council (RAC) members. Eight letters and e-mails were received from individuals, organizations, and agencies following the issuance of the scoping packet.

Scoping comments were submitted to the JFO via mail, e-mail, or in person; each comment was reviewed and substantive comments were identified. Appendix E contains a list of all substantive comments along with a response. Every comment was read and considered; however, a response was not provided to every comment. Non-substantive comments were identified; however, not all non-substantive comments received a response. Non-substantive comments include, but are not limited to, comments such as open-ended questions, opinions without supporting rationale, or comments about other projects or activities.

This project was presented and discussed at the Shoshone- Paiute Wings and Roots meetings held on March 31, 2019 and April 18, 2019. At the April 18, 2019 meeting the preliminary EA was provided to the tribal members and the BLM asked for their comments. Two comments were received at the meeting pertaining to the preliminary EA. The Tribe expressed concern with the BLM horse selection process, believing that the best horses are not released back to the range, but instead enter the adoption and sale program. The second concern expressed was that one to four studs should be released instead of 25. The authorized officer explained the scientific basis for the selection process and the number of stud horses to be released. The BLM manages wild horses based on scientific research and policy, therefore no changes were made based on the comments received at the meeting.

In May 2019, the project was uploaded to the BLM E-Planning website, along with the Preliminary EA.

5.1 List of Preparers

The following individuals participated in the preparation of this document:
Jim Klott, Wildlife Biologist
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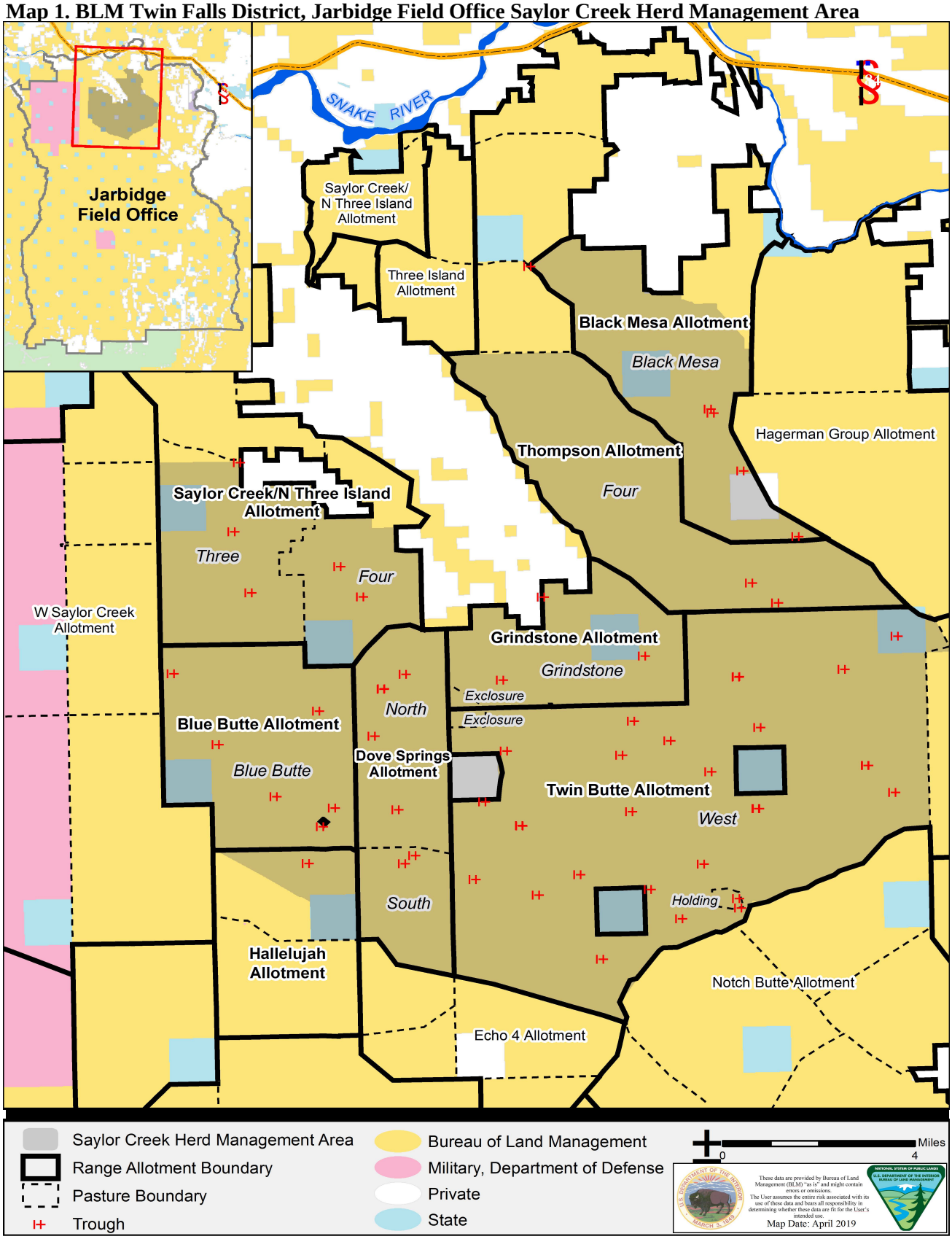
Appendix A. Map

Map 1. BLM Twin Falls District, Jarbidge Field Office Saylor Creek Herd Management Area



Appendix B. PZP and GonaCon Literature Reviews

Reference in this text to any specific commercial product, process, or service, or the use of any trade, firm or corporation name is for the information and convenience of the public, and does not constitute endorsement, recommendation, or favoring by the Department of the Interior.

Fertility Control and Fertility Control Vaccines, in general

Various forms of fertility control can be used in wild horses and wild burros, with the goals of maintaining herds at or near AML, reducing fertility rates, and reducing the frequency of gathers and removals. The WFRHBA of 1971 specifically provides for contraception and sterilization (section 3.b.1). Fertility control measures have been shown to be a cost-effective and humane treatment to slow increases in wild horse populations or, when used in combination with gathers, to reduce horse population size (Bartholow 2004, de Seve and Boyles-Griffin 2013, Fonner and Bohara 2017). Although fertility control treatments may be associated with a number of potential physiological, behavioral, demographic, and genetic effects, those impacts are generally minor and transient, do not prevent overall maintenance of a self-sustaining population, and do not generally outweigh the potential benefits of using contraceptive treatments in situations where it is a management goal to reduce population growth rates (Garrott and Oli 2013).

An extensive body of peer-reviewed scientific literature details the impacts of fertility control methods on wild horses and burros. No finding of excess animals is required for BLM to pursue contraception in wild horses or wild burros, but NEPA analysis has been required. This review focuses on peer-reviewed scientific literature. The summary that follows examines effects of fertility control vaccine use in mares. Cited studies are generally limited to those involving horses and burros, except where including studies on other species helps in making inferences about physiological or behavioral questions not yet addressed in horses or burros specifically. While most studies reviewed here refer to horses, burros are extremely similar in terms of physiology, such that expected effects are comparable, except where differences between the species are noted.

On the whole, the identified impacts are generally transient and affect primarily the individuals treated. Fertility control that affects individual horses and burros does not prevent BLM from ensuring that there will be self-sustaining populations of wild horses and burros in single herd management areas (HMAs), in complexes of HMAs, and at regional scales of multiple HMAs and complexes. Under the WFRHBA of 1971, BLM is charged with maintaining self-reproducing populations of wild horses and burros. The National Academies of Sciences (2013) encouraged BLM to manage wild horses and burros at the spatial scale of "metapopulations" – that is, across multiple HMAs and complexes in a region. In fact, many HMAs have historical and ongoing genetic and demographic connections with other HMAs, and BLM routinely moves animals from one to another to improve local herd traits and maintain high genetic diversity.

All fertility control methods affect the behavior and physiology of treated animals (NAS 2013), and are associated with potential risks and benefits, including effects of handling, frequency of handling, physiological effects, behavioral effects, and reduced population growth rates (Hampton et al. 2015). Contraception alone does not remove excess horses from an HMA's population, so one or more gathers are usually needed in order to bring the herd down to a level close to AML. Horses are long-lived, potentially reaching 20 years of age or more in the wild. Except in cases where extremely high fractions of mares are rendered infertile over long time periods of (i.e, 10 or more years), fertility control methods such as immunocontraceptive vaccines and sex ratio manipulation are not very effective at reducing population growth rates to the point where births equal deaths in a herd. However, even more modest fertility control activities can reduce the frequency of horse gather activities, and costs to taxpayers. Bartholow (2007) concluded that the application of 2-year or 3-year contraceptives to wild mares could

reduce operational costs in a project area by 12-20%, or up to 30% in carefully planned population management programs. Because applying contraception to horses requires capturing and handling, the risks and costs associated with capture and handling of horses may be comparable to those of gathering for removal, but with expectedly lower adoption and long-term holding costs. Population growth suppression becomes less expensive if fertility control is long-lasting (Hobbs et al. 2000).

In the context of BLM wild horse and burro management, fertility control vaccines rely on reducing the number of reproducing females. Taking into consideration available literature on the subject, the National Academies of Sciences concluded in their 2013 report that forms of fertility control vaccines were two of the three 'most promising' available methods for contraception in wild horses and burros (NAS 2013).

Fertility control vaccines (also known as immunocontraceptives) meet BLM requirements for safety to mares and the environment (EPA 2009a, 2012). Because they work by causing an immune response in treated animals, there is no risk of hormones or toxins being taken into the food chain when a treated mare dies. The BLM and other land managers have mainly used three fertility control vaccine formulations for fertility control of wild horse mares on the range: ZonaStat-H, PZP-22, and GonaCon-Equine. As other formulations become available they may be applied in the future.

Liquid emulsion vaccines can be injected by hand or remotely administered in the field using a pneumatic dart (Roelle and Ransom 2009, Rutberg et al. 2017, McCann et al. 2017) in cases where mares are relatively approachable. Use of remotely delivered (dart-delivered) vaccine is generally limited to populations where individual animals can be accurately identified and repeatedly approached within 50 m (BLM 2010). Booster doses can be safely administered by hand or by dart. Even with repeated booster treatments of the vaccines, it is expected that most mares would eventually return to fertility, though some individual mares treated repeatedly may remain infertile. Once the herd size in a project area is at AML and population growth seems to be stabilized, BLM can make adaptive determinations as to the required frequency of new and booster treatments.

BLM has followed SOPs for fertility control vaccine application (BLM IM 2009-090). The IM requires that treated mares be identifiable via a visible freeze brand or individual color markings, so that their vaccination history can be known. The IM calls for follow-up population surveys to determine the realized annual growth rate in herds treated with fertility control vaccines.

Porcine Zona Pellucida (PZP) Vaccine

PZP vaccines have been used on dozens of horse herds by the National Park Service, US Forest Service, Bureau of Land Management, and Native American tribes and its use is approved for free-ranging wild horse herds. Taking into consideration available literature on the subject, the National Research Council concluded in their 2013 report that PZP was one of the preferable available methods for contraception in wild horses and burros (NRC 2013). PZP use can reduce or eliminate the need for gathers and removals (Turner et al. 1997). PZP vaccines meet most of the criteria that the National Research Council (2013) used to identify promising fertility control methods, in terms of delivery method, availability, efficacy, and side effects. It has been used extensively in wild horses (NRC 2013), and in feral burros on Caribbean islands (Turner et al. 1996, French et al. 2017). PZP is relatively inexpensive, meets BLM requirements for safety to mares and the environment, and is produced as ZonaStat-H, an EPA-registered commercial product (EPA 2012, SCC 2015), or as PZP-22, which is a formulation of PZP in polymer pellets that can lead to a longer immune response (Turner et al. 2002, Rutberg et al. 2017). 'Native' PZP proteins can be purified from pig ovaries (Liu et al. 1989). Recombinant ZP proteins may be produced with molecular techniques (Gupta and Minhas 2017, Joonè et al. 2017a, Nolan et al. 2018a). ZonaStat-H can be remotely administered in the field in cases where mares are relatively approachable. Use of remotely delivered (dart-delivered) vaccine is generally limited to populations where individual animals can be accurately

identified and repeatedly approached within 50 m (BLM 2010).

Under the Proposed Action, the BLM would return to the HMA as needed to re-apply PZP-22 and/or ZonaStat-H and initiate new treatments in order to maintain contraceptive effectiveness in controlling population growth rates. Both forms of PZP can safely be reapplied as necessary to control the population growth rate. Even with repeated booster treatments of PZP, it is expected that most mares would return to fertility, though some mares treated repeatedly may not (see *PZP Direct Effects*, below). Once the population is at AML and population growth seems to be stabilized, BLM could use population planning software (WinEquus II, currently in development by USGS Fort Collins Science Center) to determine the required frequency of re-treating mares with PZP.

The BLM currently uses two PZP formulations for fertility control of wild horse mares, ZonaStat-H (PZP Native) and PZP-22. As other formulations are approved for use by BLM, they may be applied through future gathers or darting activities. For the purpose of this management plan, field or remote darting refers to applying the vaccine using a dart. Darting can be implemented when animals are gathered into corrals or opportunistically by applicators near water sources or along main WH&B trails out on the range. Blinds may be used to camouflage applicators to allow efficient treatment of as many mares as possible. PZP can also be applied via hand injections using plastic syringes when animals are gathered into corrals and chutes. When advisories on the product label (EPA 2015) are followed, the product is safe for users and the environment (EPA 2012). In keeping with the EPA registration for ZonaStat-H (EPA 2012; reg. no. 86833-1), certification through the Science and Conservation Center in Billings Montana is required to apply that vaccine to equids.

When applying native PZP (i.e., ZonaStat-H), first the primer with modified Freund's Complete adjuvant is given and then the booster with Freund's modified incomplete adjuvant is given 2-6 weeks later. Preferably, the timing of the booster dose is at least 1-2 weeks prior to the onset of breeding activity. Following the initial 2 inoculations, only annual boosters are required. For maximum effectiveness, PZP would be administered within the December to February timeframe. The procedures to be followed for application of PZP are detailed in *Appendix E. Standard Operating Procedures for Population-level Porcine Zona Pellucida Fertility control treatments.*

For the PZP-22 formulation administered during gathers, each released mare would receive a single dose of the two-year PZP contraceptive vaccine at the same time as a dose of the liquid PZP vaccine with modified Freund's Complete adjuvant. The pellets are applied to the mare with a large gauge needle and jab-stick into the hip. Although PZP-22 pellets have been delivered via darting in trial studies (Rutberg et al 2017), BLM does not plan to use darting for PZP-22 delivery in this HMA until there is more demonstration that PZP-22 can be reliably delivered via dart. Therefore, WH&Bs must be gathered for each application of this formulation.

PZP Direct Effects

The historically accepted hypothesis explaining PZP vaccine effectiveness posits that when injected as an antigen in vaccines, PZP causes the mare's immune system to produce antibodies that are specific to zona pellucida proteins on the surface of that mare's eggs. The antibodies bind to the mare's eggs surface proteins (Liu et al. 1989), and effectively block sperm binding and fertilization (Zoo Montana, 2000). Because treated mares do not become pregnant but other ovarian functions remain generally unchanged, PZP can cause a mare to continue having regular estrus cycles throughout the breeding season. More recent observations support a complementary hypothesis, which posits that PZP vaccination causes reductions in ovary size and function (Mask et al. 2015, Joonè et al. 2017b, Joonè et al. 2017c, Nolan et al. 2018b). Antibodies specific to PZP protein do not crossreact with tissues outside of the reproductive system (Barber and Fayrer-Hosken 2000).

Research has demonstrated that contraceptive efficacy of an injected liquid PZP vaccine, such as ZonaStat-H, is approximately 90% or more for mares treated twice in one year (Turner and Kirkpatrick 2002, Turner et al. 2008). The highest success for fertility control has been reported when the vaccine has been applied November through February. High contraceptive rates of 90% or more can be maintained in horses that are boostered annually (Kirkpatrick et al. 1992). Approximately 60% to 85% of mares are successfully contracepted for one year when treated simultaneously with a liquid primer and PZP-22 pellets (Rutberg et al. 2017). Application of PZP for fertility control would reduce fertility in a large percentage of mares for at least one year (Ransom et al. 2011).

The contraceptive result for a single application of the liquid PZP vaccine primer dose along with PZP vaccine pellets (PZP-22), based on winter applications, can be expected to fall in the approximate efficacy ranges as follows (based on figure 2 in Rutberg et al. 2017). Below, the approximate efficacy is measured as the relative decrease in foaling rate for treated mares, compared to control mares:

Year 1	Year 2	Year 3
0 (developing fetuses come to term)	~30-75%	~20-50%

If mares that have been treated with PZP-22 vaccine pellets subsequently receive a booster dose of either the liquid PZP vaccine or the PZP-22 vaccine pellets, the subsequent contraceptive effect is apparently more pronounced and long-lasting. The approximate efficacy following a booster dose can be expected to be in the following ranges (based on figure 3 in Rutberg et al. 2017).

Year 1	Year 2	Year 3	Year 4
0 (developing fetuses come to term)	~50-90%	~55-75%	~40-75%

The efficacies noted above, which are based on results in Rutberg et al. (2017), call into question population and economic models that assume PZP-22 can have an 85% efficacy in years 2 and 3 after immunization, such as Fonner and Bohara (2017).

The fraction of mares treated in a herd can have a large effect on the realized change in growth rate due to PZP contraception, with an extremely high portion of mares required to be treated to lead prevent population-level growth (e.g., Turner and Kirkpatrick 2002). Gather efficiency would likely not exceed 85% via helicopter, and may be less with bait and water trapping, so there would be a portion of the female population uncaptured that is not treated in any given year. Additionally, some mares may not respond to the fertility control vaccine, but instead will continue to foal normally.

Reversibility and Effects on Ovaries

In most cases, PZP contraception appears to be temporary and reversible, with most treated mares returning to fertility over time (Kirkpatrick and Turner 2002). The NRC (2013) criterion by which PZP is not optimal for wild horse contraception was duration. The ZonaStat-H formulation of the vaccine tends to confer only one year of efficacy per dose. Some studies have found that a PZP vaccine in long-lasting pellets (PZP-22) can confer multiple years of contraception (Turner et al. 2007), particularly when boostered with subsequent PZP vaccination (Rutberg et al. 2017). Other trial data, though, indicate that the pelleted vaccine may only be effective for one year (J. Turner, University of Toledo, Personal Communication to BLM).

The purposes of applying PZP treatment is to prevent mares from conceiving foals, but BLM

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acknowledges that long-term infertility, or permanent sterility, could be a result for some number of wild horses receiving PZP vaccinations. The rate of long-term or permanent sterility following vaccinations with PZP is hard to predict for individual horses, but that outcome appears to increase in likelihood as the number of doses increases (Kirkpatrick and Turner 2002). Permanent sterility for mares treated consecutively 5-7 years was observed by Nuñez et al. (2010, 2017). In a graduate thesis, Knight (2014) suggested that repeated treatment with as few as three to four years of PZP treatment may lead to longer-term sterility, and that sterility may result from PZP treatment before puberty. Repeated treatment with PZP led long-term infertility in Przewalski's horses receiving as few as one PZP booster dose (Feh 2012). However, even if some number of mares become sterile as a result of PZP treatment, that potential result would be consistent with the contraceptive purpose that motivates BLM's potential use of the vaccine.

In some mares, PZP vaccination may cause direct effects on ovaries (Gray and Cameron 2010, Joonè et al. 2017b, Joonè et al. 2017c, Joonè et al. 2017d, Nolan et al 2018b, Nolan et al. in press). Joonè et al. (2017a) noted reversible effects on ovaries in mares treated with one primer dose and booster dose. Joonè et al. (2017c) and Nolan et al (2018b) documented decreased anti-Mullerian hormone (AMH) levels in mares treated with native or recombinant PZP vaccines; AMH levels are thought to be an indicator of ovarian function. Bechert et al. (2013) found that ovarian function was affected by the SpayVac PZP vaccination, but that there were no effects on other organ systems. Mask et al. (2015) demonstrated that equine antibodies that resulted from SpayVac immunization could bind to oocytes, ZP proteins, follicular tissues, and ovarian tissues. It is possible that result is specific to the immune response to SpayVac, which may have lower PZP purity than ZonaStat or PZP-22 (Hall et al. 2016). However, in studies with native ZP proteins and recombinant ZP proteins, Joonè et al. (2017a) found transient effects on ovaries after PZP vaccination in some treated mares; normal estrus cycling had resumed 10 months after the last treatment. SpayVac is a patented formulation of PZP in liposomes that led to multiple years of infertility in some breeding trials (Killian et al. 2008, Roelle et al. 2017, Bechert and Fraker 2018), but unacceptably poor efficacy in a subsequent trial (Kane 2018). Kirkpatrick et al. (1992) noted effects on horse ovaries after three years of treatment with PZP. Observations at Assateague Island National Seashore indicate that the more times a mare is consecutively treated, the longer the time lag before fertility returns, but that even mares treated 7 consecutive years did eventually return to ovulation (Kirkpatrick and Turner 2002). Other studies have reported that continued applications of PZP may result in decreased estrogen levels (Kirkpatrick et al. 1992) but that decrease was not biologically significant, as ovulation remained similar between treated and untreated mares (Powell and Monfort 2001). Permanent sterility for mares treated consecutively 5-7 years was observed by Nuñez et al. (2010, 2017). Bagavant et al. (2003) demonstrated T-cell clusters on ovaries, but no loss of ovarian function after ZP protein immunization in macaques. Skinner et al. (1984) raised concerns about PZP effects on ovaries, based on their study in laboratory rabbits, as did Kaur and Prabha (2014), though neither paper was a study of PZP effects in equids.

Effects on Existing Pregnancies, Foals, and Birth Phenology

If a mare is already pregnant, the PZP vaccine has not been shown to affect normal development of the fetus or foal, or the hormonal health of the mare with relation to pregnancy (Kirkpatrick and Turner 2003). Studies on Assateague Island (Kirkpatrick and Turner 2002) showed that once female offspring born to mares treated with PZP during pregnancy eventually breed, they produce healthy, viable foals. It is possible that there may be transitory effects on foals born to mares or jennies treated with PZP. In mice, Sacco et al. (1981) found that antibodies specific to PZP can pass from mother mouse to pup via the placenta or colostrum, but that did not apparently cause any innate immune response in the offspring: the level of those antibodies were undetectable by 116 days after birth. There was no indication in that study that the fertility or ovarian function of those mouse pups was compromised, nor is BLM aware of any such results in horses or burros. Unsubstantiated speculative connections between PZP treatment and foal stealing has not been published in a peer-reviewed study and thus cannot be verified. 'Foal stealing,' where a near-term pregnant mare steals a neonate foal from a weaker mare, is unlikely to be a common behavioral result of including spayed mares in a wild horse herd. McDonnell (2012) noted that "foal

stealing is rarely observed in horses, except under crowded conditions and synchronization of foaling," such as in horse feed lots. Those conditions are not likely in the wild, where pregnant mares will be widely distributed across the landscape, and where the expectation is that parturition dates would be distributed across the normal foaling season. Similarly, although Nettles (1997) noted reported stillbirths after PZP treatments in cynomolgus monkeys, those results have not been observed in equids despite extensive use.

On-range observations from 20 years of application to wild horses indicate that PZP application in wild mares does not generally cause mares to give birth to foals out of season or late in the year (Kirkpatrick and Turner 2003). Nuñez's (2010) research showed that a small number of mares that had previously been treated with PZP foaled later than untreated mares and expressed the concern that this late foaling "may" impact foal survivorship and decrease band stability, or that higher levels of attention from stallions on PZP-treated mares might harm those mares. However, that paper provided no evidence that such impacts on foal survival or mare well-being actually occurred. Rubenstein (1981) called attention to a number of unique ecological features of horse herds on Atlantic barrier islands, which calls into question whether inferences drawn from island herds can be applied to western wild horse herds. Ransom et al. (2013), though, identified a potential shift in reproductive timing as a possible drawback to prolonged treatment with PZP, stating that treated mares foaled on average 31 days later than non-treated mares. Results from Ransom et al. (2013), however, showed that over 81% of the documented births in this study were between March 1 and June 21, i.e., within the normal, peak, spring foaling season. Ransom et al. (2013) pointedly advised that managers should consider carefully before using immunocontraception in small refugia or rare species. Wild horses and burros managed by BLM do not generally occur in isolated refugia, nor are they rare species. Moreover, an effect of shifting birth phenology was not observed uniformly: in two of three PZP-treated wild horse populations studied by Ransom et al. (2013), foaling season of treated mares extended three weeks and 3.5 months, respectively, beyond that of untreated mares. In the other population, the treated mares foaled within the same time period as the untreated mares. Furthermore, Ransom et al. (2013) found no negative impacts on foal survival even with an extended birthing season. If there are shifts in birth phenology, though, it is reasonable to assume that some negative effects on foal survival might result from particularly severe weather events (Nuñez et al. 2018).

Effects of Marking and Injection

Standard practices require that immunocontraceptive-treated animals be readily identifiable, either via brand marks or unique coloration (BLM 2010). BLM has instituted guidelines to reduce the sources of handling stress in captured animals (BLM 2015). Some level of transient stress is likely to result in newly captured mares that do not have markings associated with previous fertility control treatments. It is difficult to compare that level of temporary stress with long-term stress that can result from food and water limitation on the range (e.g., Creel et al. 2013). Handling may include freeze-marking, for the purpose of identifying that mare and identifying her PZP vaccine treatment history. Under past management practices, captured mares experienced increased stress levels from handling (Ashley and Holcombe 2001). Markings may also be used into the future to determine the approximate fraction of mares in a herd that have been previously treated, and could provide additional insight regarding gather efficiency.

Most mares recover from the stress of capture and handling quickly once released back to the HMA, and none are expected to suffer serious long term effects from the fertility control injections, other than the direct consequence of becoming temporarily infertile. Injection site reactions associated with fertility control treatments are possible in treated mares (Roelle and Ransom 2009, Bechert et al. 2013, French et al. 2017), but swelling or local reactions at the injection site are expected to be minor in nature. Roelle and Ransom (2009) found that the most time-efficient method for applying PZP is by hand-delivered injection of 2-year pellets when horses are gathered. They observed only two instances of swelling from

that technique. Use of remotely delivered, 1-year PZP is generally limited to populations where individual animals can be accurately identified and repeatedly approached. The dart-delivered formulation produced injection-site reactions of varying intensity, though none of the observed reactions appeared debilitating to the animals (Roelle and Ransom 2009). Joonè et al. (2017a) found that injection site reactions had healed in most mares within 3 months after the booster dose, and that they did not affect movement or cause fever. The longer term nodules observed did not appear to change any animal's range of movement or locomotor patterns and in most cases did not appear to differ in magnitude from naturally occurring injuries or scars.

Indirect Effects

One expected long-term, indirect effect on wild horses treated with fertility control would be an improvement in their overall health (Turner and Kirkpatrick 2002). Many treated mares would not experience the biological stress of reproduction, foaling and lactation as frequently as untreated mares. The observable measure of improved health is higher body condition scores (Nuñez et al. 2010). After a treated mare returns to fertility, her future foals would be expected to be healthier overall, and would benefit from improved nutritional quality in the mare's milk. This is particularly to be expected if there is an improvement in rangeland forage quality at the same time, due to reduced wild horse population size. Past application of fertility control has shown that mares' overall health and body condition remains improved even after fertility resumes. PZP treatment may increase mare survival rates, leading to longer potential lifespan (Turner and Kirkpatrick 2002, Ransom et al. 2014a). To the extent that this happens, changes in lifespan and decreased foaling rates could combine to cause changes in overall age structure in a treated herd (i.e., Turner and Kirkpatrick 2002, Roelle et al. 2010), with a greater prevalence of older mares in the herd (Gross 2000). Observations of mares treated in past gathers showed that many of the treated mares were larger than, maintained higher body condition than, and had larger healthy foals than untreated mares (BLM, anecdotal observations)..

Following resumption of fertility, the proportion of mares that conceive and foal could be increased due to their increased fitness; this has been called a 'rebound effect.' Elevated fertility rates have been observed after horse gathers and removals (Kirkpatrick and Turner 1991). More research is needed to document and quantify these hypothesized effects in PZP-treated herds. If repeated contraceptive treatment leads to a prolonged contraceptive effect, then that may minimize or delay the hypothesized rebound effect. Selectively applying contraception to older animals and returning them to the HMA could reduce long-term holding costs for such horses, which are difficult to adopt, and may reduce the compensatory reproduction that often follows removals (Kirkpatrick and Turner 1991).

Because successful fertility control would reduce foaling rates and population growth rates, another indirect effect should be to reduce the number of wild horses that have to be removed over time to achieve and maintain the established AML. Contraception would be expected to lead to a relative increase in the fraction of older animals in the herd. Reducing the numbers of wild horses that would have to be removed in future gathers could allow for removal of younger, more easily adoptable excess wild horses, and thereby could eliminate the need to send additional excess horses from this area to off-range holding corrals or pastures for long-term holding. Among mares in the herd that remain fertile, a high level of physical health and future reproductive success would be expected because reduced population sizes should lead to more availability of water and forage resources per capita.

A principle motivation for use of contraceptive vaccines or sex ratio manipulation is to reduce population growth rates and maintain herd sizes at AML. Where successful, this should allow for continued and increased environmental improvements to range conditions within the project area, which would have long-term benefits to wild horse habitat quality, and well-being of animals living on the range. As the population nears or is maintained at the level necessary to achieve a thriving natural ecological balance, vegetation resources would be expected to recover, improving the forage available to wild horses and

wildlife throughout the HMA. With rangeland conditions more closely approaching a thriving natural ecological balance, and with a less concentrated distribution of wild horses across the HMA, there should also be less trailing and concentrated use of water sources. Lower population density would be expected to lead to reduced competition among wild horses using the water sources, and less fighting among horses accessing water sources. Water quality and quantity would continue to improve to the benefit of all rangeland users including wild horses. Wild horses would also have to travel less distance back and forth between water and desirable foraging areas. Should PZP booster treatment continue into the future, the chronic cycle of overpopulation and large gathers and removals would no longer occur, but instead a consistent cycle of balance and stability would ensue, resulting in continued improvement of overall habitat conditions and animal health. While it is conceivable that widespread and continued treatment with PZP could reduce the birth rates of the population to such a point that birth is consistently below mortality, that outcome is not likely unless a very high fraction of the mares present are all treated in almost every year.

Behavioral Effects

The NRC report (2013) noted that all fertility suppression has effects on mare behavior, mostly as a result of the lack of pregnancy and foaling, and concluded that PZP was a good choice for use in the program. The result that PZP-treated mares may continue estrus cycles throughout the breeding season can lead to behavioral differences (as discussed below), when compared to mares that are fertile. Such behavioral differences should be considered as potential consequences of successful contraception. The resulting impacts may be seen as neutral in the sense that a wide range of natural behaviors is already observable in untreated wild horses, or mildly adverse in the sense that effects are expected to be transient and to not affect all treated animals.

Ransom and Cade (2009) delineate behaviors that can be used to test for quantitative differences due to treatments. Ransom et al. (2010) found no differences in how PZP-treated and untreated mares allocated their time between feeding, resting, travel, maintenance, and most social behaviors in three populations of wild horses, which is consistent with Powell's (1999) findings in another population. Likewise, body condition of PZP-treated and control mares did not differ between treatment groups in Ransom et al.'s (2010) study. Nuñez (2010) found that PZP-treated mares had higher body condition than control mares in another population, presumably because energy expenditure was reduced by the absence of pregnancy and lactation. Knight (2014) found that PZP-treated mares had better body condition, lived longer and switched harems more frequently, while mares that foaled spent more time concentrating on grazing and lactation and had lower overall body condition.

In two studies involving a total of four wild horse populations, both Nuñez et al. (2009) and Ransom et al. (2010) found that PZP-treated mares were involved in reproductive interactions with stallions more often than control mares, which is not surprising given the evidence that PZP-treated females of other mammal species can regularly demonstrate estrus behavior while contracepted (Shumake and Killian 1997, Heilmann et al. 1998, Curtis et al. 2001, Duncan et al. 2017). There was no evidence, though, that mare welfare was affected by the increased level of herding by stallions noted in Ransom et al. (2010). Nuñez's later analysis (2017) noted no difference in mare reproductive behavior as a function of contraception history.

Ransom et al. (2010) found that control mares were herded by stallions more frequently than PZP- treated mares, and Nuñez et al. (2009, 2014, 2017, 2018) found that PZP-treated mares exhibited higher infidelity to their band stallion during the non-breeding season than control mares. Madosky et al. (2010) and Knight (2014) found this infidelity was also evident during the breeding season in the same population that Nuñez et al. (2009, 2010, 2014, 2017, 2018) studied. Nuñez et al. (2014, 2017, 2018) concluded that PZP-treated mares changing bands more frequently than control mares could lead to band instability. Nuñez et al. (2009), though, cautioned against generalizing from that island population to other herds.

Nuñez et al. (2014) found elevated levels of fecal cortisol, a marker of physiological stress, in mares that changed bands. The research is inconclusive as to whether all the mares' movements between bands were related to the PZP treatments themselves or the fact that the mares were not nursing a foal, and did not demonstrate any long-term negative consequence of the transiently elevated cortisol levels. Nuñez et al. 2014 wrote that these effects "…may be of limited concern when population reduction is an urgent priority." Nuñez (2018) noted (based on unpublished results) that band stallions of mares that have received PZP treatment can exhibit changes in behavior and physiology. Nuñez (2018) cautioned that PZP use may limit the ability of mares to return to fertility, but also noted that, "such aggressive treatments may be necessary when rapid reductions in animal numbers are of paramount importance…If the primary management goal is to reduce population size, it is unlikely (and perhaps less important) that managers achieve a balance between population control and the maintenance of more typical feral horse behavior and physiology."

In contrast to transient stresses, Creel et al. (2013) highlight that variation in population density is one of the most well-established causal factors of chronic activation of the hypothalamic-pituitary-adrenal axis, which mediates stress hormones; high population densities and competition for resources can cause chronic stress. Creel et al. (2013) also state that "…there is little consistent evidence for a negative association between elevated baseline glucocorticoids and fitness." Band fidelity is not an aspect of wild horse biology that is specifically protected by the WFRHBA of 1971. It is also notable that Ransom et al. (2014b) found higher group fidelity after a herd had been gathered and treated with a contraceptive vaccine; in that case, the researchers postulated that higher fidelity may have been facilitated by the decreased competition for forage after excess horses were removed. At the population level, available research does not provide evidence of the loss of harem structure among any herds treated with PZP. Long-term implications of these changes in social behavior are currently unknown, but no negative impacts on the overall animals or populations overall, long-term welfare or well-being have been established in these studies.

The National Research Council (2013) found that harem changing was not likely to result in serious adverse effects for treated mares:

> "The studies on Shackleford Banks (Nuñez et al., 2009; Madosky et al., 2010) suggest that there is an interaction between pregnancy and social cohesion. The importance of harem stability to mare well-being is not clear, but considering the relatively large number of free-ranging mares that have been treated with liquid PZP in a variety of ecological settings, the likelihood of serious adverse effects seem low."

Nuñez (2010) stated that not all populations will respond similarly to PZP treatment. Differences in habitat, resource availability, and demography among conspecific populations will undoubtedly affect their physiological and behavioral responses to PZP contraception, and need to be considered. Kirkpatrick et al. (2010) concluded that: "the larger question is, even if subtle alterations in behavior may occur, this is still far better than the alternative," and that the "…other victory for horses is that every mare prevented from being removed, by virtue of contraception, is a mare that will only be delaying her reproduction rather than being eliminated permanently from the range. This preserves herd genetics, while gathers and adoption do not."

The NRC report (2013) provides a comprehensive review of the literature on the behavioral effects of contraception that puts research up to that date by Nuñez et al. (2009, 2010) into the broader context of all of the available scientific literature, and cautions, based on its extensive review of the literature that:

> ". . . in no case can the committee conclude from the published research that the behavior differences observed are due to a particular compound rather than to the fact that treated animals had no offspring during the study. That must be borne in mind particularly in interpreting long-term impacts of contraception (e.g., repeated years of reproductive "failure" due to

contraception)."

Genetic Effects of PZP Vaccination

In HMAs where large numbers of wild horses have recent and / or an ongoing influx of breeding animals from other areas with wild or feral horses, contraception is not expected to cause an unacceptable loss of genetic diversity or an unacceptable increase in the inbreeding coefficient. In any diploid population, the loss of genetic diversity through inbreeding or drift can be prevented by large effective breeding population sizes (Wright 1931) or by introducing new potential breeding animals (Mills and Allendorf 1996). The NRC report (2013) recommended that single HMAs should not be considered as isolated genetic populations. Rather, managed herds of wild horses should be considered as components of interacting metapopulations, with the potential for interchange of individuals and genes taking place as a result of both natural and human-facilitated movements. Introducing 1-2 mares every generation (about every 10 years) is a standard management technique that can alleviated potential inbreeding concerns (BLM 2010).

In the last 10 years, there has been a high realized growth rate of wild horses in most areas administered by the BLM, such that most alleles that are present in any given mare are likely to already be well represented in her siblings, cousins, and more distant relatives. With the exception of horses in a small number of well-known HMAs that contain a relatively high fraction of alleles associated with old Spanish horse breeds (NRC 2013), the genetic composition of wild horses in lands administered by the BLM is consistent with admixtures from domestic breeds. As a result, in most HMAs, applying fertility control to a subset of mares is not expected to cause irreparable loss of genetic diversity. Improved longevity and an aging population are expected results of contraceptive treatment that can provide for lengthening generation time; this result would be expected to slow the rate of genetic diversity loss (Hailer et al. 2006). Based on a population model, Gross (2000) found that a strategy to preferentially treat young animals with a contraceptive led to more genetic diversity being retained than either a strategy that preferentially treats older animals, or a strategy with periodic gathers and removals. The Proposed Action preferentially selects older animals to return to the range (see EA section 2.2), which similarly will tend to retain more genetic diversity than would a preference for turning back only younger animals.

Even if it is the case that repeated treatment with PZP may lead to prolonged infertility, or even sterility in some mares, most HMAs have only a low risk of loss of genetic diversity if logistically realistic rates of contraception are applied to mares. Wild horses in most herd management areas are descendants of a diverse range of ancestors coming from many breeds of domestic horses. As such, the existing genetic diversity in the majority of HMAs does not contain unique or historically unusual genetic markers. Past interchange between HMAs, either through natural dispersal or through assisted migration (i.e., human movement of horses) means that many HMAs are effectively indistinguishable and interchangeable in terms of their genetic composition. Roelle and Oyler-McCance (2015) used the VORTEX population model to simulate how different rates of mare sterility would influence population persistence and genetic diversity, in populations with high or low starting levels of genetic diversity, various starting population sizes, and various annual population growth rates. Their results show that the risk of the loss of genetic heterozygosity is extremely low except in case where all of the following conditions are met: starting levels of genetic diversity are low, initial population size is 100 or less, the intrinsic population growth rate is low (5% per year), and very large fractions of the female population are permanently sterilized. At Saylor Creek HMA, even though the number of mares is expected to be relatively low at times, most are not expected to become sterile, the starting genetic diversity is expected to be high, and there are expected to be periodic introductions of new mares from other herds; these are all conditions that favor maintenance of adequate genetic diversity over time.

It is worth noting that, although maintenance of genetic diversity at the scale of the overall population of wild horses is an intuitive management goal, there are no existing laws or policies that require BLM to

maintain genetic diversity at the scale of the individual herd management area or complex. Also, there is no Bureau-wide policy that requires BLM to allow each female in a herd to reproduce before she is treated with contraceptives.

One concern that has been raised with regards to genetic diversity is that treatment with immunocontraceptives could possibly lead to an evolutionary increase in the frequency of individuals whose genetic composition fosters weak immune responses (Cooper and Larson 2006, Ransom et al. 2014a).Many factors influence the strength of a vaccinated individual's immune response, potentially including genetics, but also nutrition, body condition, and prior immune responses to pathogens or other antigens (Powers et al. 2013). This premise is based on an assumption that lack of response to PZP is a heritable trait, and that the frequency of that trait will increase over time in a population of PZP-treated animals. Cooper and Herbert (2001) reviewed the topic, in the context of concerns about the long-term effectiveness of immunocontraceptives as a control agent for exotic species in Australia. They argue that imunocontraception could be a strong selective pressure, and that selecting for reproduction in individuals with poor immune response could lead to a general decline in immune function in populations where such evolution takes place. Other authors have also speculated that differences in antibody titer responses could be partially due to genetic differences between animals (Curtis et al. 2001, Herbert and Trigg 2005). However, Magiafolou et al. (2013) clarify that if the variation in immune response is due to environmental factors (i.e., body condition, social rank) and not due to genetic factors, then there will be no expected effect of the immune phenotype on future generations. It is possible that general health, as measured by body condition, can have a causal role in determining immune response, with animals in poor condition demonstrating poor immune reactions (NRC 2013).

Correlations between physical factors and immune response would not preclude, though, that there could also be a heritable response to immunocontraception. In studies not directly related to immunocontraception, immune response has been shown to be heritable (Kean et al. 1994, Sarker et al. 1999). Unfortunately, predictions about the long-term, population-level evolutionary response to immunocontraceptive treatments are speculative at this point, with results likely to depend on several factors, including: the strength of the genetic predisposition to not respond to PZP; the heritability of that gene or genes; the initial prevalence of that gene or genes; the number of mares treated with a primer dose of PZP (which generally has a short-acting effect); the number of mares treated with multiple booster doses of PZP; and the actual size of the genetically-interacting metapopulation of horses within which the PZP treatment takes place.

BLM is not aware of any studies that have quantified the heritability of a lack of response to immunocontraception such as PZP vaccine or GonaCon-Equine in horses. At this point there are no studies available from which one could make conclusions about the long-term effects of sustained and widespread immunocontraception treatments on population-wide immune function. Although a few, generally isolated, feral horse populations have been treated with high fractions of mares receiving PZP immunocontraception for long-term population control (e.g., Assateague Island and Pryor Mountains), no studies have tested for changes in immune competence in those areas. Relative to the large number of free-roaming feral horses in the western United States, immunocontraception has not been used in the type of widespread or prolonged manner that might be required to cause a detectable evolutionary response.

Although this topic may merit further study, lack of clarity should not preclude the use of immunocontraceptives to help stabilize extremely rapidly growing herds.

Gonadotropin Releasing Hormone (GnRH) Vaccine

This literature review is intended to summarize what is known and what is not known about potential effects of treating mares with GonaCon. As noted below, some negative consequences of vaccination are possible. Anti-GnRH vaccines can be administered to either sex, but this analysis is limited to effects on females, except where inferences can be made to females, based on studies that have used the vaccine in males.

Whether to use or not use this method to reduce population growth rates in wild horses is a decision that must be made considering those effects as well as the potential effects of inaction, such as continued overpopulation and rangeland health degradation.

Registration and safety of GonaCon-Equine

Taking into consideration available literature on the subject, the National Research Council concluded in their 2013 report that GonaCon-B (which is produced under the trade name GonaCon-Equine for use in feral horses and burros) was one of the most preferable available methods for contraception in wild horses and burros (NRC 2013)., in terms of delivery method, availability, efficacy, and side effects. GonaCon-Equine is approved for use by authorized federal, state, tribal, public and private personnel, for application to wild and feral equids in the United States (EPA 2013, 2015). Its use is appropriate for free-ranging wild horse herds. GonaCon-Equine has been used on feral horses in Theodore Roosevelt National Park and on wild horses by BLM (BLM 2015). GonaCon-Equine can be remotely administered in the field in cases where mares are relatively approachable, using a customized pneumatic dart (McCann et al. 2017). Use of remotely delivered (dart-delivered) vaccine is generally limited to populations where individual animals can be accurately identified and repeatedly approached within 50 m (BLM 2010). The Saylor Creek wild horses were in holding following the 2010 emergency gather, thus they are accustomed to human presence and are approachable.

GonaCon is an immunocontraceptive vaccine which has been shown to provide multiple years of infertility in several wild ungulate species, including horses (Killian et al., 2008; Gray et al., 2010). GonaCon uses the gonadotropin-releasing hormone (GnRH), a small neuropeptide that performs an obligatory role in mammalian reproduction, as the vaccine antigen. When combined with an adjuvant, the GnRH vaccine stimulates a persistent immune response resulting in prolonged antibody production against GnRH, the carrier protein, and the adjuvant (Miller et al., 2008). The most direct result of successful GnRH vaccination is that it has the effect of decreasing the level of GnRH signaling in the body, as evidenced by a drop in luteinizing hormone levels, and a cessation of ovulation. The lack of estrus cycling that results from successful GonaCon vaccination has been compared to typical winter period of anoestrus in open mares. As anti-GnRH antibodies decline over time, concentrations of available endogenous GnRH increase and treated animals usually regain fertility (Power et al., 2011).

As with other contraceptives applied to wild horses, the long-term goal of GonaCon-Equine use is to reduce or eliminate the need for gathers and removals (NRC 2013). GonaCon-Equine vaccine is an EPA-approved pesticide (EPA, 2009a) that is relatively inexpensive, meets BLM requirements for safety to mares and the environment, and is produced in a USDA-APHIS laboratory. The intended effect of the vaccine is as a contraceptive. GonaCon is produced as a pharmaceutical-grade vaccine, including aseptic manufacturing technique to deliver a sterile vaccine product (Miller et al. 2013). If stored at 4° C, the shelf life is 6 months (Miller et al 2013).

Miller et al. (2013) reviewed the vaccine environmental safety and toxicity. When advisories on the product label (EPA 2015) are followed, the product is safe for users and the environment (EPA 2009b). EPA waived a number of tests prior to registering the vaccine, because GonaCon was deemed to pose low risks to the environment, so long as the product label is followed (Wang-Cahill et al., *in press*).

Under the Proposed Action, the BLM would return to the HMA as needed to re-apply GonaCon-Equine and initiate new treatments in order to maintain contraceptive effectiveness in controlling population growth rates. GonaCon-Equine can safely be reapplied as necessary to control the population growth rate; booster dose effects may lead to increased effectiveness of contraception, which is generally the intent. Even with one booster treatment of GonaCon-Equine, it is expected that most, if not all, mares would return to fertility at some point, although the average duration of effect after booster doses has not yet been quantified. Although it is unknown what would be the expected rate for the return to fertility rate in mares boosted more than once with GonaCon-Equine, a prolonged return to fertility would be consistent with the desired effect of using GonaCon (e.g., effective contraception). Once the herd size in the project area is at AML and population growth seems to be stabilized, BLM could make a determination as to the required frequency of new mare treatments and mare re-treatments with GonaCon, to maintain the number of horses within AML.

GnRH Vaccine Direct Effects

GonaCon-Equine is one of several vaccines that have been engineered to create an immune response to the gonadotropin releasing hormone peptide (GnRH). GnRH is a small peptide that plays an important role in signaling the production of other hormones involved in reproduction in both sexes. The most direct result of successful GnRH vaccination in female mammals is that it has the effect of decreasing the level of GnRH signaling in the body, as evidenced by a drop in luteinizing hormone levels, and a cessation of ovulation. GnRH is highly conserved across mammalian taxa, so some inferences about the mechanism and effects of GonaCon-Equine in horses can be made from studies that used different anti-GnRH vaccines, in horses and other taxa. Other commercially available anti-GnRH vaccines include: Improvac (Imboden et al. 2006, Botha et al. 2008, Janett et al. 2009a, Janett et al. 2009b, Schulman et al. 2013, Dalmau et al. 2015), made in South Africa; Equity (Elhay et al. 2007), made in Australia; Improvest, for use in swine (Bohrer et al. 2014); Repro-BLOC (Boedeker et al. 2011); and Bopriva, for use in cows (Balet et al. 2014). Of these, GonaCon-Equine, Improvac, and Equity are specifically intended for horses. Other anti-GnRH vaccine formulations have also been tested, but did not become trademarked products (e.g., Goodloe 1991, Dalin et al 2002, Stout et al. 2003, Donovan et al. 2013, Schaut et al. 2018, Yao et al. 2018). The effectiveness and side-effects of these various anti-GnRH vaccines may not be the same as would be expected from GonaCon-Equine use in horses. Results could differ as a result of differences in the preparation of the GnRH antigen, and the choice of adjuvant used to stimulate the immune response. For some formulations of anti-GnRH vaccines, a booster dose is required to elicit a contraceptive response, though GonaCon can cause short-term contraception in a fraction of treated animals from one dose (Powers et al. 2011, Gionfriddo et al. 2011a, Baker et al. 2013, Miller et al 2013).

GonaCon has been produced by USDA-APHIS (Fort Collins, Colorado) in several different formulations, the history of which is reviewed by Miller et al. (2013). In any vaccine, the antigen is the stimulant to which the body responds by making antigen-specific antibodies. Those antibodies then signal to the body that a foreign molecule is present, initiating an immune response that removes the molecule or cell. GonaCon vaccines present the recipient with hundreds of copies of GnRH as peptides on the surface of a linked protein that is naturally antigenic because it comes from invertebrate hemocyanin (Miller et al 2013). Early GonaCon formulations linked many copies of GnRH to a protein from the keyhole limpet (GonaCon-KHL), but more recently produced formulations where the GnRH antigen is linked to a protein from the blue mussel (GonaCon-B) proved less expensive and more effective (Miller et al. 2008). GonaCon-Equine is in the category of GonaCon-B vaccines.

Adjuvants are included in vaccines to elevate the level of immune response, inciting recruitment of lymphocytes and other immune cells which foster a long-lasting immune response that is specific to the antigen. The adjuvant used in GonaCon, Adjuvac, generally leads to a milder reaction than Freund's Complete Adjuvant (Powers et al. 2011). Adjuvac contains a small number of killed *Mycobacterium avium* cells (Miller et al. 2008, Miller et al. 2013). The antigen and adjuvant are emulsified in mineral oil,

such that they are not all presented to the immune system right after injection It is thought that the mineral oil emulsion leads to a 'depot effect' that is associated with slow or sustained release of the antigen, and a resulting longer-lasting immune response (Miller et al. 2013). Miller et al. (2008, 2013) have speculated that, in cases where memory-B leukocytes are protected in immune complexes in the lymphatic system, it can lead to years of immune response. Increased doses of vaccine may lead to stronger immune reactions, but only to a certain point; when Yoder and Miller (2010) tested varying doses of GonaCon in prairie dogs, antibody responses to the 200µg and 400µg doses were equal to each other but were both higher than in response to a 100µg dose.

Antibody titer measurements are proximate measures of the antibody concentration in the blood specific to a given antigen. Anti-GnRH titers generally correlate with a suppressed reproduction system (Gionfriddo et al. 2011a, Powers et al. 2011). Various studies have attempted to identify a relationship between anti-GnRH titer levels and infertility, but that relationship has not been universally predictable or consistent. The time length that titer levels stay high appears to correlate with the length of suppressed reproduction (Dalin et al. 2002, Levy et al. 2011, Donovan et al. 2013, Powers et al. 2011). For example, Goodloe (1991) noted that mares did produce elevated titers and had suppressed follicular development for 11-13 weeks after treatment, but that all treated mares ovulated after the titer levels declined. Similarly, Elhay (2007) found that high initial titers correlated with longer-lasting ovarian and behavioral anoestrus. However, Powers et al. (2011) did not identify a threshold level of titer that was consistently indicative of suppressed reproduction despite seeing a strong correlation between antibody concentration and infertility, nor did Schulman et al. (2013) find a clear relationship between titer levels and mare acyclicity.

In many cases, young animals appear to have higher immune responses, and stronger contraceptive effects of anti-GnRH vaccines than older animals (Brown et al. 1994, Curtis et al. 2001, Stout et al. 2003, Schulman et al. 2013). Vaccinating with GonaCon at too young an age, though, may prevent effectiveness; Gionfriddo et al. (2011a) observed weak effects in 3-4 month old fawns. It has not been possible to predict which individuals of a given age class will have long-lasting immune responses to the GonaCon vaccine. Gray (2010) noted that mares in poor body condition tended to have lower contraceptive efficacy in response to GonaCon-B. Miller et al. (2013) suggested that higher parasite loads might have explained a lower immune response in free-roaming horses than had been observed in a captive trial. At this time it is unclear what the most important factors affecting efficacy are.

Females that are successfully contracepted by GnRH vaccination enter a state similar to anestrus, have a lack of or incomplete follicle maturation, and no ovarian cycling (Botha et al. 2008). A leading hypothesis is that anti-GnRH antibodies bind GnRH in the hypothalamus – pituitary 'portal vessels,' preventing GnRH from binding to GnRH-specific binding sites on gonadotroph cells in the pituitary, thereby limiting the production of gonadotropin hormones, particularly luteinizing hormone (LH) and, to a lesser degree, follicle-stimulating hormone (FSH) (Powers et al. 2011, NRC 2013). This reduction in LH (and FSH), and a corresponding lack of ovulation, has been measured in response to treatment with anti-GnRH vaccines (Boedeker et al. 2011, Garza et al. 1986).

Females successfully treated with anti-GnRH vaccines have reduced progesterone levels (Garza et al. 1986, Stout et al. 2003, Imboden et al. 2006, Elhay 2007, Botha et al. 2008, Killian et al. 2008, Miller et al. 2008, Janett et al. 2009, Schulman et al. 2013, Balet et al 2014, Dalmau et al. 2015) and β-17 estradiol levels (Elhay et al. 2007), but no great decrease in estrogen levels (Balet et al. 2014). Reductions in progesterone do not occur immediately after the primer dose, but can take several weeks or months to develop (Elhay et al. 2007, Botha et al. 2008, Schulman et al. 2013, Dalmau et al. 2015). This indicates that ovulation is not occurring and corpora lutea, formed from post-ovulation follicular tissue, are not being established.

Changes in hormones associated with anti-GnRH vaccination lead to measurable changes in ovarian structure and function. The volume of ovaries reduced in response to treatment (Garza et al. 1986, Dalin et al. 2002, Imboden et al. 2006, Elhay et al. 2007, Botha et al. 2008, Gionfriddo 2011a, Dalmau et al. 2015). Treatment with an anti-GnRH vaccine changes follicle development (Garza et al. 1986, Stout et al. 2003, Imboden et al. 2006, Elhay et al. 2007, Donovan et al. 2013, Powers et al. 2011, Balet et al. 2014), with the result that ovulation does not occur. A related result is that the ovaries can exhibit less activity and cycle with less regularity or not at all in anti-GnRH vaccine treated females (Goodloe 1991, Dalin et al. 2002, Imboden et al. 2006, Elhay et al. 2007, Janett et al. 2009a, Powers et al. 2011, Donovan et al. 2013). In studies where the vaccine required a booster, hormonal and associated results were generally observed within several weeks after delivery of the booster dose.

GnRH Vaccine Contraceptive Effects

The NRC (2013) review pointed out that single doses of GonaCon-Equine do not lead to high rates of initial effectiveness, or long duration. Initial effectiveness of one dose of GonaCon-Equine vaccine appears to be lower than for a combined primer plus booster dose of the PZP vaccine Zonastat-H (Kirkpatrick et al. 2011), and the initial effect of a single GonaCon dose can be limited to as little as one breeding season. However, preliminary results on the effects of boostered doses of GonaCon-Equine indicate that it can have high efficacy and longer-lasting effects in free-roaming horses (Baker et al. 2017) than the one-year effect that is generally expected from a single booster of Zonastat-H.

GonaCon and other anti-GnRH vaccines can be injected while a female is pregnant (Miller et al. 2000, Powers et al. 2011, Baker et al. 2013) – in such a case, a successfully contracepted mare will be expected to give birth during the following foaling season, but may be infertile during the same year's breeding season. Thus, a mare injected in November of 2018 would not show the contraceptive effect (i.e., no new foal) until spring of 2020.

Too few studies have reported on the various formulations of anti-GnRH vaccines to make generalizations about differences between products, but GonaCon formulations were consistently good at causing loss of fertility in a statistically significant fraction of treated mares for at least one year (Killian et al. 2009, Gray et al. 2010, Baker et al. 2013, 2017). With few exceptions (e.g., Goodloe 1991), anti-GnRH treated mares gave birth to fewer foals in the first season when there would be an expected contraceptive effect (Botha et al. 2008, Killian et al. 2009, Gray et al. 2010, Baker et al. 2013). Goodloe (1991) used an anti-GnRH-KHL vaccine with a triple adjuvant, in some cases attempting to deliver the vaccine to horses with a hollow-tipped 'biobullet,'but concluded that the vaccine was not an effective immunocontraceptive in that study.

Not all mares should be expected to respond to the GonaCon-equine vaccine; some number should be expected to continue to become pregnant and give birth to foals. In studies where mares were exposed to stallions, the fraction of treated mares that are effectively contracepted in the year after anti-GnRH vaccination varied from study to study, ranging from ~50% (Baker et al. 2017), to 61% (Gray et al. 2010), to ~90% (Killian et al. 2006, 2008, 2009). Miller et al. (2013) noted lower effectiveness in free-ranging mares (Gray et al. 2010) than captive mares (Killian et al. 2009). Some of these rates are lower than the high rate of effectiveness typically reported for the first year after PZP vaccine treatment (Kirkpatrick et al. 2011). In the one study that tested for a difference, darts and hand-injected GonaCon doses were equally effective in terms of fertility outcome (McCann et al. 2017).

In studies where mares were not exposed to stallions, the duration of effectiveness also varied. A primer and booster dose of Equity led to anoestrus for at least 3 months (Elhay et al. 2007). A primer and booster dose of Improvac also led to loss of ovarian cycling for all mares in the short term (Imboden et al. 2006). It is worth repeating that those vaccines do not have the same formulation as GonaCon.

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Results from horses (Baker et al. 2017) and other species (Curtis et al. 2001) suggest that providing a booster dose of GonaCon-Equine will increase the fraction of temporarily infertile animals to higher levels than would a single vaccine dose alone.

Longer-term infertility has been observed in some mares treated with anti-GnRH vaccines, including GonaCon-Equine. In a single-dose mare captive trial with an initial year effectiveness of 94 %, Killian et al. (2008) noted infertility rates of 64%, 57%, and 43% in treated mares during the following three years, while control mares in those years had infertility rates of 25%, 12%, and 0% in those years. GonaCon effectiveness in free-roaming populations was lower, with infertility rates consistently near 60% for three years after a single dose in one study (Gray et al. 2010) and annual infertility rates decreasing over time from 55% to 30% to 0% in another study with one dose (Baker et al. 2017). Similarly, gradually increasing fertility rates were observed after single dose treatment with GonaCon in elk (Powers et al. 2011) and deer (Gionfriddo et al. 2011a).

Baker et al. (2017) observed a return to fertility over 4 years in mares treated once with GonaCon, but then noted extremely low fertility rates of 0% and 16% in the two years after the same mares were given a booster dose four years after the primer dose. These are extremely promising preliminary results from that study in free-roaming horses; a third year of post-booster monitoring is ongoing in summer 2017, and researchers on that project are currently determining whether the same high-effectiveness, long-term response is observed after boosting with GonaCon after 6 months, 1 year, 2 years, or 4 years after the primer dose. Four of nine mares treated with primer and booster doses of Improvac did not return to ovulation within 2 years of the primer dose (Imboden et al. 2006), though one should probably not make conclusions about the long-term effects of GonaCon-Equine based on results from Improvac.

It is difficult to predict which females will exhibit strong or long-term immune responses to anti-GnRH vaccines (Killian et al. 2006, Miller et al. 2008, Levy et al. 2011). A number of factors may influence responses to vaccination, including age, body condition, nutrition, prior immune responses, and genetics (Cooper and Herbert 2001, Curtis et al. 2001, Powers et al. 2011). One apparent trend is that animals that are treated at a younger age, especially before puberty, may have stronger and longer-lasting responses (Brown et al. 1994, Curtis et al. 2001, Stout et al. 2003, Schulman et al. 2013). It is plausible that giving ConaGon-Equine to prepubertal mares will lead to long-lasting infertility, but that has not yet been tested.

To date, short term evaluation of anti-GnRH vaccines, show contraception appears to be temporary and reversible. Killian et al. noted long-term effects of GonaCon in some captive mares (2009). However, Baker et al. (2017) observed horses treated with GonaCon-B return to fertility after they were treated with a single primer dose; after four years, the fertility rate was indistinguishable between treated and control mares. It appears that a single dose of GonaCon results in reversible infertility. Although it is unknown whether long-term treatment would result in permanent infertility, such permanent infertility fertility would be consistent with the desired effect of using GonaCon (e.g., effective contraception).

Other anti-GnRH vaccines also have had reversible effects in mares. Elhay (2007) noted a return to ovary functioning over the course of 34 weeks for 10 of 16 mares treated with Equity. That study ended at 34 weeks, so it is not clear when the other six mares would have returned to fertility. Donovan et al. (2013) found that half of mares treated with an anti-GnRH vaccine intended for dogs had returned to fertility after 40 weeks, at which point the study ended. In a study of mares treated with a primer and booster dose of Improvac, 47 of 51 treated mares had returned to ovarian cyclicity within 2 years; younger mares appeared to have longer-lasting effects than older mares (Schulman et al. 2013). Joonè et al. (2017) analyzed samples from the Schulman et al. (2013) study, and found no significant decrease in anti-Mullerian hormone (AMH) levels in mares treated with GnRH vaccine. AMH levels are thought to be an indicator of ovarian function, so results from Joonè et al. (2017) support the general view that the anoestrus resulting from GnRH vaccination is physiologically similar to typical winter anoestrus. In a

small study with a non-commercial anti-GnRH vaccine (Stout et al. 2003), three of seven treated mares had returned to cyclicity within 8 weeks after delivery of the primer dose, while four others were still suppressed for 12 or more weeks. In elk, Powers et al. (2011) noted that contraception after one dose of GonaCon was reversible. In white-tailed deer, single doses of GonaCon appeared to confer two years of contraception (Miller et al. 2000). Ten of 30 domestic cows treated became pregnant within 30 weeks after the first dose of Bopriva (Balet et al. 2014).

Permanent sterility as a result of single-dose or boostered GonaCon-Equine vaccine, or other anti-GnRH vaccines, has not been recorded, but that may be because no long-term studies have tested for that effect. It is conceivable that some fraction of mares could become sterile after receiving one or more booster doses of GonaCon-Equine, but the rate at which that could be expected to occur is currently unknown. If some fraction of mares treated with GonaCon-Equine were to become sterile, though, that result would be consistent with text of the WFRHBA of 1971, as amended, which allows for sterilization to achieve population goals.

In summary, based on the above results related to fertility effects of GonaCon and other anti-GnRH vaccines, application of a single dose of GonaCon-Equine to gathered or remotely-darted wild horses could be expected to prevent pregnancy in perhaps 30%-60% of mares for one year. Some smaller number of wild mares should be expected to have persistent contraception for a second year, and less still for a third year. Applying one booster dose of GonaCon to previously-treated mares should lead to two or more years with relatively high rates (80+%) of additional infertility expected, with the potential that some as-yet-unknown fraction of boostered mares may be infertile for several to many years. There is no data to support speculation regarding efficacy of multiple boosters of GonaCon-Equine; however, given it is formulated as a highly immunogenic long-lasting vaccine, it is reasonable to hypothesize that additional boosters would increase the effectiveness and duration of the vaccine.

GonaCon-Equine only affects the fertility of treated animals; untreated animals will still be expected to give birth. Even under favorable circumstances for population growth suppression, gather efficiency might not exceed 85% via helicopter, and may be less with bait and water trapping. Similarly, not all animals may be approachable for darting. The uncaptured or undarted portion of the female population would still be expected to have normally high fertility rates in any given year, though those rates could go up slightly if contraception in other mares increases forage and water availability.

GnRH Vaccine Effects on Other Organ Systems

BLM requires individually identifiable marks for immunocontraceptive treatment; this may require handling and marking. Mares that receive any vaccine as part of a gather operation would experience slightly increased stress levels associated with handling while being vaccinated and freeze-marked, and potentially microchipped. Newly captured mares that do not have markings associated with previous fertility control treatments would be marked with a new freeze-mark for the purpose of identifying that mare, and identifying her vaccine treatment history. This information would also be used to determine the number of mares captured that were not previously treated, and could provide additional insight regarding gather efficiency, and the timing of treatments required into the future. Most mares recover from the stress of capture and handling quickly once released back to the HMA, and none are expected to suffer serious long term effects from the fertility control injections, other than the direct consequence of becoming temporarily infertile.

Injection site reactions associated with immunocontraceptive treatments are possible in treated mares (Roelle and Ransom 2009). Whether injection is by hand or via darting, GonaCon-Equine is associated with some degree of inflammation, swelling, and the potential for abscesses at the injection site (Baker et al. 2013). Swelling or local reactions at the injection site are generally expected to be minor in nature, but some may develop into draining abscesses. When PZP vaccine was delivered via dart it led to more

severe swelling and injection site reactions (Roelle and Ransom 2009), but that was not observed with dart-delivered GonaCon (McCann et al. 2017). Mares treated with one formulation of GnRH-KHL vaccine developed pyogenic abscesses (Goodloe 1991). Miller et al. (2008) noted that the water and oil emulsion in GonaCon will often cause cysts, granulomas, or sterile abscesses at injection sites; in some cases, a sterile abscess may develop into a draining abscess. In elk treated with GonaCon, Powers et al. (2011) noted up to 35% of treated elk had an abscess form, despite the injection sites first being clipped and swabbed with alcohol. Even in studies where swelling and visible abscesses followed GonaCon immunization, the longer term nodules observed did not appear to change any animal's range of movement or locomotor patterns (Powers et al. 2013, Baker et al. 2017).

The result that other formulations of anti-GnRH vaccine may be associated with less notable injection site reactions in horses may indicate that the adjuvant formulation in GonaCon leads a single dose to cause a stronger immune reaction than the adjuvants used in other anti-GnRH vaccines. Despite that, a booster dose of GonaCon-Equine appears to be more effective than a primer dose alone (Baker et al. 2017). Horses injected in the hip with Improvac showed only transient reactions that disappeared within 6 days in one study (Botha et al. 2008), but stiffness and swelling that lasted 5 days were noted in another study where horses received Improvac in the neck (Imboden et al. 2006). Equity led to transient reactions that resolved within a week in some treated animals (Elhay et al. 2007). Donovan et al. noted no reactions to the canine anti-GnRH vaccine (2013). In cows treated with Bopriva there was a mildly elevated body temperature and mild swelling at injection sites that subsided within 2 weeks (Balet et al. 2014).

Several studies have monitored animal health after immunization against GnRH. GonaCon treated mares did not have any measurable difference in uterine edema (Killian 2006, 2008). Powers et al. (2011, 2013) noted no differences in blood chemistry except a mildly elevated fibrinogen level in some GonaCon treated elk. In that study, one sham-treated elk and one GonaCon treated elk each developed leukocytosis, suggesting that there may have been a causal link between the adjuvant and the effect. Curtis et al. (2008) found persistent granulomas at GonaCon-KHL injection sites three years after injection, and reduced ovary weights in treated females. Yoder and Miller (2010) found no difference in blood chemistry between GonaCon treated and control prairie dogs. One of 15 GonaCon treated cats died without explanation, and with no determination about cause of death possible based on necropsy or histology (Levy et al. 2011). Other anti-GnRH vaccine formulations have led to no detectable adverse effects (in elephants; Boedeker et al. 2011), though Imboden et al. (2006) speculated that young treated animals might conceivably have impaired hypothalamic or pituitary function.

Kirkpatrick et al. (2011) raised concerns that anti-GnRH vaccines could lead to adverse effects in other organ systems outside the reproductive system. GnRH receptors have been identified in tissues outside of the pituitary system, including in the testes and placenta (Khodr and Siler-Khodr 1980), ovary (Hsueh and Erickson 1979), bladder (Coit et al. 2009), heart (Dong et al. 2011), and central nervous system, so it is plausible that reductions in circulating GnRH levels could inhibit physiological processes in those organ systems. Kirkpatrick et al. (2011) noted elevated cardiological risks to human patients taking GnRH agonists (such as leuprolide), but the National Academy of Sciences (2013) concluded that the mechanism and results of GnRH agonists would be expected to be different from that of anti-GnRH antibodies; the former flood GnRH receptors, while the latter deprive receptors of GnRH.

GnRH Vaccine Effects on Fetus and Foal

Although fetuses are not explicitly protected under the WFRHBA of 1971, as amended, it is prudent to analyze the potential effects of GonaCon-Equine or other anti-GnRH vaccines on developing fetuses and foals. GonaCon had no apparent effect on pregnancies in progress, foaling success, or the health of offspring, in horses that were immunized in October (Baker et al. 2013), elk immunized 80-100 days into gestation (Powers et al. 2011, 2013), or deer immunized in February (Miller et al. 2000). Kirkpatrick et al. (2011) noted that anti-GnRH immunization is not expected to cause hormonal changes that would lead to

abortion in the horse, but this may not be true for the first 6 weeks of pregnancy (NRC 2013). Curtis et al. (2011) noted that GonaCon-KHL treated white tailed deer had lower twinning rates than controls, but speculated that the difference could be due to poorer sperm quality late in the breeding season, when the treated does did become pregnant. Goodloe (1991) found no difference in foal production between treated and control animals.

Offspring of anti-GnRH vaccine treated mothers could exhibit an immune response to GnRH (Khodr and Siler-Khodr 1980), as antibodies from the mother could pass to the offspring through the placenta or colostrum. In the most extensive study of long-term effects of GonaCon immunization on offspring, Powers et al. (2012) monitored 15 elk fawns born to GonaCon treated cows. Of those, 5 had low titers at birth and 10 had high titer levels at birth. All 15 were of normal weight at birth, and developed normal endocrine profiles, hypothalamic GnRH content, pituitary gonadotropin content, gonad structure, and gametogenesis. All the females became pregnant in their second reproductive season, as is typical. All males showed normal development of secondary sexual characteristics. Powers et al. (2012) concluded that suppressing GnRH in the neonatal period did not alter long-term reproductive function in either male or female offspring. Miller et al. (2013) report elevated anti-GnRH antibody titers in fawns born to treated white tailed deer, but those dropped to normal levels in 11 of 12 of those fawns, which came into breeding condition; the remaining fawn was infertile for three years.

Direct effects on foal survival are equivocal in the literature. Goodloe (1991), reported lower foal survival for a small sample of foals born to anti-GnRH treated mares, but she did not assess other possible explanatory factors such as mare social status, age, body condition, or habitat in her analysis (NRC 2013). Gray et al. (2010) found no difference in foal survival in foals born to free-roaming mares treated with GonaCon.

There is little empirical information available to evaluate the effects of GnRH vaccination on foaling phenology. It is possible that immunocontracepted mares returning to fertility late in the breeding season could give birth to foals at a time that is out of the normal range (Nuñez et al. 2010, Ransom et al 2013). Curtis et al. (2001) did observe a slightly later fawning date for GonaCon treated deer in the second year after treatment, when some does regained fertility late in the breeding season. In anti-GnRH vaccine trials in free-roaming horses, there were no published differences in mean date of foal production (Goodloe 1991, Gray et al. 2010). Unpublished results from an ongoing study of GonaCon treated free-roaming mares indicate that some degree of aseasonal foaling is possible (D. Baker, Colorado State University, personal communication to Paul Griffin, BLM WH&B Research Coordinator). Because of the concern that contraception could lead to shifts in the timing of parturitions for some treated animals, Ransom et al. (2013) advised that managers should consider carefully before using PZP immunocontraception in small refugia or rare species; the same considerations could be advised for use of GonaCon, but wild horses and burros in most areas do not generally occur in isolated refugia, they are not a rare species at the regional, national, or international level, and genetically they represent descendants of domestic livestock with most populations containing few if any unique alleles (NRC 2013). Moreover, in PZP-treated horses that did have some degree of parturition date shift, Ransom et al. (2013) found no negative impacts on foal survival even with an extended birthing season; however, this may be more related to stochastic, inclement weather events than extended foaling seasons. If there were to be a shift in foaling date for some treated mares, the effect on foal survival may depend on weather severity and local conditions; for example, Ransom et al. (2013) did not find consistent effects across study sites.

Indirect Effects of GnRH Vaccination

One expected long-term, indirect effect on wild horses treated with fertility control would be an improvement in their overall health. Many treated mares would not experience the biological stress of reproduction, foaling and lactation as frequently as untreated mares, and their better health is expected to be reflected in higher body condition scores. After a treated mare returns to fertility, her future foals

would be expected to be healthier overall, and would benefit from improved nutritional quality in the mares' milk. This is particularly to be expected if there is an improvement in rangeland forage quality at the same time, due to reduced wild horse population size. Past application of fertility control has shown that mares' overall health and body condition can remain improved even after fertility resumes. Anecdotal, subjective observations of mares treated with a different immunocontraceptive, PZP, in past gathers showed that many of the treated mares were larger, maintained better body condition, and had larger healthy foals than untreated mares.

Body condition of anti-GnRH-treated females was equal to or better than that of control females in published studies. Ransom et al. (2014b) observed no difference in mean body condition between GonaCon-B treated mares and controls. Goodloe (1991) found that GnRH-KHL treated mares had higher survival rates than untreated controls. In other species, treated deer had better body condition than controls (Gionfriddo et al. 2011b), treated cats gained more weight than controls (Levy et al. 2011), as did treated young female pigs (Bohrer et al. 2014).

Following resumption of fertility, the proportion of mares that conceive and foal could be increased due to their increased fitness; this has been called by some a 'rebound effect.' Elevated fertility rates have been observed after horse gathers and removals (Kirkpatrick and Turner 1991). More research is needed to document and quantify these hypothesized effects. If repeated contraceptive treatment leads to a prolonged contraceptive effect, then that may minimize or delay the hypothesized rebound effect. Selectively applying contraception to older animals and returning them to the HMA could reduce long-term holding costs for such horses, which are difficult to adopt, and could negate the compensatory reproduction that can follow removals (Kirkpatrick and Turner 1991).

Because successful fertility control would reduce foaling rates and population growth rates, another indirect effect would be to reduce the number of wild horses that have to be removed over time to achieve and maintain the established AML. Contraception would be expected to lead to a relative increase in the fraction of older animals in the herd. Reducing the numbers of wild horses that would have to be removed in future gathers could allow for removal of younger, more easily adoptable excess wild horses, and thereby could eliminate the need to send additional excess horses from this area to off-range holding corrals or pastures for long-term holding. Among mares in the herd that remain fertile, a high level of physical health and future reproductive success would be expected because reduced population sizes should lead to more availability of water and forage resources per capita.

Reduced population growth rates and smaller population sizes could also allow for continued and increased environmental improvements to range conditions within the project area, which would have long-term benefits to wild horse habitat quality. As the local horse abundance nears or is maintained at the level necessary to achieve a thriving natural ecological balance, vegetation resources would be expected to recover, improving the forage available to wild horses and wildlife throughout the HMA or HMAs. With rangeland conditions more closely approaching a thriving natural ecological balance, and with a less concentrated distribution of wild horses across the HMA, there should also be less trailing and concentrated use of water sources. Lower population density would be expected to lead to reduced competition among wild horses using the water sources, and less fighting among horses accessing water sources. Water quality and quantity would continue to improve to the benefit of all rangeland users including wild horses. Wild horses would also have to travel less distance back and forth between water and desirable foraging areas. Should GonaCon-Equine treatment, including booster doses, continue into the future, with treatments given on a schedule to maintain a lowered level of fertility in the herd, the chronic cycle of overpopulation and large gathers and removals might no longer occur, but instead a consistent abundance of wild horses could be maintained, resulting in continued improvement of overall habitat conditions and animal health. While it is conceivable that widespread and continued treatment with GonaCon-Equine could reduce the birth rates of the population to such a point that birth is

consistently below mortality, that outcome is not likely unless a very high fraction of the mares present are all treated with primer and booster doses, and perhaps repeated booster doses.

Behavioral Effects of GnRH Vaccination

Behavioral differences should be considered as potential consequences of contraception with GonaCon. The NRC (2013) noted that all successful fertility suppression has effects on mare behavior, mostly as a result of the lack of pregnancy and foaling, and concluded that GonaCon was a good choice for use in the program. The result that GonaCon treated mares may have suppressed estrous cycles throughout the breeding season can lead treated mares to behave in ways that are functionally similar to pregnant mares.

Where it is successful in mares, GonaCon and other anti-GnRH vaccines are expected to induce fewer estrous cycles when compared to non-pregnant control mares. This has been observed in many studies (Garza et al. 1986, Curtis et al. 2001, Dalin et al. 2002, Killian et al. 2006, Dalmau et al. 2015). In contrast, PZP vaccine is generally expected to lead mares to have more estrous cycles per breeding season, as they continue to be receptive to mating while not pregnant. Females treated with GonaCon had fewer estrous cycles than control or PZP-treated mares (Killian et al. 2006) or deer (Curtis et al. 2001). Thus, concerns about PZP treated mares receiving more courting and breeding behaviors from stallions (Nuñez et al. 2009, Ransom et al. 2010) are not generally expected to be a concern for mares treated with anti-GnRH vaccines (Botha et al. 2008).

Ransom et al. (2014b) found that GonaCon treated mares had similar rates of reproductive behaviors that were similar to those of pregnant mares. Among other potential causes, the reduction in progesterone levels in treated females may lead to a reduction in behaviors associated with reproduction. Despite this, some females treated with GonaCon or other anti-GnRH vaccines did continue to exhibit reproductive behaviors, albeit at irregular intervals and durations (Dalin et al. 2002, Stout et al. 2003, Imboden et al. 2006), which is a result that is similar to spayed (ovariectomized) mares (Asa et al. 1980). Gray et al. (2009) found no difference in sexual behaviors in mares treated with GonaCon and untreated mares. When progesterone levels are low, small changes in estradiol concentration can foster reproductive estrous behaviors (Imboden et al. 2006). Owners of anti-GnRH vaccine treated mares reported a reduced number of estrous-related behaviors under saddle (Donovan et al. 2013). Treated mares may refrain from reproductive behavior even after ovaries return to cyclicity (Elhay et al. 2007). Studies in elk found that GonaCon treated cows had equal levels of precopulatory behaviors as controls (Powers et al. 2011), though bull elk paid more attention to treated cows late in the breeding season, after control cows were already pregnant (Powers et al. 2011).

Stallion herding of mares, and harem switching by mares are two behaviors related to reproduction that might change as a result of contraception. Ransom et al. (2014b) observed a 50% decrease in herding behavior by stallions after the free-roaming horse population at Theodore Roosevelt National Park was reduced via a gather, and mares there were treated with GonaCon-B. The increased harem tending behaviors by stallions were directed to both treated and control mores. It is difficult to separate any effect of GonaCon in this study from changes in horse density and forage following horse removals.

Mares in untreated free-roaming populations change bands; some have raised concerns over effects of PZP vaccination on band structure (Nuñez et al. 2009), with rates of band fidelity being suggested as a measure of social stability. With respect to treatment with GonaCon or other anti-GnRH vaccines, it is probably less likely that treated mares will switch harems at higher rates than untreated animals, because treated mares are similar to pregnant mares in their behaviors (Ransom et al. 2014b). Indeed, Gray et al. (2009) found no difference in band fidelity in a free-roaming population of horses with GonaCon treated mares, despite differences in foal production between treated and untreated mares. Ransom et al. (2014b) actually found increased levels of band fidelity after treatment, though this may have been partially a result of changes in overall horse density and forage availability.

Even in cases where there may be changes in band fidelity, the National Research Council (2013) found that harem changing was not likely to result in serious adverse effects for treated mares:

> "The studies on Shackleford Banks (Nuñez et al., 2009; Madosky et al., 2010) suggest that there is an interaction between pregnancy and social cohesion. The importance of harem stability to mare well-being is not clear, but considering the relatively large number of free-ranging mares that have been treated with liquid PZP in a variety of ecological settings, the likelihood of serious adverse effects seem low."

Kirkpatrick et al. (2010) concluded that "the larger question is, even if subtle alterations in behavior may occur, this is still far better than the alternative."

The NRC (2013) provides a comprehensive review of the literature on the behavioral effects of contraception that puts Nuñez's (2009, 2010) research into the broader context of all of the available scientific literature, and cautions, based on its extensive review of the literature that:

> ". . . in no case can the committee conclude from the published research that the behavior differences observed are due to a particular compound rather than to the fact that treated animals had no offspring during the study. That must be borne in mind particularly in interpreting long-term impacts of contraception (e.g., repeated years of reproductive "failure" due to contraception)."

Gray et al. (2009) and Ransom et al. (2014b) monitored non-reproductive behaviors in GonaCon treated populations of free-roaming horses. Gray et al. (2009) found no difference between treated and untreated mares in terms of activity budget, sexual behavior, proximity of mares to stallions, or aggression. Ransom et al. (2014b) found only minimal differences between treated and untreated mare time budgets, but those differences were consistent with differences in the metabolic demands of pregnancy and lactation in untreated mares, as opposed to non-pregnant treated mares.

Genetic Effects of GnRH Vaccination
Similar to those listed under *Genetic Effects of PZP Vaccination.*

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Appendix C. Response to Public Scoping Comments

Cmt #	Commenter	Comment	BLM Response
1	Various	Support for Alternative 2.	Comment noted.
2	Simplot Land and Livestock	It is critical that the BLM remove all excess horses from the Saylor Creek HMA in order to achieve the AML for this area.	Comment noted
3	Simplot Land and Livestock	We strongly support the proposed action of permanently removing up to 74 excess wild horses from this area.	Comment noted
4	Simplot Land and Livestock	It is also critically important the BLM utilize any and all tools available for fertility control and future gathers to keep the HMA at AML.	Comment noted
5	Simplot Land and Livestock	BLM should work with permittees in order to coordinate gathers around livestock grazing prior to any gather.	BLM will work with permittees in the affected allotments (Twin Butte, Dove Springs, Thompson) prior to the initiation of a gather.
6	Owyhee County Commissioners	We want to note for record that helicopter gathers have been successfully and humanely conducted in our county on numerous occasions. That means if gather is appropriate and a necessary method of performing the management actions required under the Wild Horse and Burro act, and should not be construed by BLM or other organizations as inappropriate, unnecessary, or inhumane .	Helicopter gathers have taken place in the past within the Saylor Creek HMA, but based on the small number of horses to be removed and the accessibility of the HMA a bait trap gather was chosen for this gather. See Section 2.3 of the EA.
7	Owyhee County Commissioners	We believe the reference to a "natural ecological balance" is incorrect in light of the fact that there is no natural water in the area designated as a Herd Management Area for the Saylor Creek horses. Absent natural water in the area, there can be no "natural ecological balance" to be managed with this herd of horses.	The Purpose and Need of this EA is to restore a natural ecological balance and to gather and remove excess adoptable wild horse, not about designating this as or not as a viable HMA. Decisions concerning the viability of the Saylor Creek HMA are made at the land use plan level and are outside the scope of this EA.
8	Owyhee County Commissioners	Language should be inserted to the effect that this horse herd has been managed and is currently managed in an area without natural water source, contrary to the intent of the " wild and free roaming" nature of horse herds protected under the Act.	Please see comment response 7.
9	Owyhee County Commissioners	This paragraph confirms that due to BLM ' s budget constraints and the ponderous requirements of NEPA, BLM' s ability to gather and manage wild horses lags far behind their growth rate. This paragraph shows that the last gather on this herd was in 2010-and that gather was not planned, but rather a reaction to a large fire.	Comment noted.
10	Owyhee County Commissioners	Continuing to maintain this band of horses in an area where this is no natural water unnecessarily contributes to the agency's larger problem.	See comment response 7.
11	Owyhee County Commissioners	In the Preliminary Issues Section, we note that absent the fact that there is not natural water, the section is incomplete and misleading. We recommend adding that as a bullet. We also recommend adding the specific number of horses over the AML to the bullet that addresses that fact. Doing so in both suggested additions more clearly shows the nature of the problem.	Please refer to Section 3.3.1 and Section 3.4, the lack of natural water in the HMA is discussed.
12	Owyhee County Commissioners	Add Alternative 3: Remove the existing horses and terminate management of this area as a HMA. Designate this as the Proposed Action Alternative.	This comment is outside the scope of this analysis. The land use plan would need to be revised or amended to remove the Saylor Creek's designation as an HMA.
13	Owyhee County Commissioners	The numbers do not calculate to return an AML of 50 if 90 to 100% of the number of horses (91 adult and 10 foals as noted in the Wild Horse section of the document) are gathered and up to 74 permanently removed.	Please see Section 3.3.3 which includes the details of the Proposed Action. Once the 2019 foal crop is born the population in the HMA is estimated to be 137 wild horses. Gathering all the horses in the HMA allows BLM to selectively remove horses and treat the released ones with fertility control vaccine.

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Cmt #	Commenter	Comment	BLM Response
14	Owyhee County Commissioners	We also believe the mix of stallions and mares proposed will be problematic for future multiple use activity in the area. We have received reports by equestrians recreating in other herd management areas of our county that wild horse stallions, after gather and human handling such as proposed in this document, have lost their fear of humans and are a risk to equestrian recreation. The number of stallions should be reduced.	The BLM has a multiple-use management mandate for meeting its mission of sustaining the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations, including recreationalists, horseback riders, and the wild horse herd. The BLM Wild Horse and Burro Handbook recommends skewed sex ratios as a management option on herds of at least 150 horses. It includes the following text (emphasis added here): "4.5.3.2 Adjust Male/Female Sex Ratios The authorized officer should consider alternatives which would manage WH&B herds for a sex ratio with a female component of less than or equal to 50 percent, as this reduces the population growth rate and extends the gather cycle. Adjusting sex ratios to favor males is another possible management tool which should be considered when the suppression of herd growth rate is desired. This management option should be considered in HMAs and complexes where the low end of AML is greater than 150 animals. Implementation of sex ratio adjustments is most feasible during maintenance gathers (4-5 years after AML is achieved). Sex ratio adjustments may be accomplished by shifting the overall sex ratio to favor males by (1) releasing greater numbers of stallions post-gather or (2) releasing geldings back to their home range following castration. Adjusting the sex ratio so that males comprise 60-70 percent of the adult herd could be considered. Herd dynamics may change somewhat with adjustments in sex ratios. An increase in the proportion of stallions may have a greater impact when water resources are limited and bands are more concentrated." The quoted text above implicitly acknowledges that this technique may not be appropriate in very small herds.
15	Owyhee County Commissioners	We are also concerned about the continued effectiveness of the fertility control efforts proposed. BLM's ability to manage is tied to budgets, workload, and outside litigative intervention. Our experience has been that BLM regularly fails to perform wild horse management in accordance with cycles and schedules adopted as part of management plans.	Comment noted.
16	Owyhee County Commissioners	BLM' s revision of the RMP should document the lack of natural water in the area which renders these animals a domestic horse herd and should eliminate the currently designated HMA.	Please see comment response 7.

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Cmt #	Commenter	Comment	BLM Response
17	AWHC	We conclude that the BLM should not proceed with this proposed analysis to manage the wild horse populations in this HMA with these largely untested and controversial population control methods. The BLM's refusal to consistently use humane PZP fertility control to maintain wild horse populations at sustainable numbers, without removals, is inexplicable as it is economically irresponsible and inhumane.	Please see Section 3.3.3, Proposed Action. BLM is analyzing the use of PZP within the Saylor Creek HMA. Both PZP and GonaCon are reviewed in Appendix B, which shows neither are untested or controversial. The NAS found both PZP and GonaCon two of the three "most promising for application to free-ranging horses and burros." Costs for both fertility control vaccines are: • PZP-22 fertility treatment costs approximately $500 per mare treated. This includes the costs of one dose liquid primer (similar to ZonaStat-H used for remote darting) and one dose time-release pellets. • ZonaStat-H (used for remote darting) costs approximately $35 per dose. • GonaCon costs approximately $100 per mare treated.
18	AWHC	The agency's attempts to remove wild horses from this HMA–when the agency itself declared that the range is capable of maintaining a larger population of horses and recently increased the Appropriate Management Level (AML)–will, if allowed, not only contribute to the millions of taxpayer's dollars that it costs to stockpile wild horses in short- and long-term holding facilities but also seriously compromise the welfare of these animals.	Please refer to Section 1.5 Conformance with Land Use Plan. The purpose and need of this gather is to remove young horses that can be easily placed into private care, thus not adding to the current horses in ORC or ORP.

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19	AWHC	The BLM's plan to use skewed sex ratios and potentially GonaCon to control populations is experimental in nature and not supported by science. NAS recommended against these options, stating that more research was needed before such strategies could be utilized in the field because of their impacts on natural behavior and social organization. Specifically, the Oregon BLM even detailed the negative impacts of sex skewing and has rejected it out of hand in its 2015 Cold Springs HMA and 2017 Stinkingwater HMA Population Management Plans . (Attachment 2, p. 25 and Attachment 3, p. 21). In sum, research has not yet accurately determined the effects of any of these proposed management tools on natural wild horse behavior. At a minimum, if BLM wishes to move forward with the use of sex skewing in this decision, it must provide a reasoned explanation for its departure from its contrary findings in 2015 and 2017.	BLM has not proposed skewed sex ratios for this gather. Skewing the sex ratio of a herd so that there are more males than females is an established BLM management technique for reducing population growth rates. By reducing the proportion of breeding mares in a population (as a fraction of the total number of animals present), the technique leads to fewer foals being born per adult horse. The BLM Wild horses and burros management handbook (BLM 2010) discusses this technique and its proper application at length. The commenter here has taken several other BLM decisions out of context. BLM offices have rejected sex ratio skewing as a management tool in cases where its use was not warranted, in light of BLM-wide guidelines from the handbook. Specifically: - In the 2017 Stinkingwater EA, BLM clearly identified that sex ratio skewing was not appropriate because the herd size was only 40 animals. ("Adjusting sex ratios to favor males is a possible management tool. However, this management option should be considered in HMAs and complexes where the low end of AML is greater than 150 animals as it may affect social structure, herd interactions (e.g., band size), and genetic health (H-4700-1).") - In the 2015 Cold Springs EA, the low end of AML was 75. Under the preferred alternative, 37 mares and 38 stallions would remain on the HMA. This is well below the 150 head threshold noted in the Handbook (H-4700-1). While the commenter has correctly quoted text from the 2015 and 2017 EAs released, revisiting that text in light of available scientific knowledge indicates that the statement about infanticide was speculative, lacking in any evidentiary support and was not based on any scientific study. BLM today does not regard that quoted text as an accurate representation of impacts that would be expected from 60:40 sex ratio skewing. BLM is not aware of any study that has documented increased levels of infanticide in herds with 60% male and 40% female wild horses. The 2010 BLM handbook text, quoted above, clarifies the current understanding about the application of this management technique. BLM notes that the 2013 NAS report did not advocate against the use of sex ratio skewing. The authors there merely cautioned that (emphasis added here) "Sex ratio typically is somewhat adjusted after a gather in such a way that 60 percent of the horses returned to the range are male….If more aggressive sex-ratio adjustments are initiated by drastically altering the number of females relative to males beyond a 40:60 ratio, care should be taken **to assess** possible additional consequences." As cited in the NAS (NRC 2013) Barthlow (2004) suggests that birth rates could decline from about 20% to 15% a year if the proportion of males increased from 0.50 to 0.57. Regarding GonaCon, NAS said "Because preserving natural behaviors is an important criterion, GonaCon seems more appropriate for use in females." [than males] and "Thus, to the extent that GonaCon preserves natural behavior patterns while effectively preventing reproduction, it is a promising candidate as a female-directed fertility control method. However, further behavioral studies of its behavioral effects are needed."

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Cmt #	Commenter	Comment	BLM Response
			Further studies of behavioral effects have been completed since the NAS was released in 2013: Ransom et al 2014 and Baker et al 2018 both address behavioral effects, which can be found in Appendix B.
20	AWHC	At a time when the BLM stockpiles nearly 46,000 wild horses in holding facilities and the NAS recommends use of humane, reversible fertility control as "a more affordable option of continuing to remove horses to long term holding facilities," this proposed action represents a continuation of the BLM's "business as usual practices" that the NAS found would be "expensive and unproductive" for the BLM and the public it serves.	Please see Section 2.2, the BLM is considering the use of Fertility Control Vaccines in the Proposed Action.
21	AWHC	The BLM must prepare an Environmental Impact Statement (EIS) rather than an Environmental Assessment (EA) because at least two distinct NEPA "significance" factors are triggered, any one of which requires preparation of an EIS.	The EA assists the JFO in project planning, compliance with applicable laws and policy, and determining whether any significant impacts could result from the analyzed actions. This EA provides evidence for determining whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI).
22	AWHC	The BLM has no reason to rely on the 1987 AML when the current ROD, with the increased AML, was not vacated. The BLM analyzed the conditions on the range and determined that the range could support an increase in the AML. Any attempt to revert to the 1987 AML would require separate and further National Environmental Policy Act (NEPA) analysis. Anything else would be in violation of the Administrative Procedure Act (APA) and Wild Free-Roaming Horses and Burros Act (WHA).	Please see Section 2.3 Alternatives Considered but Eliminated from Detailed Study.
23	AWHC	The BLM must analyze a reasonable range of alternatives to this proposed analysis. These alternatives include (a) managing wild horses on the range with the fertility control PZP, (b) abiding by the expanded AML of 50-200 horses, and (c) accommodate current wild horse numbers with range improvements and reduction or elimination of livestock grazing.	Please see Section 2.3 Alternatives Considered but Eliminated from Detailed Study.
24	AWHC	The BLM must take the requisite "hard look" at the environmental impacts of its action, which will result in short-term and long-term effects to federally protected wild horses left on the range, the family bands of wild horses that reside in these areas, the genetic diversity of these wild horse populations, and the potential measures that could mitigate the impacts resulting from the BLM's action.	Please see Section 3.2.3 Genetics. Section 4.4.6.4 of the BLM Wild Horse and Burro Management Handbook recommends that one to three young mares could be introduced every generation (about 10 years) to mitigate genetic concerns. Therefore, as a precaution, two mares (meeting the same criteria for release) from another HMA will be treated with PZP or GonaCon fertility control treatment and released as part of the approximately 25 mares to be released back onto the HMA.
25	AWHC	The BLM's decision to round up and permanently remove wild horses from this area vs. the more cost-effective options of reducing livestock grazing and managing herds on the range with PZP fertility control is irresponsible.	Comment noted. See Section 2.3.

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Cmt #	Commenter	Comment	BLM Response
26	AWHC	The BLM must analyze economic and social impacts in this proposed analysis. Additionally, the proposed analysis must not ignore the social impacts at a time when most Americans support protecting wild horses on our public lands and oppose horse slaughter, while a small minority want our public lands used for livestock grazing.	Socio-economics was dismissed from detailed study, as the proposed action would have a negligible impact on the area (Appendix F). The costs associated with certain activities included in the Proposed Action are described below. Not all activities are included in the list as it is extremely difficult to put a numerical value on such things as vegetative resource damage or decreased recreational opportunities yet there are certainly economic values associated with their improvement, maintenance, or loss. The costs associated with holding, gathering, bait/water/horseback trapping, PZP fertility treatment, and GonaCon are listed below: • Holding horses at the BLM ORC costs approximately $5 per day per horse. • ORP costs average about $2 per day per horse. • Unadopted animals receive an estimated 25 years of care, which adds up to approximately $48,000 per horse for the remainder of his or her life. • Bait/water trap gathers are currently averaging $1,100 per horse captured. • PZP-22 fertility treatment costs approximately $500 per mare treated. This includes the costs of one dose liquid primer (similar to ZonaStat-H used for remote darting) and one dose time-release pellets. • ZonaStat-H (used for remote darting) costs approximately $35 per dose. • GonaCon costs approximately $100 per mare treated. Despite the commenter's desire for BLM to evaluate the "social impacts" of the proposed action, BLM's interpretation of NEPA guidance is that social acceptability is not an issue requiring analysis. The BLM NEPA Handbook (2008) explains that BLM must analyze an issue identified through internal or external scoping if analysis is necessary to: • make a reasoned choice among alternatives (That is, does it relate to how the proposed action or alternatives respond to the purpose and need?), or • determine the significance of effects. Fully analyzing social acceptability does not relate to how the proposed action or alternatives respond to the purpose and need. This issue is not associated with a significant direct, indirect, or cumulative impact. The NEPA Handbook (2008) goes on to explain how, "An issue is more than just a position statement, such as disagreement with grazing on public lands." An issue: • Has a cause and effect relationship with the proposed action or alternatives; • Is within the scope of the analysis; • Has not been decided by law, regulation, or previous decision; and • Is amendable to scientific analysis rather than conjecture.
27	AWHC	Specifically, the BLM's decision to revert to an outdated AML, of 50 horses, will arbitrarily require roundups. Instead, the increased AML, that was set after the agency determined the range could support more horses, is still valid and should be implemented. Simply put, the current ROD raised the AML, and the agency cannot simply go back to the 1987 AML.	Please see Section 2.3 Alternatives Considered but Dismissed from Detailed Study.

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Cmt #	Commenter	Comment	BLM Response
28	AWHC	By proposing to GonaCon to control the population, the BLM must disclose and conduct an assessment of the impacts of the proposed method will have on natural behaviors, as recommended by the NAS.	The EA includes a detailed review of published scientific literature on GonaCon's mechanism of action and behavioral effects, in Appendix B. Related impacts are discussed in Section 3.2.3.
29	AWHC	Skewed sex ratios are detrimental to the natural behaviors of wild and free- roaming horses. The strategy requires more study and research before it can be considered for implementation by the BLM.	Please see comment response 19.
30	AWHC	Not much is known about the long-term safety, efficacy, and impacts to wild horse behaviors and natural social behaviors when GonaCon is used. In fact, in response to a request from the BLM to review the best science and fertility control alternatives available for use in the BLM Wild Horse and Burros Program, the NAS specifically responded that the preservation of natural horse behaviors was important and that further study was needed. Therefore, GonaCon is a controversial, uncertain, and unviable option for wild horse management.	The EA includes a detailed review of published scientific literature on GonaCon's mechanism of action and behavioral effects, in Appendix B. The 2013 NAS report concluded that GonaCon was one of the three "methods judged most promising for application to free-ranging horses and burros." Related impacts are discussed in Section 3.2.3.
31	AWHC	Preserving natural behaviors is important, so GonaCon seems [emphasis] more appropriate for use in females in that some research has suggested [emphasis] that female sexual behavior continues. However, further studies on behavioral effects of this product are needed.	The EA includes a detailed review of published scientific literature on GonaCon's mechanism of action and behavioral effects, in Appendix B. Ransom et al. 2014 and Baker et al. 2018 both address behavioral effects.
32	AWHC	The attached analysis reveals that because published research on GonaCon in horses is limited, there are remaining questions regarding negative impacts to pregnant mares (association with abortion when given in early stages of pregnancy), long-term physiological effects, and whether the vaccine is a permanent sterilant or reversible. Even the short-term social/behavior effects are not yet established.	Please see comment response 31.
33	AWHC	AWHC asks that establishing skewed sex ratios as part of the management plan for the Saylor Creek HMA be eliminated from consideration. However, if the BLM chooses to consider skewed sex ratios as a management tool, the proposed analysis must consider that skewing of sex ratios is not scientifically supported.	Please see comment response 19.
34	AWHC	Finally, when the BLM analyzes the use of these proposed management tools, it must also consider how the combination of fertility control, sex ratio skewing, and mass roundup and removal will impact the Saylor Creek HMA population in terms of genetic diversity and viability.	Please see comment response 24.
35	AWHC	The BLM must consider management of the wild horse population at current levels utilizing Catch Treat and Release (CTR) methods for the vaccination of all mares over 1 year of age with the PZP–22 or native PZP fertility control vaccine. The use of PZP fertility control is scientifically established, cost–effective and widely accepted in the mainstream wild horse advocacy and scientific communities.	Currently the population of the Saylor Creek HMA is over AML, therefore a CTR gather is not applicable. Use of fertility control only without removal of excess wild horses would be inconsistent with the WFRHBA, and would not achieve the stated purpose and need for action (Section 1.3) because it would not allow for achievement of AML.
36	AWHC	The BLM must analyze PZP in line with the NAS findings that: Removals are likely to keep the population at a size that maximizes population growth rate, which in turn maximizes the number of animals that must be removed and processed through holding facilities.	Use of PZP is part of the proposed action (see Section 2.2). The AML of the Saylor Creek HMA is 50 horses, which the JFO is required to manage by, therefore any horses over the AML of 50 must be removed.

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Cmt #	Commenter	Comment	BLM Response
37	AWHC	The proposed analysis must incorporate data showing that the PZP fertility control vaccination has been available for decades and has a 30-year proven history of being safe and effective in managing wild horse populations and is fully supported by the public and animal welfare organizations. (Attachment 1). The BLM must analyze and explain why the agency has failed to utilize PZP in a manner and at a level that will make a difference in population rates in the Saylor Creek HMA.	Use of PZP is part of the proposed action (see Section 2.2). The EA includes a detailed review of published scientific literature on PZP's effects, in Appendix B.
38	AWHC	The BLM must analyze and incorporate in this analysis that research also indicates that a two-shot protocol (PZP-22 followed by a native PZP booster) conveys three years or more of infertility in mares	This is part of the proposed action (see Section 2.2) Please see comment response 37.
39	AWHC	The BLM must include and analyze all current peer-reviewed literature on the use PZP as a management tool, including its effectiveness in reducing and maintaining herd numbers, its effects on herd behaviors, and the cost of its implementation compared to roundups and removals.	Please see comment response 37.
40	AWHC	The BLM must analyze that ongoing research supports the warning in the 2013 NAS report that the BLM's continuing practice of roundup and removals is "expensive and unproductive for the BLM and the public it serves."	As described in Section 3.2.3 and Appendix B, the use of PZP or GonaCon would reduce the growth rate for those horses remaining in the HMA.
41	AWHC	The current wild horse population should be maintained without removals by implementing reductions in livestock grazing pursuant to 43 C.F.R. 4710.5(a). The BLM has a statutory mandate to protect wild horses, while livestock grazing is permitted only at the discretion of the Interior Department. Livestock grazing is not required to fulfill the agency's "multiple use" mandate.	Outside the scope of this analysis. This action is not setting or adjusting livestock grazing levels. Livestock grazing can only be reduced or eliminated if the BLM follows regulations at 43 CFR § 4100 and must be consistent with multiple use allocations set forth in the land-use plan. Forage allocations are addressed at the planning level. Such changes to livestock grazing cannot be made through a wild horse gather decision or through 4710.5(a), and are only possible if BLM first revises the land-use plans to allocate livestock forage to wild horses and to eliminate or reduce livestock grazing. There is no requirement of the WFRHBA or the regulations to reduce or eliminate livestock as a means to restore thriving natural ecological balance. Administration of livestock grazing on public lands fall under 43 CFR Subpart D, Group 4100. Additionally, livestock grazing is also managed under each Field Office's respective RMP. Livestock grazing on public lands is also provided for in the Taylor Grazing Act of 1934. Removal or reduction of livestock would not be in conformance with the existing RMPs, is contrary to the BLM's multiple-use mission as outlined in the FLPMA and PRIA, and would be inconsistent with the WFRHBA, which directs the Secretary to immediately remove excess wild horses. Additionally this would only be effective for the very short term as the horse population would continue to increase. Eventually the HMA and adjacent lands would no longer be capable of supporting the wild horse populations.
42	AWHC	43 CFR § 4710.5 authorizes BLM to "close appropriate areas of the public lands to grazing use by all or a particular kind of livestock…[i]f necessary to provide habitat for wild horses or burros, to implement herd management actions, or to protect wild horses or burros from disease, harassment or injury." BLM typically states that the agency utilizes this regulation only in cases of emergency, but nothing in the text of the rule indicates that its applicability is limited to emergency situations.	Please see Section 2.3 Alternatives Considered but Eliminated from Detailed Study.

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Cmt #	Commenter	Comment	BLM Response
43	AWHC	Further, a fiscal emergency does exist due to the fact that wild horse holding facilities are at capacity and consuming the majority of the BLM's wild horse and burro program budget. Leaving horses on the range and making downward adjustments to taxpayer–subsidized livestock grazing levels is clearly the most cost–effective option.	Comment noted.
44	AWHC	In sum, the BLM must further analyze this alternative by providing: A breakdown of Animal Unit Months (AUMs) permitted for livestock and wildlife and the actual use of AUMs by livestock for the HMA for each of the past three years.	Please see Section 3.4 for livestock grazing information.
45	AWHC	In sum, the BLM must further analyze this alternative by providing: A listing of all allotments within the HMA, including percentages of each allotment that fall within the HMA.	Please see Section 3.3 for each Allotment within the HMA.
46	AWHC	In sum, the BLM must further analyze this alternative by providing: Rangeland assessment results (and all such assessments should be provided in the Appendix) for the past five years for all areas within the HMA (including pastures, allotments, etc.).	Range Assessment results have not been completed for the Allotments in the HMA. They are expected to be completed within the next few years.
47	AWHC	In sum, the BLM must further analyze this alternative by providing: The methodology the BLM used to differentiate livestock usage impacts from wild horse impacts, as well as the methodology used to calculate livestock AUMs versus wild horse AUMs.	Within the Saylor Creek HMA livestock are present throughout different time frames within the year, making it nearly impossible to distinguish between wild horse and livestock use. At this time wild horse use and livestock use are not differentiated. The calculations for AUMs is the same for both livestock and wild horses.
48	AWHC	In sum, the BLM must further analyze this alternative by providing: Information regarding fencing within the HMAs, including information about water sources that are available to livestock but fenced off from horses.	Please see map in Appendix A, allotment and pasture boundaries are fenced. There aren't any water sources in the HMA that are fenced off from horses.
49	AWHC	In sum, the BLM must further analyze this alternative by providing: Voluntary grazing retirement opportunities should be explored with permittees to determine an equitable means to achieve a fairer allocation of resources for wild horses on public lands.	This comment is outside the scope of this EA.
50	AWHC	Removals, if they occur, should be incremental over time. This alternative should include managing this population at the high AML of 200 horses rather than reducing it to the low AML of 50.	Please see Section 2.3 Alternatives Considered but Dismissed from Detailed Study.
51	AWHC	The BLM must consider all information it has available about the need to keep horse herds at certain population levels in order to prevent adverse genetic harm to the population including inbreeding.	Please see comment response 24.
52	AWHC	The BLM should adhere to NAS recommendations for "transparency, quality and equity" in setting and implementing AML. This must include basing decisions on sound environmental and monitoring data, a complex understanding of herd dynamics and genetic viability needs, as well as equity in resource distribution in the territory. Any NEPA analysis should also note that the AML range was established to allow the population to grow in the years between roundups.	This comment is outside the scope of this EA. The AML can only be adjusted in an RMP amendment.

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Cmt #	Commenter	Comment	BLM Response
53	AWHC	Horses outside HMAs should be relocated within the boundaries of the HMAs back inside their federally designated range. In the alternative, if horses are outside the HMA but within designated Herd Areas, those areas should be reinstated to active management to accommodate the horses' natural migratory patterns and foraging/watering preferences.	At this time there are no horses located outside the HMA boundaries.
54	AWHC	The BLM must analyze the implementation of range improvements, such as the development of additional water sources and removal of fencing, to enhance the ability of the Saylor Creek HMA wild horses to utilize the entire HMA instead of forcing them to concentrate in certain areas or move outside of the HMA. The analysis must include a map that shows the boundaries, livestock allotments, horse distribution (census map), water sources and fencing. Additionally, if there is pasture fencing, that must be disclosed and shown in the form of a map that correlates to the horse census map.	Please see Map 1 in Appendix A. All pasture and allotment boundaries are fenced. Bands of horses were observed in the West Pasture of the Twin Butte Allotment, North Pasture of the Dove Springs Allotment, and Pasture #4 of the Thompson Allotment.
55	AWHC	As discussed above, altering sex ratios causes social disruption and increases aggression on the range, as a larger number of stallions compete for a smaller number of mares. This alternative does not comply with federal law or BLM's own wild horse management policies. In addition, there is no evidence that documents sex ratio skewing as reducing population growth rates, and the BLM itself has acknowledged the negative impacts of the practice. Therefore, the proposed analysis should conclude that the maintenance of natural sex ratios is the best practice for wild horse management.	Please see comment response 19.
56	AWHC	Removal of wild horses from public lands negatively impacts the human environment for those who enjoy observing, photographing and researching these wild horses.	Horses will remain in the HMA after the gather has concluded for those who enjoy observing, photographing, and researching wild horses.
57	AWHC	Trap sites should be located on public lands to allow public observation of roundup activities. No trap site shall be located on private lands for which the owners will not give permission for public observation of roundup activities.	All traps will be located on public lands.
58	AWHC	Real-time cameras with Global Positioning System technology should be installed on all helicopters used in roundup operations and video should be live streamed on the Internet. This will improve the transparency of roundup operations and enable the BLM and public to monitor the direct impact motorized vehicle usage has on wild horses and the environment.	There are currently no requirements in the contract for the gather contractor to provide these services. Even if possible for real-time video due to the remoteness of the area and lack of service in the area the gather location would preclude the ability to transmit video in real-time. .
59	AWHC	Real-time cameras should be installed on the trap, the corral and temporary holding pens and live streamed on the Internet, again, so that BLM personnel, public and media can monitor the entire roundup operation and treatment of the horses/burros.	See comment response 58.
60	AWHC	The agency is facing an escalating fiscal crisis off-the-range as a result of the mass removal of wild horses from the range and the stockpiling of captured mustangs in government holding facilities. The removal of more horses will only add wild horses to taxpayer-funded holding facilities. These factors must be disclosed and analyzed in the analysis.	The intent of this gather is to remove horses that can be placed into private care, thus not increasing the number of horses in ORC and ORP (see Section 1.3 Purpose and Need).

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Cmt #	Commenter	Comment	BLM Response
61	ISDA	As stated in the scoping document, the AML has been exceeded by 82% in this HMA within a matter of years. This excess number of horses and the anticipated growth rate will have an adverse effect on the rangeland health of the HMA. The ISDA encourages the BLM to work proactively in order to maintain horse numbers below or at the AML for this HMA.	Comment noted. That is the purpose of the gather (see Section 1.3)
62	ISDA	The ISDA encourages the BLM to have meaningful coordination with the permittees within the Saylor Creek HMA. This coordination is essential in the implementation of the removal of wild horses. It will help ensure that livestock are not affected by the capture and that there are no conflicts with livestock management during the capture, removal, and return of wild horses to the HMA.	Please see comment response 5.
63	ISDA	We also recommend collaboration with the State of Idaho, who own lands within the HMA and will likely be impacted by this removal.	The Idaho Department of Lands is included on the mailing list for all documents related to this EA.
63	ISDA	Although ISDA is appreciative of this effort, we have some concerns with the long-term management of the Saylor Creek HMA. The first concern is BLM's proposal to release 50 horses back on to the HMA. As identified in the scoping document, the AML for this HMA is 50 horses. It is impractical to release horses back at the upper AML.	Saylor Creek does not have an AML range, the 1987 RMP simply set the AML at 50 horses.
64	ISDA	BLM has proposed the uses of fertility control, specifically Porcine Zona Pellucida (PZP) or GonaCon. Though these are good options for population control, it may not be possible to administer the fertility control to every female on an annual basis. This would subsequently lead to the birth of foals, which would cause the HMA to once again be above the AML.	Population growth suppressants are meant to slow the population growth rate, not completely eliminate the need for gathers.
65	ISDA	Also, studies found on the USDA APHIS website state that GonaCon is not 100% effective, therefore leading to the increased possibility of unwanted conception.	This is noted in Section 3.2.3 and Appendix B, thus a booster dose of GonaCon may be utilized via remote darting.
66	ISDA	The ISDA is also concerned that extenuating circumstances may hinder the BLM's ability to apply fertility control on an annual basis.	The intent of this EA, along with removal of excess horses is to slow population growth, and to develop a remote darting program for the HMA so we are able to apply it annually.
67	ISDA	Based on concerns ISDA has heard from both recreationalists and ranchers, there is an increased chance of stallion conflicts with BLM's proposal to release 25 back on to the HMA. It is known that stallions can be aggressive and there are safety concerns for the general public and ranchers riding horses in the HMA. In order to mitigate the identified issues, ISDA recommends that the BLM return a number of horses lower than the AML.	Please see comment response 14.
68	ISDA	Another concern is BLM's proposal to release a sex ratio of 50/50. The concern that we have regarding the sex ratio is the increased chance of reproduction that comes with a 50/50 ratio. In the instances where fertility control does not work or is unable to be administered, this ratio will provide a greater probability of conception within the herd. This will in turn cause the HMA to rise above the AML. ISDA recommends that the BLM identify a sex ratio that will favor stallions, as stated in the BLM Wild Horses and Burros Management Handbook in order to help to reduce the chances of this concern.	Please see comment response 14.

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Appendix D. Population Modeling

Overview

Version 1.40 of the *WinEquus Program*, developed by Dr. Steve Jenkins (Jenkins Model) was utilized to perform population modeling. The model uses average survival probabilities and foaling rates of wild horses to simulate population growth for up to 20 years. The model accounts for year-to-year variation in these demographic parameters by using a randomization process to select survival probabilities and foaling rates for each age class from a distribution of values based on these averages. This aspect of population dynamics is called environmental stochasticity, and reflects the fact that future environmental conditions that may affect horse populations cannot be known in advance. Therefore, each trial with the model will give a different pattern of population growth. Some trials may include mostly "good years", when the population grows rapidly; other trials may include a series of several "bad" years in succession. The stochastic approach to population modeling uses repeated trials to project a range of possible population trajectories over a period of years, which is more realistic than predicting a single specific trajectory.

The model incorporates both selective removal and fertility control treatment as management strategies. A simulation may include no management, selective removal, fertility control treatment, or both removal and fertility control treatment. Wild Horse and Burro Specialists can specify many different options for these management strategies such as the schedule of gathers for removal or fertility control treatment, the threshold population size which triggers a gather, the target population size following a removal, the ages and sexes of horses to be removed, and the effectiveness of fertility control treatment. Results of the population model are not considered a "prediction" of what will happen to the herd in the future. Results of the model are being used as an aid to evaluate the management practices that are identified in this document and to project population growth.

There are three data sets from three Herd Management Areas (HMAs; Garfield, Granites, and Pryor Mountain) built into and available for use in the Jenkins Model. An infinite number of data sets from other sources can also be entered into the model for local herds. Most population projections are based on the Garfield data. These data are the best available for many areas and are based on substantial field work and research. The model's projections using the Garfield data are very close to what actually occurs in the herds. Survival and foaling data was collected by M. Ashley and S. Jenkins at Garfield Flat, Nevada, between 1993 and 1999. The age and sex distribution data used was extrapolated from the 2011 release following the 2010 emergency gather of the Saylor Creek HMA.

For each simulation, a series of graphs and tables were generated which included the "most typical" trial, projected population sizes, growth rates, and gather numbers, and minimum, average, and maximum population sizes. These numbers are useful to make relative comparisons of the different alternatives, and potential outcomes under different management options. This output, together with the time series and most typical trial graphs are useful representations of the results of the program in terms of assessing the effects of the various alternatives because it shows not only expected average results but also extreme results that might be possible. The model was run for 100 trials for a 10-year period to assess the potential outcomes for these management scenarios over a long period of time. This provides for a more useful comparison of alternatives when assessing small populations. The model output provides information for 11 years.

Population Modeling Criteria

The following summarizes the criteria utilized to complete the modeling:

• Initial population: 112 (Proposed Action) 112 (No Action)
• Starting year: 2019
• Initial Gather Year: 2019
• Gather interval: minimum interval of three years (Standard interval within the modeling program)
• Effectiveness of Fertility Control PZP: Year 1: 94%, Year 2: 82%, Year 3: 68%
• Effectiveness of Fertility Control GonaCon: Year 1: 100%, Year 2: 84%, Year 3: 84%
• Gather for fertility treatment regardless of population size: No
• Continue to gather after reduction to treat females: Yes
• Threshold population size: 100
• Target population following gathers: 50
• Percent of the population that can be gathered: 95%
• Minimum age for long term pasture horses: Not Applicable
• Foals are not included in the AML
• Simulations were run for 10 years with 100 trials each

Results

Alternative 1 – No Action
This alternative was modeled using the Removal Only Option. The model displayed results through year 2029 (Figure 1). Figure 1 depicts the "most typical trial" (indicated in red) of the 100 trials (indicated in blue) simulated for this alternative.

Average population growth rates for the Alternative 1 simulations were 13.7 to 25.1% (based on 10th to 90th percentile), with a median of 19.6% (Figure 2). Average growth rates were within reasonable ranges, and none of the trials reflect a "crash" in the population. The average population size of the median trial was 350 wild horses, with the maximum number (on the highest trial) of 1227 horses by 2028.

Alternative 2 - Proposed Action utilizing PZP as the fertility control vaccine
For the Proposed Action, utilizing PZP as the fertility control vaccine, modeling was completed with both the removal and fertility control option through year 2029. Figure 3 depicts the "most typical trial" (indicated in red) of the 100 trials (indicated in blue) simulated for this alternative.

Average population growth rates for the Proposed Action simulations were 2.2 to 9.3% (based on 10th to 90th percentile), with a median of 6.1% (Figure 4). Average growth rates were within reasonable ranges, and none of the trials reflect a "crash" in the population. The average population size of the median trial was 51 to 110 wild horses.

Alternative 2 - Proposed Action utilizing GonaCon as the fertility control vaccine
For the Proposed Action, utilizing GonaCon as the fertility control vaccine, modeling was completed with both the removal and fertility control option through year 2029. Figure 5 depicts the "most typical trial" (indicated in red) of the 100 trials (indicated in blue) simulated for this alternative.

Average population growth rates for the Proposed Action simulations were -0.7 to 6.3% (based on 10th to 90th percentile), with a median of 3.4% (Figure 6). Average growth rates were within reasonable ranges, and none of the trials reflect a "crash" in the population. The average population size of the median trial was 53 to 80 wild horses.

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Figure 1. Alternative 1 - Population Size from 2019 to 2029.

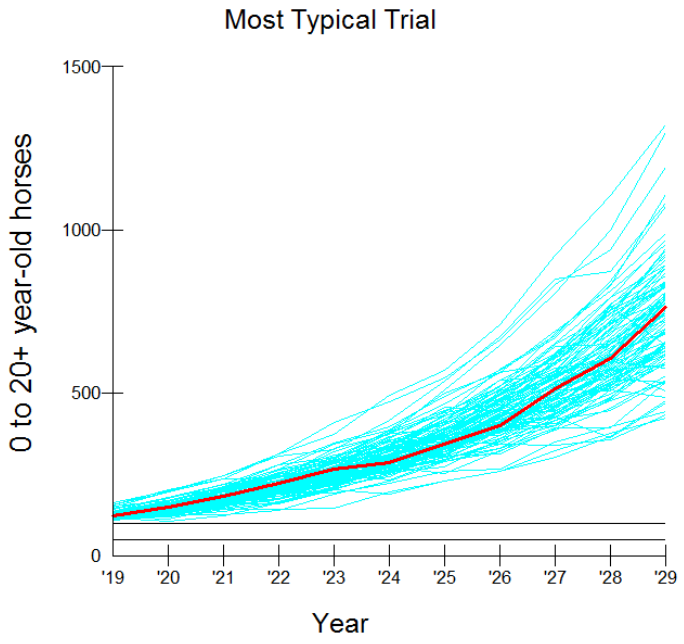


Figure 2. Alternative 1 - Growth Rates from 2019 to 2029.

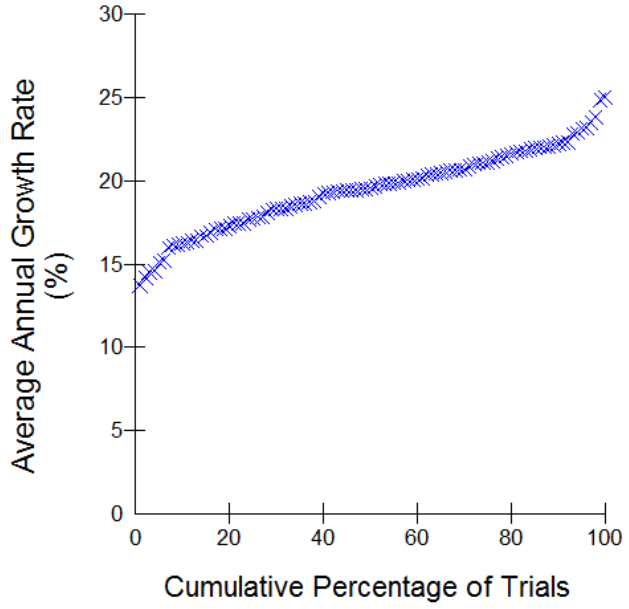


Figure 3. Proposed Action- PZP - Population Size from 2019 to 2029.

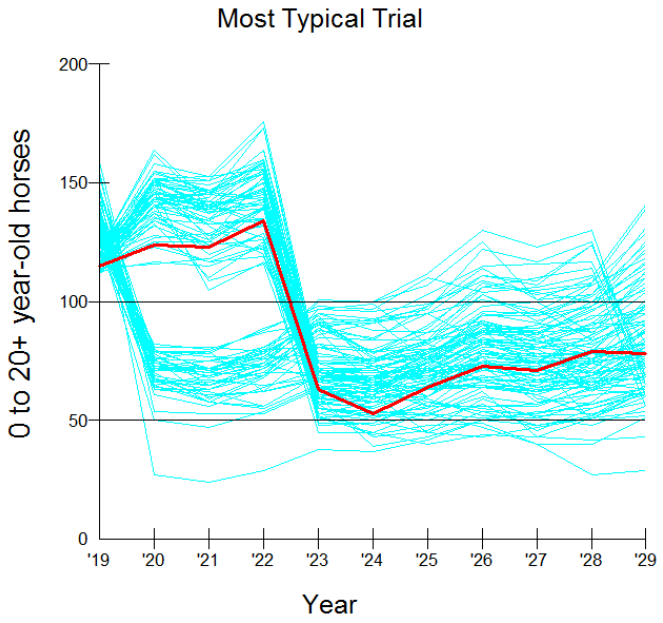


Figure 4. Proposed Action – PZP- Growth Rates from 2019 to 2029.

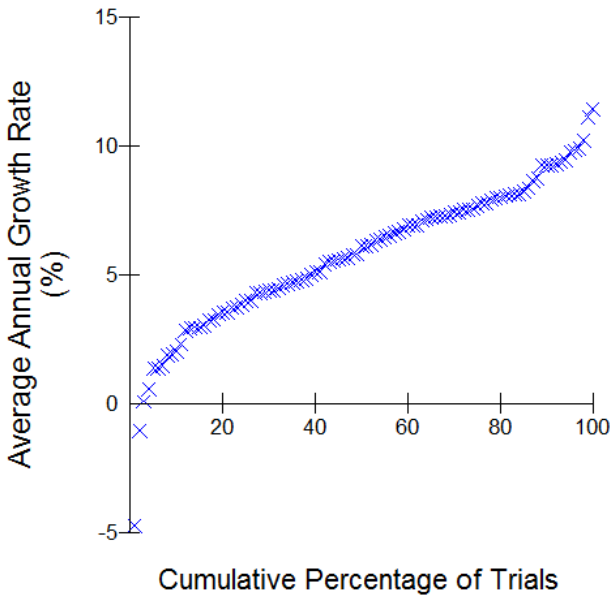


Figure 5. Proposed Action – GonaCon - Population Size from 2019 to 2029.

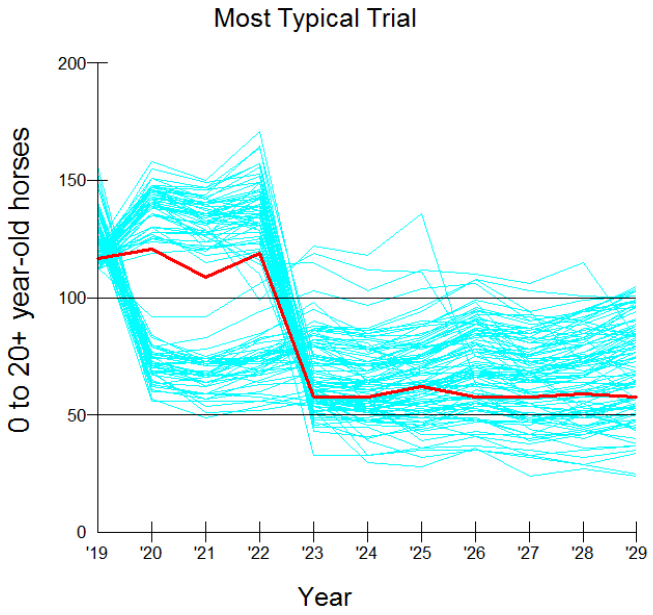
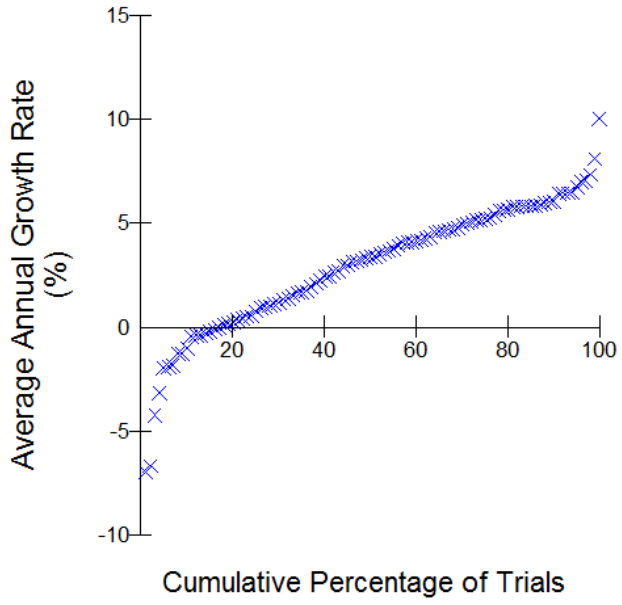


Figure 6. Proposed Action – GonaCon - Growth Rates from 2019 to 2029.



Appendix E. Standard Operating Procedures (SOPs)

Fertility control treatment SOPs

The following management and monitoring requirements are part of the Proposed Action:

1. PZP vaccine would be administered by trained BLM personnel.

2. The fertility control drug is administered with two separate injections: (1) a liquid dose of PZP is administered using an 18-gauge needle primarily by hand injection; (2) the pellets are preloaded into a 14-gauge needle. These are loaded on the end of a trocar (dry syringe with a metal rod) which is loaded into the jab-stick which then pushes the pellets into the breeding mares being returned to the range. The pellets and liquid are designed to release the PZP over time similar to a time release cold capsule.

3. Delivery of the vaccine would be as an intramuscular injection while the mares are restrained in a working chute. Half a cubic centimeter (cc) of the PZP vaccine would be emulsified with half a cc of adjuvant (a compound that stimulates antibody production) and loaded into the delivery system. The pellets would be loaded into the jab-stick for the second injection. With each injection, the liquid and pellets would be propelled into the left hindquarters of the mare, just below the imaginary line that connects the point of the hip and the point of the buttocks.

4. All treated mares would be freeze-marked on the hip to enable researchers to positively identify the animals during the research project as part of the data collection phase.

5. At a minimum, monitoring of reproductive rates using helicopter flyovers will be conducted in years two through four by checking for the presence or absence of foals. The flight scheduled for year four will also assist in determining the percentage of mares that have returned to fertility. In addition, field monitoring will be routinely conducted as part of other regular ground-based monitoring activities.

6. A field data sheet will be used by the field applicators to record all the pertinent data relating to identification of the mare including a photograph when possible, date of treatment, type of treatment (1 or 2 year vaccine, adjuvant used) and HMA. The original form with the data sheets will be forwarded to the Authorized Officer at National Program Office (NPO) in Reno, Nevada. A copy of the form and data sheets and any photos taken will be maintained at the district office.

7. A tracking system will be maintained by NPO detailing the quantity of PZP issued, the quantity used, and disposition of any unused PZP, the number of treated mares by HMA, district office, and state along with the freeze-mark applied by HMA.

8. The field office will assure that treated mares do not enter the adoption market for 3 years following treatment. In the rare instance, due to unforeseen circumstance, treated mare(s) are removed from an HMA before 3 years has lapsed, they will be maintained in either a BLM facility or BLM-contracted Long-Term Pastures (LTPs) until expiration of the 3-year holding period. In the event it is necessary to remove treated mares, their removal and disposition will be coordinated through NPO. After expiration of the 3-year holding period, the animal may be placed in the adoption program or sent to long-term pastures.

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Comprehensive Animal Welfare Program for Wild Horse and Burro Gathers SOPs

In 2015 (IM2015-151), BLM initiated a comprehensive animal welfare program (CAWP) which updated WH&B gather SOPs to formalize the standards, training and monitoring for conducting safe, efficient and successful WH&B gather operations while ensuring humane care and handling of animals gathered. These standards include requirements for trap and temporary holding facility design; capture and handling; transportation; and appropriate care after capture. The standards have been incorporated into helicopter gather contracts as specifications for performance. It includes a requirement that all Incident Commanders (IC), Lead Contracting Officer Representatives (LCOR), Contracting Officer Representatives (COR), Project Inspectors (PI), and contractors must complete a mandatory training course covering all aspects of the CAWP prior to gathers. The goal is to ensure that the responsibility for humane care and treatment of WH&Bs remains a high priority for the BLM and its contractors at all times. The BLM's objective is to use the best available science, husbandry and handling practices applicable for WH&Bs and to make improvements whenever possible, while also meeting our overall gather goals and objectives in accordance with current BLM policy, SOPs and contract requirements.

Gathers would be conducted by utilizing contractors from the Wild Horse Gathers-Western States Contract, or BLM personnel. The following procedures for gathering and handling wild horses would apply whether a contractor or BLM personnel conduct a gather. For helicopter gathers conducted by BLM personnel, gather operations will be conducted in conformance with the *Wild Horse Aviation Management Handbook* (January 2009).

Prior to any gathering operation, the BLM will provide a pre-gather evaluation of existing conditions in the gather area(s). The evaluation will include animal conditions, prevailing temperatures, drought conditions, soil conditions, road conditions, and a topographic map with wilderness boundaries, the location of fences, other physical barriers, and acceptable trap locations in relation to animal distribution. The evaluation will determine whether the proposed activities will necessitate the presence of a veterinarian during operations. If it is determined that a large number of animals may need to be euthanized or gather operations could be facilitated by a veterinarian, these services would be arranged before the gather would proceed. The contractor will be apprised of all conditions and will be given instructions regarding the gather and handling of animals to ensure their health and welfare is protected.

Trap sites and temporary holding sites will be located to reduce the likelihood of injury and stress to the animals, and to minimize potential damage to the natural resources of the area. These sites would be located on or near existing roads whenever possible.

The primary gather methods used in the performance of gather operations include:
1. Helicopter Drive Trapping. This gather method involves utilizing a helicopter to herd wild horses into a temporary trap.

2. Helicopter Assisted Roping. This gather method involves utilizing a helicopter to herd wild horses or burros to ropers.

3. Bait Trapping. This gather method involves utilizing bait (e.g., water or feed) to lure wild horses into a temporary trap.

The following procedures and stipulations will be followed to ensure the welfare, safety and humane treatment of wild horses in accordance with the provisions of 43 CFR 4700.

Helicopter Gather Methods used in the Performance of Gather Contract Operations

The primary concern of the contractor is the safe and humane handling of all animals gathered.

All gather attempts shall incorporate the following:

1. All trap and holding facilities locations must be approved by the Contracting Officer's Representative (COR) and/or the Project Inspector (PI) prior to construction. All trap and holding facilities locations must be approved by the LCOR/COR/PI prior to construction. The Contractor may also be required to change or move trap locations as determined by the LCOR/COR/PI. LCOR/COR/PI will determine when capture objectives are met. All traps and holding facilities not located on public land must have prior written approval of the landowner that will be provided to the LCOR prior to use. Selection of all traps and holding sites will include consideration for public and media observation.

2. The rate of movement and distance the animals travel must not exceed limitations set by the LCOR/COR/PI who will consider terrain, physical barriers, access limitations, weather, condition of the animals, urgency of the operation (animals facing drought, starvation, fire, etc.) and other factors. The trap site shall be moved close to WH&B locations whenever possible to minimize the distance the animals need to travel.

3. All traps, wings, and holding facilities shall be constructed, maintained and operated to handle the animals in a safe and humane manner and be in accordance with the following:

a. When moving the animals from one pasture/allotment to another pasture/allotment, the fencing wire needs to be let down for a distance that is approved by the LCOR on either side of the gate or crossing.

b. If jute is hung on the fence posts of an existing wire fence in the trap wing, the wire should either be rolled up or let down for the entire length of the jute in such a way that minimizes the possibility of entanglement by WH&Bs unless otherwise approved by the LCOR/COR/PI. No modification of existing fences will be made without authorization from the LCOR/COR/PI. The Contractor shall be responsible for restoration of any fence modification which they have made.

c. Building a trail using domestic horses through the fence line, crossing or gate may be necessary to avoid animals hitting the fence.

d. The trap site and temporary holding facility must be constructed of stout materials and must be maintained in proper working condition. Traps and holding facilities shall be constructed of portable panels, the top of which shall not be less than 72 inches high for horses and 60 inches for burros, and the bottom rail of which shall not be more than 12 inches from ground level. All traps and holding facilities shall be oval or round in design with rounded corners.

e. All portable loading chute sides shall be a minimum of 6 feet high and shall be fully covered on the sides with plywood, or metal without holes.

f. All alleyways that lead to the fly chute or sorting area shall be a minimum of 30 feet long and a minimum of 6 feet high for horses, and 5 feet high for burros and the bottom rail must not be more than 12 inches from ground level. All gates and panels in the animal holding and handling pens and alleys of the trap site must be covered with plywood, burlap, plastic snow fence or like material approximately 48” in height to provide a visual barrier for the animals. All materials shall be secured in place. These guidelines apply:

i. For exterior fences, material covering panels and gates must extend from the top of the panel or gate toward the ground.

ii. For alleys and small internal handling pens, material covering panels and gates shall extend from no more than 12 inches below the top of the panel or gate toward the ground to facilitate visibility of animals and the use of flags and paddles during sorting.

iii. The initial capture pen may be left uncovered as necessary to encourage animals to enter the first pen of the trap.

iv. Padding must be installed on the overhead bars of all gates used in single file ally.

v. An appropriate chute designed for restraining WH&B's must be available for necessary procedures at the temporary holding facility. The government furnished portable fly chute to restrain, age, or provide additional care for the animals shall be placed in the alleyway in a manner as instructed by or in concurrence with the LCOR/COR/PI.

vi. There must be no holes, gaps or openings, protruding surfaces, or sharp edges present in fence panels, latches**,** or other structures that may cause escape or possible injury.

vii. Hinged, self-latching gates must be used in all pens and alleys except for entry gates into the trap, which may be secured with tie ropes or chains.

viii. When dust conditions occur within or adjacent to the trap or holding facility, the Contractor shall be required to wet down the ground with water.

All animals gathered shall be sorted into holding pens as to age, size, temperament, sex, condition, and whether animals are identified for removal as excess or retained in the HMA. These holding pens shall be of sufficient size to minimize, to the extent possible, injury due to fighting and trampling as well as to allow animals to move easily and have adequate access to water and feed. All pens will be capable of expansion on request of the LCOR/COR/PI. Alternate pens, within the holding facility shall be furnished by the Contractor to separate mares or Jennies with small foals, sick and injured animals, and private animals from the other animals. Under normal conditions, the BLM will require that animals be restrained to determine an animal's age, sex, and ownership. In other situations restraint may be required to conduct other procedures such as veterinary treatments, restraint for fertility control vaccinations, castration, spaying, branding, blood draw, collection of hair samples for genetic testing, testing for equine diseases, application of GPS collars and radio tags. In these instances, a portable restraining chute may be necessary and will be provided by the government. Alternate pens shall be furnished by the Contractor to hold animals if the specific gathering requires that animals be released back into the capture area(s) following selective removal and/or population suppression treatments. In areas requiring one or more satellite traps, and where a centralized holding facility is utilized, the contractor may be required to provide additional holding pens to segregate animals transported from remote locations so they may be returned to their traditional ranges. Either segregation or temporary marking and later segregation will be at the discretion of the LCOR/COR/PI. The LCOR will determine if the corral size needs to be expanded due to horses staying longer, large.

FEEDING AND WATERING

a. Adult WH&Bs held in traps or temporary holding pens for longer than 12 hours must be fed every morning and evening and provided with drinking water at all times other than when animals are being sorted or worked.

b. Dependent foals must be reunited with their mares/jennies at the temporary holding facility within four hours of capture unless the LCOR/COR/PI authorizes a longer time or foals are old enough to be weaned. If a nursing foal is held in temporary holding pens for longer than 4 hours without their dams, it must be provided with water and good quality weed seed free hay.

c. Water must be provided at a minimum rate of 10 gallons per 1,000 pound animal per day, adjusted accordingly for larger or smaller horses, burros and foals, and environmental conditions, with each trough placed in a separate location of the pen (i.e. troughs at opposite ends of the pen) with a minimum of one trough per 30 horses. Water must be refilled at least every morning and evening when necessary.

d. Good quality weed seed free hay must be fed at a minimum rate of 20 pounds per 1,000 pound adult animal per day, adjusted accordingly for larger or smaller horses, burros and foals.

1. Hay must not contain poisonous weeds or toxic substances.
2. Hay placement must allow all WH&B's to eat simultaneously.

e. When water or feed deprivation conditions exist on the range prior to the gather, the LCOR/COR/PI shall adjust the watering and feeding arrangements in consultation with the onsite veterinarian as necessary to provide for the needs of the animals to avoid any toxicity concerns.

TRAP SITE

A dependent foal or weak/debilitated animal must be separated from other WH&Bs at the trap site to avoid injuries during transportation to the temporary holding facility. Separation of dependent foals from mares must not exceed four hours unless the LCOR/COR/PI authorizes a longer time or the decision is made to wean the foals.

TEMPORARY HOLDING FACILITY

a. All WH&B's in confinement must be observed at least twice daily during feeding time to identify sick or injured WH&Bs and ensure adequate food and water.

b. Non-ambulatory WH&B's must be located in a pen separate from the general population and must be examined by the LCOR/COR/PI and/or on-call or on-site veterinarian no more than 4 hours after recumbency (lying down) is observed. Unless otherwise directed by a veterinarian, hay and water must be accessible to an animal within six hours after recumbency.

c. Alternate pens must be made available for the following:

1. WH&Bs that are weak or debilitated
2. Mares/jennies with dependent foals
3. Aggressive WH&B's that could cause serious injury to other animals.

d. WH&B's in pens at the temporary holding facility shall be maintained at a proper stocking density such that when at rest all WH&B's occupy no more than half the pen area.

e. It is the responsibility of the Contractor to provide security to prevent loss, injury or death of captured animals until delivery to final destination.

f. It is the responsibility of the Contractor to provide for the safety of the animals and personnel working at the trap locations and temporary holding corrals in consultation with the LCOR/COR/PI. This responsibility will not be used to exclude or limit public and media observation as long as current BLM policies are followed.

g. The contractor will ensure that non-essential personnel and equipment are located as to minimize disturbance of WH&Bs. Trash, debris, and reflective or noisy objects shall be eliminated from the trap site and temporary holding facility.

h. The Contractor shall restrain sick or injured animals if treatment is necessary in consultation with the LCOR/COR/PI and/or onsite veterinarian. The LCOR/COR/PI and/or onsite veterinarian will determine if injured animals must be euthanized and provide for the euthanasia of such animals. The Contractor may

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be required to humanely euthanize animals in the field and to dispose of the carcasses as directed by the LCOR/COR/PI, at no additional cost to the Government.

i. Once the animal has been determined by the LCOR/COR/PI to be removed from the HMA/HA, animals shall be transported to final destination from temporary holding facilities within 48 hours after capture unless prior approval is granted by the LCOR/COR/PI. Animals to be released back into the HMA following gather operations will be held for a specified length of time as stated in the Task Order/SOW. The Contractor shall schedule shipments of animals to arrive at final destination between 7:00 a.m. and 4:00 p.m. unless prior approval has been obtained by the LCOR. No shipments shall be scheduled to arrive at final destination on Sunday and Federal holidays, unless prior approval has been obtained by the LCOR. Animals shall not be allowed to remain standing on gooseneck or semi-trailers while not in transport for a combined period of greater than three (3) hours. Total planned transportation time from the temporary holding to the BLM facility will not exceed 10 hours. Animals that are to be released back into the capture area may need to be transported back to the original trap site per direction of the LCOR.

CAPTURE METHODS THAT MAY BE USED IN THE PERFORMANCE OF A GATHER

Helicopter Drive Trapping

a. The helicopter must be operated using pressure and release methods to herd the animals in a desired direction and shall not repeatedly evoke erratic behavior in the WH&B's causing injury or exhaustion. Animals must not be pursued to a point of exhaustion; the on-site veterinarian must examine WH&B's for signs of exhaustion.

b. The rate of movement and distance the animals travel must not exceed limitations set by the LCOR/COR/PI who will consider terrain, physical barriers, access limitations, weather, condition of the animals, urgency of the operation (animals facing drought, starvation, fire, etc.) and other factors.

i. WH&B's that are weak or debilitated must be identified by BLM staff or the contractors. Appropriate gather and handling methods shall be used according to the direction of the LCOR/COR/PI as defined in this contract.

ii. The appropriate herding distance and rate of movement must be determined the LCOR/COR/PI on a case-by-case basis considering the weakest or smallest animal in the group (e.g., foals, pregnant mares, or horses that are weakened by body condition, age, or poor health) and the range and environmental conditions present.

iii. Rate of movement and distance travelled must not result in exhaustion at the trap site, unless the exhausted animals were already in a severely compromised condition prior to the gather. Where compromised animals cannot be left on the range or where doing so would only serve to prolong their suffering, the LCOR/COR/PI will determine if euthanasia will be performed in accordance with BLM policy.

c. WH&B's must not be pursued repeatedly by the helicopter such that the rate of movement and distance travelled exceeds the limitation set by the LCOR/COR/PI. Abandoning the pursuit or alternative capture methods may be considered by the LCOR/COR/PI in these cases.

d. The helicopter is prohibited from coming into physical contact with any WH&B regardless of whether the contact is accidental or deliberate.

e. WH&B's may escape or evade the gather site while being moved by the helicopter. If there are mare/dependent foal pairs in a group being brought to a trap and half of an identified pair is thought to have evaded capture, multiple attempts by helicopter may be used to bring the missing half of the pair to the trap or to facilitate capture by roping. In these instances, animal condition and fatigue will be

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evaluated by the LCOR/COR/PI or on-site veterinarian on a case-by-case basis to determine the number of attempts that can be made to capture an animal.

f. Horse captures must not be conducted when ambient temperature at the trap site is below 10ºF or above 95ºF without approval of the LCOR/COR/PI. Burro captures must not be conducted when ambient temperature is below 10ºF or above 100ºF without approval of the LCOR/COR/PI. The LCOR/COR/PI will not approve captures when the ambient temperature exceeds 105 ºF.

g. The contractor shall assure that dependent foals shall not be left behind. Any animals identified as such will be recovered as a priority in completing the gather.

h. Any adult horse or burro that cannot make it to the trap due to physical limitations shall be identified to the LCOR/COR/PI by the pilot or contractor immediately. An inspection of the animal will be made to determine the problem and the LCOR/COR/PI and/or veterinarian will decide if that animal needs to be humanely euthanized.

ROPING

a. The roping of any WH&B must be approved by the LCOR/COR/PI prior to the action.

b. The roping of any WH&B will be documented by the LCOR/COR/PI along with the circumstances. WH&Bs may be roped under circumstances which include but are not limited to the following: reunite a mare or jenny and her dependent foal; capture nuisance, injured or sick WH&Bs or those that require euthanasia; environmental reasons such as deep snow or traps that cannot be set up due to location or environmental sensitivity; and public and animal safety or legal mandates for removal.

c. Ropers should dally the rope to their saddle horn such that animals can gradually be brought to a stop and must not tie the rope hard and fast to the saddle, which can cause the animals to be jerked off their feet.

d. WH&Bs that are roped and tied down in recumbency must be continuously observed and monitored by an attendant at a maximum of 100 feet from the animal.

e. WH&Bs that are roped and tied down in recumbency must be untied within 30 minutes.

f. If the animal is tied down within the wings of the trap, helicopter drive trapping within the wings will cease until the tied-down animal is removed.

g. Sleds, slide boards, or slip sheets must be placed underneath the animal's body to move and/or load recumbent WH&Bs.

h. Halters and ropes tied to a WH&B may be used to roll, turn, and position or load a recumbent animal, but a WH&B must not be dragged across the ground by a halter or rope attached to its body while in a recumbent position.

i. All animals captured by roping must be marked at the trap site by the contractor for evaluation by the on-site/on-call veterinarian within four hours after capture, and re-evaluation periodically as deemed necessary by the on-site/on-call veterinarian.

HANDLING

Willful Acts of Abuse

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The following are prohibited:
a. Hitting, kicking, striking, or beating any WH&B in an abusive manner.

b. Dragging a recumbent WH&B across the ground without a sled, slide board or slip sheet. Ropes used for moving the recumbent animal must be attached to the sled, slide board or slip sheet unless being loaded as specified in Section C 9.2.h

c. Deliberate driving of WH&Bs into other animals, closed gates, panels, or other equipment.

d. Deliberate slamming of gates and doors on WH&Bs.

e. Excessive noise (e.g., constant yelling) or sudden activity causing WH&Bs to become unnecessarily flighty, disturbed or agitated.

General Handling
a. All sorting, loading or unloading of WH&Bs during gathers must be performed during daylight hours except when unforeseen circumstances develop and the LCOR/COR/PI approves the use of supplemental light.

b. WH&Bs should be handled to enter runways or chutes in a forward direction.

c. WH&Bs should not remain in single-file alleyways, runways, or chutes longer than 30 minutes.

d. With the exception of helicopters, equipment should be operated in a manner to minimize flighty behavior and injury to WH&Bs.

Handling Aids
a. Handling aids such as flags and shaker paddles are the primary tools for driving and moving WH&Bs during handling and transport procedures. Contact of the flag or paddle end with a WH&B is allowed. Ropes looped around the hindquarters may be used from horseback or on foot to assist in moving an animal forward or during loading.

b. Routine use of electric prods as a driving aid or handling tool is prohibited. Electric prods may be used in limited circumstances only if the following guidelines are followed:

1. Electric prods must only be a commercially available make and model that uses DC battery power and batteries should be fully charged at all times.
2. The electric prod device must never be disguised or concealed.
3. Electric prods must only be used after three attempts using other handling aids (flag, shaker paddle, voice or body position) have been tried unsuccessfully to move the WH&Bs.
4. Electric prods must only be picked up when intended to deliver a stimulus; these devices must not be constantly carried by the handlers.
5. Space in front of an animal must be available to move the WH&B forward prior to application of the electric prod. 000230 Antelope and Triple B Complexes Gather Plan EA
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6. Electric prods must never be applied to the face, genitals, anus, or underside of the tail of a WH&B.
7. Electric prods must not be applied to any one WH&B more than three times during a procedure (e.g., sorting, loading) except in extreme cases with approval of the LCOR/COR/PI. Each exception must be approved at the time by the LCOR/COR/PI.

8. Any electric prod use that may be necessary must be documented daily by the LCOR/COR/PI including time of day, circumstances, handler, location (trap site or temporary holding facility), and any injuries (to WH&B or human)

MOTORIZED EQUIPMENT

Loading and Unloading Areas

a. Facilities in areas for loading and unloading WH&B's at the trap site or temporary holding facility must be maintained in a safe and proper working condition, including gates that swing freely and latch or tie easily.

b. The side panels of the loading chute must be a minimum of 6 feet high and fully covered with materials such as plywood or metal without holes that may cause injury.

c. There must be no holes, gaps or openings, protruding surfaces, or sharp edges present in fence panels or other structures that may cause escape or possible injury.

d. All gates and doors must open and close properly and latch securely.

e. Loading and unloading ramps must have a non-slip surface and be maintained in a safe and proper working condition to prevent slips and falls**.** Examples of non-slip flooring would include, but not be limited to, rubber mats, sand, shavings, and steel reinforcement rods built into ramp. There must be no holes in the flooring or items that can cause an animal to trip.

f. Trailers must be properly aligned with loading and unloading chutes and panels such that no gaps exist between the chute/panel and floor or sides of the trailer creating a situation where a WH&B could injure itself.

g. Stock trailers shall be positioned for loading or unloading such that there is no more than 12" clearance between the ground and floor of the trailer for burros and 18" for horses. . If animals refuse to load, it may be necessary to dig a tire track hole where the trailer level is closer to ground level.

TRANSPORTATION

A. General

1. All sorting, loading, or unloading of WH&Bs during gathers must be performed during daylight hours except when unforeseen circumstances develop and the LCOR/COR/PI approves the use of supplemental light.

2. WH&Bs identified for removal should be shipped from the temporary holding facility to a BLM facility within 48 hours.

3. Shipping delays for animals that are being held for release to range or potential on-site adoption must be approved by the LCOR/COR/PI.

4. Shipping should occur in the following order of priority; 1) debilitated animals, 2) pairs, 3) weanlings, 4) dry mares and 5) studs.

5. Total planned transport time to the BLM preparation facility from the trap site or temporary holding facility must not exceed 10 hours.

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6. WH&Bs should not wait in stock trailers and/or semi-trailers at a standstill for more than a combined period of three hours during the entire journey.

B. Vehicles

1. All motorized equipment employed in the transportation of captured animals shall be in compliance with appropriate State and Federal laws and regulations applicable to the humane transportation of animals. The Contractor shall provide the CO annually, with a current safety inspection (less than one year old) for all motorized equipment and tractor-trailers used to transport animals to final destination.

2. Only tractor-trailers or stock trailers with a covered top or overhead bars shall be allowed for transporting animals from trap site(s) to temporary holding facilities, and from temporary holding facilities to final destination(s). Sides or stock racks of all trailers used for transporting animals shall be a minimum height of 6 feet 6 inches from the floor. Single deck tractor-trailers 40 feet or longer shall have two (2) partition gates providing three (3) compartments within the trailer to separate animals. Tractor-trailers less than 40 feet shall have at least one partition gate providing two (2) compartments within the trailer to separate the animals. Compartments in all tractor-trailers shall be of equal size plus or minus 10 %. Each partition shall be a minimum of 6 feet high and shall have a minimum 5 foot wide swinging gate. The use of double deck tractor-trailers is prohibited. Only straight deck trailers and stock trailers are to be used for transporting WH&B's.

3. WH&B's must have adequate headroom during loading and unloading and must be able to maintain a normal posture with all four feet on the floor during transport without contacting the roof or overhead bars.

4. The width and height of all gates and doors must allow WH&B's to move through freely.

5. All gates and doors must open and close easily and be able to be secured in a closed position.

6. The rear door(s) of stock trailers must be capable of opening the full width of the trailer.

7. Loading and unloading ramps must have a non-slip surface and be maintained in proper working condition to prevent slips and falls.

8. All partitions and panels inside of trailers must be free of sharp edges or holes that could cause injury to WH&B's.

9. The inner lining of all trailers must be strong enough to withstand failure by kicking that would lead to injuries.

10. Partition gates in transport vehicles shall be used to distribute the load into compartments during travel.

11. Surfaces and floors of trailers must be cleaned of dirt, manure and other organic matter prior to the beginning of a gather.

12. Surfaces and floors of trailers shall have non-slip surface, use of shavings, dirt, and floor mates.

C. Care of WH&B's during Transport Procedures

1. WH&B's that are loaded and transported from the temporary holding facility to the BLM preparation facility must be fit to endure travel per direction of LCOR/COR/PI following consultation with on-site/on-call veterinarian.

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2. WH&B's that are non-ambulatory, blind in both eyes, or severely injured must not be loaded and shipped unless it is to receive immediate veterinary care or euthanasia.

3. WH&B's that are weak or debilitated must not be transported without approval of the LCOR/COR/PI in consultation with the on-site veterinarian. Appropriate actions for their care during transport must be taken according to direction of the LCOR/COR/PI.

4. WH&B's shall be sorted prior to transport to ensure compatibility and minimize aggressive behavior that may cause injury.

5. Trailers must be loaded using the minimum space allowance in all compartments as follows:

a. For a 6.8 foot wide; 24 foot long stock trailer 12 to 14 adult horses;
b. For a 6.8 foot wide; 24 foot long stock trailer 18 to 21 adult burros
c. For a 6.8 foot wide; 20 foot long stock trailer 10 to 12 adult horses can be loaded
d. For a 6.8 foot wide; 20 foot long stock trailer 15 to 18 adult burros

For a semi-trailer:
a. 12 square feet per adult horse.
bi. 6.0 square feet per dependent horse foal.
c. 8.0 square feet per adult burro.
d. 4.0 square feet per dependent burro foal

6. Considering the condition of the animals, prevailing weather, travel distance and other factors or if animals are going down on trailers or arriving at their destination down or with injuries or a condition suggesting they may have been down, additional space or footing provisions may be necessary and will be required if directed by the LCOR/COR.

7. The LCOR/COR/PI, in consultation with the receiving Facility Manager, must document any WH&B that is recumbent or dead upon arrival at the destination. Non-ambulatory or recumbent WH&B's must be evaluated on the trailer and either euthanized or removed from the trailers using a sled, slide board or slip sheet.

8. Saddle horses must not be transported in the same compartment with WH&B's.

EUTHANASIA or DEATH

Euthanasia Procedure during Gather Operations
1. An authorized, properly trained, and experienced person as well as a firearm appropriate for the circumstances must be available at all times during gather operations. When the travel time between the trap site and temporary holding facility exceeds one hour or if radio or cellular communication is not reliable, provisions for euthanasia must be in place at both the trap site and temporary holding facility during the gather operation.

2. Euthanasia must be performed according to American Veterinary Medical Association euthanasia guidelines (2013) using methods of gunshot or injection of an approved euthanasia agent.

3. The decision to euthanize and method of euthanasia must be directed by the LCOR/COR/PI who must be on site and may consult with the on-site/on-call veterinarian. In event and rare circumstance that the

LCOR/COR/PI is not available, the contractor if properly trained may euthanize an animal as an act of mercy.

4. All carcasses will be disposed of in accordance with state and local laws and as directed by the LCORCOR/PI.

5. Carcasses left on the range should not be placed in washes or riparian areas where future runoff may carry debris into ponds or waterways. Trenches or holes for buried animals should be dug so the bottom of the hole is at least 6 feet above the water table and 4-6 feet of level earth covers the top of the carcass with additional dirt mounded on top where possible.

COMMUNICATIONS

a. The Contractor shall have the means to communicate with the LCOR/COR/PI and all contractor personnel engaged in the capture of wild horses and burros utilizing a VHF/FM Transceiver or VHF/FM portable Two-Way radio.

b. The Contractor shall obtain the necessary FCC licenses for the radio system.

SAFETY AND SECURITY

a. All accidents involving animals or people that occur during the performance of any task order shall be immediately reported to the LCOR/COR/PI.

b. It is the responsibility of the Contractor to provide security to prevent unauthorized release, injury or death of captured animals until delivery to final destination.

c. The contractor must comply with all applicable federal, state and local regulations.

d. Fueling operations shall not take place within 1,000 feet of animals or personnel and equipment other than the refueling truck and equipment.

e. Children under the age of 12 shall not be allowed within the gather's working areas which include near the chute when working animals at the temporary holding facility, or near the pens at the trap site when working and loading of animals. Children under the age of 12 in the non-working area must be accompanied by an adult at either location at all times.

BIOSECURITY

A. Health records for all saddle and pilot horses used on WH&B gathers must be provided to the LCOR during the BLM/Contractor pre-work meeting, including:

1. Certificate of Veterinary Inspection (Health Certificate, within 30 days).
2. Proof of:
    a. A negative test for equine infectious anemia (Coggins or EIA ELISA test) within 12 months.
    b. Vaccination for tetanus, eastern and western equine encephalomyelitis, West Nile virus, equine herpes virus, influenza, *Streptococcus equi*, and rabies within 12 months.

B. Saddle horses and pilot horses must not be removed from the gather operation (such as for an equestrian event) and allowed to return unless they have been observed to be free from signs of infectious disease for a period of at least three weeks and a new Certificate of Veterinary Inspection is obtained after three weeks and prior to returning to the gather.

C. WH&B's, saddle horses, and pilot horses showing signs of infectious disease must be examined by the on-site/on-call veterinarian.

1. Any saddle or pilot horses showing signs of infectious disease (fever, nasal discharge or illness) must be removed from service and isolated from other animals on the gather until such time as the horse is free from signs of infectious disease and approved by the on-site/on-call veterinarian to return to the gather.

2. WH&B's showing signs of infectious disease will normally not be mixed with groups of healthy WH&B's at the temporary holding facility, or during transport..

PUBLIC AND MEDIA INTERACTION

a. Due to heightened public interest in wild horse and burro gathers, the BLM expects an increasing number of requests from the public and media to view the operation. All requests received by the Contractor to view gather operation shall be forwarded to the BLM, who will provide a person with the expertise necessary to escort the public and media. The safety of the WHB's, BLM employees, Contractor crew, Contractor's private animals, and the media and public will be the first priority in determining whether a viewing opportunity will be provided, and if so, the time, location, and conditions associated with the viewing opportunity.

b. Assuming the BLM determines that providing a viewing opportunity for the media and the public is appropriate, the Contractor will establish the viewing area in accordance with instructions from the LCOR/COR/PI and current wild horse and burro program policy and guidance. BLM's observation policy will be discussed with the contractor during the pre-work meeting.

c. Member(s) of the viewing public or media whose conduct interferes with the gather operation in a way that threatens the safety of the WH&B's, BLM employees, contractor crew (including animals), the media, or the public will be warned once to terminate the conduct. If the conduct persists, the offending individual(s) will be asked to leave the viewing area and the gather operation. The LCOR/COR/PI may direct the Contractor to temporarily shut down the gather operation until the situation is resolved.

d. Under no circumstances will the public or any media or media equipment be allowed in or on the gather helicopter or on the trap or holding equipment. The public, media, and media equipment must be at least 500 feet away from the trap during the trapping operation.

e. The public and media may be escorted closer than 500 feet to the trap site if approved by the LCOR/COR and in consultation with the Contractor during the time between gather runs or before or after the gather operation.

f. The Contractor shall not release any information to the news media or the public regarding the activities being conducted under this contract. All communications regarding BLM WH&B management, including but not limited to media, public and local stakeholders, are to come from the BLM unless it expressly authorizes the Contractor to give interviews, etc.

CONTRACTOR-FURNISHED PROPERTY

a. As specified herein, it is the contractor's responsibility to provide all necessary support equipment and vehicles including weed seed free hay and water for the captured animals and any other items, personnel, vehicles (which shall include good condition trucks and stock trailers to haul horses and burros from the trap site to the holding facility and two tractor trailers in good condition to haul horses from the holding facility to the preparation facility), saddle horses, etc. to support the humane and compassionate capture, care, feeding, transportation, treatment, and as appropriate, release of WHB's. Other equipment includes but is not limited to, a minimum 2,500 linear feet of 72-inch high (minimum height) panels for horses or

60-inch high (minimum height) for burros for traps and holding facilities. Separate water troughs shall be provided at each pen where animals are being held meeting the standards in section C.6. Water troughs shall be constructed of such material (e.g., rubber, galvanized metal with rolled edges, rubber over metal) so as to avoid injury to the animals.

b. The Contractor shall provide a radio transceiver to insure communications are maintained with the BLM project PI when driving or transporting the wild horses/burros. The contractor needs to insure communications can be made with the BLM and be capable of operating in the 150 MHz to 174 MHz frequency band, frequency synthesized, CTCSS 32 sub-audible tone capable, operator programmable, 5kHz channel increment, minimum 5 watts carrier power.

c. The Contractor shall provide water and weed seed free hay.

d. The proper operation, service and maintenance of all contractor furnished property is the responsibility of the Contractor.

BLM ROLES AND RESPONSIBILITIES

a. Veterinarian
1. On-site veterinary support must be provided for all helicopter gathers.

2. Veterinary support will be under the direction of the LCOR/COR/PI. Upon request, the on-site/on-call veterinarian will consult with the LCOR/COR/PI on matters related to WH&B health, handling, welfare and euthanasia. All final decisions regarding medical treatment or euthanasia will be made by the on-site LCOR/COR/PI based on recommendations from the on-site veterinarian.

b. Transportation
1. The LCOR/COR/PI shall consider the condition and size of the animals, weather conditions, distance to be transported to the final destination or release, recommendations from the contractor and on-site veterinarian and other factors when planning for the movement of captured animals. The LCOR/COR/PI shall provide for any brand inspection services required for the movement of captured animals to BLM prep facilities. If animals are to be transported over state lines the LCOR will be responsible for obtaining a waiver from the receiving State Veterinarian.

2. If the LCOR/COR/PI determines that conditions are such that the animals could be endangered during transportation, the Contractor will be instructed to adjust speed or delay transportation until conditions improve.

GOVERNMENT FURNISHED EQUIPMENT/SUPPLIES/MATERIALS
a. The government will provide:

1. A portable restraining chute for each contractor to be used for the purpose of restraining animals to determine the age of specific individuals or other similar procedures. The contractor will be responsible for the maintenance of the portable restraining chute during the gather season.
2. All inoculate syringes, freezemarking equipment, and all related equipment for fertility control treatments.
3. A boat to transport burros as appropriate.
4. Sleds, slide boards, or slip sheets for loading of recumbent animals.

b. The Contractor shall be responsible for the security of all Government Furnished Property.

SITE CLEARANCES
a. Prior to setting up a trap or temporary holding facility, BLM will conduct all necessary legal reviews and clearances (NEPA, ARPA, NHPA, etc.). All proposed site(s) must be inspected by a government archaeologist. Once archaeological clearance has been obtained, the trap or temporary holding facility may be set up. Said clearance shall be coordinated and arranged for by the COR/ PI, or other BLM employees.

Water and Bait Trapping Standard Operating Procedures
The work consists of the capture, handling, care, feeding, daily rate and transportation of wild horses and/or burros from the States of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah and Wyoming. The method of capture will be with the use of bait and/or water traps in accordance with the standards identified in the Comprehensive Animal Welfare Program (CAWP) for Wild horse and Burro Gathers, Bureau of Land Management (BLM) Instruction Memorandum 2015-151 (Attachment 1). Items listed in the sections of the Statement of Work (SOW) either are not covered or deviate from the CAWP, the SOW takes precedence over the CAWP when there is conflicting information. Extended care, handling and animal restraint for purposes of population growth suppression treatments may be required for some trapping operations. The contractor shall furnish all labor, supplies, transportation and equipment necessary to accomplish the individual task order requirements with the exception of a Government provided restraint fly chute, as needed for population growth suppression. The work shall be accomplished in a safe and humane manner and be in accordance with the provisions of 43 CFR Part 4700, the CAWP, the specifications and provisions included in this SOW, and any subsequent SOW documents issued with individual task orders. The primary concern of the contractor shall be the safety of all personnel involved and the humane capture and handling of all wild horses and burros. It is the responsibility of the contractor to provide appropriate safety and security measures to prevent loss, injury or death of captured wild horses and burros.

Any reference to hay in this SOW or subsequent SOW documents issued with individual task orders will be implied as certified weed-free hay (grass or alfalfa). The contractor will be responsible for providing certifications upon request from the Government. The COR/PI's will observe a minimum of at least 25% of the trapping activity. BLM reserves the right to place game cameras or other cameras in the capture area to document animal activity and response, capture techniques and procedures, and humane care during trapping. No private/non-BLM camera will be placed within the capture areas.

Trapping activities would be on the HA/HMA/WHBT or outside areas specified in the task order. However, trapping could be required on adjacent land, federal, state, tribal, military, or private property. If trapping operations include work on military and/or other restricted areas, the BLM will coordinate all necessary clearances, such as background checks, to conduct operations for equipment and personnel.

The permissions to use private/state/tribal lands during task order performance will be coordinated by the BLM, contractor, and landowner. The need for these permissions will be identified in the Task Order SOW and will be obtained in writing.

Prior to any gathering operation, the BLM will provide for a pre-capture evaluation of existing conditions in the gather area(s). The evaluation will include animal conditions, prevailing temperatures, drought conditions, soil conditions, road conditions, and preparation of a topographic map with wilderness boundaries, the location of fences, other physical barriers, and acceptable gather site locations in relation to animal distribution. The evaluation will determine whether the proposed activities will necessitate the presence of a veterinarian during operations. If it is determined that capture operations necessitate the services of a veterinarian, one would be obtained before the capture would proceed. The contractor will be apprised of all conditions and will be given instructions regarding the capture and handling of animals to ensure their health and welfare is protected.

Gather sites and temporary holding sites will be located to reduce the likelihood of undue injury and stress to the animals, and to minimize potential damage to the natural and cultural resources of the area. Temporary holding sites would be located on or near existing roads.

Bait Trapping - Facility Design (Temporary Holding Facility Area and Traps)
All trap and temporary holding facility areas locations must be approved by the COR and/or the Project Inspector (PI) prior to construction and/or operation. The contractor may also be required to change or move trap locations as determined by the COR/PI. All traps and temporary holding facilities not located on public land must have prior written approval of the landowner or other management agency.

Facility design to include traps, wings, alleys, handling pens, finger gates, and temporary holding facilities, etc. shall be constructed, maintained and operated to handle the wild horses and burros in a safe and humane manner in accordance with the standards identified in the Comprehensive Animal Welfare Program (CAWP) for Wild Horse and Burro Gathers, Bureau of Land Management (BLM) Instruction Memorandum 2015-151 (Attachment 1).

Some gather operations will require the construction of an off-site temporary holding facility as identified in specific individual task orders for extended care and handling for purposes of slow trapping conditions or management activities such as research, population growth suppression treatments, etc.

No modification of existing fences will be made without authorization from the COR/PI. The contractor shall be responsible for restoring any fences that are modified back to the original condition.

Temporary holding and sorting pens shall be of sufficient size to prevent injury due to fighting and trampling. These pens shall also allow for captured horses and burros to move freely and have adequate access to water and feed.

All pens will be capable of expansion when requested by the COR/PI.

Separate water troughs shall be provided for each pen where wild horses and burros are being held. Water troughs shall be constructed of such material (e.g., rubber, plastic, fiberglass, galvanized metal with rolled edges, and rubber over metal) so as to avoid injury to the wild horses and burros.

Any changes or substitutions to trigger and/or trip devices previously approved for use by the Government must be approved by the COR prior to use.

Bait Trapping, Animal Care, and Handling
If water is to be used as the bait agent and the Government determines that cutting off other water sources is the best action to take under the individual task order, elimination of other water sources shall not last longer than a period of time approved by the COR/PI.

Hazing/Driving of wild horses and burros for the purpose of trapping the animals will not be allowed for the purposes of fulfilling individual task orders. Roping will be utilized only as directed by the COR.

Darting of wild horses and burros for trapping purposes will not be allowed.

No barbed wire material shall be used in the construction of any traps or used in new construction to exclude horses or burros from water sources.

Captured wild horses and burros shall be sorted into separate pens (i.e. by age, gender, animal health/condition, population growth suppression, etc.).

A temporary holding facility area will be required away from the trap site for any wild horses and burros that are being held for more than 24 hours.

The contractor shall assure that captured mares/jennies and their dependent foals shall not be separated for more than 4 hours, unless the COR/PI determines it necessary.

The contractor shall provide a saddle horse on site that is available to assist with the pairing up of mares/jennies with their dependent foals and other tasks as needed.

Contractor will report any injuries/deaths that resulted from trapping operations as well as preexisting conditions to the COR/PI within 12 hours of capture and will be included in daily gather activity report to the COR.

The COR/PI may utilize contractor constructed facilities when necessary in the performance of individual task orders for such management actions as population growth suppression, and/or selecting animals to return to the range.

In performance of individual task orders, the contractor may be directed by the COR to transport and release wild horses or burros back to the range.

At the discretion of the COR/PI the contractor may be required to delay shipment of horses until the COR/PI inspects the wild horses and burros at the trap site and/or the temporary holding facility prior to transporting them to the designated facility.

Wild Horse and Burro Care and Biosecurity
The contractor shall restrain sick or injured wild horses and burros if treatment is necessary in consultation with the COR/PI and/or veterinarian.

Any saddle or pilot horses used by the contractor will be vaccinated within 12 months of use (EWT, West Nile, Flu/rhino, strangles).

Transportation and Animal Care
The contractor, following coordination with the COR, shall schedule shipments of wild horses and burros to arrive during the normal operating hours of the designated facility unless prior approval has been obtained from the designated facility manager by the COR. Shipments scheduled to arrive at designated facilities on a Sunday or a Federal holiday requires prior facility personnel approval.

All motorized equipment employed in the transportation of captured wild horses and burros shall be incompliance with appropriate State and Federal laws and regulations.

Sides or dividers of all trailers used for transporting wild horses and burros shall be a minimum height of 6 feet 6 inches from the floor. A minimum of one full height partition is required in each stock trailer. All trailers shall be covered with solid material or bars to prevent horses from jumping out.

The contractor shall consider the condition and size of the wild horses and burros, weather conditions, distance to be transported, or other factors when planning for the movement of captured wild horses and burros.

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The Government shall provide for any brand and/or veterinary inspection services required for captured wild horses and burros. Prior to shipping across state lines the Government will be responsible for coordinating with the receiving state veterinarian to transport the animals without a health certificate or coggins test. If the receiving state does not agree to grant entry to animals without a current health certificate or coggins test, the Government will obtain them prior to shipment.

When transporting wild horses and burros, drivers shall inspect for downed animals a minimum of every two hours when travelling on gravel roads or when leaving gravel roads onto paved roads and a minimum of every four hours when travelling on paved roads. a)

Euthanasia or Death
The COR/PI will determine if a wild horse or burro must be euthanized and will/may direct the contractor to destroy the animal in accordance with the BLM Animal Health, Maintenance,
Evaluation, and Response Instruction Memorandum, 2015-070 (Attachment 2). Any contractor personnel performing this task shall be trained as described in this Memorandum.

Pursuant to the IM 2015-070 the contractor may be directed by the Authorized Officer and/or COR to humanely euthanize wild horses and burros in the field and to dispose of the carcasses in accordance with state and local laws.

Safety and Communication
The nature of work performed under this contract may involve inherently hazardous situations. The primary concern of the contractor shall be the safety of all personnel involved and the humane handling of all wild horses and burros. It is the responsibility of the contractor to provide appropriate safety and security measures to prevent loss, injury or death of captured wild horses and burros until delivery to the final destination.

The BLM reserves the right to remove from service immediately any contractor personnel or contractor furnished equipment which, in the opinion of the COR and/or CO violate contract rules, are unsafe or otherwise unsatisfactory. In this event, BLM will notify the contractor to furnish replacement personnel or equipment within 24 hours of notification. All such replacements must be approved in advance by the COR and/or CO.

Contractor personnel who utilize firearms for purposes of euthanasia will be required to possess proof of completing a State or National Rifle Association firearm safety certification or equivalent (conceal carry, hunter safety, etc.).

All accidents involving wild horses and burros or people that occur during the performance of any task order shall be immediately reported to the COR/PI.

The contractor shall have the means to communicate with the COR/PI and all contractor personnel engaged in the capture of wild horses and burros utilizing a cell/satellite phone or radio at all times during the trapping operations. The Contractor will be responsible for furnishing all communication equipment for contractor use. BLM will provide the frequency for radio communications.

The contractor will provide daily gather activity reports to the COR/PI if they are not present.

Public and Media
Due to increased public interest in the Wild Horse and Burro Gathers, any media or visitation requests received by the contractor shall be forwarded to the COR immediately. Only the COR or CO can approve these requests.

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The Contractor shall not post any information or images to social media networks or release any information to the news media or the public regarding the activities conducted under this contract.

If the public or media interfere in any way with the trapping operation, such that the health and well-being of the crew, or horses and burros are threatened, the contractor will immediately report the incident to the COR and trapping operations will be suspended until the situation is resolved as directed by the COR.

1. All motorized equipment employed in the transportation of captured animals shall be in compliance with appropriate State and Federal laws and regulations applicable to the humane transportation of animals. The Contractor shall provide the COR/PI with a current safety inspection (less than one year old) for all motorized equipment and tractor-trailers used to transport animals to final destination.

2. All motorized equipment, tractor-trailers, and stock trailers shall be in good repair, of adequate rated capacity, and operated so as to ensure that captured animals are transported without undue risk or injury.

3. Only tractor-trailers or stock trailers with a covered top shall be allowed for transporting animals from gather site(s) to temporary holding facilities and from temporary holding facilities to final destination(s). Sides or stock racks of all trailers used for transporting animals shall be a minimum height of 6 feet 6 inches from the floor. Single deck tractor-trailers 40 feet or longer shall have two (2) partition gates providing three (3) compartments within the trailer to separate animals. Tractor-trailers less than 40 feet shall have at least one partition gate providing two (2) compartments within the trailer to separate the animals. Compartments in all tractor-trailers shall be of equal size plus or minus 10 %. Each partition shall be a minimum of 6 feet high and shall have a minimum 5 foot wide swinging gate. The use of double deck tractor-trailers is unacceptable and shall not be allowed.

4. All tractor-trailers used to transport animals to final destination(s) shall be equipped with at least one (1) door at the rear end of the trailer which is capable of sliding either horizontally or vertically. The rear door(s) of tractor- trailers and stock trailers must be capable of opening the full width of the trailer. Panels facing the inside of all trailers must be free of sharp edges or holes that could cause injury to the animals. The material facing the inside of all trailers must be strong enough so that the animals cannot push their hooves through the side. Final approval of tractor-trailers and stock trailers used to transport animals shall be held by the COR/PI.

5. Floors of tractor-trailers, stock trailers and loading chutes shall be covered and maintained with wood shavings to prevent the animals from slipping.

6. Animals to be loaded and transported in any trailer shall be as directed by the COR/PI and may include limitations on numbers according to age, size, sex, temperament and animal condition. The following minimum square feet per animal shall be allowed in all trailers:

a. 11 square feet per adult horse (1.4 linear foot in an 8 foot wide trailer);
b. 8 square feet per adult burro (1.0 linear foot in an 8 foot wide trailer);
c. 6 square feet per horse foal (.75 linear foot in an 8 foot wide trailer);
d. 4 square feet per burro foal (.50 linear feet in an 8 foot wide trailer).

7. The COR/PI shall consider the condition and size of the animals, weather conditions, distance to be transported, or other factors when planning for the movement of captured animals. The COR/PI shall provide for anybrand and/or inspection services required for the captured animals.
8. If the COR/PI determines that dust conditions are such that the animals could be endangered during transportation, the Contractor will be instructed to adjust speed.

Safety and Communications
1. The Contractor shall have the means to communicate with the COR/PI and all contractor personnel engaged in the capture of wild horses and burros utilizing a VHF/FM Transceiver or VHF/FM portable Two-Way radio. If communications are ineffective the government will take steps necessary to protect the welfare of the animals.

a. The proper operation, service and maintenance of all contractor furnished property are the responsibility of the Contractor. The BLM reserves the right to remove from service any contractor personnel or contractor furnished equipment which, in the opinion of the contracting officer or COR/PI violate contract rules, are unsafe or otherwise unsatisfactory. In this event, the Contractor will be notified in writing to furnish replacement personnel or equipment within 48 hours of notification. All such replacements must be approved in advance of operation by the Contracting Officer or his/her representative.

b. The Contractor shall obtain the necessary FCC licenses for the radio system

c. All accidents occurring during the performance of any task order shall be immediately reported to the COR/PI.

Public and Media
Due to heightened public interest in wild horse and burro gathers, the BLM/Contractor may expect an increasing number of requests from the public and media to view the operation.

1. Due to this type of operation (luring wild horses and burros to bait) spectators and viewers will be prohibited as it will have impacts on the ability to capture wild horses and burros. Only essential personnel (COR/PI, veterinarian, contractor, contractor employees, etc.) will be allowed at the trap site during operations.

2. Public viewing of the wild horses and burros trapped may be provided at the staging area and/or the BLM preparation facility by appointment.

3. The Contractor agrees that there shall be no release of information to the news media regarding the removal or remedial activities conducted under this contract.

4. All information will be released to the news media by the assigned government public affairs officer.

5. If the public or media interfere in any way with the trapping operation, such that the health and wellbeing of the crew, horses and burros is threatened, the trapping operation will be suspended until the situation is resolved.

COR/PI Responsibilities
a. In emergency situations, the COR/PI will implement procedures to protect animals as rehab is initiated, i.e. rationed feeding and watering at trap and or staging area.

b. The COR/PI will authorize the contractor to euthanize any wild horse or burros as an act of mercy.

c. The COR/PI will ensure wild horses or burros with pre-existing conditions are euthanized in the field according to BLM policy.

d. Prior to setting up a trap or staging area on public land, the BLM and/or Forest Service will conduct all necessary clearances (archaeological, T&E, etc.). All proposed sites must be inspected by a government

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archaeologist or equivalent. Once archaeological clearance has been obtained, the trap or staging area may be set up. Said clearances shall be arranged for by the COR/PI.

e. The COR/PI will provide the contractor with all pertinent information on the areas and wild horses and burros to be trapped.

f. The COR/PI will be responsible to establish the frequency of communicating with the contractor.

g. The COR/PI shall inspect trap operation prior to Contractor initiating trapping.

h. The Contractor shall make all efforts to allow the COR/PI to observe a minimum of at least 25% of the trapping activity.

i. The COR/PI is responsible to arrange for a brand inspector and/or veterinarian to inspect all wild horses and burros prior to transporting to a BLM preparation facility when legally required.

j. The COR/PI will be responsible for the establishing a holding area for administering PZP, gelding of stallions, holding animals in poor condition until they are ready of shipment, holding for EIA testing, etc.

k. The COR/PI will ensure the trailers are cleaned and disinfected before WH&B's are transported. This will help prevent transmission of disease into our populations at a BLM Preparation Facility.

Responsibility and Lines of Communication
The Wild Horse Specialist (COR) or delegate has direct responsibility to ensure human and animal safety. The Field Manager will take an active role to ensure that appropriate lines of communication are established between the field, field office, state office, national program office, and BLM holding facility offices.

All employees involved in the gathering operations will keep the best interests of the animals at the forefront at all times.

All publicity and public contact and inquiries will be handled through the Office of Communications. These individuals will be the primary contact and will coordinate with the COR on any inquiries.

The BLM delegate will coordinate with the corrals to ensure animals are being transported from the capture site in a safe and humane manner and are arriving in good condition.

The BLM require humane treatment and care of the animals during removal operations. These specifications are designed to minimize the risk of injury and death during and after capture of the animals. The specifications will be vigorously enforced.

Resource Protection
Gather sites and holding facilities would be located in previously disturbed areas whenever possible to minimize potential damage to the natural and cultural resources.

Gather sites and temporary holding facilities would not be constructed on wetlands or riparian zones.

Prior to implementation of gather operations, gather sites and temporary holding facilities would be evaluated to determine their potential for containing cultural resources. All gather facilities (including gather sites, gather run- ways, blinds, holding facilities, camp locations, parking areas, staging areas, etc.) that would be located partially or totally in new locations (i.e. not at previously used gather locations) or

in previously undisturbed areas would be inventoried by a BLM archaeologist or district archaeological technician before initiation of the gather. A buffer of at least 50 meters would be maintained between gather facilities and any identified cultural resources.

Gather sites and holding facilities would not be placed in known areas of Native American concern.

The contractor would not disturb, alter, injure or destroy any scientifically important paleontological remains; any historical or archaeological site, structure, building, grave, object or artifact; or any location having Native American traditional or spiritual significance within the project area or surrounding lands. The contractor would be responsible for ensuring that its employees, subcontractors or any others associated with the project do not collect artifacts and fossils, or damage or vandalize archaeological, historical or paleontological sites or the artifacts within them.

Should damage to cultural or paleontological resources occur during the period of gather due to the unauthorized, inadvertent or negligent actions of the contractor or any other project personnel, the contractor would be responsible for costs of rehabilitation or mitigation. Individuals involved in illegal activities may be subject to penalties under the Archaeological Resources Protection

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Appendix F. Impacts Analysis Table

To comply with the National Environmental Policy Act (NEPA), the BLM is required to address specific elements of the environment that are subject to requirements specified in statute or regulation or by executive order. The following table outlines the elements that must be addressed in all environmental analyses, as well as other resources deemed appropriate for evaluation by the BLM, and denotes if the Proposed Action, sequential alternatives, or the No Action Alternative affects those elements.

Supplemental Authorities	Present	Affected	Rationale
Areas of Critical Environmental Concern	***No***	***No***	No ACECs are present in the project area.
Air Quality (Clean Air Act)	***Yes***	***No***	Minimal effects to the air quality in the project area. For that reason, air quality could not be analyzed in detail.
Cultural Resources (National Historic Preservation Act)	***Yes***	***No***	To prevent any impacts to cultural resources, trap sites and temporary holding facilities would be located in previously disturbed areas. Cultural resource inventory and clearance would be required prior to using trap sites or holding facilities outside existing areas of disturbance.
Fish Habitat (BLM Sensitive and ESA)	***No***	***No***	There are no fish bearing streams within the Saylor Creek HMA. Fish habitat is not affected by the proposed gather of wild horses.
Floodplains (Executive Order (EO) 11988)	***Yes***	***No***	The floodplains for the three ephemeral streams within the HMA (Saylor Cr, Deadman Cr. and Pothole Cr) would not be modified by the proposed gather of wild horses.
Fuels / Fire Management	***No***	***No***	Fire and fuels conditions should not be affected by the proposed gather of wild horses in the HMA.
Invasive, Non-native Species (Federal Noxious Weed Control Act, EO 13112)	***Yes***	***Yes***	Actions may impact spread of invasive, non-native species.
Lands / Access	***Yes***	***No***	The proposed action is not anticipated to impact the existing land uses within the project area. The level of access to the area may be limited during gather of the horses; however, these will be short-term in nature and limited to the duration of the gather activities.
Livestock Grazing	***Yes***	***Yes***	Availability of forage and difficulty of managing livestock will be affected
Migratory Birds (Migratory Bird Treaty Act, EO 13186)	***Yes***	***No***	Due to wild fires, the project area is nearly all grassland. Small limited patches of sagebrush habitat are present. Birds present are principally grassland and generalist species. Ravens may be attracted to bait (if used). Ravens and raptors could panels as perch sites. Impact to nesting migratory birds would be avoided it trapping occurred from late summer to early spring. Potential impacts would negligible, localized and could not be meaningfully analyzed.
Native American Religious Concerns	***Yes***	***No***	Access to sacred sites and religious practices will not be impeded by the gather of wild horses.

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(American Indian Religious Freedom Act)			
Paleontology	***Yes***	***No***	Impacts to fossil sites from wild horses have not been documented in the project area.
Rangeland Health Standards and Guidelines	***Yes***	***Yes***	Grazing by wild horses could affect rangeland health.
Recreation	***Yes***	***No***	Minimal effects to the dispersed recreation activities for the project area. Could not be analyzed in detail.
Socio-economics	***Yes***	***No***	The proposed action will not impact the socioeconomics of the areas.
Soils	***Yes***	***No***	Minimal effects to the soils, as trapping would occur at previously disturbed trough sites. Could not be analyzed in detail
Threatened or Endangered Plant Species (Endangered Species Act)	***No***	***No***	Plants listed under the ESA or their critical habitat is not present in the project area, though potential habitat for slickspot peppergrass does occur. Inventory in portions of the area documented slickspots, but no slickspot peppergrass plants. Multiple wildfires and subsequent stabilization treatments have altered habitat in the HMA and are largely unsuitable for slickspot peppergrass. Because water troughs would be used as trap sites, impacts would occur within existing disturbance footprint. Additional impacts to habitat from a reduction of herd size could not be meaningfully analyzed.
Threatened or Endangered Animal Species (Endangered Species Act)	***No***	***No***	No listed or candidate species are present in the project area. Habitat used by yellow-billed cuckoo does not occur in the area.
Threatened or Endangered Aquatic Species (Endangered Species Act)	***No***	***No***	There are no ESA listed aquatic species or their habitat present in the Saylor Creek HMA. ESA listed species or designated critical habitat their habitat would not be affected by the proposed gather of wild horses to the HMA.
Vegetation including Special Status Plant Species	***Yes***	***No***	Special status plants Greeley springparsley (*Cymopterus acaulis* var. *greeleyorum*), whitewooly buckwheat (*Eriogonum ochrocephalum* var. *calcareum*), and Antelope Valley beardtongue (*Penstemon janishiae*) are known to be present in the HMA, including pastures where trapping would occur. Known population do no occur within or adjacent to trough sites where trapping in planned and the most impacts are anticipated, and thus will not be directly impacted by project activities. Additional impacts to habitat from a reduction of herd size could not be meaningfully analyzed due to the small magnitude of anticipated impacts and the large distance to known populations of sensitive plants.
Visual Resources	***Yes***	***No***	Any visual effects would be short term and minor in nature. The project sites fall within a VRM Class IV area. The objective of this class is to provide for management activities which require major modification of the existing character of the

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			landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements. This project complies with the VRM Class IV objective.
Wastes (hazardous or solid) (Resource Conservation and Recovery Act Comprehensive Environmental Response Compensation and Liability Act)	***Yes***	***No***	No hazardous wastes would be present in the project area. Vehicles accessing the project area would be maintained and operated to prevent accidental leaks or spills.
Water Rights	***Yes***	***No***	Water rights would not be affected.
Water Quality (drinking/ground) (Safe Drinking Water Act, Clean Water Act)	***No***	***No***	Surface water is not present within the Saylor Creek HMA. Water quality and/or quantity would not be affected.
Wetlands/Riparian Zones (EO 11990)	***No***	***No***	The three ephemeral streams within the Saylor Creek HMA do not contain surface water sufficient to support riparian or wetland vegetation. Riparian areas and wetlands would not be affected.
Wild and Scenic Rivers (Wild and Scenic Rivers Act)	***No***	***No***	There are no suitable or eligible Wild and Scenic River segments near the project area.
Wilderness and/or Wilderness Study Areas (Wilderness Act, Federal Land Policy and Management Act)	***No***	***No***	The project is not within any designated Wilderness area. The project is not within, or adjacent to, any Wilderness Study Areas. The area does not contain wilderness characteristics.
Wildlife including Special Status Species	***Yes***	***No***	Ferruginous hawk nest and golden eagles nest within the HMA using cliffs and rock outcrops as nest sites. Several special status species associated with grassland habitat (long-billed, curlew, short-eared owl, burrowing owl, and grasshopper sparrow) nest within the HMA. Piute ground squirrels are present at low density in the HMA. Wild fires have eliminated any sizeable (> 20 ac) areas of sagebrush habitat used by pygmy rabbit, sage-grouse, Brewer's sparrow, sagebrush sparrow, sage thrasher and loggerhead shrike. Habitat for sage-grouse was historically present in the West Pasture of the Twin Butte Allotment; however, sage-grouse use is unlikely because recurring wildfires have essentially removed sagebrush, a key habitat component for sage-grouse. There are no records of sage-grouse leks within the HMA. Potential impacts to special status wildlife would be localized and negligible. Impacts could not be meaningfully be analyzed.
Wild Horses	***Yes***	***Yes***	Please refer to Section 3.2

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Appendix G. Literature Cited

Angle, M., J. W. Turner Jr., R. M. Kenney, and V. K. Ganjam. 1979. Androgens in feral stallions. Pages 31–38 in Proceedings of the Symposium on the Ecology and Behaviour of Wild and Feral Equids, University of Wyoming, Laramie.

Asa, C. S. 1999. Male reproductive success in free-ranging feral horses. Behavioural Ecology and Sociobiology 47:89–93.

Asa, C. S., D. A. Goldfoot, and O. J. Ginther. 1979. Sociosexual behavior and the ovulatory cycle of ponies (Equus caballus) observed in harem groups. Hormones and Behavior 13:49–65.

Asa, C. S., D. A. Goldfoot, M. C. Garcia, and O. J. Ginther. 1980a. Dexamethasone suppression of sexual behavior in the ovariectomized mare. Hormones and Behavior.

Asa, C., D. A. Goldfoot, M. C. Garcia, and O. J. Ginther. 1980b. Sexual behavior in ovariectomized and seasonally anovulatory pony mares (Equus caballus). Hormones and Behavior 14:46–54.

Asa, C., D. Goldfoot, M. Garcia, and O. Ginther. 1984. The effect of estradiol and progesterone on the sexual behavior of ovariectomized mares. Physiology and Behavior 33:681–686.

Ashley, M.C., and D.W. Holcombe. 2001. Effects of stress induced by gathers and removals on reproductive success of feral horses. Wildlife Society Bulletin 29:248-254.

Ashley, M.C., and D.W. Holcombe. 2001. Effects of stress induced by gathers and removals on reproductive success of feral horses. Wildlife Society Bulletin 29:248-254.

Bagavant, H., C. Sharp, B. Kurth, and K.S.K. Tung. 2002. Induction and immunohistology of autoimmune ovarian disease in cynomolgus macaques (Macaca fascicularis). American Journal of Pathology 160:141-149.

Baker, D.L., J.G. Power, J.I. Ransom, B.E. McCann, M.W. Oehler, J.E. Bruemmer, N.L. Galloway, D.C. Eckery, and T.M. Nett. 2018. Reimmunization increases contraceptive effectiveness of gonadotropin-releasing hormone vaccine (GonaCon-Equine) in free-ranging horses (Equus caballus): Limitations and side effects. PLoS ONE 13(7): e0201570.

Baker, D.L., J.G. Powers, J. Ransom, B. McCann, M. Oehler, J. Bruemmer, N. Galloway, D. Eckery, and T. Nett. 2017. Gonadotropin-releasing hormone vaccine (GonaCon-Equine) suppresses fertility in free-ranging horses (Equus caballus): limitations and side effects. Proceedings of the 8th International Wildlife Fertility Control Conference, Washington, D.C.

Baker, D.L., J.G. Powers, M.O. Oehler, J.I. Ransom, J. Gionfriddo, and T.M. Nett. 2013. Field evaluation of the Immunocontraceptive GonaCon-B in Free-ranging Horses (Equus caballus) at Theodore Roosevelt National Park. Journal of Zoo and Wildlife Medicine 44:S141-S153.

Baldock, P. A. J., H. A. Morris, A. G. Need, R. J. Moore, and T. C. Durbridge. 1998. Variation in the short-term changes in bone cell activity in three regions of the distal femur immediately following ovariectomy. Journal of Bone and Mineral Research 13:1451–1457.

Balet, L., F. Janett, J. Hüsler, M. Piechotta, R. Howard, S. Amatayakul-Chantler, A. Steiner, and G. Hirsbrunner, 2014. Immunization against gonadotropin-releasing hormone in dairy cattle: Antibody titers, ovarian function, hormonal levels, and reversibility. Journal of Dairy Science 97:2193-2203.

Barber, M.R., and R.A. Fayer-Hosken. 2000. Evaluation of somatic and reproductive immunotoxic effects of the porcine zone pellucida vaccination. Journal of Experimental Zoology 286:641-646.

Bartholow, J. 2007. Economic benefit of fertility control in wild horse populations. The Journal of Wildlife Management 71:2811-2819.

Bartholow, J.M. 2004. An economic analysis of alternative fertility control and associated management techniques for three BLM wild horse herds. USGS Open-File Report 2004-1199.

Bartholow, J.M. 2007. Economic benefit of fertility control in wild horse populations. Journal of Wildlife Management 71:2811-2819.

DRAFT

Bechert, U., J. Bartell, M. Kutzler, A. Menino, R. Bildfell, M. Anderson, and M. Fraker. 2013. Effects of two porcine zona pellucida immunocontraceptive vaccines on ovarian activity in horses. The Journal of Wildlife Management 77:1386-1400.

Bechert, U.S., and M.A. Fraker. 2018. Twenty years of SpayVac research: potential implications for regulating feral horse and burro populations in the United States. Human-Wildlife Interactions 12:117-130.

Beck, J.L. and D.L. Mitchell. 2000. Influence of livestock grazing on sage grouse habitat. Wildlife Society Bulletin 28:993-1002.

Beckett, T., A. E. Tchernof, and M. J. Toth. 2002. Effect of ovariectomy and estradiol replacement on skeletal muscle enzyme activity in female rats. Metabolism 51:1397–1401.

Beever, E. 2003. Management implications of the ecology of free-roaming horses in semi-arid ecosystems of the Western United States. Wildlife Society Bulletin 31(3):887-895.

Beever, E.A., and P.F. Brussard. 2000. Examining the ecological consequences of feral horse grazing using exclosures. Western North American Naturalist 60(3):236-254.

Belsito, K. R., B. M. Vester, T. Keel, T. K. Graves, and K. S. Swanson. 2008. Impact of ovariohysterectomy and food intake on body composition, physical activity, and adipose gene expression in cats. Journal of Animal Science 87:594–602.

Berger, J. 1985. Interspecific interactions and dominance among wild Great Basin ungulates. Journal of Mammalogy 66(3):571-573.

Berger, J. 1986. Wild horses of the Great Basin. University of Chicago Press, Chicago.

Bertin, F. R., K. S. Pader, T. B. Lescun, and J. E. Sojka-Kritchevsky. 2013. Short-term effect of ovariectomy on measures of insulin sensitivity and response to dexamethasone administration in horses. American Journal of Veterinary Research 74:1506–1513.

Boedeker, N.C., L.A.C. Hayek, S. Murray, D.M. De Avila, and J.L. Brown. 2012. Effects of a gonadotropin-releasing hormone vaccine on ovarian cyclicity and uterine morphology of an Asian elephant (Elephas maximus). Journal of Zoo and Wildlife Medicine 43:603-614.

Bohrer, B.M., W.L. Flowers, J.M. Kyle, S.S. Johnson, V.L. King, J.L. Spruill, D.P. Thompson, A.L. Schroeder, and D.D. Boler. 2014. Effect of gonadotropin releasing factor suppression with an immunological on growth performance, estrus activity, carcass characteristics, and meat quality of market gilts. Journal of Animal Science 92:4719-4724.

Borsberry, S. 1980. Libidinous behaviour in a gelding. Veterinary Record 106:89–90.

Botha, A.E., M.L. Schulman, H.J. Bertschinger, A.J. Guthrie, C.H. Annandale, and S.B. Hughes. 2008. The use of a GnRH vaccine to suppress mare ovarian activity in a large group of mares under field conditions. Wildlife Research 35:548-554.

Bowen, Z. 2015. Assessment of spay techniques for mare in field conditions. Letter from US Geological Survey Fort Collins Science Center to D. Bolstad, BLM. November 24, 2015. Appendix D in Bureau of Land Management, 2016, Mare Sterilization Research Environmental Assessment, DOI-BLM-O-B000-2015-055-EA, Hines, Oregon.

Brown, B.W., P.E. Mattner, P.A.Carroll, E.J. Holland, D.R. Paull, R.M. Hoskinson, and R.D.G. Rigby. 1994. Immunization of sheep against GnRH early in life: effects on reproductive function and hormones in rams. Journal of Reproduction and Fertility 101:15-21.

Bureau of Land Management (BLM). 2010. Wild Horse and Burro Management Handbook 4700-1.

Bureau of Land Management. 1987. Jarbidge Resource Management Plan: Record of Decision. BLM Boise District. Boise, ID.

Bureau of Land Management. 2004. Permit Renewal and Vegetation Allocation Environmental Assessment No. ID-097-2004-011.

Bureau of Land Management. 2007. Environmental Assessment of Noxious and Invasive Weed Treatment for Boise District Office and Jarbidge Field Office.

Bureau of Land Management. 2010. 4700-1 Handbook. Wild Horses and Burros Management. Washington. DC.

DRAFT

Camara, C., L.-Y. Zhou, Y. Ma, L. Zhu, D. Yu, Y.-W. Zhao, and N.-H. Yang. 2014. Effect of ovariectomy on serum adiponectin levels and visceral fat in rats. Journal of Huazhong University of Science and Technology [Medical Sciences] 34:825–829.

Chaudhuri, M., and J. R. Ginsberg. 1990. Urinary androgen concentrations and social status in two species of free ranging zebra (Equus burchelli and E. grevyi). Reproduction 88:127–133.

Coates-Markle, L. 2000. Summary Recommendations, BLM Wild Horse and Burro Population Viability Forum April 1999, Ft. Collins, CO. Resource Notes 35:4.

Coit V. A., F. J. Dowell, and N. P. Evans. 2009. Neutering affects mRNA expression levels for the LH- and GnRH-receptors in the canine urinary bladder. Theriogenology 71:239-247.

Coit, V.A., F.J. Dowell, and N.P.Evans. 2009. Neutering affects mRNA expression levels for the LH-and GnRH-receptors in the canine urinary bladder. Theriogenology 71:239-247.

Colborn, D. R., D. L. Thompson, T. L. Roth, J. S. Capehart, and K. L. White. 1991. Responses of cortisol and prolactin to sexual excitement and stress in stallions and geldings. Journal of Animal Science 69:2556–2562.

Collins, G. H., and J. W. Kasbohm. 2016. Population dynamics and fertility control of feral horses. Journal of Wildlife Management 81: 289-296.

Cooper, D.W. and C.A. Herbert. 2001. Genetics, biotechnology and population management of over-abundant mammalian wildlife in Australasia. Reproduction, Fertility and Development 13:451-458.

Cooper, D.W. and E. Larsen. 2006. Immunocontraception of mammalian wildlife: ecological and immunogenetic issues. Reproduction 132, 821–828.

Cothran, E.G. 2010. Genetic Analysis of the Saylor Creek HMA, ID. Texas A&M University. College Station.

Crabtree, J. R. 2016. Can ovariectomy be justified on grounds of behaviour? Equine Veterinary Education 28: 58–59.

Creel, S., B. Dantzer, W. Goymann, and D.R. Rubenstein. 2013. The ecology of stress: effects of the social environment. Functional Ecology 27:66-80.

Crowell-Davis, S. L. 2007. Sexual behavior of mares. Hormones and Behavior 52:12-17.

Curtin, C.G. 2002. Livestock grazing, rest, and restoration in arid landscapes. Conservation Biology 16:840-842.

Curtis, P.D., R.L. Pooler, M.E. Richmond, L.A. Miller, G.F. Mattfeld, and F.W Quimby. 2001. Comparative effects of GnRH and porcine zona pellucida (PZP) immunocontraceptive vaccines for controlling reproduction in white-tailed deer (Odocoileus virginianus). Reproduction (Cambridge, England) Supplement 60:131-141.

Curtis, P.D., R.L. Pooler, M.E. Richmond, L.A. Miller, G.F. Mattfeld, and F.W. Quimby. 2008. Physiological Effects of gonadotropin-releasing hormone immunocontraception in white-tailed deer. Human-Wildlife Conflicts 2:68-79.

Curtis, P.D., R.L. Pooler, M.E. Richmond, L.A. Miller, G.F. Mattfeld, and F.W Quimby. 2001. Comparative effects of GnRH and porcine zona pellucida (PZP) immunocontraceptive vaccines for controlling reproduction in white-tailed deer (Odocoileus virginianus). Reproduction (Cambridge, England) Supplement 60:131-141.

Dalin, A.M., Ø. Andresen, and L. Malmgren. 2002. Immunization against GnRH in mature mares: antibody titres, ovarian function, hormonal levels and oestrous behaviour. Journal of Veterinary Medicine Series A 49:125-131.

Dalmau, A., A. Velarde, P. Rodríguez, C. Pedernera, P. Llonch, E. Fàbrega, N. Casal, E. Mainau, M. Gispert, V. King, and N. Slootmans. 2015. Use of an anti-GnRF vaccine to suppress estrus in crossbred Iberian female pigs. Theriogenology 84:342-347.

de Seve, C.W. and S.L. Boyles Griffin. 2013. An economic model demonstrating the long-term cost benefits of incorporating fertility control into wild horse (Equus caballus) management in the United States. Journal of Zoo and Wildlife Medicine 44:S34-S37.

DRAFT

de Seve, C.W. and S.L. Boyles-Griffin. 2013. An economic model demonstrating the long-term cost benefits of incorporating fertility control into wild horse (Equus caballus) management in the United States. Journal of Zoo and Wildlife Medicine 44(4s:S34-S37).

Deniston, R. H. 1979. The varying role of the male in feral horses. Pages 93–38 in Proceedings of the Symposium on the Ecology and Behaviour of Wild and Feral Equids, University of Wyoming, Laramie.

Dixson, A. F. 1993. Sexual and aggressive behaviour of adult male marmosets (Callithrix jacchus) castrated neonatally, prepubertally, or in adulthood. Physiology and Behavior 54:301–307.

Dong, F., D.C. Skinner, T. John Wu, and J. Ren. 2011. The Heart: A Novel Gonadotrophin-Releasing Hormone Target. Journal of Neuroendocrinology 23:456-463.

Donovan, C.E., T. Hazzard, A. Schmidt, J. LeMieux, F. Hathaway, and M.A. Kutzler. 2013. Effects of a commercial canine gonadotropin releasing hormone vaccine on estrus suppression and estrous behavior in mares. Animal Reproduction Science, 142:42-47.

Dunbar, I. F. 1975. Behaviour of castrated animals. The Veterinary Record 92–93.

Duncan, C.L., J.L. King, and P. Stapp. 2017. Effects of prolonged immunocontraception on the breeding behavior of American bison. Journal of Mammalogy 98:1272-1287.

Eagle, T. C., C. S. Asa, R. A. Garrott, E. D. Plotka, D. B. Siniff, and J. R. Tester. 1993. Efficacy of dominant male sterilization to reduce reproduction in feral horses. Wildlife Society Bulletin 21:116–121.

Elhay, M., A. Newbold, A. Britton, P. Turley, K. Dowsett, and J. Walker. 2007. Suppression of behavioural and physiological oestrus in the mare by vaccination against GnRH. Australian Veterinary Journal 85:39-45.

Environmental Protection Agency (EPA). 2012. Porcine Zona Pellucida. Pesticide fact Sheet. Office of Chemical Safety and Pollution Prevention 7505P. 9 pages.

EPA (United States Environmental Protection Agency). 2009a. Pesticide Fact Sheet: Mammalian Gonadotropin Releasing Hormone (GnRH), New Chemical, Nonfood Use, USEPA-OPP, Pesticides and Toxic Substances. US Environmental Protection Agency, Washington, DC

EPA 2013. Notice of pesticide registration for GonaCon-Equine. US Environmental Protection Agency, Washington, DC.

EPA. 2009b. Memorandum on GonaCon ™ Immunocontraceptive Vaccine for Use in White-Tailed Deer. Section 3 Registration. US Environmental Protection Agency, Washington, DC.

EPA. 2015. Label and CSF Amendment. November 19, 2015 memo and attachment from Marianne Lewis to David Reinhold. US Environmental Protection Agency, Washington, DC.

Evans, J. W., A. Borton, H. F. Hintz, and L. D. Van Vleck. 1977. The Horse. San Francisco, California: W.H. Freeman and Company. Pages 373–377.

Evans, R.A., and J.A. Young. 1978. Effectiveness of rehabilitation practices following wildfire in a degraded big sagebrush-downy brome community. Journal of Range Management 31(3):185-188.

Feh, C. 1999. Alliances and reproductive success in Camargue stallions. Animal Behaviour 57:705–713.

Feh, C. 2012. Delayed reversibility of PZP (porcine zona pellucida) in free-ranging Przewalski's horse mares. In International Wild Equid Conference. Vienna, Austria: University of Veterinary Medicine.

Feist, J. D., and D.R. McCullough. 1976. Behavior patterns and communication in feral horses. Zietschrift für Tierpsychologie 41:337–371.

Fettman, M. J., C. A. Stanton, L. L. Banks, D. W. Hamar, D. E. Johnson, R. L. Hegstad, and S. Johnston. 1997. Effects of neutering on bodyweight, metabolic rate and glucose tolerance of domestic cats. Research in Veterinary Science 62:131–136.

Fleischner, T.L. 1994. Ecological Costs of Livestock Grazing in Western North America. Conservation Biology 8:629-644.

Fonner, R. and A.K. Bohara. 2017. Optimal control of wild horse populations with nonlethal methods. Land Economics 93:390-412.

DRAFT

French, H., E. Peterson, R. Ambrosia, H. Bertschinger, M. Schulman, M. Crampton, R. Roth, P. Van Zyl, N. Cameron-Blake, M. Vandenplas, and D. Knobel. 2017. Porcine and recombinant zona pellucida vaccines as immunocontraceptives for donkeys in the Caribbean. Proceedings of the 8th International Wildlife Fertility Control Conference, Washington, D.C.

Ganskopp, D., and M. Vavra. 1987. Slope use by cattle, feral horses, deer, and bighorn sheep. Northwest Science 61(2):74-81.

Garcia, M. C., and O. J. Ginther. 1976. Effects of Ovariectomy and Season on Plasma Luteinizing Hormone in Mares. Endocrinology 98:958–962.

Garrot. R. A., and I. Taylor. 1990. Dynamics of a feral horse population in Montana. Journal of Wildlife Management 54:603-612.

Garrott , R.A., and D.B. Siniff. 1992. Limitations of male-oriented contraception for controlling feral horse populations. Journal of Wildlife Management 56:456-464.

Garrott, R.A., and M.K. Oli. 2013. A Critical Crossroad for BLM's Wild Horse Program. Science 341:847-848.

Garza, F., D.L. Thompson, D.D. French, J.J. Wiest, R.L. St George, K.B. Ashley, L.S. Jones, P.S. Mitchell, and D.R. McNeill. 1986. Active immunization of intact mares against gonadotropin-releasing hormone: differential effects on secretion of luteinizing hormone and follicle-stimulating hormone. Biology of Reproduction 35:347-352.

Getman, L.M. 2009. Review of castration complications: strategies for treatment in the field. AAEP Proceedings 55:374-378.

Gionfriddo, J.P., A.J. Denicola, L.A. Miller, and K.A. Fagerstone. 2011a. Efficacy of GnRH immunocontraception of wild white-tailed deer in New Jersey. Wildlife Society Bulletin 35:142-148.

Gionfriddo, J.P., A.J. Denicola, L.A. Miller, and K.A. Fagerstone. 2011b. Health effects of GnRH immunocontraception of wild white-tailed deer in New Jersey. Wildlife Society Bulletin 35:149-160.

Goodloe, R.B., 1991. Immunocontraception, genetic management, and demography of feral horses on four eastern US barrier islands. UMI Dissertation Services.

Government Accountability Office (GAO). 2008. Bureau of Land Management; Effective Long-Term Options Needed to Manage Unadoptable Wild Horses. Report to the Chairman, Committee on Natural Resources, House of Representatives, GAO-09-77.

Government Accountability Office (GAO). 2008. Bureau of Land Management; Effective Long-Term Options Needed to Manage Unadoptable Wild Horses. Report to the Chairman, Committee on Natural Resources, House of Representatives, GAO-09-77.

Gray, M.E. and E.Z. Cameron. 2010. Does contraceptive treatment in wildlife result in side effects? A review of quantitative and anecdotal evidence. Reproduction 139:45-55.

Gray, M.E., D.S. Thain, E.Z. Cameron, and L.A. Miller. 2010. Multi-year fertility reduction in free-roaming feral horses with single-injection immunocontraceptive formulations. Wildlife Research 37:475-481.

Gray, ME., 2009. The influence of reproduction and fertility manipulation on the social behavior of feral horses (Equus caballus). Dissertation. University of Nevada, Reno.

Green, N.F. and H.D. Green. 1977. The wild horse population of Stone Cabin Valley Nevada: a preliminary report. In Proceedings, National Wild Horse Forum. University of Nevada Reno Cooperative Extension Service.

Gross, J.E. 2000. A dynamic simulation model for evaluating effects of removal and contraception on genetic variation and demography of Pryor Mountain wild horses. Biological Conservation 96:319-330.

Gupta, S., and V. Minhas. 2017. Wildlife population management: are contraceptive vaccines a feasible proposition? Frontiers in Bioscience, Scholar 9:357-374.

Guttilla, D. A., and P. Stapp. 2010. Effects of sterilization on movements of feral cats at a wildland–urban interface. Journal of Mammalogy 91:482–489.

DRAFT

Hailer, F., B. Helander, A.O. Folkestad, S.A. Ganusevich, S. Garstad, P. Hauff, C. Koren, T. Nygård, V. Volke, C. Vilà, and H. Ellegren. 2006. Bottlenecked but long-lived: high genetic diversity retained in white-tailed eagles upon recovery from population decline. Biology Letters 2:316-319.
Hailer, F., B. Helander, A.O. Folkestad, S.A. Ganusevich, S. Garstad, P. Hauff, C. Koren, T. Nygård, V. Volke, C. Vilà, and H. Ellegren. 2006. Bottlenecked but long-lived: high genetic diversity retained in white-tailed eagles upon recovery from population decline. Biology Letters 2:316-319.
Hall, S. E., B. Nixon, and R.J. Aiken. 2016. Non-surgical sterilization methods may offer a sustainable solution to feral horse (Equus caballus) overpopulation. Reproduction, Fertility and Development, published online: https://doi.org/10.1071/RD16200

Hampson, B. A., J. M. Morton, P. C. Mills, M. G. Trotter, D. W. Lamb, and C. C. Pollitt. 2010b. Monitoring distances travelled by horses using GPS tracking collars. Australian Veterinary Journal 88:176–181.

Hampson, B. A., M. A. De Laat, P. C. Mills, and C. C. Pollitt. 2010a. Distances travelled by feral horses in 'outback' Australia. Equine Veterinary Journal, Suppl. 38:582–586.

Hampton, J.O., T.H. Hyndman, A. Barnes, and T. Collins. 2015. Is wildlife fertility control always humane? Animals 5:1047-1071.

Hanley, T.A., 1982. The nutritional basis for food selection by ungulates. J. Range Manag. 35, 146–151.

Hanley, T.A., and K.A. Hanley. 1982. Food resource partitioning by sympatric ungulates on Great Basin rangeland. Journal of Range Management 35(2):152-158.

Hansen, R., R. Clark, and W. Lawhorn. 1977. Foods of wild horses, mule deer, and cattle in the Douglas Mountain area, Colorado. Journal of Range Management. 30:116-118.

Hanser, S.E., and N.J. Huntly. 2006. Biogeography of small mammals of fragmented sagebrush-steppe landscapes. Journal of Mammalogy 87(6):1165-1174.

Hart, B. L. 1968. Role of prior experience in the effects of castration on sexual behavior of male dogs. Journal of Comparative and Physiological Psychology 66:719–725.

Hart, B. L., and R. A. Eckstein. 1997. The role of gonadal hormones in the occurrence of objectionable behaviours in dogs and cats. Applied Animal Behaviour Science 52:331–344.

Hart, B. L., and T. O. A. C. Jones. 1975. Effects of castration on sexual behavior of tropical male goats. Hormones and Behavior 6:247–258.

Heilmann, T.J., R.A. Garrott, L.L. Cadwell, and B.L. Tiller, 1998. Behavioral response of free-ranging elk treated with an immunocontraceptive vaccine. Journal of Wildlife Management 62: 243-250.

Henneke, D.R., G.D. Potter, J.L. Kreider, and B.F. Yeates. 1983. Relationship between body condition score, physical measurements and body fat percentage in mares. Equine veterinary Journal 15:371-372.

Herbert, C.A. and T.E. Trigg. 2005. Applications of GnRH in the control and management of fertility in female animals. Animal Reproduction Science 88:141-153.

Hobbs, N.T., D.C. Bowden and D.L. Baker. 2000. Effects of Fertility Control on Populations of Ungulates: General, Stage-Structured Models. Journal of Wildlife Management 64:473-491.
Hobbs, N.T., D.C. Bowden and D.L. Baker. 2000. Effects of Fertility Control on Populations of Ungulates: General, Stage-Structured Models. Journal of Wildlife Management 64:473-491.
Holtan, D. W., E. L. Squires, D. R. Lapin, and O. J. Ginther. 1979. Effect of ovariectomy on pregnancy in mares. Journal of Reproduction and Fertility, Supplement 27:457–463.

Holechek, J.L., R.D. Pieper, and C.H. Herbel. 2010. Range management: principles and practices (6th Edition). Prentice-Hall.

Hooper, R. N., T. S. Taylor, D. D. Varner, and B. T. L. 1993. Effects of bilateral ovariectomy via coloptomy in mares: 23 cases (1984-1990). Journal of the American Veterinary Medical Association 203:1043–1046.

Hsueh, A.J.W. and G.F. Erickson. 1979. Extrapituitary action of gonadotropin-releasing hormone: direct inhibition ovarian steroidogenesis. Science 204:854-855.

Huang, R. Y., L. M. Miller, C. S. Carlson, and M. R. Chance. 2002. Characterization of bone mineral composition in the proximal tibia of Cynomolgus monkeys: effect of ovariectomy and nandrolone decanoate treatment. Bone 30:492–497.

Hubbard, R. E., and R. M. Hansen. 1976. Diets of wild horses, cattle, and mule deer in the Piceance Basin, Colorado. J. Range Manage. 29:389-392.

Imboden, I., F. Janett, D. Burger, M.A. Crowe, M. Hässig, and R. Thun. 2006. Influence of immunization against GnRH on reproductive cyclicity and estrous behavior in the mare. Theriogenology 66:1866-1875.

Jacob, J., G. R. Singleton, and L. A. Hinds. 2008. Fertility control of rodent pests. Wildlife Research 35:487.

Janett, F., R. Stump, D. Burger, and R. Thun. 2009b. Suppression of testicular function and sexual behavior by vaccination against GnRH (Equity™) in the adult stallion. Animal Reproduction Science 115:88-102.

Janett, F., U. Lanker, H. Jörg, E. Meijerink, and R. Thun. 2009a. Suppression of reproductive cyclicity by active immunization against GnRH in the adult ewe. Schweizer Archiv fur Tierheilkunde 151:53-59.

Jenkins, S.H. 1996. Wild Horse Population Model. Version 3.2.

Jenkins, S.H. 1996. Wild Horse Population Model. Version 3.2.

Jerome, C. P., C. H. Turner, and C. J. Lees. 1997. Decreased bone mass and strength in ovariectomized cynomolgus monkeys (Macaca fascicularis). Calcified Tissue International 60:265–270.

Jessop, B.D., and V.J. Anderson. 2007. Cheatgrass invasion in salt desert shrublands: Benefits of postfire reclamation. Rangeland Ecology and Management 60(3):235-243.

Jeusette, I., J. Detilleux, C. Cuvelier, L. Istasse, and M. Diez. 2004. Ad libitum feeding following ovariectomy in female Beagle dogs: effect on maintenance energy requirement and on blood metabolites. Journal of Animal Physiology and Animal Nutrition 88:117–121.

Jeusette, I., S. Daminet, P. Nguyen, H. Shibata, M. Saito, T. Honjoh, L. Istasse, and M. Diez. 2006. Effect of ovariectomy and ad libitum feeding on body composition, thyroid status, ghrelin and leptin plasma concentrations in female dogs. Journal of Animal Physiology and Animal Nutrition 90:12–18.

Jewell, P. A. 1997. Survival and behaviour of castrated Soay sheep (Ovis aries) in a feral island population on Hirta, St. Kilda, Scotland. Journal of Zoology 243:623–636.

Joonè, C.J., H. French, D. Knobel, H.J. Bertschinger, and M.L. Schulman. 2017b. Ovarian suppression following PZP vaccination in pony mares and donkey jennies. Proceedings of the 8th International Wildlife Fertility Control Conference, Washington, D.C.

Joonè, C.J., H.J. Bertschinger, S.K. Gupta, G.T. Fosgate, A.P. Arukha, V. Minhas, E. Dieterman, and M.L. Schulman. 2017a. Ovarian function and pregnancy outcome in pony mares following immunocontraception with native and recombinant porcine zona pellucida vaccines. Equine Veterinary Journal 49:189-195.

Joonè, C.J., M.L. Schulman, and H.J. Bertschinger. 2017d. Ovarian dysfunction associated with zona pellucida-based immunocontraceptive vaccines. Theriogenology 89:329-337.

Joonè, C.J., M.L. Schulman, G.T. Fosgate, A.N. Claes, S.K. Gupta, A.E. Botha, A-M Human, and H.J. Bertschinger. 2017c. Serum anti-Müllerian hormone dynamics in mares following immunocontraception with anti-zona pellucida or -GnRH vaccines, Theriogenology (2017), doi: 10.1016/

Kamm, J. L., and D. A. Hendrickson. 2007. Clients' perspectives on the effects of laparoscopic ovariectomy on equine behavior and medical problems. Journal of Equine Veterinary Science 27:435–438.

Kane, A.J. 2018. A review of contemporary contraceptives and sterilization techniques for feral horses. Human-Wildlife Interactions 12:111-116.

Kaseda, Y., H. Ogawa, and A. M. Khalil. 1997. Causes of natal dispersal and emigration and their effects on harem formation in Misaki feral horses. Equine Veterinary Journal 29:262–266.

DRAFT

Kaur, K. and V. Prabha. 2014. Immunocontraceptives: new approaches to fertility control. BioMed Research International v. 2014, ArticleID 868196, 15 pp. http:/dx.doi.org/10.1155/2014/868196
Kean, R.P., A. Cahaner, A.E. Freeman, and S.J. Lamont. 1994. Direct and correlated responses to multitrait, divergent selection for immunocompetence. Poultry Science 73:18-32.
Khalil, A. M., and N. Murakami. 1999. Effect of natal dispersal on the reproductive strategies of the young Misaki feral stallions. Applied Animal Behaviour Science 62:281–291.
Khalil, A.M., N. Murakami, and Y. Kaseda. 1998. Relationship between plasma testosterone concentrations and age, breeding season, and harem size in Misaki feral horses. Journal of Veterinary Medical Science 60:643-645.
Khodr, G.S., and T.M. Siler-Khodr. 1980. Placental luteinizing hormone-releasing factor and its synthesis. Science 207:315-317.
Killian, G., D. Thain, N.K. Diehl, J. Rhyan, and L. Miller. 2008. Four-year contraception rates of mares treated with single-injection porcine zona pellucida and GnRH vaccines and intrauterine devices. Wildlife Research 35:531–539.
Killian, G., N.K. Diehl, L. Miller, J. Rhyan, and D. Thain. 2006. Long-term efficacy of three contraceptive approaches for population control of wild horses. In Proceedings-Vertebrate Pest Conference.
Killian, G., T.J. Kreeger, J. Rhyan, K. Fagerstone, and L. Miller. 2009. Observations on the use of GonaConTM in captive female elk (Cervus elaphus). Journal of Wildlife Diseases 45:184-188.
Kimball, S. and P.M. Shiffman. 2003. Differing effects of cattle grazing on native and alien plants. Conservation Biology 17:1681-1693.
King, S.R.B., and J. Gurnell. 2005. Habitat use and spatial dynamics of takhi introduced to Hustai National Park, Mongolia. Biological Conservation 124:277-290.
King, S.R.B., and J. Gurnell. 2006. Scent-marking behaviour by stallions: an assessment of function in a reintroduced population of Przewalski horses (Equus ferus przewalskii). Journal of Zoology 272:30–36.
Kinter, C.L., B.A. Mealor, N.L. Shaw, and A.L. Hild. 2007. Postfire invasion potential of rusk skeletonweed (Chondrilla juncea). Rangeland Ecology and Management 60(4):389-394.
Kirkpatrick, J. 2012. Sworn statement of Dr. Jay Kirkpatrick. Unpublished record of opinion.
Kirkpatrick, J. F., and A. Turner. 2008. Achieving population goals in a long-lived wildlife species (Equus caballus) with contraception. Wildlife Research 35:513.
Kirkpatrick, J.F. and A. Turner. 2002. Reversibility of action and safety during pregnancy of immunization against porcine zona pellucida in wild mares (Equus caballus). Reproduction Supplement 60:197-202.
Kirkpatrick, J.F. and A. Turner. 2003. Absence of effects from immunocontraception on seasonal birth patterns and foal survival among barrier island wild horses. Journal of Applied Animal Welfare Science 6:301-308.
Kirkpatrick, J.F. and J.W. Turner. 1991. Compensatory reproduction in feral horses. The Journal of Wildlife Management 55:649-652.
Kirkpatrick, J.F. and J.W. Turner. 1991. Compensatory reproduction in feral horses. Journal of Wildlife Management 55:649-652.
Kirkpatrick, J.F., A.T. Rutberg, and L. Coates-Markle. 2010. Immunocontraceptive reproductive control utilizing porcine zona pellucida (PZP) in federal wild horse populations, 3rd edition. P.M. Fazio, editor. Downloaded from http://www.einsten.net/pdf/110242569.pdf
Kirkpatrick, J.F., A.T. Rutberg, L. Coates-Markle, and P.M. Fazio. 2012. Immunocontraceptive Reproductive Control Utilizing Porcine Zona Pellucida (PZP) in Federal Wild Horse Populations. Science and Conservation Center, Billings, Montana.
Kirkpatrick, J.F., I.M.K. Liu, J.W. Turner, R. Naugle, and R. Keiper. 1992. Long-term effects of porcine zonae pellucidae immunocontraception on ovarian function in feral horses (Equus caballus). Journal of Reproduction and Fertility 94:437-444.

DRAFT

Kirkpatrick, J.F., R.O. Lyda, and K. M. Frank. 2011. Contraceptive vaccines for wildlife: a review. American Journal of Reproductive Immunology 66:40-50.

Kitchell, K., S. Cohn, R. Falise, H. Hadley, M. Herder, K. Libby, K. Muller, T. Murphy, M. Preston, M. J. Rugwell, and S. Schlanger. 2015. Advancing Science in the BLM: An Implementation Strategy. Bureau of Land Management. March 2015.

Knight, C.M. 2014. The effects of porcine zona pellucida immunocontraception on health and behavior of feral horses (Equus caballus). Graduate thesis, Princeton University.

Krysl, L.J., M.E. Hubbert, B.F. Sowell, G.E. Plumb, T.K. Jewett, M.A. Smith, and W. Waggoner. 1984. Horses and cattle grazing in the Wyoming Red Desert, I. food habits and dietary overlap. Journal of Range Management 37(1):72-76.

Lee, M., and D. A. Hendrickson. 2008. A review of equine standing laparoscopic ovariectomy. Journal of Equine Veterinary Science 28:105–111.

Levy, J.K., J.A. Friary, L.A. Miller, S.J. Tucker, and K.A. Fagerstone. 2011. Long-term fertility control in female cats with GonaCon™, a GnRH immunocontraceptive. Theriogenology 76:1517-1525.

Line, S. W., B. L. Hart, and L. Sanders. 1985. Effect of prepubertal versus postpubertal castration on sexual and aggressive behavior in male horses. Journal of the American Veterinary Medical Association 186:249–251.

Linklater, W. L., and E. Z. Cameron. 2000. Distinguishing cooperation from cohabitation: the feral horse case study. Animal Behaviour 59:F17–F21.

Liu, I.K.M., M. Bernoco, and M. Feldman. 1989. Contraception in mares heteroimmunized with pig zonae pellucidae. Journal of Reproduction and Fertility, 85:19-29.

Loesch, D. A., and D. H. Rodgerson. 2003. Surgical approaches to ovariectomy in mares. Continuing Education for Veterinarians 25:862–871.

Lundon, K., M. Dumitriu, and M. Grynpas. 1994. The long-term effect of ovariectomy on the quality and quantity of cancellous bone in young macaques. Bone and Mineral 24:135–149.

Madosky, J.A., D.I. Rubenstein, J.J. Howard, and S. Stuska. 2010. The effect of immunocontraception on harem fidelity in a feral horse (Equus caballus) population. Applied Animal Behaviour Science: 128:50-56.

Magiafoglou, A., M. Schiffer, A.A. Hoffman, and S.W. McKechnie. 2003. Immunocontraception for population control: will resistance evolve? Immunology and Cell Biology 81:152-159.

Mask, T.A., K.A. Schoenecker, A.J. Kane, J.I.Ransom, and J.E. Bruemmer. 2015. Serum antibody immunoreactivity to equine zona protein after SpayVac vaccination. Theriogenology, 84:261-267.

Mavropoulos, A., S. Kiliaridis, R. Rizzoli, and P. Ammann. 2014. Normal masticatory function partially protects the rat mandibular bone from estrogen-deficiency induced osteoporosis. Journal of Biomechanics 47:2666–2671.

McCann, B., D. Baker, J. Powers, A. Denicola, B. Soars, and M. Thompson. 2017. Delivery of GonaCon-Equine to feral horses (Equus caballus) using prototype syringe darts. Proceedings of the 8th International Wildlife Fertility Control Conference, Washington, D.C.

McDonnell, S.M. 2012. Mare and foal behavior. American Association of Equine Practitioners Proceedings 58:407-410.

McInnis, M.L., and M. Vavra. 1987. Dietary relationships between feral horses, cattle and pronghorn in southeastern Oregon. Journal of Range Management 40(1):60-66.

McKinnon, A.O., and J.R. Vasey. 2007. Selected reproductive surgery of the broodmare. Pages 146-160 in Current therapy in equine reproduction, J.C. Samper, J.F. Pycock, and A.O. McKinnon, eds. Saunders Elsevier, St. Louis, Missouri.

Menard, C., Duncan, P., Fleurance, G., Georges, J., Lila, M., 2002. Comparative foraging and nutrition of horses and cattle in European wetlands. J. Appl. Ecol. 39, 120–133

Miller, L.A., J.P. Gionfriddo, K.A. Fagerstone, J.C. Rhyan, and G.J. Killian. 2008. The Single-Shot GnRH Immunocontraceptive Vaccine (GonaCon™) in White-Tailed Deer: Comparison of Several GnRH Preparations. American Journal of Reproductive Immunology 60:214-223.

DRAFT

Miller, L.A., K.A. Fagerstone, and D.C. Eckery. 2013. Twenty years of immunocontraceptive research: lessons learned. Journal of Zoo and Wildlife Medicine 44:S84-S96.
Miller, R. 1983. Seasonal Movements and Home Ranges of Feral Horse Bands in Wyoming's Red Desert. Journal of Range Management 36:199–201.
Mills, L.S. and F.W. Allendorf. 1996. The one-migrant-per-generation rule in conservation and management. Conservation Biology 10:1509-1518.
National Research Council (NRC). 2013. Using science to improve the BLM wild horse and burro program: a way forward. National Academies Press. Washington, DC.
National Research Council (NRC). 2013. Using science to improve the BLM wild horse and burro program: a way forward. National Academies Press. Washington, DC.
National Research Council of the National Academies (NRC). 2015. Review of proposals to the Bureau of Land Management on Wild Horse and Burro sterilization or contraception, a letter report. Committee for the review of proposals to the Bureau of Land Management on Wild Horse and Burro Sterilization or Contraception. Appendix B in: BLM, 2016, Mare sterilization research Environmental Assessment DOI-BLM-OR-B000-2015-0055-EA, BLM Burns District Office, Hines, Oregon.
Nelson, K. J. 1980. Sterilization of dominant males will not limit feral horse populations. USDA Forest Service Research Paper RM-226.
Nettles, V. F. 1997. Potential consequences and problems with wildlife contraceptives. Reproduction, Fertility and Development 9, 137–143.
Nickolmann, S., S. Hoy, and M. Gauly. 2008. Effects of castration on the behaviour of male llamas (Lama glama). Tierärztliche Praxis Großtiere 36:319–323.
Nock, B. 2013. Liberated horsemanship: menopause…and wild horse management. Warrenton, Missouri: Liberated Horsemanship Press.
Nock, B. 2017. Gelding is likely to cause wild horses undo suffering. Unpublished record of opinion.
NRC (National Research Council). 2013. Using science to improve the BLM wild horse and burro program: a way forward. National Academies Press. Washington, DC.
Nuñez, C.M., J.S. Adelman, and D.I. Rubenstein. 2010. Immunocontraception in wild horses (Equus caballus) extends reproductive cycling beyond the normal breeding season. PLoS one, 5(10), p.e13635.
Nuñez, C.M., J.S. Adelman, H.A. Carr, C.M. Alvarez, and D.I. Rubenstein. 2017. Lingering effects of contraception management on feral mare (Equus caballus) fertility and social behavior. Conservation Physiology 5(1): cox018; doi:10.1093/conphys/cox018.
Nuñez, C.M.V, J.S. Adelman, J. Smith, L.R. Gesquiere, and D.I. Rubenstein. 2014. Linking social environment and stress physiology in feral mares (Equus caballus): group transfers elevate fecal cortisol levels. General and Comparative Endocrinology. 196:26-33.
Nuñez, C.M.V. 2018. Consequences of porcine zona pellucidz immunocontraception to feral horses. Human-Wildlife Interactions 12:131-142.
Nuñez, C.M.V., J.S. Adelman, C. Mason, and D.I. Rubenstein. 2009. Immunocontraception decreases group fidelity in a feral horse population during the non-breeding season. Applied Animal Behaviour Science 117:74-83.
O'Farrell, V., and E. Peachey. 1990. Behavioural effects of ovariohysterectomy on bitches. Journal of Small Animal Practice 31:595–598.
Olsen, F.W., and R.M. Hansen. 1977. Food relations of wild free-roaming horses to livestock and big game. Red Desert, Wyoming. Journal of Range Management 30(1):17-20.
Ostermann-Kelm, S.D., E.A. Atwill, E.S. Rubin, L.E. Hendrickson, and W.M. Boyce. 2009. Impacts of feral horses on a desert environment. BMC Ecology 9(22).
Ouren, D.S., C. Haas, C.P. Melcher, S.C. Stewart, P.D. Ponds, N.R. Sexton, L. Burris, T. Fancher, and Z.H. Bowen. 2007. Environmental effects of off-highway vehicles on Bureau of Land Management lands: a literature synthesis, annotated bibliographies, extensive bibliographies, and

DRAFT

internet resources. Open File Report 2007-1353, U.S. Department of Interior, U.S. Geological Survey, Reston, Virginia. 225 p.
Pader, K., L. J. Freeman, P. D. Constable, C. C. Wu, P. W. Snyder, and T. B. Lescun. 2011. Comparison of Transvaginal Natural Orifice Transluminal Endoscopic Surgery (NOTES®) and Laparoscopy for Elective Bilateral Ovariectomy in Standing Mares. Veterinary Surgery 40:998–1008.
Payne, R. M. 2013. The effect of spaying on the racing performance of female greyhounds. The Veterinary Journal 198:372–375.
Pearce, O. 1980. Libidinous behaviour in a gelding. Veterinary Record 106:207–207.
Pellant, M., P. Shaver, D.A. Pyke, and J.E. Herrick. 2005. Interpreting indicators of rangeland health, version 4. Technical Reference 1734-6. U.S. Department of the Interior, Bureau of Land Management, National Science and Technology Center, Denver, CO. BLM/WO/ST-00/001+1734/REV05. 122 pp.
Powell, D.M. 1999. Preliminary evaluation of porcine zona pellucida (PZP) immunocontraception for behavioral effects in feral horses (Equus caballus). Journal of Applied Animal Welfare Science 2:321-335.
Powell, D.M. and S.L. Monfort. 2001. Assessment: effects of porcine zona pellucida immunocontraception on estrous cyclicity in feral horses. Journal of Applied Animal Welfare Science 4:271-284.
Powers, J.G., D.L. Baker, M.G. Ackerman, J.E. Bruemmer, T.R. Spraker, M.M. Conner, and T.M. Nett. 2012. Passive transfer of maternal GnRH antibodies does not affect reproductive development in elk (Cervus elaphus nelson) calves. Theriogenology 78:830-841.
Powers, J.G., D.L. Baker, R.J. Monello, T.J. Spraker, T.M. Nett, J.P. Gionfriddo, and M.A. Wild. 2013. Effects of gonadotropin-releasing hormone immunization on reproductive function and behavior in captive female Rocky Mountain elk (Cervus elaphus nelsoni). Journal of Zoo and Wildlife Medicine meeting abstracts S147.
Prado, T., and J. Schumacher. 2017. How to perform ovariectomy through a colpotomy. Equine Veterinary Education 13:doi: 10.1111/eve.12801
Ramsey, D. 2005. Population dynamics of brushtail possums subject to fertility control. Journal of Applied Ecology 42:348–360.
Ramsey, D. 2007. Effects of fertility control on behavior and disease transmission in brushtail possums. Journal of Wildlife Management 71:109–116.
Ransom, J. I., and B. S. Cade. 2009. Quantifying Equid Behavior--A Research Ethogram for Free-Roaming Feral Horses. Publications of the US Geological Survey. U.S. Geological Survey Techniques and Methods 2-A9.
Ransom, J.I. and B.S. Cade. 2009. Quantifying equid behavior: A research ethogram for free-roaming feral horses. U.S. Geological Survey Techniques and Methods Report 2-A9.
Ransom, J.I., B.S. Cade, and N.T. Hobbs. 2010. Influences of immunocontraception on time budgets, social behavior, and body condition in feral horses. Applied Animal Behaviour Science 124:51-60.
Ransom, J.I., J.E. Roelle, B.S. Cade, L. Coates-Markle, and A.J. Kane. 2011. Foaling rates in feral horses treated with the immunocontraceptive porcine zona pellucida. Wildlife Society Bulletin 35:343-352.
Ransom, J.I., J.G. Powers, H.M. Garbe, M.W. Oehler, T.M. Nett, and D.L. Baker. 2014b. Behavior of feral horses in response to culling and GnRH immunocontraception. Applied Animal Behaviour Science 157: 81-92.
Ransom, J.I., J.G. Powers, N.T. Hobbs, and D.L. Baker. 2014a. Ecological feedbacks can reduce population-level efficacy of wildlife fertility control. Journal of Applied Ecology 51:259-269.
Ransom, J.I., N.T. Hobbs, and J. Bruemmer. 2013. Contraception can lead to trophic asynchrony between birth pulse and resources. PLoS One 8(1), p.e54972.
Reichler, I. M. 2009. Gonadectomy in Cats and Dogs: A Review of Risks and Benefits. Reproduction in Domestic Animals 44:29–35.

DRAFT

Rios, J. F. I., and K. Houpt. 1995. Sexual behavior in geldings. Applied Animal Behaviour Science 46:133–133.

Röcken, M., G. Mosel, K. Seyrek-Intas, D. Seyrek-Intas, F. Litzke, J. Verver, and A. B. M. Rijkenhuizen. 2011. Unilateral and Bilateral Laparoscopic Ovariectomy in 157 Mares: A Retrospective Multicenter Study. Veterinary Surgery 40:1009–1014.

Roelle, J. E., F. J. Singer, L. C. Zeigenfuss, J. I. Ransom, L. Coates-Markle, and K. A. Schoenecker. 2010. Demography of the Pryor Mountain Wild Horses, 1993–2007. pubs.usgs.gov. U.S. Geological Survey Scientific Investigations Report 2010-5125.

Roelle, J.E. and J. I. Ransom. 2009. Injection-site reactions in wild horses (Equus caballus) receiving an immunocontraceptive vaccine. US Geological Survey Report 2009-5038.

Roelle, J.E. and S.J. Oyler-McCance, S.J., 2015. Potential demographic and genetic effects of a sterilant applied to wild horse mares. US Geological Survey Report 2015-1045.

Roelle, J.E., and J.I. Ransom. 2009. Injection-site reactions in wild horses (Equus caballus) receiving an immunocontraceptive vaccine: U.S. Geological Survey Scientific Investigations Report 2009–5038.

Roelle, J.E., F.J. Singer, L.C. Zeigenfuss, J.I. Ransom, F.L. Coates-Markle, and K.A. Schoenecker. 2010. Demography of the Pryor Mountain Wild Horses, 1993-2007. U.S. Geological Survey Scientific Investigations Report 2010–5125.

Roelle, J.E., S.S. Germaine, A.J. Kane, and B.S. Cade. 2017. Efficacy of SpayVac ® as a contraceptive in feral horses. Wildlife Society Bulletin 41:107-115.

Roessner, H. A., K.A. Kurtz, and J.P. Caron. 2015. Laparoscopic ovariectomy diminishes estrus-associated behavioral problems in mares. Journal of Equine Veteriniary Science 35: 250–253 (2015).

Rotenberry, J.T., and S. Knick 1995. Evaluation of Bias in Roadside Point Count Surveys of Passerines in Shrubsteppe and Grassland Habitats in Southwestern Idaho. p. 99-101. In C.J. Ralph, J. R. Sauer, and S. Droege editors. Monitoring bird populations by point counts. USDA Forest Service, General Technical Report, PSW-GTR-149., Albany, CA. 187 p.

Rowland, A.L., K.G. Glass, S.T. Grady, K.J. Cummings, K. Hinrichs, and A.E. Watts. 2018. Influence of caudal epidural analgesia on cortisol concentrations and pain-related behavioral responses in mares during and after ovariectomy via colpotomy. Veterinary Surgery 2018:1-7. DOI: 10.1111/vsu.12908

Rubenstein, D.I. 1981. Behavioural ecology of island feral horses. Equine Veterinary Journal 13:27-34.

Rubin, C., A. S. Turner, S. Bain, C. Mallinckrodt, and K. McLeod. 2001. Low mechanical signals strengthen long bones. Nature 412:603–604.

Rutberg, A. 2011. Re: Modified decision record, WY-040-EA11-124. Unpublished record of opinion.

Rutberg, A., K. Grams, J.W. Turner, and H. Hopkins. 2017. Contraceptive efficacy of priming and boosting does of controlled-release PZP in wild horses. Wildlife Research: http://dx.doi.org/10.1071/WR16123

Sacco, A.G., M.G. Subramanian, and E.C. Yurewicz. 1981. Passage of zona antibodies via placenta and milk following active immunization of female mice with porcine zonae pellucidae. Journal of Reproductive Immunology 3:313-322.

Salter, R. E. Biogeography and habitat-use behavior of feral horses in western and northern Canada. in Symposium on the Ecology and Behaviour of Wild and Feral Equids 129–141 (1979).

Saltz, D., M. Rowen, and D. I. Rubenstein. 2000. The effect of space-use patterns of reintroduced Asiatic wild ass on effective population size. Conservation Biology 14:1852–1861.

Sarker, N., M. Tsudzuki, M. Nishibori, and Y. Yamamoto. 1999. Direct and correlated response to divergent selection for serum immunoglobulin M and G levels in chickens. Poultry Science 78:1-7.

Saunders, G., J. McIlroy, M. Berghout, B. Kay, E. Gifford, R. Perry, and R. van de Ven. 2002. The effects of induced sterility on the territorial behaviour and survival of foxes. Journal of Applied Ecology 39:56–66.

DRAFT

Schaut, R.G., M.T. Brewer, J.M. Hostetter, K. Mendoza, J.E. Vela-Ramirez, S.M. Kelly, J.K. Jackman, G. Dell'Anna, J.M. Howard, B. Narasimhan, and W. Zhou. 2018. A single dose polyanhydride-based vaccine platform promotes and maintains anti-GnRH antibody titers. Vaccine 36:1016-1023.

Scholz-Ahrens, K. E., G. Delling, P. W. Jungblut, E. Kallweit, and C. A. Barth. 1996. Effect of ovariectomy on bone histology and plasma parameters of bone metabolism in nulliparous and multiparous sows. Zeitschrift für Ernährungswissenschaft 35:13–21.

Schulman, M.L., A.E. Botha, S.B. Muenscher, C.H. Annandale, A.J. Guthrie, and H.J. Bertschinger. 2013. Reversibility of the effects of GnRH-vaccination used to suppress reproductive function in mares. Equine Veterinary Journal 45:111-113.

Schumacher, J. 1996. Complications of castration. Equine Veterinary Education 8:254-259.

Schumacher, J. 2006. Why do some castrated horses still act like stallions, and what can be done about it? Compendium Equine Edition Fall:142–146.

Science and Conservation Center (SCC). 2015. Materials Safety Data Sheet, ZonaStat-H. Billings, Montana.

Scott, E. A., and D. J. Kunze. 1977. Ovariectomy in the mare: presurgical and postsurgical considerations. The Journal of Equine Medicine and Surgery 1:5–12.

Searle, D., A.J. Dart, C.M. Dart, and D.R. Hodgson. 1999. Equine castration: review of anatomy, approaches, techniques and complications in normal, cryptorchid and monorchid horses. Australian Veterinary Journal 77:428-434.

Seidler, R. G., and E. M. Gese. 2012. Territory fidelity, space use, and survival rates of wild coyotes following surgical sterilization. Journal of Ethology 30:345–354.

Shoemaker, R. W., E. K. Read, T. Duke, and D. G. Wilson. 2004. In situ coagulation and transection of the ovarian pedicle: an alternative to laparoscopic ovariectomy in juvenile horses. Canadian Journal of Veterinary Research 68:27-32.

Shoemaker, R., Bailey, J., Janzen, E. and Wilson, D.G., 2004. Routine castration in 568 draught colts: incidence of evisceration and omental herniation. Equine Veterinary Journal, 36:336-340.

Shumake, S.A. and G. Killian. 1997. White-tailed deer activity, contraception, and estrous cycling. Great Plains Wildlife Damage Control Workshop Proceedings, Paper 376.

Sigrist, I. M., C. Gerhardt, M. Alini, E. Schneider, and M. Egermann. 2007. The long-term effects of ovariectomy on bone metabolism in sheep. Journal of Bone and Mineral Metabolism 25:28–35.

Sigurjónsdóttir, H., M. C. Van Dierendonck, S. Snorrason, and A. G. Thorhallsdóttir. 2003. Social relationships in a group of horses without a mature stallion. Behaviour 140:783–804.

Skinner, S.M., Mills, T., Kirchick, H.J. and Dunbar, B.S., 1984. Immunization with Zona Pellucida Proteins Results in Abnormal Ovarian Follicular Differentiation and Inhibition of Gonadotropin-induced Steroid Secretion. Endocrinology, 115:2418-2432.

Smith, J. A. 1974. Proceedings: Masculine behaviour in geldings. The Veterinary Record 94:160–160.

Stout, T.A.E., J.A. Turkstra, R.H. Meloen, and B. Colenbrander. 2003. The efficacy of GnRH vaccines in controlling reproductive function in horses. Abstract of presentation from symposium, "Managing African elephants: act or let die? Utrecht University, Utrecht, Netherlands.

Symanski, R. 1994. Contested Realities: Feral Horses in Outback Australia. Annals of the Association of American Geographers. 84:251-269.

Thompson, D. L., Jr, B. W. Pickett, E. L. Squires, and T. M. Nett. 1980. Sexual behavior, seminal pH and accessory sex gland weights in geldings administered testosterone and(or) estradiol-17. Journal of Animal Science 51:1358–1366.

Thompson, T.W., B.A. Roundy, E.D. McArthur, B.D. Jessop, B. Waldron, and J.N. Davis. 2006. Fire rehabilitation using native and introduced species: a landscape trial. Rangeland Ecology and Management 59(3):237-248.

Turner, J.W, A.T. Rutberg, R.E. Naugle, M.A. Kaur, D.R.Flanagan, H.J. Bertschinger, and I.K.M. Liu. 2008. Controlled-release components of PZP contraceptive vaccine extend duration of infertility. Wildlife Research 35:555-562.

DRAFT

Turner, J.W., and J.F. Kirkpatrick. 2002. Effects of immunocontraception on population, longevity and body condition in wild mares (Equus caballus). Reproduction (Cambridge, England) Supplement, 60, pp.187-195.

Turner, J.W., I.K. Liu, A.T. Rutberg, and J.F. Kirkpatrick. 1997. Immunocontraception limits foal production in free-roaming feral horses in Nevada. Journal of Wildlife Management 61:873-880.

Turner, J.W., I.K. Liu, D.R. Flanagan, A.T. Rutberg, and J.F. Kirkpatrick. 2007. Immunocontraception in wild horses: one inoculation provides two years of infertility. Journal of Wildlife Management 71:662-667.

Turner, J.W., I.K. Liu, D.R. Flanagan, K.S. Bynum, and A.T. Rutberg. 2002. Porcine zona pellucida (PZP) immunocontraception of wild horses (Equus caballus) in Nevada: a 10 year study. Reproduction Supplement 60:177-186.

Turner, J.W., I.K.M. Liu, and J.F. Kirkpatrick. 1996. Remotely delivered immunocontraception in free-roaming feral burros (Equus asinus). Journal of Reproduction and Fertility 107:31-35.

Twigg, L. E., T. J. Lowe, G. R. Martin, A. G. Wheeler, G. S. Gray, S. L. Griffin, C. M. O'Reilly, D. J. Robinson, and P. H. Hubach. 2000. Effects of surgically imposed sterility on free-ranging rabbit populations. Journal of Applied Ecology 37:16–39.

Tyler, S. 1972. The behaviour and social organisation of the New Forest ponies. Animal Behaviour Monographs 5:85–196.

Van Dierendonck, M. C., H. De Vries, and M. B. H. Schilder. 1995. An analysis of dominance, its behavioural parameters and possible determinants in a herd of Icelandic horses in captivity. Journal of Zoology 45:362–385.

Van Dierendonck, M. C., H. De Vries, M. B. H. Schilder, B. Colenbrander, A. G. Þorhallsdóttir, and H. Sigurjónsdóttir. 2009. Interventions in social behaviour in a herd of mares and geldings. Applied Animal Behaviour Science 116:67–73.

Van Dierendonck, M. C., H. Sigurjónsdóttir, B. Colenbrander, and A. G. Thorhallsdóttir. 2004. Differences in social behaviour between late pregnant, post-partum and barren mares in a herd of Icelandic horses. Applied Animal Behaviour Science 89:283–297.

Vinke, C. M., R. van Deijk, B. B. Houx, and N. J. Schoemaker. 2008. The effects of surgical and chemical castration on intermale aggression, sexual behaviour and play behaviour in the male ferret (Mustela putorius furo). Applied Animal Behaviour Science 115:104–121.

Wang-Cahill, F., J. Warren, T. Hall, J. O'Hare, A. Lemay, E. Ruell, and R. Wimberly. In press. Use of GonaCon in wildlife management. Chapter 24 in USDA-APHIS, Human health and ecological risk assessment for the use of wildlife damage management methods by APHIS-Wildlife Services. USDA APHIS, Fort Collins, Colorado.

Webley, G. E., and E. Johnson. 1982. Effect of ovariectomy on the course of gestation in the grey squirrel (Sciurus carolinensis). Journal of Endocrinology 93:423–426.

Wright, S. 1931. Evolution in Mendelian populations. Genetics 16:97-159

Yao, Z., W. Si, W. Tian, J. Ye, R. Zhu, X. Li, S. Ki, Q. Zheng, Y. Liu, and F. Fang. 2018. Effect of active immunization using a novel GnRH vaccine on reproductive function in rats. Theriogenology 111:1-8. https://doi.org/10.1016/j.theriogenology.2018.01.013

Yoder, C.A. and L.A. Miller. 2010. Effect of GonaCon™ vaccine on black-tailed prairie dogs: immune response and health effects. Vaccine 29:233-239.

Zhang, Y., W.-P. Lai, P.-C. Leung, C.-F. Wu, and M.-S. Wong. 2007. Short- to Mid-Term Effects of Ovariectomy on Bone Turnover, Bone Mass and Bone Strength in Rats. Biological and Pharmaceutical Bulletin 30:898–903.

Zoo Montana. 2000. Wildlife Fertility Control: Fact and Fancy. Zoo Montana Science and Conservation Biology Program, Billings, Montana.

DRAFT